Chapter 5

Single-Channel Ground and Airborne Radio System with Internet Controller in the TI

The SINCGARS SIP/ASIP is the primary voice radio within the digitized division and the primary data radio at platoon level. The INC provides data routing capabilities down to the lowest levels of the TI. This chapter discusses the functional description, deployment, operational software, operational procedures, users, and tactics and techniques of the SINCGARS SIP/ASIP with INC in the TI.

FUNCTIONAL DESCRIPTION

5-1. Modern battlefield communications requirements include a communications interface that provides voice and packet data communications over a CNR in support of operations at brigade and below. The CNR supports three principal modes of communications:

- Secure voice.
- Secure packet switching.
- Secure serial data.

5-2. As the digitized division's primary CNR, the SINCGARS SIP/ASIP provides both voice and data capabilities. Both radios consist of the RT-1523 and the AM-7239 vehicular amplifier adapter (VAA). The SINCGARS SIP-configured platforms use the RT-1523C/D model radio and AM-7239C/D model VAA. The SINCGARS ASIP-configured platforms use the RT-1523E model radio and AM-7239E model VAA. Several vehicular and manpack RS configurations can be assembled from these components.

5-3. User controls and displays are on the radios' front panel. Electrical connectors permit interfacing from audio and data devices to the other components of the radio configuration.

5-4. Figure 5-1 lists the features of the RT-1523C/D/E.

RT-1523C/D/E Features
RT 1523C/D/E provides–
• FM operations in the very high frequency (VHF) band (30.000 to 87.975 MHz).
• Single-channel and frequency hopping (FH) operation.
• Twenty-five kilohertz (kHz) channel spacing for 2,320 operating frequencies.
• Eight single-channel frequencies and six hopsets.
• Analog voice communications using handsets, loudspeakers, and vehicular intercom.

Figure 5-1. RT-1523C/D/E Features

RT-1523C/D/E Features (Continued)
• Digital data communications with data rates of 600, 1,200, 2,400, 4,800, 9,600, and 1,6000 bits per second (bps) and enhanced data rates of 1200N, 2400N, 4800N, 9600N, PCKT, and RS-232). • The remote controller/communications site. • Control for external RF power amplifier. • The capability to interoperate with a second RT in a retransmit (radio relay) configuration. • BIT.
RT-1523C/D's controls/indicators include– • Preset channel selector (single-channel, FH). • RF transmit power selector (low [LO], medium [MED], high [HI], power amplifier [PA]). • Function selector (Off, Test, Squelch On, Squelch Off, Retransmit, Remote, Load, Zero-All, and Standby [STBY]). • Mode selector (single-channel, FH, frequency hopping–master [FH-M]). • Volume control/whisper mode select. • Data mode key selection. • Display that includes a signal strength indicator, holding battery indicator, and a message display section. • Internal COMSEC module. • Six COMSEC keys (five traffic encryption keys [TEKs] and one key encryption key [KEK]). • COMSEC selector switch on the front panel includes: ▪ Plain text (PT). ▪ Cipher text (CT). ▪ Time delay (TD). ▪ Receive variable (RV). ▪ Zeroize (Z).
RT-1523Es features include– • Function switch (Off, Test, Squelch On, Squelch Off, Retransmit, Remote, Load, Zero, and Standby). • Enhanced display (backlight selectable). • Enhanced BIT. • RT mode switch may remain in FH position to change net identification. • New keypad with SIP features. • GPS connector. • Auxiliary (AUX) connector for HRCRD/2-wire adapter. • Menu capability using MENU key on keypad.

Figure 5-1. RT 1523C/D/E Features (Continued)

5-5. RT-1523C/D/E model radios are backward compatible with older versions. They provide enhanced and packet data modes. However, when used, packet data modes are not compatible with non-SINCGARS SIP/ASIP radios in the same network.

5-6. The VAA is also backward compatible with older versions. It serves as the vehicular mount for two RTs and houses the INC. The INC is a tactical router providing interfaces for synchronous and asynchronous data terminal equipment, data circuit-terminating equipment devices, or other ABCS devices.

5-7. Table 5-1 lists planning ranges for voice and data transmissions. The planning ranges are based on LOS communications and represent average performance under normal conditions. Operating ranges depend upon location, LOS, weather, surround noise levels, and other factors. An OE-254 antenna or extended range manpack antenna increases ranges for both data and voice transmissions. At the same time, enemy jamming and mutual interference conditions degrade operating ranges. In data communications, lower baud rates increase the operating range. Also, the enhanced data mode (EDM) has longer operating range than the standard data mode (SDM). Performance data for versions C and D RTs are almost identical.

CAUTION

SINCGARS SIP/ASIP, SINCGARS integrated COMSEC (ICOM), SINCGARS non-ICOM, and AN/VRC-12 series radios should not be mixed in a TI environment. Although all radios would be voice-compatible, non-SINCGARS SIP radios cannot invoke priority voice service during packetized data net operation, nor can they sense when the net is packet busy. Special consideration must also be given to SINCGARS SIP manpack radios (AN/PRC-119D) since they are not TI-compatible without internal reprogramming.

Table 5-1. Planning Ranges for Voice and Data Transmissions

Communications Mode	RF PWR	Range
Manpack Radio		
Voice	LO	200–400 m
	M	400 m–5 km
	HI	5–10 km
SDM data (600-4800 bps)	HI	3–5 km
SDM data (16000 bps)	HI	1–3 km

Table 5-1. Planning Ranges for Voice and Data Transmissions (Continued)

Communications Mode	RF PWR	Range
EDM data (1200N)	HI	5–10 km
EDM data (2400N)	HI	5–8 km
EDM data (4800N)	HI	3–5 km
EDM data (9600N)	HI	1–3 km
Vehicular Radio		
Voice (SR or LR radio)	LO	200–400 m
Voice (SR or LR radio)	M	400 M–5 km
Voice (SR or LR radio)	HI	5–10 km
Voice	PA	10–40 km
SDM Data (SR radio)		
600-4800 bps	HI	3–5 km
16000 bps	HI	1–3 km
SDM data (LR radio)		
600-2400 bps	PA	5–25 km
4800 bps	PA	5–22 km
16000 bps	PA	3–10 km
EDM data (SR radio)		
1200N-2400N bps	HI	5–10 km
4800 bps/PCKT	HI	5–10 km
9600N bps	HI	5–10 km
EDM data (LR radio)		
1200N-2400N bps	PA	20–35 km
4800 bps/PCKT	PA	15–25 km
9600N bps	PA	10–25 km

OPERATIONAL SOFTWARE

5-8. The SINSGARS SIP/ASIP employment enhances current C4 software, hardware, procedures, and techniques present on the battlefield. Therefore, the signal operator and repairman have a pivotal role in the success of the maneuver units on the battlefield because the SINCGARS SIP/ASIP serves as one of the key force multipliers. The SINCGARS SIP/ASIP compliments other state-of-the-art C4 equipment, such as the FBCB2.

DEPLOYMENT

5-9. On the digitized battlefield, the SINCGARS SIP/ASIP is deployed throughout the division and is the primary data and voice provider at brigade and below. The TI utilizes its SINCGARS SIP/ASIP components to provide capabilities for voice and data transmissions.

5-10. The doctrinal communications networks at brigade and below generally apply to the deployment practices that are established on the modern battlefield. These networks serve only as guidelines for establishing radio networks. The actual networks established depend on the existing situation, command guidance, and equipment available. Units from echelons battalion and up generally establish the following categories of VHF-FM networks:

- C2.
- Administrative/Logistics.
- Intelligence.

5-11. Communications networks are further divided into–

- BOSs of maneuver.
- FS.
- Intelligence and electronic warfare.
- Air defense (AD).
- CSS.
- Mobility and survivability.

5-12. These units establish internal communications networks and are subscribers in at least one other network. See FM 11-53 for more information on these networks.

5-13. Within the TI, it is no longer possible to enter or monitor (eavesdrop) radio nets other than those for which the system is set up. This applies if the vehicle's communications suite is functioning as a primary or a secondary server. Leaving an assigned net will prevent the server from performing its function for the net, and the net will crash.

5-14. Tables 5-2, 5-3, and 5-4 list typical networks formed at the brigade, battalion/task force (TF), and company/team level.

Table 5-2. Brigade Level Radio Nets

Net Stations	Div CMD Net	Bde CMD Net	Div OPS Net	Bde OPS Net	Div INT Net	Bde INT Net	Div A2C2 Net	Div A/L Net	Bde A/L Net
Brigade Commander	Yes	Yes	No	Yes	No	No	No	No	No
Battalion/TF Executive officer (XO)	No	Yes	No	Yes	No	No	No	No	Yes
Brigade S3 Operations	No	Yes	Yes	Yes	No	No	Yes	No	No
Brigade S2 Operations	No	No	Yes	Yes	Yes	Yes	No	No	No
Brigade S1/S4 Operations	No	No	No	Yes	No	No	No	Yes	Yes
Brigade S3 TAC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Brigade S3 Plans	No	Yes	Yes	Yes	Yes	No	Yes	No	No
Forward Support Battalion Operations	No	Yes	No	Yes	No	No	No	Yes	Yes
Aviation Support Operations	No	Yes	No	Yes	No	Yes	Yes	No	Yes
Brigade FS	No	Yes	No	Yes	No	Yes	No	No	Yes
Military Police Units	No	No	No	Yes	No	Yes	No	No	Yes
Engineer Units	No	Yes	No	Yes	No	Yes	No	No	Yes
AD Artillery Units	No	Yes	Yes	Yes	No	No	Yes	No	Yes
Chemical Units	No	No	No	Yes	No	Yes	No	No	Yes
Liaison Officer (LNO)	No	No	No	Yes	No	Yes	No	No	No
Brigade Reconnaissance Troop Command Post (CP)	No	Yes	No	Yes	No	Yes	No	No	Yes

Table 5-3. Battalion/TF Level Radio Nets

Net Stations	Bde CMD Net	Bn CMD Net	Bde OPS Net	Bde INT Net	Bn O&I Net	Bde A/L Net	Bn A/L Net
Battalion/TF Commander	Yes	Yes	Yes	No	No	No	No
Battalion/TF XO	Yes	Yes	No	No	No	No	Yes
Battalion/ TF S3 Operations	No	Yes	Yes	No	Yes	No	No
Battalion/ TF S2 Operations	No	No	Yes	Yes	Yes	No	No
Battalion/TF S1/S4 Operations	No	Yes	No	No	No	Yes	Yes
Battalion/TF TAC	Yes	Yes	Yes	Yes	Yes	Yes	Yes
S1/S4 Operations	No	Yes	No	No	No	Yes	Yes
Battalion/TF FS	No	Yes	No	No	Yes	No	No
AD Artillery Units	No	Yes	Yes	No	No	No	Yes
Chemical Units	No	No	No	Yes	No	Yes	No
Battalion/TF Scout Platoon Leader	No	Yes	No	Yes	No	Yes	No
Scout Platoon Sergeant	No	Yes	No	No	Yes	No	No

Table 5-4. Company/Team Level Radio Nets

Net Stations	Bn CMD Net	Bn O&I Net	Bn A/L Net	Co CMD Net	Plt CMD Net
Company/Team Commander	Yes	No	No	Yes	No
Company XO	Yes	No	No	Yes	No
Company 1SG	No	No	Yes	Yes	No
Maneuver Platoon Leader	No	No	No	Yes	Yes
Maneuver Platoon Sergeant	No	No	No	Yes	Yes

OPERATIONAL PROCEDURES

5-15. Upgrading SINCGARS SIP/ASIP components and configurations to support the TI provides a basis for implementing operational procedures to take full advantage of the following:

- Improved forward error correction to:
  - Increase throughput over previous versions of the SINCGARS radios.
  - Improve bit error rates over previous communications ranges.
  - Improve interference protection.
- New FH packet data waveform that reduces overhead and improves throughput.
- Improved channel access algorithm that allows mixed voice and packet data operation in a common net.
- A INC in every vehicular FBCB2 that provides packet radio relay nodes across the battlefield for horizontal and vertical integration of C2 elements. In addition, the INC provides a programmable interface for protocol conversion between battlefield functional area (BFAs) to support a seamless architecture.
- Capabilities that support three types of communications architectures:
  - Point-to-point — single link paths.
  - Packet switching — numerous interconnected nodes that form multilink transmission paths.
  - Circuit switching — numerous interconnected switches that form multilink transmission paths.

5-16. See the FBCB2 pocket guide for detailed instructions on SINCGARS initialization, operation, and troubleshooting.

CAUTION

Before initializing any FBCB2 device attached to the TI, first ensure that all radios are turned on. This includes the SINCGARS, EPLRS, and NTDR. Rationale: When a TI FBCB2 device is turned on, it immediately begins sending SA data. Consequently, if the radio is not turned on first (ready to pass FBCB2 data), the buffered SA data will then congest the communications link (possibly to a point of communications failure).

RETRANSMISSION OPERATIONS

5-17. To support retransmission operations, two SINCGARS SIP/ASIP radios can be interconnected to permit the reception of information on one RT and to retransmit that information on the other RT. Figure 5-2 shows the typical retransmission set-up. The retransmission configuration propagates voice or EDM only.

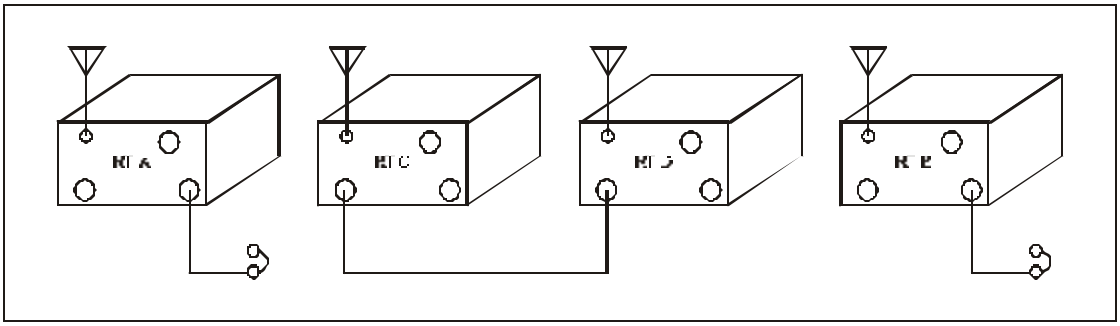

Figure 5-2. Retransmission Set-up

5-18. The RT provides interface signal and control lines for radio retransmission capabilities when the RT function switch is placed in the retransmit (RXMT) mode. The RXMT operation requires two radios with a retransmission connection between the RXMT connectors.

5-19. A six-pin RXMT connector is the physical retransmission interface for each SINCGARS SIP/ASIP RT. The RXMT connectors of both RTs at a RXMT site are connected via the cable assembly CX-13298 or a one-way cable CX-13307/VRC (F1-F1), depending on the type of service desired.

USERS

5-20. The typical SINCGARS SIP/ASIP user consists of key decision makers (commanders and selected staff personnel including signal officers, warrant officers, operators, and maintainers). All users must have knowledge of the SINCGARS SIP/ASIP and the role it plays in the TI. It transmits and receives typical battlefield C2 information. Also, SA data is transmitted, received, and passed through the radio network. Because the SINCGARS SIP/ASIP device has an embedded INC capability, automatic routing of C2 and SA information is transparent to the operator. Modern digital battlefield procedures dictate that the SINCGARS SIP/ASIP and EPLRS radios mutually support the flow of data throughout the battlespace. Figure 5-3 shows this mutual support of data flow requirements.

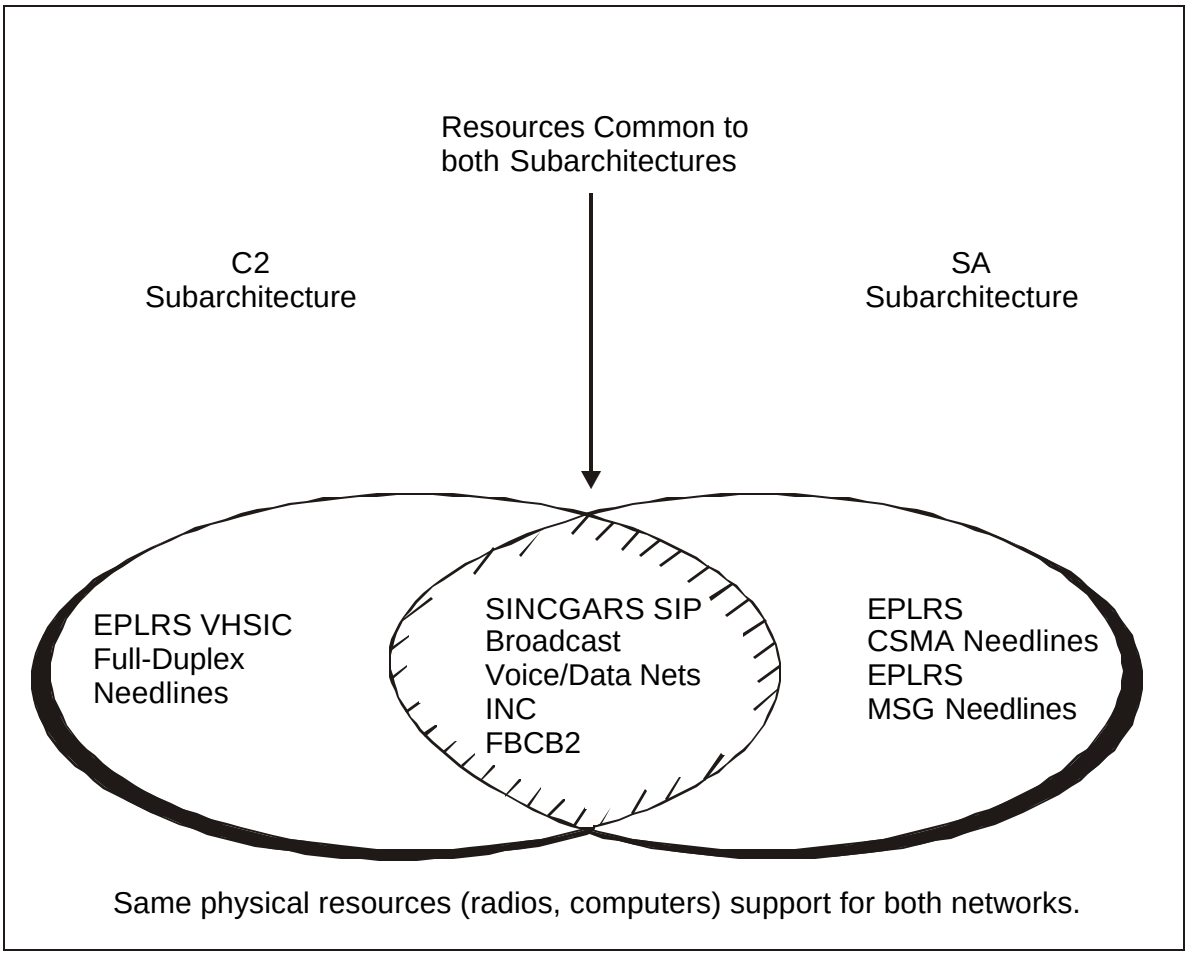

Figure 5-3. SINCGARS SIP/ASIP and EPLRS Provide Mutual Support

5-21. Because of the TI architecture, a variety of new or adjusted procedures is necessary. For efficient and effective communications, the signal operator must ensure–

- Voice communications have top priority.
- All SA messages are fully automated (no operator action required).
- Speed of service (SOS) is emphasized (SA information has precedence over C2 data messages).
- The user manually initiates C2 messages in JVMF.
- Confirmation of message delivery is possible (default for messages are without an acknowledgment—user can set for acknowledgment).
- The user can send messages to any FBCB2 in the communications network and is not limited to other FBCB2s directly connected to the network. The TI is a router-based network rather than a point-to-point network.
- The communications path is transparent to the user—same as commercial Internet or the radio.

TACTICS AND TECHNIQUES

5-22. TI employment provides optimal support to commanders, staffs, units, and soldiers/weapon platforms. The TI leverages technology and achieves horizontal and vertical integration on the battlefield. It enhances the commander's ability to manage time, control tempo, reduce staff layering, and enhance information exchange, analysis, and processing. The SINCGARS SIP/ASIP effectively supports TI operations.

SINCGARS SIP/ASIP FILL

5-23. SINCGARS SIP/ASIP radios require that they be filled, or loaded, with various pieces of information to ready them for full operation. This information consists of net definition for up to six FH nets (data such as keys, hopsets, lockouts, and time of day), up to six COMSEC keys, and up to eight single-channel frequencies. This information may be loaded into the radio one piece at a time via multiple fills from a Mode 1 fill device or, in the case of time-of-day and single-channel frequencies, manually via the radio keypad/display. Mode 2 and Mode 3 fills combine most of this information into a single fill process.

5-24. Fill devices capable of performing a Mode 2 or Mode 3 fill allow the operator to initialize this radio by performing a simple, single fill operation. Mode 2 and Mode 3 fill processes are nearly identical in terms of their implementation. However, the fill information for each is slightly different. Table 5-5 lists the Mode 2 and Mode 3 fill information.

Table 5-5. Mode 2 and Mode 3 Fill Information[1]

Mode	Information Loaded
Mode 2	COMSEC keys TRANSEC keys Hopsets Lockouts
Mode 3	COMSEC keys TRANSEC keys Hopsets Lockouts Time-of-day Single-channel frequencies

[1] Mode 2 fill is a subset of a Mode 3 fill.

COMSEC KEY FILL

5-25. SINCGARS SIP/ASIP COMSEC key fill is accomplished using the ANCD (AN/CYZ-10). The ANCD automates cryptonet control operations for radio nets employing electronically keyed COMSEC equipment. It is a rugged, hand-held, PC-based device that uses tailored application software that is hosted on the ANCD. The software provides user-friendly operation by guiding the operator step-by-step through the required operation. The ANCD screen displays are configured to present data that is controlled by the operator or the ANCD software.

INC FILL

5-26. The most prevalent network modification involves a task reorganization arising from progress of the military operation. SINCGARS SIP/ASIP radios that are affected by each task reorganization must receive new initialization data. Transfer of the modified initialization data should occur through signal channels to the SINCGARS SIP/ASIP radios.

5-27. INCs and other router initialization, using the simple network management protocol (SNMP), receive all necessary data from the FBCB2 host over the serial, directly connected, point-to-point interface. The INC supports task reorganization by accepting changes to the initialization data in the same manner that it receives the initial deployment data (via SNMP). If necessary, a load device directly attached to its configuration port can initialize the INC.