(U) CRYPTOLOGIC ALMANAC

~~(S//SI)~~ The Longest Search: The Story of the Twenty-one-Year Pursuit of the Soviet Deep Space Data Link, and How It Was Helped by the Search for Extraterrestrial Intelligence

~~(S//SI)~~ There is a long history in SIGINT collection of searching for particularly important signals – commonly referred to as "the most wanted." For most of these signals, the search lasted for a few years. This was because the target signals usually were associated with a well-defined event, such as a missile launch, and resources already existed in place or could be surged. Also, the search could be justified on national security grounds. But one signal defied collection for twenty-one years – the Soviet deep space probe broadband telemetry link that carried scientific and orbital video and radar imaging and mapping data. The search began in 1962 and eluded the best efforts of SIGINT collection specialists and signals analysts until 1983. If this search was not quite a Moby Dick-like obsession, it never entirely left the minds of those analysts who wanted the signal, either. The decades-long search encountered a number of obstacles that included failed Soviet deep space missions, the loss of intercept sites in Turkey and Ethiopia, and skeptical intelligence and defense communities that questioned the point of it all.

~~(S//SI)~~ Notice of this signal first appeared in 1962 with the launch of the first successful Soviet interplanetary probe known as Mars 1. (Before 1962, seven probes had been launched towards Venus and Mars. However, only Venus 1 left earth orbit, and two weeks later radio contact was lost.) Eventually, the Mars 1 probe lost its attitude control, causing the high-gain antenna to lose earth-lock at a distance of 106 million miles. However, before this accident, the Soviets announced that the satellite would be communicating on four frequencies – 163, 32, 8, and 5 centimeters (or approximately 183 MHz, 922 MHz, 3.7 GHz, and 5.7 GHz). With the announced telemetry channels identified, over the next fifteen years, with the help of intercept from sites such as STONEHOUSE in Asmara, Ethiopia, the exact frequency and data types for the first three links were intercepted and identified. The first two were tagged as satellite control lunar telemetry and imaging channels. The third was reserved for experiments involving measurements of occultation (the passage of a celestial body between two others and the resulting observations) and was not used very often. But it was the fourth frequency, a channel evidently used for high-rate scientific or imaging data transmission that SIGINT collectors wanted, but could not find. Over the next decade, Soviet probes to Mars and Venus (Mars 5 in 1973 and Veners 9 and 10 in 1975) successfully traveled to those planets and sent back high-quality pictures and scientific data. The Soviets had released the pictures and scientific information from these missions to the press. But the intelligence community remained unable to intercept the data transmissions from satellites.

~~(S//SI)~~ The problem with intercepting the 5-centimeter broadband signal was a matter of timing and scale. Soviet mission control was located in the Crimea. Satellite transmissions were of short duration – only when the station in Crimea could "see" the satellite, though the Soviets could and did

deploy space event support ships to augment their coverage. United States field stations were in the same predicament. They could intercept transmissions only during the same short windows the best sites were located along the same meridian as the Crimean site. The field station in Asmara could intercept the narrow-band transmissions, both uplink and downlink, but even it could not find the 3-centimeter signal. In 1975 the STONEHOUSE mission had withdrawn and, while the Venera 9 and 10 missions were en route to Venus, the sites in Turkey had been closed. The CIA managed a last-minute effort to use a former NASA deep space facility near [redacted]. The station was up and searching, but nothing was heard.

(S) Another part of the problem negating the intercept of the signal was uncertainty about the exact frequency of the wideband signal. The existence of the signal was not a case of disinformation; there was enough circumstantial evidence from the telemetry in the command links to suggest that scientific information and pictures were being taken. The problem was the immense frequency band that had to be searched – a band somewhere between a half to three-quarters of a Gigahertz. Also, because of distance, the signal from space would be extremely weak. To widen the search bandwidth to find it would let in too much background noise and could bury the desired signal. A narrower search band would preclude ever covering the entire possible frequency range.

(S) Other agencies attempted to discover the frequency, or at least narrow the range. CIA hardware specialists visited displays of Soviet satellites at various international space expositions. At Paris in 1968 and at Los Angeles in 1977, the Soviets displayed full-scale replicas of satellites used to photograph the Moon and Venus. Experts studied the waveguides that led from the sensor packages to the radio transmitters and discovered that the equipment was configured to transmit a signal somewhere between 5.6 to 6.3 GHz. Also, some Western astronomers who were aware of the search for the missing data signal discreetly queried their Soviet colleagues about the Soviet data link. One was told that it was 5.9 GHz.

(S//SI) In June 1983 the Soviets launched two new probes to Venus – Venera 15 and 16. The intended mission of both satellites was radar mapping of the surface of Venus – a project that the United States was planning for 1988. If the U.S. intelligence community was to have a chance to collect the deep space data link, it had to hurry. An intercept station was chosen for the attempt [redacted], which previously had been used successfully [redacted] for the collection of Soviet space signals. This time, though, the analysts had a new asset, a system designed specifically for the collection of signals from deep space. Called a Radio Frequency Interference (RFI) van, it was a unique configuration of receivers, spectrum analyzers, and computers. It included a digital signal analysis subsystem that could monitor 64,000 radio channels, each 205Hz wide simultaneously. However, the RFI van belonged to a research group working for the National Aeronautics and Space Administration (NASA) – the Search for Extraterrestrial Intelligence or SETI.

(U) The SETI project had begun in the 1970s as part of the search for radio signals from space that might come from other habitable planets. The program had many critics from all quarters. One year it received the Golden Fleece Award from Senator William Proxmire (D-WI), who was famous for skewering government programs that appeared to waste money. Despite hoots of derision and funding

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cuts, SETI remained. Along the way, the scientists in the project had developed some specialized equipment and routines for searching the heavens and the electromagnetic spectrum for signs of intelligent life. One product of this research was the specialized RFI van. At the time of the 1985 Soviet Venus mission it was located at the Goldstone, California, deep space tracking station managed for NASA by the Jet Propulsion Laboratory. It was there for SETI research and to monitor the weak signals from U.S. deep space probes like the Voyager series.

(S//SI) With the Soviet spacecraft on their way to Venus, [redacted] obtained permission [redacted] to use the facility to cover the Venera satellites due to arrive at Venus in October. [redacted] allowed a search until 15 October; [redacted] NASA arranged for the pickup of the van. A USAF C-5A was flown in and the van loaded – it barely fit. It was flown to the [redacted] and towed to the observatory. By early October the van was hooked up. On 10 and 14 October Venera 15 and 16, respectively, arrived in orbit. The command link, [redacted] was active and monitored by a number of ground sites. The information from this link was relayed by DEFSMAC to collectors [redacted] (The [redacted] was separated from the regular observatory personnel. The SETI specialists were given sanitized search parameters and limited feedback on results.)

(S//SI) However, the Soviets refused to cooperate. They spent the first several weeks adjusting the orbits of the two satellites over Venus's polar region and made little use of the broadband data link to transmit back pictures. On October 15 the period allotted for the intercept ended; [redacted] probably interested in the effort, offered another week, beginning on 7 November, to search again for the signal. Personnel at the site spent the next three weeks adjusting and calibrating the equipment. While they waited, their frustration grew when the Soviets announced that on 19 October the first radar pictures covering a million square kilometers had been transmitted back to earth. On 8 November the [redacted] with the RFI van was turned on and the search began again.

(S) Shortly after midnight on 9 November, Venus rose above the horizon. The antennas at [redacted] and at other sites, began listening. DEFSMAC coordinated the search. The [redacted] uplink in the Crimea passed instructions to the two Venera spacecraft to start the radar mapping the surface of Venus. The two spacecraft began their mission. At 0635Z a teletypewriter at DEFSMAC clattered briefly with a crisp message [redacted] "We have it. [redacted] The twenty-one-year search was over.

(S) In the final analysis, though, there seems to have been few obvious benefits from this prolonged search for the Soviet deep space data link. Obviously the intercept effort was a technical achievement. The SETI RFI van pointed the way to advanced collection and signal analysis systems. There may have been some application to the study of Soviet space communications, especially with its constellation of intelligence satellites that circled the earth. Perhaps, though, just the satisfaction of solving a twenty-one-year mystery was enough for those involved.

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