The Radio Telephone Operator (RTO) Handbook

Tactics, Techniques, and Procedures

FOREWORD

The Joint Readiness Training Center (JRTC), Center for Army Lessons Learned (CALL) cell compiled this handbook from extracts of technical manuals, lesson outlines from the U.S. Army Signal School, and unit standing operating procedures (SOPs). Other references include, but are not limited to, field manuals, quick reference cards, manufacturers' web sites, and interviews with signal personnel. The purpose of the radio telephone handbook is to provide a quick reference guide for RTOs to support successful mission accomplishment. Supporting leaders with reliable communications is a direct result of detailed planning, Soldiers' lives hinge on our ability to plan tactical operations. Communications must support the scheme of maneuver and be synchronized and integrated to put maximum focus on a specific objective at a specific time to ensure the leader accomplishes the mission. Today's battlefield is three-dimensional and signal operations require the same application of thought. Soldiers must understand the requirements for success in a tactical environment and leaders must keep soldiers informed and updated on all key information.

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The Radio Telephone Operator (RTO) Handbook

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CHAPTER 1

USER INFORMATION AND REFERENCES

This chapter provides a compendium of basic user information and references necessary for all RTOs. It is not a complete guide to SINCGARS or RTO duties. Rather it is a start point and a handy reference for any soldier who may be tasked with RTO duties. Because the RTO is the small unit leader's walking, talking tactical operations center, this chapter also provides a similar start point for unit leaders, from team to battalion, who need to be familiar with the SINCGARS and RTO duties.

1. REFERENCES.

>   a. **TM 11-5820-890-10-8,** *Operators Manual, SINCGARS Ground Combat Net Radio, ICOM*.

>   b. **TM 11-5820-890-10-6,** *SINCGARS ICOM Ground Radios Operator's Pocket Guide*.

>   c. **TM 11-5820-890-10-7,** *SINCGARS ICOM Ground Radios NCS Pocket Guide*.

>   d. **FM 11-32,** *Combat Net Radio Operations*.

>   e. **TM 11-5825-291-13,** *Satellite Signals Navigation Sets*.

>   f. **TB 11-5825-291-10-3,** *The PLGR Made Simple*.

>   g. **TB 380-41 (Change 1),** *Procedures for Safeguarding, Accounting and Supply Control of COMSEC Material*.

2. PURPOSE. This guide establishes procedures, guidelines, and information on operating the SINCGARS radio system. It is designed to supplement unit level RTO training and certification and act as a quick reference for RTOs when faced with a communications problem.

3. GENERAL.

>   a. SINCGARS ASIP is a "user owned and operated" solid-state frequency modulated (FM) combat net radio (CNR), that operates in the 30.000 to 87.995 MHZ frequency range in the single channel (SC) or frequency hopping (FH) mode. The ASIP replaces the RT-1523A and RT-1523B model SINCGARS. The ASIP is compatible with the older SINCGARS and with NATO forces in SC, squelch off mode. It provides electronic warfare (EW) protection and a reduced electromagnetic signature in the FH mode.

>   b. The AN/CYZ-10 automated net control device (ANCD) is a hand-held device capable of receiving, storing, and transferring data between ANCDs, or between ANCD and an ASIP radio. The primary application for this device is to fill the ASIP with FH data, time, communications security (COMSEC), and loadset information. ANCDs are non-repairable controlled cryptographic items (CCI) and must be stored IAW TB 340-1 (change 1). Loaded ANCD with "Secret" information must be stored in a 3-combination safe. ANCDs that are not loaded must be secured with no less than two barrier protection, i.e. a locked door and wall locker using a 200 series lock.

c. The AN/PSN-11 precision lightweight global positioning system receiver (PLGR) is a hand-held Global Positioning System (GPS). The primary application for this device is precision position location and land navigation via programmable waypoints. The secondary application for this device is to update and verify the date and time in the ASIP radio. The PLGR is a high dollar item and should be safeguarded accordingly.

d. The ASIP and ANCD are CCI and require double-barrier protection IAW DA PAM 25-380-2. All unattended ASIP radios will be zeroed. Radios will be reloaded when required using the ANCD.

e. Maintenance procedures are the same for the older SINCGARS radio. The ASIP is accountable by serial number. When the RT-1523E has been determined non-mission capable (NMC) by unit-level maintenance personnel, it will be turned in to the forward support battalion (FSB), direct support unit (DSU) for repairs. The DSU will then determine if the radio will be replaced or held for repair in the shop. A property book transaction (lateral transfer) is required should the radio be exchanged for a working RT-1523F. Only company communications chiefs and/or RTOs will turn-in equipment to the battalion communications section.

4. OPERATING PROCEDURES.

a. Net synchronization time (NET).

(1) The ASIP has an internal master clock. Each channel (1 through 6) also has the ability to maintain separate time. Time is primarily loaded into the ASIP via the ANCD and alternately the PLGR. If the ANCD is used, ensure the time in the ANCD has accurate ZULU time stored. GPS ZULU time is the standard time zone used for all division radios.

(2) The ZULU time stored in an ANCD will drift significantly over time and if loaded into the ASIP will not allow communications with other net members. All RTOs must verify accurate time in the ASIP after loading their radios. All RTOs must also maintain accurate time (hour, minute, and seconds) on a digital watch to quickly verify time. Time must be within + or – 4 seconds to communicate with other ASIPs. Accurate ZULU time can be obtained by the following methods:

(a) Calling the atomic clock – DSN 763-1401 Commercial (202) 763-1401

(b) Via PLGR (must be + or – 1 second)

(c) Top of the hour on any 5 kHz frequency via HF radios (PRC-104).

(3) Julian date (JD). The ASIP JD is the last two digits of the full Julian date. See Appendix A (Julian date calendar) for the correct Julian date. The JD is also automatically loaded via the ANCD. If a net member loads the incorrect JD or accidentally changes the JD, all communications with other net members will be lost.

(4) During FH operations, the net control station (NCS) will always maintain accurate time and will operate a radio in the frequency hop master (FH-M) mode. The NCS for each net is the only radio authorized to operate in the FH-M mode. This will ensure time accuracy throughout the net. Should the NCS radio fail

during any part of the mission, the alternate NCS will switch his radio to the FH-M mode.

b. Initial net opening. The battalion standard is Hot Start net opening procedure. The procedure is covered in Chapter 3 (Operator Tasks).

c. Passive late net entry. This procedure allows a radio with correct hop set and COMSEC information but inaccurate time (+ or – 59 seconds) to enter a net. The procedures are covered in Chapter 3 (Operator Tasks).

d. Loadset.

(1) Loadsets are made up of the following components:

(a) TranSec key (TSK) – frequency hop data

(b) Esets – net IDs (example F302)

(c) COMSEC keys (TEK and KEK) – transmission encryption keys

(d) Lockout sets – restricted frequencies within the frequency hop data.

(2) The ANCD transfers a loadset to an ASIP radio. This loadset is transferred by a menu-driven procedure during normal loading procedures of the ASIP with the ANCD.

(3) Net IDs are normally fixed and will follow the numbering scheme listed below. Specific net IDs within the below listed ranges are designated in the signal operating instructions (SOI).

Note: These are sample division standards only and may change for real world contingencies or deployments

FH000-099 Theater/Joint

FH100-299 Corps/Service

FH300-399 (1st BDE)

FH400-499 (2nd BDE)

FH500-599 (3rd BDE)

FH600-699 (AVN BDE)

FH700-799 (DIVARTY)

FH800-899 (DISCOM)

FH900-999 (DIV HQs)

e. Operational security (OPSEC). OPSEC is defined as any measure an operator takes in order to safeguard information from the enemy. OPSEC can be anything from

minimizing the number of net IDs loaded into a radio, to zeroing an ANCD or radio if capture by the enemy is imminent, thereby denying the enemy the ability to exploit the ANCD or radio for intelligence against U.S. Forces. All personnel assigned to, attached to, or under the operational control of the battalion will follow these procedures to maximize OPSEC.

(1) Loadsets contain only the primary net used by the operator. If the RTO requires additional nets he will manually load the ASIP with the required net. Minimize the number of channels used.

(2) ANCDs only contain the loadset and COMSEC required by the operator.

(3) New editions of the signal operating instructions (SOI) and COMSEC should not be distributed below the battalion level until authorized by the brigade signal officer (SIGO).

(4) All RTOs must know all compromise procedures and codewords prescribed in Chapter 2 (Compromise Procedures) and understand the steps for each procedure.

(5) Safeguard any radio cheat sheets that list call signs and net IDs and account for cheat sheets according to classification (for official use only [FOUO], classified, secret, etc.). Whenever possible, memorize this information.
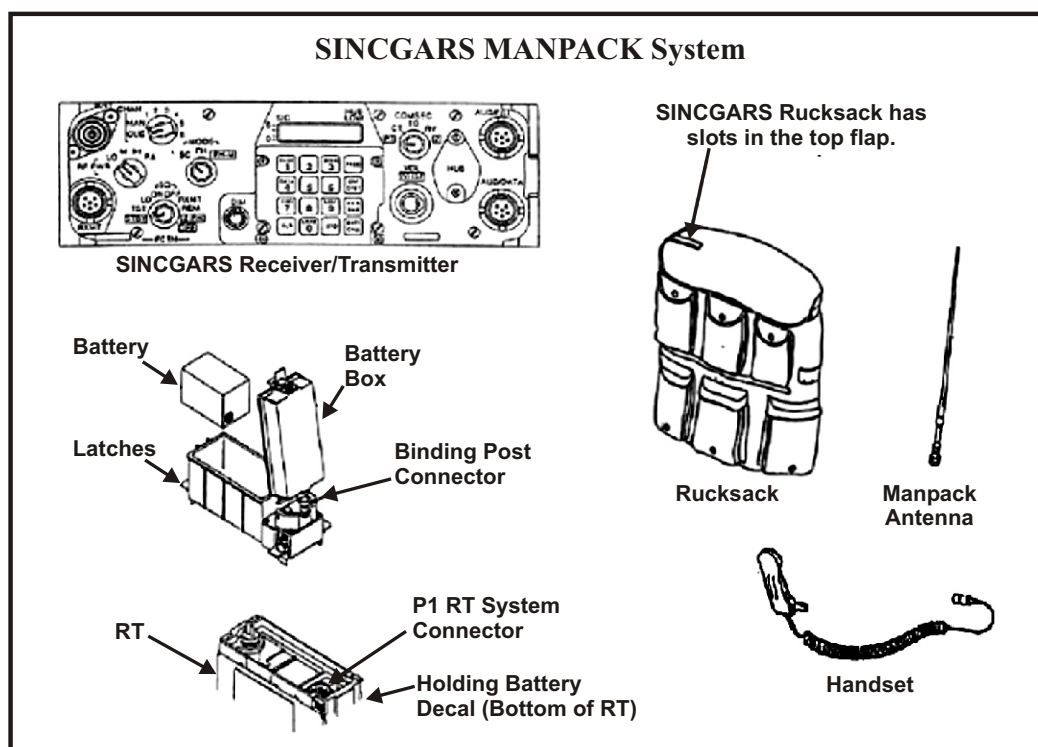
Figure 1

f. Common prowords: Common prowords are those words that are used on a regular basis while conducting radio operations. They are NOT interchangeable as the meanings are specific and clear to the receiver. An example is "Say Again" versus "Repeat." "Say Again" means to repeat the last transmission, while "Repeat" is in reference to fire support to fire the last mission again.

Proword	Meaning
ALL AFTER	I refer to the entire message that follows…
ALL BEFORE	I refer to the entire message that proceeds…
BREAK	I now separate the text from other parts of the message.
CORRECTION	There is an error in this transmission. Transmission will continue with the last word correctly transmitted.
GROUPS	This message contains the number of groups indicated by the numeral following.
I SAY AGAIN	I am repeating transmission or part indicated.
I SPELL	I shall spell the next word phonetically.
MESSAGE	A message that requires recording is about to follow. (Transmitted immediately after the call.) This proword is not used on nets primarily employed for conveying messages. It is intended for use when messages are passed on tactical or reporting net.
MORE TO FOLLOW	Transmitting station has additional traffic for the receiving station.
OUT	This is the end of my transmission to you and no answer is required or expected.
OVER	This is the end of my transmission to you and a response is necessary. Go ahead: transmit.
RADIO CHECK	What is my signal strength and readability, i.e. How do you hear me?
ROGER	I have received your last transmission satisfactorily, radio check is loud and clear.
SAY AGAIN	Repeat all of your last transmission. Followed by identification data means "repeat - (portion indicated)."

THIS IS	This transmission is from the station whose designator immediately follows.
TIME	That which immediately follows is the time or date-time group of the message.
WAIT	I must pause for a few seconds.
WAIT-OUT	I must pause longer than a few seconds.
WILCO	I have received your transmission, understand it, and will comply, to be used only by the addressee. Since the meaning of ROGER is included in that of WILCO, the two prowords are never used together.
WORD AFTER	I refer to the word of the message that follows.
WORD BEFORE	I refer to the word of the message that precedes.

CHAPTER 2

COMPROMISE PROCEDURES

Compromise of sensitive signal information, like death and taxes, is inevitable and always unwelcome. Still the effects of compromise can be minimized through common sense precautions and standardized corrective measures embedded in unit SOPs. The operative word in dealing with compromise is a common understanding of those procedures based on repetitive drills. This chapter offers a possible template for units in establishing compromise procedures. But remember like all such standardized procedures, this SOP is absolutely worthless if not practiced and understood by all in a unit.

1. PURPOSE. This chapter establishes procedures, guidelines, and information on compromise procedures. It is designed to standardize the process for executing compromise procedures. The compromise procedures reflect the steps used by the division and brigade.

2. GENERAL. A compromise is defined as any COMSEC fill device or COMSEC-filled and functioning radio that falls into enemy hands before the operator can zero the device. The procedures listed below detail actions to take to minimize compromises, actions to take if a compromise is imminent, and actions to take after a net becomes compromised.

3. PROCEDURES.

    a. Minimizing compromise

        (1) ANCDs are not distributed below the infantry company headquarters or below antitank platoon headquarters level. Combat multipliers will not deploy with ANCDs and will receive all radio fills from the maneuver element they are supporting. Ensure all CCI is properly accounted for and secured at all times.

        (2) Signal operation instructions (SOI) data is not distributed below battalion level. The new challenge and password is announced over a secure command net daily at 0001 hours (ZULU).

        (3) All command vehicles leaving the tactical operation center (TOC) or headquarters command post secure their ANCDs at that TOC or command post (CP).

        (4) Excess ANCDs within a deployed unit are zeroed.

    b. If compromise is imminent

        (1) If carrying an ANCD, the operator immediately zeroes the ANCD by hitting the red zero key four times, then removes the COMSEC encryption key (CIK) and destroys it. By destroying the ANCD's CIK, the ANCD is inoperable.

        (2) Operators announce on the radio, "ALL STATIONS THIS NET, THIS IS (call sign) WATERGATE, WATERGATE, WATERGATE!" and then immediately zero the COMSEC by turning the function knob to "Z." This message alerts other net members that you have zeroed your radio's COMSEC

because you are being captured. You may still use the radio, but only in a non-secure mode, until you can receive another ANCD fill.

c. After a compromise

(1) If you suspect a net is compromised DO NOT announce over the net, "THIS NET IS COMPROMISED!" Use an alternate secure net to notify your higher headquarters and/or announce over the net, "ALL STATIONS THIS NET, THIS IS (call sign) RED EYE, RED EYE, RED EYE!" This message alerts other net members that you suspect the net is compromised and all classified traffic must come to a halt.

(2) Compromised nets continue to operate on the compromised traffic encryption key (TEK) until the net control station (NCS) directs a change of the TEK or net ID. The directive will only come from the battalion signal officer.

(3) Once the mission allows, the NCS directs a net ID or TEK change using the following codewords:

Net ID

RATTLESNAKE 1: Change to STRIKE NET 1

RATTLESNAKE 2: Change to STRIKE NET 2

RATTLESNAKE 3: Change to original NET ID

An alternate method is to change the Julian date (JD) on the radio net using codewords and leaving the net ID alone. Example:

Julian Date

WARRIOR SPIRIT 1: Change JD + 3

WARRIOR SPIRIT 2: Change JD + 5

WARRIOR SPIRIT 3: Change JD + 7

(4) The NCS directs over-the-air-rekey (OTAR) using either the automatic remote keying (AK) method or manual remote keying (MK) method. The procedures for both tasks are covered in Chapter 4 (NCS Tasks). Once either method is executed, the NCS makes a radio check with all net members. An alternate NCS acts as a "sweeper" and remains on the old net ID or TEK until all members are notified and comply with the change.

(5) Actual STRIKE net IDs are found in the SOI and must be memorized. STRIKE net IDs WILL NOT BE WRITTEN DOWN ANYWHERE.

(6) Once the new net is established, it is clear for classified traffic again.

(7) Codewords used to initiate change of SOI editions are as follows:

SOI

COBRA: Change to B edition TEK/SOI

PYTHON: Change to C edition TEK/SOI

COTTONMOUTH: Change to original TEK/SOI

(8) The battalion has the capability to send new SOI information electronically via the ASIP and ANCD using the broadcast method. The battalion will only use this method as a last resort if other means of disseminating the SOI information proves impossible or impractical. The broadcast method is a very time intensive process because the ANCD will only process data at a 16 kb/s rate and normally allows units to receive one time period at a time. The procedure includes a polling feature which allows the NCS to determine by automatic query if up to 16 net members (designated by special ID numbers) did or did not receive the SOI information sent by broadcast.

(a) The following list assigns polling ID numbers for each net member:

Unit/Section	Polling #
A Co	1
B Co	2
C Co	3
D Co	4
ALOC	5
CBT TRNS	6
Retrans	7

(b) SOI broadcast can handle up to 16 polling numbers. Polling numbers 8-16 will only be assigned when required.

CHAPTER 3

OPERATOR TASKS

The RTO, like any other soldier, has a standard set of tasks to accomplish in training and actual operations. For the practiced RTO, such tasks become almost second nature, especially those tasks that are daily requirements. On occasion even an experienced operator may need to refresh his/her memory when a less practiced requirement pops up. For less experienced RTOs, the need for a standard list of tasks is self-evident. This chapter offers all RTOs, both experienced and novice, a standard list of tasks and a quick guide on how they are accomplished.

PURPOSE. To provide operators of ASIP radios with a quick reference to assist in task performance during training and operations. Using this RTO handbook, the properly trained ASIP operator should be able to perform, without assistance, all operator tasks.

Task 1 (Load SC Frequency into ASIP): The ASIP operator is required to perform this task in preparation for the employment of single channel communications, use of the CUE (key the radio) and ERF (electronic remote fill) methods of late net entry, and for single channel frequency updates. The operator determines the required frequencies from the ANCD or another source. These frequencies are then loaded into the radio by use of the receiver-transmitter (RT) keyboard.

Task 2 (Load COMSEC/FH Data/Sync Time using the ANCD): This task is required in preparation for a Hot Start net opening and, without sync time, for COMSEC/FH data updates. Performance of this task involves the use of an ANCD as a source of COMSEC keys, FH data (hopset, TSK, and net ID), and sync time. By use of the ICOM fill procedure, COMSEC, FH data, and sync time are simultaneously loaded into all six channels of the ASIP radio. Upon completion of the ICOM fill, the radio is fully prepared for secure, frequency hopping communications.

Task 3 (Perform Hot Start Net Opening): This task is required when the net has been down for any reason and is to become operational at a prescribed time. This task involves loading the radio with COMSEC keys, FH data, and sync time by use of the ICOM fill procedure (See Operator Task 2) and calling the NCS in secure frequency hopping mode to request net entry.

Task 4 (Perform Passive Late Net Entry): This task is required when the sync time in your radio becomes more than 4 seconds (plus or minus), but less than one minute, different from net sync time. Passive late net entry enables an individual operator to re-enter the net without action on the part of the NCS or other net operators. This task makes use of a feature built into the ASIP radio and involves two steps: placing the RT in passive late net entry mode and waiting for the radio to adjust its sync time to that of the net. When this method of late net entry does not work, the Hot Start procedure or CUE and ERF method of late net entry should be used.

Task 5 (Receive Net Update ERF from NCS): This task is performed when there is a requirement to change or update some element of FH data and the operational situation makes it impossible or impractical to disseminate the new data by physical connection of ANCD to ANCD. In such cases, the NCS alerts net operators that they are to receive a net update ERF. Operators then change the RT FCTN from SQ ON to LD, remaining on the operational channel. The NCS sends the ERF on the operational channel (not on

MAN as during a Cold Start net opening). Once the net update ERF has been sent, the new data may be made effective immediately or stored for later implementation. (ERF, broadcast, and OTAR communications).

Task 6 (Perform CUE and ERF Late Net Entry (LNE): This task may be required when a radio has been out of the net for some period or has lost its sync time. The preferred action is to try passive late net entry first (See Operator Task 4). This method requires the operator to load CUE and MAN frequencies, "cue" the NCS in plain text (PT), repeat the "cue" until a response is received, switch COMSEC to cipher text (CT) to receive the NCS response, use single channel mode, and receive and store an ERF when it is sent. (A simpler method of re-entering the net when the passive method does not work is the Hot Start procedures (See Operator Task 3).

Task 7 (Change Net ID): This operator task is performed when there is a requirement to communicate with a net or station that is not a part of the operational loadset or loadsets, if more than one radio is being used. Commanders, staff officers, drivers, and others who frequently move about the battlefield should be able to perform this task without assistance. Use of this procedure enables the operator to contact virtually any SINCGARS net within division.

PREPARATION TASK 1: Preparation Settings from MENU

SUBTASKS	ACTION	RESULT
a. Set RT Volume	1. Press MENU 2. Press Digit (1-9) for VOL Setting (0) for Whisper Mode	Press MENU to display VOL level Display reads WHSP if 0 selected
b. Set RTChannel	1. Press MENU (until CHAN) 2. Press Digit (1-6) for Channel desired: (0) for MAN, (7) for CUE	Display reads (1-6), (Q) for CUE, (M) for Manual
c. Set RT Mode	1. Press MENU (until PWR) 2. Press CHG for desired PRW setting	Display reads (LO, M, HI, PA)
d. Set RT Mode	1. Press MENU (until MODE) 2. Press CHG for desired MODE	Display reads (SC, FH, FHM)
e. Set COMSEC	1. Press MENU (until CMSC) 2. Press CHG for desired CMSC setting	Display reads (PT, CT, TD, RV)
f. Set Backlight	1. Place RT in SQ ON 2. Press FREQ/Backlight 3. Press CHG until desired setting	Backlight lights (4 settings Low to High, then OFF)

Default settings are: VOL (5), CHAN (1), PWR (LO), MODE (FH), COMSEC (CT).

OPERATOR TASK 1: Load Single Channel Freq into ASIP

SUBTASKS	ACTION	RESULT
a. Prepare to perform task	1. Obtain proper freq from ANCD	(Load CUE freq only if directed) *
	2. Set RT controls:** COMSEC to PT Mode to SC FCTN to Z-FH, TST, and then to LD CHAN to MAN, CUE, or 1 - 6	RT display shows "GOOD" (or see unit maintainer)
b. Load SC Freq	1. Press: [FREQ]	Display shows [00000] or [30000]
	2. Press: [CLR]	Display shows [_____]
	3. Enter 5-digits SC freq.	Display shows SC [XXXXX]
c. Store SC freq.	Press STO (within 7 sec)	Display blinks once (data is stored)
d. Prepare to communicate	1. Repeat: Step b-1 for each freq needed	(As directed by NCS or unit SOP)
	2. Set: FCTN to SQ ON	Loading of SC freq is complete

*Only NCS and Alt NCS will load a CUE frequency.

**RT settings for ASIP are set via MENU.

OPERATOR TASK 2: Load COMSEC/FH Data/Synch Time using the ANCD*

1. Select: SOI Radio Supervisor
2. Send Receive Database; set up COMSEC Time
3. Send to: **Radio** ANCD Stu Pc
4. Select: **iCom** Nonicom Abn Rcu Haveq
5. Connect to RT AUD/FILL Connector [ ]
6. Set FCTN switch to LD on RT [ ]
7. Do you want to include time? (**Y**/N)
8. Press [LOAD] on RT
9. Transfer in progress/Transfer successful

- *The ICOM fill procedure loads the radio with COMSEC keys, FH data, and synch time for all six ASIP channels.*

- *Select "RCU" to fill an RCU with COMSEC keys. Procedure is the same as that shown for "ICOM".*

- *Throughout this manual, when [ ] appears in the lower right corner of a screen, you must press the down arrow on ANCD to proceed.*

- *Load time as part of ICOM fill during net openings and Hot Start late net entry only, not net updates.*

- *RT settings for ASIP are set via MENU.*

OPERATOR TASK 3: Perform Hot Start Net opening

SUBTASKS	ACTION	RESULT
Load RT with COMSEC/FH, date, and time*	(See Operator Task 2 for ICOM fill)	COMSEC/FH data and time load into all 6 channels of the RT
Enter net	Call NCS in CT, FH and request to enter net	Hot Start net opening is complete*

All ASIP radios will accept time from an ANCD as part of a load set and from a PLGR as a separate loading of time.

OPERATOR TASK 4: Perform Passive Late Net Entry (LNE)

SUBTASKS	ACTION	RESULT
Use passive method of late net entry	(1) Press: FREQ SYNC	 Display shows [F XXX] Display shows [LF XXX]
	(2) Wait for radio traffic to be heard (Do not press PTT)	Display shows [F XXX] ("L" is dropped)
	(3) Call NCS and re-enter net	Passive LNE is complete*

If traffic is not heard for three minutes or more after using passive late net entry method, use the Hot Start procedure or CUE and ERF method. DO NOT KEY THE HANDSET WHILE IN THE PASSIVE LATE NET ENTRY MODE, IT WILL THROW YOUR SYNC TIME OFF.

OPERATOR TASK 5: Receive Net Update ERF from NCS

SUBTASKS	ACTION	RESULT
Prepare to receive net update operational channel	(1) Stay on net	N/A
	(2) Set: FCTN to LD	N/A
Receive and store net update	(1) Standby for NCS to send ERF	N/A
	(2) Note Signal Display Activation	Display shows [HF XXX]
	Press: STO	Display shows [STO]
	Enter: X (1 – 6)*	Display shows [STO X]; blinks
Check communications	1) Set: CHAN to X FCTN to SQ ON	N/A
	(2) Call or respond to NCS	Net update ERF is complete**

NCS will direct the channel for storage of ERF. When update becomes effective, this channel becomes new net operational channel.

**It is assumed that the operator had the same COMSEC key loaded in channels 1 thru 5.*

OPERATOR TASK 6: Perform CUE and ERF Late Net Entry

SUBTASKS	ACTION	RESULT
Use CUE and ERF Method of LNE*	1. Load CUE freq (and MAN if not loaded	See Operator Task 1
	2. Set COMSEC to PT	RT must be in PT to send CUE
	3. Press PTT (4-5 sec)	Press PTT, but do not talk
	4. Set (at once) COMSEC to CT	NCS/Alt NCS will answer in CT
	5. Wait for answer	N/A
	6. Repeat every 15 seconds until NCS answers	CUE goes through only if net is quiet
	7. Request NCS send you an ERF	Go to MAN when NCS directs
	8. Receive & store ERF when sent	See Operator Task 4
	9. Re-enter: net	CUE & ERF LNE is complete

An operator having a loaded ANCD and access to GPS time may elect to re-enter the net by use of the Hot Start procedure.

OPERATOR TASK 7: Change Net ID

SUBTASKS	ACTION	RESULT
Set proper RT controls	Set * FCTN to LD CHAN to 1-6 (channel in which data is stored)	
Enter new net ID in RT	Press: FREQ CLR ID numbers (3) STO	 Display shows: [F XXX] Display shows: [F ___] Display shows: [F XXX] Display blinks; net ID is stored
Resume normal communications	Set FCTN to SQ ON CHAN to 1-6 (as desired)	New net ID is now available for use

The ASIP radio allows a change of all three digits of a net ID with the MODE switch set to FH or FH-M.

CHAPTER 4

NET CONTROL STATION (NCS) TASKS

Without an effective net control station, a radio net will degenerate rapidly into chaos under the stress of training. Actual combat only accelerates that process. It is up to NCS to maintain net procedures and discipline. As in the case with operator tasks, the experienced NCS will know the routine tasks and be able to perform them without hesitation. For non-routine tasks, the standard task list provided here should help. Novice NCS personnel will also find this list and "how to" guide useful.

PURPOSE. To provide net control station (NCS) personnel with quick reference to assist in task performance during training and operations. Using this RTO Handbook, properly trained NCS personnel should be able to perform, without assistance, all NCS tasks.

Task 1 (Conduct Hot Start Net Opening): This task represents a basic NCS requirement, to open the SINCGARS secure, frequency hopping net. During use of the Hot Start net opening procedure, NCS responsibilities are primarily supervisory. Each operator loads the radio with COMSEC keys, FH data, and sync time in preparation for the net opening. Upon completing the ICOM fill, the operator merely calls the NCS in secure, FH mode and requests permission to enter the net. NCS requirements are limited to ensuring that operations are provided the required data for net opening and respond to operator requests for net entry.

Task 2 (Respond to CUE Calls): An important feature of the SINCGARS radio is its ability to be contacted by a non-frequency hopping radio, or an HF radio lacking data or sync time, through a process known as "CUEing." To CUE, set the calling radio on the prescribed CUE frequency, press the push-to-talk switch, and wait for a response. This action causes a "CUE" message to appear in the RT display of the NCS and alternate NCS radio.

Task 3 (Transmit Updated FH Data Via Net Update ERF): This task enables the NCS to electronically transmit new FH data to net operators when distribution by physical connection of ANCD to ANCD is impossible or impractical. This procedure may be used to update (change) hopsets, TSKs, net Ids, and sync time. The task involves alerting net operators, sending the ERF using the net operational channel, confirming receipt of the ERF, and making a communications check when the changed FH data is put into effect.

Task 4 (Transfer SOI Information Using Broadcast Mode): This procedure enables an NCS to send SOI information electronically to net members wherever updating by physical connection of ANCD to ANCD proves to be impossible or impractical. The Broadcast mode requires approximately two minutes to transmit one time period of a battalion SOI extract. The procedure includes a polling feature that allows the NCS to determine by automatic query if up to 16 net operators (designated by special ID numbers) did or did not receive the SOI information sent by Broadcast mode.

Task 5 (Send TEK to other NCSs Using MK Method of OTAR): This procedure allows an NCS to transfer a TEK (not a KEK) electronically, over-the-air-rekey (OTAR) to other NCSs. This capability is useful when the tactical situation or terrain makes it impossible or impractical to pass new TEK by physical connection of ANCD to ANCD.

Receiving NCSs store the new TEK in their ANCDs. The new TEK can then be passed to operators by physical transfer. NCS Tasks 5 and 7 are performed together by Source and Target NCSs, respectively.

Task 6 (Receive and Store TEK Sent by MK Method OTAR): This task is performed by target NCSs when a source NCS electronically transmits a TEK using the MK method of OTAR. This procedure allows target NCSs to store the new TEK in their ANCDs for physical distribution to net operators when required. The sending NCS directs receiving NCSs to perform this task as an integral part of the MK OTAR process. This task supplements NCS Task 5 above.

Task 7 (Send TEK to Net Operators Using the AK Method of OTAR): This procedure enables an NCS to transfer electronically a TEK (not a KEK) directly from the NCS ANCD to net member radios. In the AK method, the TEK transferred to net member radios automatically, and instantaneously replaces the TEK being used. Also, the KEK in the net member radio is automatically updated (changed) during the AK procedure. After sending a TEK by AK OTAR, the source NCS must load the new TEK. While the AK method of OTAR requires no action on the part of the receiving net members, it is quite demanding of the source NCS.

NCS TASK 1: Conduct Hot Start Net Opening.

SUBTASKS	ACTION	RESULT
Load NCS RT with COMSEC/FH data and time	See Operator Task 2 or ICOM fill procedure	COMSEC/FH data and time are loaded into all 6 RT channels*
Load net RTs with COMSEC/FH data and time	Direct net members to perform Operator Task 3 (Hot Start)	Net member RTs are prepared to enter FH, CT net upon request
Admit members to net	Respond to call in FH, CT mode	

ANCD converts current date to two-digit Julian date.

NCS TASK 2: Respond to CUE calls.

SUBTASKS	ACTION	RESULT
Note "CUE" in RT display	1. Switch to CUE channel	Caller CUEs in PT, listens in CT
	3. Call CUE caller on CUE freq, in CT	CUE caller gets response
	3. Direct CUEer go to MAN/CT	Must have MAN FREQ loaded in MAN CHAN
	4. Determine CUE caller's need	
	5. Provide ERF if appropriate (NCS Task 3)	If CUEer wishes to enter net
	6. Return to operational channel	
	7. Displace if enemy has DF capability	CUE & MAN freq. can be DF'd

NCS TASK 3: Transmit Updated FH Data Via Net Update ERF.

SUBTASKS	ACTION	RESULT
Prepare to send net update ERF	1. Obtain updated FH Data; and effective time	Obtain from SIGO, ANCD, or SOI as appropriate
	2. Load new FH	Perform ICOM fill or data into NCS radio change ESET in one channel
Prepare net operations for net update ERF	1. Alert net, update ERF is to be sent	Wait until the net is clear of operational traffic
	2. Inform operators what channel to store ERF	Facilitates channel change when data is to store ERF effective
	3. Advise operators when new FH data is effective	May be immediate or at later specified time
Send net update ERF Press for 3 sec.	1. Set FTCN to LD	If NCS RT is not in F-M, set it there for sending ERF
	2. Press [LOAD] on RT	RT display shows [HLD]
	3. Enter channel where ERF date is stored	RT display shows [HFXXX], blinks, and beeps
	4. Press [ERF] on RT keypad	RT display shows [SEND], beeps, and shows [HFXXX]
	5. Change FCTN from LD back to SQ ON	N/A

NCS TASK 4: Transfer SOI information using Broadcast Mode.

SUBTASKS	ACTION	RESULT
Prepare NCS radio to send SOI by Broadcast	1. Ensure RT is set to SQ ON, CT, and FH-M	N/A (Normal NCS RT settings)
	2. Change DATA from OFF to 1200	Broadcast (uses date mode set to 1200 bps)
Prepare ANCD for SOI data Broadcast # This screen will appear only in QREF file is stored in ANCD	1. Turn ANCD on	Select: **SOI** Radio Supervisor
	2. Enter SOI	qRef Group Net sufX Pyro Tmpd **Set** C/s Find Memo
	3. Enter SET	Select: Choose **Send** Receive
	4. Enter SEND	Scroll (/) & press ENTR to Select SOI set [ ]
	5. Press down arrow	SOI Set: (name) Edn: (name)
	6. Press (/) to display; and press ENTR to select	Do you want to transfer QREF? # (Y/**N**)
	7. Respond NO	Do you want to specify groups to send? (**Y**/N)
	8. Respond YES	Scroll (/) & press ENTR to select groups [ ]
	9. Press (/) to display; and press ENTR	1 group selected —keep selecting (Y/**N**)
	10. Enter YES to continue; NO to quit	Do you want to specify a time pd to send? (**Y**/N)
	11. Respond YES	Enter Time Pd (# - #) = ># #
	12. Enter Time Period; and press ENTR	Include Suffix & Smoke/Pyro data? (**Y**/N)

NCS TASK 4: Transfer SOI information using Broadcast Mode. (Cont.)		
	13. Respond YES to include; respond NO to exclude	Send to: Ancd Pc Broadcast Stu
	14. Enter BROADCAST	Enter ID for each polled ANCD and 0 when done* [ ]
	15. Press down arrow	Polled : 1234567890123456 = > # #
	16. Enter IDs for polling (see example); press ENTR	Polled: 12*456**901*34*6= > # #
	17. Enter "0" to quit	Do you want to save this SOI set? (**Y**/N)
	18. Respond YES (to save SOI data)	New SOI set name: = > ? ? ? ? ? ? ? ? ? ?
	19. Enter SOI set name and press ENTR	Connect ANCD to RT AUD/DATA [ ]
	20. Press down arrow	Press **SEND** to send(**WAIT**)
Prepare net operator for receipt of SOI Broadcast	1. Say: Standby for Broadcast follow my instruction/ACK	Alerts net members to an immediate requirement
	2. After ACK, say Go to SQ ON, FH, CT, DATA-1200	Ensures net radios and ANCDs are properly prepared
	3. Say: Turn ANCD ON	Select: **SOI** Radio Supervisor
	4. Say: Enter SOI	qRef Group Net sufX Pyro Tmpd **Set** C/s Find Memo
	5. Say: Enter SET	Select: Choose Send **Receive**
	6. Say: Enter RECEIVE	Receive from: Ancd Pc **Broadcast** Stu

NCS TASK 4: Transfer SOI information using Broadcast Mode. (Cont.)		
	7. Say: Enter BROADCAST	Enter broadcast ID (1 – 16): = > # #
	8. Say: Enter SOP broadcast ID and press ENTR	Broadcast ID set to X Polling: ON/OFF [ ]
	9. Say: Press down arrow	Connect ANCD to RT AUD/DATA [ ]
	10. Say: Connect ANCD to RT AUD/DATA and handset to AUD/FILL*	Emphasize AUD/DATA for ANCD connection
	11. Say: When ready, press down arrow and ACK	Press RCV to receive (**WAIT**)
Send SOI info by Broadcast Mode	1. Say: Standby; broadcast will now be sent; press RCV **now**; send **now**	Alerts operators that broadcast is about to be sent; coordinates pressing of SEND and RCV
	2. Press [SEND] on NCS ANCD	Processing. Please wait.
		Sending of SOI data completed

ANCD connects to bottom fill port and handset is connected to top fill port

NCS TASK 5: Send TEK to other NCSs Using MK Method of OTAR.

SUBTASKS	ACTION	RESULT
Prepare Source NCS radio to send MK OTAR	1. Set FCTN to SQ ON	N/A
	2. Set MODE to FH-M	N/A
	3. Set COMSEC to CT	N/A
	4. Set DATA to OFF	N/A
Prepare Source ANCD to send MK OTAR	1. Turn ANCD on	Select: SOI **Radio** Supervisor
	2. Enter RADIO	Send Receive Database Setup **Comsec** Time
	3. Enter COMSEC	Vg Ld Rv Ak **Mk** vU
	4. Enter MK	Select key Quit (name/number)
	5. Press PgDn to display; and ENTR to select	Connect to RT and press [SEND] (WAIT)
	6. Connect Source ANCD to RT using fill cable	N/A
Prepare Target NCSs to receive MK OTAR	1. Say: Standby for MK OTAR Acknowledge	Target NCSs are alerted; CT contact is confirmed
	2. After ACK, say: Make NCS Task 6 preparations; ACK when ready to receive MK OTAR	Readies Target NCSs to receive MK OTAR
	3. After ACK, say: OTAR will now be sent; after receipt of OTAR return to chan 1	Provides final coordination guidance for MK OTAR

NCS TASK 5: Send TEK to other NCSs Using MK Method of OTAR. (Cont.)

Send TEK by MK OTAR	1. Say: Go to chan 6 now; press [RCV] **now**	N/A
	2. Go to chan 6 and press [SEND] **now**	Transfer in Progress/1 Keys Transferred
	3. Return to chan 1	Prepares Source NCS radio for comm with Target NCSs
	4. Wait 30 sec. after sending; say: OTAR completed; TEK ID is XXXXXXXX; effective at (DTG), ACK	Informs Target NCSs of TEK ID and effective time; advises Source NCS which stations did and did not receive OTAR

NCS TASK 6: Receive and Store TEK Sent by MK Method of OTAR.

SUBTASKS	ACTION	RESULT
Prepare radio for receipt of MK OTAR	1. Set FCTN to SQ ON	N/A
	2. Set COMSEC to CT	N/A
	3. Set DATA to OFF	N/A
Prepare Source ANCD to send MK OTAR	1. Turn ANCD on	Select: SOI **Radio** Supervisor
	2. Enter RADIO	Send Receive Database Setup **Comsec** Time
	3. Enter COMSEC	Vg Ld **Rv** Ak Mk vU
	4. Enter RV	Connect to RT press [RCV] (WAIT)
	5. Connect ANCD to RT AUD/FILL port	N/A
	6. ACK to Source NCS when ready to receive OTAR	(Responds to Source NCS's MK OTAR instructions)

NCS TASK 7: Send TEK to Net Operators using AK Method of OTAR.

SUBTASKS	ACTION	RESULT
Prepare Source NCS radio to send AK OTAR	1. Set FCTN to LD	N/A
	2. Set MODE to FH-M	N/A
	3. Set COMSEC to CT	N/A
	4. Set DATA to OFF	N/A
Prepare Source ANCD to send MK OTAR	1. Turn ANCD on	Select: SOI **Radio** Supervisor
	2. Enter RADIO	Send Receive Database Setup **Comsec** Time
	3. Enter COMSEC	Vg Ld Rv **Ak** Mk vU
	4. Enter AK	Select key Quit (name/number)
	5. Press PgUp/PgDn to KEK desired; press ENTR	Select key Quit (name/number) **KEK**
	6. Enter QUIT	Select key Quit (name/number)
	7. Press PgDn to TEK desired; press enter	Connect to RT and press [SEND] (Wait)
Send AK OTAR	1. Say: Standby for MK OTAR Acknowledge	Target operatiors are alerted CT contact is confirmed
	2. Press [SEND] on ANCD	Transfer in progress/1 Keys Transferred
		Vg **Ld** Rv Ak Mk vU
Load TEK sent by AK OTAR in NCS radio	1. Enter LD	Select: **Tek** Kek
	2. Enter TEK	Select key Quit (name/number) **XMT**

NCS TASK 7: Send TEK to Net Operators using AK Method of OTAR. (Cont.)		
	3. Press PgDn to display and ENTR to select	Connect ANCD to RT
	4. Enter Quit	Press [LOAD] on RT
	5. Connect ANCD to RT AUD/FILL; press [ ]	
	6. Press [LOAD]/[STO]/and [X]	1 Keys Transferred
		Vg Ld Rv Ak Mk **vU**

CHAPTER 5

PRECISION LIGHTWEIGHT GLOBAL POSITIONING SYSTEM RECEIVER (PLGR) TASKS

The ability for soldiers to accurately determine their location has always been a major problem. The Global Positioning System (GPS) has revolutionized land navigation. Ideally, soldiers should be able to determine their position accurately to within 10 meters. But before such a standard can be achieved, soldiers, and particularly RTOs, must be proficient in the use of GPS.

1. **DEFINITION:** The GPS is a satellite-based, radio navigational system. It consists of a constellation with 24 active satellites that interface with a ground-, air-, or sea-based receiver. Each satellite transmits data that enables the GPS receiver to provide precise position and time to the user. The GPS receivers come in several configurations, hand-held, vehicular-mounted, aircraft-mounted, and water craft-mounted.

2. **OPERATION:** The GPS is based on satellite ranging. It calculates the user's position on earth by measuring the distance from a group of satellites in space to the user's location. For accurate three-dimensional data, the receiver must track four or more satellites. Most GPS receivers provide the user with the number of satellites that it is tracking, and whether or not the signals are good. Some receivers can be manually switched to track only three satellites if the user knows his altitude. This method provides the user with accurate data much faster than that provided by tracking four or more satellites. Each type receiver has a number of mode keys that have a variety of functions. To better understand how the GPS receiver operates, refer to the operators' manual (**TB 11-5825-291-10-2,** *Soldier's Guide for the PLGR (Precision Lightweight GPS Receiver)*

3. **CAPABILITIES:** The GPS provides worldwide, 24-hour, all weather, day or night coverage when the satellite constellation is complete. The GPS can locate the position of the user accurately to within 21 meters—95 percent of the time. However, the GPS has been known to accurately locate the position of the user within 8 to 10 meters. It can determine the distance and direction from the user to a programmed location or the distance between two programmed locations called waypoints. It provides exact date and time for the time zone in which the user is located. The data supplied by the GPS is helpful for missions that require soldiers to know their exact location including:

- Sighting

- Surveying

- Tactical reconnaissance

- Sensor emplacement.

- Artillery forward observing

- Close air support

- General navigation

- Mechanized maneuvers

- Engineer surveying

- Amphibious operations

- Parachute operations

- Signal intelligence

- Electronic warfare

- Ground-based forward air control

This data is displayed on the AN/PSN-11 and is also available from a serial data port.

4. **LIMITATIONS:** A constellation of 24 satellites broadcasts precise signals for use by navigational sets. The satellites are arranged in six rings that orbit the earth twice each day. The GPS navigational signals are similar to light rays, so anything that blocks the light will reduce or block the effectiveness of the signals. The more unobstructed the view of the sky, the better the system performs.

5. **COMPATIBILITY:** All GPS receivers have primarily the same function, but the input and control keys vary between the different receivers. The GPS can reference and format position coordinates in any of the following systems:

- Degrees, minutes, seconds (DMS): Latitude/longitude-based system with position expressed in degrees, minutes, and seconds.

- Degrees, minutes (DM): Latitude/longitude-based system with position expressed in degrees and minutes.

- Universal traverse mercator (UTM): Grid zone system with the northing and easting position expressed in meters.

- Military grid reference system (MGRS): Grid zone/grid square system with coordinates of position expressed in meters.

The following is a list of land navigation subjects from other sections in which the GPS can be used to assist soldiers in navigating and map reading:

- Grid coordinates. GPS makes determining a 4-, 6-, 8-, and 10-digit grid coordinate of a location easy. On most GPS receivers, the position mode will give the user a 10-digit grid coordinate to their present location.

- Distance and direction. The mode for determining distance and direction depends on the GPS receiver being used. One thing the different types of receivers have in common is that to determine direction and distance, the user must enter at least one-way point (WPT). When the receiver measures direction and distance from the

present location or from waypoint to waypoint, the distance is measured in straight line only. Distance can be measured in miles, yards, feet, kilometers, meters, or nautical knots or feet. For determining direction, the user can select degrees, mils, or rads. Depending on the receiver, the user can select true north, magnetic north, or grid north.

- Navigational equipment and methods. Unlike the compass, the GPS receiver when set on navigation mode (NAV) will guide the user to a selected way point by actually telling the user how far left or right the user has drifted from the desired azimuth. With this option, the user can take the most expeditious route possible, moving around an obstacle or area without replotting and reorienting.

- Mounted land navigation. While in the NAV mode, the user can navigate to a way point using steering and distance, and the receiver will tell the user how far he has yet to travel, and at the current speed, how long it will take to get to the way point.

- Navigation in different types of terrain. The GPS is capable of being used in any terrain; especially more open terrain like the desert.

- Unit sustainment. The GPS can be used to read coordinates to quickly and accurately establish and verify land navigation courses.

6. **CONCEPT OF OPERATION**: The precision lightweight global positioning system receiver (PLGR) is a highly accurate satellite signal navigation set (referred to as AN/PSN-11).

The AN/PSN-11 is designed for battlefield use anywhere in the world. It is sealed watertight for all weather day or night operation. The AN/PSN-11 is held in the left hand and operated with the thumb of the left hand. Capability is included for installation in ground facilities and air, sea, and land vehicles. The AN/PSN-11 is operated stand-alone using prime battery power and integral antenna. It can be used with an external power source and external antenna.

The AN/PSN-11 provides the user with position coordinates, time, and navigation information if no obstructions block the line-of-sight satellite signal from reaching the antenna. Valid crypto keys are used to protect the AN/PSN-11 from intentionally degraded satellite signals.

Many data fields, such as elevation, display units of information. The format of the units can be changed to the most familiar format.

Map coordinates are entered as a waypoint. When a waypoint is selected as a destination, the AN/PSN-11 provides steering indications, azimuth, and range information to the destination. A desired course to a waypoint is entered. Offset distance from this course line is shown.

Up to 999 waypoints can be entered, stored, and selected as a destination. A route is defined for navigation either start-to-end or end-to-start. The route consists of up to nine legs (10 way points) linked together.

7. **CHARACTERISTICS:** The AN/PSN-11 is less than 9.5 inches long, 4.1 inches wide, and 2.6 inches deep. It weighs 2.75 pounds with all batteries in place. The small size and light weight make the set easy to carry and use. The durable plastic case is sealed for all-weather use. The

AN/PSN-11 features make it easy to use. (These features are highlighted in the physical description.)
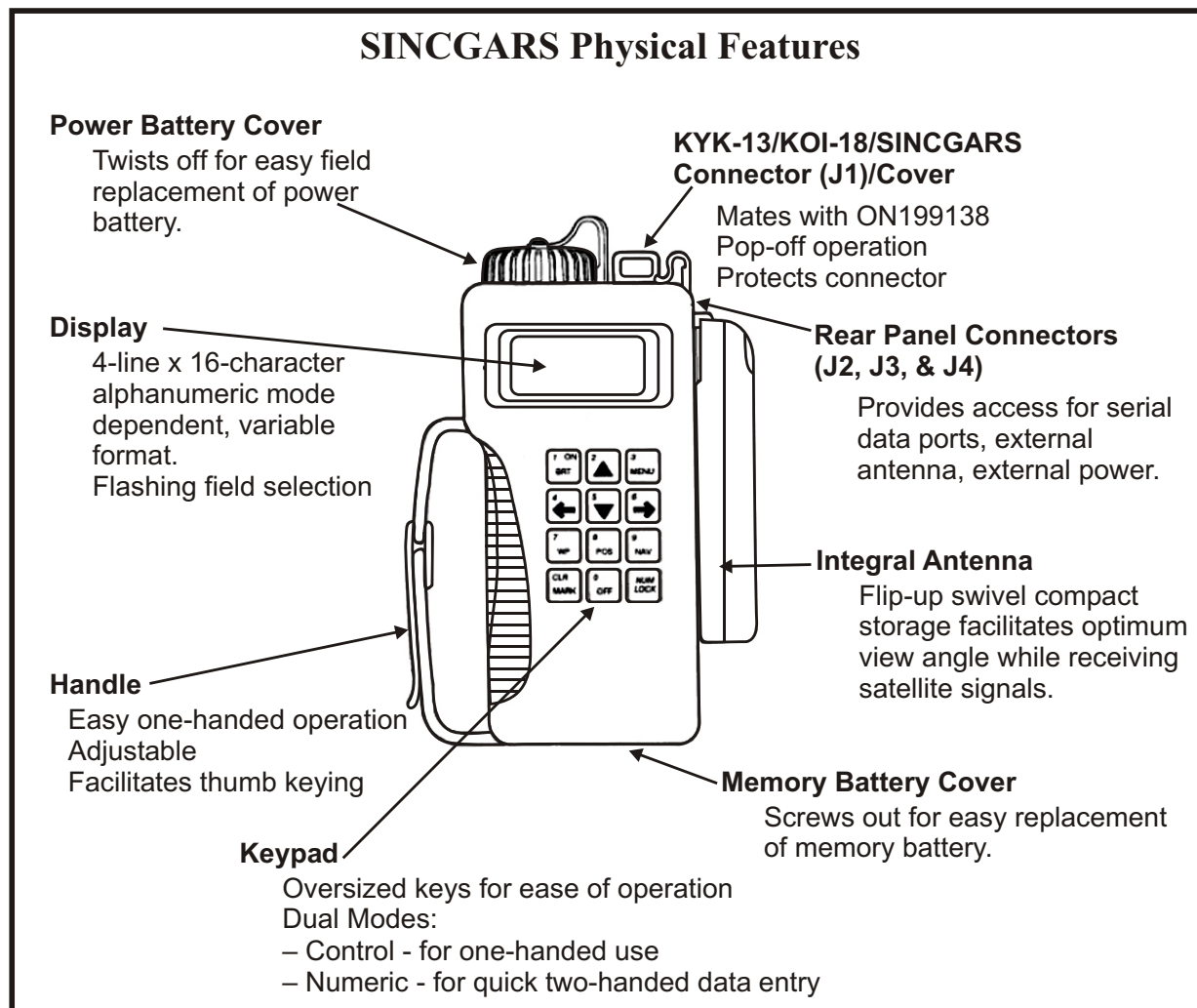
Figure 1

8. **SETUP AND CONTROL:** Setting up the operation parameters of the PLGR is critical. This section describes the display, procedures, and principles used in setting the AN/PSN-11 displays to suit the needs of the user. This display consists of seven pages that allows the user to control the following parameters:

- Operating mode

- Type of satellites to use

- Coordinate system

- Units

- Magnetic variation

- Display customization

- Navigation display mode

- Elevation hold mode

- Time and error formats

- Datum

- Automatic off timer

- Datum port configuration

- AutoMark mode

To set the PLGR up for continuous operation:

Turn the PLGR **ON**. Once it has completed its built-in-test (BIT) press the MENU key and move the cursor to **SETUP**. Activate the SETUP function.

<move>	select
STATUS	**SETUP**
INIT	TEST
HELP	<MORE> P

Figure 2. Setup

The first screen allows the operator to set the operating mode and SV-Type. Scroll through the operating modes and select CONT and mixed for the SV-Type.

SETUP MODE:	**CONT**
Continuous	POS
and VEL	update
SV-TYPE:	**mixed P**

Figure 3. Operating mode and SV-type

The second screen allows the operator to setup the units. Scroll through the available coordinates and select MGRS-New and Metric. For the elevation (Elev) select meter and MSL and for the angle (ANGL) select degrees (Deg) and magnetic (Mag).

```
SETUP              UNITS
MGRS-New           Metric
Elev: meter          MSL
ANGL: Deg          Mag   P
```

Figure 4. Set up the units

The third screen should be set for the MAGVAR (Magnetic variation or GM angle for your area). The operator can select calculate (Calc) the degree or manually enter degrees as an easterly or westerly GM angle; for example, E00Figure 6. Magnetic variation or GM angle setup.4.0 for the Fort Polk map sheet.

```
SETUP              MAGVAR
TYPE:             Calc   deg
WWm                1995
                     P
```

Figure 5. Magnetic variation or GM angle setup

The fourth screen of setup allows the operator to set the elevation hold (ELHold), TIME, and error (ER). The operator should set the ELHold to automatic. As for time, the operator needs to know from their present location how many hours they are ahead of or behind Greenwich Mean Time. For example, during daylight savings time, Fort Polk, LA. is Loc=Z-0500. To set the ERR, the operator selects -+m to let him know in meters how accurate the PLGR is operating.

```
SETUP
ELHold:             automatic
TIME:             Loc=Z-0400
ERR:=+-m              P
```

Figure 6. Set elevation, time, hold, and error

The fifth screen of setup allows the operator to set the PLGR datum (DTM) to their area of operation and to set the Automatic Off Timer. The PLGR has fifty-two map datum sets available. The operator should set the PLGR datum to their area of operation. For example, if your map datum is WGS-84, the operator sets the PLGR to WGS-84. If the map is 1927 North America datum, the operator sets the datum to NAS-C. The automatic timer off is used to turn the PLGR off after a prescribed time once it has acquired a fixed position. The operator should set this mode to off.

```
SETUP  DTM:            NAS-C
NA27CONUS /Clk66
AUTOMATIC              OFF
TIMER: off             P
```

Figure 7. Set the PLGR datum

The sixth screen in setup is the in/out (I/O) port screen. This page allows the operator to control serial communications, HAVEQUICK and 1PPS options. Select Standard unless otherwise directed and select Off for HAVEQUICK and 1PPS.

```
SETUP                 I/O
SERIAL:               Standard
HAVEQUICK:            Off
1PPS: Off             P
```

Figure 8. In/out port screen

The seventh screen is setup AUTOMARK. This feature allows the operator to have the PLGR periodically wake-up, acquire a position fix, store the position as a waypoint, or return to the mode of operation it was previously in. The operator should set this mode to off. The remaining pages for SETUP are for advanced GPS users.

```
SETUP                 AUTOMARK
MODE: off             WP002
26-04-01              0935L
REPEAT     00h00m     P
```

Figure 9. AUTOMARK setup

Once the PLGR is set up, the operator can obtain a position. This procedure is accomplished by activating the position (POS) key. The position displayed is "old" information until the receiver collects and calculates satellite data and displays the current position. The receiver must be tracking three satellites to obtain a two-dimensional fix position and four or more satellites for a three-dimensional fix position. The third dimension is elevation.

9. **WAYPOINT OPERATIONS:** A waypoint is the location of a point on a desired course described by coordinates or a physical location. A normal mission consists of a series of waypoints. The waypoints available on the AN/PSN-11 are 999 (numbered 01 through 999).

This paragraph describes the AN/PSN-11 waypoint displays and waypoint operations. The waypoint display pages are used to perform the following operations:

- Enter, edit, or review waypoints

- Copy waypoints

- Determine the distance between waypoints

- Calculate a new waypoint

- Clear waypoints

- Define a mission route

To enter a waypoint, the operator needs to press the waypoint (WP) key. When the waypoint menu appears, the ENTER function flashes. The operator presses the down arrow key to activate this field. Now the operator enters a waypoint name, grid zone designator, 100,000-meter grid square identifier, 10-digit grid coordinate, and elevation.

WP	<move>	sel
ENTER	EDIT	COPY
SR-CALC	RNG	CALC
DIST	CLEAR	ROUTE

Figure 10. Enter a waypoint

To enter a waypoint name, the operator presses the right arrow key until the first letter of the word UNUSED (WP#) is flashing. Scroll up or down through the alphabet changing the letter U to whatever is desired. For example, if the operator wanted to name their waypoint NORTH STAR, the operator scrolls down the alphabet until the letter U is changed to the letter N. The operator repeats this process for the remaining letters.

WP002		UNUSED002
B		MGRS-New
AN	00000e	00000n
No EL		CLR P

Figure 11. Unused

WP002		**NORTHSTAR**
10T		MGRS-New
EG	**13130e**	**95750n**
No EL		CLR **N**

Figure 12. Change a name

Second line, the operator enters the grid zone designator for their area of operation. For example, the Fort Polk area falls in the 15R zone.

Third line, the operator must enter a 10-digit grid coordinate with its 100,000-meter grid square identifier. For example, if the waypoint location is Carnis Village, Fort Polk map sheet, the 100,000-meter grid square identifier is WQ. Then, the operator plots the grid coordinates on the map and enters it into the PLGR.

Note: Operator plots 8-digit grid coordinates, however a 10-digit coordinate is entered. Therefore, the 5th and 10th digit entered is a zero (0).

For the fourth line, if the elevation of the waypoint is known, the operator can enter it. If the elevation is not known the operator can just leave the data as zero or No EL. The operator moves the cursor until the Up and Down arrow symbol appears before the letter P or N in bottom right corner. When activating the down arrow key the operator stores the waypoint into the PLGR's memory. The PLGR notifies the operator that the waypoint has been stored.

Note: When entering numbers, the number lock (NUM LOCK) can be activated. The letter N appears in the bottom right corner allowing the operator to use the numbers on the keypad rather then scrolling up/down.

10. **NAVIGATION:** Navigation (NAV) is using the AN/PSN-11 to find your present position, relative to other points. The AN/PSN-11 provides azimuth, range, and steering information in a variety of formats. There are four navigation display modes that may be accessed and selected. The navigation display mode selected determines the type of information shown on the navigation displays. These navigation displays give the user the most useful information for a certain mission profile: SLOW, 2D FAST, 3D FAST, or CUSTOM.

In SLOW NAV mode, the AN/PSN-11 performs two-dimensional (2D) NAV. Slow NAV mode is used for land or sea, when the user cannot maintain the minimum speed necessary (about 1.5 kmph).

In 2D FAST NAV mode, the AN/PSN-11 performs two-dimensional (2D) NAV. 2D fast NAV mode is used for land or sea, when the user can maintain the minimum speed necessary for GPS to compute navigation parameters based on velocity.

In 3D FAST NAV mode, the AN/PSN-11 performs three-dimensional (3D) NAV. 3D fast NAV mode has an APPROACH sub-mode. 3D fast NAV mode is used for air, when the user can travel in three dimensions and can maintain the minimum speed necessary for GPS to compute navigation parameters based on velocity.

In CUSTOM NAV mode, the AN/PSN-11 displays users' navigational pages as desired. It can be set up to support the individual user's performance or mission requirements. The following custom display modes are available:

- Direct

- Course to

- Course from

- Route

- Approach

To navigate with the PLGR on land in a dead-reckoning method, the PLGR NAV mode is accomplished as follows:

The operator presses the NAV key activating the NAV function. The first screen that appears is the NAV mode. For example, SLOW, 2D FAST, 3D FAST, CUSTOM, DIRECT, CRS (course) TO, and CRS (course) FROM.

```
2D        FAST        DIRECT
WP002   NORTHSTAR002
                              P
```

Figure 13. Navigation mode

The operator selects the **2D FAST** and **DIRECT.** The second line is the waypoint to be navigated. (To choose the desired waypoint, scroll through the waypoints that are stored.)

To see the azimuth that the navigator should be traveling, go to the next page by pressing the down arrow key. This page tells the navigator their current azimuth (TRK=tracking) and the correct azimuth (AZ). The fourth line tells the navigator steering (STR), a direction (<>), and the number of degrees the navigator needs to move to travel on the correct azimuth.

```
NORTHSTAR002              +-30m
TRK 305.3M
AZ    311.3M
STR >6                     P
```

Figure 14. Azimuth

The third screen tells the navigator the range or distance to their waypoint and how much time (TTG2) it will take them to get to their waypoint. This page also lets the navigator know what the elevation difference is from their present location to the waypoint and by how much they will miss their waypoint (MMD).

RNG	3598.55km	
TTG2AN	0036:05	
ELD	-00050m	
MMD2	30m	P

Figure 15. Range or distance

CHAPTER 6

AUTOMATED NET CONTROL DEVICE (ANCD) TASKS

The ANCD system replaced the paper version SOI, the KYK 13, and MX 18290 Hopset Device.

The ANCD was designed with the capability of loading the SINCGARS radio with COMSEC and frequency hopping data without the use of the KYK 13 and the MX 18290 (Hopset Device). The ANCD also provides the operators with frequencies, call signs, suffixes, expanders, and other SOI information, except Authentication Table. This chapter provides the knowledge RTOs need to transfer COMSEC/FH data and SOI information from ANCD to ANCD, extract SOI information from an ANCD, and load SINCGARS radio using Mode 2 fill. The chapter also describes how to store data sent by over the air rekeying (OTAR) and Broadcast mode

Characteristics of the ANCD

      1. Size: 6.3" x 4.4" x 2.0"

      2. Weight: Approximately 2 pounds with batteries

      3. Power Source: 3 3 volt lithium batteries

      4. Purpose: Used to transfer and store COMSEC keys, frequency hop (FH) data and display, transfer and store SOI information.

      5. The ANCD eliminates the use of the KYK 13, KYX 15, KOI 18, MX 18290, and the paper SOI.

Main Menu

      1. The main menu consists of 3 areas:

            a. SOI pertains to SOI Information.

            b. Radio pertains to COMSEC keys/FH data to be loaded into the radio.

            c. Supervisor pertains to areas performed by the supervisor "only."

      2. Selection of main menu areas:

            a. Use the ARROW key function by pressing either the left or right arrow keys then press the ENTER key.

            b. Press the corresponding capital letter on the keyboard to take you directly to a specific topic. For example:

            S - for signal operating instructions

            R - for radio

            U - for supervisor

Transfer COMSEC keys/FH data (controlled PE)

1. To transfer COMSEC keys/FH data, one ANCD must be selected as the SOURCE ANCD and the other as the TARGET ANCD.

2. Turn on ANCD.

3. Enter RADIO.

4. Sub menu will display:

a. SEND used to send COMSEC keys/FH data to a radio, ANCD, STU (secure telephone unit), and PC (personal computer).

b. RECEIVE used to receive COMSEC keys/FH data from ANCD, CFD (COMSEC fill device), STU, PC, and MX (ECCM fill device MX 18290)

c. DATABASE used to display, modify, remove, copy, and build COMSEC keys/FH data.

d. SETUP used to set up ANCD to operate either on ICOM or NONICOM.

e. COMSEC used to generate variables (VG), load (LD), receive variables (RV), automatic key (AK), manual key (MK), and variable update (VU).

f. TIME used to set the Julian date and the hours and minutes (24 hour) manually into the radio.

To transfer COMSEC keys/FH data one ANCD must be set up as the SOURCE ANCD.

1. Press the ON/OFF key to turn on the ANCD of the Source ANCD.

2. Select RADIO: Depress the cursor on the keyboard then press ENTER or press "R" for radio.

3. Enter SEND.

4. Select ANCD and press ENTER.

5. Select DATABASE and press ENTER.

6. ANCD will ask: Do you want to include TIME? Y/N? ENTER "Y" for yes.

7. Connect both ANCDs with fill cable (W4) and press SEND on the ANCD keyboard.

Note: The receiving ANCD must press RECEIVE on the ANCD Keyboard within 20 seconds.

8. Display screen on the sending ANCD will show preparing to transfer time and then both ANCDs will show TRANSFER IN PROGRESS. Once the transfer has been completed, the display screen will show TRANSFER SUCCESSFUL.

To receive COMSEC/HF data one ANCD must be set up as the TARGET ANCD.

1. Turn on the ANCD.

2. Select RADIO and press ENTER.

3. Select RECEIVE and press ENTER.

4. Receive From: Select ANCD and press ENTER.

5. Select DATABASE and press ENTER.

6. Do you want to delete FH and COMSEC data? YES must be selected in order to proceed.

7. Connect to ANCD and press receive (RCV).

Notes: DO NOT press RCV until the SOURCE ANCD is ready.

Receive must be pressed within 20 seconds after SOURCE ANCD sends data.

8. The TARGET ANCD display screen will show: TRANSFER IN PROGRESS. Once transfer is complete, display screen will show: TRANSFER SUCCESSFUL.

To perform before operations preventive maintenance checks and services (PMCS) on SINCGARS radio and load the radio with required data the following steps must be accomplished in the exact order:

1. Obtain the required single channel frequencies from the ANCD when you are operating in the division support command (DISCOM)

NET Time Period 01:

a. MAN

b. CUE

Note: The MAN channel is normally loaded but NOT the CUE channel. Channels 1 through 6 are loaded only if required by unit SOP.

2. Set RT controls.

a. FCTN to LD

b. MODE to SC

c. COMSEC to PT/CT

d. CHAN to CUE/MAN/1 6

3. Press FREQ.

4. Press CLR.

5. Load Frequency obtained from ANCD.

6. Press STO.

7. Repeat steps "C" through "F" for each single channel frequency required to be loaded.

8. Set FCTN to SQ.

Load COMSEC keys and frequency hopping data using Mode 2 fill.

1. Preparation of ANCD for Mode 2 fill.

a. Turn on ANCD and SINCGARS radio.

b. Set SINCGARS radio up to load COMSEC keys and frequency hopping (FH) data:

- COMSEC to CT

- FCTN to LD

- MODE to FH

- CHAN to MAN

- DATA to OFF

c. Select: RADIO on ANCD and press ENTER.

d. Select: SEND and press ENTER.

e. Select: RADIO and press ENTER.

f. Select: ICOM and press ENTER.

g. Connect to RT AUD/Fill connector using the (W4) fill cable..

h. Set FCTN control knob on radio to LD.

i. Display will show: Do you want to include TIME? Y/N? ENTER "N" for no.

Note: Time must be entered manually. The RT is not set up to receive the clock from the ANCD, however for an accurate time you can use the GPS (Global Positioning System) to load the time into the RT.

j. Press LOAD on radio.

k. Display screen on ANCD will show "TRANSFER IN PROGRESS," then "ICOM TRANSFER SUCCESSFUL."

> **Note:** The Mode 2 fill procedure loads the radio with one load set, containing COMSEC keys and FH data for all six (6) channels. If there is more than one load set stored in the ANCD, the one shown as "Default Identification" (DI) will be loaded into the radio when the Mode 2 fill procedure is used.

Enter secure, frequency hopping net using Hot Start net opening procedures.

1. Julian date calendar

   a. Obtained from NCS

   b. Located in **TM 11 5820 890 10 8** *(SINCGARS) Operator's Manual* page A 3 (Appendix A)

2. Procedure for loading Julian date into SINCGARS radio

   a. Set: FCTN to LD.

   b. Press: TIME (display shows "DD").

   c. Press: CLR (display shows "_ _").

   d. Enter: JULIAN DATE.

   e. Press: STO (Julian date loaded into RT).

3. Procedure for loading SYNC time into SINCGARS radio

   a. Turn on ANCD.

   b. Enter: RADIO (display will show HH:MM:SS).

   c. Press: TIME (display shows HHMM).

   d. Press: CLR (display shows "_ _ _ _").

   e. Enter: HOUR (same as ANCD).

   f. Enter: MINUTES (add 1 minute to clock on RT).

   g. Press: STO (store time when clock on ANCD shows 60 or 00 seconds).

   h. Set Channel Selector Switch to net ID IAW SOI.

4. Requirement to call NCS once data and SYNC time have been loaded into the SINCGARS radio.

   "NCS, THIS IS STATION (NR), OVER."

Following the Hot Start net opening procedure, the SINCGARS radio in now ready to communicate in the FH mode. CT net and net opening is completed for the operator.

Quick and Dirty Loading

1. Install SINCGARS radio:

    a. Install battery into battery box and connect to RT.

    b. Connect whip antenna-to-antenna base hand tight.

    c. Connect antenna base RT ANT hand tight.

    d. Connect handset (H-250) to AUDIO DAT1.

2. Prepare RT to be loaded using ANCD:

    a. Set FCTN knob to TST. Wait for GOOD on display.

    b. Set FCTN knob to LD.

    c. Set COMSEC knob to CT.

    d. Set MODE knob to FH.

    e. Clear audio alarm in handset to solid tone (press handset twice).

3. Prepare ANCD and load RT:

    a. Turn on ANCD and enter RADIO at the main menu.

    b. At next three screens SEND, RADIO, and ICOM press ENTER.

    c. Follow guidance for next two steps by pressing down arrow.

    d. Enter Y at the next menu (TIME), then press LOAD on the RT.

4. Load single channel frequency:

    a. Set MODE knob to S3.

    b. Set CHAN knob to desired position.

    c. On the keypad press FREQ+CLR.

    d. On the keypad enter the frequency given and press STO.

5. Set RF PWR to desired setting (LO, M, HI).

6. Set FCTN knob to SQ ON and conduct a radio check using proper procedures and prowords.

CHAPTER 7

RTO PACKING LIST AND CHECKLIST

Radio telephone operators (RTOs) are required to understand their respective radio systems as well as the tactical maneuver plan. RTOs are the commander's ears and, as such, will continuously monitor radio transmissions and report any tactical developments to their commander ASAP. RTOs should not only carry the radio, but also take an active role in monitoring and controlling the operation with minimal guidance. As stated earlier, the RTO is the walking, talking tactical operations center for the small unit leader.

Each RTO should have as a minimum:

- Appropriate radio system with 2 handsets, long-whip, and short whip antennas

- Appropriate COMSEC in the radio

- COMMEX time and place

- Challenge/password and number combination

- Effective change over time

- Task force net IDs/call sign quick reference (CMD, O/I, A/L)

- Retrans plan (If applicable)

- Tactical plan/execution checklist

- Late net entry procedures

- Pen, pencil, and water proof paper or laminated reporting log sheets

- Digital watch (continuously updated with plugger time)

- Pre-made field expedient 292 antenna

- Flashlight

- Poncho

- Extra batteries

- Map

- Extra BNC or barrel connectors (connects antenna to radio)

CHAPTER 8

PREVENTATIVE MAINTENANCE CHECKS AND SERVICES (PMCS) FOR ADVANCED SYSTEMS IMPROVEMENT PROGRAM (ASIP) RADIOS

Just as any soldier checks and maintains his weapon, the RTO checks and maintains his equipment. The welfare of the entire unit rides on the shoulders of the RTO. If the RTO does not maintain his equipment, he and his unit will not be able to communicate. The unit that cannot communicate when necessary, will not survive, much less accomplish its mission.

Item #	When	Item to Check/Service	Operator Procedure	Not Fully Mission Capable If:
1	Before During After	CONTROLS	a. Check for cracked or broken controls	Broken control does not function properly*
			b. Check for loose controls	Loose control does not function properly*
			c. Check for frozen controls	Frozen control does not function properly*
			d. Check for missing control knobs	Knob missing and control does not function properly*
2	Before During After	CABLES: RF (W2) RF (CG-3855) RF (CG-3856) Audio/Data (W4) PA Power (CX 13303)	a. Check for missing cables b. Check for proper installation c. Check for tightness of connectors d. Check for obvious damage to cables	Cable missing Cable is damaged and cannot be used**

Checklist (Cont.)				
3	Before During After	ANTENNAS: AS-3683 AS-3900 AS-3916 AS-4266	a. Check for proper installation b. Check for proper grounding (vehicular radios) c. Check for broken antenna parts d. Check for tie-downs and antenna tips	Antenna is not properly grounded Antenna part is broken and cannot be used Antenna part is missing
4	Before	Power: Manpack Vehicular Either Radio	a. Check for presence of main battery b. Check for availability of vehicular power c. Move COMSEC from Z to PT, adjust DIM, move FCTN from OFF to Z-FH, check that RT display lights	RT display does not show "GOOD" Self-test ends with other than "GOOD"
5	Before	SELF-TEST	a. With FCTN in Z-FH, check that display shows "GOOD" b. Move FCTN to TST and check that RT display shows "GOOD" at end	RT display does not show "GOOD" Self-test ends with other than "GOOD"

Checklist (Cont.)				
6	Before	KEYPAD	With RT set to CT, SC, LD, and channel shown; a. Press FRQ, CLR, and enter test frequency: CUE: 31000 MAN: 32000 CHAN 1: 43000 CHAN 2: 54000 CHAN 3: 65000 CHAN 4: 76000 CHAN 5: 87000 CHAN 6: 87975 b. Press STO for each entry.	Any test frequency (0 -9) cannot be entered in the RT Any test frequency cannot be stored in RT.
7	Before	DATA LOADING: SC freq COMSEC key FH data Sync time	a. Load SC freq b. Load COMSEC key c. Load FH data d. Load sync time***	SC Freq will not load COMSEC key will not load FH data will not load Sync time will not load
8	Before	COMM Check:**** Voice/data SC mode FH mode Plain text Cypher text RXMT mode	a. Check for side tone. b. Check voice comm in SC-PT and FH-CT (check SQ OFF while in SC mode.) c. If data comm mission-required, check data comm in FH-CT, using mission-related data device. ***** d. If RXMT is mission-required, check RXMT in all mission-related modes	Side tone is not heard Cannot communicate in SC-PT or FH-CT voice modes Cannot communicate in mission-required data mode using mission-related data device. Cannot retransmit in mission-related modes.

"Does not function properly" means that a control will not do what it is intended to do, for example, turning the FCTN knob does not change the radio's function. It may be necessary to

wait until Item 8 (Communications Check) to determine for sure that some controls do or do not function properly.

** "Damaged and cannot be used" means that after visual inspection or operational check, you determine that a piece of equipment is faulty and, therefore, will not support your mission requirements or presents a safety hazard.

*** Use of the ICOM fill procedure is appropriate here, but separate checks of COMSEC keys, FH data, and sync time elements are required.

**** Operators with special requirements (NCS for example) should check those functions that are important to mission operations (ERF for example). Skip this step if tactical situation prohibits transmitting.

***** Unless your mission is likely to require use of data mode or retransmission operations, you do not need to perform these two checks.

CHAPTER 9

TROUBLESHOOTING GUIDE

Even with the most dedicated maintenance, "Murphy's Law" affects the daily lives of all RTOs. The difference between an excellent RTO and a poor one is his/her ability to figure out what is wrong and then fix it. This chapter offers a short guide on troubleshooting common problems. Consider these tips as "Immediate Action Drills" for the RTO.

OPERATOR TROUBLESHOOTING GUIDE 1

STEPS	CHECKS	ACTIONS
1. Verify correct RT control settings	1. Does ANCD indicate that data is being transferred?	YES: Go to step 2 NO: Continue
	2. Does RT indicate that data has been received?	YES: Problem is solved NO: Go to step 2
2. Verify ANCD data storage	Does ANCD contain loadset?	YES: Continue NO: Load/replace ANCD*, cont.
3. Ensure ANCD is functional	1. Is battery light low?	YES: Replace battery, cont. NO: Go to step 4
	2. Does ICOM fill now load RT?	YES: Problem is solved NO: Go to step 4
4. Ensure fill cable is serviceable	1. Is cable damaged, cut, or broken?	NO: Continue YES: Replace cable*, cont.
	2. Is fill cable properly connected to ANCD &RT?	YES: Continue NO: reconnect, cont.
	3. Does ICOM fill now load RT?	YES: Problem solved NO: Go to step 5
5. Re-run SINCGARS radio PMS	1. Does RT pass all checks and tests?	YES: Continue NO: See unit maintenance
	2. Does ICOM fill now load RT?	YES: Problem solved NO: See unit maintenance

Where action is to "replace"ANCD and fill cable ,it is anticipated that the operator will borrow such an item for the purpose of troubleshooting. If borrowing is not feasible, it will be necessary for the operator to contact unit maintenance to obtain a substitute item or request assistance with the problem.

OPERATOR TROUBLESHOOTING GUIDE 2
Operator is unable to Contact the Net NCS*

STEPS	CHECKS	ACTIONS
Verify correct RT control settings	1. Is FCTN switch set to SQ ON?	YES: Continue NO: GO to SQ ON, cont.
	2. IS CHAN switch set to net operational channel?	YES: Continue NO: Change CHAN, cont.
	3. Is COMSEC set to CT (or PT if in use)?	YES: Continue NO: Reset COMSEC, cont.
	4. Is MODE set to FH (or SC if in use)?	YES: Continue NO: Change MODE, cont.
	5. Is RF PWR set properly for NCS location?	YES: Continue NO: Change RF PWR, cont.
	6. Is VOL set to hear NCS or net traffic	YES: Go to step 2 NO: Reset VOL, go to step 2
Verify ANCD data storage	1. Is TEK loaded in operational channel?	YES: Continue NO: Reconnect, cont.
	2. Can NCS now be contacted?	YES: Problem is solved NO: Go to step 5
Ensure ANCD is functional	1. Is correct net ID loaded in operational channel?	YES: Continue NO: See unit maintenance
	2. Can NCS now be contacted	YES: Problem is solved NO: See unit maintenance
Ensure fill cable is serviceable	1. Are ANCD and RT times within +/- 2 seconds?	YES: Continue NO: Use passive LNE***, cont
	2. Can NCS now be contacted?	YES: Problem is solved NO: Go to step 5
Re-run SINCGARS radio PMS	1. Does RT pass all checks and tests?	YES: Continue NO: See unit maintenance
	2. Can NCS now be contacted?	YES: Problem is solved NO: See unit maintenance

* If other traffic can be heard on the net, problem is assumed to rest with the NCS station.

** ANCD time may not be valid if it has been more that 24 hours since ICOM fill of radio

*** Passive late net entry (LNE)

OPERATOR TROUBLESHOOTING GUIDE 3

STEPS	CHECKS	ACTIONS
Perform passive late net entry (LNE)	1. Does RT display show: "LF XXX"?	YES: Wait for traffic on net, cont NO: Adjust dim switch, cont.
	2. Is traffic heard and "L" dropped from display?	YES: Problem is solved NO: Go to step 2
Check VOL control setting	1. Is VOL set high enough to hear traffic?	YES: Go to step 3 NO: Adjust VOL, cont.
	2. Is traffic now heard?	YES: Problem is solved NO: Go to step 3
Ensure that handset is working	1. Is handset operational?	YES: Go to step 4 NO: Replace item, cont.
	2. Is traffic now heard?	YES: Problem is solved NO: Go to step 4
Verify sync time*	1. Are ANCD and RT times within +/- 2 seconds?	YES: Go to step 5 NO: Reload sync time, cont.
	2. Is traffic now heard?	YES: Problem is solved NO: Go to step 5

Verify FH data	1. Is there FH data loaded in the operational channel?	YES: Continue NO: Reload RT, cont.
	2. Is traffic now heard?	YES: Problem is solved NO: Continue
	3. Is correct net ID loaded in operational channel	YES: Go to step 6 NO: Change net ID, cont.
	4. Is traffic now heard?	YES: Problem is solved NO: Go to step 6
OPERATOR TROUBLESHOOTING GUIDE 3 (Cont.)		
Manpack only** - check main battery	1. Does main battery need to be changed?	YES: Replace battery, cont. NO: Go to step 7
	2. Is traffic now heard?	YES: Problem is solved NO: Go to step 7
Perform Hot Start net entry	1. Do COMSEC/FH data load in RT?	YES: Continue NO: Go to TS Guide 1
	2. Is traffic now heard?	YES: Problem is solved NO: Continue ****
	3. Can NCS be contacted?	YES: Problem is solved NO: See unit maintenance

* ANCD time may not be valid if it has been more than 24 hours since ICOM fill of radio.|

** For vehicular radios, skip this step and continue with Step 7. Placing RF PWR in HI and pressing PTT can check battery power. Signal display of 2 or less indicates your battery is weak.

*** Operator has option of using CUE and ERF method of late net entry in lieu of the Hot Start procedure if desired.

**** The possibility that there is no traffic on the net must be considered. Try to contact your NCS to check serviceability of your radio

.

CHAPTER 10

FIELD EXPEDIENT ANTENNAS

Communications are affected by a host of variables. Range sought, weather, terrain, or atmospherics can affect signal strength without warning. Standard whip antennas may not be up to the task, especially when transmitting under difficult conditions. Field expedient antennas can dramatically improve both transmission and reception ranges. The effective RTO knows how to set up such an antenna and has the material needed to do so.
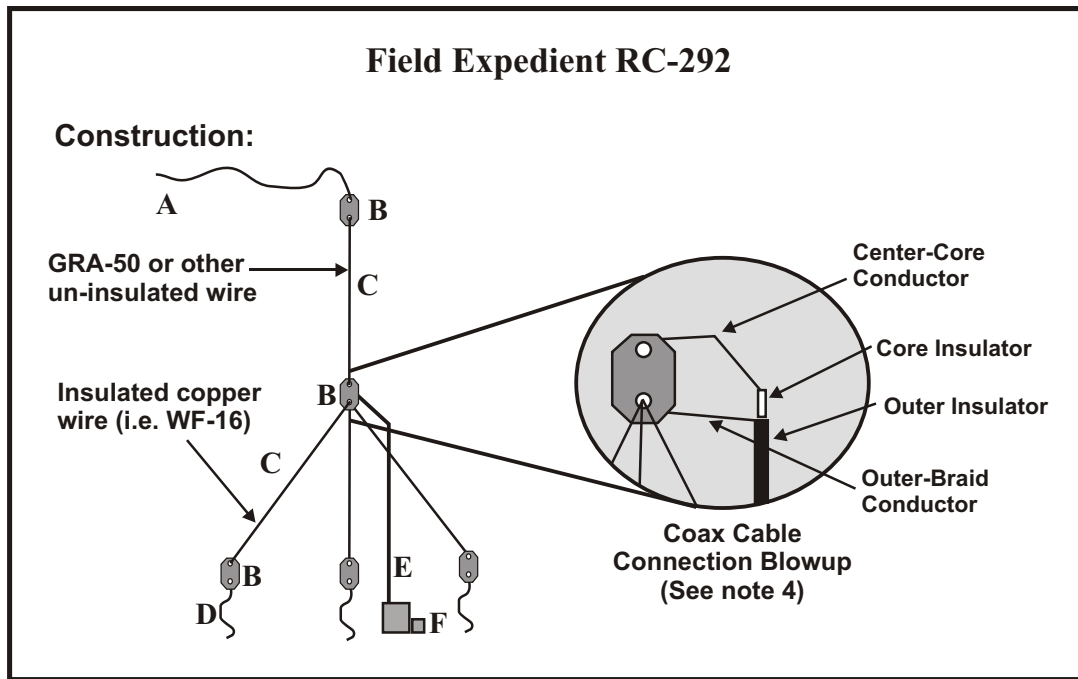
Figure 1

Parts List:

A) 65 feet of gutted 550 cord

B) 5 insulators

C) Four 6.5 feet lengths of antenna elements (16 gauge copper wire, see note 2).

D) Three 1 foot long gutted 550 cord (see note 3).

E) 50 feet of coax cable (RG-58 or RH-174

F) Solderless BNC connector (see note 4).

Notes:

1) Insulators should be made of a semi-flexible plastic (i.e., spoons, flashlight lenses, etc.).

2) Use wire from GRA-50 dipole antenna for the radiator element.

3) 550 cord end is tied in a loop to create a slip knot to put ends of sticks through during execution.

4) Once coax is connected, use electrical tape to secure and cover bare wires.

Field Expedient Antenna Erection

Tree limb
20-30 feet high

Radiator

Ground Plane

4-6 foot sticks

Radio

Canteen or rock to
throw over limb
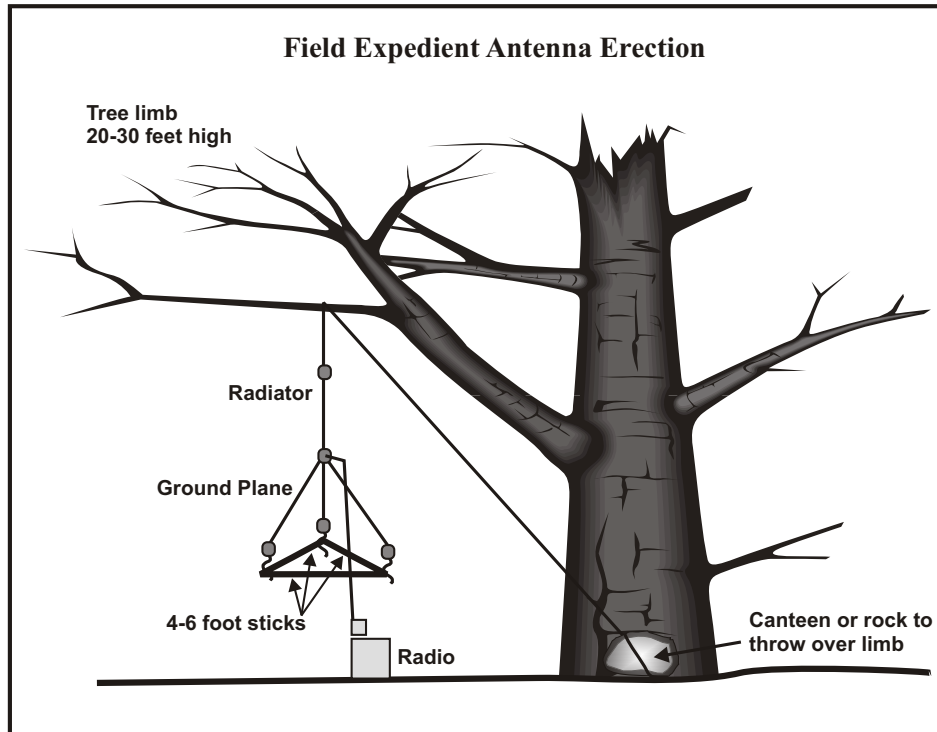
Figure 2

CHAPTER 11

ADVANCED SYSTEMS IMPROVEMENT PROGRAM (ASIP)

RADIO RANGES AND BATTERY USAGE

As indicated in the previous chapter, there are numerous factors that affect the range of a radio. This chapter examines the effects of two such factors: the radios themselves and their batteries. Power settings and modes affect the ranges offered by most radios. Battery life not only affects the length of time a radio will work but also how much power it can generate. Lower power settings obviously extend battery life. Heavy transmission activity shortens battery life. An excellent RTO knows from experience how long he can expect his batteries to last in any operation. He also knows which mode offers the best balance between transmission power and durability.

1. PURPOSE. Provide operators a guide to use as a planning tool for range capabilities of the ASIP. Also, provide operators of the ASIP radios and associated equipment general guidelines regarding the number of hours a particular type battery is expected to remain serviceable.

2. GENERAL.

 a. Planning ranges. The planning ranges for the ASIP are based on line-of-sight (LOS) and are average for normal conditions. Ranges depend upon location, sighting, weather, and antenna used. Use of the OE-254 will increase ranges.

 b. Battery usage. It is important to understand that the times presented are the result of computations as well as experience. Hours of service will vary depending on how long the battery was in storage prior to use, temperature when being used, and other factors that cannot be clearly defined. Even so, these times offer the RTO a basis for planning battery requirements.

3. PLANNING RANGES FOR THE ASIP.

TYPE COMM	RF PWR	RANGE
VOICE	LOW (LO)	200 M TO 400 M
VOICE	MEDIUM (M)	400 M TO 5 KM
VOICE	HIGH (H)	5 KM TO 10 KM
VOICE	PWR AMP (PA)	10 KM TO 40 KM
DATA 600-4800 BPS 16000 BPS		3 KM TO 5 KM 1 KM TO 3 KM

4. EXPECTED BATTERY LIFE.

MANPACK RADIO MAIN POWER
(BA5590 with RF set to HI)

VOICE/DATA (FH & CT)	ASIP
Normal (Operator)	33 hours
Heavy (NCS)	TBD
Standby (STBY)	3 months

REMOTE CONTROL UNIT (RCU)
(BA5590 with RF set to HI)

VOICE/DATA (FH & CT)	ASIP
Normal (Operator)	TBD
Heavy (NCS)	TBD
Standby (STBY)	3 months

HOLD-UP BATTERY (HUB)
(BA5372)

USE	ASIP
Back-up	6 months
Continuous or extended use	Monthly

ANCD MAIN POWER

TYPE OF USE	LOADED WITH 3 BA5123s	LOADED WITH 1 9-volt
Normal (primary SOI reference)	30 hrs	10 hrs
Heavy (NCS-frequent data transfers)	10 hrs	5 hrs
Loaded in OFF position	2+ months	1+ month

PLGR BATTERY

BATTERY TYPE	NOMEN	Continuous Use
Lithium (main)	BA5800	20 hrs
AA-alkaline	BA30588	8 hrs
Lithium (memory)	LS6	1 year

APPENDIX A

JULIAN DATE CALENDAR

Julian Date Calendar (Regular Year)												
Day/Mo	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	01	32	60	91	21	52	82	13	44	74	05	35
2	02	33	62	92	22	53	83	14	45	75	06	36
3	03	34	63	93	23	54	84	15	46	76	07	37
4	04	35	63	94	24	55	85	16	47	77	08	38
5	05	36	64	95	25	56	86	17	48	78	09	39
6	06	37	65	96	26	57	87	18	49	79	10	40
7	07	38	66	97	27	58	88	19	50	80	11	41
8	08	39	67	98	28	59	89	20	51	81	12	42
9	09	40	68	99	29	60	90	21	52	82	13	43
10	10	41	69	00	30	62	91	22	53	83	14	44
11	11	42	70	01	31	63	92	23	54	84	15	45
12	12	43	71	02	32	63	93	24	55	85	16	46
13	13	44	72	03	33	64	94	25	56	86	17	47
14	14	45	73	04	34	65	95	26	57	87	18	48
15	15	46	74	05	35	66	96	27	58	88	19	49
16	16	47	75	06	36	67	97	28	59	89	20	50
17	17	48	76	07	37	68	98	29	60	90	21	51
18	18	49	77	08	38	69	99	30	62	91	22	52
19	19	50	78	09	39	70	00	31	63	92	23	53
20	20	51	79	10	40	71	01	32	63	93	24	54
21	21	52	80	11	41	72	02	33	64	94	25	55
22	22	53	81	12	42	73	03	34	65	95	26	56
23	23	54	82	13	43	74	04	35	66	96	27	57
24	24	55	83	14	44	75	05	36	67	97	28	58
25	25	56	84	15	45	76	06	37	68	98	29	59
26	26	57	85	16	46	77	07	38	69	99	30	60
27	27	58	86	17	47	78	08	39	70	00	31	62
28	28	59	87	18	48	79	09	40	71	01	32	63
29	29		88	19	49	80	10	41	72	02	33	63
30	30		89	20	50	81	11	42	73	03	34	64
31	31		90		51		12	43		04		65

Julian Date (Leap Year)												
Day/Mo	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
1	01	32	61	92	22	53	83	14	45	75	06	36
2	02	33	62	93	23	54	84	15	46	76	07	37
3	03	34	63	94	24	55	85	16	47	77	08	38
4	04	35	64	95	25	56	86	17	48	78	09	39
5	05	36	65	96	26	57	87	18	49	79	10	40
6	06	37	66	97	27	58	88	19	50	80	11	41
7	07	38	67	98	28	59	89	20	51	81	12	42
8	08	39	68	99	29	60	90	21	52	82	13	43
9	09	40	69	00	30	61	91	22	53	83	14	44
10	10	41	70	01	31	62	92	23	54	84	15	45
11	11	42	71	02	32	63	93	24	55	85	16	46
12	12	43	72	03	33	64	94	25	56	86	17	47
13	13	44	73	04	34	65	95	26	57	87	18	48
14	14	45	74	05	35	66	96	27	58	88	19	49
15	15	46	75	06	36	67	97	28	59	89	20	50
16	16	47	76	07	37	68	98	29	60	90	21	51
17	17	48	77	08	38	69	99	30	61	91	22	52
18	18	49	78	09	39	70	00	31	62	92	23	53
19	19	50	79	10	40	71	01	32	63	93	24	54
20	20	51	80	11	41	72	02	33	64	94	25	55
21	21	52	81	12	42	73	03	34	65	95	26	56
22	22	53	82	13	43	74	04	35	66	96	27	57
23	23	54	83	14	44	75	05	36	67	97	28	58
24	24	55	84	15	45	76	06	37	68	98	29	59
25	25	56	85	16	46	77	07	38	69	99	30	60
26	26	57	86	17	47	78	08	39	70	00	31	61
27	27	58	87	18	48	79	09	40	71	01	32	62
28	28	59	88	19	49	80	10	41	72	02	33	63
29	29	60	89	20	50	81	11	42	73	03	34	64
30	30		90	21	51	82	12	43	74	04	35	65
31	31		91		52		13	44		05		66

APPENDIX B

WORLD TIME CHART (TIME CONVERSION TABLE)

GMT Zone Cities or Areas

GMT Greenwich Mean Time (GMT), Dakar, Dublin, London, Reykjavik

GMT-1 Cape Verde	GMT+1 Algiers, Berlin, Danderyd, Madrid, Milano, Paris, Rome, Vienna
GMT-2 Mid-Atlantic	GMT+2 Cairo, Damascus, Holargos, Israel
GMT-3 Brazilia, Buenos Aires	GMT+3 Kuwait, Moscow, Qatar, Riyadh
GMT-4 Antigua, Atlantica, Grenada	GMT+4 Abu Dhabi, Muscat
GMT-5 Eastern United States (EST), Lima, Montreal	GMT+5 Islamabad, Karachi
GMT-6 Belize, Central United States (CST), Houston, Mexico City	GMT+6 Almaty, Dhaka
GMT-7 Mountain United States (MST)	GMT+7 Bangkok, Jakarta
GMT-8 Pacific United States (PST), Vancouver	GMT+8 Beijing, Hong Kong, Singapore, Manila
GMT-9 Alaska	GMT+9 Osaka, Tokyo
GMT-10 Hawaii	GMT+1- Brisbane, Guam, Melbourne, Sydney
GMT-11 Samoa	GMT+11 Magadan, Solomon Islands
GMT-12 Eniwetok	GMT+12 Auckland, Fiji, Wellington

World Time Chart
(Time Conversion Table)

-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	GMT	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12
NN	1p	2	3	4	5	6	7	8	9	10	11	MN	1a	2	3	4	5	6	7	8	9	10	11	NN
1p	2	3	4	5	6	7	8	9	10	11	MN	1a	2	3	4	5	6	7	8	9	10	11	NN	1
2	3	4	5	6	7	8	9	10	11	MN	1a	2	3	4	5	6	7	8	9	10	11	NN	1	2
3	4	5	6	7	8	9	10	11	MN	1a	2	3	4	5	6	7	8	9	10	11	NN	1	2	3
4	5	6	7	8	9	10	11	MN	1a	2	3	4	5	6	7	8	9	10	11	NN	1	2	3	4
5	6	7	8	9	10	11	MN	1a	2	3	4	5	6	7	8	9	10	11	NN	1	2	3	4	5
6	7	8	9	10	11	MN	1a	2	3	4	5	6	7	8	9	10	11	NN	1	2	3	4	5	6
7	8	9	10	11	MN	1a	2	3	4	5	6	7	8	9	10	11	NN	1	2	3	4	5	6	7
8	9	10	11	MN	1a	2	3	4	5	6	7	8	9	10	11	NN	1	2	3	4	5	6	7	8
9	10	11	MN	1a	2	3	4	5	6	7	8	9	10	11	NN	1	2	3	4	5	6	7	8	9
10	11	MN	1a	2	3	4	5	6	7	8	9	10	11	NN	1	2	3	4	5	6	7	8	9	10
11	MN	1a	2	3	4	5	6	7	8	9	10	11	NN	1	2	3	4	5	6	7	8	9	10	11
MN	1a	2	3	4	5	6	7	8	9	10	11	NN	1	2	3	4	5	6	7	8	9	10	11	MN
1a	2	3	4	5	6	7	8	9	10	11	NN	1	2	3	4	5	6	7	8	9	10	11	MN	1
2	3	4	5	6	7	8	9	10	11	NN	1	2	3	4	5	6	7	8	9	10	11	MN	1	2
3	4	5	6	7	8	9	10	11	NN	1	2	3	4	5	6	7	8	9	10	11	MN	1	2	3
4	5	6	7	8	9	10	11	NN	1	2	3	4	5	6	7	8	9	10	11	MN	1	2	3	4
5	6	7	8	9	10	11	NN	1	2	3	4	5	6	7	8	9	10	11	MN	1	2	3	4	5
6	7	8	9	10	11	NN	1	2	3	4	5	6	7	8	9	10	11	MN	1	2	3	4	5	6
7	8	9	10	11	NN	1	2	3	4	5	6	7	8	9	10	11	MN	1	2	3	4	5	6	7
8	9	10	11	NN	1	2	3	4	5	6	7	8	9	10	11	MN	1	2	3	4	5	6	7	8
9	10	11	NN	1	2	3	4	5	6	7	8	9	10	11	MN	1	2	3	4	5	6	7	8	9
10	11	NN	1	2	3	4	5	6	7	8	9	10	11	MN	1	2	3	4	5	6	7	8	9	10
11	NN	1	2	3	4	5	6	7	8	9	10	11	MN	1	2	3	4	5	6	7	8	9	10	11

Legend

Yesterday PM	Today AM	Today PM	Tomorrow AM	MN = Midnight	NN = Noon

APPENDIX C

RADIO FREQUENCY (RF) SPECTRUM

The Army uses several types of single-channel radios, that operate in different frequencies across the RF spectrum as shown.
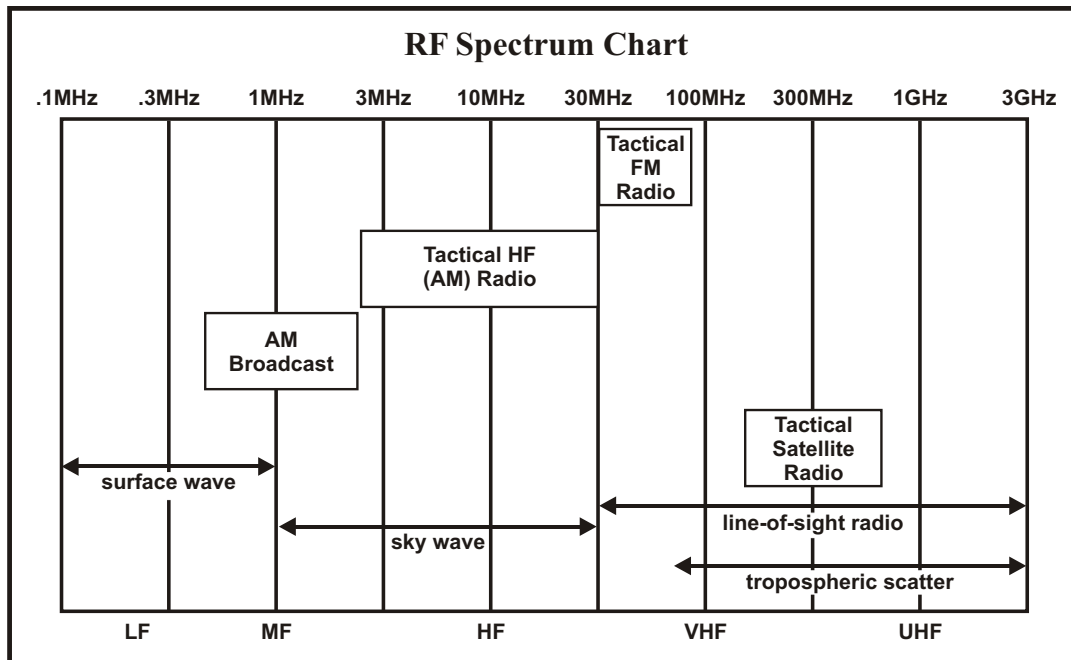
RF Spectrum Chart

| .1MHz | .3MHz | 1MHz | 3MHz | 10MHz | 30MHz | 100MHz | 300MHz | 1GHz | 3GHz |

Tactical FM Radio

Tactical HF (AM) Radio

AM Broadcast

Tactical Satellite Radio

surface wave

sky wave

line-of-sight radio

tropospheric scatter

LF   MF   HF   VHF   UHF

Figure 1

The Army uses the following single-channel radios:

FM Radio. The FM radio has a range of approximately 35 to 40 kilometers, which covers a brigade/battalion maneuver area. FM radio transmissions are normally line-of-sight (LOS) and large terrain features can block transmission. FM radios can transmit data.

HF Radio. HF radio's longer range overcomes terrain limitations for users with greater dispersion. Using the improved high frequency radio (IHFR) provides a versatile capability for short- and long-range communications. HF is the only tactical communications asset that may achieve long-range communications independent of terrestrial or satellite relays. HF communications may be either voice or secure data. HF is also useful where LOS cannot be achieved. The capabilities of the single-channel radio make it flexible, securable, mobile, and reliable. However, the radio is the most detectable means of electronic communications and is subject to intentional and unintentional electronic interference. Good electronic protection and remoting techniques are highly recommended.

TACSAT Radio. The use of satellite communications gives the commander the greatest range. It is useful when users are separated by long distances, such as rapid deployment forces and special operations units. The single channel tactical satellite (TACSAT) radio transmits in the UHF/VHF range that requires the antenna to have LOS with the satellite. Satellite access time must be requested in advance. This radio has a narrow and wide bandwidth and can transmit data. These radios are used in functional networks such as command, administrative, logistical, fire support, and intelligence nets.

APPENDIX D
GLOSSARY

ANCD   automated net control device

ASIP   Advanced Systems Improvement Program

CCI   commander's critical information

CIK   communication security encryption key

CODEWORD   one-word notice that refers to other information

COMMEX   communications exercise

COMSEC   communications security

CT   cypher text

CUE   to key the radio net

ERF   electronic remote fill

FM   frequency modulated

GMT   Greenwich Mean Time (ZULU)

GPS   Global Positioning System

ICOM   integrated COMSEC

JD	Julian date
MANPACK	man portable radio set
NCS	net control station
NET	net synchronization time, also refers to a network
NET ID	network identification
OTAR	over the air rekey
PLGR	precision lightweight GPS receiver
Polling	radio transmitting priority
Prowords	proper words for radio transmission (not slang)
PT	plain text
RCU	remote control unit
RETRANS	re-transmisson of a radio broadcast
RF	radio frequency
RT	receiver transmitter
SINCGARS	Single Channel Ground and Air Radio System
SOI	signal operating instructions

SOP   standing operating procedures

TEK   transmission encryption key

CONCLUSION

Although this handbook's primary audience is the radio telephone operator, it must be stressed and clearly understood that a communications problem is everyone's concern until it is solved! As highly qualified representatives of the Signal Corps, signal soldiers are all trainers. When a user has a communications problem, we try to educate them so they become self-reliant. If we fail to train properly, we must not only do our work, but we must also do someone else's work. We must train as if we are going to war. This means we cannot accept the training standard that communications assets go unescorted into threat areas days in advance just to ensure communications are ready. Once in a tactical situation, specific channels for accurate and timely intelligence, battle tracking, and environmental and situational awareness must be developed. This information must be disseminated to the lowest levels possible. All teams must get this information promptly. The information ensures the teams understand and can support the maneuver schemes and are synchronized with other battlefield functional areas (BFAs) across the battlefield. Awareness of the enemy or threat enables the soldier to feel secure in their surroundings. As a radio telephone operator, you are tasked with great responsibility. Plan for success and win the information war.