(U) Cryptologic Almanac 50th Anniversary Series

EO 1.4.(c)

(U) Collection and Processing at NSA

~~(TS//SI)~~ It was mornings like this that made you really appreciate an overseas assignment. I was working mids in the spring of 1965 at [redacted] one year into a five-year PCS. Along toward dawn you would hear through the open window the sound of a cowbell. Soon, a sheepherder with his flock, led by a bellwether, would go past, en route to the antenna field to graze. Nothing like it at Fort Meade! Sure, five miles away [redacted] were probably getting ready to start the killing again; but at that moment, in that place, peace and the sound of the bellwether's bell prevailed.

~~(C//SI)~~ By the beginning of the 1960s, radio communications worldwide were overwhelmingly high-frequency manual Morse (HFMM) and high-frequency radioprinter (HFRP), and U.S. collection capabilities were geared toward this. There was a large overseas establishment of intercept stations which aimed at intercepting all HF communications of interest. NSA and the SCAs (Service Cryptologic Agencies) had intercept stations in [redacted] countries and the Continental United States, Alaska, Hawaii, and [redacted]

~~(C//SI)~~ Rhombic antennas had dominated the 1950s. These were used as the standard collection antennas because the gain exceeded other antennas by up to five times, but a rhombic field at a major site could occupy 100 acres. At [redacted] local farmers used the rhombic field to graze sheep. Where space was a problem, log periodic antennas were also used. In most cases, stations used a number of different types of antennas. In addition to the rhombic antennas we had, among others, a large log periodic k [redacted]

~~(S)~~ The rhombics were connected by coaxial cable to the intercept building. Once inside the building, the cables terminated in an RF distribution room, [redacted] Operators in the early days often used Hammarlund SP-600 or RYCOM receivers. The SP-600 was an analog receiver without any sort of digital readout, so the operator had to guess the frequency. In the 1960s the Watkins Johnson R-390, which had digital readout with manual tuning, became the standard.

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~~(U//FOUO)~~ An improvement in collection was the introduction in the 1950s of the Wullenweber, or Circularly Disposed Antenna Array (CDAA). This design, pioneered by the Germans in WWII, was first used in U.S. SIGINT operations by the U.S. Navy, which was primarily interested in the CDAA's DF capabilities. The Naval Security Group (NSG) began its systems R&D work in 1956 and fielded its first CDAA, an FRD-10, in 1962. By 1966, NSG had built 13 FRD-10s in three foreign countries, the U.S., and its territories.

~~(C//SI)~~ In the 1950s the Air Force Security Service (USAFSS) began designing from the ground up a new collection system based on the Wullenweber. [redacted] finally included two components: GLR-1, [redacted] and GLR-4, [redacted] After extensive modifications, the GLR-1 was fielded as the FLR-12. The FLR-9 antenna of the GLR-4 system was, with a circumference of 1,200 feet, the largest single antenna ever designed for [redacted] and earned the cognomen of "elephant cage."

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~~(C//SI)~~ While improvements were being made in antennas, there was also improvement in the actual means of copying traffic. After WWII, intercept operators used standard typewriters to copy manual Morse traffic on continuous-form paper [redacted]. These typewriters were modified to type letter text only in uppercase. Hard-copy was forwarded via courier, while particularly important items were forwarded in TECSUM (Technical Summary) format via regular communications circuits.

~~(S//SI)~~ The first attempt to improve the copy and forwarding system was called [redacted] The [redacted] equipment consisted of a modified Remington-Rand typewriter with special keys to indicate such traffic components as callsigns, preambles and case notations. The new feature was that it could output both hard-copy and a seven-level paper tape which was used to input the data into communications equipment. This was replaced by the Teletype Model 35, extensively modified with the addition of the special tagging keys. NSA named the device the AG-22 and changed the output to eight-level tape. These tapes could then be introduced directly into the OPSCOMM system. The plan was to install these at every HF field site. Unfortunately, the OPSCOMM system could not handle the volume of data this would produce. It operated at only 60-100 words per minute and was already being swamped by other requirements, such as TECSUM forwarding. The solution, developed in 1968 and first installed in December 1969, was STRAWHAT, a 9600-baud data link system from field sites to processing centers. It used a time division multiplex system capable of up to eight-level forwarding and could be patched directly from the circuit terminal to a computer.

~~(S//SI)~~ The AG-22/STRAWHAT system, however, caused other problems. A large field site, with many manual Morse positions, produced a considerable amount of eight-level tape, and handling this tape at the station could be a major problem. In the mid-60s, NSA

began working on a system for accepting manual Morse data directly onto a magnetic tape. The method chosen, called IATS (Improved AG-22 Terminal System), called for wiring up to 128 intercept positions to a Honeywell 316 computer. Intercept files were packed onto a magnetic tape to be transmitted periodically on a high-speed data link to NSA. Even with this there were sometimes problems. During a major crisis, when events were breaking rapidly, the periodic transmissions of data only every four or six hours caused an unacceptable delay in processing. In one case, the station started converting the tapes to five-level paper tape which was then sent via the CRITICOMM circuits originally designated for the transmission of critical information or data. Using this procedure, the elapsed time between intercept and publication of the item to users was sometimes less than two hours. On the other hand, toward the end of that crisis, the field site requested immediate notification when they could conclude this procedure, as they were hip-deep in paper tape.

~~(C//SI)~~ Once the data were received at NSA, whether by AG22/STRAWHAT or by IATS, they were immediately accessible for processing. Plaintext traffic, [redacted] were passed on to the appropriate analysts via internal NSA electrical circuits. Encrypted traffic was transmitted directly either to the appropriate computer for solution or to a cryptanalyst for study. EO 1.4.(c)

[redacted] As a result, the U.S. Air Force started using airborne intercept carried mostly in C-130 aircraft. The Air Force had [redacted] RC-130s emphasizing voice collection, and in 1963 [redacted] RC-135s with limited ELINT capability were added to the fleet. During the 1960s the Strategic Air Command (SAC) used RB-47s with limited ELINT capability, and the Navy used EC-121s and P3 Orions in support of naval operations.

~~(U//FOUO)~~ Another method for "carrying intercept to the enemy" was on board a ship. The first Technical Research Ship (TRS) was the Oxford, which put to sea in 1961. Oxford was a WWII Liberty ship configured with [redacted] COMINT and [redacted] ELINT positions. The TRS program was originally designed to provide additional intercept in the eastern Mediterranean, but Oxford was diverted almost immediately to Cuba. The next ship in the program was the Valdez, a former Military Sea Transport Service (MSTS) vessel with [redacted] positions, also launched in 1961. The Navy ships, Oxford, Georgetown, Jamestown, Belmont, and Liberty, were designated "USS" and had Navy crews; the MSTS ships, Valdez and Muller, were designated "USNS" and had civilian contract crews with Navy SIGINT personnel. In 1968 a third MSTS ship was added, the Pueblo.

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~~(S//SI)~~ There were no further major advances in collection or forwarding until the introduction of space satellites as collectors in 1967. These satellites were used primarily to collect ELINT. [redacted] The next step in the usage of satellites, remoting, would prove to be even more expensive, but promised great savings in the long run.

~~(S//SI)~~ The remoting concept involved the establishment of unmanned intercept sites in "safe" areas which would then transmit the intercepted signals to remote operating facilities (ROFs) in the United States [redacted]

~~(U//FOUO)~~ But there are no sheep.

~~[(U//FOUO)~~ David P. Mowry, Center for Cryptologic History, 972-2893s, dpmowry]

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