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Common-User Switched Telecommunications for C^3 Systems

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Abstract

Much has been accomplished in the past few years to improve both the Korean. Telecommunications Agency (KTA) networks and U.S. Defense Communications System (DCS) in Korea and make the more responsive to the C^3 needs of CFC and ROK and U.S. military forces. We describe the quality and capacity of Korea's Public Switched Network (PSN) and the U.S. DCS System for Command, Control and Communication (C3) systems.

The quality of the transmission system is as good as that in any nation, and its capacity and survivability for military use has been improved. The U.S. Digital Switch Network (DSN-Voice) in Korea and the KTA Public Switched Network both provide easy-to-use, reliable, efficient telephone service without large numbers of operators. The four sub-nets of the U.S. Defense Data Network (DDN) has been expanded in connectivity and capacity, but except for the unclassified MILNET they are used primarily for U.S. or out-of-country data systems connectivity. We analyzed the major existing and planned multichannel transmission and common-user switched telecommunications systems for the Korean theater of operation.

We studied the communications systems' ability to support combined military operations. The discussion includes the survivability and interoperability aspects of the transmission networks, connectivity for in-country and out-of-country communications, and the interconnection and interoperability between selected U.S. and ROK networks and systems. We found that the U.S. DCS transmission networks and the associated

operational networks as well as other U.S switched systems, the Korean telecommunications networks support Combined Forces Command (CFC) operations.

The U.S. DCS networks and the Korean telecommunications networks provide the potential interconnection and interoperability between the U.S. DSC in Korea and the ROK military and civil systems. To support US. Theater and tactical units that move from their fixed location, on the move SPIDER tactical communications system can interface with the U.S. TRI-TAC/MSE system as well as the commercial KTA switching system.

Keywords: Common-user switched telecommunications, defense communications system, interoperability, $C^{3.}$

1. Introduction

Military modernization efforts are a key variable when assessing the Korean Peninsula. The modernization trends of all the countries involved in the region have great significance in determining the types of engagement that could be fought [1]. Much has been accomplished substantially in the past two decades to improve both Korea PSN and the U.S. DCS transmission network and make them more responsive to the C^3 need of Combined Forces Command (CFC) and Republic of Korea (ROK) and U.S. military forces. South Korea is the world leader in Internet speed, having fastest average internet connection speed at 26.1 Mbps [2].The Korean theater's fiber optics backbone system over1, 200 km is the critical backbone of communications infrastructure. A modern digital fiber optics cable system replaced the aging analog microwave transmission back-bone and this makes the more responsive to the C^3 needs of CFC and ROK and U.S. military forces [3]. The quality of the transmission system is as good as that in any nation, and its capacity and survivability for military use has been improved. The U.S. Digital Switch Network (DSN-Voice) in Korea and the PSN both provide easy-to-use, reliable, efficient telephone service without large numbers of operators. The four sub-nets of the U.S. Defense Data Network (DDN) has been expanded in connectivity and capacity, but except for the unclassified MILNET they are used primarily for U.S. or out-of-country data systems connectivity. The STU-III has greatly improved the U.S. and CFC secure-voice capability, and the United States has expanded the capacity and survivability of its out-of-country military voice, record, and data systems with multiple means and routes. This chapter reviews the major existing and planned multichannel transmission and common-user switched telecommunications systems for the Korean theater of operation. In this paper we study the communications systems' ability to support combined military operations. The discussion includes the survivability and interoperability aspects of the transmission networks, connectivity for in-country and out-of-country communications, and the interconnection/interoperability between selected U.S. and ROK networks and systems. Specifically, we address the U.S. DCS transmission networks and the associated operational networks as well as other U.S switched systems, the Korean telecommunications networks that support CKC operations, and the potential interconnection/interoperability between the U.S. DSC in Korea and the ROK military and civil systems.

The four sub-nets of the U.S. Defense Data Network (DDN) have been expanded in connectivity and capacity, but except for the unclassified MILNET they are used primarily for U.S. or out-of-country data systems connectivity. The STU-III has greatly improved the U.S. and CFC secure-voice capability, and the U.S. has expanded the capacity and survivability of its out-of-country military voice, record, and data systems with multiple means and routes. The transmission network comprises multimedia transmission systems such as microwave radios, cable, leased commercial lines, satellite and High Frequency (HF) systems and control equipment that provide communications connectivity

between different user locations (i.e., C3 nodes) [4]. Different types and quantities of switches and transmission components are then configured to form operational networks, thus providing multiple types of services such as clear voice, secure voice, and message/data communications networks. Some of the operational networks, especially the major ones, can automatically alter their transmission routes to provide more effective communications connectivity, survivability, and capacity utilization for a large number of users. They are referred to as 'switched' or 'common user' networks.

After this introduction, we describe the U.S. transmission networks in section 2, Korean transmission systems in section 3, survivability and interoperability issues in section 4, and conclusion in section 5.

2. U.S. Transmission Networks

The DCS is a U.S. multi-channel, multimedia long-haul communications networks that interconnects all fixed U.S. land, maritime, and air facilities worldwide [5]. It is the primary means by which the theater-level commanders communicate with each other, with subordinate tactical commanders, and with higher authorities outside the theater of operations. DCS can also include connectivity extended from a theater-level U.S. command to a high echelon U.S. tactical command. Figure 1 illustrates the major U.S. transmission networks currently used by the military in Korea. The DCS in Korea includes the fiber optics cable backbone, the Pulse Coded Modulation (PCM) cable systems, the digital microwave systems, and most channels and digital groups in the Korea Telecommunications Authority (KTA) systems used by the United States. It also shows parts of the KTA systems originally installed and still used in support of CFC operations at theater level. These systems are known as the ROK Army Bypass and the ROK Air Force Peace Fortune systems. The Korean theater DCS is particularly important because most theater/ tactical command and support organizations rely on it to perform the wide range of command operations. Currently almost all U.S. Air Force communications in Korea are carried by the DCS. The United States is responsible for Echelon Above Corp (EAC) communications in the CFC. These circuits are supported primarily by the DCS. The executive agent for the DCS in Korea is the U.S. Army. The primary organization involved in theater communication operations and planning is First Signal Brigade, a unit of the Army Information Systems Command at Fort Huachuca.

DCS Fiber Optics Cable Network

The fiber optics cable networks are the major DCS telecommunications systems in Korea. The cable, as shown in Figure 1, follows the corridor of U.S and CFC command posts and other organizations from Uijongbu in the north through Seoul to Pusan on the southern coast. The cable is contained in a duct system. Except for major river crossings the ducts were to be buried up to 5 feet underground along the backbone and deeper at all detours and spurs. Restoral packages will be used to repair damages to the cable or terminal locations.

Repeater vans, local terminal vans, and radio reconstitution vans are to be used for restoral. The DCS backbone consists of 12 fibers occupying one of the three tubes. The basic characteristics of the U.S. fiber optics transmission system are: 64 kb/s voice channels, 24 voice channels grouped with the AN/FCC-98 multiplexer into a 1.544 Mb/s data stream, 28 1.544 Mb/s grouped with the AT&T MX3 multiplexer into a 44.736 Mb/s data system, and A two-way, 90 Mb/s link supported by the two optic fibers. The fiber optics cable system incorporates the deployment of AN/FCC-98 multiplexers at every node, partly for reliability and partly to permit interconnection with potential tactical or civil communications systems [6]. The AN/ FCC-98 multiplexer can accept the following types of input and combine them in a 1.544 Mb/s output stream: Analog voice (up to 24 channels, digitized to 64 kb/s), Special cards for 64, 56, 50, 48, 0-20, 128, 256, and 512 kb/s. This permits interconnection with communications links with these characteristics provided that the other digital characteristics are also compatible. Interconnects can also be made at the full 1.544 Mb/s rate. While this does not these "outside" circuits can be integrated into the DCS because of differences in bit rate, switching algorithms, and other details, all transmission systems in Korea can be interconnected in some manner. In most cases one type of network and system can at least serve as a conduit or pipeline for another type of network and system.

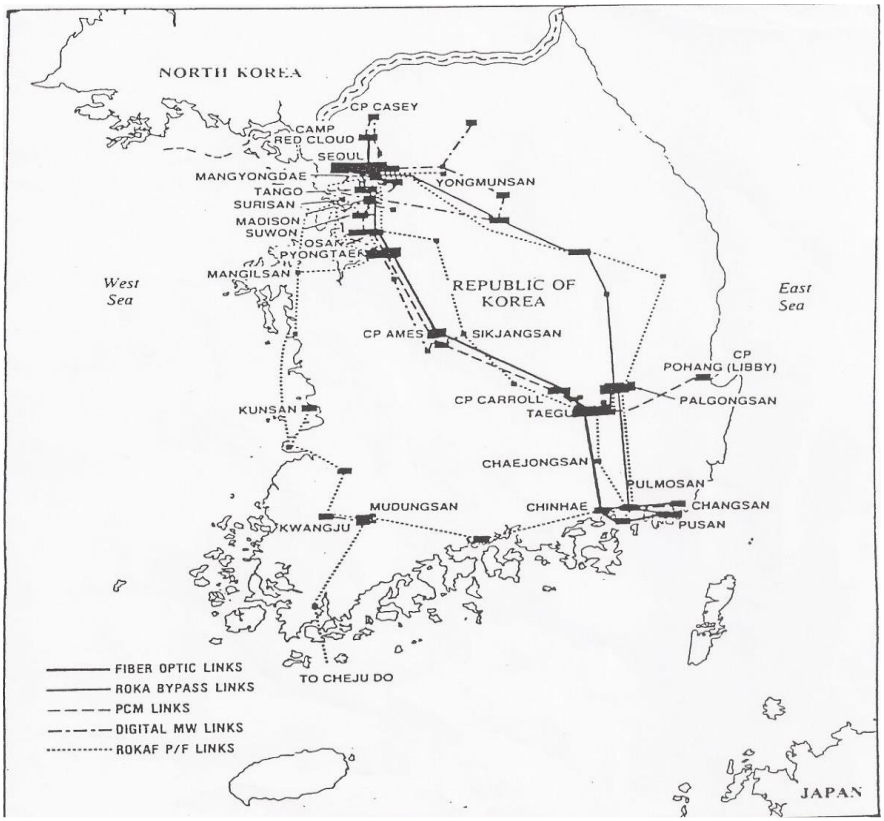

Figure 1: Major Korea Communications Networks used by the DCS

The PCM Cable System

The PCM cable system shown in Figure1 was originally installed to provide control of the pumping stations for the Petroleum, Oil and Lubricant (POL) Distribution System, Korea (PDSK) [7]. The Trans-Korea Pipeline extends from Pohang on the east coast of Korea to Seoul and provides multilevel petroleum products to U.S. forces and storage points along the POL pipeline route. The cable is 252 miles long and has 234 repeaters. It serves seven pumping stations located at Seoul, Osan, Pyongtaek, Taejon, Waegon, Taegu and Pohang. The original system was been on a 12-pair communications cable serving the pipeline. Recently completed upgrades have increased the capacity for the segment extending from the north of Seoul to Pyongtaek to 96 channels. The rest of the system currently remains at a 24-channel capacity. Although originally intended exclusively for pipeline control, this cable is now operated as part of the DCS to provide access to U.S. activities in the ROK as a backup or alternate route to segments of the DCS analog microwave or fiber optics cable networks. Access to the PCM system at selected communications sites gives voice frequency access to technical controllers and subscribers. Locations include Pyongtaek, Taejon, Camp Carroll, and Camp Walker. The full 24-circuit capacity is available for restoring high priority circuits in emergencies. However, priority is given to essential pipeline control circuits.

Digital Microwave System

The digital microwave network uses AN/FRC-162 radios and AN/FCC-97 and CV-104 multiplexers [8-9]. The primary function of this net is to connect special outlying U.S. sites to Osan Air Base and Pyongtaek. The initial phase connects the area north of Seoul with sites in the Seoul vicinity and the Osan and Pyongtaek area. The major trunks include 72 circuits from Seoul to Osan with 48 circuits through-grouped to Pyongtaek and 24 circuits from Seoul directly to Pyongtaek. The circuits are routed over other DCS transmission systems from Osan to the Pyongtaek.

Transportable System for Reconstitution of C^3

Road Warrior is a mobile (transportable) communications support package for CINCCFC(Commander-in- Chief, Combined Forces Command) and USFK (U. S. Forces Korea) [10]. It provides communications support for a transportable alternate command post. The package includes terminal equipment for AUTODIN, RATT, and secure and non-secure voice subscribers. The transmission equipment in the package includes: A line of sight tropospheric (LOS/TROPO) multichannel microwave terminal that can be connected to a DCS microwave site, An AN/TSC-85 SHF SATCOM terminal that can be connected to any DSCS terminal having GMF SATCOM interface equipment within the coverage of the same DSCS satellite, and other GMF SATCOM terminals in the ROK, An AN/URC-101 UHF SATCOM terminal for access to a UHF SATCOM net, HF and VHF-FM radios with RWI for operation in long-haul RATT or tactical FM nets if required.

Commando Runner is a USAF/7AF program that integrates upgraded, transportable U.S. tactical communications equipment from the TRI-TAC family to support KTACS communications needs when the DCS in Korea could not support essential requirements [11]. The equipment could also be used for DCS restoral and/or reconstitution if necessary. Commando Runner equipment includes both transmission and switching equipment. The transmission equipment includes AN/TRC-170 TROPO/LOS terminals, AN/TSC-94A and 100A SHF SATCOM terminals, both with TRI-TAC DGM multiplex; AN/TSQ-111 tactical communication technical control equipment; and DCS interface equipment for operation with DCS transmission and switching system. The terminal and switching includes both circuit and message switches. The Army 1st Signal Brigade has access to several SHF SATCOM terminal that can be used to reestablish connectivity between U.S. and CFC nodes that have been disrupted by losses in DCS connectivity. In the event of a North Korean attack of the ROK, several out-of-country U.S. Army Signal Battalions equipped with TRI-TAC equipment could also be made available to reconstitute and/or extend and modify the DCS in Korea, although it could be several days before they arrive. In additions, the 1st Signal Brigade is scheduled to receive over 100 items of transportable TRI-TAC block III equipment. This equipment includes transportable automatic switches, technical and system control equipment, and multichannel microwave terminals and relays. It replaces old manual switches and transportable PCM microwave equipment and can be used to establish up to six nodes of echelons above corps communications with links between nodes and to the fiber optics cable. It can also provide temporary low capacity microwave links to bridge segments of fiber optics cable until it can be repaired.

Analog Microwave System

The analog microwave system was the primary DCS radio transmission system in Korea. The central feature is a "backbone" string of microwave relays connecting most of the major commands and support organizations from CP Red Cloud in the north (DMZ support) to Changsan and Pusan in the south. Short spurs extend the communications connectivity to the off-backbone sites. A limited number of cable links supplement the backbone, primarily in the northern area. The basic transmission equipment for this system are the AN/FRC-109 solid state microwave radios ad AN/FCC-18 solid state multiplexers. The network supports up to 120 voice channels from Uijongbu to Seoul, 600 channels from Seoul to Taegu, and 360 channels from Taegu to Pusan. The cable connections in the northern part of this network primarily connect Seoul, Camp Red Cloud (HQ CFA), and Osan.

3. Korean Transmission Systems

The ROKA Bypass

The KTA operates all civil and non-tactical military communications systems in Korea. A mixed cable-microwave communications system, called the ROKA Bypass, supports the ROK Army, linking the Army's major headquarters (HQ

ROKA in Taejon, HQ FROKA at Wonju, HQ TROKA at Yongsan, and HQSROKA at Taegu) and major outlying installations. This system, originally funded by the U.S. Government, was completed and turned over to the ROKA in 1967. Subsequent modifications have upgraded the system to 960 channels from its original 600-circuit capacity and improved its quality. USFK/EUSA (Eighth U.S. Army) can access this network and use part of the available channel capacity as a backup to the U.S. operated DCS circuits. The ROKA Bypass is shown in Figure 1. The system is currently a Frequency Division Multiplexing (FDM) analog system similar to the DCS analog system. The ROKA system includes buried coaxial cable from the Seoul area to Paegunsan, and microwave links using Korean-operated mountain-top sites from Paegunsan south to the Taegu area on to Changsan on the south coast. The system provides the DCS with an alternate route, well removed from the main backbone route, between the DCS facilities at Yongsan and Camp Walker through the central part of Korea. If necessary, Changsan can be directly connected with Yongsan by patching through at Taegu. This system can support some of the high-speed data needs of Worldwide Military Command and Control System (WWMCCS)and TACCIMS, and USFK has requested four T-1 groups on the system quid pro quo. The current interconnects between the analog microwave and ROKA Bypass system are as follows: 1) Seoul, between the Yongsan DCS station and ROKA site 1 with coaxial cable, 2) Palgongsan, between the northern and southern portions of the ROKA system and the DCS site at Camp Walker with a U.S. microwave link, 3) Pulmunsan, ROKA site 12 and Changsan with a DCS microwave link. The concept plans for removal of the U.S. analog microwave system require changes in these interconnection to provide for the continued availability of DCA-to-ROKA bypass interconnects.

The ROKAF Peace Fortune Network ROKA

The ROKAF Peace Fortune communications network supports the Korean Tactical Air Control System (KTACS), connecting the Hardened Tactical Air Control Center (HTACC) at Osan Air Base with the Control and Reporting Centers (CRCs), Control and Reporting Posts (CRPs), and other KTACS elements including the air cases throughout the country. At shown in Figure 1, it is basically a microwave relay net. The U.S. Air Force uses the Peace Fortune network for about 10 percent of its communications. The bulk of U.S. Air Force communications travel over DCS circuits where available, but a number of Air Force installations are served only by Peace Fortune. The most important of these is the Kwanju Air Base at the peninsula's southwestern section. The U.S. contingency airfields are likewise not DCS-supported, but relatively little U.S. communications traffic is needed until augmentation forces are developed to these bases. U.S. Air Force communications to the augmentation forces would then be over additional Peace Fortune circuits, "commando runner" systems, and U.S. communications capabilities deployed with the reinforcement forces. Existing interconnections with the DCS microwave analog system are listed in Table 1. These interconnections are to be continued as part of the concept plan for getting U.S. 'Soldiers off the Mountaintop', which proposes a change to the

theater communications system to reduce personnel support requirements, by modification of necessary technical controls.

Table 1: Peace Fortune-DCS Interconnects

ROKAF	DCS	Voice Frequency Channel Capacity
Yongmunsan	Baeson	12
Osan	Bucket	120
Mangilsan	Fayetteville	12
Taegu	Camp Walker	60
Kunsan	Kunsan	12

OUT-of-Country Communications

As illustrated in Figure 1, U.S. military communications connectivity to locations outside the Korean peninsula such as Hawaii, Continental U.S. (CONUS), Okinawa, Japan and Philippines is accomplished through the Defense Satellite Communications System (DSCS) gateways at Camp Carrol in Songso, and CO TANGO, and through the microwave gateway to Japan at Changsan. In addition, the USFK also leases channels from the commercial satellite communications system, INTELSAT, which has terminal at Kunsan and Boeum. These systems can connect the DCS in Korea to CONUS, Hawaii, Japan, Guam, and Clark AFB in Philippines. During crisis and exercises, the U.S. armed forces can also operate transportable SHF and UHF SATCOM terminals for other out-of-country communications locations if needed.

DCS Data Networks

There are two DCS Data Networks in Korea, the Automatic Digital Network (AUTODIN) and the Defense Data Network (DDN). AUTODIN is a worldwide store and forward switched record communications operational network that provides secure data communications between various data and message terminals and/or computer processors. Pacific AUTODIN Switching Centers (ASCs) are located in Hawaii, Guam, Japan, and Camp Walker in Korea. This ASC services approximately 50 full-time subscribers and about 10 contingency subscribers that are normally called up twice a year during exercises. The DDN is a worldwide packet switching network designed to provide host-to-host computer communications, terminal-to-host communications, and electronic mail. DDN is composed of the MILNET, DSNET 1, DSNET 2, and DSNET 3. The MILNET is an unclassified common user network that supports general automated data processing services such as finance, personnel, supply, and electronic mail. The DSNET 1 is a SECRET level common-user network and can support subscribers requiring SECRET level classification. The DSNET 2 is a TOP SECRET level network and the DSNET 2 is a TOP SECRET/special intelligence network. There are four MILNET Packet Switching Nodes (PSNs) in Korea. They are located at Camp Walker, Kunsan, Osan, and Yongsan. Figure 2 shows these nodes and their connectivity to the worldwide network. The only DSNET 1 PSN in Korea is located at Yongsan and has dual connectivity in the worldwide network through Japan and Hawaii. The only

DSNET 2 PSN in Korea is located at Camp Walker and is connected to both Makalapa and Hickam. The WWMCCS host is connected off the PSN (20) [12]. Another PSN (50) for Camp Walker is pending. It is to be connected to both the PSN and the WWMCCS host in Korea and out of theater to Ft. Buckner. There are two DSNET 3 PSN in Korea. They are located at TANGO and Osan, and interconnected by a 50Kbps circuit. In addition. TANGO is connected to Camp Smith and Clark, and Osan to Hickam and CP Zama.

4. Survivability and Interoperability Issues

Over the past decade the military circuit-switching subsystems of the DCS and the KTA have been even greatly improved. The switches have changed from analog and manual to mostly digital and automatic. From an increased number of switching centers and multiple connectivity among these centers. This is also true for the KTA military and

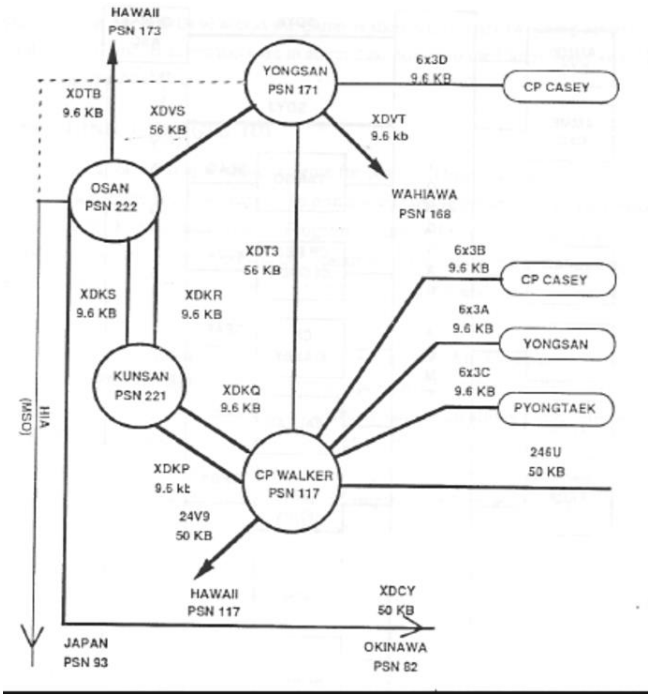

Figure 2: DDN and MILNET in Korea

Public Switched Network and the U.S. DDN for out-of-country data. The switching centers supporting fixed installations are as hard as the command centers they support and should survive as long as the command centers. Both the U.S. Army and Air Force component's communications support units are being issued transportable switching centers from the TRI-TAC family of equipment to provide a limited support to transportable command centers and communications restoral. The only two record message switches in theater are the AUTODIN ASC (Automatic Switching Center) at Taegu and the Army Automatic Message Switching Element (AMME) at Yongsan, although some

AUTODIN terminals can be dual-homed. Both of these switches are subject to damage by North Korean air and special purpose forces attack. While essential C^3 data can continue to flow over dedicated in-country systems such as TACCIMS and the out-of-country DDN sub networks, there could be a major backup of administrative and logistics traffic. The U.S. PMC cable and digital microwave systems in Korea provide some alternate route capability for fiber optics cable. The links, capacity, and some limitations of the cable are:

- Uijongbu to Yongsan (10 T-1 Multiplexing lines; Cable routing and the type of repeaters used on the system make it susceptible to long outages.

1. Yongsan to Tango (10 T-1 Multiplexing lines).
2. TANGO to Suwon (8 T-l Multiplexing lines).
3. Suwon to Osan (8 T-1 Multiplexing lines).
4. Osan to CP Humphreys (7 T-1 Multiplexing lines).
5. Bucket to CP Humphreys Filed station (2 T-1 Multiplexing lines).
6. CP Humphreys to Taejon (2 T-1 Multiplexing lines: Due to the number and type of repeaters, the system is unreliable and will not support data higher than 4.8 Kbps).
7. Taejon to CP Carroll (2T-1 Multiplexing lines: Due to the number and type of repeaters, the system is unreliable and will not support data higher than 4.8 Kbps).

- CP Carroll to CP Walker (2 T-1 Multiplexing lines: Needs to be upgraded to support 50, 56, 64 Kbps and T-1 data rates).

The ROKAF microwave communications network, also known as the “Peace Fortune” system, can be used on a quid pro quo basis for a few high priority voice quality channel reroutes, but rapid use of these reroutes is not possible because of the time required for full coordination with the ROKAF and the KTA. If the programmed projects are completed, the Peace Fortune system will provide an alternate route for four T-1 groups and this will allow for restoral of a minimal approximately 4 percent FO cable capability. The Southern Loop could provide a substantial restoral capability. Additional alternate route capability could be provided by minor upgrades to the Camp Walker-to-Camp Humphreys PCM cable to give it a fully five T-1 group capability and this will bring the digital microwave system up to DCS standards and integrating it into the DCS. Integration of the digital microwave into the DCS needs to include the interfaces and re-channelization needed to make full use of its alternate route capability. We believe that above actions when taken together can provide an acceptable restoral capability during the armistice. They may also provide minimum essential theater communications connectivity in the initial stages of combat operations until additional transportable systems arrive in-country and system reconstitution actions can be taken. ROK Army already developed and deployed SPIDER system to provide theater-level communications survivability.

At theater level, the needed communications interoperability involves the KTA and the DCS. The types of interoperability needed are T-1 groups between two DCS nodes over KTA transmissions systems, individual circuit and channel

leases between DCS nodes or subscribers, and DSN telephone exchange to KTA telephone exchange operations. For the current fixed DCS there does not seem to be any technical problems in providing either T-1 groups or individual circuits, when the DCS uses transportable TRI-TAC equipment for extension, restoral or relocation purposes. It is also possible to connect most CFC and U.S. DSN telephone exchanges to KTA telephone exchanges on a manual or one-way automatic basis. Higher level of direct dialing between the systems is possible for both local and DDD calls by most subscribers. However, except during periods short of crisis, this capability is limited to prevent unauthorized calls. In times short of combat the time required to change the service to satisfy changing needs or alternate routing requirements is excessive. If the KTA's response to CFC needs are to be rapid in times of combat the technical interfaces and procedures for allowing access to KTA systems on a direct dialing in and out dialing basis and for alternate routing or for restoring voice connectivity must be in place and exercised frequently. Procedures for restoring high speed data connectivity should also be developed, recognized by the appropriate technical controllers, and exercised in frequent combined communications training operations. While the lack of interoperable digital multiplex schemes can be partly overcome by de-multiplexing and interfacing at the channel level, this procedure creates a problem of encryption. This technical interface designs and procedures for interoperability should be developed for each location and configuration control of the interfaces should be maintained.

5. Conclusion

Survivability of theater communication systems in Korea depends on both the systems' switches and transmission links. The transmissions are not as survivable as the switching system. The fiber optic cable provides the capacity and quality needed for theater operations, but it is a single thread system that carries almost all critical circuits.

If it is cut at any point, the critical circuits through that point are out until they are restored. Although the complete cable system is not easy to destroy, sections of the cable are highly vulnerable to physical damage resulting from wartime sabotage, incidental activities such as construction work, certain inclement weather such as heavy rain and typhoons, vandalism, and power and other equipment malfunctions. These types of damage along any part of the cable can cause outages that require circuit reroutes while service on the cable is being restored.

The digital microwave system currently provides no easily accessible restoral capabilities for the FO cable. To support U.S. theater and tactical units that move from their fixed location, on the move SPIDER tactical communications system can interface with the U.S. TRI-TAC/MSE system as well as the commercial KTA switching system. And technical interface designs and procedures for interoperability should be developed for each location and configuration control of the interfaces should be maintained.

References

[1] Joseph Trevithick, Here's America's plan for nuking its enemies, including North Korea, The War Zone, 2017.

[2] Ryan Browne, US aircraft carrier-led strike group headed toward Korean Peninsula, CNN Politics, U.S. Military, 2017.

[3] Young C. Park, Study of U.S. and ROK bilateral C3 interoperability, IJST 9 (24) (2016), 53-60.

[4] Young C. Park, Interconnection study of joint tactical communications systems. IJST 8 (34) (2015), 1-7.

[5] Amber Corrin, DISA to replace DCO with new collaboration services tool, C4ISRNET, 2015.

[6] Carl E. Vuono, General support maintenance manual multiplexer sets AN /FCC-98(V) 1 (2013), 2-4.

[7] Joel B. Hudson, Petroleum supply in Korea, Quaerter master Professional Bulletin, Spring, 2000.

[8] James R. Hammer, AN/FRC-162 Digital radio characterization, Ft. Belvoir Defense Technical Information Center (1976), 24-27.

[9] Edward F. New, Digital transmission evaluation project AN/FRC 162 Test, Army Communications-Electronics Engineering Installation Agency, Fort Huschuca Arizona (1976), 12~16.

[10] Tapio Saarelainen, Jorma Jormakka, C4I2-Tools for the future battlefield warriors, 2010 Fifth International Conference on Digital Telecommunications (2010), 38-43.

[11] Young C. Park, Verification of the transfer address digits from Spider to TRI-TAC/MSE networks, International Journal of Applied Engineering Research (IJAER) 10 (90) (2015), 409-412.

[12] Tom Van Vleck, B2 security evaluation, Multics (2015), 5-11.