

Troposcatter in South East Asia

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Introduction

Some people know the background of Backporch tropo scatter system in Vietnam but a very few people know the origin of the origin of the Integrated Wideband Communications System (IWCS) and the AN/TRC-132 Troposcatter Terminal. I have been fortunate to be involved in the events leading up to the CINCPAC proposal for the IWCS and its final design and installation as well as the creation of the AN/TRC-132 tropo terminal.

Before the Beginning

In the late 50's I served in the Japan Signal Battalion and served as the Radio Officer of the US Army Japan. The Signal Officer and our commander was Colonel Tom Riley. *(In 1965-66 Colonel Riley was the Signal Officer of the US Army, Vietnam and reported to General Westmoreland,` CG, US Army, Vietnam and to Brigade General Bob Terry, the CG, 1st Signal Brigade.)*

One day my boss, Major Ralph Keefer (later Lieutenant Colonel), and I were summoned to Colonel Riley's office. Also present was a Colonel from Washington. This Colonel had just returned from Indonesia where he was involved in a project for the transfer of Philco Troposcatter equipment to the Indonesian Army. **This Indonesian Troposcatter equipment became the foundation of the IWCS, which was not even conceived until more than five years later.**

The Indonesian system was quite interesting to us since we were in the process of planning a tropo scatter system for Japan. This system, The Japan Tropo System, was approved and funded in 1960 and completed in 1961. For more information on this system read "[Japan Troposcatter System](#)".

Backporch Tropo System

During the period 1960-1963, I was assigned to the US Army Signal Corps Research and Development Laboratories at Fort Monmouth, NJ as their liaison officer to the Air Force Rome Air Development Center (RADC) at Griffiss AFB, NY. While at RADC I became familiar with the Air Force developed AN/MRC-85. The AN/MRC-85 was a 10-kilowatt, quadruple diversity tropo scatter terminal housed in three semi-trailers and using permanently installed 60-foot antennas.

Page Engineers was awarded a contract to install the Backporch Tropo Scatter System in Vietnam using the Air Force AN/MRC-85 equipment. These AN/MRC-85s were moved from Europe and Alaska to Vietnam. This installation was completed in 1963. Backporch interconnected Phu Lam (Saigon), Nha Trang, Qui Nhon, Da Nang, Pleiku and Ubon AB in Thailand.

First Trip to the Far East

1963, Colonel Larry Bengel, my mentor and a former commander of the Japan Signal Battalion, had me transferred to his office in the Office of the Chief Signal Officer (OCSigO). He sent me to the Philippines, Taiwan, Okinawa, Vietnam and Thailand to investigate two non functional Tropo Scatter Systems, the ITT installed link between the Philippines (Clark Air Force Base) and Taiwan and the Philco Ford installed link between Saigon (Phu Lam) and Bangkok (Bang Ping).

During this trip I visited the 39th Signal Battalion at Tan Son Nhut. They were operation the Backporch system as well as AN/TRC-90 tropo systems. The only quality control was a circuit that looped through the Backporch system and terminated in the Operations tent. The Operations Officer could get some indication of system quality by the level of background noise on the EE-8 telephone.

Quality of the many circuits in Vietnam was less than desirable since many circuits were extended over tactical communications systems. During this visit I was given a diagram of the interconnection of circuits in Vietnam. I have retained this diagram through the years. My copy is about the 15th through a copy machine and is barely readable and not suitable for reproduction. I have redrawn this diagram and attached it to this article. I think it speaks for its self.

Friend at CINCPAC

During this trip I met Navy Commander Ray Ward at CINCPAC J6. I got to know Ray quite well. During the next two years we met several times a year and talked by phone frequently to discuss communications problems in the Pacific. There will be more about Ray later.

Friend at DCA-SEA

I traveled to the Philippines and met with Navy Captain Marshal Ward, Commander, Defense Communications Agency - South East Asia (DCA-SEA). Captain Ward was very helpful and said he would provide me with assistance in dealing with the US Embassy and the Armed Forces of the Philippines.

Transferred to STRATCOM

In early 1964 the US Army Strategic Communications Command (STRATCOM) was designated a major command and Colonel Bengel was transferred to the command as the deputy commander. Shortly thereafter I was transferred to STRATCOM as the Radio Officer. The Director of Engineering was Colonel Kenji Hino with whom I had served in Japan and my immediate boss was Lieutenant Colonel Ralph Keefer, my old boss from Japan.

AN/TRC-90 and AN/TRC-132 Tropo Terminals

In the early 1960's Collins Radio provided the Army Signal Corps with one or two tropo links that provided communications to the Department of the Army radio transmitter and/or receiver sites in the Washington area. Collins saw an opportunity and designed a transportable tropo terminal and they were successful in selling six to the Signal Corps for use in Vietnam. The tropo terminal, the AN/TRC-90, consisted of a single

one-kilowatt transmitter with dual diversity receivers and 15-foot antennas. These terminals were deployed to Vietnam in 1963.

The AN/TRC-90 had a limited range due to its antenna size, power and diversity. This caused some problems in Vietnam. The Signal Officer, US Army Pacific (USARPAC) discussed this problem with Collins Radio and Collins Radio developed a 10-kilowatt power amplifier to be added to the AN/TRC-90. Collins Radio made an unsolicited proposal to USARPAC for six 10-kilowatt power amplifiers in shelters together with trailer mounted power generators. In the fall of 1963 this proposal was forwarded to the STRATCOM for technical review.

It fell on my shoulders to review this proposal. The shortcomings of the original AN/TRC-90 were obvious. The increase in power was not the best technical or deployment solution. Furthermore, there would be major logistical problems with the additional shelter for the 10-kilowatt amplifier, its accompanying power generator and the logistics to support it. The same improvement could be accomplished with the addition of a second one-kilowatt transmitter and two additional receivers, thus converting the AN/TRC-90 from a dual diversity system to a quadruple diversity system. The expected cost of a quadruple diversity AN/TRC-90 would have been essentially the same as for a 10-kilowatt amplifier together with its accompanying power generator.

The USARPAC request for the 10-kilowatt power amplifiers was not approved. This did not sit well with the Signal Officer, USARPAC.

A dual diversity system transmits one frequency that is received on two antennas and two receivers. A quadruple diversity system transmits two frequencies, each of which is received on two antennas and four receivers. In both cases the received signals are then combined to provide an optimum signal.

If I proposed a new configuration of the AN/TRC-90 it would have been very difficult, if not impossible, to get it approved. There is always a better way to skin a cat. Proposals from contractors are usually considered to be based on a solid technical foundation.

I contacted my good friend, Joe Culp, Army Marketing Manager of Collins Radio (*several years later Joe became President of Collins Radio*). We developed a plan to develop an unsolicited proposal to STRATCOM for a quadruple diversity configuration of the AN/TRC-90.

One Saturday in late November 1963, I spent the day in Joe's office together with two Collins engineers. At the end of the day we had created the floor plan and the entire interior configuration of a quadruple diversity AN/TRC-90. This was a memorable day in another respect. This was the day of the Auburn - Alabama football game. My son was watching it on the TV and making reports to me via an open phone line all afternoon. At the end of the day I was extremely happy, we had configured a quadruple diversity AN/TRC-90 and Auburn had beat Alabama 10 - 8.

During the next couple of months Collins created an unsolicited proposal to STRATCOM for a quadruple diversity AN/TRC-90, later designated the AN/TRC-132. As Radio Officer, I was responsible for the evaluation of this proposal. I gave it a strong technical and economic endorsement and it was eventually approved, funded and

contracted to Collins. The first AN/TRC-132's arrived in Vietnam in late 1966. *This is the first time I have discussed my involvement in the creation of the AN/TRC-132.*

Second Trip to the Far East

On an extended trip to the Far East in 1964, Commander Ray Ward of CINCPAC J6 asked me if I could review some possible tropo links in Thailand to see if they were feasible. Ray provided me with maps, equipment parameters and site locations. I had a STRATCOM engineer with me. We worked all weekend studying the maps and performing enough analysis to determine the feasibility of the proposed tropo links. On Monday morning I reported to Ray that all of the potential links were feasible. He never explained the rationale for his request but did say he would have something to show me when I returned from my trip to the Philippines, Okinawa, Vietnam and Thailand.

When I arrived in the Philippines, Captain Ward, DCA-SEA, fulfilled his promise to provide me with assistance. With support from Page Engineers and the Armed Forces of the Philippines, we made site surveys and selected a new site in the mountains near Bagio, about 90 miles from Clark AFB. The success of the reconfiguration of the Clark AFB to Taiwan system was in part due to Major Emmett Paige (later Lieutenant General), who was assigned to the DCA-SEA. Although Emmett was not officially assigned to help me (he worked nights), he spent his free time assisting me with the US Embassy and the Armed Forces of the Philippines. Through his assistance we obtained the new site for the Clark AFB to Taiwan tropo system.

A contract was awarded to Page Communications Engineers to reconfigure the Philippine (Clark AFB) - Taiwan system by moving the Clark terminal to an elevated site called Cabuyo, about 90 miles north of Clark AFB. New 120-foot antennas were installed at Cabuyo for the link to Taiwan. The Taiwan site was basically unchanged. The Cabuyo site was then interconnected to a new site at Clark AFB via a diffraction link. This reconfigured link interconnected with a Collins Radio installed microwave system in Taiwan, a Collins Radio installed tropo link between Taiwan and Okinawa and on to Japan via the Japan Troop System. **For the first time there was multi-channel communications available from Japan to the Philippines.**

New sites were selected for the Saigon - Bangkok tropo link and a modification was made to the Philco contract to relocate both terminals. The Saigon terminal was moved to Vung Tau, approximately 40 miles southeast of Saigon and the Bangkok terminal was moved to Green Hill, approximately 70 miles northeast of Bangkok. These two new sites were interconnected to Saigon (Phu Lam) and Bangkok via microwave links. After this reconfiguration, this system was able to transmit voice traffic but its performance was not up to DCA Standards.

IWCS Born

On my return to Hawaii, about three weeks later, Ray Ward said that the Army had a lot of Philco tropo equipment stored at Sacramento. Yes, this is the Philco tropo equipment I had heard about in Japan in 1959. There were diplomatic problems that prevented the shipment of the equipment to Indonesia and it had been in storage in Sacramento for several years.

Southeast Asia communications requirements were growing and Ray saw an opportunity to jump start communication expansions. He understood the military procurement system and knew that it would be easier to get funds to reuse existing equipment than to buy all new equipment. He showed me a draft message that was being staffed within CINCPAC that proposed the establishment of an Integrated Wideband Communications System (IWCS) for Southeast Asia. The system would use the Philco equipment in Thailand and new equipment in Vietnam. The equipment in Vietnam would have to be compatible with the Air Force provided Backporch Tropo Scatter system previously installed in Vietnam by Page Communications Engineers. The message also recommended that the US Army contract and provide these systems. **These actions led to the establishment of the IWCS.**

Ray was the staff officer that had the responsibility for communications in Southeast Asia and wrote and staffed the CINCPAC IWCS message. **Ray had the concept, did the research, proposed the idea and wrote the message, making Commander Ray Ward the father of IWCS.** (*Ray Ward retired as a navy Captain*)

IWCS task to Army and STRATCOM

When I returned to Washington, I reported to my boss, Lieutenant Colonel Ralph Keefer. I told him about this message and that we were about to be given the responsibility for a major project. **He didn't believe me at this time, but in October 1964 the CINCPAC message arrived in the JCS.** It was not until April 1965 that the JCS approved the project and tasked the Army (STRATCOM) with the responsibility for the engineering of the IWCS on an expedited basis.

Major Emmett Paige provides funding and procurement leadership

We knew that we had to move quickly to determine funding requirements and sell the final program to the various military headquarters. The procurement agency was the US Army Communications Systems Agency (USACSA) at Fort Monmouth and the key individual for the IWCS project was Major Emmett Paige. I met Emmett in Japan in 1959 and we worked together in the Philippines in 1963. We had also worked together on several projects during 1964-65 while he was at Fort Monmouth. Emmett had the responsibility for the procurement and selling the IWCS project and I was responsible for the engineering. We worked closely together to move the IWCS project forward. Due to his lead, the approval and funding went smoothly and quickly and the Secretary of Defense approved the funding of the project in August 1965. [Headquarters STRATCOM recognized our efforts in 1967.](#)

IWCS System Specifications

The design of the links and engineering also was accomplished on an accelerated pace. Two STRATCOM engineers, Major Paige and I wrote the final procurement technical specifications in one long weekend.

We added two elements to the IWCS that were not part of the original plan, a Saigon microwave system and a Communications Command and Control facility. We did not ask anyone for approval, we just did it. We never received any complaints.

Saigon Microwave System

I was familiar with the various military installations in the Saigon area so we added microwave interconnections from the IWCS terminal at Phu Lam, Tan Son Nut AB, MACV HQ and the US Embassy.

Communications System Command and Control Center

During my assignment in Japan we had an operational control center for the long lines links throughout Japan. This control center was at the Headquarters, US Army Japan and had direct communications to all major nodes but relied on verbal reports from outlying nodes of any communications problems.

Based on this experience I saw the need for two sophisticated operational control centers that were external to the actual communication system and the individual Tech Controls. We added two separate, stand alone, Operations Communications Command and Control Centers to the procurement specifications, one for Vietnam and one for Thailand. These control centers were to be the heart of the IWCS with alarms from all IWCS nodes received and displayed on wall mounted displays and control panels. The control centers also had direct communications to the major IWCS nodes in their respective countries. Details of this Operational Control Centers is detailed in an article; [“Communications System Command and Control”](#) published in the IEEE Transactions on Communications, Vol. Com-18, No 2, April 1970. **This was the first Communications System Command and Control Center ever created for any US military communication system.**

Contract Awards

In September 1965 letter contracts were awarded to Page Communications Engineers for the Vietnam portion of the IWCS and Philco Corporation for the Thailand portion of the IWCS.

Pleasant Surprise on the way to Saigon

In September 1965 I was transferred to Vietnam as part of a team to establish STRATCON - South East Asia. My flight from Hawaii was by an odd route. I flew via Japan and the Philippines. There was a layover of a few hours in Japan and in the Philippines. When I arrived at Clark AFB. Marshall Cain, a civilian from DCA-SEA, met me. We had known each other when Marshall was assigned to DCA Headquarters in Washington. He had been sent by Captain Ward, Commander, DCA-SEA to invite me to visit him in his office and to visit the Clark terminal of the reconfigured Philippine to Taiwan tropo system. This was a special courtesy by Captain Ward, one that I have never forgotten. I visited the Clark terminal of what by then was known as the Phil - Tai - Oki Tropo System, which interconnected with the Japan Tropo System. **For the first time there was quality multi-channel voice communications from Japan to the Philippines.**

Captain Ward passed away in January 2012 and is buried at Arlington National Cemetery.

Conclusions

Many of you know of the role the IWCS played in providing for the expanded communications requirements in Vietnam. I had the privilege of being involved in the IWCS from its inception until contract award and of going to Vietnam in September 1965 and being involved in the IWCS installation. I then spent my last two years on active duty in OCSigO where I continued my involvement in the Southeast Asia and the IWCS.

