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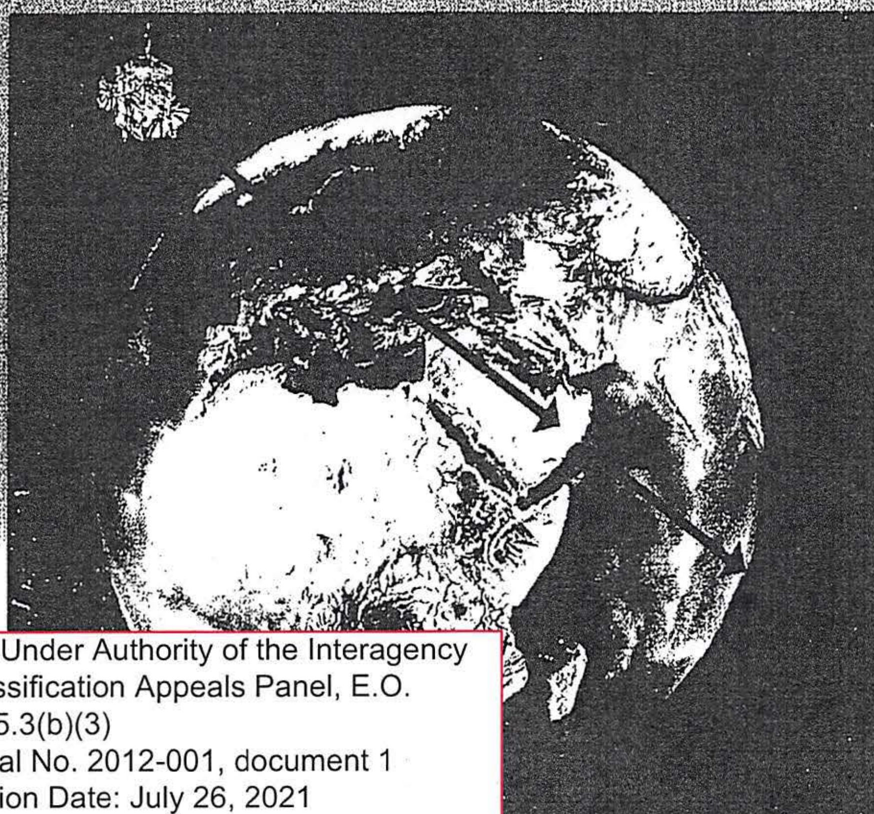
Series VI
Volume 5

The Foreign Missile and Space TELEMETRY Collection Story – The First 50 Years

Part One: The 1950s and 1960s



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UNITED STATES CRYPTOLOGIC HISTORY

Special Series
Volume 8

The Foreign Missile and Space TELEMETRY Collection Story - The First 50 Years

Part One: The 1950s and 1960s

Richard L. Bernard

CENTER FOR CRYPTOLOGIC HISTORY

NATIONAL SECURITY AGENCY

2004

SECRET//NOFORN//X1, X6

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(U) FOREWORD

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November 29, 1999

Richard Bernard
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Ft. George G. Meade, Maryland

Dear Dick,

I'm writing to commend and congratulate you on completion of the first volume of "The Foreign Missile and Space Telemetry Collection Story – the First Fifty Years," even though I think you have overly credited my personal contributions compared to so many of our talented associates. In particular, you do not give yourself sufficient credit for your leadership role for so many years.

As I reflect on the early period of telemetry collection before today's National Technical Means capabilities, you've made it easy to recall the primitive but growing capabilities of those early days, when so much of the problem involved the difficult military logistics of remote ground sites and the risky flight operations of airborne systems. We owe a lot to those military teams – soldiers, sailors and aircrews – for the success of the collection systems this history chronicles. The pictorial history you collected and included, which are priceless memories for members of the early TELINT community, is an important part of the history and helps to bring the story alive. Your research to identify the many individuals who made critical and remarkable contributions with limited funds, but using the advanced technology of those times, is especially valuable for giving them a long-overdue recognition for their contributions to our nation's security during those Cold War years. Finally I'd like to urge the readers of this history to study the "lessons learned" sections carefully – Dick has skillfully written them in a way that the lesson core is relevant to today's complex projects.

Sincerely,

Bill Perry

William J. Perry

(U) Introduction

(U//FOUO) This history project was undertaken under the sponsorship and guidance of the National Security Agency Center for Cryptologic History (CCH). Working space and a considerable amount of reference material provided by the Defense Special Missile and Astronautics Center (DEFSMAC). The author specifically wishes to thank Dr. David Hatch, Dr. Thomas Johnson, and Mr. Barry Carleen of the CCH for their advice and guidance. The document has also benefited by a number of photos of TELINT field systems and locations provided by GTE, the current parent of Sylvania-EDL, where much of the original contractor work was performed. It has also benefited from background information provided by Raytheon, the current parent of HRB, another key contractor in the 1950s and 1960s. The key documents and personnel interviews that were used in developing the material are listed, but the author takes full responsibility for any errors of fact or interpretation that may appear in the document.

(U//FOUO) The primary topic of this document is telemetry collection against foreign missiles, satellites, and space vehicles. All chapters in the document contain information on telemetry collection systems planning, operational targeting, and collection coordination, with some discussion of field processing, national-level processing and analysis, and intelligence results. Emphasis is on Telemetry Intelligence (TELINT), now called Foreign Instrumentation Signals Intelligence (FISINT) collection, with limited mentions of activities in other interrelated "INT's" as necessary to put the TELINT information into proper context. Each chapter (usually a 10-year period has a table showing significant events, a photograph of each collection site/asset the first time it is discussed, and selected geographic portrayals.

(U//FOUO) Throughout this document the reader may be confused by the fact that identical projects, locations, or missions will have several names. Primarily as a security measure, but often to assign short titles or covernames consistent within a participating organization, different names were assigned to the same effort. For example, as a matter of NSA policy, any contractor project was assigned a different name by the contractor than the one used by NSA. Within the U.S. DoD, each military service agency often had its own name for an NSA project. Also, operational missions, particularly those controlled by the JCS had a separate name, and often a different one for each deployment. Likewise any project that had foreign participation was often given a separate name by the foreign partner. I have tried to minimize this confusion by showing alternate names within the text and on several of the charts and tables within the document.

(U) Endnotes are provided at the end of each chapter.

(U) A chart showing all of the project names/and a summary of information on each telemetry collection (or coordination) project mentioned in the text for the 1950s and 1960s are provided in Appendix A.

(U) Additional detailed information on selected telemetry collection projects and facilities that were started in the 1950s and 1960s is presented in Appendix B.

(U) There were two outstanding leaders in the U.S. who had significant influence on early telemetry collection projects, the coordination of collection efforts, and the thought-provoking analysis and conclusions that were reached during that period. They were Dr. William J. Perry, more often known as "Bill" Perry, and Mr. Charles C. Tevis, more often known as "Charlie" Tevis. In large measure these two individuals shaped the successes that were achieved during the 1950s and 1960s. Charlie Tevis died in 1994, and among other recognition he received for his lifelong interest in foreign weapons systems intelligence was that the new DEFSMAC operations center at NSA was dedicated to his honor in 1999. The commemoration plaque reads, "His vision is our reality today and our inspiration for tomorrow." Dr. Perry now holds several positions at Stanford University and has contributed information and ideas that have been included in the document, and he has graciously provided the forward for the document.

(U) This monograph, which covers the 1950s and 1960s, is Part One of a fifty-year history of telemetry collection. Part Two, to be published at a later date, will deal with collection from 1970 up to 2003.

(U) Chapter 1
In the Beginning (1950s)

(U) Arguably, the Space Age began with the experiments in rocketry by Robert Goddard in the 1920s. The military Space Age began during World War II with the launch of V1 and V2 rockets by Nazi Germany against London in 1945.

(U) The clear demonstration of the military power of even uncontrolled rockets motivated the major powers in the postwar period to begin conducting research to turn rockets from the crude, uncontrolled flying bombs used by the Germans into longer-range weapons with precise control. In addition to their use as weapons, rockets were developed to launch earth-orbiting satellites and other space vehicles.

(U) The United States conducted its own experiments in rocketry, and was at the same time concerned with the rate of development of missiles in the Soviet Union As the Cold War intensified, the American intelligence community looked for ways to collect information about Soviet progress in missile and space vehicles.

(U) TELINT (Telemetry Intelligence) or, in its more modern terminology, FISINT (Foreign Instrumentation Signals Intelligence), was an important asset in understanding Soviet development in long-range weaponry. This document will use the terms "telemetry" and "TELINT" since those were the terms in use in the 1950s and 1960s, the period under consideration.

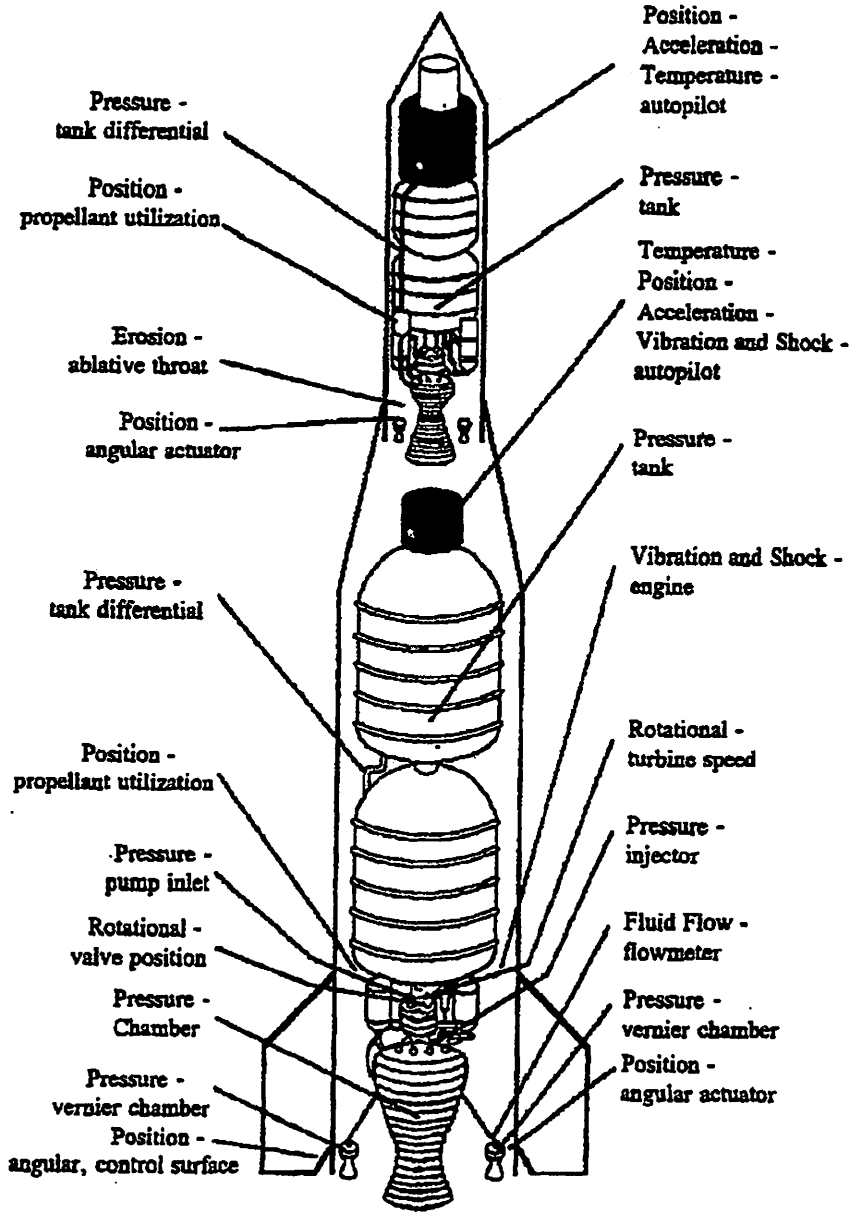
(U) Why Telemetry Is Important

(U//FOUO) There are engineering, and sometimes operational, requirements for designers and operators of missile and satellite systems to know how the vehicle is performing. Typically during development and test firings of all types of missiles or space vehicle launches, the sponsor wants to know the performance of propulsion components and the directional guidance system. This information is almost always acquired through telemetry, and performed in real time both for testing decisions (e.g., missile destruction if it is off course) and for later performance evaluations.

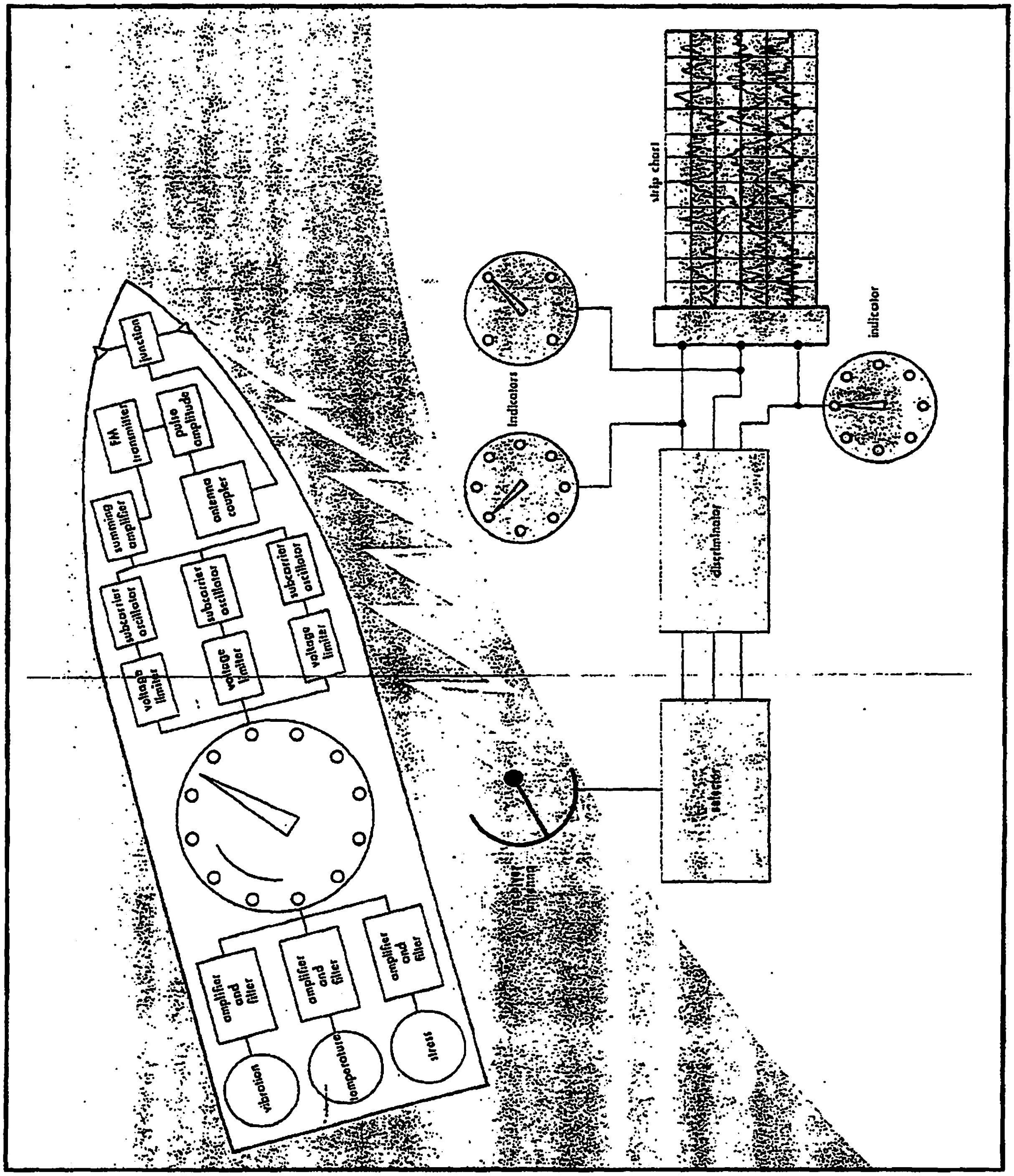
(U//FOUO) "Telemetry" is an electromagnetic signal(s) emanating from a missile or spacecraft and intended to convey data to selected users, usually at ground stations. "Tele" is the Greek word meaning "far off" and "meter" is Greek for "to measure."

(U//FOUO) A corollary signal is "beaconry," here defined as an electromagnetic signal emanating from an object intended to allow ground sites to determine the position and/or trajectory of a missile or spacecraft. Test range instrumentation is also an intelligence target.

(U//FOUO) Through intercept of foreign telemetry, one country may find it possible to determine how another country's missiles, satellites, and space probes are functioning; it is also possible in this way to receive the information the vehicles may be collecting on behalf of their own country. In short, TELINT collects, processes, and analyzes information from foreign missiles and satellites. (Telemetry was also often available from aircraft test flights in the development phase, but this document will concentrate on telemetry intelligence from foreign missile and space events.)

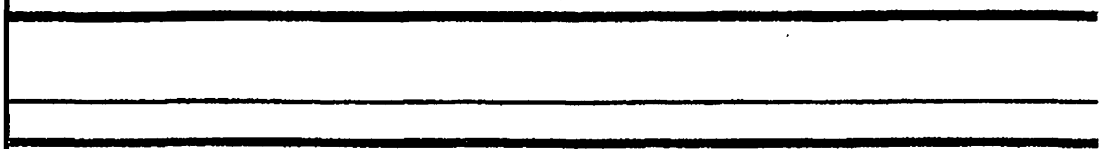


(U) Fig. 1. Missile functions that may be measured by telemetry

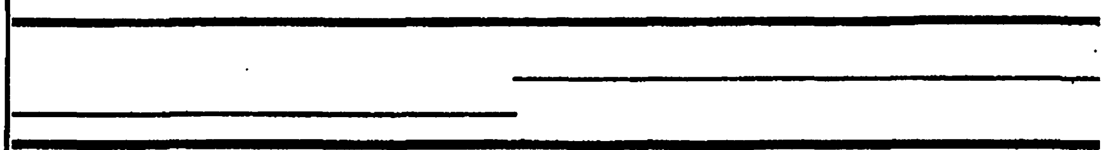


(U) Fig. 2. Transducer information is combined into a telemetry signal that is transmitted to the ground to be received, recorded, and displayed; different parameters are transformed from measurements using "transducers" and sent back to earth using radio telemetry.

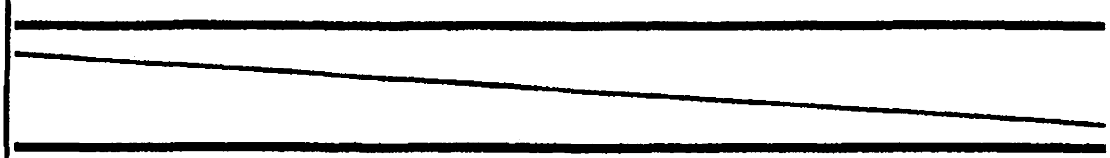
Typical Telemetry Displays



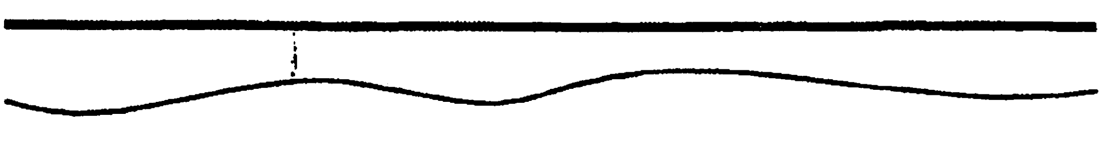
This trace shows an invariant channel - one that has not changed during this measurement interval. This is typical of a fuel level when no fuel has been used.



This trace shows a discrete step change that is typical of an "off/on" event such as turning on a camera or heater.



This trace shows a ramp change that represents something changing slowly over time. This could be the steady discharge of a battery at a continuous rate.



This trace shows a continuously changing curve which could represent the movement of an elevator on an airplane.

(U) Fig. 3. Selected "channels" of measurements from a missile test firing after the information has been received and converted back to data

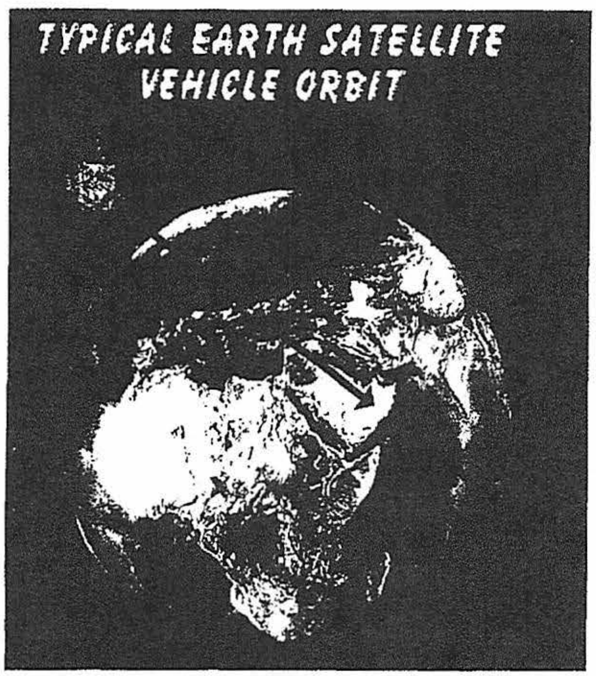
1.4(c)

[redacted]

(U//FOUO) Guidance functions are measured for satellite launches and propulsion; in addition, telemetry and beacons are used to evaluate the activities of a satellite once it is injected into orbit. Mission and satellite health data, particularly for scientific and reconnaissance satellites, are usually sent back to earth via radio telemetry or specialized data links.

(S) A member of NSA's research organization, PL 86-36/50 USC 3605 [redacted] has described TELINT this way:

> **The raw telemetry data is noisy, degraded, incomplete, and imperfectly instrumented, and from this uninviting material it is necessary to extract the particulars of the rocket flight, the characteristics and performance of the missile, and the implications of the missile operation.**[1]



(U) Fig. 5. A typical satellite orbit

1.4(c) [redacted]

(U) Fig. 6. Different types of earth orbits typically used by satellites – 1.4(c) 1.4(c) [redacted]

(U) The First Telemetry Intercepts

(U//FOUO) As might be expected, the earliest technique used by the U.S. to track Soviet missiles and space launches in the 1950s was radar. The U.S. Air Force created the Distant Early Warning (DEW) system to detect missile and space launches that came into the system's view, primarily over Alaska, Canada, and Greenland.

(U//FOUO) Later, air, land and sea-based radars were developed specifically to track foreign missiles. For example, the first FPS-17 radar was designed specifically to detect Russian missiles launched from the Kapustin Yar test launch area. One was installed in 1955 at Diyarbakir, Turkey, and a second was installed on Shemya Island, Alaska, in the late 1950s. Later, higher precision tracking radars were added to those locations. The U.S. Navy had an HF radar system for tracking satellites that passed over the U.S. starting in 1957. This became the Naval Space Surveillance "fence," which came into full operation in 1961.[2]

(U//FOUO) Optical tracking was also used by the U.S. and the Soviets, starting with Baker-Nunn camera systems and developing into precision optical (and eventually laser) tracking systems.

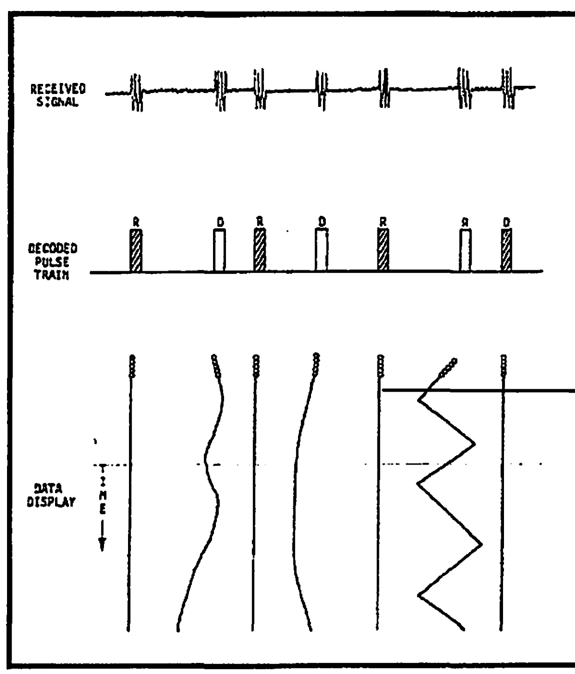
(C) At the end of World War II, both the United States and the Soviet Union captured German scientists who had worked to develop weapons systems for Nazi Germany. In the early 1950s German scientists who had been taken forcibly to the USSR after WWII were repatriated to Germany. These returnees reported that the Soviets were working on ballistic missiles based on the German war efforts. The Soviets had acquired some V-2 rockets, and it is believed they started test firing them from Kapustin Yar in 1947, with assistance from the captured and relocated German scientists.[3]

(C) This was important information for Western intelligence agencies. Also important for future collection of information about Soviet missile developments, the scientists reported that the Soviets may have been using the German "Messina I" nine-channel telemetry system originally used on the V-2 rocket weapons.

(S) [redacted] of CIA's ELINT (Electronic Intelligence) Branch, at a U.S./U.K. Guided Missile Intelligence Conference held in the U.K. in late 1954, argued that existing [redacted] sites in Turkey could probably obtain TELINT from Soviet guided missile tests at the Kapustin Yar launch site. He repeated his arguments, supported by mathematical calculations, in a memo on January 10, 1955.[4]

(C) In the summer of 1955 and into 1956, the U.S. Army Security Agency (ASA) searched for Soviet missile-related communications at Sinop, Turkey, under a project codenamed BRIMFULL. Their tasking was not to collect VHF missile telemetry but to collect the signal, believed to be transponded at the UHF frequency of 605 MHz, from the missile radio guidance system. The ASA site installed special receivers, with the operators told to set them for frequency modulated (FM) signals. Dr. William Perry (then a systems engineer at the Electronic Defense Laboratories in California), after studying data obtained from the repatriated German rocket engineers, believed the signal was more likely to be amplitude modulated (AM).

(S) The U.S. telemetry collection efforts against Soviet missile telemetry signals culminated on June 20, 1956, when the first successful telemetry was recorded from a Soviet SS-1 short-range missile launched from the Kapustin Yar Missile Test Range (KYMTR). The signal, a 16-channel pulse position modulated (PPM) and amplitude modulated (AM) signal at the VHF frequency of 61 MHz, was designated Type A by the Army-Navy Electronic Evaluation Group (ANEEG), a U.S. DoD joint service ELINT coordinating group.[5] It is believed that later in 1957 the Sinop site intercepted the first "S-Band" beacon from a missile at 2800 MHz.[6]



(U) Fig. 7. Diagram of how a PPM/AM signal is received and displayed

(S) On 20 July 1956, a second telemetry signal; which was 48 channels, called Type B, was intercepted under the guidance of Henry DeCourt, another ANEEG engineer who later become an NSA senior manager. (This signal was later designated S302 in the NSA ELTEX designation series and was used in the 1960s for both early Soviet ballistic missile launches and space vehicle applications.) The Type A and Type B telemetry signals used by the Soviets were both based on telemetry systems Germany had developed during WWII. Later Soviet telemetry systems (Types C, D, and E) were their own designs.[7] Table 1-1 below summarizes these signals.

(S) Search continued for the R-10 guidance transponder signal. It was never intercepted, possibly because of line-of-sight limitations based on the missile trajectories, the low power of the signal, or possibly because the Soviets were not using that guidance system.[8]

(S) From 1956 until early 1958, the only useful telemetry was being collected from three land-based sites (Sinop, Samsun, and Trabzon) and two aircraft platforms (the Navy P4M [redacted] and Army/Navy A3D [redacted] in Turkey. In 1958 EGGSHELL in Iran became operational, and Shemya began collecting reentry data from TTMTR ICBM missiles impacting into the Kamchatka impact area. In 1959 sites at Peshawar, Pakistan, and Wakkanai, Japan, began producing useful data.

(S) By early 1957, the U.S. Army Security Agency (ASA) had established a telemetry analysis capability and a major collection site at Sinop and had established a telemetry collection facility on Shemya, assisted by Haller, Raymond and Brown (HRB), and Electronic Defense Laboratories (EDL). ASA also had a transportable van deployed to Wakkanai, Japan.[9]

(S) By 1958 the USAF Security Service had established several collection sites on the Black Sea in Turkey, near the southern USSR border. A Security Service collection system codenamed [redacted] had been installed at Samsun, Turkey, which emphasized coverage of KYMTR, and at Trabzon, Turkey, for coverage of TTMTR, the Tyuratam Missile Test Range. Other Security Service collection sites were at Wakkanai, Japan, Peshawar, and Shemya.

(S) The U.S. Air Force Security Service (AFSS) produced a comprehensive handbook, "ELINT Collection of Space Vehicle Signals," that provided an overview of Soviet test range operations, the target signals, and procedures for signal collection for field collection activities (as well as processing activities). This gave an excellent

(S) Table 1-1 Early Soviet Missile Telemetry Signals

Initial U.S. Names	Signal Type	Telemetry Channels	Primary Use	[redacted]
Type A ATo1	PPM/AM	16	MRBMs	
Type B ATo2	PPM/AM	48	ICBMs & ESVs	
Type C [redacted]	PPM/AM	[redacted]	MRBMs &ICBMS	
Type D [redacted]	PPM/AM		various	
Type E [redacted]	PPM/AM		several	

overview of what was known about the Soviet missile and space program in 1958, including COMINT aspects.[10]

~~(S)~~ Activity at TTMTR was considered of such importance that all field sites were to report activity at EMERGENCY Precedence using a special series of reports called [redacted] An initial report would be issued three hours after Soviet launches, when that information was available.[11]

(U) Bing Crosby (Unknowingly) Helps

~~(S)~~ A typical telemetry collection system used VHF Yagi antennas, NEMS-Clarke 1302 receivers, and Ampex FR1104 recorders — a 4-channel 100-KHz bandwidth recorder with fifteen minutes running time. Modified records with seven channels were provided in the late 1950s. Magnetic tapes used at ELINT field sites in those times were generally two to four channels and had a recording bandwidth of 100 kHz. This was somewhat improved by running a then conventional 1/4-inch two-track recorder that normally recorded at 100 MHz bandwidth at double speed in order to get 200 MHz.[12]

(U) The magnetic tape recorders eventually used for high fidelity recordings – both by the U.S. broadcasting and the U.S. intelligence communities – had a surprising start.

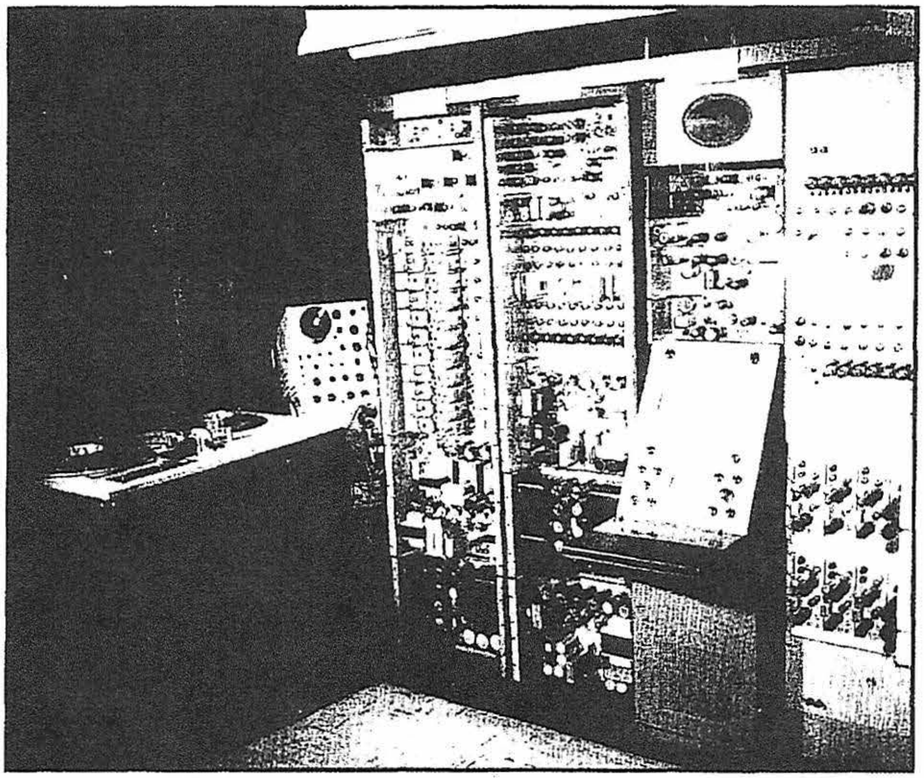
(U) In 1946 singer Bing Crosby wanted to shift his weekly radio show from "live" to recorded, but found significant disadvantages to all the recording mediums then available for his use. In June 1947, his production company became aware of some wartime German recording technology that a man named Jack Mullin had brought back to the United States. Mullin, then working for a film company, was hired to record the Crosby show with this new technology. Using magnetic tape rather than wax disk records allowed editing, by cutting and splicing the tape, as well as significantly improving audio quality.

(U) Crosby hired Mullin in 1950 to head a small — twenty-five person — organization to do recorder development; it was called the Crosby Enterprises Research Laboratory. Crosby also guided and underwrote Ampex (an acronym for Alexander M. Poniatoff plus the initial letters of "excellence"), which was also making improvements to the German technology. By 1950 the Crosby group, working with Ampex, modified an Ampex 300 recorder to operate at 60 ips, which allowed 100-kHz telemetry recordings to be made on a single track of 1/2-inch tape on fourteen-inch reels.

(U) The U.S. government became interested in this technology and used it to record telemetry from its Pacific Missile Test Range firings. It was later adopted by the intelligence community for various purposes, including TELINT collection.[13]

(U) In 1951 Crosby encouraged the development of video recording by his group, and Ampex also began a parallel development. By 1953 Ampex had developed a rotary head recorder for television. The Crosby Enterprises recorder efforts, spearheaded by Mullin, evolved into a broadband recorder that could record 1,000-kHz signals on fourteen tracks of one-inch tape at 120 ips on fourteen-inch reels, which allowed for about fifteen to twenty minutes of recording on one reel.

(U) In 1957 Crosby sold his recorder development interests to the 3M Corporation, which was then into the magnetic tape business; this evolved into the MINCOM series of recorders. By the end of the 1950s, both Ampex and MINCOM were well established in providing tape recorders for instrumentation signals, usually on one-inch-wide tape with fourteen recording tracks, with each track capable of recording 1,000-kHz (1 MHz) signals. Ampex and MINCOM became the primary providers of instrumentation tape recorders for TELINT use for the next twenty-five years.[14]



*(U) Fig. 8.
The early (1951) development model of Crosby Ampex 200 video recorder and its associated electronics. Note the use of vacuum tubes and that the video "monitor" is a console in itself*

*(U) Fig. 9
Bing Crosby viewing the video recorder. Jack Mullin is shown on the left, and Wayne Johnson, another Crosby Enterprises engineer, is on the right*

(U) The Management (or lack thereof) Approach

(U//FOUO) During the early 1950s the U.S. Air Force, along with the U.S. Army, had the most interest in the developing Soviet missile threat. The threat was addressed independently by many organizations, but coordination among U.S. military departments, CIA, and NSA was minimal at best, competitive at worst.

(U//FOUO) However, in the summer of 1955 a Joint Intelligence Community Task Force, PL 86-36/50 USC 3605 [redacted] was set up for a summer study in Landsberg, Germany, and became known as the RETRIBUTOR LANDSBERG GROUP (RLG). (RETRIBUTOR PL 86-36/50 USC 3605 [redacted]

(U//FOUO) The task force concluded that plans for Soviet ballistic missile testing were probably under way. The USAF started follow-up actions in its Security Service, then under Major General John Samford, USAF, later to become director of NSA, and at ATIC (Air Technical Intelligence Center) under Brigadier General "Hal" Watson, USAF, at Dayton, Ohio. The USAF also established the Soviet Missile Technical Intelligence Group (SMITIG) at San Antonio, Texas. SMITIG activities involved reviewing and reporting on COMINT traffic as well as such collateral information as additional interrogation of German rocket scientists repatriated by the Soviets. There were no Army, Navy or NSA representatives at SMITIG.[15]

(U//FOUO) When SMITIG reports came out, DIRNSA (then Lieutenant General Ralph Canine, USA) objected to the USAF release of the report, which contained a lot of COMINT information that had not been subject to proper NSA reviews. However, he then had an intensive COMINT analysis effort commence at NSA, initially under Dr. Leslie Rutledge and then under CIA Statute CIA Statute [redacted] who later became associate deputy director for science and technology (ADDS&T) at CIA.

(U//FOUO) SMITIG continued its efforts until 1958 when it was disestablished. It was probably put out of operations because NSA was finally becoming heavily involved, and, ATIC wanted better control of the intelligence studies effort and moved that function to Wright-Patterson Air Force Base at Dayton, Ohio. Also, at the time, the Guided Missile and Astronautics Intelligence Committee was being activated under the United States Intelligence Board to provide top-level policy and analysis on intelligence efforts against foreign missile and space activities.[16]

(U//FOUO) The U.S. Army started parallel efforts at Redstone Arsenal under Carl Duckett, who later became deputy director for science and technology (DDS&T) at CIA. The Army effort involved contract assistance from a young electronics engineer/analyst named Dr. William Perry at the Sylvania Electronics Defense Laboratory (EDL) in Mountain View, California. Sylvania was selected by the Army as a "captive" R&D organization to focus on its growing need for electronic countermeasures (ECM), a more technologically complex activity than Army Laboratories could handle at that time. Dr. Perry had joined EDL in 1954 and headed it from 1960 to 1963. He left GTE and founded Electromagnetic Systems Laboratories (ESL), Inc., but in the late 1970s left ESL to become director of defense research (DDR&E) in the Pentagon. "Bill" Perry continued his interest in foreign missile and space intelligence throughout his career, which included being under secretary of defense, research and engineering, from 1977 to 1981 and secretary of defense from 1994 to 1997.

(U//FOUO) The processing and analysis of collected telemetry data were also done by several organizations, often in an uncoordinated manner, and often under contract with companies like Sylvania-EDL, HRB-Singer, Jet Propulsion Laboratory (JPL), Lockheed Missile and Space Division, General Electric, and the Space Technology Laboratory (STL) of Ramo-Woldridge.

(C) NSCID 17, promulgated in 1955, established ELINT policy and provided for a National Technical Processing Center (NTPC); it was established in mid-1956 at the Naval Security Group Nebraska Avenue facility and replaced the Army-Navy Electronic Evaluation Group (ANEEG) that had been started in 1952. NSCID 17 still allowed for separate management of CIA and DoD ELINT activities; CIA had formed its own ELINT collection and processing program in 1954.[17]

(C) In 1956 the NTPC was given the added responsibility of processing telemetry from Soviet missiles. Initially NTPC had about 100 people, none from NSA. However, in 1958 NTPC was transferred to NSA when NSCID 6 was rewritten to centralize management of DoD and military ELINT management at NSA.[18]

(C) NSA began collection coordination and analysis in force in 1958 when the Soviet Missile and Astronautics Center (SMAC), the forerunner of Defense/SMAC, was formed to provide an around-the-clock watch center. Later, elements of the Office of General Studies (GENS), GENS-1 (Soviet Ground Forces Division), GENS-4 (Russian Technical Services Division), and GENS-6 (Advanced Weaponry and Astronautics Division), were combined as A4, the Office of Advanced Weaponry and Astronautics. At that time the SMAC (now called the SIGINT Missile and Astronautics Center) was designated as A41. When the NSA mission was expanded to include ELINT (bringing TELINT - Telemetry Intelligence - as part of the responsibilities), the SMAC center became the focal point for all SIGINT collection coordination against foreign missile targets.[19] Table 1-2 summarizes the missile targets.

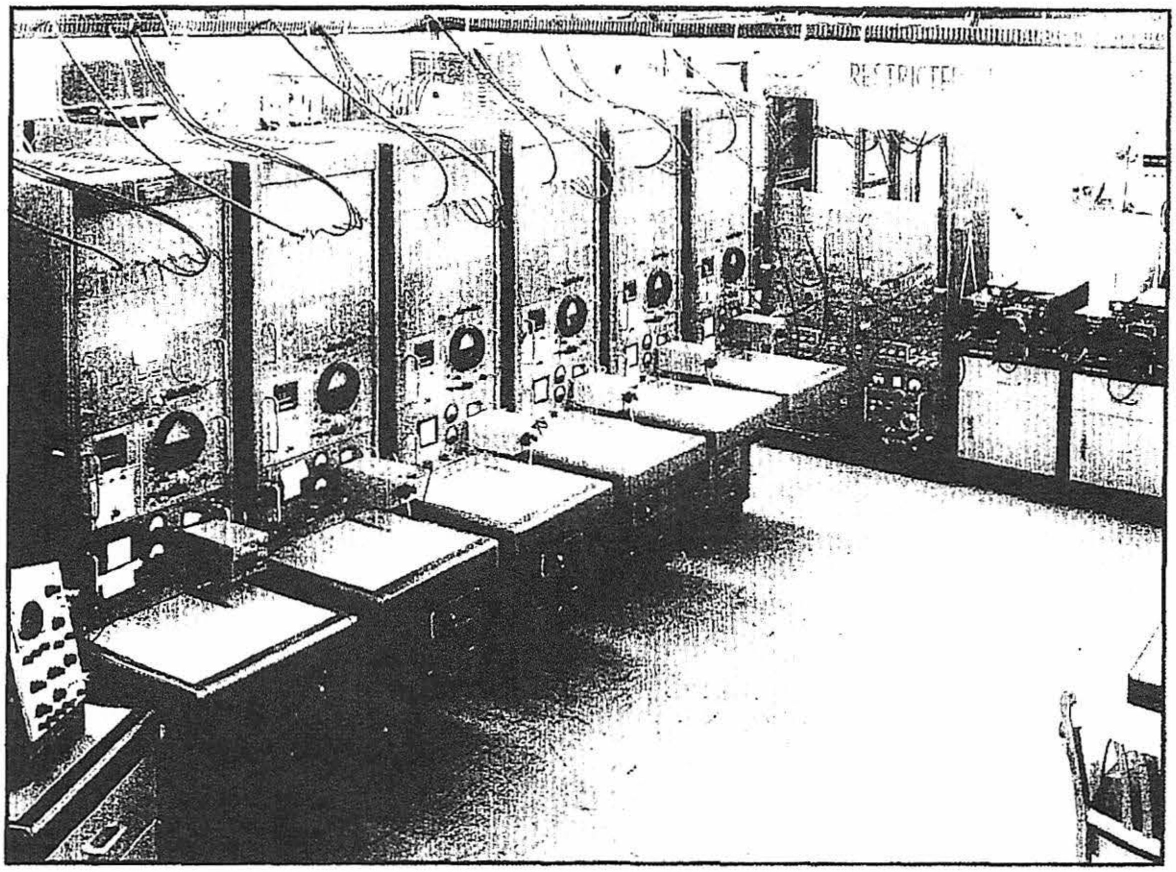
(C) When Defense/SMAC was established in 1964, selected Defense Intelligence Agency (DIA) responsibilities for Department of Defense non-SIGINT collection coordination and the DIA responsibility for initial all-source reporting against foreign missile and space events were added to the SMAC SIGINT activities. Thus, U.S. Department of Defense operational actions and early reporting became focused in one operations center, which remains in place today, albeit updated and modernized several times. (The formation of Defense/SMAC is covered more fully in Chapter 2 of this document.)

(U) New Signals

(S) By the late 1950s the Soviets had started using Type C, D, and E telemetry signals for their missile tests. 1.4(c) [redacted] 1.4(c) [redacted] became the workhorse signals for the Soviet missile and space program in the late 1960s and on into the 1970s.

(U//FOUO) Based on what was known in 1956, EDL began construction of several systems to go after missile telemetry. Lewis Franklin, a Senior Engineer at EDL, credits Ray Franks, an antenna design engineer, as the first to build a broadband log periodic antenna for use in the VHF band that was able to receive a broad frequency range of signals at a higher signal gain than a Yagi antenna. A second key technical element was the NEMS-Clarke 1302 motor-driven sweeping broadband receiver, which was instrumental in successful collections of early Soviet and Chinese missile and space telemetry where the U.S. did not know the exact frequencies ahead of time and had to search frequency bands.[20]

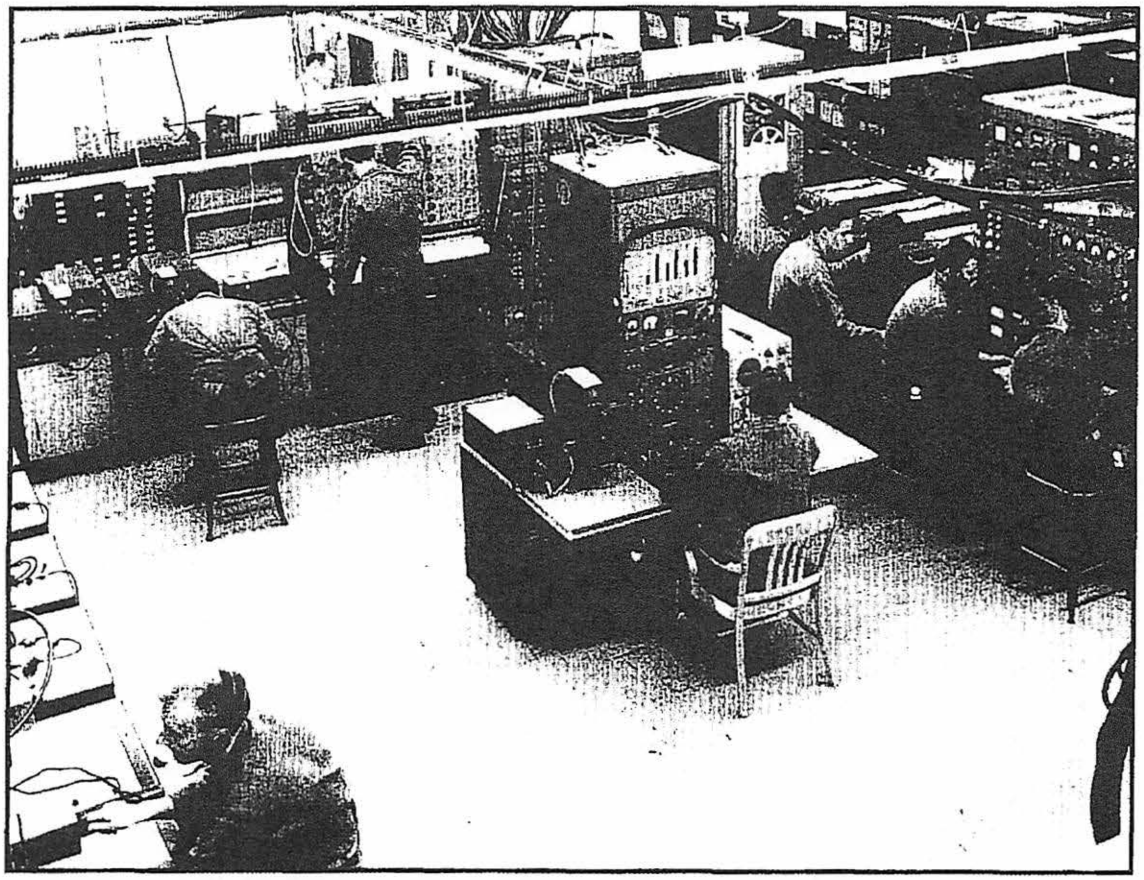
(U//FOUO) One of the first of the early EDL collection systems was Project 5110 in 1956/57 for Sinop, Turkey.



(U//FOUO) Fig. 10. The VHF search positions using the NEMS Clarke motor driven receivers used for the 5100 system (on the right)

(S) Other efforts were implemented at the Army Security Agency facility at Shemya, Alaska, to look for Soviet ICBM missile reentry telemetry at the impact area on Kamchatka. Using his ingenuity for finding resources, an Army sergeant named Clampett put together a "system" in an unused "Jamesway" building. This was respectfully called "Fort Clampett." The "Fort Clampett" equipment was operated from 1956 until early 1959. The first successful collection of ICBM reentry telemetry from a Soviet ICBM fired into the Kamchatka impact area came on 30 January 1958 from the ASA site at Shemya.[21]

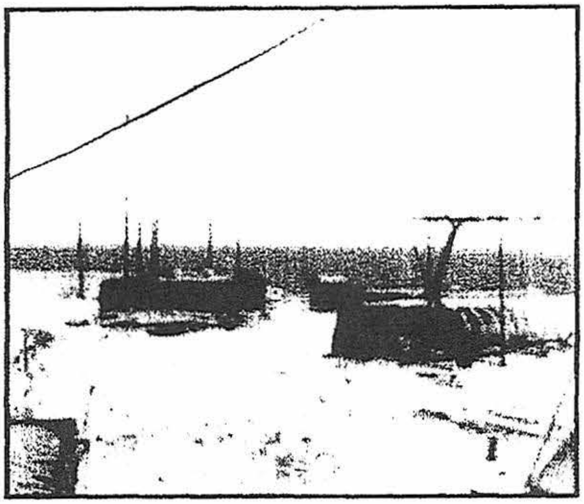
(C) Based on this initial interception of missile reentry telemetry, EDL was tasked to build two systems called ESGM, "Earth Satellite Vehicle and Guided Missile." Originally, ESGMs were to be installed at Wakkanai, Japan, and Shemya, Alaska, but, because of difficulties in obtaining approval from the Japanese government for the Wakkanai installation, the second system was modified to be transportable and was delivered to Helemano, Hawaii.[22]



(U//FOUO) Fig. 11. The EDL Project 5110 antenna control console with VHF receivers and 1.4(c) [redacted] *receivers on the left. The system was installed at Sinop in 1957.*

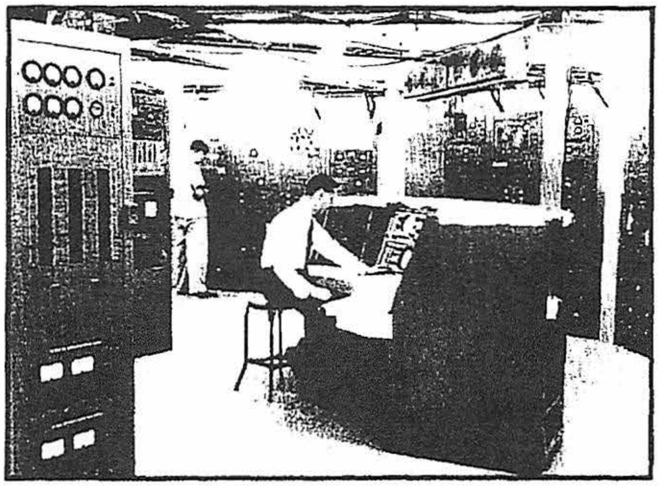
~~(S)~~ By 1958 a set of equipment called System 5110 (VHF) and 5113 (SHF) was deployed to Sinop, Turkey, along with a modified SCR-584 based 1.4(c) 1.4(c) [redacted]

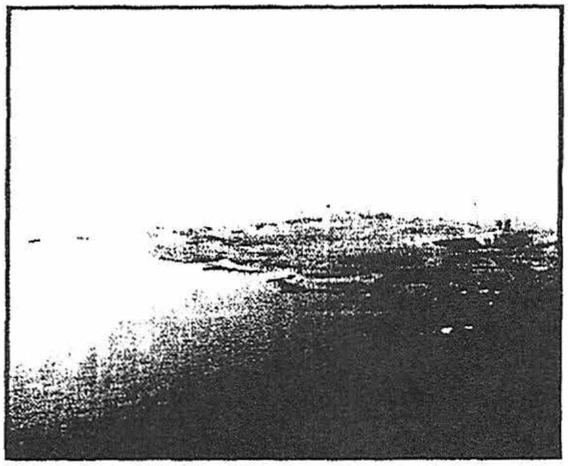
1.4(c) 1.4(c) [redacted] It is worthy of note that USASA fully integrated civilian contractor tech reps into the workforce, both at ground sites and in airborne operations, and this often provided a valuable additional source of engineering and systems analysis experience.



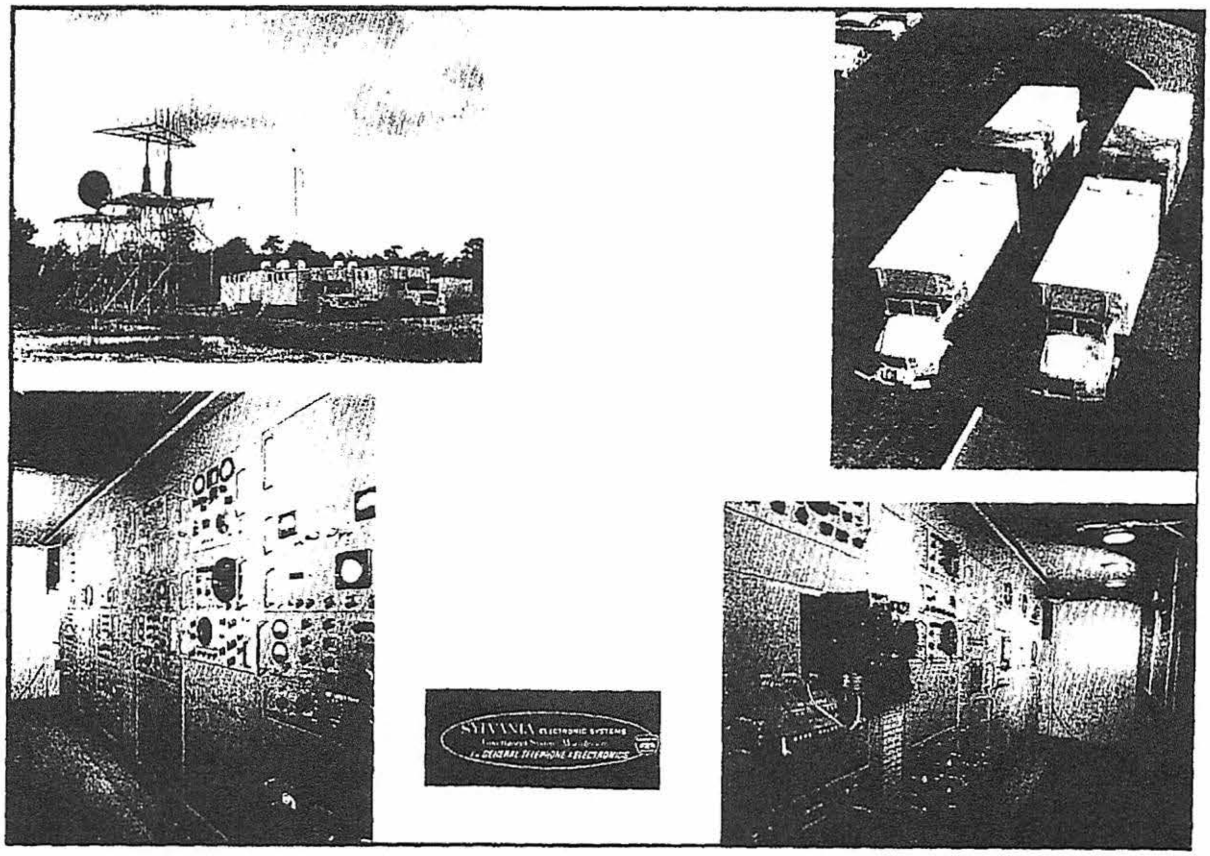
(U//FOUO) Fig. 12. "Fort Clampett" on Shemya. The building and antennas (on the left) and some supply "Quonset" huts that literally blew away into the ocean during a storm in late 1959. The same storm, with winds over 100 knots, damaged beyond repair two U.S. Navy telemetry collection planes that were on Shemya at the time, and it severely damaged the Navy aircraft hangar.

(U//FOUO) Fig. 13. The ESGM antenna control tracking console for the system while it was being staged in Mountain View, CA, by EDL. The VHF receiving positions, using manually tuned NEMS Clarke receivers, are behind and to the left of the antenna control operator, and the SHF receivers are behind and to the right of the operator.

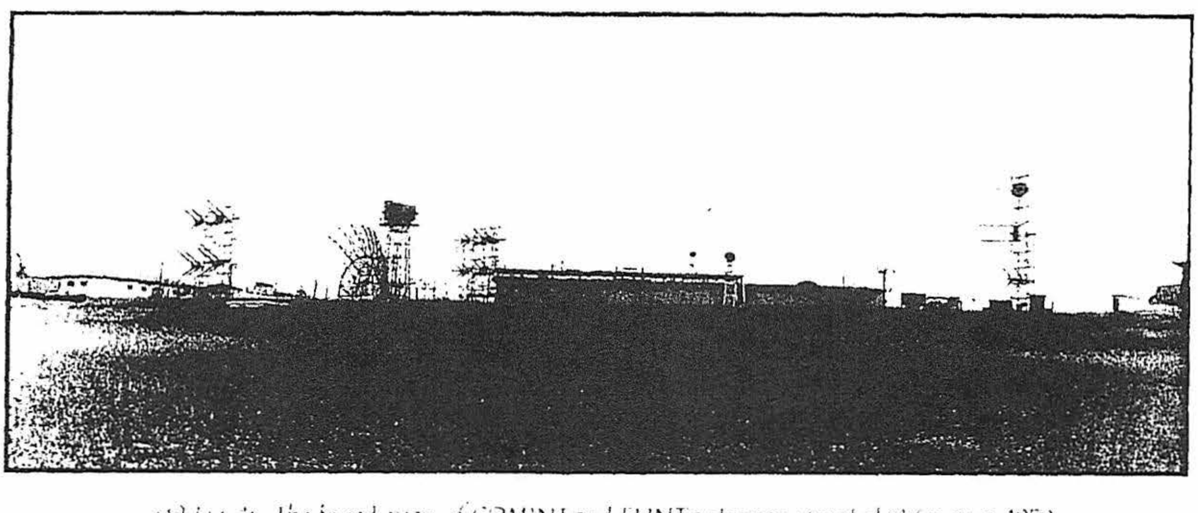




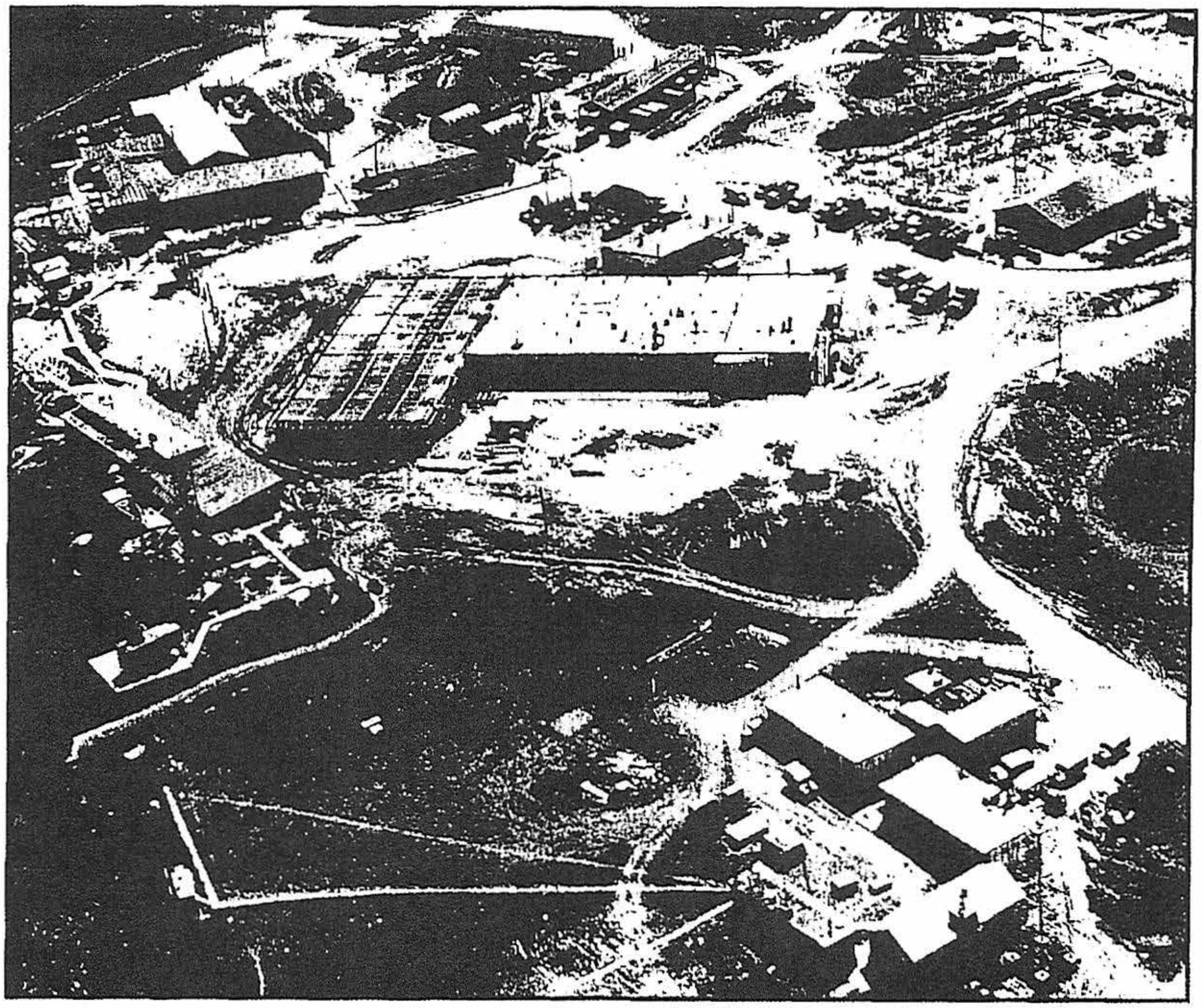
(U//FOUO) Fig. 14. Shemya Island in 1959 with ESGM; and AN/FPS 17 radar (top right)



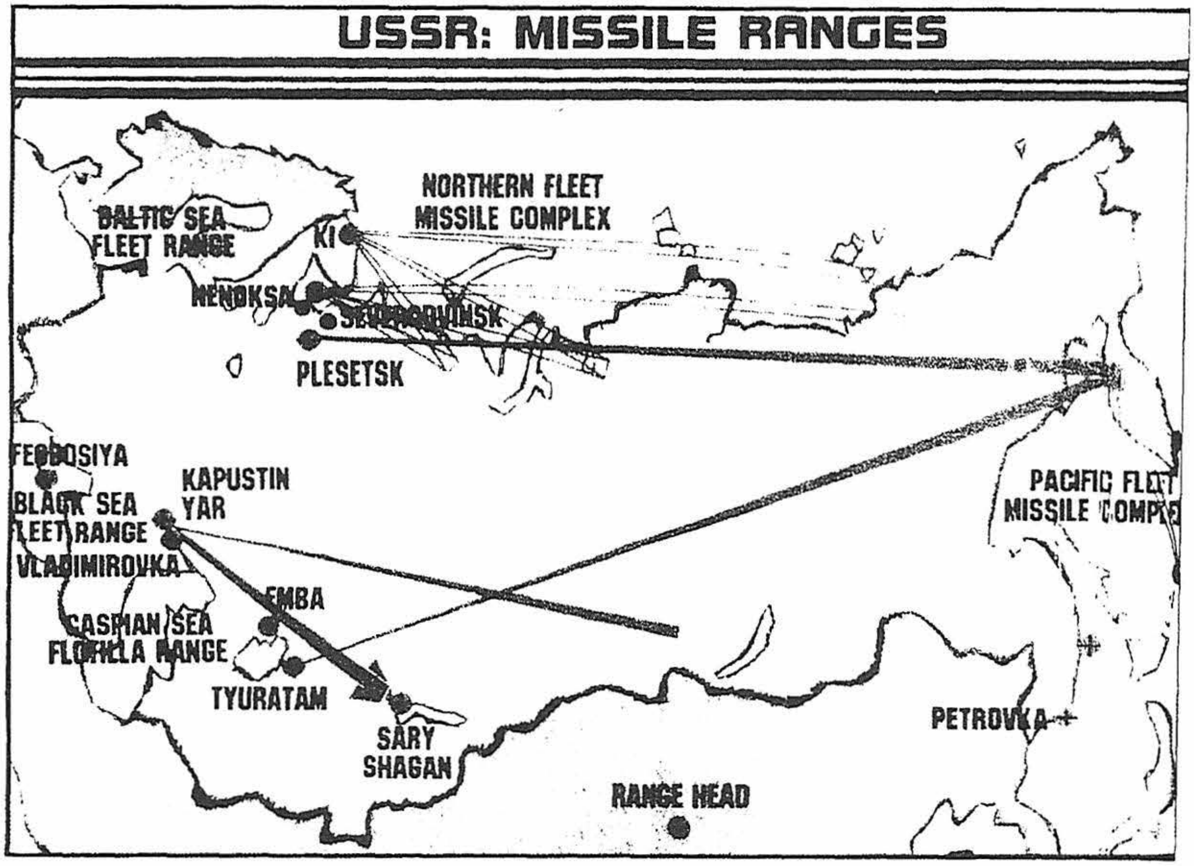
*(U//FOUO) Fig. 15 A montage of the EPL 5110/5115 system that was deployed to Sinop, with the equipment in v
since there was not enough space for the equipment in the small operations building available at that time. Person
facilities were in such short supply that some ASA enlisted personnel were still living in tents at that time.*



~~(C)~~ Fig. 16 The broad array of COMINT and ELINT antennas operated at Sinop in 1959



~~(S//NF)~~ Fig. 17. Most of the Sinop facility in 1959/60 with the one of the [redacted] antenna vans at the left of the photo about halfway down the side. [redacted]



(S) Fig. 18. Soviet primary missile launch sites (Kapustin Yar and Tyuratam at that time) as well as other Soviet launch and impact facilities that developed later. Kapustin Yar was primarily involved in short range ballistic missiles (SRBM), medium range ballistic missiles (MRBM), and intermediate range missile (IRBM) testing. Tyuratam was involved in intercontinental ballistic missile (ICBM) launches and space vehicle launches.

(U) Table 1-2 Missile Designators and Ranges

Missile Abbreviation	Range Designation	Range Distance
SRBM	Short Range	under 1,000 km
MRBM	Medium Range	1,000-3,000 km
IRBM	Intermediate Range	3,000-5,500 km
ICBM	Intercontinental Range	over 5,500 km

(S) By the late 1950s the major U.S. Army ground sites were at Shemya and Sinop, with a smaller site at Soya Point, Japan. The U.S. Navy had several "patrol" aircraft configured for missile radar, optics, and telemetry collection. The U.S. Air Force had ground sites at Samsun, Diyarbakir, and Trabzon, Turkey; Wakkanai, Japan; and Peshawar. It also flew and operated the PL 86-36/50 RB-47 aircraft from Incirlik AFB near Adana, Turkey. Even the ASA ground station at Teufelsberg in Berlin, which had many taskings, had an adjunct mission to search for telemetry.

(U) CIA Involved from the Beginning

~~(S)~~ In 1956 CIA determined that COMINT, and perhaps telemetry, from the Kapustin Yar missile/space launch site could be collected from locations in northern Iran. Therefore, it set up a temporary "clandestine" facility at the Shah's hunting palace outside the city of Behshahr and called it EGGSHELL, initially manned on a TDY basis by CIA Office of Communications personnel. The "temporary" site soon expanded and in 1959 began to collect telemetry from newly operational Tyuratam Missile Test Range (TTMTR). It eventually became a permanent location, soon to be called TACKSMAN I. PCS personnel, with family accommodations and amenities would staff it as the operations expanded over the years.

~~(S)~~ 1.4(c) [redacted] 1.4(c) [redacted] 1.4(c) [redacted] CIA also had a telemetry collection package configured for the U-2 flights from Turkey and Pakistan.[24]

(U) Contractors in Collection and Analysis

(U//FOUO) Much of the technical work and some of the analysis were done by a number of companies under contract to one of the military services in the 1950s.

(U//FOUO) Electronics Defense Laboratory (EDL), under the guidance of Dr. William Perry in the late 1950s, was formed by the U.S. Army Signal Corps R&D Laboratories in 1953, with fifty employees, as an industrial source of Electronic Countermeasures (ECM) studies and systems. By 1959, as a result of its mission to develop countermeasures equipment and techniques for the Army, EDL was a prime contractor in preparing concepts, developing technology, providing equipment, integrating systems, analyzing results, and supporting operations for foreign telemetry.[25]

(U//FOUO) A report prepared by EDL in February 1959, with Bill Perry as author, shows EDL's comprehensive activities. The booklet provided a summary of ELINT R&D applicable to the foreign missile and satellite problem and recommended approaches and/or projects — almost all of which were pursued, although not necessarily contracted to EDL. The document discussed requirements for increased frequency coverage, twenty-four-hour ELINT signal search, and the need for obtaining pre-burnout and ground guidance signals.[26]

(U//FOUO) Another key company was Haller, Raymond and Brown (HRB), formed in 1947 by Dr. George Haller, Dr. Richard Raymond, and Dr. Walter Brown. HRB was an outgrowth of early ELINT work done by Haller and Raymond during WWII. One of HRB's early contracts, in 1958, was as subcontractor to RCA for one of the first uses of a "modern" computer (Burroughs 101-E) to analyze telemetry. By 1958 the company was part of Singer and was known as HRB-Singer for many years; it was later acquired by E-Systems, and is now part of Northrop-Grumman.[27]

(U//FOUO) EDL and HRB remained heavily involved in studies, signal analysis, and collection system development for the next forty years, with emphasis on field collection systems and intelligence studies using the results of the collected telemetry data.

(U//FOUO) Other contractors who participated in the final processing and substantive analysis of the data included the Missile and Space Division of the Lockheed Corporation, the Jet Propulsion Laboratory, and the Space Technology Laboratory of the Ramo-Woldridge Corporation.

(U) NSA Gets an Expanded Role

(C) While collection resources increased during the late 1950s, telemetry and beacon analysis (and the intelligence conclusions resulting therefrom) was still somewhat fragmented, and there were still a lot of unknown factors.

(C) In May 1959, the Air Force Air Technical Intelligence Center (ATIC) convened a seminar at Inglewood, California, to discuss the status of ballistic missile intelligence. Almost fifty missile and space telemetry and analytic experts from all participating intelligence analysis organizations were assembled. The group concentrated on powered flight telemetry data; one key question was whether the Soviet IRBMs and ICBMs were using radio or inertial guidance. Key participants included Bill Perry (from EDL), Albert "Bud" Wheelon (from STL), Eberhardt Rechtin (from JPL), Carl Duckett (from ABMA), and David S. Brandwein (from STL), all of whom rose to senior management positions in the intelligence and defense community in later years. CIA Statute [redacted] CIA Statute [redacted] attended from CIA. NSA representatives included Major Roger Stubblefield, USAF, (COSA-5); PL 86-36/50 USC 3605 [redacted] (COSA-5); and PL 86-36/50 USC 3605 [redacted] (GENS-6).

(C) The conference concluded that a great deal of additional COMINT, ELINT, and RADINT data and analysis were needed on Soviet ballistic missile and space launch programs. This seminar led, if indirectly, to the formation of the NSA-managed Telemetry and Beacon Analysis Committee in 1960.[28]

(C) U.S. collection of telemetry signals from foreign missiles and — after the Soviet Union launched SPUTNIK in 1957 — satellites was difficult, since almost all signals were VHF or higher line-of-sight signals, and had to be "tracked" as the target moved along its trajectory or orbit.

(C) Technical challenges were compounded by management challenges. Some U.S. organizations, primarily NSA, considered the signals COMINT, but most other organizations considered telemetry as ELINT. This brought on classification policies and procedures to resolve. The question was settled in 1959, when the United States Intelligence Board (USIB) declared that telemetry was to be treated as ELINT, not COMINT.

(C) The signals themselves did not easily pass through either configuration of existing receivers, COMINT or ELINT, nor were existing SIGINT antennas normally configured to follow, much less "track," signal targets moving as fast as missiles and satellites. In the 1950s the U.S. was fortunate just to obtain the signals, usually VHF PPM, and record them on 1/4-inch "wide-band" magnetic tapes in the field for display and analysis at NSA or other U.S. analysis centers. (100 kHz and 200 kHz bandwidth was considered wideband in those days.)

(C) By the end of the 1950s, it was clear that the intelligence community had a major problem on its hands. With customers such as the U.S. military and users who had to design countermeasures clamoring for analytic results about Soviet missile and space activities, NSA found itself right in the middle of the problem.[29] By the late 1950s, there was a growing call for coordination of activities in the light of the expansion and importance of Soviet missile and space activities.

(U//FOUO) Up until 1959, AFCIN-Z on the USAF Air Staff had been the primary DoD coordinating element for ELINT. With the new NSCID 6 of 15 September 1958, NSA became responsible for coordinating DoD ELINT, including TELINT. Some CIA personnel assigned to AFCIN-Z returned to CIA, and some integrated into NSA in January 1959.

(C) In 1959 NSA agreed to take over management of the USASA-sponsored telemetry analysis effort being done by HRB and JPL. NSA concentrated its analysis on shorter range missiles, the

Air Force on ICBMs and IRBMs, and the Army on beacon and guidance systems.

~~(C)~~ At the same time, NSA created the concept for the Telemetry and Beacon Analysis Committee (TEBAC). The idea was to focus talent in government and industry to determine what signals meant in terms of technical intelligence and bring better coordination to the many technical aspects of processing. Initial TEBAC membership was NSA, USAF, USA, Lockheed Missile and Space Division, Sylvania's Electronics Defense Laboratory, HRB-Singer Inc., the Jet Propulsion Laboratory (JPL), and the Space Technology Laboratory of the Ramo-Woldridge Corporation. Membership was extended to CIA and associate membership to GCHQ — NSA's opposite number in the United Kingdom – and the U.K. Ministry of Defense.[30]

(U) Lessons Learned

~~(S)~~ Joseph Burke, a long-time TELINT manager summed up NSA's view of the situation in an address to the DIRNSA, Lieutenant General Samford, and other senior NSA and CIA officials in August 1959. Burke reviewed the history of collection, processing, and analysis, then noted that signal collection results went from 54 reported intercepts in 1956 and 150 in 1957, to over 200 by August 1959. In addition to a very small cadre of analysts at NSA and at NTPC, the Army had an in-house effort supplemented by contractors, which was turned over to NSA in March 1959, and the USAF had a largely contractor-based analytic effort. Burke highlighted management and analytic difficulties encountered with such a wide variety of collection platforms and organizations, and finished by noting that NSA was already producing reports from telemetry data, integrating COMINT and Soviet radar tracking data. He said that NSA hoped to expand the Agency's role in coordinating contractor support being provided to the USAF by LMSC and STL.[31]

We might summarize the lessons of the 1950s in this way.

(U//FOUO) **Lesson 1**: When faced with a highly technical and complex problem, form an organization that has the technical competence and the charter to address at least a large part of the problem. The U.S. Army did this when they established the Electronic Defense Laboratory (EDL) to support the Army's mission to combat the growing Soviet missile threat. The Army gave EDL the flexibility to recruit the right people, and permitted them access to the intelligence information they needed to do a good job.

(U//FOUO) **Lesson 2**: With many well meaning but fragmented efforts by several organizations attacking a similar (if not common) problem, i.e., the growing threat from numerous Soviet missile developments, put someone in charge. This started with the formation of the Army-Navy Electronic Evaluation Group (ANEEG), followed by the National Technical Processing Center (NTPC), both with limited success; it culminated with the establishment of NSA as primary DoD focal point for direction or guidance for collecting, processing, and analyzing telemetry from foreign missiles and satellites.

(U//FOUO) **Lesson 3**: When several organizations tackle a complex technical problem with many unknowns, and each can contribute to improving the situation, find a management mechanism that allows all the players to participate. This was done when the separate intelligence organizations agreed to NSA leadership in the concept for the Telemetry and Beacon Analysis Committee (TEBAC) in 1959. This group shared information and exposed government and contractor conclusions to "peer group" review to an extent unprecedented at this time.

(U//FOUO) The 1950s could be characterized as a time when the U.S. intelligence community "got its act together" on a set of emerging Soviet missile and space telemetry targets. This would

(S) Table 1-3 U.S. Telemetry Collection Assets Available by 1959

Location/Name	Facility Type	Based In	Platform/Site Operator
Sinop	Ground (KY)	Turkey	USASA
Samsun	Ground (KY/TT)	Turkey	USAFSS
Diyarbakir	Ground (KY/TT)	Turkey	USAFSS
Trabzon	Ground (KY/TT)	Turkey	USAFSS
1.4(c) [redacted]	Air (KY/TT)	Turkey	Army/Navy
	Air (KY/TT)	Turkey	Air Force
Shemya	Ground (Impact)	Alaska	USASA/USAFSS
EGGSHELL	Ground (KY/TT)	Iran	CIA
Peshawar	Ground (TT)	Pakistan	USAFSS
Wakkanai	Ground (Impact)	Japan	USAFSS/USASA
1.4(c) [redacted]	Air (Impact)	Japan/Alaska	Army/Navy
1.4(c) [redacted]	Air (TT)	Pakistan	CIA

soon evolve into a cohesive and coordinated collection program spearheaded by NSA in the 1960s.

(U//FOUO) Table 1-4 shows the increase in Soviet missile and space events detected by TELINT in the late 1950s.[32] Table 1-5 shows some of the significant activities and events of the 1950s.

(U//FOUO) Despite the increase in telemetry collection shown above, it is instructive to note the conclusions reached by the United States Intelligence Board estimates prepared by the Guided Missile and Astronautics Intelligence Committee (GMAIC) in September 1959. In summary, the NIE stated:

> **Soviet programs in the development of guided missiles and in space flight have been carried forward on a wide front over the past year.... Evidence on some systems is extensive but for the most** 1.4(c) [redacted]

(S) Table 1-4 Late 1950s Soviet Missile/Space Telemetry Intercepts

Type	1956	1957	1958	1959	Total
IRBMs and Verticals	18	43	62	71	194
Space Vehicles	0	2	1	3	6
ICBMs	0	0	4	15	19
Pacific Impacts	0	0	0	2	2
Totals	18	45	67	91	221

(C) Table 1 5 Significant TELINT Activities/Events for the 1950s

Year	Activity/Event
1950	Crosby Group and Ampex begin to develop magnetic tape recorders with sufficient bandwidth to record telemetry. Ampex 300 modified to produce 100 KHz band width
1952	Army-Navy Electronics Evaluation Group (ANEEG) established at Naval Security Station on Nebraska Avenue
1953	First use of Ampex 300 to provide 1-MHz recording capability in an RB-47 Soviet overflight
1954	CIA forms its own ELINT program
1955	NSCID-17 provides policy guidance for DoD and CIA ELINT/TELINT activities RETRIBUTOR/LANDSBERG Study Group established to review Soviet missile activity
1956	First identified intercept of Soviet missile launch telemetry (from Sinop, Turkey) National Technical Processing Center (NTPC) given TELINT processing responsibilities
1957	Crosby 1-MHz recorder installed on an RB-S7 Crosby recording group sold to MINCOM
1958	NSCID-6 assigns ELINT responsibilities to NSA. NSA Soviet Missile and Astronautics Center (SMAC) established First Soviet ICBM re-entry telemetry collected (from Shemya, Alaska)
1959	NTPC transferred to NSA to become COSA-5 Telemetry and Beacon Analysis Committee (TEBAC) concept developed by NSA Start of U-2 flights designed to collect telemetry

Notes

1 (U) [redacted] "A review of Telemetry Processing."

2 (U) Stanley G. Zabetakis and John F. Peterson, "The Diyarbakir Reader," *Studies in Intelligence*, Vol. 8, no. 4, Fall 1964.

3 (U) [redacted] "Early History of the Soviet Missile Program (1945-1953)," *Cryptologic Spectrum*, Vol. 5, No. 3, Summer 1975. James Harford, Korolev — *How One Man Masterminded the Soviet Drive to Beat America to the Moon* (John Wiley and Sons, 1997).

4 (U) [redacted] Chief, CIA ELINT Branch, memo "Coverage of Soviet Guided Missile Firings," to Chief, Electronics Branch, 10 January 1955.

5 (U) [redacted] "Sinop Revisited," *NSA Technical Journal*, Twentieth Anniversary Issue, 1975, 41. (U) Among the participants in this project were two later NSA senior officials: [redacted] then an engineer with ANEEG, and James Donnelly, then an ASA enlisted man.

6 (U) U.S. Air Force, "Report of Intelligence Community Telemetry Seminar on 18-22 May 1959," ATIC Document AT-9-4594, 55.

7 (U) Interview, Lewis Franklin, 10 September 1998.

8 (U) Thomas R. Johnson, *American Cryptology during the Cold War, 1945-1989* (Ft. Meade: Center for Cryptologic History. [redacted] Sinop Revisited."

9 Interview, January 1999, Robert Phillips, field engineer, analyst, and system planner at Sylvania-EDL in the 1950s; now on staff with the GTE Corporation.

10 (U) USAF Security Service, "ELINT Collection."

11 (U) Ibid.

12 (U) [redacted] R-412 document, "A Review of Telemetry Processing and Analysis," S-136, 23 September 1961. USAF Security Service, Air Force Communications Center, "ELINT Collection of Space Vehicle Signals," December 1958. Interview, Lewis Franklin.

13 (U) Interview, Robert Phillips.

14 (U) Steven Schoenherr, *Der Bingle Technology* (University of San Diego, 1996). "Der Bingle" was an affectionate nickname for Bing Crosby, one of the most popular entertainers of his time. "Tape Recordings: Future Boom," *Fortnight*, 6 January 1954, 21-22.

15 (U) Some of the participants in SMITIG included Joseph Amato (then an AFSS civilian, later an NSA senior), Corley Wonus (then a member of ATIC, later a key manager in Science and Technology area at CIA), and Captain Roger Stubblefield, USAF, who later came to NSA as a civilian.

16 (U) Roger Stubblefield, "The Origins of the U.S. Technical Intelligence Efforts on the Soviet Missile Development Program," unpublished Memorandum for the Record, 22 January 1997, Center for Cryptologic History, Bernard papers. Interview, James Donnelly.

17 (U) Robert S. Knapp, *The Central Intelligence Agency: the First Thirty Years* (CIA: History Staff, 1990).

18 (U) Johnson, *American Cryptology*. Potts, "Sinop Revisited."

19 (U) Frank J. Irons, "Reflections on the Soviet Strategic Missile Threat of 1960," *Cryptologic Spectrum*, vol. 11, no. 3, Summer 1981. Johnson, *American Cryptology*.

20 (U) Interview, Lewis Franklin.

21 (U) Interview, Robert Phillips.

22 (U) Interview, Robert Phillips. Johnson, *American Cryptology*.

23 (U) Interview, Lewis Franklin.

24 (U) Stubblefield, "Origins." Interview, James Donnelly. Gregory W. Pedlow & Donald E. Welzenbach, *The Central Intelligence Agency and Overhead Reconnaissance: the U-2 and OXCART Programs, 1957-1974* (CIA History Staff, 1992).

25 (U) Sylvania Electronic Systems, Electronic Defense Laboratories, circa 1966.

26 (U) William J. Perry, "Recommendations for Augmentation of Guided Missile ELINT Program," (Electronic Defense Laboratory, 6 February 1959).

27 (U) Edward W. Keller, *The History of HRB — 50 Years of Excellence* (25 April 1997.

28 (U) "Report of Intelligence Community Telemetry Seminar on 18-22 May 1959.

29 (U) Melville J. Boucher, "Talomatry and How It Grew," *Cryptologic Spectrum*, Fall 1971.

30 (U) [redacted] "TEBAC: A Unique Intelligence Community Resource," 10 November 1988.

31 (U) Joseph P. Burke, "U.S. Effort to Analyze and Interpret Soviet Telemetry Signals," GENS-6 document TSC No 007/59, enclosure C. C. Tevis memo, "GENS /AWARD -73/59," undated.

32 (U) "Annual ELINT Review — 1960," C (COSA)-51 document S-61-5700, 30 June 1962, 130.

33 (U) National Intelligence Estimate (NIE) 11-5-59, entitled "Soviet Capabilities and Guided Missiles and Space Vehicles," 8 September 1959.

(U) Chapter 2
The SPACOL Plan and DEFSMAC
(Early 1960s)

(U) Management Actions under the New DoD ELINT Directive

~~(S)~~ In March 1960, on behalf of the community, NSA prepared a joint "progress report" to OSD concerning the status of the transition of ELINT responsibilities to NSA. The portion addressing telemetry made the following points/actions.

~~(S)~~ NSA had tasked the Air Force with processing and analysis for missile, satellite, and space probe telemetry, and had tasked the Army with processing and analysis of beacon and selected telemetry signals. NSA had redirected its effort, with JPL contractor support, to perform analysis on Soviet and space probe telemetry, and was continuing to develop processing and reporting effort for encrypted telemetry.

~~(S)~~ In addition, NSA had created a processing coordination group to exchange technical data and eliminate unnecessary duplication of effort. This group soon became the Telemetry and Beacon Analysis Committee, or TEBAC. As part of this effort, NSA had created an ad hoc government/industry group to develop standards for signal demodulation and analog production techniques and equipment.[1]

~~(S)~~ During 1960 coordination of all-source collection against Soviet missile and space activities in the Pacific Ocean area improved considerably, with NSA Pacific (NSAPAC) performing a coordinating role for SIGINT activities. The effort was known by the covername [redacted] with [redacted] the covername for the SIGINT component. These were later changed to [redacted] Requirements had been outlined by the Critical Collection Priorities Committee of the United States Intelligence Board. Table 2-1 shows some of the collection platforms.

~~(C)~~ There were also fixed and mobile Army, Navy, and Air Force COMINT assets. USAFSS and NSA provided technical support from Johnston Island and NSG and NSA at the Navy station at Wahiawa, Hawaii. Tip-off of impending events was usually done through encrypted Navy

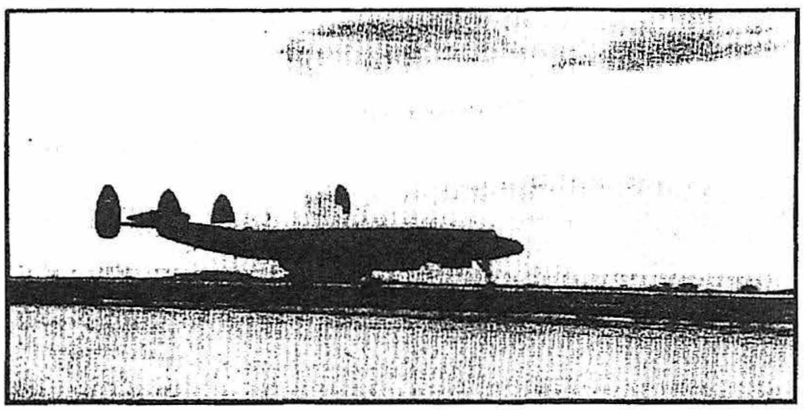
~~(C)~~ *Table 2-1 Collection Assets Available for Pacific Broad Ocean Area (BOA) Activities in 1960*

Service	Collection Platforms
Army	One [redacted] (ESGM) transportable TELINT system (usually deployed to Johnston Island)
	One ARPA-ARGMA C-130 aircraft
Navy	Two A3D-2Q aircraft [redacted]
	Two WV-2Q aircraft [redacted]
	One DER (Radar "Picket Ship")
	One Special Platform [redacted]
Air Force	One RB-47 [redacted]

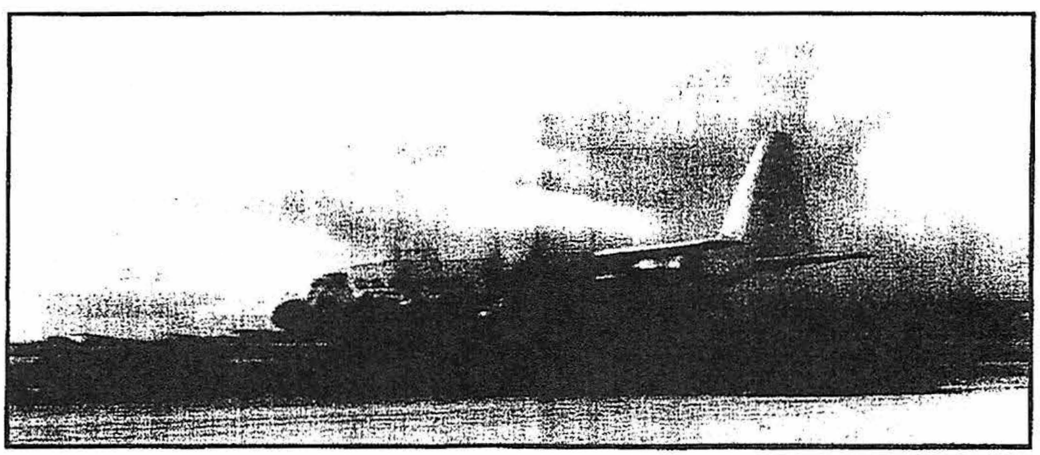
HF broadcasts from Hawaii, i.e., the [redacted] broadcast.[2]

~~(S)~~ In early 1960 the Navy P4M [redacted] aircraft began operating from Shemya and CIA [redacted] (U-2 aircraft telemetry collection mission) from Incirlik Air Base in Adana, Turkey, and Peshawar, Pakistan. There were fourteen U-2 flights flown from Adana along the Soviet border in 1959 alone. On a flight along the Soviet-Iranian border in 1959, one of the first U-2 flights was successful in intercepting telemetry from a Soviet ICBM during first-stage flight.

tests were the "picket" ships that formed the ocean part of the Distant Early Warning (DEW) line of radars across the northern U.S., Canada, and Greenland. For DEW line support these ships came under the command of the Barrier Pacific Command (COMBARPAC); when supporting collection against Soviet ICBM test firings, they were subordinate to the Pacific Fleet (COMPACFLT) under the covername [redacted]. The U.S. Navy Destroyer Escort – Radar (DER) ships involved were the USS *Newell*, USS *Wilmhoite*, the USS *Lansing*, USS *Savage*, and USS *Vance*.



~~(S)~~ Fig. 19. The WV 2Q (also named EC 121 Super Constellation) [redacted] aircraft at Johnston Island in 1960. The SHF radar antenna was modified to act as an SHF intercept antenna for telemetry.



(U//FOUO) Fig. 20. One of the ARPA-ARGMA C-130 aircraft at Johnston Island in 1960

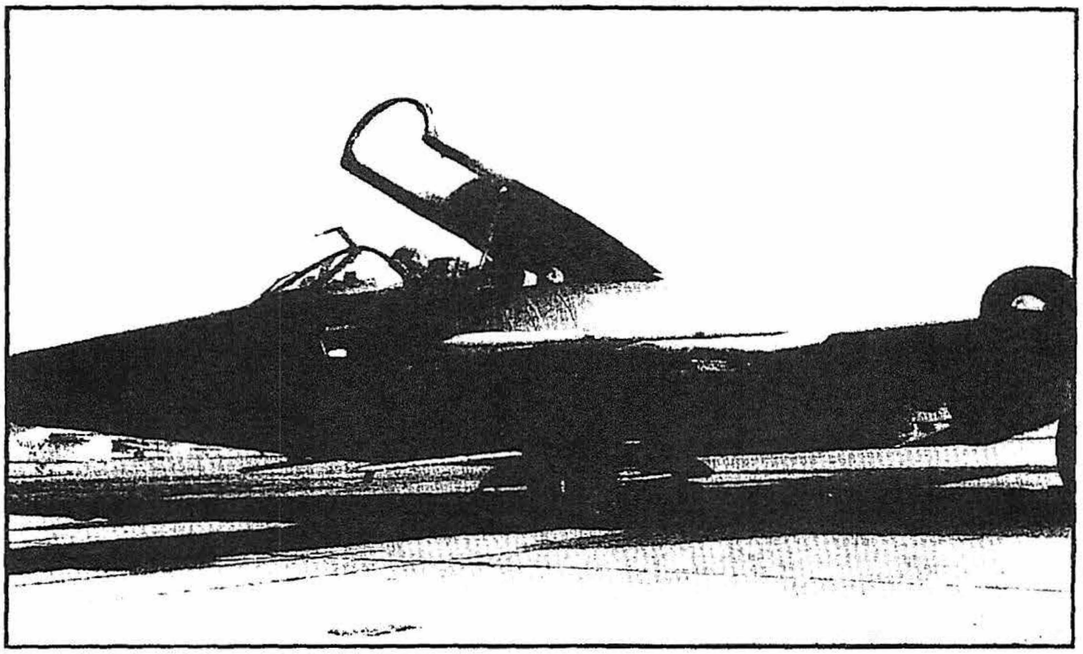
(U//FOUO) Part of the maritime assets included in Pacific Ocean deployments to collect intelligence from Soviet ICBM extended range

~~(S)~~ In the southern European/Asian area, an RB-57F aircraft flew under operational control of the Navy with Army technical support, codenamed [redacted] The equipment was not "manned" in the usual sense, but controlled by the navigator. It initially flew from Turkey against KYMTR activity, but in the mid-1960s flew from Peshawar against the top priority Sary Shagan Soviet ABM testing site. NSA provided overall operational and technical SIGINT guidance through ASA.[3]

~~(S)~~ Meanwhile, back at NSA, various organizations became involved with the "Telemetry Problem" as a result of the new NSA responsibilities in ELINT. One of these efforts was a study by [redacted] of the R4 (Research) organization in 1961 reviewing telemetry processing and analysis activities with a view toward highlighting additional activities that might/should be performed in the R&D area. As described by [redacted]

> The Soviet telemetry problem is a sprawling and articulated complex of COMINT and ELINT activities, agencies, equipment, and programme (*sic*), which has, since 1957, mushroomed into a major NSA undertaking.

~~(S)~~ The study noted that at least four to six major NSA PROD organizations were involved in collection and processing of telemetry signals, and three NSA R&D organizations were involved in developing equipment for telemetry collection and processing. (Soon there would be four R&D organizations when R6 was formed to implement the SPACOL program.)



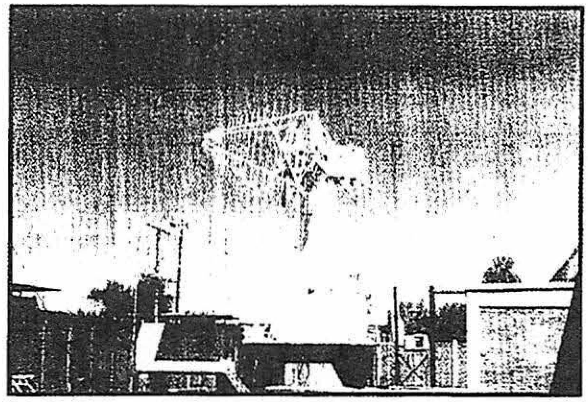
(C) Fig. 21. An RB-57 [redacted]

(U) The First Major General Collection Systems

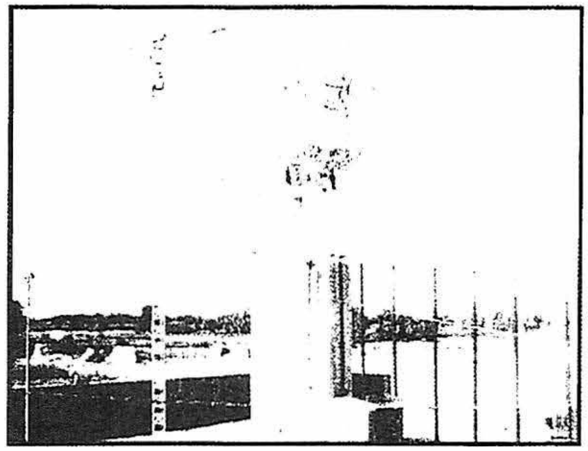
~~(C)~~ In early 1960 NSA became aware that two satellite tracking stations with forty-foot dish antennas being built for ARPA by Collins Radio in Dallas, Texas, would not be needed for the U.S. satellite program and could be made available to the intelligence community. NSA had the systems modified to cover anticipated Soviet telemetry frequencies, and these became the BANKHEAD I system at Peshawar, to be operated by AFSS; and BANKHEAD II at Chitose, Japan, to be operated by ASA. These were to be installed in the summer of 1961, but this was delayed until early 1962, and the systems did not become operational until 1963.

(C) BANKHEAD I's primary mission was to cover launches [redacted] from KYMTR, and BANKHEAD II was to cover early orbits [redacted] satellites from TTMTR as well as [redacted] telemetry data from ICBM test launches. Dr. James A. Donnelly, later a senior executive at NSA, was a key participant in establishing BANKHEAD I in 1963 and in guiding the early operations there. He had the foresight to [redacted]

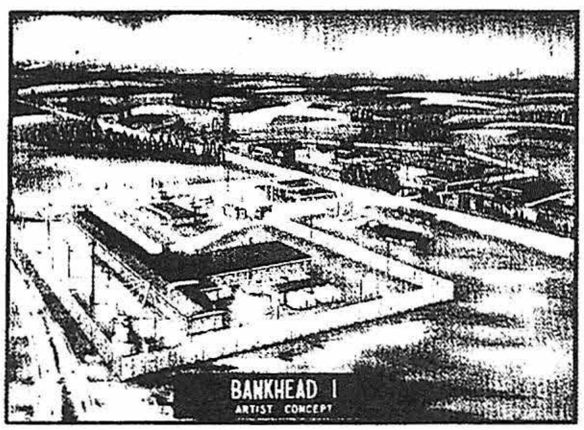
(C) The U.S. tenure in Pakistan, and any ability to expand operations, was always in question, even though a ten-year lease for the site was part of the 1959 mutual assistance pact between Pakistan and the U.S.



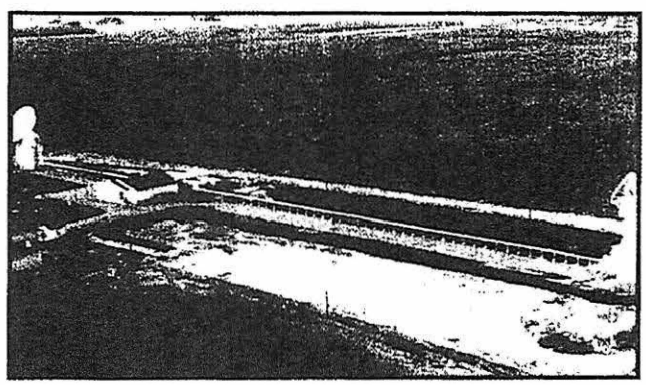
(U) Fig. 23. VHF "low-band" antenna



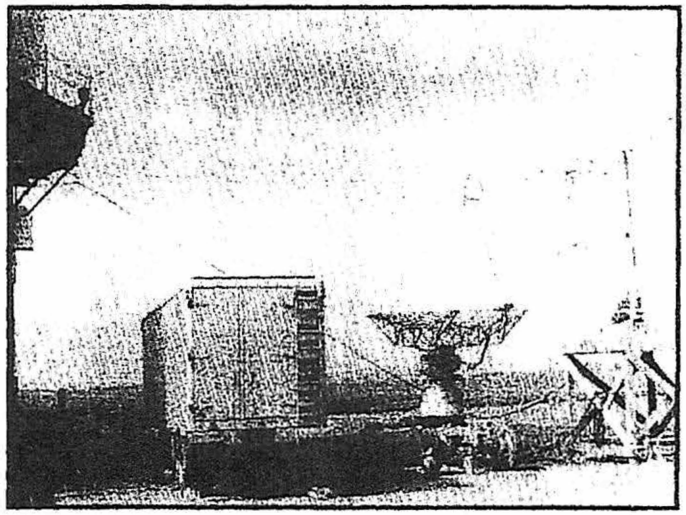
(C//NF) Fig. 24. SHF "high-band" antenna. At that time the BANKHEAD I collection equipment was integrated, but some of the telemetry processing was done in the U.S. exclusion area.



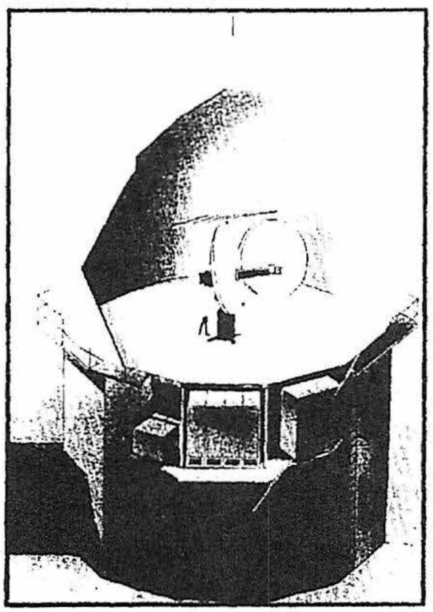
(U//FOUO) Fig. 22. An artist's concept of the BANKHEAD I compound



(C) Fig. 25. The initial BANKHEAD II facility at Chitose



~~(S)~~ *Fig. 26. A modified MLQ-19 system next to the Arctic tower that housed the other ASA telemetry collection systems. An ESGM VHF Yagi antenna is to the right. By this time the ESGM system on Shemya had been upgraded.*



(U//FOUO) Fig. 27. Artist's concept of the upgraded ESGM system that was installed at Shemya in 1962.

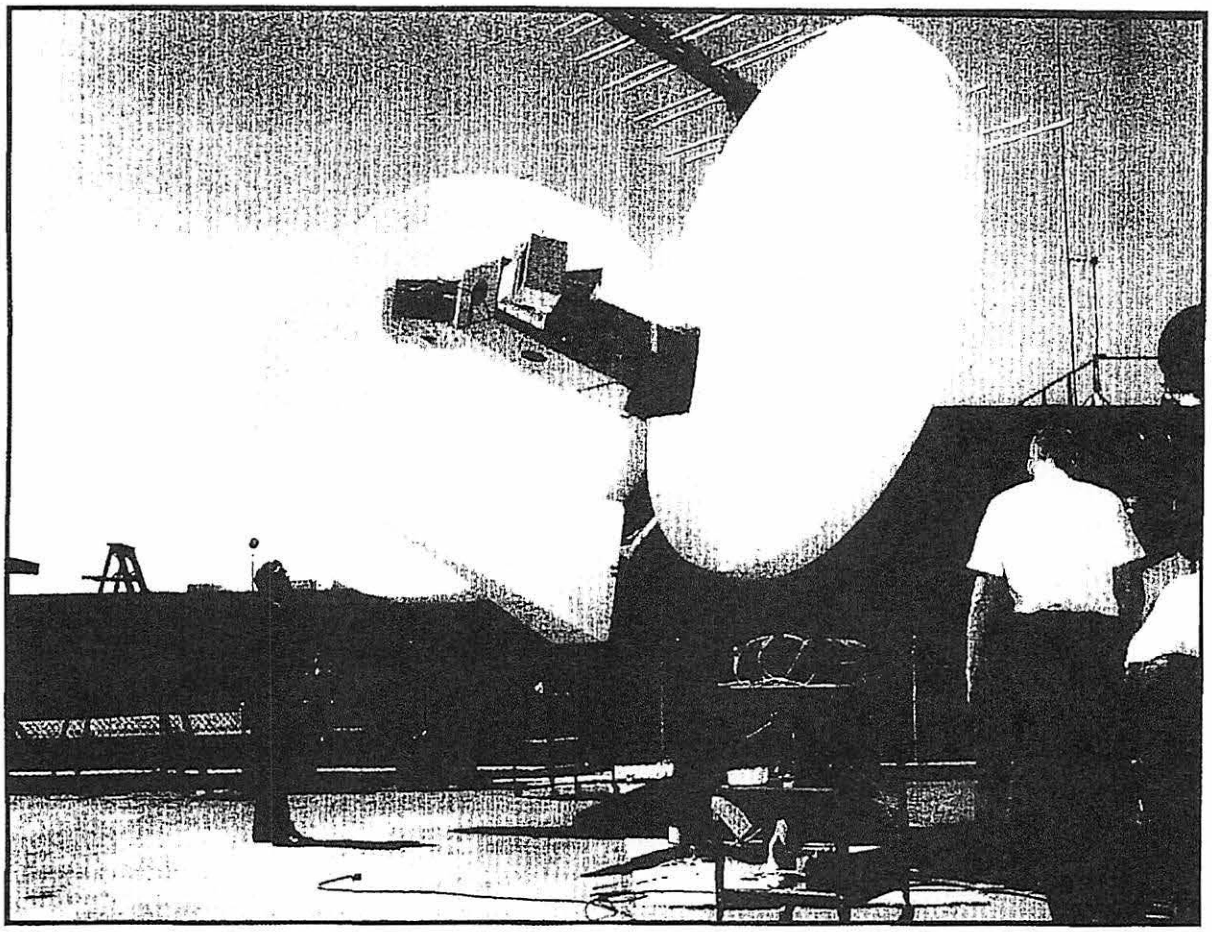
~~(C)~~ Other ground site collection continued from Turkey, Iran, and Alaska. In 1960 ASA had arranged for EDL to move an MLQ-19 missile jamming system to Shemya to be used in a "passive" mode as a telemetry collector.[5]

~~(S)~~//REL USA, UK) Frank Lewis informed GCHQ of NSA telemetry collection plans in May of 1961 at a UKUSA systems conference and described the effort in progress. GCHQ later became an important partner, with facilities in 1.4(c) [redacted]

(U) Land-Based Collection

~~(S)~~ By 1962 the Soviets had launched eight satellites in the Cosmos series. Six of these were from Kapustin Yar that were not recoverable, and two from Tyuratam that were deorbited and recovered by the Soviets. CIA postulated that the ones from Kapustin Yar were probably scientific, as announced by TASS, but that 1.4(c) 1.4(c) 1.4(c) 1.4(c) [redacted] This added urgency to collecting signals from Soviet satellites.[7]

~~(S)~~ One aspect of this was the collection and processing of signals from those Soviet satellites that carried humans. The Soviet manned space program was not only of scientific interest, but was a military threat as well. Major Yuri Gagarin,



1.4(c) [redacted]

of the Soviet Air Force, was launched into orbit on the VOSTOK-1 satellite on 12 April 1961. 1.4(c) [redacted] (based on the analysis of the TV the Soviets had used when they put two canines into orbit) put the U.S. intelligence community in a position to anticipate the television signal and keep the U.S. directly informed of his actions.

~~(S)~~ When Gagarin's initial orbit was over the Pacific, the satellite-to-ground television signal at 83 MHz that focused on his activities inside the space capsule was intercepted both by the ASA facility at Shemya, Alaska, and by the ASA PL 86-36/50 USC 3605 [redacted] facility at Helemano, Oahu, Hawaii.[8]

~~(S)~~ The 83 MHz signal had first been intercepted in August 1960 by an AFSS site in Turkey and later by the CIA EGGSHELL site in Iran. The office of Collection and Signal Analysis and R&E engineers developed signal demodulation equipment that was sent to Hawaii and Alaska in anticipation of the use of the 83 MHz signal for space flight by the Soviets; they successfully intercepted the signal. 1.4(c) [redacted]

1.4(c)

[redacted]

1.4(c)

[redacted]

(U) In the late 1950s, N.C. "Nate" Gerson of the NSA R/D organization studied ways of increasing the reception of prelaunch and launch reception of VHF telemetry signals, particularly from Tyuratam. Bob Alde, of the then Research and Development (RADE) Group, had encouraged Nate by the comment "One good intercept is worth $5M." As Nate recorded in an unclassified report in 1998:

> **To attack the problem I first examined natural causes that allowed proposition over extended ranges: sporadic E clouds at 110 km allowed extended ranges to 1,500-1,000 km; transequatorial propagation allowed 7,000-11,000 km ranges north-south via the ionosphere layer; high solar activity raised the upper frequency support limit of the ionosphere to 40-50 MHz for distances to 4,000 km. Other possibilities are auroral ionization, magnetic channeling (for VHF), meteorological ducting, antipodal propagation and meteor scatter. The occurrence of each phenomenon depended upon location, time of day, month of the year, and often time in the solar cycle. Because of their different physical origins, their properties, statistics, and climatology were different. However, when present they could be exploited for SIGINT. While each method provided some potential for intercept, few of them provided continuous or reliable coverage when needed. It was... essential to recognize their limitations.[12]**

1.4(c)

[redacted]

(U) Sea-Based Collection

~~(S)~~ Some Military Sea Transport Ships (MSTS) USNS *Valdez* and USNS *Robinson* were converted for SIGINT use and manned by Naval

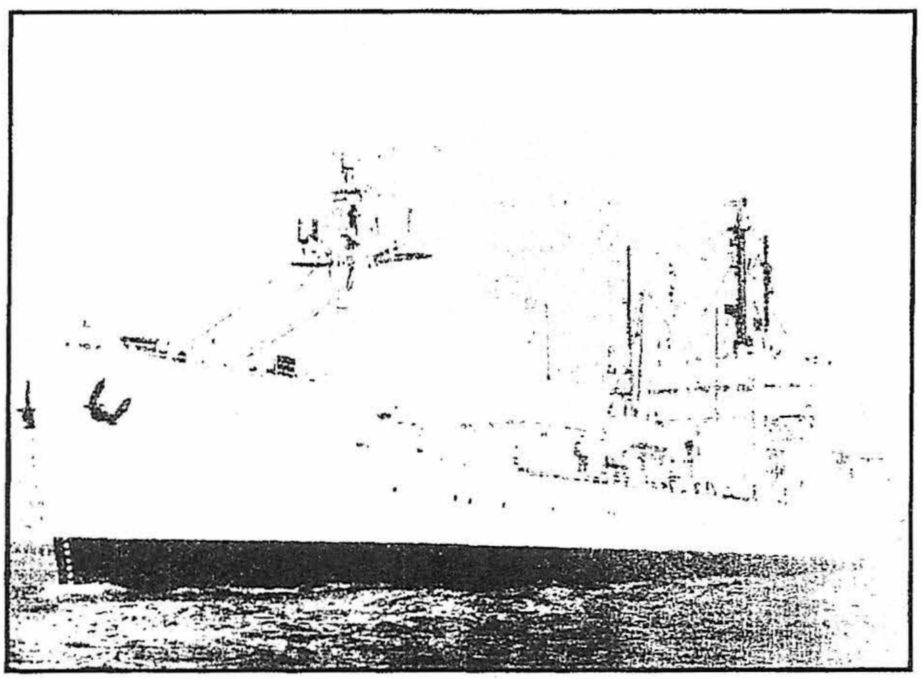
Security Group and Army Security Agency operators. Along with the USS *Liberty*, the ships were used to cover Soviet ESV operations associated with the Soviet Space Event Support Ships (SSESS) off the coast of Africa. One of these ships intercepted telemetry from the re-entry phase of a Soviet ESV manned by Cosmonaut Titov in 1961.[14]

~~(S)~~ In 1963 the U.S. Advanced Missile Range Instrumentation Ship (ARIS) USS *Timberhitch*, provided with temporary equipment shelters and manned by ASA personnel, operated until the Robinson returned to the Pacific area in mid-1963. Thus began a long stretch of using U.S. missile test range ships for collection of telemetry and other types of missile intelligence collection. JCS called this the ELEVENTH FATHOM program.

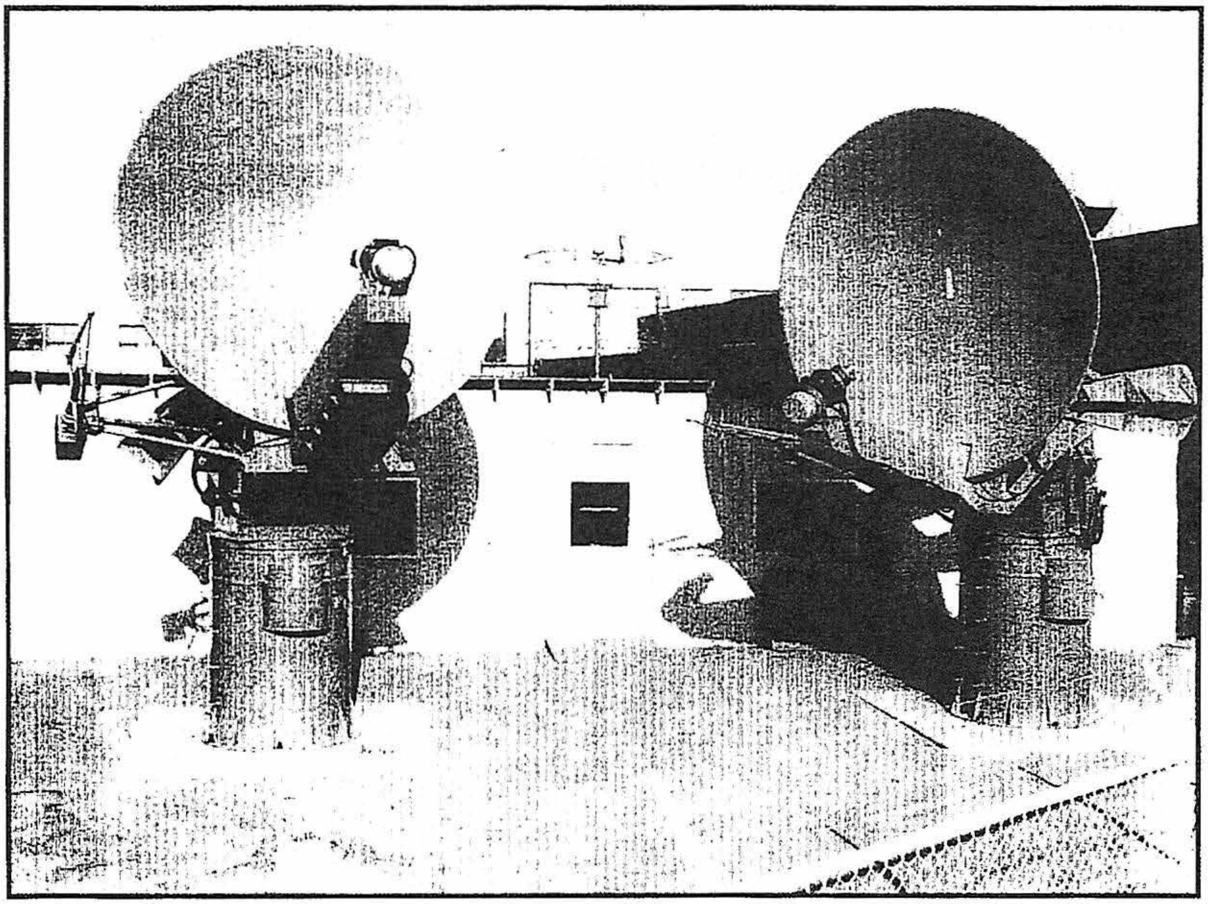
~~(S)~~ These ships were soon replaced by the *Arnold* and the *Vandenberg* ARIS ships. The USN also outfitted four destroyer escorts (the USS *Perry*, USS *Berry*, USS *McMorris*, and USS *Jones*) with missile intelligence collection sensors; these were called [redacted] (later [redacted] platforms and replaced the Destroyer Escort ships that had been doing limited RADINT collection against Soviet Pacific ocean missile test firings.[15]

(U) Airborne Collection

~~(S)~~ Since all of the signals used for Soviet telemetry transmission were "line-of-sight" signals, U.S.-sponsored ground- or sea-based sites were not entirely able to collect the critical launch phase telemetry from missile and space launches, or later the re-entry/impact telemetry from missiles. Typically, aircraft collection was needed for the "first stage" and the "reentry" phases, and radar or infrared data were also necessary to obtain the full information needed by U.S. intelligence customers, particularly those involved in designing U.S. missile defense systems.



(U//FOUO) Fig. 29. An SHF tracking antenna that was part of the equipment installed on the Valdez



~~(S)~~ *Fig. 30. Two RASTAS (the Sylvania-EDL project name) antenna systems, one of which was installed on the ill-fated USS Liberty*

~~(S)~~ The "line-of-sight" limitations of ground- or sea-based collection platforms drove the requirement for airborne collection. Several platforms were configured for telemetry collection, but successful collection usually depended on COMINT warning of missile and satellite launch activity that indicated when to fly the aircraft. In-flight reception of U.S. encrypted broadcasts [redacted] giving the status of Soviet launches often allowed these airborne platforms to be at the right place at the right time.

~~(S)~~ Some of the early efforts included Navy P4M and P2V aircraft, which had two propeller and two jet engines with tailored equipment configurations. The first of these flew in 1957.[16]

~~(S)~~ [redacted] was a SAC EB-47E (TT), also called [redacted] flying from Adana, Turkey, along the Soviet-Iranian border; and by the early 1960s had signal recognizers for the VHF PPM/AM signals and for the Soviet missile tracking radars which contained a transponded signal from the missile to give the Soviets more accurate trajectory information. The [redacted] platform flew primarily against TTMTR events and had a restricted flight path since it was a "bomber" aircraft and was carefully monitored by the Soviets. Also in the mid-1960s, [redacted] aircraft flew from Wheelus AB in Libya against re-entry of Soviet manned space flights and from Hickam AFB in Hawaii and Wake Island against Soviet ICBM re-entries in the Pacific Ocean. One of the [redacted] aircraft crashed while landing at Adana, Turkey, because of high crosswinds.[17]

the Pentagon gatekeeper at DDR&E, since the U.S. Navy [redacted] aircraft was just coming into the inventory with similar characteristics.[18]

[redacted]

~~(S)~~ The EB-47s had a limited technical capability, e.g., the antennas were on only one side of the aircraft, they had altitude limitations, and they had to fly conservative flight profiles along the USSR border. In general, [redacted] did not often collect any early "First Stage" powered flight telemetry from TTMTR launches. A proposal to replace the EB-47 [redacted] with a re-engined RB57F that could fly at an increased altitude came from the Air Force in 1965 but was turned down by Dr. Eugene Fubini,

~~(S)~~ By 1963 the [redacted] RB57F had improved engines that allowed altitudes up to 60,000 feet, was flown by Pakistani pilots, and was codenamed [redacted] ASA and contractors provided ground support and telemetry processing. (The government of Pakistan required that these aircraft be flown by Pakistani pilots, which added another variable to the collection efforts.) This platform had 1 MHz bandwidth recording tapes. One of the aircraft, as well as the U.S. crew, was lost on a flight from Adana in 1966, possibly when the pilot's oxygen supply failed. The telemetry collection missions were not well loved by the pilot and navigator/equipment "operator" since they had to stay on pure oxygen for an hour before each flight as well as on the flight itself. 1.4(c) [redacted]

1.4(c) [redacted]

(S) Navy A3D SEABRINE/FARMTEAM aircraft flew from Adana and Peshawar. Still later, in the early 1960s Navy EA3B SEABRINE aircraft would fly in the Atlantic and Pacific areas, again manned by ASA SIGINT operators supervised by a Navy "evaluator." ASA called the effort FARM TEAM. All flights from Pakistan ceased during and after the 1965 war between Pakistan and India.[20]

(U) Very Special Efforts

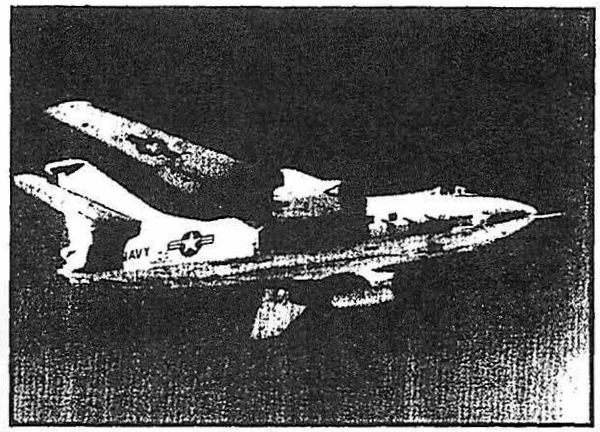
1.4(c) [redacted]

1.4(c) [redacted]

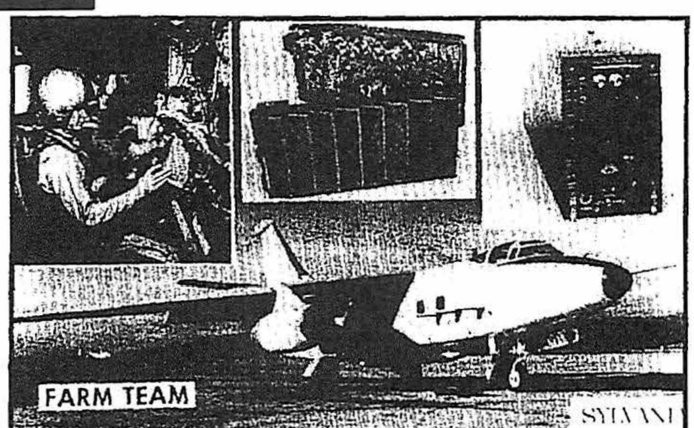
(S) Another technique tried was to launch piggy-back satellites on U.S. space launches; one called SIVET (named after pioneer collector Charles Tevis – SIVET being Tevis spelled backwards) to see if telemetry could be at least recognized and recorded on 50 kHz bandwidth (the maximum then available on these packages) recordings and relayed back to the U.S. in order to "verify" that launches had occurred. The main test 1.4(c) [redacted]

1.4(c) [redacted]

(S) Engineers considered using missiles or gun-launched projectiles launched from Turkey to produce cesium clouds that could possibly reflect telemetry from KYMTR firings. This plan (Project BROADBENT) was never implemented because of the political considerations of firing a missile (albeit vertically) close to the USSR. Several other forms of "unusual" signal propagation modes were studied and tested. Nate Gerson in R/D at NSA did many of these studies.[23]



(U//FOUO) Fig. 32. The A3D SEABRINE/FARMTEAM aircraft



(U//FOUO) Fig. 33. The antenna and payload were installed in the former bomb bay. The Navy and ASA operated the equipment, supported by Sylvania EDL.

(U) An NSA Plan Emerges

~~(S)~~ During early 1960 production organizations (primarily COSA and GENS) started reviewing intelligence requirements and making longer range collection plans. It soon became apparent other NSA elements and skills were required to develop a comprehensive plan. NSA adopted the usual solution to a complex management and technical problem – form a committee, in this case the Space Surveillance SIGINT Planning Board (SSSPB). The committee approach was NSA's first large effort at an across-the-board, end-to-end "system" planning effort (collection, processing, deployment, manning, training, logistic support, etc.) and – best of all – it worked!

~~(S)~~ Although compiling an overall plan today sounds as if it should have been an obvious move, remember that until NSA was faced with this new form of SIGINT it had been relatively easy to just "add-on" to conventional COMINT, mostly HF, and ELINT conventional sites/systems as new signal types emerged.

~~(S)~~ The study was chaired by Guy Stephens. Group members included Walter G. Deely (later deputy director for information security); [redacted] soon to be appointed chief of R6, the Office of SPACOL Management, which would implement the new systems recommended by the study); [redacted] already responsible for the BANKHEAD I and II systems); Melville J. Boucher from GENS (later a key manager in the Group A missile/space organization); and [redacted] and Thomas Dewey from R/D, both of whom later developed processing systems for missile/space telemetry applications.

~~(S)~~ The SSSPB completed a draft plan in May 1961 and in December a new office — R6 — was formed in R&D. The original title was to be the Office of SPACOL Management, but was changed to "Office of Special Program Management" to protect the word SPACOL, considered CONFIDENTIAL in the early years. The new office was to flesh out the plan, arrange for developing the systems, and achieve an operational capability by 1965.

~~(S)~~ The U.S. intelligence objectives (included in the SSSPB study) against space targets for the mid-1960s were as follows:

> **First priority – Soviet activities in and relating to space which contribute significantly to, or are indicative of, Soviet military capabilities.**
>
> **1) Space vehicle with a weapon delivery capability**
> **2) Reconnaissance, weather, communication, ECM, ELINT, geodesy, and navigation satellites**
> **3) Maneuverable vehicles, whether manned or not**
> **4) Space platforms**
> **5) Space order-of-battle inventory**
>
> **Second Priority – Soviet exploitation of space for scientific and psychological purposed to include**
>
> **1) Biological probes and satellites**
> **2) Manned space vehicle**
> **3) Lunar planetary probes (manned and unmanned)[24]**

~~(S)~~ The requirements were straightforward, but the USAF and NORAD (North American Air Defense Command, today part of the USAF Space Command) imposed a timeliness requirement on analysis and reporting of some of the data that was in many cases impossible to meet, given the state of the art in signal tracking, telemetry analysis and communications at that time. These requirements, however, drove the system design to do as much processing and reporting as possible at the point of intercept.[25]

~~(S)~~ Another problem in getting the program started was posed by the DoD resource manager, Deputy Director of Defense Research and Engineering – DDR&E – Dr. Eugene Fubini. Only after many reviews and questions did he approve the approach but stipulated that NSA could have a total of only $40M instead of the approximately $80M estimated in the draft plan. Based on the fiscal "guidance" from Dr. Fubini, the "final" SSS Technical Development Plan (TDP) was completed in September 1962; and he released the funding for the program that October.[26]

~~(S)~~ Now approved and funded, the TDP called for establishing a BANKHEAD III (soon to be called HIPPODROME) site/system at Sinop, Turkey; [redacted] and a STONEHOUSE deep space telemetry system at Asmara, Ethiopia. BANKHEAD III and STONEHOUSE were to be operated by the Army Security Agency, since they already had field stations in those locations. Planning was deferred for the BANKHEAD IV system planned for Alaska. As it happened, the planned second and third STONEHOUSE sites were not funded at this point (and in fact never got funded or built). Contracts for [redacted] and STONEHOUSE were in place in 1963 and for BANKHEAD III by early 1964.

~~(S~~//NF) [redacted] Both goals were met, including an initial operating capability in early 1965. The BANKHEAD III (HIPPODROME) system ended up costing over $7 million; STONEHOUSE cost over $8 million. Each of the U.S.-managed sites was expected to require about 100 people to operate, including several contract technical and engineering representatives, and two to four NSA "expert" telemetry analysts. [redacted]

(U) Implementation

(U//FOUO) Fortunately, in parallel with development of the TDP, NSA R&D had EDL complete a design approach for "example" missile and satellite SPACOL sites. EDL was uniquely qualified to do this study because they were one of the few industrial organizations involved in processing and analyzing Soviet missile and space telemetry at that time and had built many of the existing collection equipment configurations already in the field.

(U//FOUO) This author joined R6 in August of 1962 as project manager of [redacted] I was soon joined by [redacted] USAF, who became deputy project manager.

[redacted]

1.4(c) [redacted]

(S) One major change from the SSS TDP was the determination that a 150-foot dish system, called PL 86-36/50 USC 3605 [redacted] would have to be added to the originally planned 85-foot antenna at STONEHOUSE in order to have enough antenna gain to receive the Soviet lunar deep space signal at 183 MHz as the probes arrived at Mars (the Soviet ZOND probes) or at the moon (the Soviet Lunik probes).

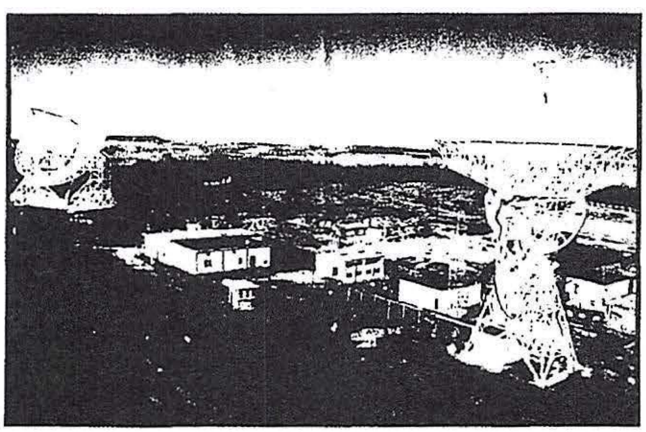
1.4(c) [redacted]

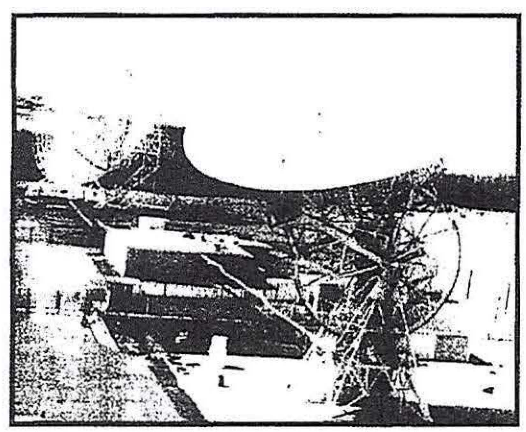
(S) The additional two contemplated STONEHOUSE facilities were never completed, but others were: the 1.4(c) [redacted] These were used in later years part time to obtain a portion of the data that would have been obtained by the other STONEHOUSE-type facilities.

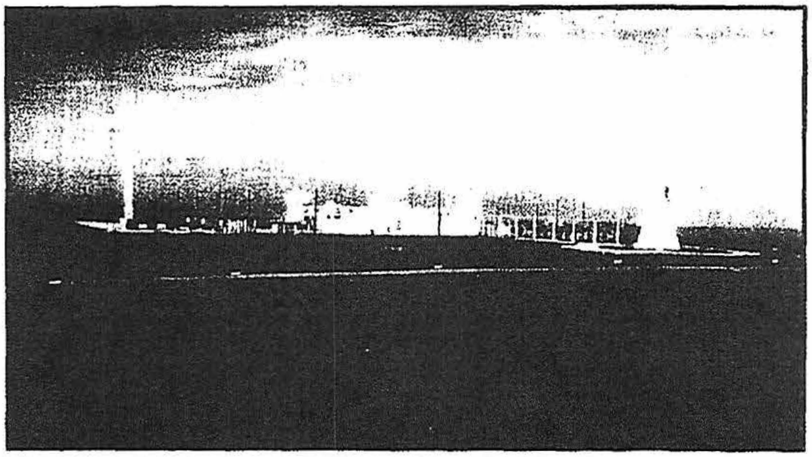
(C) In parallel with the EDL "BANKHEAD" study was one called STONEBANKS being done by Western Development Laboratories (WDL) on collection against "deep space" probes. This system required significantly larger antenna sizes and different equipment configurations for use against Soviet planetary signals and distance targets.

(S) A new site, at a nearby hilltop location close to the main compound at ASA Field Station Sinop, was selected for the BANKHEAD III facility, and given the name HIPPODROME. The initial installation was completed in 1966. The

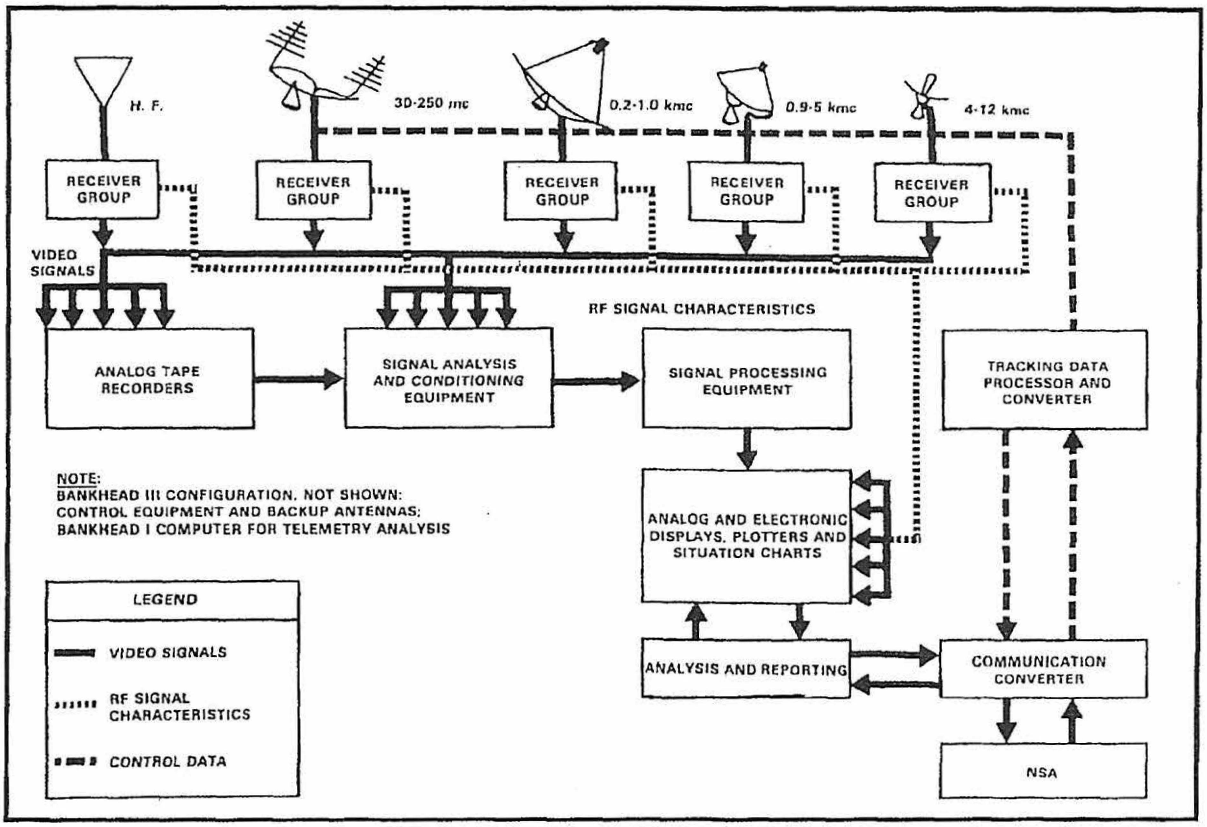
(U//FOUO) Fig. 36. (left) The STONEHOUSE site during system installation.
(U//FOUO) Fig. 37. The completed facility in 1965







(U) Fig. 38. The BANKHEAD III system as installed circa 1966



~~(C)~~ Fig. 39. "Block diagram" of the BANKHEAD III system showing the breakdown of the antenna frequency ranges and other functions performed by the system

BANKHEAD III system contract was awarded to LTV Electrosystems in Greenville, Texas.

(U) Collection Operations Coordination Takes Shape

~~(S)~~ The NSA SIGINT Missile Analysis Center (SMAC), spearheaded by Joseph P. Burke, was formed as A41 in 1963 based on a plan distributed in August of 1962. The plan called for fewer than twenty "high speed" (100 words/minute) OPSCOMM circuits, and estimated a total initial cost, including construction, of less than $250,000, a rather modest beginning. The watch center was to be supported by a "SIGTRACK" ephemeris-processing center to process special tracking data. SMAC ended up with OPSCOMMs to sixteen collection facilities and customers.[28]

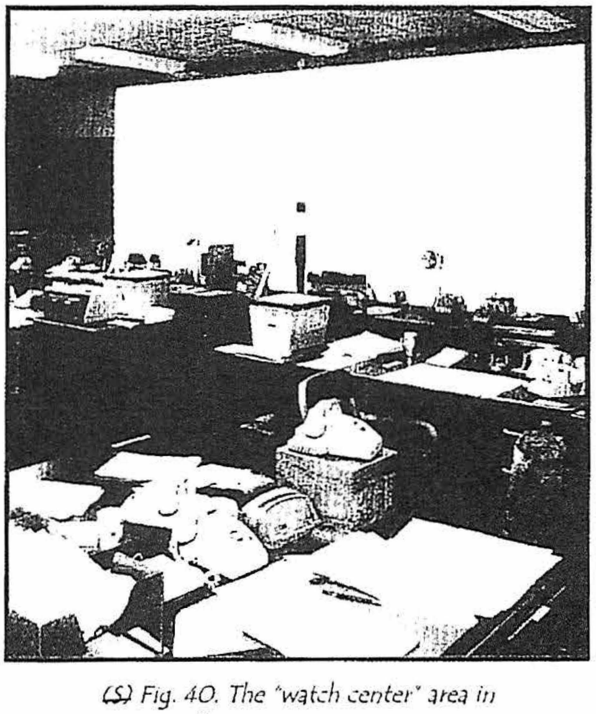
(S) In late 1963 CIA formed the Foreign Missile and Space Analysis Center (FMSAC) to pull together CIA coordination of collection and analysis/interpretation of data concerning missiles and space. Carl E. Duckett, a missile expert previously at Redstone Arsenal, was named first director. FMSAC was disestablished in 1973 when its analytic functions were merged into the Office of Scientific Intelligence (OSI) at CIA.[29]

(S) Also in late 1963, DoD senior officials felt that further improvements were needed within the department for management and coordination of foreign telemetry collection and processing. On 25 September Roswell Gilpatric, deputy secretary of defense, tasked Dr. Eugene G. Fubini, assistant secretary of defense for DR&E, and DIA director Lieutenant General Joseph F. Carroll, USAF, jointly to review DoD management of missile and space intelligence activities, with DoD Directive 5105.28 as a reference.

(S) Gilpatric had previously discussed this topic with DCI John McCone, who sent a letter back to Secretary of Defense Robert S. McNamara on November 26, 1963, noting he had already formed FMSAC, to have primary responsibility for all-source collation and analysis of Soviet missile and space firings. McCone noted that the formation of FMSAC could present an opportunity for it to become the U.S. tasking authority for U.S. collection resources.

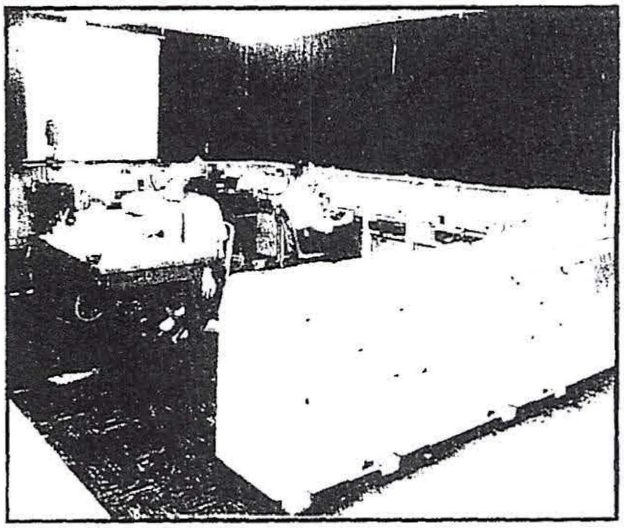
(S) On 19 December 1963, Dr. Fubini replied to the deputy director of Central Intelligence that such an expansion of the analytic functions of FMSAC appeared to duplicate functions already being performed within CIA and DoD. Fubini suggested CIA should hold any such expansion in abeyance until the DoD study was completed and the results furnished to CIA. He noted that $150M and over 5,000 DoD personnel were programmed to support missile and space intelligence activities in the FY-64 program.

(S) The DoD study, completed on 20 February 1964, recommended that the secretary of defense establish a Defense SMAC organization that combined DIA and NSA responsibilities.[30] Also at that time, Don Borrmann, assigned to the Intelligence Community Staff, became aware of the formation of CIA's FMSAC and recommended to the NSA Deputy Director for Operations (then Major General John J. Davis, USA) that NSA form a FMSAC-like organization to coordinate DoD missile and space collection assets. Borrmann and Colonel Max Mitchell, USAF, from DIA drafted the DEFSMAC charter.



(S) Fig. 40. The "watch center" area in Defense/SMAC, circa 1966

~~(S)~~ Defense/SMAC was formed under DoD Directive S-5100.43 dated April 27, 1964, "Defense Special Missile and Astronautics Center" With "intelligence" reporting responsibilities (as opposed to SIGINT "information" reporting done by NSA). DIA assigned twenty-three billets to the organization. NSA assigned eighty-one, most of which were already filled by previously established NSA SMAC and "SIGTRACK" contingents. Charles C. Tevis from NSA was named director, and Colonel Max Mitchell, USAF, from DIA was appointed deputy director a few months later. Charles L Gordon was named chief of the A41 (SMAC Division) that provided the NSA people and administrative arrangements on behalf of NSA.[31]



~~(S)~~ *Fig. 41. The Defense/SMAC "tracking" area, some of the OPSCOMMs to NORAD and to some of the collection sites (1966)*

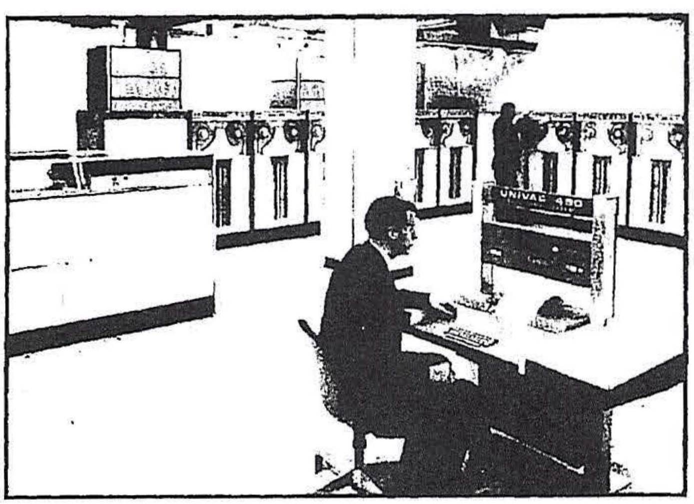
~~(S)~~ Key functions and responsibilities described in the DoD Directive were as follows:

1. Twenty-four-hour surveillance of foreign missile and space activities

2. Tasking and technical control of all DoD intelligence collection activities directed against foreign missile and space activities

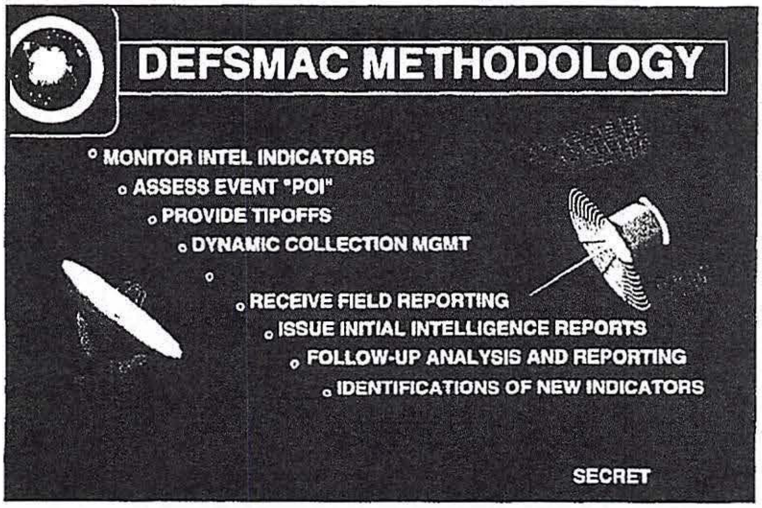
3. Technical support, including tip-off, to all DoD missile and space intelligence collection activities and to assist them in the performance of their respective missions

4. Current analysis and reporting of foreign missile and space events based on data collected by DoD missile and space intelligence collection activities and received at Defense/SMAC up to 72 hours after the event[32]



~~(S)~~ *Fig. 42. The UNIVAC 490 in the basement of NSA that was used to generate* 1.4(c) [redacted] 1.4(c) [redacted] *and process "tracking" data collected by he various SIGINT locations (1966)*

(U//FOUO) Lieutenant General Joseph F. Carroll, USAF, signing as director, DIA, with Lieutenant General Gordon A. Blake, USAF, signing for NSA, promulgated an implementing Memorandum of Understanding on May 29, 1964, putting Defense/SMAC (later to be abbreviated DEFSMAC) in business. Charles C. Tevis, the first director of Defense/SMAC — which



~~(S)~~ *Fig. 43. Summary of the methodology used by Defense/SMAC when it was formed*

ties of interest. Defense/SMAC would notify SIGINT facilities at those locations via OPSCOMMs of information to be broadcast, and the HF transmitters at those locations would send the information in coded messages every ten minutes, alternating between various transmitting sites. Defense/SMAC had codenames for each; overall they were the FOXTROT broadcast. 1.4(c) [redacted]

officially began operations on June 1, 1964 — promulgated the specific implementation plan for the Center on 4 June 1964.[33]

1.4(c) [redacted]

(U//FOUO) In the summer of 1964, in order to improve the knowledge of key NSA and CIA managers on the capabilities of each other's collection efforts, Dr. Wheelon, DDS&T at CIA, 1.4(c) [redacted] He took CIA Statute [redacted] Carl Duckett, head of FMSAC; Major General John Davis, USA, NSA Deputy Director of Production; Joe Amato, from NSA's A Group; and Charlie Tevis, director of Defense/SMAC, for a worldwide tour of telemetry collection facilities sponsored by both agencies.

1.4(c) [redacted]

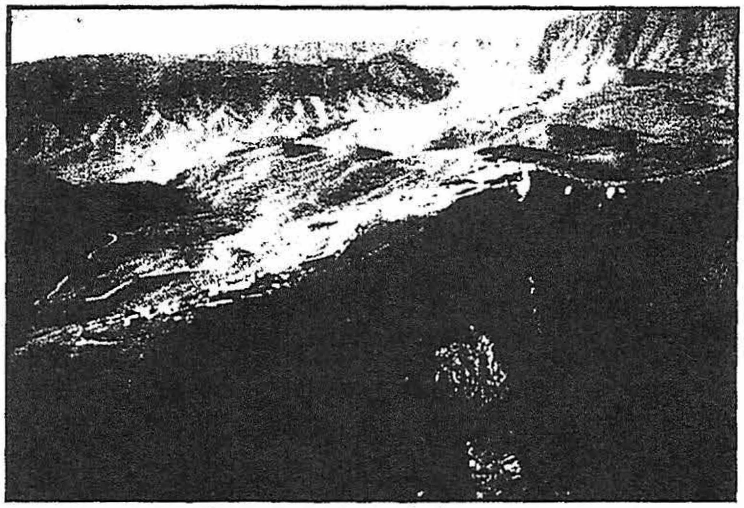
(S) Fig. 44. FOXTROT broadcast locations

~~(C)~~ In June 1965 NSA produced a comprehensive Space SIGINT Collection Plan based largely on the SSS TDP and the Defense/SMAC Implementation Plan. It was also derived from the current United States Intelligence Board Guided Missile and Astronautics Intelligence Committee (GMAIC) requirements, and took into account soon-to-be-operational SPACOL systems. The plan included specific requirements for passive tracking accuracy for the SPACOL systems. The plan drove the accuracy requirements for the next several years and led to development, design, and incorporation of monopulse tracking for the BANKHEAD II replacement system (JAEGER) in 1966 as well as the addition of signal Doppler tracking equipment and processing (called the PL 86-36/50 USC 3605 [redacted] projects) for several BANKHEAD systems and STONEHOUSE in the late 1960s.[35]

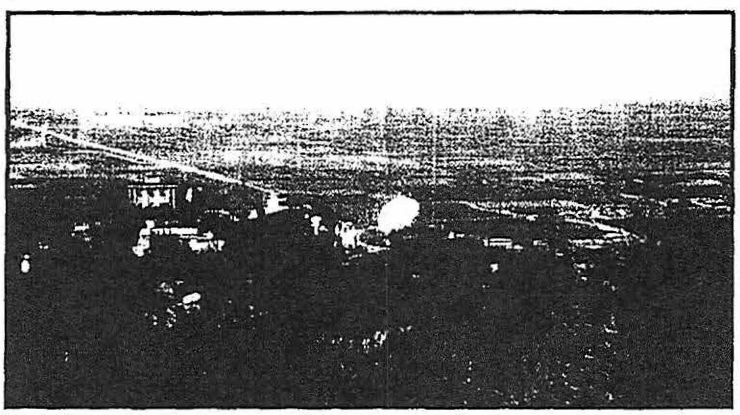
(U) CIA and DoD Add Collection of Various Types

~~(S)~~ CIA was also very active in telemetry collection. The TACKSMAN I site in Iran continued to expand. By now, the Office of Communications personnel had been transferred to the CIA Office of ELINT, which became responsible for both TACKSMAN sites in 1962. Each TACKSMAN site had an operating personnel complement of about twenty-five people.[36]

~~(S)~~ For more complete coverage on Soviet space probes, where mission objectives normally were known (Mars, Venus, or the moon), several radio research stations were often requested to provide data. These facilities were the



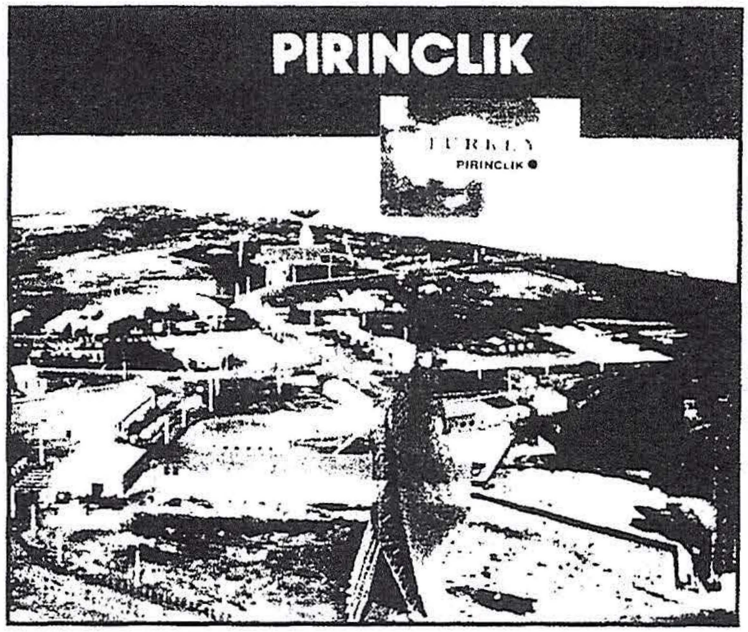
~~(S)~~ Fig. 46. The TACKSMAN II facility. This site was much closer to Tyuratam, and also to Sary Shagan, where the Soviets began testing antiballistic missile interceptors.



~~(S)~~ Fig. 45. TACKSMAN I facility, including the Shah's summer palace. In 1964 CIA established another site in Iran, called TACKSMAN II (also established as a clandestine site), on a remote mountaintop near Kapkan, Iran.

1.4(c) [redacted]

1.4(c) [redacted] 1.4(c) [redacted] When the U.S. Navy facilities were used to look for ELINT and telemetry signals that might be reflected from the moon, or "moon bounce" searches, the efforts were called PAMOR, an acronym for "passive moon reflections."

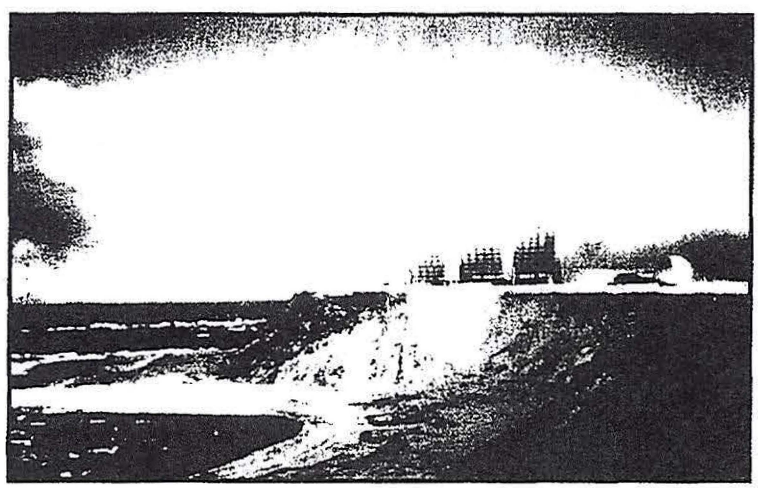


(S) Fig. 47. The Diyarbakir Radar facility. These radars were targeted primarily at the KYMTR missile launches and satellite launches from TTMTR.

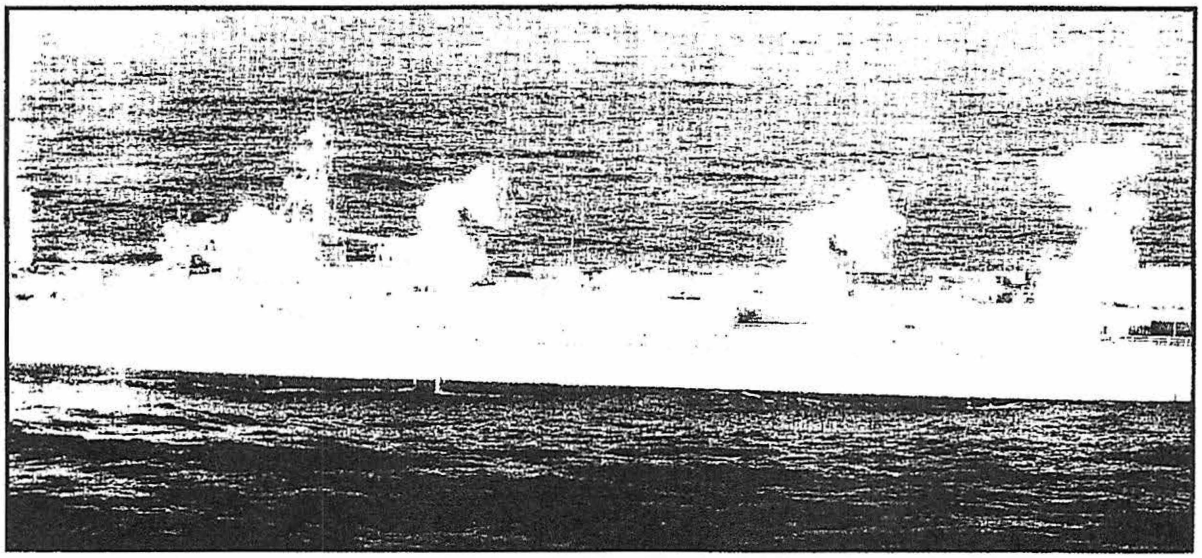
(U) Other Foreign Missile/Space Technical Intelligence Sources

(S) Intelligence from radar systems, initially operated by the USAF Security Service and tasked by NORAD, provided NORAD with essential information on foreign missile and space activity, and also was an important adjunct to Defense/ SMAC on many events, particularly missile test firings. Fixed beam FPS-17 radar was located near Diyarbakir, Turkey, in 1956 and was followed by an eighty-five-foot dish FPS-79 tracking radar in 1964. The FPS-17, in addition to its initial mission to surveil missile launches from KYMTR, came to provide derivation of missile trajectories, identification of earth satellite launches, calculation of satellite ephemeris (position and orbit), and synthesis of booster rocket performance.[37] Similarly, there was an FPS-17 installed in 1959 and a later a sixty-foot antenna FPS-80 radar at Shemya, Alaska, in 1961. The Shemya radars covered TTMTR missile impacts on Kamchatka and firings into the Pacific Ocean, as well as launches of KYMTR satellites.

(C) From time to time the TRADEX radar on Roi Namur, normally used to track U.S. missiles test fired from Vandenberg AFB into the Pacific test range, was used against Soviet missiles fired into the Pacific. Also, the ARIS ships *Arnold* and



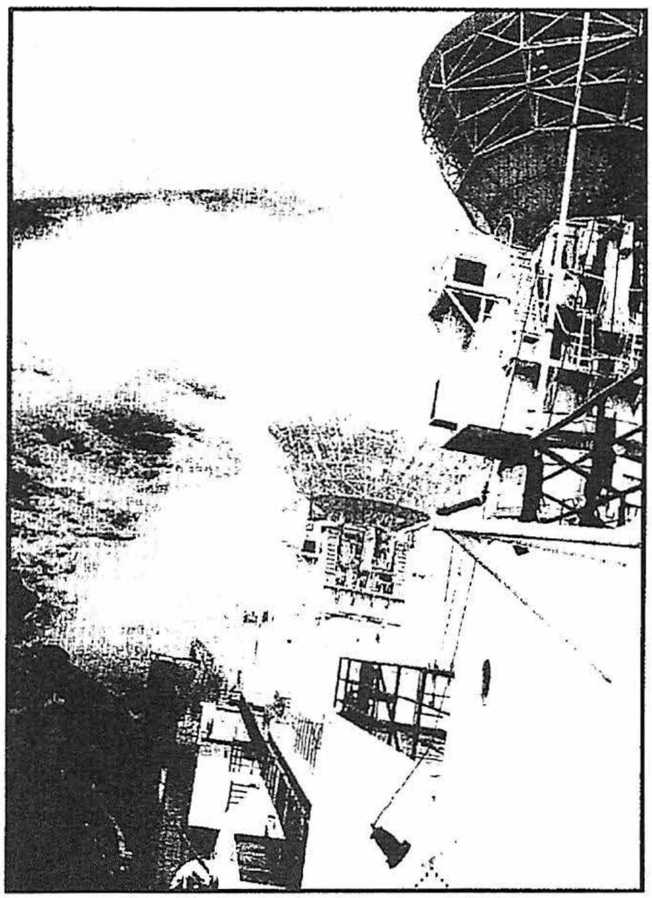
(U//FOUO) Fig. 48. FPS 17 and FPS 80 at Shemya. The responsibility for operating these radars was transferred from USAFSS to the Air Defense Command (ADC), part of NORAD, in 1962.



(U) Fig 49. The USNS Hoyt S Vandenberg ARIS during a "normal" cruise

Vandenberg had radar tracking capability and were deployed against Kamchatka and Pacific Ocean firings. At times the BMEWS radars at Clear, Alaska, and Thule, Greenland, provided data on TTMTR launches. Further, the Space Defense Center radars at Flyingsdale's Moor, England; the FPS-85 at Moorstown, New Jersey; and the USAF Eastern Test Range radars at Trinidad, West Indies, and on Antigua, Canary Islands, were often helpful in locating and tracking Soviet satellites during their early orbits.[38]

(S) Systems to exploit over-the-horizon HF radar reflection data, giving missile trajectory information from Soviet missiles were also developed. These used both "forward-scatter" and "back-scatter" radar reflections. ASA operated stations in Peshawar, Ankara, and Adak called the [redacted] system, to collect missile reflections from Soviet tracking radars. The USAF had a "forward scatter" system that transmitted HF signals from Okinawa and the Philippines and had signal receiving stations at San Paulo, Spain; San Vito, Italy; Aviano, Italy; Foggia, Italy; and Salonika,



(U) Fig. 50. The Vandenberg ARIS during a Pacific storm in 1967

Greece. 1.4(c) [redacted]

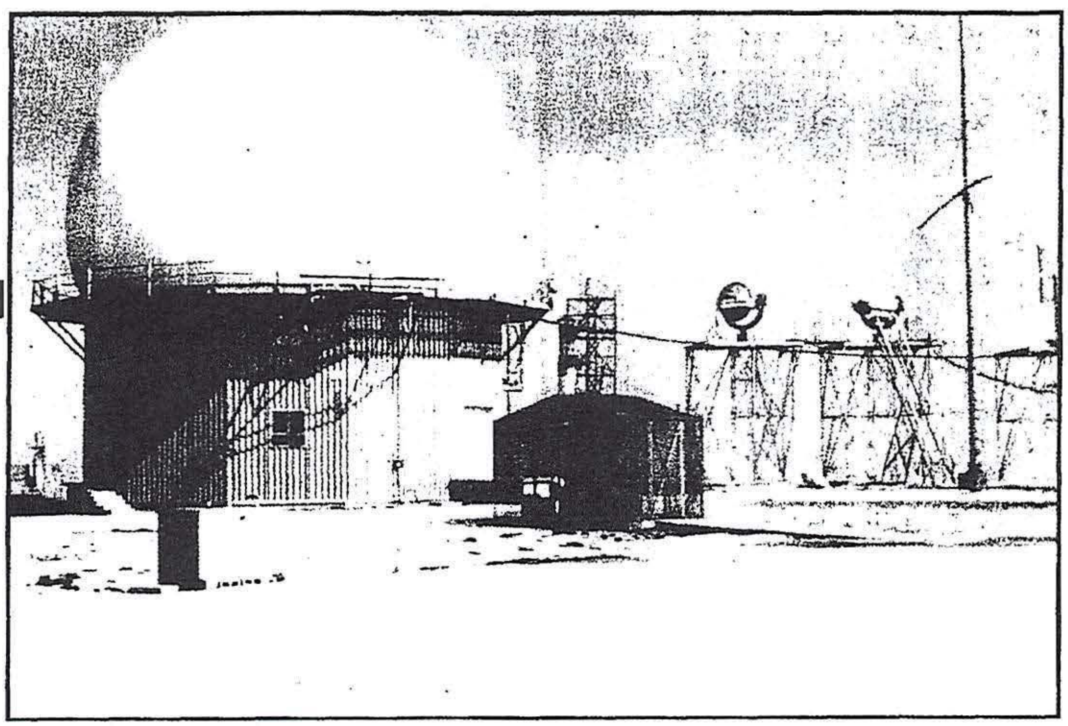
(S) The results from these HF "radar" systems were not always usable by Defense/SMAC in the early years because trajectory tracking results were often not available within a seventy-two-hour reporting deadline. But the data and reports were used by NSA and other organizations in long-term missile assessment reports.

(S) Another source of data used for long-term missile analysis in the early 1960s was the ACOUSTINT data collected by ASA from Sinop and Ankara; Meshed and Teheran, Iran; Peshawar and Lahore, Pakistan; Chitose, Japan; and Taegu, Korea.[39]

(U) How About Those Uplinks?

(S) Soviet uplink data were needed by the U.S. intelligence community to understand both missile (and later) satellite systems and to better understand downlink telemetry, which usually reflected the uplink commands. One of the earliest attempts at uplink collection was performed by Lewis Franklin and Robert Phillips from Sylvania-EDL in early 1960, working from a C-130 aircraft with SHF radar modified to act as a signal collection antenna. The C-130 was deployed to the Pacific Ocean impact area for Soviet ICBM tests and where it was suspected that Soviet ships deployed to the area had a command "uplink" function.

(S) In a continuing effort to learn more about Soviet command uplinks to its satellites and space probes, the Command Link Intercept Program (CLIP) was established to use aircraft to look for and record these signals. A ground facility at Sinop, 1.4(c) [redacted]



(U//FOUO) Fig. 51. PL 86-36/50 [redacted] as originally installed in the main operations compound at Sinop

1.4(c) [redacted]

(S) The U.S. Navy A3D aircraft often flew missions looking for uplinks (these were called BUSY SIGNAL when flown as CLIP missions in the Pacific). Much of this early work was sponsored primarily by the Army, which had the IRBM defensive mission in DoD, in order to get IRBM data that could be used to design U.S. defensive measures. The Army was supported by the Navy, which had aircraft that could perform the required collection flight profiles.[40]

(U) Critical Results

(U) In 1961 Dr. "Bud" Wheelon and Sidney Graybeal stated:

> **In point of fact, the telemetry contains most of the information the Soviet engineers themselves get from a shot. Our exploitation of this unique source, however, is less efficient than the Soviet because, first, we do not know which measurement is assigned to which channel, second, we do not have the calibration or absolute values of readings on the several channels, and third, we do not intercept transmissions covering the entire flight because of radio horizon libations. Painstaking technical analysis has gradually solved many facets of the channel identification problems and making encouraging progress on calibration.**

(S) During the 1957-1960 "Missile Gap" controversy in American politics about the balance of power in missiles between the U.S. and the Soviet Union, telemetry played a key role in determining if the Soviet Union was outstripping the U.S. in development and deployment of intercontinental ballistic missiles. The Director of Central Intelligence convened an Ad Hoc Panel on the Soviet ICBM Program. The "Hyland Panel" included Dr. Lawrence Hyland of Hughes Aircraft, Albert Wheelon of Space Technology, and William Perry of Sylvania Electronic Defense Laboratory. This was followed by a detailed study by the Guided Missile and Astronautics Intelligence Committee (GMAIC) and a CIA Task Force series of studies that concentrated on the deployment status of the Soviet ICBM program.

(S) A U-2 aircraft, accompanied by an Air Force RB-57D Canberra, provided electronic intelligence to help solve the "Missile Gap" dilemma. Their flight along the Soviet-Iranian border achieved the first telemetry intercepts from a Soviet ICBM during first-stage flight, eighty seconds after launch.[41]

(S) These panels provided evaluations of data that led to the resolution of this controversy, primarily on the basis of the SIGINT/TELINT detection of test firings and results at a lower rate than would be expected for a crash program, and the lack of evidence of extensive operational locations for any deployed ICBMs, specifically the first generation SS-6.[42]

(S) After combining intercepts with valuable information contributed by the West's agent-in-place Lieutenant Colonel Oleg Penkovskiy, it was concluded that the Soviets had deployed a total of only four SS-6 ICBMs. Telemetry analysis, and the analysis of the Soviet ICBM test launch program, indicated that the Soviets were still in a development and testing phase for their ICBMs in 1960, and thus probably had not embarked on the extensive deployment phase that some intelligence analysts had projected during the "Missile Gap" debates.[43]

(S) In a similar way, during the Cuban Missile Crisis in 1962, telemetry provided significant assistance to the president and the crisis management team, albeit in a less direct way than in the "Missile Gap" situation. Charles Tevis from NSA was one of the first experts called to the Navy Yard to assist in evaluating photographic information from U-2 flights. Telemetry analysis was able to provide performance characteristics on the SS-4 MRBM and

SS-5 IRBM missiles that gave the U.S. high confidence in its knowledge of the range and accuracy of those MRBM/IRBMs.[44]

(U) Summary of the 1960s

(S) In the early 1960s, NSA, other DoD components, and CIA took strides to improve intelligence information sources, particularly telemetry collection and analysis, and to coordinate those assets in order to get the maximum information from telemetry from Soviet, and later PRC, missile and space development efforts. The establishment in 1962 of NSA R6 to implement Phase I of the broad study of Soviet/PRC missile and space targets was a key management and systems development action by NSA. The formation of SMAC by NSA; then Defense/SMAC by DIA/NSA in 1964 (with a DoD multisensor collection coordination role and a joint DIA/NSA intelligence reporting role); and the establishment of FMSAC, also in 1964, by CIA are illustrations of these measures.[45] Table 2-2 lists some of the significant TELINT events of the early 1960s.

(U) Lessons Learned in the Early 1960s

(U//FOUO) Some of the most important "lessons learned" from the U.S. efforts to gain knowledge of foreign (primarily Soviet) missile and space activities in the early 1960s were these:

(U//FOUO) **Lesson 1**: When faced with a highly technical and complex problem, form an organization that has the technical competence and the charter to address at least a large part of the problem, a "lesson" repeated from the 1950s. This author believes NSA did this when the Agency formed the R6 Office of Special Programs with sufficient funding and with the flexibility to assign the right people to this effort, and then directed that all other necessary NSA and Service Cryptologic Agency elements support the effort.

(U//FOUO) R6 was given an internal staff of budgeting, accounting, scheduling, logistics planning and documentation specialists; a first for projects in NSA at that time.

(U//FOUO) This "lesson" was also applied by DoD, DIA, and NSA with the formation of the Defense Special Missile and Astronautics Center (Defense/SMAC) in 1964 to provide operational control and guidance to SIGINT and non-SIGINT collectors and early reporting on collection and field analysis results.

(U//FOUO) In a similar vein, CIA formed the Foreign Missile and Space Analysis Center (FMSAC) to bring together all-source analysis of foreign missile/space intelligence targets and also provide guidance to the CIA unique collection resources against those targets.

(U//FOUO) **Lesson 2**: In planning and implementing systems to be operated by an organization different than the one which develops it, and where the data are to be used by different organizations, involve those organizations in the planning and implementation phase of the effort. This was done by the NSA R6 organization to the maximum extent possible, and supported by the NSA PROD and ASA organizations to a significant degree. Both PROD and USASA assigned individuals either full time or part time to R6. CIA even assigned an integree for a period of time, who later became station chief at TACKSMAN II.

(U//FOUO) **Lesson 3**: Telemetry analysis results can often help resolve U.S. national crises. This was seen in both the "Missile Gap" controversy of 1960 and the "Cuban Missile Crisis" in 1962. Telemetry analysis provided great confidence on the U.S. knowledge of the MRBM performance characteristics and capabilities during the Cuban Missile Crisis. The contributions of the budding U.S. TELINT capabilities during these crises went a long way to sustaining an aggressive U.S. and partnership collection program during the next few decades.

~~(S)~~ Table 2-2 Significant TELINT Events for the Early 1960s

Year	Activity/Event
1960	Initial NSA (PROD) study of SIGINT requirements against foreign space targets
1961	NSA established the Space Surveillance SIGINT Planning Board (SSSPB)
1962	DoD/DDR&E approval obtained for SPACOL program NSA R6,Office of Special Program Management, formed and implemented
1963	BANKHEAD II (Japan) began operations 1.4(c) [redacted] STONEHOUSE and PL 86-36/50 USC 3605 [redacted] contract awarded to Harris-Radiation BANKHEAD I (Pakistan) began operations
1964	Defense/SMAC formed by NSA and DIA BANKHEAD III (Turkey) contract awarded to E-Systems 1.4(c) [redacted] TACKSMAN II established by CIA

Notes

1 (U) Louis W. Tordella, Memorandum for the Secretary of Defense, "ELINT Activities," NSA Serial: N0850, 1 March 1960.

2 (U) Captain Everett B. Gladding, USN, "Report on Special Collection Effort, September-October 1960, NSAPAC Serial 60/0153TSC, 14 November 1960.

3 (U) Louis W. Tordella, Memorandum to CNO, "Concept of Operations for PL 86-36/50 USC 3605 [redacted] NSA Serial N4245, 3 November 1960.

4 Johnson, *American Cryptology*, 304. Interview, James Donnelly, 29 July 1998.

5 (U) PL 86-36/50 USC 3605 [redacted] "A41-SMAC Division — Office Secretary of Defense OSD Inspection," 28 October 1965. Interview, Robert Phillips.

6 (U) Frank Lewis, "Notes of a Talk on Space SIGINT given by Mr. F. Lewis, NSA, on Wednesday, 10th May 1961," Attachment E to GCHQ document M/8761/ MA2018 of 9 May 1961. CCH Series File, Bernard Collection.

7 (U) Henry G. Plaster, "The Likelihood of a Reconnaissance Mission for the Soviet COSMOS Series Satellites," Office of Scientific Intelligence memorandum no. 78, OSI-SM/62-2, 3 December 1962.

8 (U) Henry G. Plaster, "Snooping on Space Pictures," *Studies in Intelligence*, Vol. 8, no. 4, Fall 1964. Declassified version available at the National Archives and Records Administration, College Park, RG 263, Entry 27.

9 (U) PL 86-36/50 USC 3605 [redacted] "Spacecraft Passenger Television from Laika to Gagarin," *NSA Technical Journal*, Vo. XXI, no. 2, Spring 1976, p. 1.

10 (U) Gene Poteat, "Some Beginnings of Information Warfare — Stealth, Countermeasures, and ELINT, 1960-1975," *Studies in Intelligence*, Vol. 42, no. 1, 1998.

11 (U) Interview, Lewis Franklin, 10 September 1998.

12 (U) N. C. Gerson, "SIGINT in Space," Report K-TSR-04-98, STINFO Document no. S-245, 785, 7 December 1998. Also published in *Studies in Intelligence*, Summer 1984.

13 (U) PL 86-36/50 [redacted] "Sporadic E Intercept of the On-the-Pad Telemetry," Memorandum for the Record, 1 July 1966. Marshall S. Carter, "LITTLE DUKE,"

Memorandum to DDR&E, NSA Serial N0560, 29 April 1966. Albert D. Wheelon and Sidney N. Graybeal, "Intelligence for the Space Race," *Studies in Intelligence*, Vol. 5, no. 4, Fall 1961. Declassified version available at NARA, RG 263, Entry 27. Interview, James Donnelly.

14 (U) [redacted] "A41-SMAC Division."

15 (U) Johnson, *American Cryptology during the Cold War*, 317.

16 (U) Interview, Lewis Franklin.

17 (U) Robert Hopkins, "The [redacted] Stratojets," Air Enthusiast/Forty One, no date.

18 (U) Carter, "LITTLE DUKE." Interview, Lewis Franklin.

19 (U) Tordella, [redacted] Interview, James Donnelly.

20 (U) Johnson, *American Cryptology during the Cold War*, 314. September 1998 Interviews: James Donnelly, Lewis Franklin, Charles Empey.

21 (U) Gerson, "SIGINT in Space."

22 (U) Interview, Lewis Franklin.

23 (TS//SI) Marshal S. Carter, "CLASSIFIED TITLE," memorandum to DDR&3, NSA Serial N0886, 27 July 1965. Gerson, "SIGINT in Space." Interview: Lewis Franklin.

24 (U//FOUO) H. D. Wagoner, *Space Surveillance SIGINT Program* (U//FOUO). United States Cryptologic History Special Series No. 3, 1980.

25 (U//FOUO) Wagoner, *Space Surveillance.*

26 (U//FOUO) Ibid.

27 (U//FOUO) Ibid.

28 (U) Memorandum, "Plans for Establishment of a SIGINT Missile and Astronautic Center, NSA TS Control No. 62-03743, August 1962.

29 (U) Knapp, *The Central Intelligence Agency.*

30 (U) Eugene G. Fubini and Lt. Gen. Joseph F. Carroll, USAF, "Department of Defense Review of Missile and space Intelligence Programs of DOD Components," 20 February 1964.

31 (U) Johnson, *American Cryptology during the Cold War*, 345.

32 (U) Robert S. McNamara, "Defense Special Missile and Astronautics Center (DEFENSE/SMAC)," DoD Directive S-5100.43, 27 April 1964.

33 (U) Gordon A. Blake and Joseph F. Carroll, "Memorandum of Understanding between the Defense Intelligence Agency and the National Security Agency, Subject: (U) Establishment of the Defense Special Missile and Astronautics Center (DEFENSE/SMAC)," 29 May 1964. Charles C. Tevis, "Defense/SMAC Memorandum No. 1," Serial A-4/079-64, 4 June 1964.

34 (U) [redacted] "A41-SMAC Division."

35 (U) Richard A. Schmidt, "Space Collection Plan," P2 memo P2/307-65, 9 June 1965. NSA GMAIC Requirements Working Group, "Space SIGINT Collection Plan FY 1967-1971, attachment to the above, March 1965.

36 (U) Corley Wonus, "The TACKSMAN Project," *Cryptologic Quarterly*, Vol. 12, 1993.

37 (U) [redacted] "A41-SMAC Division."

38 (U) Zabetakis & Peterson, "The Diyarbakir Radar."

39 (U) [redacted] "A41-SMAC Division."

40 (U) [redacted] "A41-SMAC Divisions;" (U) Interview: Lewis Franklin.

41 (U) James Harford, Korolev — *How One Man Masterminded the Soviet Drive to Beat America to the Moon*, 162.

42 (U) Leonard F. Parkinson and Logan H. Potter, "Closing the Missile Gap," in Michael Warner and Scott A. Koch, *Fifty Years of the CIA* (CIA Center for the Study of Intelligence, 1998), 111-33.

43 (U) Gerson, "SIGINT in Space."

44 (U) Interview: Lewis Franklin. Mary S. McAuliff, ed., *CIA Documents on the Cuban Missile Crisis*, 1962 (CIA History Staff, 1992).

45 (U) David S. Brandwein, "Telemetry Analysis," *Studies in Intelligence*, Vol. 8, no. 4, Fall 1964. A declassified version is available at NARA, College Park, RG 263, Entry 27.

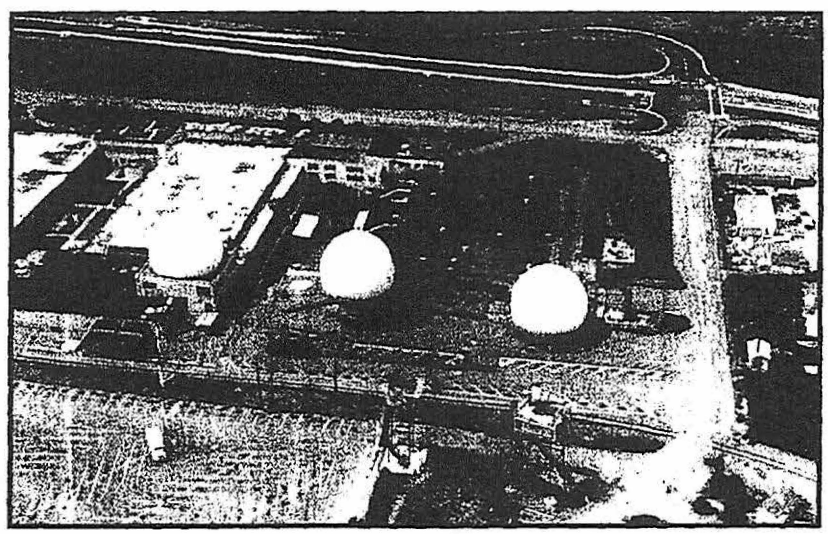
(U) Chapter 3
The Major Systems and Early Results (Late 1960s)

(U) Expanding the Phase I SPACOL System

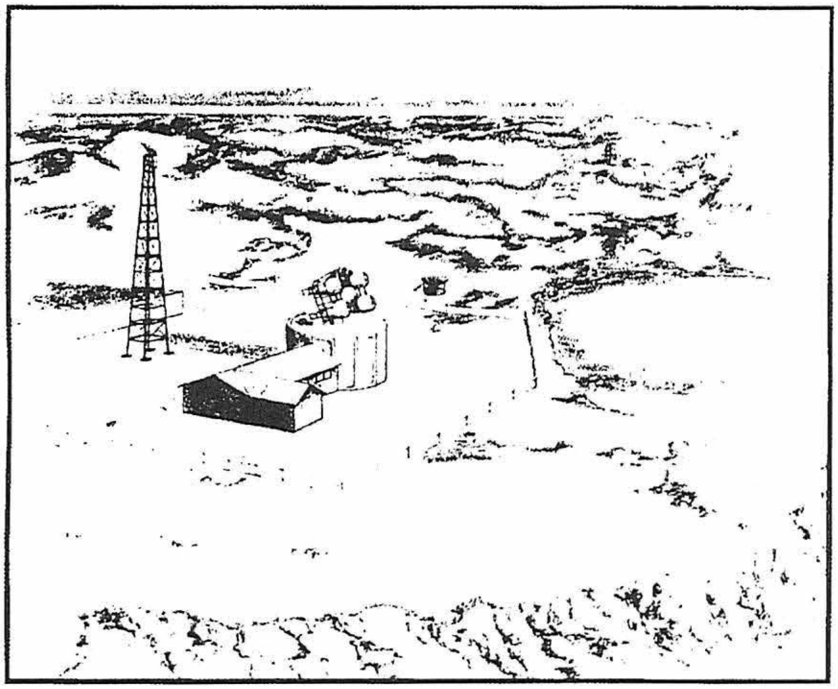
(U//FOUO) It was apparent by early 1965 that BANKHEAD I and II were not going to fully meet their original operational goals. The equipment in many cases was not completely suitable for the mission (since it had been designed for U.S. space vehicle telemetry collection); much of the equipment, particularly the hydraulic antenna drive systems, was not reliable; spare parts were not easy to obtain; and the equipment required maintenance skills not readily available to USAFSS and USASA. A survey was completed by NSA and USAFSS and ASA that described these limitations as well as other operational, logistic, and training problems.

(U//FOUO) While this study was being evaluated, Sylvania-EDL submitted an unsolicited proposal to USASA describing replacing BANKHEAD II in Japan and the ESGM system at Shemya, Alaska, with systems similar to [redacted] NSA and ASA agreed that this was a cost-effective and timely solution to the growing requirements for collection of Soviet earth-orbiting space vehicles. NSA (R6) was given responsibility for acquiring the systems, in conjunction with ASA planning and future manning.

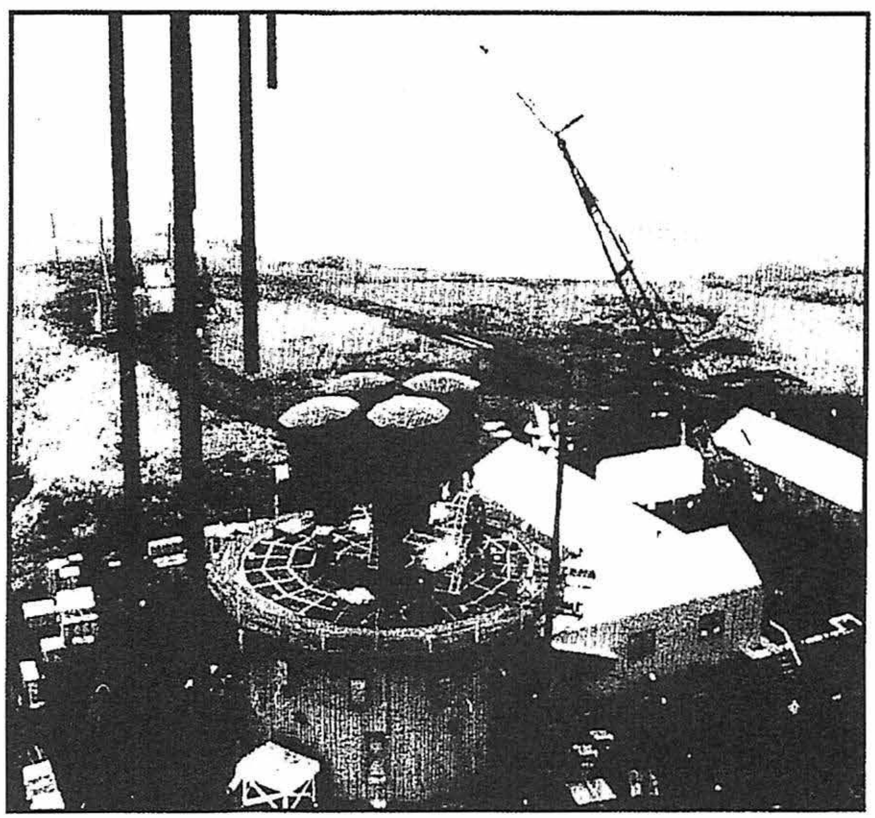
~~(C)~~ The system to be located on Shemya was codenamed ANDERS (called HARDBALL I by EDL), and the one to replace BANKHEAD II at Chitose was [redacted] (called HARDBALL II by EDL). Sylvania-EDL was awarded a sole-source contract in 1966 based on refinements to their unsolicited proposal. This author became the R6 program manager for both projects, assisted by [redacted] USAF, on ANDERS and [redacted]



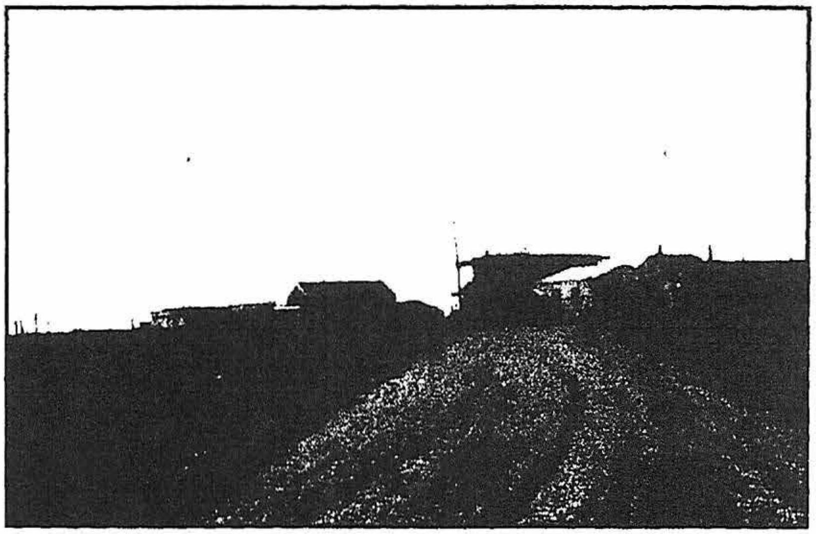
~~(S)~~ Fig. 52. The HARDBALL (ANDERS [redacted] systems during final testing at the Sylvania-EDL Mountain View, CA, facility. Graham A. Grande was the Sylvania program manager and later joined NSA as a senior manager. The third radome contained the HARDBALL III very accurate monopulse passive tracking thirty-foot dish antenna that was added to the original Sylvania-EDL [redacted]



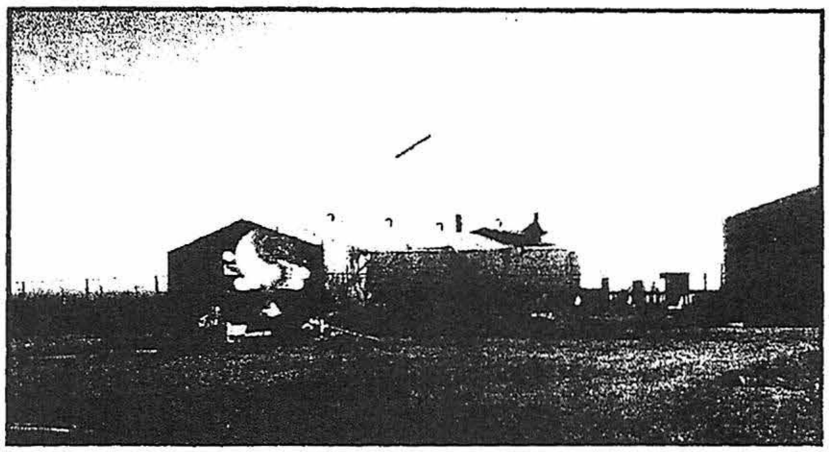
(U) Fig. 53. Artist's concept of ANDERS



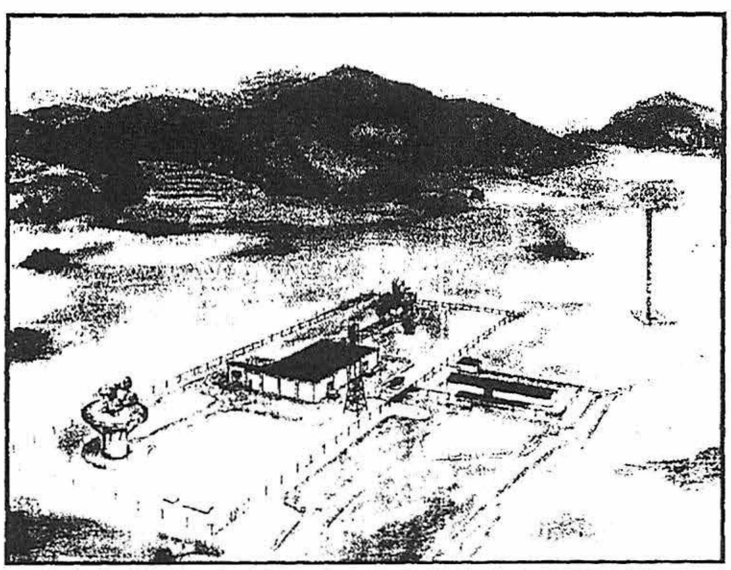
(U//FOUO) Fig. 54. The ANDERS antenna system during installation at Shemya taken from the antenna calibration tower



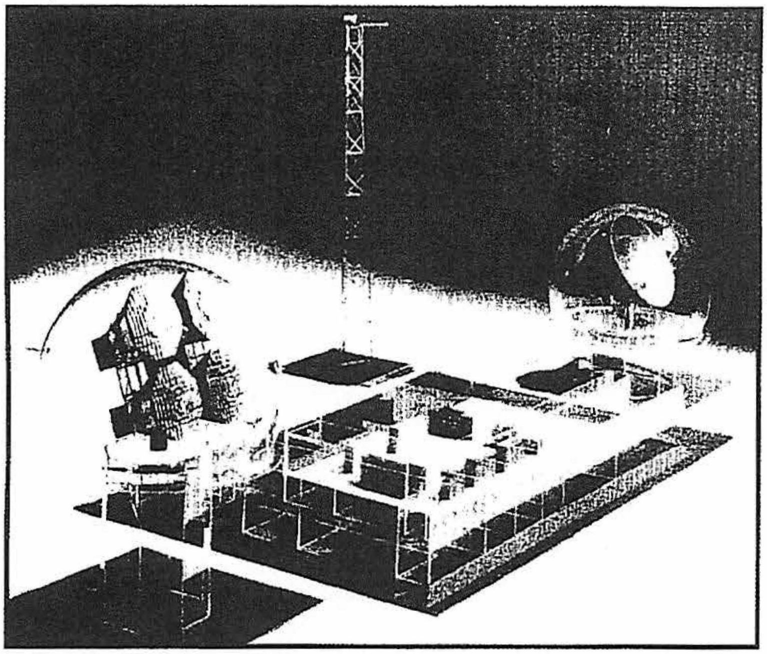
(U//FOUO) Fig. 55. The completed ANDERS facility. Captain Robert E. Baker, USA, eventually to become an NSA senior executive, was the opera-tions officer at Shemya during the ANDERS installation and later became the maintenance officer at [redacted]



(U//FOUO) Fig. 56. The CHAOS system which was installed by USASA on Shemya to provide coverage while the ESGM Upgrade system was de-installed and ANDERS was being installed in 1967.



(U) Fig. 57. Artist's concept of [redacted]



(U//FOUO) Fig. 58. Model of the two [redacted] antenna systems and the operation building

~~(C)~~ After war between India and Pakistan broke out in late 1965, and U.S.-Pakistani relations deteriorated, it was becoming apparent that the USAFSS tenure in Pakistan was limited, and no plans were made to upgrade the BANKHEAD I system. While the loss of BANKHEAD I would reduce coverage of Soviet and PRC missile and satellite activity, other collectors, particularly TACKSMAN II, filled in much of the loss.[1]

(U) NSA and Defense/SMAC Progress

~~(C)~~ In late 1965 the Office of the Secretary of Defense conducted an "inspection" of Defense/SMAC to determine how effectively NSA was carrying out the DoD directive that established the center. At that time all of the operations elements of Defense/SMAC at NSA had been administratively centralized in the A4 organization, called

PL 86-36/50 USC 3605

[redacted]

(U) Fig. 59. Completed [redacted] installation in 1967 the Office of Advanced Weaponry and Astronautics and headed by PL 86-36/50 USC 3605 [redacted] The component that directly supported the NSA component was designated the A41 Division under Charles L. Gordon. A41 had over seventy full-time people assigned to the Defense/SMAC mission and had control of over twenty full-time or call-up OPSCOMMs. OPSCOMMs included one to a 1.4(c) [redacted]

(S) Soviet missile and space activities were already at a significant level by 1965. Soviet missile/space events during 1965 included twenty-four ICBMs launched to Kamchatka and two to the Pacific Ocean; twenty-three ESVs, including the first Molniya communications satellite; a manned (VOSKHOD II) mission; six space probes and twelve shorter range missiles. During the first nine months of 1965, Defense/SMAC produced 1,012 electrical reports and 253 possible launch alerts. It also sent over 28,000 items over the OPSCOMM in support of the effort. Defense/SMAC received almost 300,000 messages over the formal message distribution system, and this number did not include the 2,323 batches of special tracking data received over the OPSCOMMs. While initially abbreviated Defense/SMAC starting in 1964, this later changed to DEF/SMAC, and (starting in about 1985) then DEFSMAC, which is still in use today.[2]

(S) The Tyuratam Missile Test Range (TTMTR) was conducting missile test firings of ICBMs to Kamchatka and the Pacific ocean; training firings of operational SRBMs, MRBMs, and IRBMs by the Soviet Rocket Forces to Kamchatka; launching manned and communications satellites; and launching Mars, Lunar and Venus space probes. The Kapustin Yar Missile Test Range (KYMTR) was launching SRBMs, 1,000-nm MRBMs, 2,000-nm IRBMs, some SAMs, and some single and multi-payload satellites. The Plesetsk Missile and Space Center (PMSC) in northwestern Russia was testing ICBMs and launching space vehicles, and the Northern Fleet Missile Complex (NFMC) was launching SLBMs, cruise missiles, and other naval missiles.

(S) The Sary Shagan Missile Test Range (SSMTR) was testing antimissile missiles, strategic SAMs (e.g., SA-5), and associated radar tracking systems. The Vladimirovka Advanced Weapons and Research Complex (VAWARC) tested air-to-air, air-to-ground, and surface-to-surface cruise missiles. The VAWARC included the Caspian Sea Special Test Range (CSSTR) that tested air-to-surface missiles for the Soviet naval forces. The Vladimirovka Lake Balkhash Test Range (VLBTR) (now considered part of VAWARC) conducted surface-to-surface cruise missile tests. The Soviets also had Missile Range Instrumentation Ships (SMRIS), Soviet Space Operations Control Ships, and Space Event Support Ships (SSESS) that required monitoring. The locations of these ships, along with their communications patterns, frequently gave good indications of upcoming Soviet missile/space events.

(S) NSA now often obtained Soviet missile and satellite tracking data in near real time. In addition to this, and later with near real-time passive tracking data from the SPACOL assets, NSA contributed significantly to NORAD's ability to determine if there was a threat from any of the events, as well as reconstructing the trajectory/orbits of Soviet missiles/satellites.[3]

1.4(c) [redacted]

[redacted]

(U) Major Ground-Based Collection Systems

(S) The ten-year lease for the site in Peshawar expired in 1968 and was not renewed by Pakistan; Peshawar was evacuated and closed by 1970. Some of the SEABRINE and [redacted] airborne operations continued from Adana. Fortunately, the CIA TACKSMAN sites in Iran were in operation by that time, and along with the soon-to-be activated RAINFALL system, could replace much of the Soviet telemetry collection then being done by BANKHEAD [5]

(U//FOUO) The maintenance and spare parts problems that had beset BANKHEAD I and BANKHEAD II unfortunately continued for BANKHEAD III and STONEHOUSE. Discussions with the U.S. Army Electronics Command (ECOM) determined that they were primarily logistics problems, most of which were inherent with "one-of-a-kind" operational systems at overseas locations. More and more, the original contractors for the systems were requested to provide logistic support and on-site maintenance and engineering support, particularly at the "short tour" (one year) site at Sinop.

(S) By the end of 1967 both ANDERS and JAEGER were operational, and [redacted] and STONEHOUSE were performing their missions well. The original [redacted] system planned for JAEGER had been augmented by an additional thirty-foot tracking dish in order to assist NSA and NORAD with early orbit determinations ESVs and extended range ICBMs fired into the Sea of Japan or the Pacific Ocean. The new technical approach called HARDBALL III was a "broad band 2-channel monopulse" system invented by Sylvania-EDL, and it provided sufficiently [redacted]

(S) By the end of 1968 the SIGINT Space Surveillance (SSS) "SPACOL" plan was considered completed. R6 continued to perform system upgrades to major SPACOL systems for several years, but switched its emphasis to other major

(U//FOUO) Table 3-1 SPACOL Program Budget/Cost Summary

Project Name(s)	Initial Est.($K in 1962)	Final Est.($K in 1965)Final	Actual($K in 1969)
ANDERS	5,903	3,777	2,989
BANKHEAD III (HIPPODROME)	8,755	8,343	10,071
[redacted]	5,042	7,092	7,487
[redacted]			
(STONE-HOUSE Add-on)			
STONEHOUSE	5,861	9,051	10,357
[redacted]			
Totals	**29,850**	**34,547**	**37,383**

Note: Estimates and actuals include construction, government furnished equipment, NSA labor, and NSA travel costs.

field collection and processing systems such as [redacted] By the end of the 1960s, NSA/R6 had expended most of the $40,000,000 originally allocated for the SPACOL program. Table 3-1 shows this fiscal summary.

(U//FOUO) The completed BANKHEAD systems all had similar features, but individual components varied. Table 3-2 shows a summary of the BANKHEAD system characteristics and a rough "quality" evaluation that was made in 1969.

Over the years this platform, and its successors, produced data not available from any other source.

[redacted]

~~(C)~~ **Table 3-2 BANKHEAD Systems Initial Subsystems Features**

Subsystem	[redacted]	BANKHEAD III(HIPPODROME)	ANDERS	[redacted]
HF Receivers	[redacted]	6	3	4
VHF Receivers		6	9	11
VHF Auto-track		Poor	Good	Good
UHF Receivers		2	1	3
UHF Auto-track		Poor	Good	Exc
SHF Receivers		1	7	4
SHF Tracking		Poor	Good	Good
Computer Control		Fair	Good	V. Good
Recording		Good	Good	Good
Analysis (GFE)		Fair	Good	Good
Multiple Target Capability		Fair	None	V. Good
Doppler Tracking		None	None	Good

(U) Added Collection Assets

[redacted]

[redacted]

1.4(c)

[redacted]

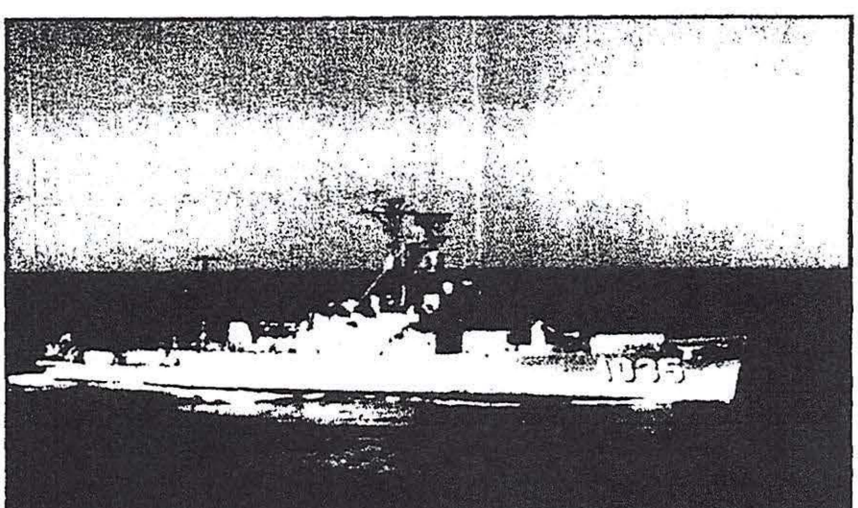
1.4(c) [redacted]

~~(S)~~ By 1967 NSA also often used U.S. Navy large high-gain dish facilities on an ad hoc basis for certain high-priority collection against Soviet space events. One of these, called PL 86-36/50 [redacted] by NSA, was the Naval PL 86-36/50 USC 3605 [redacted] facility PL 86-36/50 USC 3605 [redacted] to collect space vehicle telemetry, and other signals being downlinked to Soviet ships in the Atlantic Ocean. The Naval Security Group participated by providing equipment operators and a communications van and operators. Field analysis and reporting were done by NSA personnel.[8]

~~(S)~~ In the mid-1960s the U.S. Navy A3B aircraft were replaced with SEABRINE A3D platforms in the Pacific, based at Atsugi, Japan, but usually flying missions from Shemya, Alaska. In the Atlantic A-3s were based in Rota, Spain, but usually flew only missions from Adana, Turkey, and Peshawar. The four destroyer escorts, codenamed PL 86-36/50 USC [redacted] one of which is shown in Figure 63, and the two ARIS ships remained active.

~~(C)~~ Starting in 1968, the USAF modified three EC-135 aircraft to be specifically configured to receive COMINT, ELINT, TELINT, and optical information from missiles test fired into Kamchatka or the Pacific Ocean. They had the PL 86-36/50 USC 3605 [redacted]

~~(C)~~ Fig. 64. COBRA BALL I missile intelligence collection aircraft, initially called WANDA BELLE and then RIVET AMBER before successive upgrades to the COBRA BALL configuration



(C) Fig. 63 PL 86-36/50 [redacted] *destroyer escort missile intelligence ship*

[redacted]

(S) A VHF telemetry collection position was established on Ascension Island at the Air Force Eastern Test Range (AFETR) site and was equipped and manned by NSA "as-needed" by temporary teams of operators and signal analysts. This was called [redacted] and was used to obtain telemetry collection from Soviet space vehicles and planetary probes on their first orbit or during the injection phase for planetary probes.

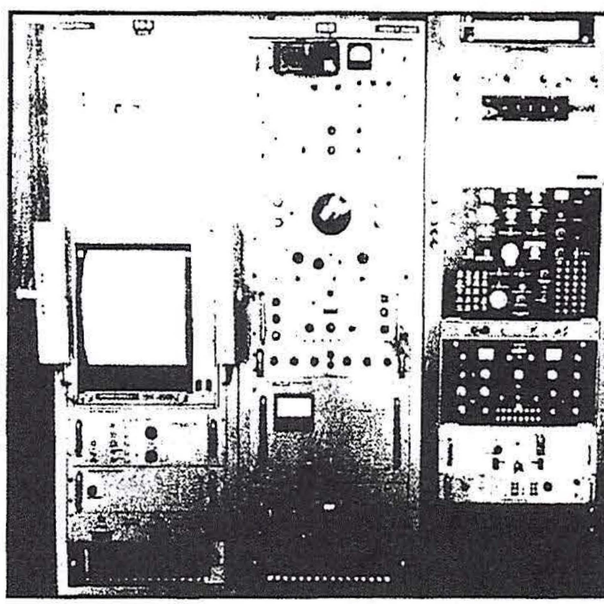
(U) Processing the Telemetry Data

(S) Early processing of telemetry data consisted primarily of demodulating the signal, decommutating the telemetry and producing an analog display of each telemetry channel for an analyst to review. [redacted] This process was, with no imagination added, called producing "Analogs."

(S) Analogs could be produced photographically by displaying data on the face of a CRT and then passing light-sensitive film or paper in front of the tube. Digital analogs were prepared by digitizing the telemetry in a format for computer processing and then displaying the data on photo recordings. In the early 1960s up to twelve channels of data could be presented on one analog chart/scroll. Analogs were the best portrayal of the data for analysis, particularly to U.S. missile/space experts, who were accustomed to seeing similar characteristics from U.S. missile/space development programs.

(S) The sheer volume and time needed to produce these analogs soon exceeded the ability of NSA and the intelligence community S&T centers to keep up with the increasing volume and importance of the data. NSA and CIA began converting data into digital form and providing computer analysis wherever feasible. In January 1962 the Digital Decommutation Facility (DDF) started operations, and in July 1965 digitizing equipment called [redacted] began operations at NSA. [redacted] could produce both analog display output and a digital tape for further selected computer processing.[10]

(S) Field processors for specific telemetry signals began in the mid-1960s, and one of the first field units to be deployed was the P-136-1 and P-136-4 units in 1967 to the BANKHEAD sites. These were designed by [redacted] from NSA's telemetry processing center. (Folklore



(S) Fig. 65. A P 136 1 and a P 136 4 telemetry demodulator in a rack layout along with the ZURO analog chart display unit (in the left rack) at the [redacted]

has it that the "P" designated units had been designed by [redacted] and the 136 designated was developed within the C136 organization.)

(C) Telemetry processing formats were initially set by the Ad Hoc Telemetry Engineering Committee (AHTEC) and later by the Astronautics and Missile Signals Engineering Group (AMSEG), both related to the Telemetry and Beacon Analysis Committee (TEBAC) chaired by NSA. Distribution of "analogs" and digital tape copies to U.S. and U.K. analysis organizations is established by TEBAC.

(U) Significant Collection and Analysis Results

(S) During early operations the STONEHOUSE system collected signals from and tracked several Soviet lunar and Mars probes, and intercepted for the first time special signals from the Soviet Molniya-1 communications satellite. STONEHOUSE was also tasked to look for "moon bounce" reflections of the Sary Shagan [redacted] The intelligence results of the STONEHOUSE (and other collectors) efforts against the Soviet Lunar probe Luna 9 in early 1966 were included in an article written by James D. Burke (a JPL scientist under contract to NSA and CIA for many years as an expert on planetary explorations) and published in CIA's *Studies in Intelligence*.

(S) [redacted] ANDERS was credited with being the first site to intercept a special signal from [redacted]

ocean-area" firing. [redacted] also confirmed data from Cosmos 192 and obtained additional intercepts of these data.[12]

(S) A 1969 quarterly (April - June 1969) evaluation of JAEGER noted that 311 wideband telemetry tapes were sent from the site to NSA. These data included limited reentry telemetry from [redacted] ICBMs launched from TTMTR, and zero-orbit telemetry from four ESVs launched from TTMTR and six from PMSC.[13]

(S) By now telemetry and beaconry signal collection was showing significant progress compared to the late 1950s. Almost 20,000 "wide band" (1 MHz at 120 IPS) fourteen-track MINCOM CM-100 tapes were sent to NSA for analysis, and this was only 60 percent of what had been initially intercepted by all of the assets. Eventually 75 percent, or about 15,000, of the tapes were processed and "analogs" distributed for telemetry/beaconry analysis, much of which was done under contract to companies with expertise in missile or space telemetry, often with experience from U.S. telemetry and U.S. missile and space systems.[14]

(S) [redacted]

(C) By the late 1960s, a significant effort was being made to automate storage and use of the data needed for record keeping and collection management, collection results, and DEFSMAC or NSA reporting of collection results, particularly missile trajectory data. Table 3-3 summarizes some of these computer applications.

(U) Table 3-5 DEFSMAC Computer Processing Support

Approx. Date	Project Name	Computer Name	Program Functions
1963	PL 86-36/50 USC 3605 [redacted]	UNIVAC 490/494	PL 86-36/50 USC 3605 [redacted]
1965		IBM 360	
1966		NSA-built	
1966		IBM 7094	
1967		CDC 6400/6600	
1967		???	
1968		APD-30	
1968		IBM 360	
1969		UNIVAC 490/494	
1969		UNIVAC490/494	

(U) Summary

~~(S)~~ The late 1960s were characterized by completion and initial operations of all of the approved major ground-based SPACOL systems, namely, 1.4(c) [redacted] STONEHOUSE, BANKHEAD III (HIPPODROME), ANDERS, and PL 86-36/50 [redacted] by NSA and USASA. Also it was characterized by the expansion and operations of the TACKSMAN I and TACKSMAN II facilities by CIA and the full operational status of Defense/SMAC. The late 1960s were also marked by the addition of several airborne platforms and several ships. Table 3-4 provides highlights of significant events in the 1960s.

(U) Lessons Learned in the Late 1960s

(U//FOUO) **Lesson 1:** The Service Cryptologic Agencies were overly optimistic that the military departments could provide adequate "logistic support" to "few-of-a-kind" complex electronic systems like the BANKHEAD systems and STONEHOUSE. This became even more apparent when the systems had to be modified almost continuously to meet evolving TELINT requirements, usually with state-of-the-art equipment. NSA and ASA had to adjust engineering and logistic support plans to involve the primary system contractor and subcontractors more closely as well as provide added logistic support from NSA resources. NSA had proposed this approach as part of the original SPACOL system planning, and the locations that readily adopted it had the fewest problems with the engineering aspects of system operation. Having adequate on-site, or on-call, engineering support from civilian and industry "experts" was a prime factor in successful telemetry analysis at field sites.

(U//FOUO) **Lesson 2:** Once a plan is in existence, keep it updated. The rapid expansion of Soviet space activities in the late 1960s, the approval of the initial SPACOL network, and the formation and operation of DEFSMAC all called for a review of telemetry collection and data processing planning. This was accomplished in 1965, based on United States Intelligence Board requirements and the NSA Guided Missile and Astronautics Intelligence Committee Requirements Working Group. This plan then served as the basis for planning for the late 1960s by NSA and other organizations.

(U) Table 8-4 Significant ELINT Events for the Late 1960s

Year	Significant Event
1965	[redacted]
	STONEHOUSE (Asmara, Ethiopia) began operations.
	All airborne collection from Pakistan ceased.
	First digitizing of telemetry began at NSA [redacted]
1966	BANKHEAD III (Sinop, Turkey) began operations.
	[redacted]
1967	ANDERS (Shemya, Alaska) began operations.
	[redacted] Chitose, Japan) began operations.
	[redacted]
1968	SPACOL Plan (Phase I) considered complete.
	First telemetry collected from Sary Shagan Missile Test Range.
1969	BANKHEAD I (Peshawar, Pakistan) closed.
	COBRA BALL I started operations at Shemya, Alaska.

Notes

1 (U) H. D. Wagoner, *Space Surveillance SIGINT Program*.

2 (U) [redacted] A41-SMAC Division."

3 (U) Ibid.

4 (U) Vincent A. Las Casas, *NSA's Involvement in U.S. Foreign SIGINT Relationships through 1993* (Center for Cryptologic History, Series VI, Vol. 4, CCH-E32-95-01, 1995).

5 (U) Johnson, *American Cryptology during the Cold War*, 387.

6 (U) Craig G. Roberts, "Broad-band Two-Channel Monopulse Tracking System," Sylvania Elecronic Defense Laboratories, Technical Report ECOM-0181-E134, February 1968.

[redacted]

8 (U) K06/K3, "project [redacted] (U) Operations Plan for [redacted] (U)," May 1968.

9 (U) "COBRA BALL and COBRA EYE — Alaskan Observers," n.d., probably about 1990.

10 (U) [redacted] "Computer Processing of Soviet Telemetry," *NSA Technical Journal*, Vol. XIII, no. 3, Summer 1968.

11 (U) James D. Burke, "Seven Years to Luna 9," *Studies in Intelligence*, Vol. 10, no., Summer 1966. A declassified version is available at NARA, RG 363, Entry 27. Interview: James Donnelly.

12 (U) Wagoner, *Space Surveillance SIGINT Program*.

13 (U) "K47 Evaluation Report No. 020-69 for US-46s [redacted]" 3 October 1969.

14 (U) [redacted] "A Review of Telemetry Processing and Analysis," 26. Boucher, "Talomatry and How it Grew."

Appendix A – 1950s/1960s TELEMETRY COLLECTION AND COORDINATION ASSETS

1.4(c)

[redacted]

Appendix A – 1960s TELEMETRY COLLECTION AND COORDINATION ASSETS

1.4(c)

[redacted]

Appendix A – 1950s/1960s TELEMETRY COLLECTION AND COORDINATION ASSETS

1.4(c)

[redacted]

(U) Appendix B
1950s/1960s Selected TELINT Asset Descriptions

Description No.	Description Title	Page
1	~~(S)~~ ANDERS (ANFRR-81) – Land-Based SIGINT – Shemya, Alaska	76
2	~~(S)~~ ARIS – Seaborne (2 ships) Multi-INT – Usually Western Pacific	77
3	~~(S)~~ BRIGHT CRESCENT – Seaborne (4 DE ships) Multi-INT	78
4	~~(S)~~ COBRA BALL – Airborne Multi-INT – Usually Western Pacific	79
5	1.4(c) [redacted]	80
6		81
7		82
8		83
9	~~(S)~~ HIPPODROME – Land-Based TELINT –Sinop, Turkey	84
10	~~(S)~~ PL 86-36/50 [redacted] Land-Based TELINT – Chitose, Japan	85
11	1.4(c) [redacted]	86
12	~~(S)~~ SEABRINE – Airborne TELINT – Usually Western Pacific	87
13	~~(S)~~ STONEHOUSE – Land-Based SIGINT – Asmara, Ethopia	88
14	1.4(c) [redacted]	89
15	~~(S)~~ TACKSMAN I – Land-Based SIGINT – Bahshar, Iran	90
16	~~(S)~~ TACKSMAN II – Land-Based TELINT – Meshed, Iran	91

Description 1
~~(S)~~ ANDERS (AN//FRR-81) – Land-Based SIGINT – Shemya, Alaska

SYSTEM TYPE: Telemetry/SPACOL

OPERATOR: CGUSASA

NAMES USED: ANDERS

LOCATION: 52.43N 174.05E Shemya, Alaska

CLASSIFICATION: SECRET

EQUIPMENT: AN/FRR-81

MISSION and

1.4(c)

[redacted]

Description 2
~~(S)~~ ARIS – Seaborne (2 ships) Multi-INT – Usually Western Pacific

---

SYSTEM TYPE: RADINT/Telemetry/Photographic

OPERATOR: Air Force Eastern Test Range (AFETR)

Advanced Range Instrumentation Ship I (ARIS I) USNS *General N. H. Arnold*, T-AGM-9, formerly PL 86-36/50 USC 3605 [redacted] Sierra. Advanced Range Instrumentation Ship II (ARIS II) USNS *General H. S. Vandenberg* T-AGM-10, POLL COUNT, TANGO. Reference Operational Directive 0079.

NAMES USED: PL 86-36/50 USC 3605 [redacted]

LOCATION: Varies according to operating location – home port Port Kennedy, Florida

CLASSIFICATION: SECRET

EQUIPMENT: C, L, and UHF Band Radars, QRC 467B Telemetry Equipment, Boresight, IFLOT FIXED and SLAVED Cameras, Univac 1206 Digital Computer.

MISSION and

1.4(c) [redacted]

Description 3
(S) BRIGHT CRESCENT – Seaborne (4 DE Ships) Multi-INT Usually Western Pacific

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SYSTEM TYPE:	ELINT, COMINT, RADINT, Photography, Debris/Water Sample Collection
OPERATOR:	Commander-in-Chief Pacific (CINCPAC), Commander Task Force 92 (CTF-92)
NAMES USED:	BRIGHT CRESCENT (U)
CLASSIFICATION:	SECRET Group-3
EQUIPMENT:	USS *Claude Jones* (DE-1033) CTF 92.2.4 USS *Charles Berry* (DE-1035) CTF 92.2.1 USS *John R. Perry* (DE-1034) CTF 92.2.3 USS *McMorris* (DE-1036) CTF 92.2.2

MISSION and

1.4(c)

[redacted]

Description 4
(S) COBRA BALL – Airborne Multi-INT – Usually Western Pacific

SYSTEM TYPE:	OPINT/Telemetry
OPERATOR:	Detachment 1, 6th Strategic Wing, 15th Air Force, Strategic Air Command (SAC) Contractor Ling-Temco-Vought (LTV)
NAMES USED:	COBRA BALL, BURNING STAR
LOCATION:	52.73N 174.10E Stages primarily from Shemya, Alaska, and secondary from Eielson AFB, Alaska.
CLASSIFICATION:	SECRET Group-3
EQUIPMENT:	RC135S
MISSION and CAPABILITIES:	OPINT – BC101 Ballistic Streak Camera. TELEMETRY – RAVEN 1-4 positions COMMUNICATIONS – URC53, HF Receiver for Broadcast

1.4(c)

[redacted]

1.4(c)

[redacted]

~~(S)~~ 1.4(c) [redacted] - *Description 6 Transportable TELINT* - 1.4(c) [redacted]

SYSTEM TYPE: Telemetry

OPERATOR: US AIR FORCE

NAMES USED: PL 86-36/50 USC 3605 [redacted]

LOCATION: Transportable

CLASSIFICATION: SECRET

EQUIPMENT: N/A

MISSION and 1.4(c) [redacted]

(S) [redacted] Description 7 Land-Based TELINT – [redacted]

SYSTEM TYPE: TELEMETRY

OPERATOR: AFETR Patrick AFB Florida

NAMES USED: PL 86-36/50 USC 3605 [redacted]

LOCATION: 1.4(c) [redacted]

CLASSIFICATION: SECRET

EQUIPMENT: Semi-automatic – equipped with a signal recognizer, a 14-track recorder, and 6 receivers (4 CEI-970, 4 CEI-416 and 1 R390)

MISSION and

1.4(c) [redacted]

1.4(c)

[redacted]

Description 9
~~(S)~~ HIPPODOME – Land-Based TELINT – Sinop, Turkey

SYSTEM TYPE: Telemetry/SPACOL

OPERATOR: CGUSASA

NAMES USED: HIPPODROME

LOCATION: 42.10N 35.11E Sinop, Turkey

CLASSIFICATION: SECRET

EQUIPMENT: AH/FRR-69

MISSION and

1.4(c)

[redacted]

~~(S)~~ PL 86-36/50 USC 3605 [redacted] – Description 10 Land-Based TELINT – Chitose, Japan

SYSTEM TYPE: Telemetry/SPACOL

OPERATOR: USASA Field Station Chitose

NAMES USED: PL 86-36/50 USC 3605 [redacted]

LOCATION: 42.51N 141.44E Chitose, Japan

CLASSIFICATION: SECRET

EQUIPMENT: AN/FRR-82

MISSION and

1.4(c) [redacted]

~~(C)~~ [redacted] *Description 11* *Transportable TELINT –* [redacted]

SYSTEM TYPE: Telemetry (SPACOL)

OPERATOR: [redacted] Transportation SPACOL facility, U.S. Army Security Agency (USASA)

NAMES USED: [redacted]

LOCATION: [redacted]

CLASSIFICATION: SECRET

EQUIPMENT: AN/MSQ-90 (V) Monitor System

MISSION and [redacted]

Description 12
~~(S)~~ SEABRINE –Airborne TELINT –Usually Western Pacific

SYSTEM TYPE:	Telemetry
OPERATOR:	AIRCRAFT: U.S. Navy, INTERCEPT CREW: CGUSASA
NAMES USED:	SEABRINE
LOCATION:	Mobile
CLASSIFICATION:	SECRET
EQUIPMENT:	AN/MSQ-90 (V) Monitor System

MISSION and

1.4(c)

[redacted]

Description 13
~~(S)~~ STONEHOUSE – Land-Based SIGINT – Asmara, Ethiopia

SYSTEM TYPE: Telemetry SPACOL

OPERATOR: CGUSASA

NAMES USED: STONEHOUSE

LOCATION: 15.35N 38.91E Asmara, Ethiopia

CLASSIFICATION: SECRET

EQUIPMENT: N/A

MISSION and CAPABILITIES: Provides collection, analysis and passive tracking of all signals (telemetry, standard data transmission, communications, etc.) emanating from foreign deep space vehicles

1.4(c)

[redacted]

Description 14

~~(S)~~ 1.4(c) [redacted] *– Land-Based SIGINT –* 1.4(c) [redacted]

SYSTEM TYPE: TelemetrySPACOL

OPERATOR: Naval Research Lab. and NSG

NAMES USED: 1.4(c) [redacted]

LOCATION: 1.4(c) [redacted]

CLASSIFICATION: SECRET

EQUIPMENT: N/A

MISSION and 1.4(c) [redacted]

Description 15
~~(S)~~ TACKSMAN I – Land-Based SIGINT – Behshahr, Iran

SYSTEM TYPE: TELEMETRY/BEACONRY

OPERATOR: Central Intelligence Agency (CIA)

NAMES USED: TACKSMAN I (TMAN)

LOCATION: 36.45N 53.38Z, Behshahr, Iran, Elevation 650 feet

CLASSIFICATION: SECRET

EQUIPMENT: N/A

MISSION and

1.4(c)

[redacted]

Description 16
~~(S)~~ TACKSMAN II – Land-Based TELINT – Meshed, Iran

SYSTEM TYPE:	ELINT/TELEMETRY/BEACONRY
OPERATOR:	Central Intelligence Agency (CIA)
NAMES USED:	TACKSMAN II (TACKS), PL 86-36/50 USC 3605 [redacted]
LOCATION:	37.17N 58.55E (TACKS), Meshed, Iran, Elevation 5,645 Feet
CLASSIFICATION:	SECRET
EQUIPMENT:	N/A

MISSION and

1.4(c) [redacted]

(U//FOUO) Mr. Bernard is a consultant and volunteer in the NSA Center for Cryptologic History. He is a retired NSA Senior Executive with over thirty years' experience in SIGINT, primarily as a program manager and executive for developing field collection and processing systems. He began his career at NSA as a USAF second lieutenant in 1953 in computer engineering. He became an NSA civilian employee in 1954.

(U//FOUO) After transferring to an R&D Office in 1960, Mr. Bernard held staff positions until he joined the R&D organization responsible for developing the fledgling set of systems, called SPACOL systems, to obtain telemetry from the rapidly emerging Soviet [redacted] ect manager for [redacted] 1.4(c) [redacted] 1.4(c) *and for many other new systems and upgrades to several other field systems. Mr. Bernard then continued to plan and develop many COMINT, ELINT, and TELINT Line-Of-Sight field systems over the next several years; he became office chief and then deputy group chief of NSA line-of-sight system development organizations. In 1980 he became director of the Defense Special Missile and Astronautics Center (DEFSMAC) and held that position for three years. Mr. Bernard has an electrical engineering degree and a Master of Engineering Administration degree. He is professionalized as an Electronic Engineer and was a charter member of the NSA Senior Cryptologic Executive Service.*