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SPECIAL SERIES
Number 3

UNITED STATES CRYPTOLOGIC HISTORY

SPACE SURVEILLANCE SIGINT PROGRAM ~~(C)~~

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Classified by NSA/CSSM 123-2
Review in November 2010

NATIONAL SECURITY AGENCY
CENTRAL SECURITY SERVICE

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Approved for Release by NSA on Appeal on 04-17-2019, MDR Case # 104418

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UNITED STATES CRYPTOLOGIC HISTORY

Special Series

Number 3

SPACE SURVEILLANCE SIGINT PROGRAM (~~C~~)

H.D. Wagoner

NATIONAL SECURITY AGENCY/CENTRAL SECURITY SERVICE
1980

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Foreword

~~(C)~~ The Space Surveillance Sigint Program came into existence in the early 1960s when both the United States and the Soviet Union were racing to get satellites launched and were preparing for unmanned and manned exploration of outer space.

~~(S-CCO)~~ As with many programs, technology advances at such a rapid rate that policy governing its use is often left far behind. So it was with the SSS program: the capability to exploit signals emanating from foreign space vehicles existed, but a program for managing this collection activity was very much needed.

(U) ~~(FOUO)~~ This history was originally prepared in draft in 1968, and a limited number of copies were circulated throughout the Agency. We are indebted to [redacted] who served as project officer of the SSS program, for reviewing this history and locating the photographs used, and to [redacted] of the History and Publications Staff for performing the copy editing and seeing the manuscript through the printing process.

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Vincent J. Wilson, Jr.
Chief, Cryptologic History and Publications Staff

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INTRODUCTION

~~(S)~~ The Space Surveillance Sigint Program was developed by NSA during 1960–1961 in an effort to provide an adequate U.S. collection capability to meet high priority Sigint requirements relating to Soviet space activities. It was intended to make the best possible use of existing knowledge and hardware to supplement the Sigint collection, processing, and reporting capabilities which then applied to the Soviet missile program. These resources were already considered by NSA to be inadequate to cover Soviet missile activity. Within these resources the ability to detect the launch of earth satellites or other space vehicles was very limited.

~~(S)~~ The SSS program, as originally submitted to the Department of Defense for review, proposed establishment of five Bankhead and three Stonehouse systems. They were to be capable of collecting signals from space vehicles, tracking such vehicles, and performing preliminary on-site processing of intercepted signals. They were to employ improved, high-speed communications to make near real-time reporting possible. As a result of review and guidance by the DOD (DDR&E), the program was revised to eliminate two of the proposed Stonehouse deep-space systems and to modify or defer some equipment for the Bankhead systems. The deletions made it possible to complete the reduced program within a DOD-imposed expenditure ceiling of $40 million.

(U) By careful management, the SSS program was held within the imposed fund limitations and was completed almost on schedule. The installed systems performed very creditably, considering that various compromises had been necessary; that some of the systems were given operational tasks before testing could be completed; and that operations were handicapped by shortages of adequately trained and experienced maintenance personnel. Logistic problems also sometimes made it difficult or impossible to obtain adequate spare parts when needed. These problems and accomplishments are summarized more fully in Chapter IV.

(U) Chapter I presents the developments from 1957 to 1961 which led up to the SSS program. Chapter II describes the planning and organizational phase of the SSS program between 1961 and 1964. Chapter III summarizes the major steps in the preparation of sites, fabrication of equipment, delivery, installation, testing, manning and initial tasking of the various systems, as well as some of the problems which developed.

~~(C)~~ As is the case in the writing of most histories, it was difficult to determine where to begin the history of NSA's Space Surveillance SIGINT Program. In retrospect, it seems that the launching of the first Russian Sputnik in 1957 had given adequate warning that a well-organized and well-managed effort was needed to make sure that the U.S. would be able to collect and exploit radio signals (and any other exploitable electromagnetic emissions) which might be transmitted by the U.S.S.R.'s space vehicles. Such an effort would supplement the information obtainable by active surveillance under the Air Force's Spacetrack, Army's Doploc, and Navy's Spasur Programs.

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CHAPTER I

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Background of the SSS Program, 1957–1961 (U)

Beginnings (U)

~~(C)~~ In the fall of 1957 John E. Libbert, technical advisor to the USAF's Elint Coordinating Group (AFCIN–Z), attempted to define the "exact nature of, and responsibilities for, exploiting of Elint data originating in, and associated with, earth satellite vehicles." He concluded that:

> . . . 11. Present Elint activity concerning ESVs is adequate to cope with current military requirements.
>
> . . .12. Exhaustive scientific and/or technical exploitation of ESV Elint data could provide vital data on a vast number of subjects not now included as military matters, for which at present there appears to be no defined responsibility assigned within the U.S. Government.
>
> . . .13. Present DOD Elint facilities could undertake some or all of the exploitation possibilities but would require augmentation accordingly.
>
> . . .14. Both as regards present ESVs and particularly those expected in the future, clarification must be obtained as to responsibilities for, and extent and nature of, Elint exploitation of ESV activities.
>
> *Recommendations:*
>
> . . .15. It is recommended that policy and other guidance be obtained from appropriate DOD and other governmental boards and agencies.[1]

~~(C)~~ In January 1958, W.M. Holaday, Director of Guided Missiles, DOD, recommended

> that immediate steps must be taken to prepare a plan for the coordinated application of our national capability to accomplish tracking, data collecting, and computing necessary to obtain maximum information from the various satellites the U.S. and U.S.S.R. will launch.

He requested that the Secretary of the Navy establish a working group

> with appropriate Army and Air Force representation as well as representation from the IGY (International Geophysical Year) group of the National Academy of Sciences to assess this problem on the national basis and draw up a plan which can be put into effect at the earliest practicable date. . . .[2]

~~(C)~~ Roy W. Johnson, Director of the Advanced Research Projects Agency (ARPA) added shortly thereafter that

> . . .I am also much concerned about our ability to track and interpret data from the next U.S.S.R. satellite that may be launched and, more importantly, to ascertain that a U.S.S.R. satellite has been placed in orbit in the event it is not immediately announced by the U.S.S.R. It would be very embarrassing to us for the U.S.S.R. to announce that they had had a third satellite up for a number of weeks or months and we not [be] aware of, or able to show that we knew of, its existence.

He urged that the satellite tracking review group consider

> whether we can, at present, or with any reasonable means at hand in the Departments, discover any new U.S.S.R. satellites, whether they are announced or not and whether they are radiating or not. I should be advised of any specific actions that need to be taken to improve or solve the problem.[3]

~~(C)~~ Late in April 1958, the Director of ARPA called attention to the fact that:

> . . .various intelligence components of the Department of Defense and elsewhere are engaged in considerable programs with the capability of detecting and tracking satellite vehicles. The intelligence community has, in addition, a considerable responsibility for and a high interest in certain aspects of the information to be collected and disseminated under the plan to be formulated by the Satellite Tracking Review Group.
>
> 3. I suggest that it might be useful if an intelligence representative, possibly the Chairman of the Interagency Guided Missile Intelligence Committee were invited to participate actively in the planning of the Satellite Tracking Review Group.[4]

~~(S)~~ (S//SI)

[redacted]

~~(C)~~ The primary source of intelligence to be obtained from the electronic emissions from space vehicles was telemetry between them and ground stations, although communications from manned vehicles, voice (or other) would also yield intelligence. Telemetry was considered to be Elint rather than Comint. Until September 1958 it was therefore outside NSA's (but not the SCAs') province. Then NSCID No. 6 (new series) assigned national responsibilities for Elint as well as Comint to NSA, although the new role

was subject to certain reservations. In the following months NSA attempted to work out with the services, JCS, and DOD an acceptable definition of its Elint responsibilities, to integrate the Elint functions and resources it had acquired into the NSA organizational structure, and to make a start at developing needed plans and programs to carry out the Sigint mission.[6]

~~(C)~~ In September 1959, Colonel C.P. Richman, USAF, NSA Elint Coordinator, summarized the actions which he believed NSA should take including:

> a. Continue to develop detailed technical data concerning those intercept facilities under the coordinating jurisdiction of 'Space Track' (496L) which will be of assistance to NSA in exploiting transmissions from foreign satellite or space vehicles. . . .
>
> b. Develop within NSA a detailed plan for the employment of NSE (National Sigint Establishment) resources to meet the requirements for information from subject vehicles. Pending the final approval of USIB of such requirements (see d. below) those requirements submitted by the ARPA panel and approved in principle by USIB, should be assumed as the basis for such planning. NSA plan should include:
>
> (1) Collection aspect. . . .
>
> (2) Exploitation aspect - data presentation and reduction.
>
> (3) Communications aspect - to include tie-in with Space Track as appropriate.
>
> (4) Financial support to implement.
>
> Such NSA planning must be completed within the shortest possible time. As soon as it is relatively firm within NSA—prior to formal coordination with the cryptologic services—the plan should be discussed with appropriate Space Track personnel for the purposes of determining in which areas mutual assistance or common use of facilities might fill gaps in either program. As of now, six weeks from date appears to be about the proper time for such discussion. Cosa should be action.
>
> c. Consider the question of NSA liaison with or at Space Track, ...Ops action.
>
> d. Continue by all means possible to expedite USIB early consideration of the space requirements currently in GMAIC. This may be done by the NSA members of the various committees which deal in this area—GMAIC, Space Surveillance Committees, etc. I have personally urged Colonel McFarland to expedite the passage to USIB.[7]

~~(C)~~ There were also internal efforts within NSA (Prod) to secure additional equipment for intercept stations currently tasked with missile and space-vehicle collection requirements. This equipment was intended to provide a "quick and dirty" operational capability to obtain directional bearings from signals emitted by Soviet missiles, satellites, and space probes within four to six months.[8]

(U) Early in 1958 the Advanced Research Projects Agency (ARPA) was directed by the Secretary of Defense

> . . . to undertake research, experimentation, and system development to obtain at the earliest practicable date a space surveillance system capable of satisfying the military requirements of the various services and commands.

The project was named Shepherd.

(U) ARPA soon encountered so much disagreement with the services that it made little progress with Project Shepherd. When the personnel assigned to that project tried to reorient it, only one tentative program, "Advanced Sensors," was programmed by ARPA, and in the end, funds for that were withheld because the services individually were funding parallel programs. There was, however, a "lack of common purpose and communications" in these activities which were attributed, by an Institute for Defense Analysis (IDA) study, to the absence of an "effective management group."[9]

~~(S)~~ During 1960 the space surveillance projects then under way amounted to about $21.2 million. There were also other programs not specifically part of space surveillance which might aid it, including BMEWS, Midas, Saint, Vela and Nike-Zeus. The Midas program was developing an ability to detect ICBM launches and to react to launching of new satellites or space probes as well as ICBMS. Project Saint was intended to demonstrate the feasibility of satellite inspection by means of co-orbital maneuvers and close up observation. Project Vela had as one of its missions the detection of nuclear explosions in space and a related interest in tracking vehicles leaving the near-earth region which might carry a test nuclear weapon.

(U) Other programs covered long-range detection (over-the-horizon radar), radar research, radar discrimination, and optical and infrared research. Although there had been little contact with NASA, it was considered important from both an economic and scientific basis that an advanced program in space surveillance be coordinated with NASA activities of mutual interest.[10]

(U) ARPA indicated to IDA analysts that the need for work on an advanced detection system was not completely clear. It felt that there was a need to obtain suitable requirements from the services and that these requirements could not be "firmed up" without estimates of performance costs and probable performance value. This was another way of saying that "an operational analysis should be performed by or for the military commands as a basis for generating firm requirements." The responsibility for developing sound requirements was transferred to NORAD. The IDA analysts were afraid that NORAD might accept

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the views of various groups for costly new systems before the need for such was fully determined.

~~(C)~~ The IDA study briefly examined the problem of intelligence requirements and responsibility and concluded that a

> high-level decision on these matters of the responsibility of the intelligence community and the source of support for research and development to meet pure intelligence requirements must be forthcoming in the immediate future.

The main points covered were summarized as follows:

> A. An operational analysis of the space surveillance mission, to obtain a cost-effectiveness relationship for deriving practical requirements, is long overdue.
>
> B. Considerable effort ($21.2 million) already exists in the form of projects directly oriented towards satellite surveillance. However, the efforts appear quite uncoordinated.
>
> C. There is a serious lack of effort towards obtaining an improved capability to detect and track foreign space probes, and to obtain satellite configuration.
>
> D. Immediate selection is necessary of an effective management agency to coordinate the various efforts, review their progress, and insure that no gaps remain uncovered.
>
> E. There are many other programs in the Defense Department which are related to space surveillance. Efforts in these must be coordinated with surveillance and research and development.
>
> F. The need to begin immediate procurement of an advanced state-of-the-art surveillance sensor is uncertain. More economical solutions may be possible and should be carefully considered.
>
> G. The role of the intelligence community in the surveillance mission is poorly understood. Clarification of this role and specification of the proper source of intelligence R&D support are necessary.[11]

Requirements for Space Intelligence (U)

~~(S)~~ The first Priority National Guided Missile and Astronautics Intelligence Objectives as of mid-1960 covered:

> H. Soviet activities in and relating to space which contribute significantly to, or are indicative of, Soviet military capabilities.
>
> 1) Space vehicles with a weapon delivery capability.
> 2) Reconnaissance, weather, communications, ECM, Elint, geodesy, and navigation satellites.
> 3) Maneuverable vehicles, whether manned or not.
> 4) Space platforms.
> 5) Space order-of-battle inventory.
>
> Second priority objectives were:
>
> Soviet exploitation of space for scientific and psychological purposes to include:
>
> (1) Biological probes and satellites.
> (2) Manned space vehicles.
> (3) Lunar and planetary probes (manned and unmanned).[12]

~~(S)~~ There were also specific statements of requirements for intelligence regarding the Soviet space programs, including a USAF requirement submitted in January 1960, which stated that:

> A knowledge of current Soviet interest and activities is needed to evaluate what counter actions may be expected when R/D systems are replaced by operational weapons systems. Requirement requests the following information be provided:
>
> (1) Information indicating that the Soviets intend to physically intercept or destroy a U.S. space vehicle.
> (2) Information indicating that the Soviets plan to trigger telemetry readout from a U.S. space vehicle.
> (3) Information that the Soviets plan to or are jamming reception of signals from a U.S. space vehicle.[13]

~~(S)~~ Possibly the most critical and controversial aspect of the space intelligence requirements was that of timeliness—how rapidly space-related Sigint must be produced and delivered to the consumer. Ideally the USAF wanted to have prelaunch notification that a space vehicle was to be launched, the time of launch, and orbital and trajectory data either before launching or within a few minutes following launch and before the vehicle's first pass over the U.S., U.S. possessions, or U.S. installations elsewhere. Other requirements specified that, for refined scientific data, the intelligence was required in varying periods from a few minutes after launch to a matter of several weeks later. In the case of intelligence to be derived from telemetry transmitted by a space vehicle or communications with the vehicle from a ground station, the requirements that intelligence be distributed to the consumer within minutes of initial intercept meant, among other things, that the material intercepted must either be processed at the point of intercept and results communicated directly to the consumer by high-speed electrical means, or that the intercept be relayed electrically to NSA for central processing on a "real-time" basis and almost immediately distributed to the consumer. Unfortunately, however, existing communications systems were not capable of handling this type of communications load, nor was NSA prepared to process the material "on line," even though it could be delivered by electrical means. The alternative—preliminary processing at the point of intercept to extract early warning information (including tracking data for use by other sites) and selection or compression of material to be forwarded to NSA electrically—seemed more feasible but still posed difficult problems.

Project BANKHEAD (U)

~~(C)~~ In the spring of 1960, NSA learned that two multipurpose satellite tracking stations being built by the Collins Radio Company in Dallas, Texas, for ARPA would not be needed for the U.S. satellite program and could be made available to the intelli-

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gence community: NSA (Cosa) and Signal Corps representatives investigated and evaluated the status of the surplus equipment, and concluded that NSA should take over the ARPA contract. They recommended that certain modifications be made in the equipment, and that it then be installed at sites in [redacted] and [redacted] It was expected that the equipment would be operational in July 1961 and would provide a current state-of-the-art collection capability for the two intercept stations selected. This project was designated as "Bankhead."[14]

(U) DOD gave preliminary approval to this proposal and agreed to provide the additional $1.5 million needed for the modifications considered necessary. An NSA-USASA-USAFSS-SigC Engineering Working Group was established to work on the project.[15]

~~(S)~~ By the time the alterations were made in the Bankhead contract, the estimated completion date was changed to February 1962. It was expected that the station at [redacted] could be operational in early spring 1962 and that the installation at [redacted] would be operational by June 1962. Project Bankhead was to provide [redacted]

~~(C)~~ During the summer and fall of 1960, Prod representatives made a study of requirements for [redacted] transmissions from space probes. The system visualized by Prod representatives was to be assembled almost entirely from off-the-shelf equipment. NSA R/D representatives, however, expressed reservations about the Prod view that little R/D effort would be required. They thought more development work would be needed on most of the equipment. R/D representatives concluded that the collection plan was a good, clear-cut plan of what could be done to enhance intercept collection from ESVs, and that the plan should allow NSA to prepare OSO/OSD and DDR&E for future resource requirements, which would follow if the implementation plan was approved. It was roughly estimated that the collection plan might cost about $30 million, the processing plan an additional $70 million, and that additional manpower resources would be required.

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(U) Prod (Gens) representatives agreed that data reduction and data processing related to the space program would involve a major R/D effort, and proposed that R/D representatives participate in developing an exploitation plan. R/D agreed to cooperate in this approach.[17]

~~(S)~~ The collection plan was verbally approved by DIRNSA on 13 December 1960, and Lieutenant General Donald N. Yates, USAF, Deputy Director, Defense Research and Engineering, OSD, was briefed on 14 December on NSA's "U.S. Comint/Elint Requirements Study for Collection of Foreign Earth Satellite and Space Vehicle Transmissions." He indicated that OSD would support prompt action on the collection plan.[18]

~~(S)~~ The requirements study referenced concluded, among other things, that:

1. Intercept resources available to the United States for current Sigint operations have only limited application to the intercept of transmissions from foreign space vehicles. Sigint operations against such vehicles therefore demand the employment of special techniques and resources not currently in the Sigint inventory.

2. Intercept systems capable of detecting the existence of non-radiating space vehicles are not the responsibility of the National Security Agency. However, there is a reasonable chance that the launch of ESVs and space probes will continue to be detected by Comint and Elint detection and tracking of radiating vehicles.

3. Continued study is necessary before intercept plans can be formulated in detail. The extremely wide range of possible ESV orbits and space-probe trajectories present a complex of intercept problems rather than a single one.

4. Since it is impossible to forecast the detailed nature of transmissions from space vehicles, and these may vary considerably from one vehicle to another, there is a need for effective engineering support at the intercept sites in order that transmissions detected by search can be exploited at the earliest possible stage.

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c. Asmara, Ethiopia.

7. Special intercept facilities are required for telemetry and beaconry intercept and for tracking on these signals.

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8. Intercept facilities must possess relatively broad frequency spectrum coverage.

~~(C)~~ Headquarters, NORAD/CONAD concurred in the conclusions of the "NSA Comint Elint Requirements Study for Collection of Foreign Earth Satellite and Space Vehicle Transmissions," and recommended that it be approved and implemented. It also stated that a "corollary requirement of NORAD is real-time (or near real-time) transmissions of data from proposed central processing centers to NSA to NORAD."[20]

DOD–NASA Agreement (U)

~~(C)~~ On 13 January 1961, the Defense Department (DDR&E) and the National Aeronautics and Space Administration signed an "Agreement. . . on Functions Involved in Space Surveillance of U.S. and Foreign Satellites and Space Vehicles." This agreement referred to an earlier "Operations Plan for Outer Space," of 11 June 1960. Areas of interest in the space surveillance field were defined:

> a. Military requirements for space surveillance. . . . can be briefly summarized as the ground environment required in support of manned and unmanned military space systems and the detection, identification, and tracking of all space vehicles launched by foreign governments which might have missions inimical to the interest of the United States. The system developed against these requirements must have the potential capability of supporting counterattack or neutralizing action against enemy space vehicles. There is a continuing military requirement to augment our intelligence capability to provide information, pre- and post launch on the physical and electronic characteristics, and nature and purpose of foreign space shots. The data collection, analysis, and distribution systems in support of these requirements must be secure, must normally operate in real-time, and must be responsive to the demands imposed upon them by interested military operational commands. These requirements will be met by the Department of Defense programs.
>
> . . . *Plan of Action–DOD*
>
> The Department of Defense, through the JCS, has assigned to CINC, NORAD the operational control of the military space detection and tracking. The central data collection and cataloging center to meet DOD requirements will be established within the NORAD COC. It will take over the military functions and responsibilities presently handled experimentally by the Spacetrack Center in Cambridge. NORAD will assure operational control of military space detection and tracking sensors primarily serving its new mission.
>
> . . . The Department of Defense program will provide for augmentation of its space vehicle intelligence effort, including electronic surveillance and examination of foreign space vehicles, and improve photographic and other methods for determination of potential military capabilities of the foreign objects. . . .

Notes

[1](U) M/R by John E. Libbert, "Elint Exploitation of ESVs," 27 Nov 1957.

[2](U) Memorandum from W. M. Holaday for the Secretary of the Navy, "Satellite Tracking," 18 Jan 1958.

[3](U) Memorandum from Roy W. Johnson, Director, ARPA, for the Secretary of the Navy, "Satellite Tracking," 10 Mar 1958.

[4](U) Memorandum from Roy W. Johnson, ARPA, for the Secretary of the Navy, "Satellite Tracking," 25 April 1958.

[5]~~(S-CCO)~~ Memorandum from William J. Pond, NSA Rep, GMIC (Guided Missile Intelligence Committee), for Prod–05, [redacted]

[6]~~(S)~~ D/F from Ops (Frank C. Austin) to Dir/Prod with copies to R/D, Csfc, Comp, "Reconnaissance Satellites and Space Surveillance," 11 May 1959.

[7]~~(S)~~ Memorandum from Colonel C.P. Richman, USAF, to Mr. Austin, Ops, "Surveillance of ESV and Space Vehicles," 1 Sept 1959.

[8](U) D/F from Gens to Cosa, "Urgent Requirement for High Resolution, Long Range D/F Equipment," 26 Oct 1959.

[9](U) *Space Surveillance Program Review*, by D. Duke and D. L. Fisher, Institute for Defense Analysis, Research and Engineering Support Division, February 1961, (Contract SD–SO, Technical Report 61–3) pp. 2–3.

[10](U) *Space Surveillance Program Review*, Institute for Defense Analysis, February 1961, pp. 3–17.

[11](U) *Ibid.*, pp. 3–17.

[12](U) Guided Missile and Astronautics Intelligence Committee, "Priority National Guided Missile and Astronautics Intelligence Objectives," 26 June 1960.

[13](U) PR No. 7–60, USAF Requirement AFCIN–IC4–(2A3–59–13)–(274)–59, CRLS 9 & 10, 7 Jan 1960.

[14](U)~~(FOUO)~~ M/R by LTJG [redacted] USN, Cosa–2, "NSA Proposal for Use of Two ARPA Forty-Foot Antenna Stations," 1 Apr 1960; (U) "Memorandum from ARPA for Assistant Secretary of Defense, Special Operations, "Possible Intelligence Use of Two 40-Foot Antennas," 31 May 1960.

[15](U)~~(C)~~ Message from DIRNSA to CUSASA, USAFSS, "Project Bankhead," 2 Sept 1960, AGO 09066/02.

[16](U)~~(C)~~ M/R by LTJG [redacted] USN, Cosa–24 Project Engineer, "Project Bankhead," 17 Nov 1960.

[17](U)~~(C)~~ M/R by Howard C. Barlow, Deputy Director, R/D, "Meeting on Super Bankhead," 8 Dec 1960.

[18](U) D/F from Gens to Dir/Prod, "Space Exploitation Program," 22 Dec 1960; (U) D/F from Dir/Prod to Dir R/D and Tcom, "Space Exploitation Program," 27 Dec 1960.

[19]~~(S-CCO)~~ NSA, "United States Comint/Elint Requirements for Collection of Foreign Earth Satellite and Space Vehicle Transmissions," Dec 1960.

[20](U) Message from AF SSO CONAD to DIRNSA, 14 Feb 1961, AGI 142130Z.

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CHAPTER II

NSA's Planning and Organizing to Execute the SSS Program, 1961–1964 (U)

Planning (U)

~~(C)~~ Early in 1961, NSA reviewed NORAD's draft Development Plan for NORAD Space Detection and Tracking System (Spadats) 496L SPO dated 16 January 1961 at the oral request of DDR&E, and commented that:

> 1. . . . While certain first priority national intelligence objectives can be satisfied through active radar and optical tracking, the identification and purpose of the vehicle is unlikely to derive from these sources. The National Security Agency proposes that a Comint/Elint capability can best satisfy the first priority requirements for information concerning preparation to launch, launch itself, initial orbit or trajectory and identification of the military or scientific nature of the operation.
>
> 2. To be effective, the Space Detection and Tracking System (Spadats) under NORAD will require information on an immediate basis which contributes to a determination of the nature and purpose of each vehicle. In most cases, this information will derive from successful intercept and analysis of communications and electronics transmissions. Thus, the NORAD plan. . . and the NSA plan. . . are compatible and mutually supporting. A truly effective United States space surveillance system therefore requires implementation of both the space detection and tracking system and the Sigint collection and analysis systems. The North American Air Defense Command had concurred in and evidenced strong support for the NSA plan for an improved Sigint collection system. . . .[1]

(U) It was pointed out that while NSA had scheduled completion of its "minimum capability Sigint collection and analysis system (Phase I)" to become operational by 1 January 1964 in order to coincide with NORAD's target date for Phase I of Spadats, it would be necessary to have supplemental funds available for this purpose in FY62, since none were in the NSA FY62 budget or could be included before the FY63 budget. A summary of the time phasing and budget estimates to cover the program was attached, and DDR&E was advised that a detailed funding and development plan would be forwarded in about 30–60 days. NSA proposed that the NSA plan become Part II of a Department of Defense Plan for Space Surveillance.

~~(C)~~ To expedite and improve coordination of the efforts by Cosa, Gens and R/D to develop and secure approval of adequate planning, programming, and funding documents for an NSA Space Exploitation Program (Spexpro), NSA established a planning board under the chairmanship of Mr. Guy H. Stephens of Gens. The following were designated as members: Gens – M. J. Boucher, W. G. Deeley; Cosa – [redacted]; R/D – [redacted], T. Dewey.

~~(C)~~ The group, the Space Surveillance Sigint Planning Board (SSSPB), was to serve between 1 March and 1 June 1961. It was expected to complete a detailed fiscal plan by 1 May 1961 and a detailed technical plan by 1 June 1961; specific responsibilities for the program could then be assigned.[2]

~~(S)~~ The SSSPB submitted a *SSSPB Draft Funding Plan for Space Surveillance Sigint* to the Deputy Director, NSA, on 27 April 1961, with copies to the affected organizations in NSA and to the SCAs, whose representatives had helped to prepare the plan. Total construction and equipment costs were estimated to be $79,313,000, with yearly O/M costs of $17,191,000 through FY64 and $20,828,000 thereafter. These estimates covered five Bankhead sites, three Stonehouse sites and the National Center. It was planned that

> with the exception of one Bankhead site recommended in [redacted] the three cryptologic services will man the other seven sites with all possible skills in their inventory. Because of the new skills necessary to make this system work, certain NSA civilian, and NSA or SCA contract personnel will become part of the initial deployed package.

~~(S)~~ The draft funding plan also stated that:

> The Bankhead collection objective will be to record all wanted signals in the [redacted] The on-site processing

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objective will be to derive orbital elements and perform initial signal and telemetry analysis with computer assistance in order to determine all possible initial answers concerning the purpose of the space vehicle. The reporting objective will be to satisfy NORAD location requirements so their active sensors may acquire the vehicle and, more important, to identify the purpose of the vehicle. Additionally, the orbital elements will be passed to other pertinent sites for acquisition purposes. Each site will be connected to and through NSA by both 100-wpm and 2400-bit-per-second communications. NSA processing and reporting will pick up where the individual stations stop, but in this case within a few minutes in necessary instances.

The Stonehouse sites will be essentially collection activities with enough processing capability to direct efficient collection efforts at the site and to provide a measure of technical reporting to NSA and a minimum electrical Sigint product reporting capability for especially significant items.[3]

The Grey Book (U)

~~(S)~~ In May 1961, the SSSPB completed and distributed a more detailed *Development and Funding Plan for Space Surveillance Signal Intelligence*, which became known as "the Grey Book." This included an abstract which summarized the SSSPB's major conclusions and recommendations:

Present cryptologic resources against foreign space vehicles are deficient in frequency spectrum coverage, in sensitivity, in ability to follow targets, and in quick-reaction processing. A system has been designed to remedy these deficiencies so as to meet those national requirements for space surveillance which can best be met through Sigint; that is, earliest detection of launch time, place and direction, earliest assessment of vehicle's probable purpose, and continuing information on vehicle activity and performance. This data, acquired by the passive electronic sensors of the National Sigint Establishment, will be of critical importance in alerting, guiding, and supplementing the active sensors (radar, etc.) available to NORAD to perform its space surveillance mission as tasked by DOD.

[redacted]

. . . . While the equipment will consist largely of state-of-the-art equipment, it is designed to permit updating in the post-1964 period with a minimum of waste. The national nature of the plan is underscored by the fact that [redacted]

~~(S)~~ The potential military threat posed by Soviet progress in space technology was pointed out, including the fact that "the U.S.S.R. assuredly possesses the propulsion capability required to place high-yield nuclear warheads in orbit," along with a probable requirement for reconnaissance satellites "for targeting mobile and deployed strategic forces." NORAD's estimate of the Soviet threat was quoted, with the prediction that by late 1964 the U.S.S.R. could have between 50 and 150 major useful vehicles in terrestrial orbit, including:

Bombardment	30
Reconnaissance	60
Communication Command	40
Jamming	40
Navigation, Weather, Communication, etc.	24
Scientific	12

~~(S)~~ Sigint objectives were described in the Grey Book as follows:

1. The overall objective of the Space Surveillance Sigint system is to fulfill Priority National Intelligence Objectives and to satisfy the requirements of NORAD, other commands, and USIB agencies by intercepting, locating, and analyzing the electromagnetic emissions of foreign space vehicles. The system is designed to perform partial processing on site, with immediate backup by the National Center, to report on a near-real-time basis: (a) the place and time of launch, and (b) the nature, location and probable purpose of the vehicle. . . .

2. Further objectives, to be satisfied by continued collection and processing on at least a sampling basis are:

a. To confirm or deny reported nature, purpose, and activity of the vehicle.

[redacted]

b. To assist in monitoring U.S. space vehicles, as time permits and if required.

~~(C)~~ It was noted that most of the continuing requirements, unlike NORAD's early-warning requirement, would be satisfied by NSA's National Center through fusion of information collected by the various space collection sites with information from other sources.

~~(S)~~ It was emphasized that, in the selection of proposed sites, purely technical considerations had to be compromised by the availability of land, logistics, and economics, and that existing Sigint stations were selected in every case "except where the technical requirements would be unduly compro-

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mised." None of the [redacted] sites considered to date appeared acceptable. A site in [redacted] was said to be the essential link in the Bankhead chain. It was planned that four Bankhead sites would have antennas capable of intercepting frequencies from [redacted]

~~(U)~~ ~~(C)~~ At Bankhead sites I and II, however, the two 40-foot dish antennas acquired from ARPA would be substituted for [redacted] antennas.

~~(U)~~ ~~(C)~~ Recording equipment at the Bankhead [redacted]

~~(U)~~ ~~(C)~~ A field processing and analysis system was to include a signal analysis unit, tracking programmer, signal processing unit, computer and ancillary equipment, computer displays, orbit and trajectory determination, telemetry analysis and [redacted]

~~(C)~~ The plan specified that each Bankhead site would be connected with the National Center at NSA by two secure duplex communication links. One would be a 100-word-per-minute link to be used for intelligence reporting, exchanging alerts or tip-offs, orbital element information, technical support and, if necessary, raw tracking data. The other was to be a 2400-bit-per-second data link capable of transmitting selected, digitized telemetry. Buffer storage was to be provided at both ends of the data link to permit input to, or output from, computers.

~~(S)~~ The entire system was to have a Space Surveillance Sigint (SSS) Center at NSA Headquarters, operating on a twenty-four-hour basis, which would exercise control, provide technical support, and perform analytic and reporting functions.

(U) It was estimated that the complete SSS system would require 649 military personnel, 186 civilian employees plus 109 contract personnel, or a total of 944 people. Personnel procurement was to start in FY62 in order to meet the 1 January 1964 target data for full operation. It was also pointed out that training of personnel would need to start long before the system was completed. It was planned to set up a rotation system between the field sites and the National SSS Center.

~~(C)~~ Military construction and equipment procurement costs for FY62/64 were estimated at about $78.5 million, annual operating costs at about $20.9 million. These costs did not include Bankhead V [redacted] for which construction and equipment costs were estimated to be about $12.1 million, with operating costs about $3.76 million.

~~(C)~~ There were apparently doubts within NSA regarding the validity of some of the requirements the SSSPB plan was trying to meet—particularly the early-warning requirements stated by NORAD. If these were not considered valid or urgent, it would be possible to stretch out the Spacol program over a longer period, thereby reducing the rate of expenditure required.[4]

~~(C)~~ During May and June 1961 the SSSPB plan was reviewed by the NSA Scientific Advisory Board (NSASAB) and members of three of its panels who asked a variety of questions regarding some of the plans, assumptions, and conclusions. The NSASAB was apparently convinced that collection of Sigint from space vehicles was feasible and desirable. It recommended, however, that the NORAD requirement for near-real-time reporting by 1964 be further investigated and assessed.[5]

~~(S)~~ Dr. Fubini, D/DDR&E, also raised a number of questions regarding NSA's proposed plans: Why did NSA think the space vehicles would transmit? Why should its system be considered "operational"? Had "deception" been considered? The answers prepared by the SSSPB were that the SSS system was a general purpose system intended to meet NSA's intelligence requirements, which would exist even if there were no NORAD, and that the system was "operational" to the extent that some of its features were designed in direct support of NORAD. It was conceded that while a few vehicles would not emit signals, almost all others would do so. It was also not correct to assume that NORAD was concerned only with so-called "black" vehicles but rather with all vehicles from an order-of-battle point of view, that it must consider all Soviet vehicles as potentially hostile until they were identified. Also NORAD and the JCS operational commanders recognized that a great majority of the Soviet military vehicles would be active reconnaissance satellites, mapping vehicles, etc. Although the Soviets might try to disguise the real intent of a vehicle, as was the case in other intelligence operations, this should not discourage the U.S. from trying to intercept and identify emitted signals.[6]

~~(S)~~ Other questions asked were: How do we relate to NORAD? Are we prepared to use its

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outputs, or are we trying to duplicate all its work? NSA replied that:

> Spadats will detect space vehicles using active and optical equipment at certain sites, but will have limitations as to detection range, timeliness, and identification ability. Bankhead sites will complement Spadats [redacted] Only by using data from both systems can NORAD maintain reasonably complete and timely space order of battle, including information on vehicle purpose and performance. Approximate vehicle position information is required to assist the Sigint collection operation; when this information is available from NORAD; we will use it. The [redacted] We do not plan to duplicate NORAD facilities.

~~(S)~~ How dependent would the NSA Spacol/SSS program be on the availability of prelaunch information? Could not the Soviets launch a space vehicle in such a way that it would escape detection through the [redacted] of the Bankhead [redacted] The SSSPB replied that the proposed system would use, but not be dependent upon, [redacted] although the Stonehouse sites, [redacted] Bankhead and Spadats. It was regarded as extremely unlikely that the U.S.S.R. would be able to launch space vehicles without detection.

~~(C)~~ Why, if the Soviets could follow their probes from the U.S.S.R., did the U.S. need Stonehouse [redacted] It was pointed out that all Soviet probes would not be visible from the U.S.S.R. at all times, and that the U.S.S.R. had requested permission to install additional collection sites in South America, Australia, and possibly Africa. The alternative was to depend on a "dump method" of returning data to the U.S.S.R. when the probes were within view from the U.S.S.R.

~~(C)~~ NSA was asked by the DDR&E if the proposed NSA space collection center was to be in a separate building, if it was to be a contract operation, and why additional equipment was needed? The SSSPB reply was that existing processing and computing equipment was already fully committed to other high-priority problems which could not be dropped; that additional equipment would be needed but was to be installed in the existing NSA building; that substantial savings would result from the use of some of the same models of equipment already owned by NSA, and, that a minimum number of new people would be required since existing people and resources would be used in developing and operating the SSS program center.

~~(C)~~ Could existing systems be used for the space collection program? The SSSPB explained at some length why no other available system would meet the space-collection requirements, even if a reasonable number of modifications were made. However, the board pointed out that specific components of the other systems, where suitable, were to be incorporated into the new system.

~~(C)~~ Dr. Fubini was assured that there were no plans to discard the "1962 model" Bankhead systems and that no funds were being requested to replace any major items in these systems. The two secondary tracking stations received from ARPA were being modified under a $3.5 million contract to provide coverage of both the VHF and UHF frequency ranges rather than a single frequency range, and to provide improved tracking, monitoring, search, and magnetic tape recording.[7]

(U) Some of the same or similar questions were also raised by DDR&E regarding the Air Force's Space Detection and Tracking System (Spadats).

~~(C)~~ At the end of July 1961, NSA forwarded to DDR&E two alternative plans. Plan A was considered to be a "normal R&D approach" to meet the established space surveillance Sigint objectives, and Plan B was "an enlarged and expedited program developed by SSSPB." The NSASAB reviewed Plan B and concluded that the NORAD requirements on which Plan B was based were not complete enough for assessment. DIRNSA decided to submit both plans to DDR&E, since it was believed that "the urgency of the NORAD requirements must be evaluated before an intelligent decision can be made."[8]

~~(S)~~ NSA reported that a "critical examination of national space surveillance requirements had been conducted. Plan A was consistent with existing FY62 RDT&E resources, and would "concentrate on the programmed resources of Bankhead I and II, passive Sigint collection system, to satisfy immediate needs for Sigint space surveillance and processing." The essential elements of the Plan A proposal were as follows:

1. Addition of minimum analytic capability to Bankhead I and II [redacted] by FY63 to enable these sites (a) to make a "fair" validity estimate of the nature and purpose of an indeterminate percentage of radiating Soviet space vehicles within a few hours after detection and (b) to collect data [redacted]

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2. Completion by 1966–67, essentially on a normal budget cycle, of two additional collection sites, a simplified collection system in [redacted] and one Stonehouse, deep-space collection system in Asmara, Ethiopia.

3. Studies to be continued, both locally and under contract for improvements in our RF and analytic capability, including simultaneous coverage of multiple targets and an alternate means of implementing the Stonehouse deep-space collection plan (preferably as a joint venture with United States military space programs).

~~(C)~~ Following completion of the studies, a detailed program (five years) was to be developed for an increased Sigint space surveillance capability. The results of the studies would permit reasonably accurate cost estimates of total resources necessary to carry out the program. FY62 RDT&E costs should not exceed $1.2 million, which could be made available within the NSA budget.

~~(S)~~ Plan B represented a much enlarged systems concept as NSA's contribution to the national space surveillance program. Phase I of the expedited project established [redacted] (Bankhead) [redacted]

...The estimated total cost of this program is approximately $90 million for the period FY62 through FY64 and an annual operating cost of approximately $20 million. ...Recognized inadequacies of Plan A compared to Plan B were:

a. Identification of the nature and purpose of fewer foreign space vehicles on their zero orbits.

b. Lower validity identification.

c. Reduction of intercept coverage of the U.S.S.R. (both geographical and in terms of percentage of vehicle passes detected).

d. Only partial coverage of deep-space probes.

e. Less reliable intersite tip-off.

f. Completion three to four years later.

6. If the NORAD requirements and timetable are considered to be of such an urgency that an expedited, enlarged program for space surveillance is warranted, the FY62 funds required to carry on Plan B must be made available in the first part of FY62.

7. It is requested that a determination be made as to which of the alternatives should serve as NSA's primary guidance in fulfillment of Sigint space surveillance responsibilities.[9]

~~(C)~~ It appears that Dr. Fubini doubted that either the Secretary of Defense or the President would approve NORAD's full program for space surveillance. If they did, approval of NSA's $110 million plan would be almost automatic. If, on the other hand, NORAD's request were disapproved, NSA would still stand a good chance of having a less expensive SSS program, one without the part directed at "near-real-time reporting on hostile vehicles," approved. He pointed out, however, that a third possibility—endorsing NORAD's estimate of the nature of the space threat but directing a much cheaper system to meet it—was likely. In this event, NSA's role and funding requests would be reexamined on their merits.

~~(C)~~ Dr. Fubini suggested that NSA prepare a revised Plan A. Some of the SSSPB members concluded that NSA's SSS plans would soon be competing with NORAD's for the DOD space-surveillance dollar, and that the high cost of Spadats was causing reconsideration of alternatives, one of which involved reliance on Sigint, "to perform a not inconsiderable fraction of the total space-surveillance task."[10]

~~(C)~~ NSA representatives, Dr. Solomon Kullback and Mr. Howard C. Barlow, met with Dr. Fubini on 13 September 1961 and were advised that DDR&E had recommended approval of NSA's Plan A; that NORAD's Spadats plan would be reduced to about 25 percent of the $1.7 billion originally estimated, and that the NSA and NORAD plans should be kept separate but must be closely related.[11]

(U) When the SSSPB was established on 31 March 1961, it was expected that its work would be completed and the group dissolved by 1 June 1961. However, the NSASAB recommended changes in the SSSPB's proposed plans for the SSS program, and this, combined with the critical reception of the plan by OSD, DDR&E, caused DIRNSA to request the preparation of alternative proposals. The SSSPB continued to function through the summer and fall of 1961, reporting to D/DIRNSA.[12]

~~(C)~~ NSA complied with Dr. Fubini's request that it propose alternative programs for Space Surveillance Sigint, and transmitted three plans to DDR&E early in November with a recommendation that Plan Two be approved. This plan was believed to provide the growth potential needed to meet the full national requirements.[13]

~~(C)~~ One point made by NSA was that

The SSS problem differs from normal Sigint problems in that it involves moving targets emitting an unpredictable variety of wide bandwidth signals. It requires a general solution approach now, since we would lack the necessary lead time to develop equipments if we were to wait for each signal to be observed. Such a solution involves considerable initial expense for site construction and equipment irrespective of the numbers of space vehicles launched, but is far more economical in the long run than a multiplicity of 'crash' ad hoc attempts as new vehicles and signals appear.[14]

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~~(S)~~ It was explained that Plan One offered the greatest probability of meeting Sigint requirements by 1965, particularly early identification of space vehicles before they could make a first pass over U.S. territory or U.S. forces abroad. Plan One differed from the Plan B submitted in May 1961 in that the original target date set by NORAD was shipped to 1 July 1965. It was also assumed that the [redacted] site (Bankhead IV) would be collocated with an existing Sigint station, that a full U.S. site in [redacted] was not politically attainable, and that the alternative was a minimum facility manned by [redacted] As a result of recommendations by NSASAB and DDR&E, the ability to search for other targets while collecting from one target, and the ability to cope with foreign communication satellites had been added; probable additional communications costs were identified.

~~(C)~~ Plan Two took into consideration the guidance given NORAD—that the space surveillance operational target date should be changed to mid-1965, that DDR&E would support development and deployment of one full-capability Spadats facility in addition to the NORAD control center, but that additional facilities would have to wait. It therefore proposed that only one Bankhead site have the full computer-equipped configuration. Plan Two would provide a reduced interim capability but all eight sites were to be constructed and eventually be able to meet stated intelligence requirements.[15]

(U) Savings would result from elimination of the proposed 2400-bit-per-second communications and switching centers to link the computers, and from elimination of a separate NSA SSS computer, together with relaxation of the "crash" aspect of the construction program, training, etc. The savings would be reflected in slower reporting, a lower confidence factor in reporting, and increased vulnerability to communication difficulties.

~~(C)~~ Plan Three assumed that the DOD would not confirm the "near-real-time" reporting requirements expressed in the DOD–NASA Agreement, sought by NORAD and other operational commands, and approved by JCS. Quick-reaction capability was to be limited to intersite tip-off and efficient operational control of collection resources. Computer analysis and high-speed data communications were dropped, and premium construction costs to meet a 1965 operational date were avoided. It was noted, however, that while the reduced system comtemplated in Plan Three would not meet the operational commander's stated requirements, it would represent a great improvement over existing collection facilities. The total cost of Plan Three was to be spread over four and one-half years, rather than three years. Total estimated costs for the three plans were:

Plan One	$67,946,000
Plan Two	56,663,000
Plan Three	35,176,000[16]

(U) Plan Two was accepted by DDR&E in December 1961 with certain modifications—limit the number of sites which would be provided a search capability, specify that existing receivers from commercial sources or resulting from earlier government development programs would be used, and ordered a detailed technical development plan be prepared and reviewed by DDR&E before any system development money was committed. It was informally indicated that approximately $20.6 million would be made available as the FY63 funding level, and that these funds would be distributed as follows:

	NSA	ARMY	AIR FORCE	TOTAL
RDT&E	$ 6.2	-0-	-0-	$ 6.2
Procurement	8.1	-0-	-0-	8.1
Military Construction	-0-	4.5	1.8	6.3
Grand Totals	$14.3	$ 4.5	$ 1.8	$20.6[17]

(U) In mid-December 1961, DIRNSA, Vice Admiral L.H. Frost, USN, announced the establishment of a new "Spacol Management Office" for the purpose of "directing the implementation of the approved DOD program for the research, design, development, construction, installation, and initial service test of the Spacol system. R3 will develop Spacol plans in collaboration with D31."[18]

(U) The Spacol Management Office was to be the "principal NSA element responsible for the allocation or expenditure of Spacol resources, and for conducting liaison with organizations external to NSA on Spacol or subjects directly related to Spacol."

(U) (FOUO) [redacted] Chief of the Office of Analytic Equipment Development, (K1), was designated Spacol project manager and chief of the new office. The latter was to be staffed with personnel "from all appropriate Agency elements in order to achieve an optimum group of personnel who are specialists in all the functional areas involved in Spacol."

(U) ~~(C)~~ The Office of Spacol Management (R6) was subsequently designated the "Office of Special Program Management." It was organized to work as a team within which there would be functional specialization to permit engineering personnel to concentrate on engineering while nonengineering personnel would

handle other major responsibilities necessary for system development without duplicating the skills and effort of other organizations. The office (R6) consisted of a chief, administrative and clerical staff, and four branches. R61 was a program controls and support organization charged to prepare and monitor control procedures, and to support the other organizations. It was to perform the following functions:

1 Conceptual Phase: Prepare fiscal and implementation plans, participate in site surveys and technical support requirements for Technical Development Plans;

2 Preprocurement Phase: Prepare management and fiscal provisions for purchase descriptions, review purchase descriptions, prepare and process precontractual documentation, and participate in analysis of contract proposals;

3 Development Installation Phase: Provide administrative services on contracts, perform fiscal and schedule analysis, report on all active contracts, provide technical representatives for contracting officers on active contracts, plan for and direct movement of systems to operational sites, originate installation planning, participate in Category III testing, and coordinate requirements and plans in NSA and with the SCAs.

R62 was to provide project management and engineering services for Bankhead V, Anders, and Jaeger; R63, for Bankhead III; and R64 for Stonehouse.

Developing the Final Technical Development Plan (U)

(U) The Spacol program was given an FY63 funding level of about $20 million, and its assumed total cost was set at about $40 million. The Secretary of Defense approved implementation of the "more austere" version of the plans submitted by NSA. NSA was told that the final Spacol development plan would be "tied to maximum utilization of existing capabilities in this critical signal collection area"; and was directed to minimize "the necessity for continual ad hoc responses to events" and to "provide a balance for an austere but vigorous and technically adequate growth of capability."[19]

~~(S)~~ DDR&E requested that NSA prepare a detailed development plan within the stated funding assumptions, and specified important issues to be kept in mind in preparing the plan. They included:

1. Achievement of a significant capability by 1965 is required in both the Bankhead and Stonehouse collection sites.

2. Early capability in at least one Stonehouse site in 1964 is highly desirable to obtain the earliest useful collection capability against both very high altitude satellites, and also on manned or unmanned lunar vehicles and other deep-space probes.

3. The . . . plan . . . should identify the equipments proposed in enough detail so that the equipment lists formulated can be subjected to early decisions as to their applicability and availability.

4. Particular attention must be paid to the potentials inherent in building on existing and near-future signal collection installations and capabilities. The engineering plan should list existing capabilities, pointing out their shortcomings and weaknesses and should identify which ones cannot be employed in Spacol; the plan should also indicate the degree to which existing capabilities will be complemented by the new proposed capabilities, as deemed desirable or necessary because of the future growth of collection requirements.

5. The NORAD requirement is obscure because it appears tied to a threat that is neither defined nor clearly met by passive devices of the Spacol type. In view of this, the development plan should include statements regarding the reliability, usefulness, and cost effectiveness of extremely rapid reporting as compared to more deliberate reporting with higher assurance and reliability.

6. The plan should discuss the traffic handling ability which can be incorporated in the Spacol system within the funding confines mentioned earlier . . . .

7. The plan should specify the variety of precision tracking capabilities which need to be incorporated in both the Bankhead and Stonehouse receiving stations. . . .

8. Careful attention should be given to the data processing and communications systems associated with Spacol. In particular, it should be possible on the basis of the development plan to specify those items of information which can be developed by relatively simple equipments at the field sites; those which would require a rather extensive data processing facility of at least one site; and those cases in which it would be most efficient to do the processing at NSA after communicating the data to NSA headquarters . . . .

9. In general, the development plan must describe, in detail, the way in which the Spacol system grows as a function of time . . . .

10. The operational planning which shows how the Stonehouse system can make use of initial information received from the Bankhead sites should be

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specified—in particular, how these two sites complement one another in the very high altitude satellite and space-probe work, and how the handover is to be accomplished. Details are required as to how the overall number of Stonehouse stations is related to overall performance, on the basis of anticipated Soviet trajectories.

11. The plan should include a discussion of the relative merits of mobile and fixed installations at certain of the sites, including the time phasing of such alternative sites and the uses to which the mobile equipments could be put if they are subsequently replaced by fixed equipments—e.g., use of the mobile equipment as gap fillers.

12. NSA has recently been asked to begin some investigations on how the presently conceived Spacol effort could be complemented if a [redacted] It would be desirable that the development plan for Spacol specify to what extent this capability would complement the conventional Spacol capability in the event that the [redacted] collection platform should prove to be technically feasible at an early enough time.[20]

(U) DDR&E noted that some of this planning was under way, and added that the development plan had been discussed with Dr. [redacted] of the NSA Scientific Advisory Board. He had suggested that the appropriate NSASAB panel meet about the middle of January 1962 to advise NSA on submission of the engineering development plan. DDR&E concurred in the latter's advice and suggested that an initial review of the proposed development plan be held in March 1962. NSA was also encouraged to seek the cooperation and assistance of any other organization "capable of making substantive contributions to the NSA preparation of its development plan."

(U) The new Spacol Management Office had difficulty in finding satisfactory answers to some of the questions raised by DDR&E regarding the SSS program, and in obtaining the information needed to develop an adequate technical development plan. These difficulties appear to have been due both to the fact that some of the questions were inherently difficult to answer and to bureaucratic friction between the various organizations involved.[21]

~~(C)~~ R6 representatives visited NORAD headquarters early in February 1962 and briefed NORAD representatives on the status of the SSS program and plans. NORAD had heard that the program was being cut in the "real-time reaction" area and was concerned that its requirements would not be met. NORAD representatives indicated their concern regarding the matter of survivability in the event of an enemy attack in which NSA was destroyed, and they were considering setting up a small NSA-type operation in their underground Combat Operations Center (COC). NORAD was also particularly concerned with securing [redacted] from Bankhead sites [redacted] described in a Hughes Aircraft Company study, "Identification of Radiating and Non-Radiating High Altitude Vehicles." This study deemphasized the relative importance of analyzing [redacted] a cryptologic function that could be left to NSA.

~~(C)~~ The NSA representatives reported that NORAD's approach failed to appreciate that

even though they get immediate reporting . . . to build up the required amount of information for an inference on vehicle purpose, [redacted] Bankhead, [redacted]

The R6 representatives made a number of recommendations for NSA action including:

1. Prepare a draft NSA position on the desirability and feasibility of providing a small SIGINT processing element for NORAD underground COC (425L). In the absence of any official NORAD proposal, this position should not be forwarded, but some advance consideration is recommended . . . .

2. Inform NORAD of results of Bankhead site survey as soon as possible . . . .

3. Provide NORAD an explanation of present NSA capabilities for alternate routings of communications from Bankhead or other field Sigint sites to NORAD in the event of outage or destruction of the NSA Center . . . .

4. Make a current reappraisal of the desirability of having a permanent NSA Liaison Officer at NORAD, as suggested by JCS on 5 Dec 1960 . . . .

5. Pursue the NSA–NORAD mutual agreement requested by NORAD in June 1961 and recommended by ADP in his report of 27–28 July 1961

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TDY to NORAD so that detailed agreements on such matters as Spacol support can be keyed to an overall understanding . . .

6. NSA should ask USIB to pronounce on the validity and relative importance of the near-real-time reporting aspect of space surveillance requirements compiled by NORAD and accepted by JCS on 19 June 1961 (JCSM-415-61 and JCS 2283/137), in view of the effect subsequent DDR&E challenges to this concept are having on NSA's own planning . . . .

7. Ask NSA field activities (and SUSLO-L), which have not already done so to brief their respective unified or specified commanders on NSA's SSS plans and to ascertain any special requirements for space surveillance Sigint. (Their overall space surveillance requirements were expressed to NORAD 24-25 January 1961 and are included in the Spadats requirements study) . . . .[22]

~~(C)~~ The first NSA report on the "Status of Space Surveillance Sigint Planning" and "SPACOL Status Report-1 April 1962" was forwarded to DDR&E early in April 1962. In part, it reported that:

> Our principal efforts during the quarter just ended have concentrated on five areas: establishing a management approach, reviewing systems requirements, firming up site selection, collecting background information, and establishing system design criteria.
>
> Progress and achievement in this phase can be measured not in terms of hardware, nor by the volume of planning papers during the quarter, but rather by the greater measure of confidence achieved in the extent and limits of our knowledge in each area . . . .[23]

~~(S)~~ Planning for the SSS program and discussion of requirements had been confined to consideration of requirements for intelligence on Soviet space operations, but in May 1962 Production Group B also stated requirements as follows:

[redacted]

> 2. Consequently it is suggested that the mission of Bankhead and Stonehouse facilities as outlined in para. 2.a. of the referenced A4 D/F be amended as follows:
>
> [redacted]

(U) Dr. Fubini wrote DIRNSA early in May 1962 acknowledging receipt of the first SPACOL Status Report which he considered

> very informative in giving a broad general treatment of the subject, but it is not detailed enough in treating the specific problems as presented in DDR&E guidance letter, . . . in sufficient breadth or depth to allow us to go ahead with confidence on appropriation or obligation. Although the contracts and studies in-being mentioned in the report may cover all of the unanswered issues, their content is not embodied even summarily in this report and, therefore, we will need more information. This information must address itself to and be presented in the same format as the detailed DDR&E guidance, . . .
>
> We should like to emphasize the concern of this office with the statements made in the report which assume that Spacol is going to go ahead on the basis of the present knowledge. FY63 funds will be made available only upon presentation to DDR&E of an acceptable development plan; therefore, any commitment that may have implied the availability of these funds could bring about undesirable consequences. In this connection, it is requested that NSA provide us with written confirmation that all contracts issued to date on Spacol can be completed within the present (FY62) funds. Incremental funding is not considered to be a satisfactory answer to this question. The comptroller is being advised of our concern about these funds by a copy of this letter. The NSA report ... does not provide fiscal details that in any way recognize expenditure limitations that were placed upon Spacol by DDR&E. Our examination of the program indicates that discrepancies might easily exceed $100 million.
>
> . . . it is requested that NSA prepare an additional report on Spacol. This report should be a technical development plan prepared in accordance with the specific guidance from ODDR&E dated 20 December 1961, and should be submitted to ODDR&E on or before 10 June 1962 in order that we can determine our position on FY63 funding of Spacol.
>
> It is further requested that your report indicate the NSA manpower used to date, and that required to prepare the above report.[25]

(U) ~~(FOUO)~~ A note of 11 May 1962 from Dr. Louis Tordella, D/DIRNSA, to Mr. [redacted] commented regarding the above, ". . . I can readily see why Fubini got upset. Let's put more conditionals in our statements of what we plan to do." A memorandum was forwarded to DDR&E on 5 June 1962 assuring him that the apparent assumption in the first report that Spacol was in fact going ahead was made merely for planning purposes; that no contracts had been let specifically supporting Spacol; that a study contract under negotiation would be financed entirely from FY62 funds already available to NSA, and that no commitments extending into FY63 would be made until approved by DDR&E. The remaining material requested was to be forwarded separately by 10 June 1962, as requested, but that deadline was extended.[26] The proposed technical development plan was forwarded to DDR&E on 19 June 1962. When all or part of the plan had been approved, a secret, edited version was to be prepared for use by the participants in the program.[27]

~~(C CCO)~~ After reviewing this plan, DDR&E wrote DIRNSA on 14 August 1962 that:

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1. . . . The contents of the document are a good, broad and comprehensive treatment of the subject matter, with sufficient detail to analyze in depth the features of the proposed program. In this analysis, it appeared to us that several of the technical issues were not completely resolved, as was to be expected in view of the preliminary nature of the TDP. On the whole, however, the report is satisfactory, and furnishes a most appropriate basis for further guidance regarding the technical issues which we consider to require additional clarification in a modified TDP. . . .

. . . 3. Specifically the modified TDP should include some or all of the following provisions for further definition of the Spacol system characteristics, while preserving a well-balanced system capability:

a. Based on an anlysis of cost versus effectiveness, consider deleting Bankheads IV and V from the system, since, while they fulfill 16 percent of the system requirements, they also incur 25 percent of the cost.

b. Since Bankheads I and II upgrading is a cost estimate only representing 25 percent of the system costs with no clearly defined system improvement value, consider deferring this item until that time when value versus cost determination indicate that such action is necessary to maintain an adequate system capability.

c. Because missile-oriented capabilities are currently being used for space collection, consider planning for continuing utilization of that missile-oriented capability, and identify in detail that unique and nonoverlapping capability which will be furnished by the specifically provided equipment of the Spacol system.

d. Since user requirements can be fulfilled by combinations of various amounts and types of data, consider simpler, less costly alternatives for fulfilling NORAD requirements, specifically including procedural changes required to provide Spadats with Comint generated data.

4. . . . I am also concerned about the cost estimates for the Spacol system as described in the June report. It is noted there that the proposed program has associated with it a current cost estimate very close to the budgeted funding. In view of the historical fact that the initial planning estimates of cost are often considerably below final program costs, and to insure that the maximum funding of $40 million at Spacol system completion not be exceeded, it would be prudent to plan for a present base cost estimate substantially under the $40 million level.

It is not the intent of this constraint to set arbitrary funding limitation on the program; however, the impact of the revisions of the TDP you will make in consonance with paragragh 3 will undoubtedly have the automatic effect of substantially reducing the present cost estimate to a base planning figure of perhaps $25 million. In any case, program planning and the associated management and contractual arrangement must be undertaken so as to avoid final expeditures in excess of budgeted amounts.[28]

(U) It was also anticipated that NSA would be able to complete its revisions of the TDP in line with the above guidance not later than 7 September 1962, and that following receipt of the modified TDP, release of additional funds could be authorized.

(U) ~~(C)~~ NSA forwarded its proposed changes in the "SSS Technical Development Plan" to DDR&E about two weeks ahead of the indicated deadline. The proposed modifications, in effect, divided the program into two phases:

1. Phase I included the "add-on" items for Bankhead I, II, and V, Stonehouse I, and Bankhead III installations, and the NSA Processing Center. These items were to be undertaken immediately and their estimated total cost was $21,405,000.

2. Phase II included upgrading Bankhead I and II and the installation of Bankhead IV, and was to be deferred until FY65 when accurate cost data on Phase I would be available.

(U) ~~(C)~~ This approach provided a mechanism for funds control while maintaining a balanced system capability. It was pointed out "that 'cost' of the modification is a two-year delay in the Bankhead IV installation and one additional year of less productive operation of Bankheads I and II." No funds were to be obligated for Phase II without DDR&E approval, and NSA would furnish DDR&E a detailed funding summary covering Phase I and recommendations for Phase II by 1 June 1964. Further discussion of certain points requested by DDR&E was also enclosed.[29]

(U) On 18 September 1962, DDR&E approved FY63 RDT&E funds for Spacol, raising the total of funds approved from $37,343,400 to a total of $43,559,400, and releasing $6,216,000 for the Spacol project based on the technical development plan as modified on 23 August 1962.[30]

(U) ~~(C)~~ NSA discovered, however, that the reductions in Phase I included FY63 MCA (Military Construction Army) funds amounting to $1,285,000 for Bankhead I and $1,553,000 for Bankhead II—construction which could not be deferred from FY63 to FY65. Therefore, it requested that the authorization for Phase I be adjusted by adding these amounts to make the total for Phase I $24,183,000, with a corresponding reduction in Phase II. It pointed out that these adjustments could be made without exceeding the $25 million planning limitation imposed by DDR&E.[31]

~~(S)~~ The complete "NSA Space Surveillance Sigint, Technical Development Plan, September 1962" was approved on 20 September 1962. The changes approved by DDR&E had been incorporated. Primary Sigint objectives of the SSS program were stated as follows:

. . . To meet the aspects of space surveillance which Sigint is best able to fulfill. . . Space Surveillance Sigint objectives, to be met by monitoring signals from the space vehicles themselves, are:

Near-Real Time Reporting:

1. Time and estimated place of launch.
2. Nature, location, and probable purpose of vehicle.

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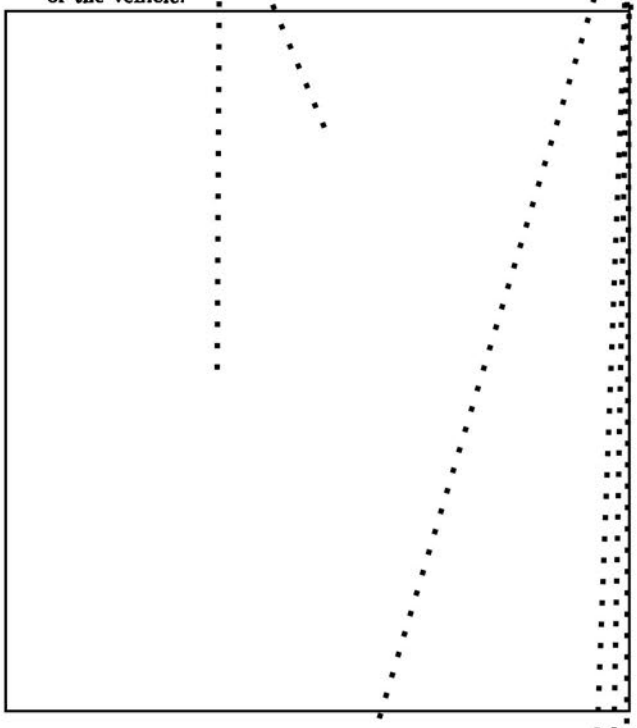
Continued Reporting (sampling or other basis):

1. To confirm or deny reported nature, purpose, and activity of the vehicle.



~~(C)~~ The technical development plan analyzed existing missile and space-collection sites and installations in terms of their potentials and limitations in relation to known space-collection requirements. Proposed SSS facilities were similarly evaluated. The results, so far as the SSS program was concerned, were summarized in a table showing "Estimated Relative Value of Proposed SSS Facilities." (see Figure 1.) Phasing charts for the Bankhead and Stonehouse I systems covering the period FY62 to FY67 were also included (see Figure 2.). After the [redacted] installations at Bankhead sites I and II were completed, the next major improvements would occur about eighteen months later, when the Bankhead III and V sites would become operational. [redacted]

~~(S)~~ It was expected that a major improvement in the speed with which intelligence could be derived from telemetry intercepted by Bankhead I and II could be secured by on-site processing and analysis of telemetry [redacted] see Figure 3.). A developmental model of a facility for producing "quick-look" analogs was to be installed at Bankhead II [redacted] shortly after installation of the basic collection system during the winter, and a similar facility added to Bankhead I early in 1963 (Figure 4 is a Bankhead system diagram).

(U) The Stonehouse system was patterned after the NASA deep-space instrumentation facility (DSIF) since the data to be collected was similar (Figure 5 is a Stonehouse system diagram).

SSS Management Program (U)

(U) ~~(C)~~ Planning and implementing the SSS program were to be directed and coordinated by NSA while specific responsibilities were divided among NSA, the service cryptologic agencies, other government agencies and private contractors, with due regard for limitations on resources and the special talents available and needed. It was expected that there would be one system contractor for the Bankhead system, and another for the Stonehouse system. The service cryptologic agencies were to participate in system procurement to the

> extent necessary to allow them to conduct the training, provisioning and construction activities for which they will be responsible.[32]
>
> Detailed site selection, provision of adequate real estate, structures, and support facilities will be accomplished by the appropriate service cryptologic agency under the guidance of NSA. . .

Communications were to be provided by the Defense Communications Agency, based on requirements submitted by NSA.

(U) NSA was to provide each of the SCAs with a statement of the number and type of operational personnel required per shift, and the SCAs were to apply appropriate manning factors and provide the necessary personnel. Telemetry and signal analysts were to be furnished by NSA (see Figure 6.)[33]

(U) ~~(C)~~ It was pointed out that many of the people would require extensive training in advance of their assignment to one of the SSS sites. It was expected that the service technical schools would provide basic training courses for operators and maintenance personnel and that NSA would provide advanced or supplementary training where required. There would be on-the-job training (OJT) in missile and earth-satellite tracking at established tracking stations in the zone of the interior. Initial assignees to Bankhead and Stonehouse stations would be given OJT by the system contractor at his plant before shipment of the equipment overseas.

(U) ~~(C)~~ Three classes of funds—Military Construction Appropriations Defense Agency (MCDA), Procurement Appropriation Defense Agency (PDA),

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and Research, Development, Test and Evaluation (RDT&E)—were required for the SSS program (see Figure 7.). Technical difficulties in siting Bankhead IV made it necessary to replace $1,675,000 of MCDA funds requested for FY63 with an estimated $5 million in FY65 funds. PDA funds were needed for procurement of commercially available collection and processing equipment, for [redacted] Bankhead IV and V, for spares for one year after installation, and for handling charges, etc. RDT&E funds were necessary to cover the systems engineering and development effort. Specialized training costs were met by internal programming within O/M budgets.[34]

PERT Adopted (U)

(U) ~~(C)~~ The PERT (program evaluation review techniques) system was adopted for management control in the development of the SSS program. In addition to time-oriented networks already prepared, the system included: time-scaled networks for each Bankhead and Stonehouse site; monthly inputs of time changes; and use of a computer to identify critical paths and distribution of analysis information.[35]

Space Sigint Requirements (U)

~~(S)~~ In the spring of 1963 NASA wrote NSA to confirm its hope that NSA might be able to collect and exploit data transmissions from Soviet lunar spacecraft before they could be obtained from NASA's own lunar exploration program. The data would be of great value in the Apollo manned lunar landing program. A statement of NASA's data collection requirements was enclosed, and it was noted that these would also be levied on the intelligence community through GMAIC (Guided Missile and Astronautics Intelligence Committee).

> . . . NSA has primary responsibility for the collection of such data transmissions, it is desirable that you consider this problem area immediately. The NASA would appreciate receiving a proposed ground instrumentation support plan for meeting these requirements from NSA and your comments on the enclosed requirements.
>
> In connection with the instrumentation support plan, the NASA reviewed your 'Space Surveillance Sigint (C) S144037 Technical Development Plan,' dated September 1962. The plan generally appears to be capable of meeting the NASA requirements except in respect to the timing of certain facilities. It is evident that the proposed 85-foot diameter antenna at Asmara is a key facility for obtaining proper support of the NASA requirements. The availability of this installation at the earliest possible date would be highly desirable, even if the facilities are activated on a subsystem basis.
>
> . . . 4. In summary the tentative NASA views are:
>
> . . . c. The use of existing [redacted] facilities on an interim basis and the optimizing of the capabilities of the 40-foot antennas in [redacted] should be examined in detail.
>
> . . . d. The proposed NSA facility at Asmara should be accelerated. The NASA is willing to assist the NSA in this regard, if desired by the NSA.[36]

~~(S)~~ Representatives of CIA, DIA, and NSA met on 24 July 1963 to discuss Sigint space-collection plans and related intelligence requirements. During this discussion an NSA representative pointed out that, even when the Interim Deep-Space Facilities Plan was fully implemented, it would provide primary [redacted] in the plan. Dr. Wheelon, CIA, mentioned that there were other facilities which could possibly contribute to our collection capability, and that in his discussion with Dr. Fubini it appeared that DOD might not have realized the full impact on the intelligence community caused by deletion of Bankhead IV and Stonehouse II and III from the SSS program. Dr. Wheelon said that he would recommend to the DCI that "the door be left open on CIA's review of that portion of the Combines Cryptoloic Program dealing with space, pending the results of further study of space intelligence requirements." It was also decided that CIA and DIA representatives would draft a proposed letter for NSA to send to USIB stating that NSA had not received space intelligence requirements covering the period through 1970 and requesting that USIB prepare such requirements and indicate their priority compared with other requirements previously submitted.[37]

~~(S)~~ In the fall of 1963 representatives of CIA, DIA, CCPC (Critical Collection Priorities Committee), GMAIC and NSA concluded that USIB had not defined intelligence requirements to be levied on NSA well enough to allow it to develop a national plan for space collection. They pointed out that, since the cost of space collection was extremely high, NSA could not obtain adequate funds and other support unless USIB's specific needs were spelled out in detail. NSA requested, therefore, that USIB develop such requirements and give them to NSA for use in determining if existing plans were adequate. If plans were inadequate, NSA was to notify USIB and submit to OSD a proposal for augmenting resources. Two other studies of missile and space intelligence were also then under way: a DOD-wide review addressed primarily to the efficiency and responsiveness of collection and analytic

efforts, and a full-scale evaluation of the total effort against the Soviet missile and ESV problems.[38]

SSS Program Priorities and Funding (U)

(U) ~~(C)~~ Early in November 1963, NSA submitted a "Bankhead I and II Upgrading Funding Summary" to DDR&E at the latter's request, but pointed out that the indicated priorities and line item costs might change by the time the "SSS Phase II Funding Plan" was submitted, as required by DDR&E, prior to 1 June 1964. This material was for use in connection with the DOD FY65 budget review. Specific projects were listed in priority order for FY65 and FY66. NSA predicted that some of the lower priority projects listed for FY66 would not be completed as part of the SSS program either because the need proved to be insufficient or because they could be deferred. Also, although there would be benefits from accomplishing some of the higher priority FY66 projects in FY65, it was believed that the scheduling was reasonable and that funding for Bankhead I and II in FY65 should remain at the current level of $2,995,492.[39]

Program Review, April 1964 (U)

~~(C)~~ In April 1964, NSA forwarded to DDR&E a review of the first eighteen months of the "Space Surveillance Sigint Program (Phase I)." This document attempted to update the "SSS Technical Development Plan" of September 1962 by identifying the more significant necessary departures from the plan, and the reallocation of funds within the approved total of $40 million.

> It was anticipated that some of the detail of the TDP would have to be changed to meet the impact of new conditions. Problems created by changing requirements, dollar limitations, gold flow restrictions, the impact of foreign policies and technological adjustments in system design have been met by responsive and realistic solutions.[40]

(U) ~~(C)~~ The SSS program was progressing in accordance with the approved plan; three major system contracts had been awarded for Stonehouse, Bankhead III and Bankhead V equipments. Complete fabrication of Stonehouse and Bankhead V equipment was expected within six months; the Bankhead III contract had been awarded several weeks earlier and was expected to be completed on schedule. Stonehouse construction was expected to be about five months late, because of local political complications, and might be further delayed because of local land acquisition problems. The only significant change in system design reported was the addition of a 150-foot antenna (Bayhouse) to Stonehouse. It was predicted that the SSS program would be completed within the approved $40 million ceiling.

(U) Hardware fabrication had been left largely to commercial contractors while design of advanced subsystems was assigned to the NSA R/D Organization.

(U) ~~(C)~~ The Stonehouse contract was awarded to Radiation, Incorporated, of Melbourne, Florida on 1 August 1963, as the low bidder of two firms. Five companies were solicited on the Bankhead III contract, and the contract was awarded to Ling-Temco-Vought of Greenville, Texas on 12 March 1964. The Bankhead V contract was awarded to Sylvania Electronic Systems-West, on 15 July 1963, on a sole-source basis because it was believed that the construction to be acomplished under severe weather conditions at this site did not allow the time required for competitive bidding.

(U) Each purchase description included a "work package" approach by which all the work was divided in accordance with PERT cost techniques into units which readily could be compared, and which made regular reporting and contract supervision easier and more effective. Fixed-price incentive contracts were used, since only a small amount of development work was involved in each contract.

(U) ~~(C)~~ The original TDP concept of communications support was retained; it included duplex links from the collection sites to the NSA Operations Building and between sites. Technical data could be exchanged and raw intelligence data could be forwarded to NSA at a rate of 100 words-per-minute. Since there was no requirement for field computers to have direct input to an agency computer, there was no need for transmission of digitized data, although it was expected that the communications system would be able to provide such service. Since the Army provided some terminal equipment from its own resources, and some planned high-speed teletype equipment could not be procured for timely installation in the Bankhead circuits, the cost of communications support for the SSS program was only $302,000, instead of the $540,000 programmed.

~~(C)~~ The remote locations of the Bankhead and Stonehouse sites, the size and weight of the equipment components, the contractual requirements for GBL (government bill of landing) delivery, and the installation schedules specified in each individual contract, required that careful attention be given to the

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transportation of each system from the CONUS. The Bankhead I and II systems were transported by rail, water and air to [redacted] and under then existing DOD policies, no charges were made to NSA for this service. Add-on equipment for those sites was airlifted.

~~(S)~~ The Bankhead III system was shipped by water; provision was made for this in the contract and paid for by NSA. Shipment of Bankhead V equipment had to be phased to avoid the winter weather in [redacted] Initially, air transportation from Moffet Naval Air Station, close to the contractor's plant at Mountain View, California was planned, but shipment by water was found to be better. The ideal appeared to be to use a small, chartered vessel directly from the West Coast to [redacted] f the system check at the contractor's plant, the contractual installation schedules, and the weather permitted, water transport was to be used.

(U) The largest and most expensive transportation problem concerned the Stonehouse system, especially the 150-foot and 85-foot dish antennas. Moving all the equipment overland from the port of Massawa to Kagnew Station posed unusual difficulties. Costs were estimated at $787,500, which included $250,000 for the ship charter, $425,000 for a cartage contract to supplement Kagnew Station motor pool facilities, haulage for the large antennas in the CONUS, and shipment of vehicles for use between Massawa and Asmara.

(U) Funds required for data processing equipment for the SSS program center at the Operations Building, Fort Meade were rather drastically reduced from an estimate of $2,540,000 in FY64 funds to $579,000 in FY65, plus $302,000 in FY64. These reductions were made because some of the equipment was not needed and other equipment having wider application was purchased from other funds.[41]

Notes

[1](U) Memorandum from Director, NSA for DDR&E, Serial: N 0920, "Space Surveillance Development Planning," 15 Mar 1961.

[2](U) (FOUO) M/R from [redacted] Chief, Aneq, to Messrs. Barlow and Conley, "Discussion of Spexpro," 3 Mar 1961; ~~(C)~~ Message from DIRNSA to COMUSAFSS, HDNAVSECGRU, CUSASA, SSSPB 1001/61, AGO 03100/31, 31 Mar 1961; (C) D/F from Deputy Director to AG, "Establishment of the Space Surveillance Sigint Planning Board (SSSPB)," 31 Mar 1961.

[3]~~(C)~~ D/F from SSSPB to Deputy Director, NSA, "SSSPB Draft Funding Plan for Space Surveillance Sigint," 27 April 1961, and attached Draft, p. 2.

[4](U) M/R from R.O. Alde, K3 (Sind) for Howard C. Barlow, Deputy ADRD, "Validity of Requirements of the SSSPB Plan," 22 May 1961.

[5](U) RDT&E Task Report, "Benson," Regulation No. 06-01, 3 Aug 1961, p. 4.

[6](U) (FOUO) Memorandum (transmitting questions and proposed replies) from SSSPB, Guy H. Stephens to Director, NSA, "Fubini Questions," 15 June 1961, with inclosure.

[7](U) (FOUO) Memorandum from SSSPB, Guy H. Stephens to Director, NSA, "Fubini Questions," 15 June 1961; (U) M/R by [redacted] Jr., and Melville J. Boucher, SSSPB, "Meeting 4 August 1961 with ... Dr. Fubini...," 7 Aug 1961.

[8]~~(C)~~ Memorandum from Director, NSA to DDR&E, Serial: N 2006, "Space Surveillance Sigint Program," 31 July 1961, with two inclosures and M/R by A.W. Rose, 27 July 1961.

[9](U) *Ibid.* The M/R to the NSA memorandum to DDR&E states, "3....The SSSPB members are not completely in accord with this memo, feeling that it should give more support to Plan B." NSA took a safe, tactical position without committing itself regarding the validity or urgency of the requirements Plan B was intended to meet.

[10](U) (FOUO) M/R by [redacted] Jr. (R SSSPB member and Melville J. Boucher, A41 SSSPB member), "Meetings, 4 August 1961 with ..., Dr. Fubini...," 7 Aug 1961.

[11](U) (FOUO) M/R by [redacted] R022, "Discussion with Dr. Fubini," 19 Sept 1961.

[12](U) (FOUO) M/R by Guy H. Stephens, Chairman, SSSPB (unsigned and undated), but attached to draft memorandum from Director, NSA to M-6, "Continuation of SSSPB," 4 Aug 1961.

[13]~~(C)~~ M/R by [redacted], and M.J. Boucher, SSSPB, "Space Surveillance Sigint [SSS] Meeting 1 Nov 1961...," 2 Nov 1961; (C) Memorandum from Director, NSA to DDR&E, Serial: N 2468, "Space Surveillance Sigint Program," 6 Nov 1961.

[14]~~(C)~~ "Outline of Proposed Programs for Space Surveillance Sigint," 6 Nov 1961.

[15](U) *Ibid.*

[16](U) *Ibid.*

[17](U) (FOUO) M/R by R.O. Alde, K3, "Preparation of Detailed R/D Plans for Collection System of Spacol," 27 Nov 1961; (U) M/R by [redacted] Jr., K12, "Status of Spacol," 5 Dec 1961; (U) Memorandum from Director, NSA to ADN, ADP, ADRD, ADC, ADMS, "Spacol Planning and Programming," 4 Dec 1961; (U) D/F from ADN to ADP, ADRD, ADC, ADMS, "Spacol Planning and Programming," 5 Dec 1961; (U) Memorandum from Harold Brown, OSD, DDR&E to Director, NSA, "Spacol," 20 Dec 1961.

[18](U) D/F from Director, NSA to ADN, ADP, ADRD, ADMS, "Establishment of the Spacol Management Office," 15 Dec 1961; (U) Memorandum from D/ADRD to ADN, ADP, ADMS, and C/Group C, "Responsibilities of the Spacol Management Office (R3)," 19 Dec 1961. While the numerical designator for the new office was announced as R3, this was almost immediately changed to R6.

[19](U) Memorandum from Harold Brown, OSD, DDR&E to Director, NSA, "Spacol," 20 Dec 1961.

[20](U) *Ibid.*

[21](U) (FOUO) D/F from R3 (later R6) to C12, "Spacol Background Questions," 13 Feb 1963; (U) D/F from C12 to R6, "Spacol Background Questions," 8 Mar 1962; (U) Memorandum from [redacted] R6, to NSASAB Communications Panel, "Spacol Development Plan," 21 Feb 1962.

[22](U) (FOUO) [redacted] and M.J. Boucher, "Report on TDY to NORAD, 6 Feb 1962," R6 to Chief R6, 12 Mar 1962.

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[23](C) Memorandum from NSA to DDR&E, Serial: N 0543, "Status of Space Surveillance Sigint Planning," 3 April 1962 with inclosure, "Spacol Status Report–1 April 1962," with TS–controlled supplement.

[24](C) Comment No. 2 from Group B to C1, "Role of Spacol in Overall Elint Collection Scheme," 9 May 1962.

[25](U) Memorandum from D/DDR&E to Director, NSA, "Spacol," 4 May 1962.

[26](U) Memorandum from NSA (ADRE) to DDR&E, Serial: N 0793, "Spacol." 5 June 1962.

[27](C) Memorandum from NSA (ADRE) to DDR&E, Serial: N 0962, "Space Surveillance Sigint Technical Development Plan," 19 June 1962.

[28](U) Memorandum from DDR&E to Director, NSA, "Spacol Technical Development Plan (TDP)," 14 Aug 1962.

[29](U) Memorandum from NSA to DDR&E, Serial: N 1320, "Spacol," 23 Aug 1962.

[30](U) Memorandum from DDR&E to Director, NSA, "Approval of FY63 NSA RDT&E Program for Spacol," 18 Sept 1962; (U) Memorandum from DDR&E to Director, NSA, "Spacol," 8 Oct 1962.

[31](C) Memorandum from Director, NSA, to DDR&E, Serial: N 1495, "Spacol–Revised MCA Funding Schedule for Bankhead I and II [redacted]," 4 Oct 1962. The term "SSS Program" is used to refer to the specific $40 million program approved by DOD and means "Space Surveillance Sigint Program."

[32](C) NSA, "Space Surveillance Sigint, Technical Development Plan," Sept 1962, pp. 115–16.

[33](U) *Ibid.*, p. 116.

[34](U) *Ibid.*, p. 121. *See also* Appendices, pp. 125 ff. including particularly: I, National Objectives and Requirements, pp. 125–6; II, USIB Requirements for SSS, p. 127; IV, NSA Support for NORAD Spadats, pp. 138–40; V, Requirements for Timeliness, pp. 141–3; IX, Present Collection Sites, pp. 186–91, XV, Site Selection, pp. 199.

[35](C) "Space Surveillance Sigint Quarterly Report," 1 Oct 1962.

[36](S) Letter from Robert C. Seamans, Jr., Associate Administrator, NASA, to Lieutenant General Gordon A. Blake, USAF, Director, NSA, 27 Mar 1963. [*Ed. Note:* Subject line not known because correspondence could not be located.]

[37](C) M/R by B.K. Buffham, "Space Collection Discussion with CIA and DIA," 12 Aug 1963.

[38](C) Memorandum from Director, NSA, for USIB, Serial: N 1523, "Space Intelligence Collection," 9 Oct 1963 with M/R by B.K. Buffham, EADP, 8 Oct 1963.

[39](U) (C) Memorandum from NSA (ADRE) for DDR&E, Serial: N 1662, "Bankhead I and II Upgrading Funding Summary," 7 Nov 1963.

[40](C) Memorandum from NSA (ADRD) to DDR&E, Serial: N 0457, "Review of Space Surveillance Sigint Program," 9 Apr 1964, with inclosure, "Space Surveillance Sigint Review," 1 Apr 1964.

[41](U) *Ibid.*

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Facility	Value (% of Total)	Basic Reasons for Value
Stonehouse I (Asmara)		
	100%	Space probe and high ESV coverage.

*This total for field sites is still only 80% of the task; NSA SMAC and gap-fillers supply the rest.

Figure 1
Estimated Relative Value of Proposed SSS Facilities.
(Figure is ~~SECRET CCO.~~)

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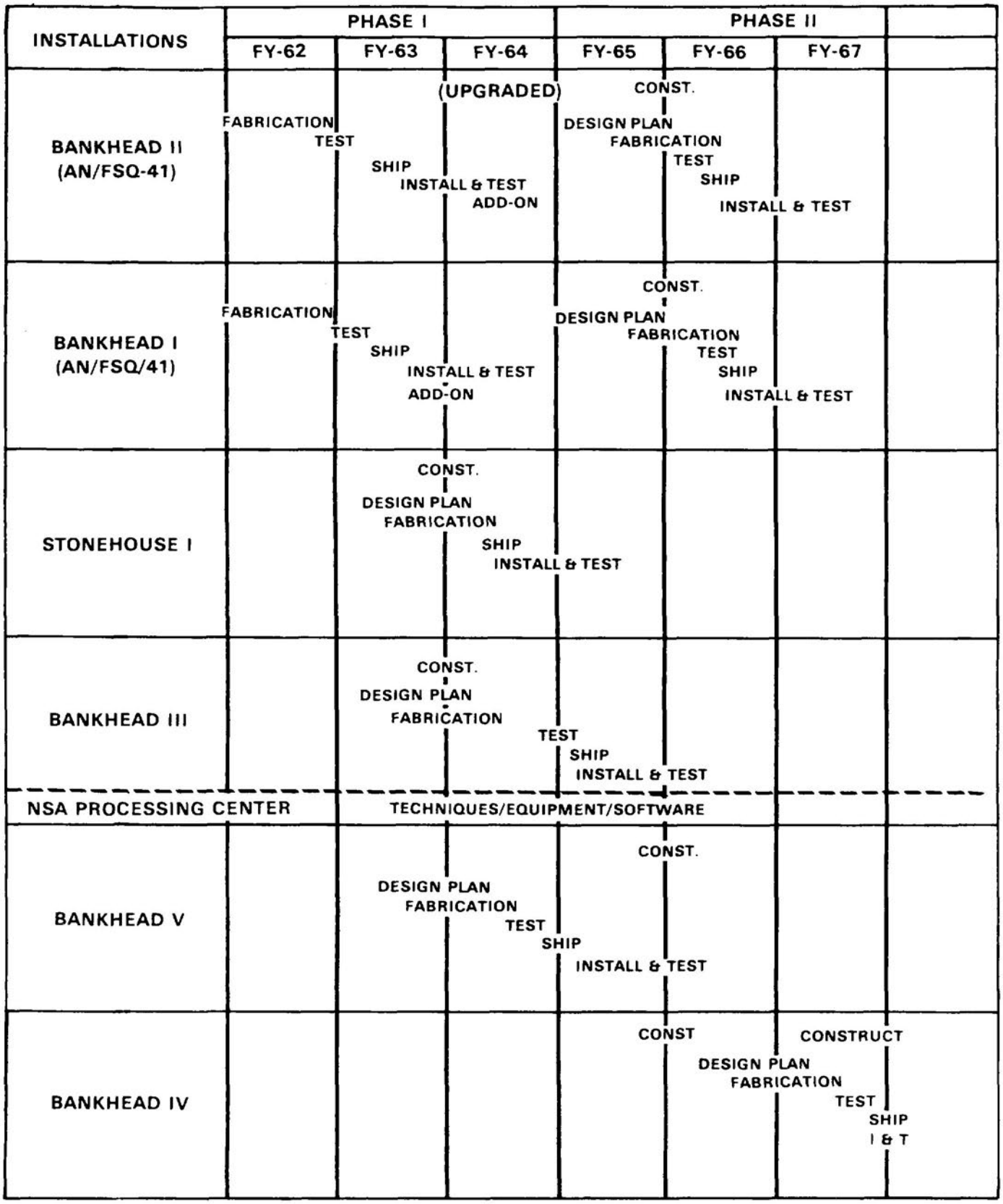

Figure 2

Planned Bankhead and Stonehouse System Phasing (September 1962).

(Figure is UNCLASSIFIED.)

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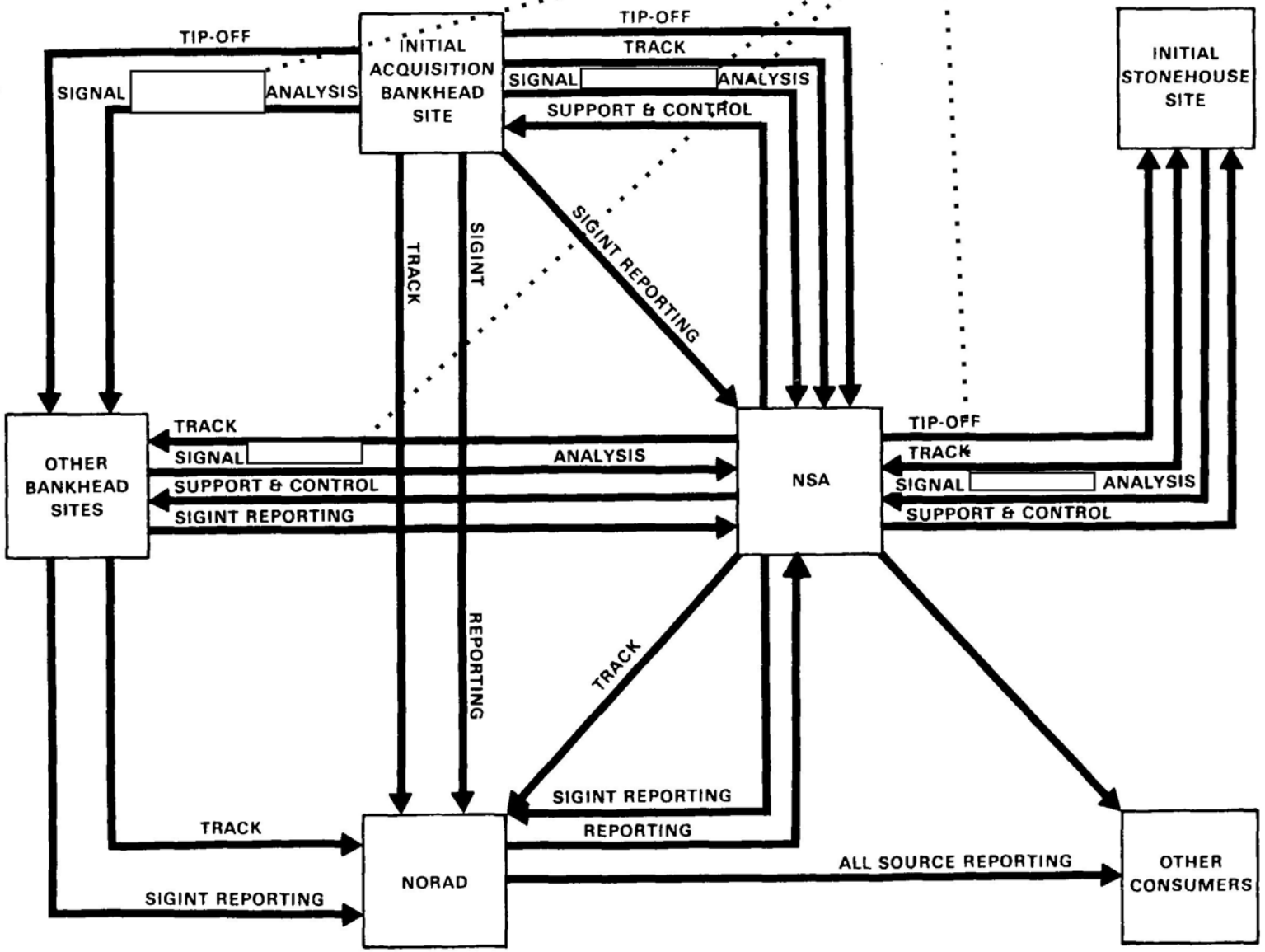

Figure 3
Control and Data-Flow Diagram.
(Figure is ~~SECRET CCO.~~)

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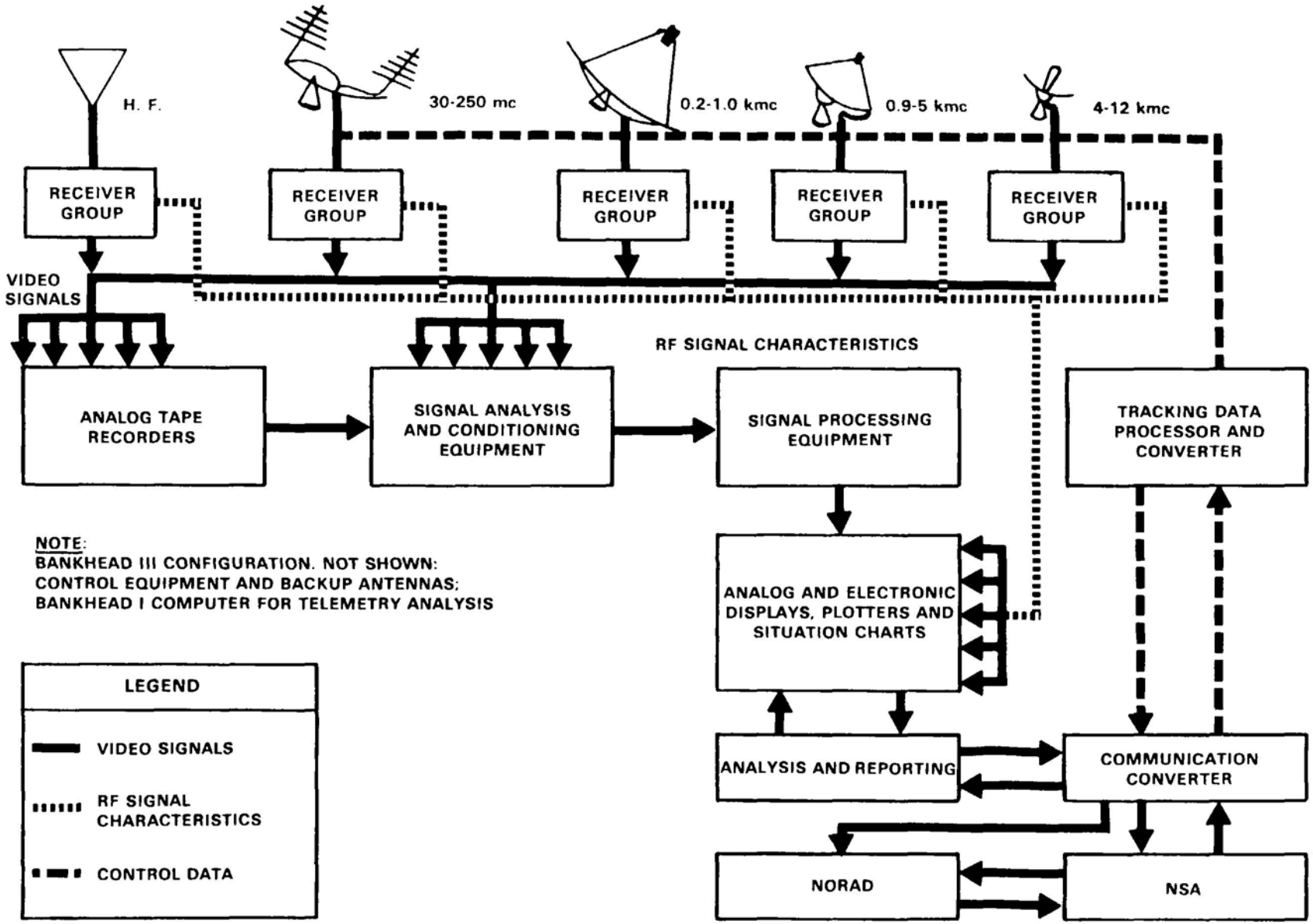

Figure 4

Bankhead System Diagram.

(Figure is ~~CONFIDENTIAL~~.)

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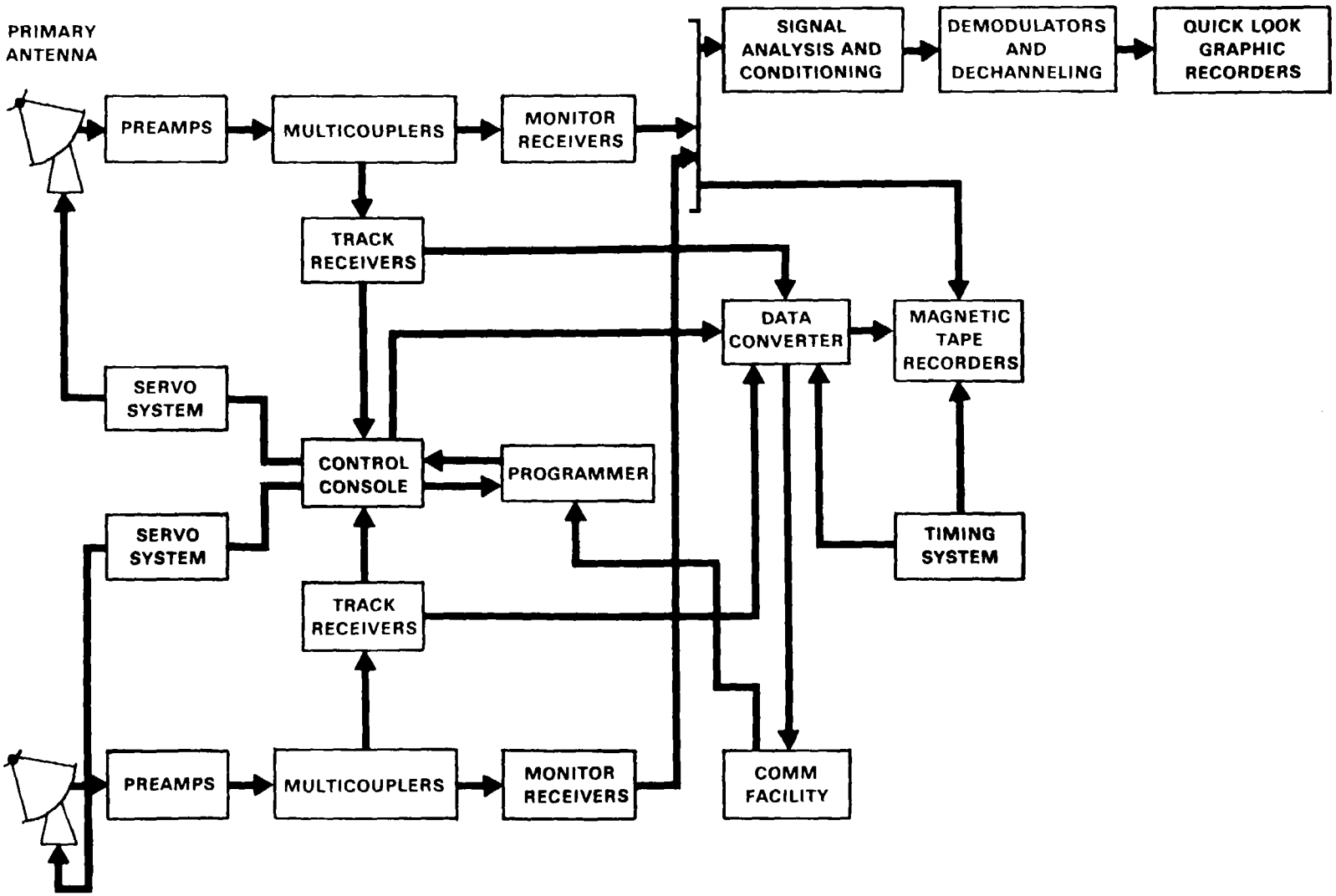

Figure 5
Stonehouse System Diagram.
(Figure is UNCLASSIFIED.)

INSTALLATIONS	INTERIM (FY64)	INTERMEDIATE (FY65)	FINAL (FY67)
1. **Bankhead I** (AN/FSQ-41)	AFSS ..... 73 T-R ..... 12 NSA 3	AFSS ..... 73 T-R ..... 12 NSA 3	See item 5
Bankhead II (AN/FSQ-41)	ASA ..... 73 T-R ..... 3 NSA 3	ASA ..... 73 T-R ..... 3 NSA 3	See item 5
2. **Stonehouse I**	—	ASA ..... 24 T-R ..... 5 NSA 2	ASA ..... 120 T-R ..... 3 NSA 19
3. **Bankhead III**	—	ASA ..... 120 T-R ..... 3 NSA 19	ASA ..... 120 T-R ..... 3 NSA 19
National Processing Center	NSA 41	NSA 51	NSA 51
4. **Bankhead V***	—	T-R 25	T-R 25
5. **Bankhead I** Upgraded	—	—	AFSS ..... 118 T-R ..... 12 NSA 19
Bankhead II Upgraded	—	—	ASA ..... 116 T-R ..... 12 NSA 19
6. **Bankhead IV**	—	—	AFSS ..... 30 T-R ..... 5 NSA 4
TOTALS	73	217	280
ASA	73	73	148
AFSS	15	23	37
T-R**	47	78	114
NSA			
Grand Totals (Cumulative)	208	391	559

*Not included in personnel totals.
**Contact technical representatives and/or engineering personnel.

Figure 6
Personnel Manning Table (September 1962).
(Figure is UNCLASSIFIED.)

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	INSTALLATIONS IN PRIORITY ORDER	MCDA*	PDA**	RDT&E	TOTALS BY INSTALLATION	CUMULATIVE TOTALS (000 omitted)
	1. Bankhead I Add On	$ —	$ 308	$ 247	$ 555	$ 555
	Bankhead II Add On		584	301	885	1,440
PHASE I	2. Stonehouse I	431	3,389	1,731	5,651	7,091
FY63–64	3. Bankhead III	1,392	4,697	2,456	8,545	15,636
	NSA Processing Center	—	1,620	920	2,540	18,176
	4. Bankhead V	—	2,363	866	3,229	21,405
	Phase I Total	1,823	13,061	6,521	—	—
PHASE II	5. Bankhead I Upgrading	1,225	3,897	711	5,833	27,238
FY65–67	Bankhead II Upgrading	1,553	2,834	515	4,902	32,140
	6. Bankhead IV	5,000	2,363	286	7,649	39,789
	Phase II Total	7,779	9,094	1,512	—	—
FUTURE***	7. Stonehouse II	1,515	3,589	635	5,639	45,428
	8. Stonehouse III	929	3,489	635	5,053	50,481
	Future Total	2,444	6,978	1,270	—	—
	Grand Totals	12,045	29,133	9,303	—	—

*Military Construction Appropriation Defense Agency.
**Procurement Appropriation Defense Agency.
***Items 7 and 8 are shown for future planning purposes only.

Figure 7
Bankhead and Stonehouse Funding Estimate (September 1962).
(Figure is UNCLASSIFIED.)

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CHAPTER III

Constructing and Equipping the Stations (U)

Bankhead I and II (U)

~~(C)~~ Construction at the Bankhead I site [redacted] was delayed by an order to suspend overseas defense construction that would increase the drain on U.S. monetary gold reserves. Operators for the [redacted] equipment were trained at HQUSAFSS, but the construction hold-order delayed equipment familiarization at the contractor's plant, and additional training was given to fill in the delay.[1]

(U) ~~(C)~~ Installation at Bankhead I was planned for the fourth quarter of FY63 and the station became operational in August 1963 (first quarter of FY64).

[redacted]

(U) ~~(C)~~ Construction of the Bankhead II site at [redacted] progressed on schedule. Generators installed for emergency power were used as the primary source until a frequency converter plant could be completed in the spring of 1965. Requirements for a signals' [redacted] analysis position were prepared, but the choice of a small computer (Scientific Data System's [SDS] 910) for handling tracking data had to await completion of operational analysis studies for tracking data handling and tracking errors.

~~(S)~~ Bankhead II was scheduled for installation during the second quarter of FY63 and the station became operational in February 1963 (third quarter FY63). The Bankhead II site was suitable for

[redacted]

~~(S)~~ Interim add-on equipment for Bankhead I and II was a priority action in Phase I of the TDP. It was intended to provide additional target acquisition capabilities, improved signals analysis, better recording equipment, increased tracking data-processing capabilities, and to extend frequency coverage. The improved equipment at each site included:

1. Two Mosely x-y plotters to aid in acquisitions of the ESVs.
2. Mincom CM-114, fourteen-track recorders to replace the old seven-track models.
3. [redacted]
4. A signals [redacted] analysis position to aid in new signal identification and proper operation of collection and recording equipment.[4]

(U) ~~(C)~~ Bankhead I also had an SDS-910 tracking data processor which expanded or condensed antenna-pointing information and provided more efficient and accurate transmission of tracking data over teletype circuits. Bankhead II was to receive this equipment during the summer of 1964.

~~(S)~~ NSA developed plans for further upgrading Bankhead I and II as part of Phase II of the SSS program for FY65 and FY66. The upgrading was to be accomplished simultaneously with the move of the AN/FSQ-41(V) from vans to permanent space in the new operations area at each site. Wornout and obsolescent equipment was to be replaced as necessary. Preliminary planning for Phase II improvements included:

(1) Improved photo readout system.
(2) Improved analog decommutation.
(3) [redacted]
(4) Replacement of obsolescent preamplifiers and multicouplers.
(5) Replacement of the low-band track receiver with one which was less complex and could be more easily maintained. Provide VHF search receivers with an electronic scanning capability.

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(6) Video demodulators and displays.
(7) Servo system redesign.
(8) Additional frequency coverage (Bankhead I only).
(9) Additional display units.
(10) Multiple target capability (Bankhead I only).
(11) High-band antenna replacement, if required.
(12) Low-band antenna replacement, if required.
(13) Doppler tracking system.
(14) [redacted] telemetry readout unit.
(15) Improvements in signals' [redacted] analysis equipment.
(16) Integration of the track data processor with the existing data handling system, AN/FSQ-41(V).
(17) Standard multiplex system for use with the CM-114 recorder.
(18) Field analog reproduction facility.[5]

(U) ~~(C)~~ When the provisioning and logistic support for Bankhead II broke down, USASA and NSA acted together to identify the underlying causes, initiate immediate remedies, and review existing and proposed procedures to prevent a recurrence of the breakdown. The two major contributing factors identified were: (1) inadequate supply procedures, and (2) poor reporting from the site to USASA/NSA. The supply procedures were improved to eliminate unnecessary handling, provide expeditious processing of priority requests and shorten procurement time by use of an open-end support contract. The status reporting problem was solved by establishment of a semimonthly report from each site to regional and command headquarters to NSA and to the other sites covering all technical, maintenance, and supply problems.[6]

(U) ~~(C)~~ NSA and the user agencies (USASA and USAFSS) tried to prevent recurrence of the supply problems at other SSS sites by joint and periodic reviews of all manuals, parts documentation, and provisioning. NSA expected that these efforts, together with proper supply procedures, would permit normal supply channels to support the SSS systems. ASA and AFSS were assuming full engineering support for the AN/FSQ-41(V), but NSA continued to participate in these support activities to insure the fullest utilization of the interim capability and to insure proper feedback of experience and know-how in the upgrading phase of other SSS sites.[7]

(U) ~~(C)~~ There was a serious RFI (radio frequency interference) problem at Bankhead II [redacted] and efforts were made to overcome this problem by use of suitable filters.

(U) ~~(C)~~ Bankhead I was authorized 73 military operating personnel and 13 contractor maintenance personnel for 24-hour operations. Bankhead II was authorized 77 military operating, maintenance, and support personnel and 3 contractor maintenance personnel for 16-hour coverage. Each station was also authorized two NSA analysts. Increases in manning requirements were expected as a result of expanded coverage, the increased capability of the Bankhead I and II systems, and provision of a full 24-hour analytic capability.

(U) ~~(C)~~ Preliminary training on the AN/FSQ-41(V) was provided by the contractor (Collins Radio) at Dallas, Texas prior to field installation of the system. Subsequent training requirements were satisfied by OJT programs on site. To train additional military personnel, NSA established a training program in FY65 and FY66. It was expected that other operating and maintenance training requirements would be satisifed through the system contract, at service schools, or by normal OJT training.[8]

(U) ~~(C)~~ Additional military construction was also needed at each site to house the add-on equipment. Four extra vans temporarily were used at Bankhead I, and a "Butler hut" at Bankhead II. Permanent buildings for both Bankhead I and II were planned for Phase II of the SSS program.

~~(S)~~ Equipment to aid in the readout of [redacted] signals was under development in 1962 as part of the general R/D program supporting the missile and space programs. Specifications and a purchase order were prepared to purchase two of these equipments (Tadds) for use as part of the Bankhead III exploitation system. NSA/RD also surveyed the current state of the art in [redacted] readout systems to determine what equipments were best suited for an improved system. Other efforts to improve techniques and electronic equipments to make signal handling and analysis more automatic were also under way (see Figures 8 and 9.).[9]

Bankhead III (U)

~~(C)~~ Bankhead III was collocated with [redacted] (see Figure 10), where installation and testing of the system was to have been completed during the third quarter of FY65. Slippage in obtaining the preferred site and the decision to expedite Bankhead V procurement delayed award of the system contract for Bankhead III. It was awarded to Ling-Temco-Vought, Inc., LTV Temco Aerosystems Division, Greenville, Texas on 13 March 1964. It provided for the following contract parameters:[10]

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Target cost	$4,580,000
Target profit	400,000
Target price	4,980,000
Ceiling price	5,496,000
Spread	516,000
Sharing formula	85/15%
GFE	$ 536,000
Final system contract	7,368,000
Construction	2,036,000
	$9,940,000

Bankhead IV (U)

(U) ~~(C)~~ The Bankhead IV site was planned for [redacted] but the fact that no existing military base could be used raised the probable construction costs to about $5 million (total costs were estimated at $9 to 10 million). That was considered disproportionately high for the site's anticipated productivity. It appeared to have the lowest potential intelligence return in relation to investment. When the [redacted] study also indicated a higher equipment cost per site for the SSS program, it was decided to drop the Bankhead IV system in order to remain within the $40 million program ceiling established by DOD. The Bankhead IV requirement was subsequently met by the equipment installed at [redacted] in May 1967 for the Anders project (see Figure 11).[11]

Bankhead V (U)

~~(C)~~ By the spring of 1963 it became apparent that the only feasible method of meeting the scheduled operational date for Bankhead V, where [redacted] installation problems threatened to cause a seven- or eight-month slippage, was to negotiate a sole-source contract with the Bankhead study contractor. Since Bankhead V was to be the "only extensive space surveillance Sigint facility [redacted] this action to expedite procurement was considered justified.[12]

[redacted]

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[redacted]

(U) ~~(C)~~ A contract for a design plan was awarded in April 1963, after evaluation of the Bankhead design study, and completed in June 1963. It called for a more flexible system than that envisioned by the TDP and indicated that the cost of the equipment would be slightly higher than anticipated. A revised purchase description, more in consonance with the TDP, was prepared and the equipment contract was awarded on 20 July 1963.[13]

~~(C)~~ The personnel authorization for Bankhead V was limited to 15. No expansion was planned except for communicators and administrative personnel to be hired in the fall of 1964 to support the project after the equipment had arrived.

(U) ~~(C)~~ It was originally planned that the VHF antenna would be housed in an [redacted]

[redacted]

(see Figure 12).[14]

Stonehouse (U)

~~(C)~~ An alternate site to Asmara, Ethiopia for Stonehouse was considered on [redacted] The U.S. Ambassador to Ethiopia advised suspension of all activity on the Stonehouse program prior to the visit of the Emperor of Ethiopia to the United States in October 1963. He recommended that no contracts be let, or construction started, or any contacts made with Ethiopian personnel until after the Emperor's visit. The contract for Stonehouse equipment, however, was in the final phase of negotiation. The Corps of Engineers was ready to request bids on the military construction and expected to award the construction contract by the end of August, or earlier. Negotiations were to continue on the equipment contract but the potential contractor was warned to avoid direct or indirect contact with the Ethiopian government until cleared by NSA. Funds for military construction were withheld until approval was received

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from Ambassador Korry to begin work on Stonehouse in Asmara.[15]

~~(S)~~ The initial contract for Stonehouse equipment with Radiation, Inc., of Melbourne, Florida was modified—after competitive bidding—to include a new 150-foot antenna. It was considered necessary because the [redacted] and because NSA and NASA requirements confirmed the need for it. The operations schedule for Stonehouse was affected by a delay in the availability of the station facilities.[16]

(U) To fulfill the basic requirements of the TDP, an 85-foot parabolic antenna with an x-y mount was selected and equipped with several interchangeable cassegrain feeds and provision for mounting antenna feeds at the apex of the structure, in order to provide the flexibility in frequency coverage desired.

~~(C)~~ Requirements for the preamplifier subsystem continued to be of primary importance to the success and future development of the system. However, more realistic estimates of the initial requirements of the station combined with reasonable development of the required masers indicated that maser coverage be provided only from 2 to 3 gc. in the initial installation. Additional frequency coverage by maser preamplifiers was planned as additional maser units became available through normal R/D development.

~~(C)~~ [redacted]

(U) Maintenance personnel for Stonehouse were assigned to the project and given training courses by the equipment contractors and some of the specialized equipment suppliers, while operating personnel were generally to be trained at the site after installation of the equipment. It was also planned to keep an NSA engineer at the site for at least the first year of operation (see Figure 13).

Bankhead I and II Upgrading (U)

(U) ~~(C)~~ The NSA Phase II Upgrading Plan for Bankhead I and II was approved by DIRNSA and forwarded to DDR&E for review on 1 June 1964. Following this review, DDR&E directed NSA to conduct on-site technical surveys of each interim system. DIRNSA then wrote USASA and USAFSS defining the requirements of the survey and instructed each to provide certain technical support. A plan of action was prepared jointly by NSA, USASA, and USAFSS survey party members. Their work began on 14 September and ended on 22 October 1964, when the last members of the party returned to CONUS. The letter from DIRNSA noted that DDR&E felt that the proposed manning figures in the plan required additional analysis and that improved efficiency and a reduction in personnel could be achieved through "training, documentation, and a more responsive logistics system." NSA had begun to implement the interim phase of the "upgrade plan," including initiation of purchase requests for the new traveling-wave tube, high-band preamplifiers and the [redacted] and high-band acquisition aid for Bankhead II.[18]

(U) ~~(C)~~ At about the same time, an unsolicited proposal was received from Sylvania Electronic Systems-West (SES-West) to build copies of the Bankhead V system for upgrading Bankhead I and II, and for Bankhead III (in case of termination of the current contract with Ling-Temco-Vought). It was concluded that the last part of the proposal was not economically sound, but that the proposal for Bankhead I and II would be considered in the context of the survey team report.[19]

(U) ~~(C)~~ The survey team concluded, with reference to Bankhead I, that the RF portions of the AN/FSQ-41(V) were "almost entirely unsuitable for retention. The entire HF receiving system must be replaced...." It was also recommended that the "servomechanical subsystem, including both antenna pedestals, should not be retained...." They recommended retention of the antenna programmer, computer, and externals analysis equipment of the data subsystem, the Dial-X intercom system, and existing Bankhead maintenance, test and support equipment. They also proposed specific actions by NSA, HQUSASA, or by HQUSAFSS.[20]

(U) ~~(C)~~ A so-called "alert concept," by which full manning would be provided only during alert periods, was considered. This proposal was opposed by the Bankhead operations officer on the grounds that the heavy activity of the preceding three-month period had demonstrated the need for full 24-hour manning.[21]

(U) ~~(C)~~ With regard to Bankhead II, the survey group concluded that the high-band RF subsystem should not be considered for use in the upgraded system; that the limited dynamic range of the low-band RF subsystems was even more of a problem than in the high-band subsystem. It recommended that the

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[redacted] antenna be used without tracking capability; that a decision on use of the components of the HF subsystem be made on the basis of requirements; that the entire high-band servo-mechanical components be replaced in the upgraded system, and that the low-band servo-mechanical system also be replaced.

(U) ~~(C)~~ It recommended retention of the recorders, antenna programmer, [redacted] analysis equipment, the programmed [redacted] and SDS-910. The Dial-X intercom could be used if it met the line requirements and if continuity of operations problems could be overcome.

(U) ~~(C)~~ The survey group reported that maintenance personnel at the Bankhead II site had made a "sustained, superior effort to make this station operational," but had been severely hampered by the difficulty in obtaining parts, by inadequate instruction manuals, and by a system that had never been fully operational. It recommended that the upgraded Bankhead II have some added features not specified in the Bankhead III purchase description, including:

1. A periodic system check and periodic maintenance procedure that will assure that the system will properly operate on a mission. . .
2. A specification on average hours before burn out on light bulbs, and the instrument lights should be tinted to prevent glare.
3. Radomes.
4. High-quality, positive-lock connectors should be used throughout.

(U) ~~(C)~~ The site had not been successful in its attempts to get complex test equipment repaired. On several occasions delicate instruments, shipped to the [redacted] depot for repair, returned incapable of improved performance.[22]

(U) ~~(C)~~ As was the case with Bankhead I, the Bankhead II operations officer was opposed to the "alert concept" because activity during the preceding three months had been so heavy that 24-hour manning had become normal. Operator training on the AN/FSQ-41(V) was conducted on the job, and individual position instructions were considered desirable, as at Bankhead I. Military analysts for the signal [redacted] analysis positions were not authorized, but Opins-10 was to be amended to allow for them. Training of Bankhead maintenance people was expected to insure that maintenance personnel had some experience with solid-state components. In general, the survey group concluded that the staffing factor for the isolated Bankhead II must be higher than for Bankhead I because personnel would have to take more leave and emergency leave since hospital and extended medical care for dependents was available only in [redacted]

~~(S)~~ On 9 November the government accepted the Bayhouse 150-foot parabolic antenna from the system contractor in time to track and intercept signals from [redacted] although Stonehouse was still incomplete. Bankhead V also tracked and intercepted signals [redacted] and from the NASA satellite Nimbus and Canadian Alouette during testing. Signals from other U.S. space vehicles were also intercepted daily. Meetings were held with USASA personnel in anticipation of their assuming maintenance and operational responsibility for Stonehouse by mid-1965. NSA also formed a small operations staff to be ready when Stonehouse and Bankhead V became operational.[24]

(U) ~~(C)~~ The Bankhead I and II survey report was distributed to obtain technical contributions from field and headquarters personnel, to be used in preparing a technical development plan for upgrading the Bankhead I and II installations.

~~(S)~~ The operations building and associated facilities at Bankhead V [redacted] were completed, system hardware installed, the radome erected, and operational checks begun. On-site acceptance tests were about 90 percent completed by the end of 1964. The Bankhead V system was turned over to station personnel on 26 February 1965 for full operation and maintenance. NSA exercised operational control, provided technical guidance and some operational supplies, and received the collected data and reports. [redacted] The officer-in-charge requested that manning be increased from 15 to 19 for the planned 65 hours of operation per week. During the first half of 1965, Bankhead V produced significant results: intercepts [redacted] not obtainable from other sites. Its operational performance and success were considered to be outstanding.[25]

(U) When construction of the Stonehouse operations building slipped, portions of the Stonehouse equipment were temporarily installed in the feed-storage building to save time and allow subsystem checkout to proceed. Maintenance and operating per-

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sonnel arrived at the site. NSA and USASA gave careful attention to maintenance and supply procedures and spare-parts requirements. A memorandum of understanding was prepared by NSA and USASA defining responsibility for Category III testing. After system acceptance, USASA was to take possession of the installation and thereafter exercise all necessary operating and maintenance functions. USASA would be responsible for Category III testing. Documentation and spares were to be furnished, and they had to be found acceptable before the Category III testing was concluded and the system declared ready for operation. Stonehouse was to be declared an operational facility ready for unlimited tasking only after both NSA and USASA had certified that the criteria of the Category III test plan had been met.[26]

(U) Three recognized categories of testing were to be completed.

Category I—Tests conducted by the system contractor under government surveillance at the producing plant to determine if system performance complied with contract specifications.

Category II—Tests conducted by the system contractor in accordance with directions of the technical representatives of the contracting officer. After such tests successfully demonstrated that system performance met contract requirements, the system was accepted by the government.

Category III—On-site operational tests which also included many other functions necessary for optimum system performance prior to operational tasking. They covered effective operation and maintenance by the using service, adequacy of construction and utilities services, communications, system documentation, site organization and management, logistics, training, test equipment and modification procedures.

~~(S-CCO)~~ The Stonehouse installation was accepted from the contractor on 17 May 1965 and complete Category III testing started immediately thereafter, but urgent operational requirements forced USM-4S simultaneously to accept tasking while starting the first test phase. During the quarter, signals were [redacted] The result was considered to be high-quality intelligence product of significant consumer interest. Category III testing was suspended during the following quarter because of high-priority operational tasking. Testing resumed at the end of September, but with the stipulation that it might be interrupted again if high-priority targets appeared.[27]

(U) Teams of NSA observers visited the Stonehouse installation from 17 to 26 November, on 30 November, and on 9 December 1965 to participate in Category III tests. Their observations were intended to assist USASA in "establishing the system in a steady state for optimum and maximized performance," and secondarily to identify any operational or maintenance problems on which NSA could take corrective action regarding Stonehouse and any new system developments.

~~(S)~~ The Stonehouse hardware appeared to the NSA team to be versatile, to be operating according to design specifications, and to have a potential exceeding the specifications. There had, however, been problems with the phase-lock receiver and the computer peripheral gear, difficulties which caused degradation of [redacted] results, and serious hydraulic problems with the 85-foot antenna.

(U) There also appeared to be too little coordination between operations and maintenance personnel; it was suggested that if an equipment status board were prominently displayed in the operations room, this situation would be improved.[28]

(U) The Stonehouse facility was manned largely by military personnel with a small number of civilians (8 civilians of 51 total), including an NSA senior electronics engineer who had been the project engineer during the system development, a senior electronics technician, and an RCA contract technician. USASA also employed, under a maintenance services contract, five technical personnel from Radiation, Inc., the system development contractor. The NSA team concluded that the military personnel were barely adequate to perform their assigned functions and that there was a serious problem of continuity which appeared to be mostly a matter of training and experience rather than numbers of people. There also appeared to be a complete lack of clerical support; specialized maintenance personnel were typing, driving, and performing escort duties despite the critical character of system maintenance and the fact that heavy emphasis should be put on maintenance training. The team recommended that a full-time training officer be assigned to Stonehouse to organize a responsive training program, and that more effort be put into OJT training, which for military personnel appeared to be very limited.[29]

(U) The NSA team also recommended that the OIC of the installation be a major, with two captains—one for operations and the second, an electronics engineers (EE), for maintenance; that the OIC should also be an EE or, more importantly, that he be familiar with NSA operations and experienced with

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Sigint; and that NSA should furnish a qualified civilian analyst. A programmer familiar with tracking was also considered necessary.

(U) Thirty equipments at Stonehouse were "deadlined" (out of order) on 24 November 1965. Despite elaborate efforts to insure that adequate initial spares would be provided with the equipment when it was installed and that additional parts could be promptly secured when needed, delays in obtaining needed parts were often prolonged. Little use was apparently being made by USASA of procedures approved by the U.S. Army Electronics Command (USAECOM) for procuring repair parts for unique items through the prime contractor or the subcontractors.[30]

(U) The most useful suggestion that the NSA observers felt they could make to USASA was that frequent visits be made to Stonehouse by working-level personnel engaged in resupply procedures. They also concluded that ". . .until all the documentation is in, the pipelines filled, and usage data has been developed, Stonehouse will require extraordinary attention and interest. With routine handling, the list of deadlined equipment will increase, not diminish."

(U) Technical manuals were criticized by site personnel as being written for people with a higher level of education and experience than those actually assigned to use them, and it was observed that documents, even when available at the site, were not used. It was also noted that valuable technical reports, prepared by the senior technical representative at the Stonehouse site, were seriously delayed by the lack of typing services.[31]

(U) The Stonehouse station management had not been able to advance from a "day-to-day crash approach to problem solving," and so much time was needed to meet immediate operational and maintenance problems that little time was left to establish normal procedures and practices for handling most problems.

> The same critical comment is made of the NSA organizations at Fort Meade which receive operational data from the site and are responsible for providing a constant flow of technical feedback. In the plainest of language, Stonehouse has not received the level of competent management—from either NSA or ASA—which it must have to consistently and expertly render its mission.[32]

(U) This condition was attributed to the pressure of competing requirements, to a community-wide shortage of "broadly experienced talent," and to the fact that Stonehouse was the first installation of its kind. That it was the first made it particularly important that its problems be carefully analyzed in an effort to avoid "the same organizational pains" with other large, space-collection facilities in the future. Unfortunately, there had been a tendency to regard Stonehouse as "just another overseas facility," and NSA operational personnel had not been able to give the project adequate attention. The same was believed to be true of HQUSASA, which had assigned a junior lieutenant as project officer and had also given him other assignments wich prevented him from being fully effective on the Stonehouse project.

(U) ~~(C)~~ The NSA team's report stated:

> . . .7. The site, given a relatively unskilled cadre of operators and maintenance personnel, a new system, and an unresponsive supply system never fully organized itself. Operational tasking by NSA, before the Category III test period had even begun, effectively forced the site to go to day-to-day measures. Training never achieved its goal; contract and NSA maintenance personnel were so busy keeping the system on the air they gave little thought to making personnel sufficiently expert to assume very much of the load. . .
>
> 8. In spite of all these events, the system has been operational and has been effective. But it could have been, and should be, more effective. . . .
>
> 9. . . . .Operators generally did not appear to know how to set up their equipment, comprehend the meaning of information displays, or even understand the function of the equipment.
>
> 10. Opinion of NSA observers was not unanimous that the present operators could be trained to do their jobs. One opinion had it that only technical personnel could configure the equipment to meet mission requirements. Considering the total system knowledge required to patch around 'deadlined' equipment and reconfigure the patch panels, this may be true. . . .
>
> . . .15. Recommendations:
>
> a. It is recommended that a training program be conducted at USM-4S to include the following:
>
> (1) Description of orbital elements (keplerian, spherical, cartesian).
> (2) Description of orbital data (az-el-range, az-el, doppler).
> (3) Explanation of vocabulary of orbital mechanics.
> (4) Description of how orbits are determined.
> (5) Description of data being sent to Stonehouse (prognosticated launch times, look-angle generation procedures).
> (6) Exploration of graphic aids (x-y to az-el conversion chart, plotting boards, Spadats bulletin).
>
> It is estimated that such a training program would require 10 hours, preferably 2 hours per day. It is suggested that NSA send a qualified person to USM-4S for a period of one week to conduct the training. . . .
>
> b. It is recommended that the following additional hardware be installed at USM-4S. . . .
>
> c. In order to fully utilize the above recommended hardware and to increase the site's capabilities, specific software are [sic] recommended which would accomplish the following tasks:
>
> (1) Increase the types of inputs to generate program track data. . . .
> (2) Generate data matrices for the antenna programmer. . . .
> (3) Accept antenna data. . . .

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(4) Increase programmer functions. . . .

d. It is recommended that the following software be provided for normal housekeeping functions:

(1) Automatic system checkout.

(2) Update operator display via Nixie tubes and a three position switch for x-y, az-el, RAD and HAD data.

(3) Frequency bookkeeping.

e. It is recommended that computer programs be written to give Stonehouse capabilities to:

(1) Input Spadats elements and output a programmer tape, earth trace, lighting conditions, lifetime of a satellite, and plotter tape.

(2) Input track data and output a targeting and data statistics.

(3) Input station locations and output global tracking coverage.[33]

(U) It was also reported that SMAC (Special Missile and Astronautics Center) personnel used last-minute telecons to pass instructions regarding system configuration for particular missions. They often included equipment which was either not at the site or was "deadlined." The NSA observers suggested that, as long as personnel at the site were capable of reconfiguring available equipment, the way it was done be left to them. If instructions must be given, the telecons should take place at least eight hours before mission activation.

(U) It was noted on the positive side that experienced NCOs at the site appeared "knowledgeable, dedicated and capable of performing their duties." Generally the Stonehouse system was producing intelligence data and meeting most tasking requirements despite administrative, operational, and maintenance problems.[34]

(U) Completion of Category III testing was further delayed by priority tasking through the remainder of 1965 and the first half of 1966.[35]

(U) (C) As further considerations was given to the steps needed to improve the Bankhead I and II systems, and to collection requirements and costs, NSA officials became convinced that it would not be advantageous to use existing equipment in the upgrading process. It was estimated that the maximum amount which might be saved by retaining usable equipment at both sites would not exceed $1 million and that the advantages of new equipment, thoroughly integrated and tested in the United States before shipment overseas, would in the long run outweigh the temporary savings,[36]

(S) R6 proposed that a new system, to be operated by USAFSS personnel, be procured to replace the AN/FSQ-41 at [redacted] and that a [redacted] Consideration was also given to the possibility of operating Bankhead I [redacted] with NSA civilian personnel in grades 11 through 13, and to ascertaining the amount of backing which could be expected from the DOD. It was intended to implement the revised plans on a schedule which would make it possible to have both sites in operation by mid-1967. It appears, however, that these proposals did not receive final approval within NSA.[37]

(C) [redacted] caused deferral by DDR&E, on 30 November 1965, of further efforts by NSA to proceed with a major upgrading of Bankhead I (a project which had been redesignated as [redacted]. The interim facility was to continue in use for the present. A joint study was started by NSA and USAFSS, however, to determine alternate methods of improving Bankhead I facilities within the existing political limitations. This included phased, routine replacement of the more critical portions of the system and "optimum utilization of the new operations space without attracting undue attention." Political conditions in [redacted] became less favorable for retention of the U.S. intercept station at [redacted] Project [redacted] and Bankhead I were dropped from the SSS program in June 1966.[38]

(U) (C) NSA and USASA conducted a broad examination of space-collection requirements for the [redacted] and measures needed to upgrade space-collection facilities at both [redacted]

(U) (C) A technical development plan was also prepared for upgrading space collection facilities at [redacted] (designated Project Anders). A purchase description was released to Sylvania Electronics Systems-West on 11 February 1966 covering both the Anders equipment (scheduled for completion and installation in first quarter of FY68) and similar equipment for the Jaeger [redacted] project (see Figure 14).[40]

(U) (C) Preliminary acceptance tests on the Bankhead III equipment were completed at the plant of LTV Electrosystems, Inc., on 29 January 1966. The equipment was then dismantled and packed for shipment to [redacted] and scheduled for delivery at the site by 11 April 1966. Reinstallation, checkout, and final acceptance tests were to be completed by 18 July 1966, to be followed by USASA Category III tests.[41]

Program Status in the Second Half of 1966 and 1967 (U)

(U) By the autumn of 1966, USASA and NSA were considering formal termination of Stone-

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house (AN/FRR-65v) Category III testing. Most of the operational and maintenance problems identified a year earlier remained unsolved. They included the inability of the military system to give prompt responsive support, certain technical inadequacies of military maintenance personnel, and a continuing lag in the updating of documentation. A manpower survey early in 1966 identified the need for additional maintenance billets, and plans were made to fill this need through the normal CCP cycle. At a meeting in September 1966 in Philadelphia, USAECOM representatives divulged that they had never attempted to fill a supply pipeline to Stonehouse or any other SSS installation, and that procurement never began until a requisition was received. Two years after NSA began to urge the necessary action, USAECOM was considering contracting for the resupply of systems parts. It was expected that this approach, if followed, would at least start the Stonehouse and other SSS programs on the road to reliable operations.[42]

(U) Stonehouse continued to be operational during the second half of 1967 and in 1968, and only final contract settlement with Radiation, Inc. remained to be completed as far as the SSS program was concerned.[43]

(U) (C) Some Category III testing was continued at the Bankhead III site [redacted] during the last quarter of 1966. Category III tests to determine system operational capability began on 15 September 1966 but were suspended on 12 November 1966 until the VHF antenna, which had separated from its pedestal, had been repaired. Phase III tests were resumed on 5 December 1966 and completed on 31 December 1966; the test report was finished early in February 1967. Reports on Phase I and II had already been published. The arrival of two additional contractor technicians in January 1967 resulted in significant improvement in the operational condition of the equipment. The system continued to operate satisfactorily through the first and second quarters of FY68 and it was concluded that LTV Electrosystems, Inc., the developer, had essentially satisfied contractual requirements. Some technical discrepancies which were noted at the time of final acceptance were still being corrected by the contractor at the end of the third quarter of FY68.

(U) (C) Bankhead III's site was the most difficult of the SSS program sites to support directly. It was in a short-tour area, a fact which aggravated the problem of securing an adequate number of trained maintenance and operations personnel. The electronic installation was the largest in the SSS program network; its electromechanical equipment was not protected by radomes but exposed to salt air. Bankhead III was also plagued by a greater number of spare-parts supply problems than other SSS sites. These were major factors responsible for this site's uneven operational performance record, although the system was capable of "eminently satisfactory performance" when fully operational.[44]

Notes

[1] (C) "Space Surveillance Sigint Quarterly Report," 1 Oct 1962.

[2] (C) "Space Surveillance Sigint Program Review," 1 Apr 1964.

[3] (C) "Space Surveillance Sigint Quarterly Report," 1 Oct 1962, pp. 3-4; (C) "Space Surveillance Sigint Program Review," 1 Apr 1964.

[4] (U) *Ibid.*, p. 24.

[5] (U) *Ibid.*, pp. 27-28.

[6] (U) *Ibid.*, pp. 29-30.

[7] (U) *Ibid.*

[8] (U) *Ibid.*, pp. 30-31.

[9] (U) "SSS Quarterly Report," 1 Jan 1963.

[10] (C) "Space Surveillance Sigint Program Review," 1 Apr 1964, pp. 34-35; (C) "Space Surveillance Sigint Program, Final Summary Report of Development Status," 1 Apr 1968.

[11] (U) *Ibid.*, p. 43; SSS "Final Summary Report of Development Status," 1 Apr 1968.

[12] (C) Memorandum from NSA, ADRE to DDR&E, Serial: N 0491, "Space Surveillance Sigint Program," 9 Apr 1963.

[13] (C) "Space Surveillance Sigint Program Review," 1 Apr 1964, pp. 45-46.

[14] (U) *Ibid.*, p. 52.

[15] (U) "SSS Program Quarterly Report," 15 July 1963.

[16] (C) "Space Surveillance Sigint Program Review," 1 Apr 1964, p. 57.

[17] (U) *Ibid.*, pp. 65-67.

[18] (U) (C) Letter from Director, NSA to USASA, USAFSS, Serial: N 0896, "Bankhead I and II Upgrading Plan," 23 July 1964.

[19] (C) "Space Surveillance Sigint Quarterly Report," 1 Oct 1964.

[20] (C) "Space Surveillance Sigint Bankhead I and Bankhead II Survey Report," 10 Nov 1964, pp. 19, 39-40.

[21] (U) *Ibid.*, p. 31.

[22] (U) *Ibid.*, pp. 47, 75-76.

[23] (U) *Ibid.*, pp. 60-61.

[24] (C) "Space Surveillance Sigint Quarterly Report," 1 Jan 1965.

[25] (C) *Ibid.*; "Space Surveillance Sigint Quarterly Report," 1 Apr 1965 and 1 July 1965; "Space Surveillance Sigint Program, Final Summary Report of Development Status," 1 Apr 1968.

[26] (U) *Ibid.*; "Memorandum of Understanding between the National Security Agency and the U.S. Army Security Agency for the Category III Testing of the Stonehouse System," 6 Jan 1965; (C) "Space Surveillance Sigint Quarterly Report," 1 Apr 1965.

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[27] ~~(C)~~ "Space Surveillance Sigint Quarterly Report," 1 July 1965; ~~(S)~~ See also messages from Director, NSA to Secretary of Defense and DIA, re NASA use of [redacted], 16 Mar 1966; ~~(C)~~ "Space Surveillance Sigint Quarterly Report," 1 October 1965.

[28] (U) "Report of NSA Observers of the Category III Testing of Stonehouse," p. 8.

[29] (U) *Ibid.*, pp. 8–14.

[30] (U) *Ibid.*, pp. 15–18.

[31] (U) *Ibid.*, pp. 18–20.

[32] (U) *Ibid.*, p. 21.

[33] (U) *Ibid.*, pp. 24–25.

[34] (U) *Ibid.*, p. 26.

[35] ~~(C)~~ "Quarterly Status Report of Space Surveillance Sigint Program," 1 July 1966.

[36] (U) ~~(C)~~ Memorandum from R6 to Director, NSA, "Bankhead I and II Upgrading Plans," 18 June 1965, with attachments.

[37] (U) *Ibid.*

[38] ~~(C)~~ "Space Surveillance Sigint Quarterly Report," 1 Jan 1966 and 1 July 1966.

[39] (U) *Ibid.*

[40] ~~(C)~~ "Space Surveillance Sigint Quarterly Report," 1 Apr 1966.

[41] (U) *Ibid.*

[42] ~~(C)~~ "Space Surveillance Sigint Quarterly Report," 1 Oct 1966.

[43] ~~(C)~~ "Space Surveillance Sigint Quarterly Report," 1 Oct 1967 and 1 Jan 1968.

[44] ~~(C)~~ "Space Surveillance Sigint Quarterly Report," 1 Jan 1967, 1 Apr 1967, and 1 Jan 1968; ~~(C)~~ "Space Surveillance Sigint Program Final Summary Report of Development Status," 1 Apr 1968.

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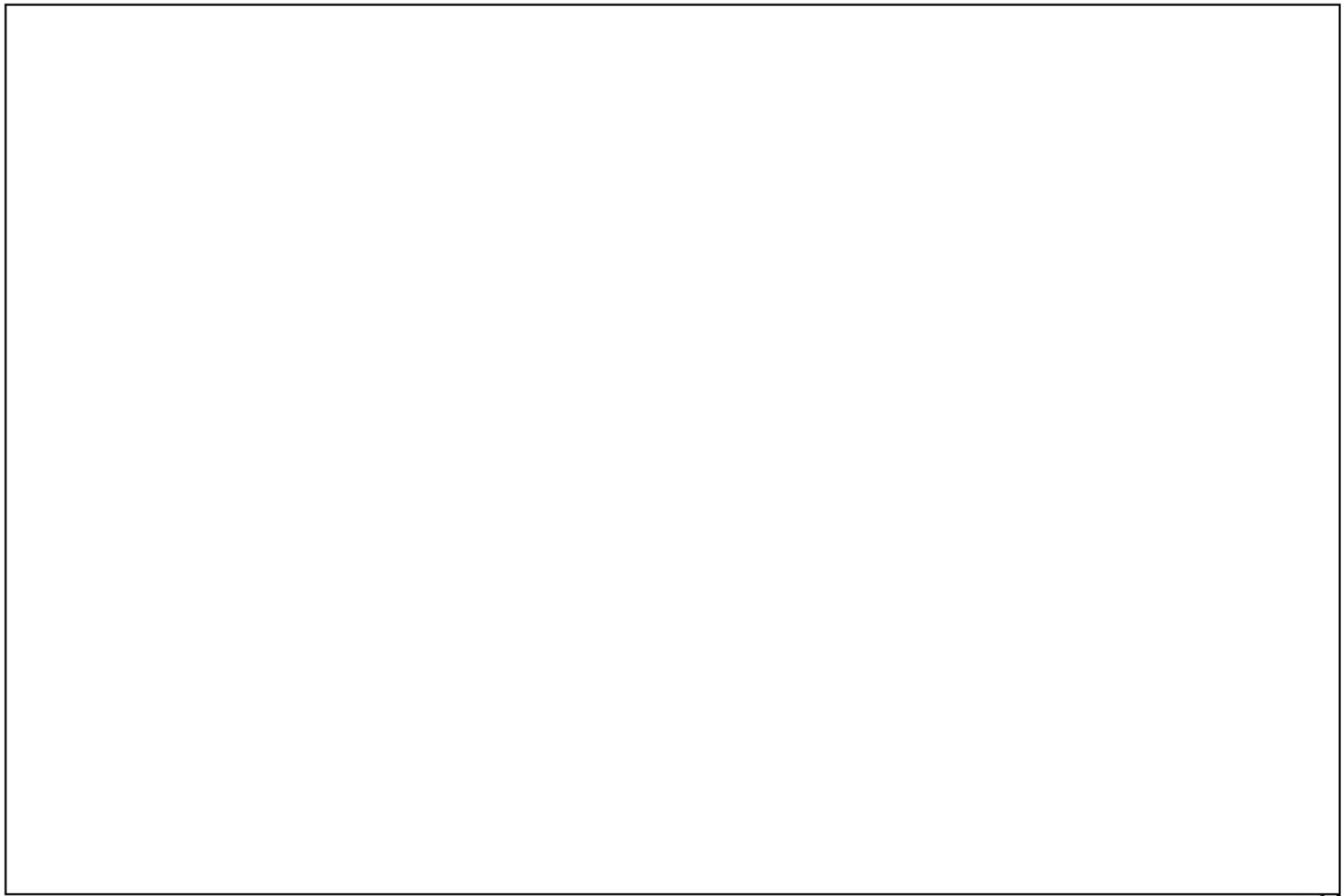

Figure 8

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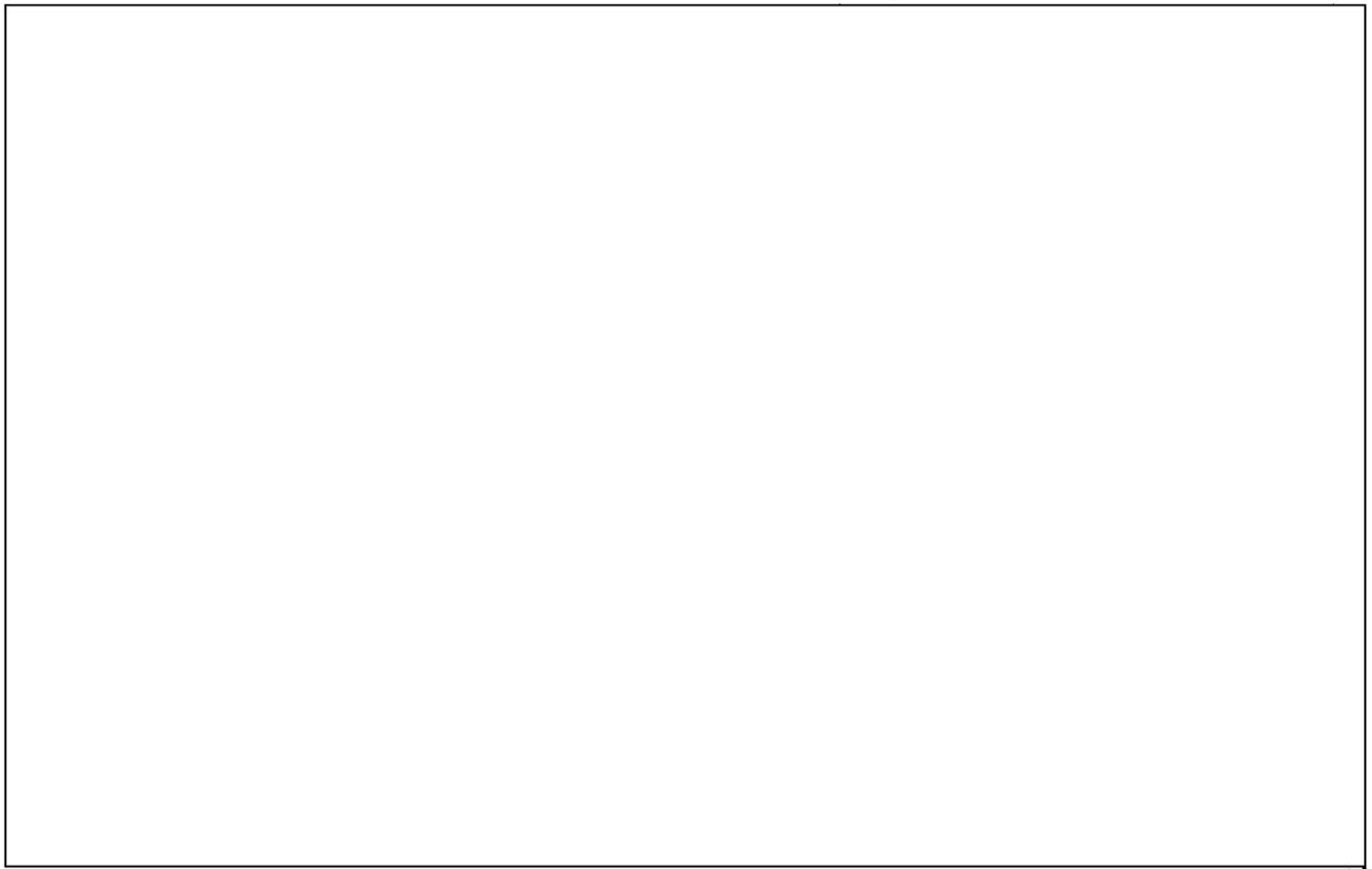

Figure 9

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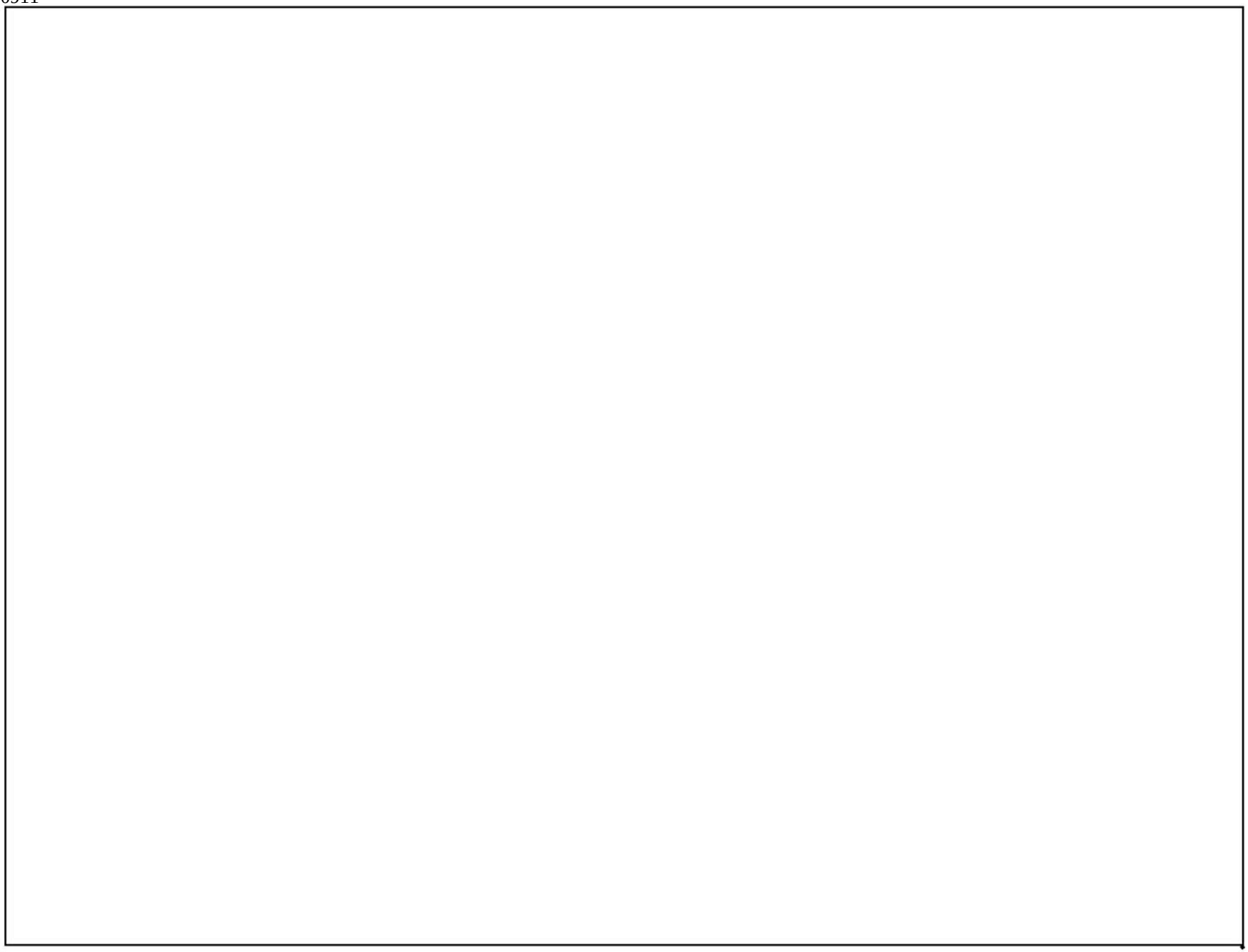

Figure 10

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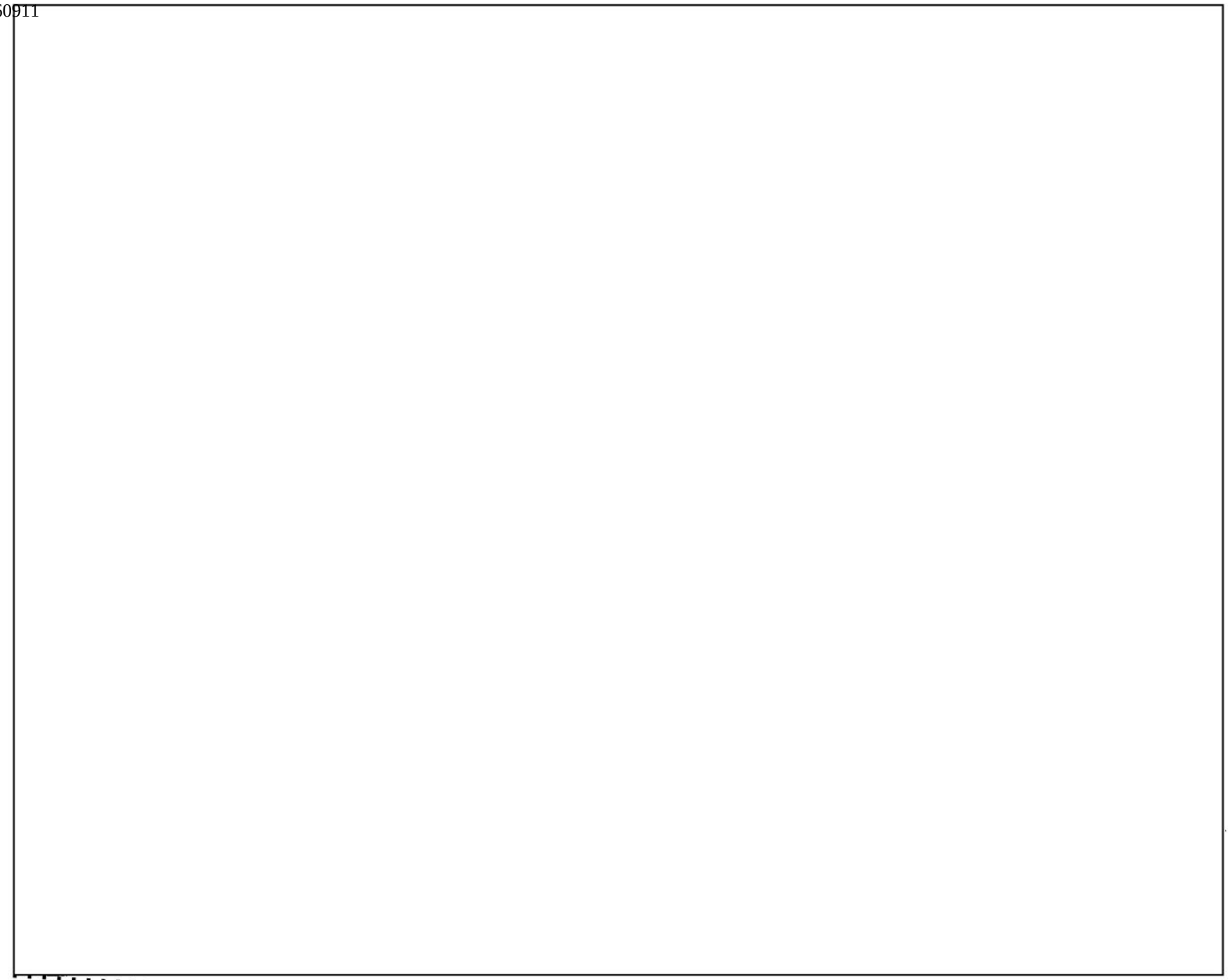

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Figure 11

Figure 12

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OGA

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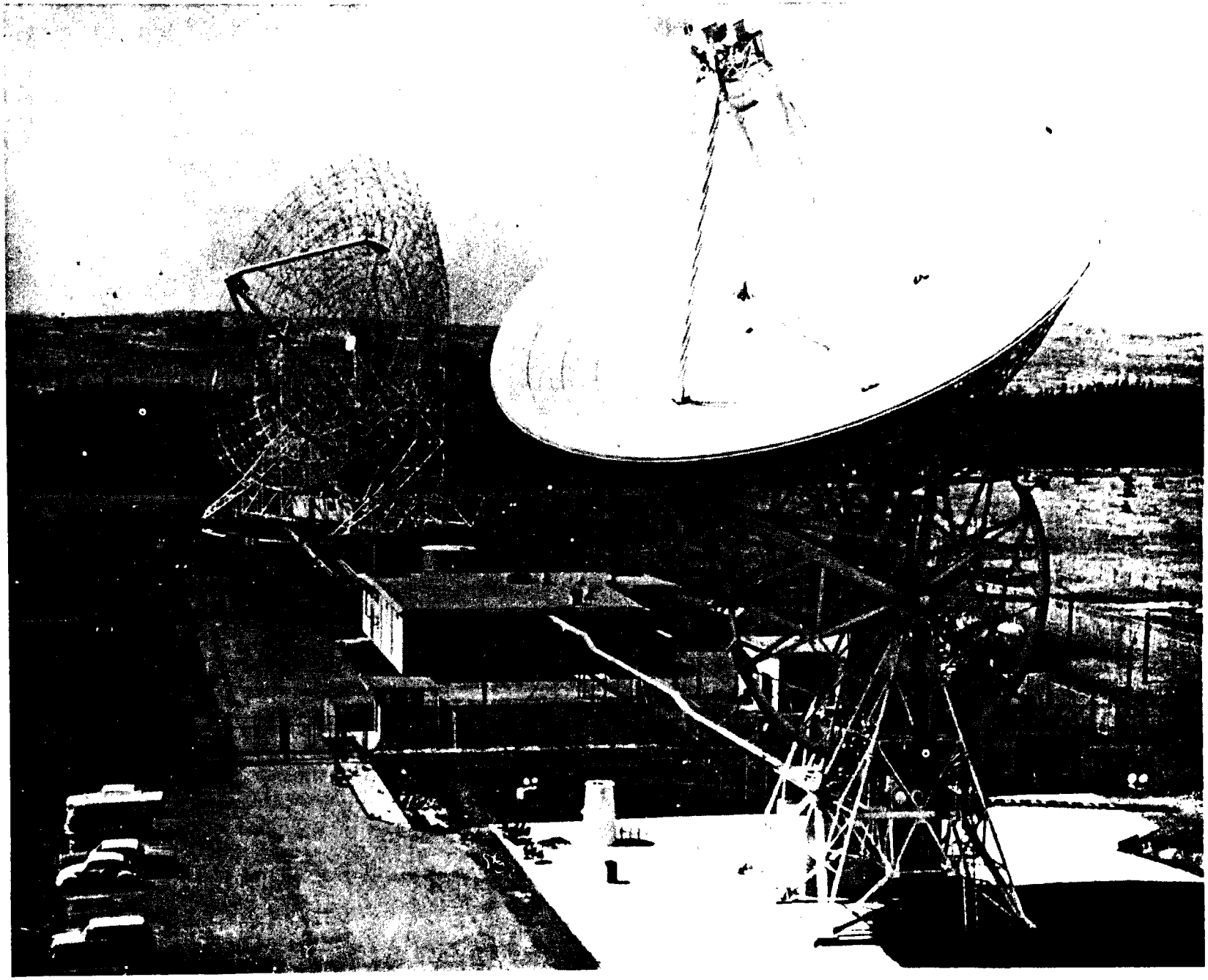

Figure 13
Stonehouse, Asmara, Ethiopia.
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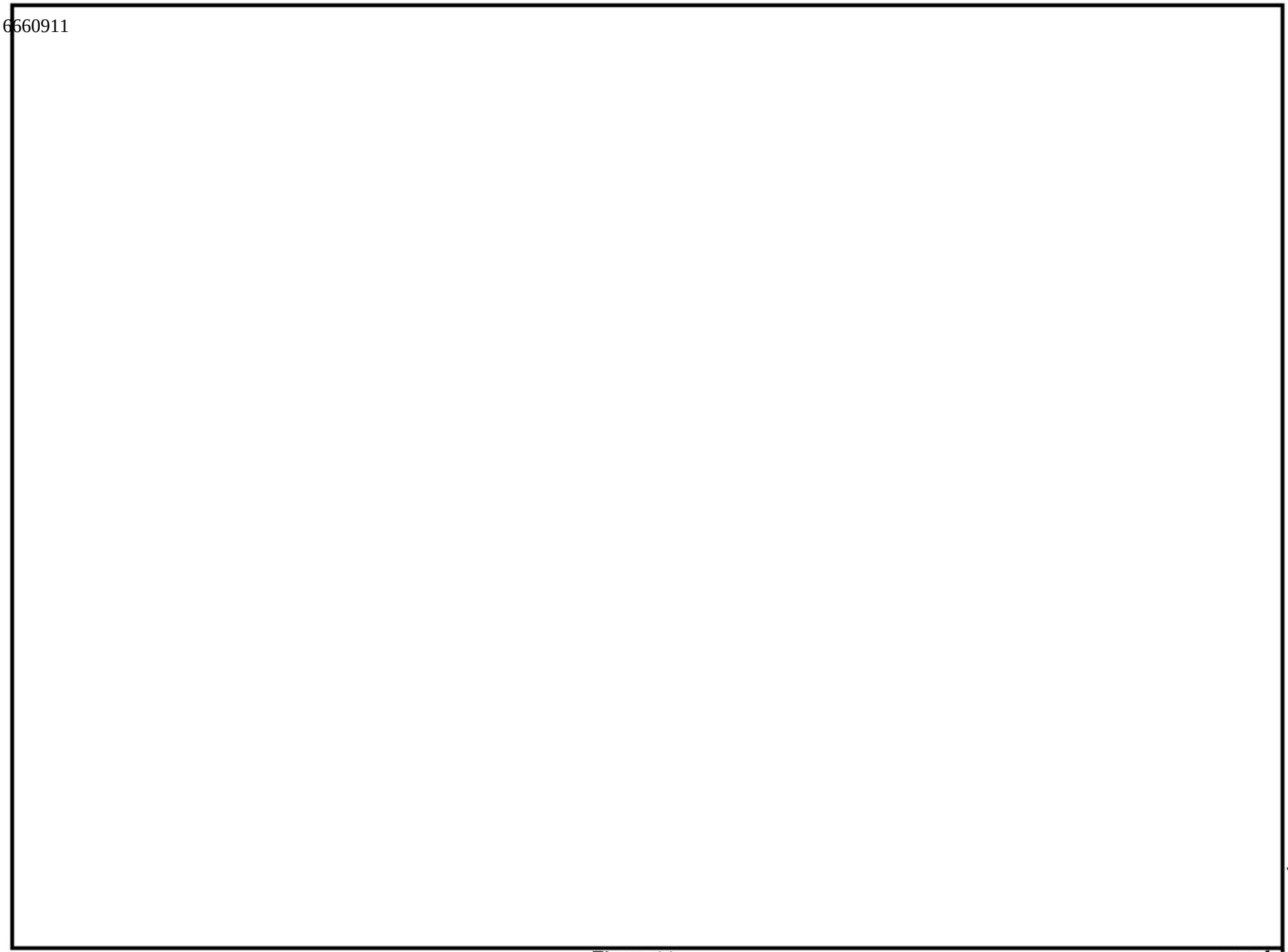

Figure 14

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EO 3.3b(3)
EO 3.3b(6)
PL 86-36/50 USC 3605

CHAPTER IV

Completion and Certain Lessons of Experience (U)

Accomplishments and Culmination (U)

(U) By 1968 Stonehouse had been tasked with many missions not known in 1962, and new equipment had been added outside the SSS program to keep up with intelligence requirements. The system had made substantial intelligence contributions, despite the problems created by the need to reconfigure the system to cover new targets.

~~(C)~~ The Anders system (AN/FRR-81(V)) was shipped on schedule from Sylvania's plant at Mountain View, California to [redacted] and the last of the components arrived by 23 May 1967. Installation was begun by the contractor in May and was completed on 17 June 1967. The system was accepted by the government on 15 September 1967, following satisfactory Category II tests. Category III tests were then started by USASA, and completed on 15 January 1968. No major engineering or operational problems developed as the system began full operation, and met or exceeded performance requirements.

[redacted]

(U) ~~(C)~~ Jaeger's primary and secondary systems (AN/FRR-82(V)) successfully completed Category I testing at Sylvania's plant on 26 May 1967. Aircraft tracking test results for the [redacted] were almost three times as accurate as the contract specified. Sylvania thereby earned a $50,000 performance incentive payment negotiated in the contract. The equipment was then loaded aboard ship at Redwood City, California for shipment to [redacted] and arrived at the site on schedule in July 1967.

(U) ~~(S)~~ Installation and Category II testing of Jaeger was completed on 12 November 1967, and the system was accepted by the government on 15 November 1967, one month ahead of schedule. Category III testing was then started by USASA.

~~(S)~~ During Category III testing [redacted]. No significant operational or maintenance problems were reported during the remainder of 1967.[2]

(U) ~~(C)~~ NSA and USASA also jointly prepared an integrated technical support purchase description for application of Jaeger and Anders. It was agreed to contract with Sylvania (SES-West) for resupply covering essential unique spare parts, engineering services, modifications control, and configuration management. USASA provided the necessary funds but the contract was handled through NSA, which negotiated a basic ordering agreement with SES-West, the system developer. It was planned that, beginning with FY69, USASA would take over completely.[3]

Lessons Learned (U)

(U) ~~(C)~~ The office of Special Program Management (R6) concluded from its experience with system development under the SSS program that:

a. Its most basic problem was that of educating and counseling the system contractors from the interpretation of operational requirements through close supervision of fabrication and testing.

b. Each of the five systems built under the SSS program by three contractors was uniquely designed to meet specific mission requirements, located in a completely different physical, electronic and operational environment, and had to be completed within such a short period, ranging from 16 to 28 months, that some normal procurement and fabrication processes had to be compressed or eliminated.

c. At the beginning of the program, a basic decision was made that the systems would be assembled from

commercial off-the-shelf components in order to eliminate requirements for new research or development. It proved necessary, however, to modify some of the components and develop new interfaces between equipments. The assembly of such large electronic (and electromechanical) systems by this procedure reduced costs and saved time but, nevertheless, required professional engineering judgment of the highest quality.

d. While each of the system contractors had an established quality control program, their effectiveness varied from company to company. They also were not completely effective in the case of printed circuit boards and contractor-developed equipment.

e. The mechanical, electromechanical, and hydraulic components of the systems proved less reliable than the electronic components. There were unusually severe dust, heat, and moisture problems where equipment that had to be located outside was not protected by radomes.

f. Systems were usually installed on, or even ahead of, schedule, but Category II tests were frequently delayed by component failures. Operational requirements were met prior to system acceptance.

g. The experience with each contract was applied to those which followed, as far as available time and funds permitted, and resulted in improved operational characteristics though all problems were not solved.[4]

(U) ~~(C)~~ Regarding systems technical support problems, policies, and procedures, R6 concluded that:

a. Neither NSA or USASA foresaw clearly the impact of the SSS program on the conventional resupply system, maintenance and maintenance training procedures, test equipment requirements, technical manuals, system drawings, provisioning documentation, system spare parts requirements, and other elements of a successful maintenance program. Some warning was given by spare parts and documentation shortages for Bankheads I and II, but there was apparently not time enough to benefit from this experience before other system contracts were let.

b. It was assumed that the systems would require only routine logistical support. "It was not realized that the operation and maintenance of large systems is entirely dependent upon a systems approach, and that the key to systems availability begins with senior engineering support, to be followed by highly trained operator and maintenance personnel, who would have documentation available written for system use, and with the reliable and dependable backup of a responsive spare parts supply system."

c. Other early difficulties were attributed to the fact that, at the start of the program, contract specifications, data items, and guidance were not systems oriented; that maintenance personnel were trained so far ahead that they did not remember what they had learned by the time the systems were operational; that conventional provisioning methods delayed spare parts procurement; and that resupply procedures failed to meet SSS program operational requirements.

d. Most of the above difficulties were overcome by the time the last systems in the program became operational. While nothing could be done to change short-tour areas, experienced personnel from long-tour installations were available and training methods were improved. Technical documentation requirements were streamlined and documents which maintenance personnel did not use were eliminated.

e. "Probably the most significant concept to emerge from the SSS program had been mutual USASA/NSA recognition that these systems definitely require special follow-on engineering and logistical supporting programs. Beginning with Jaeger and Anders, as they entered the Category III test phase, a technical support contract was established, and internal USASA/NSA procedures were agreed upon. . . ."

f. The office of Special Program Management concluded that it probably had "gone far beyond its original organizational charter in attempting to transfer knowledge gained during systems development to tasking, operator, and maintainer organizations. This effort includes all aspects of technical support (which are defined to include engineering modifications, documentation, configuration management, training and logistics). And this effort to transfer knowledge for the purpose of assuring systems availability for operations has been just as large an undertaking as the original system development, and sometimes more difficult."

g. It also believed that "significant new approaches . . ., have been developed by the office of Special Program Management and will be implemented in the future to derive the most meaningful technical support data, at the lowest cost and in phase with hardware development, installation and acceptance. The concept is predicated on the point that both system performance and system availability must be parallel technical efforts, from the start of design planning."[5]

(U) The fiscal status of the SSS program in April 1968 when it was completed is shown in Figure 15.

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SSS PROGRAM FISCAL SUMMARY
(IN THOUSANDS)

SYSTEMS IN ORDER OF INSTALLATION	ADD-ONS	GOVERNMENT FURNISHED EQUIPMENT	SYSTEM CONTRACT	MILITARY CONSTRUCTION	TOTALS
BANKHEAD II (AN/FSQ-41(V))	$328	—	—	$1,012	$1,340
BANKHEAD I (AN/FSQ-41(V))	560	—	—	754	1,314
BANKHEAD V	—	$1,077	$4,193	—	5,270
STONEHOUSE (AN/FRR-65 (V))	—	401	8,354	1,185	9,940
BANKHEAD III (AN/FRR-69 (V))	—	536	7,368	2,036	9,940
ANDERS (AN/FRR-81 (V))	—	234	2,791	—	3,025
JAEGER (AN/FRR-82 (V))	—	479	4,213	—	4,692
TOTALS	$888	$2,727	$26,919	$4,987	$35,521*

*Although the SSS program was originally approved for $40 million, $35,521,000 is the current best estimate of all costs, subject to the close-out of the fixed price, incentive fee contracts. The difference of $4,479,000 is accounted for by the following:

July 1964 program funding reduced by DOD	$2,000,000
Nov 1965 program funding reduced by DOD	1,200,000
Construction funds not made available	220,000
Construction funds held in reserve by BOB	252,000
Construction funds in excess	807,000
	$4,479,000

Figure 15
Fiscal Status of SSS Program, April 1968.
(Figure is UNCLASSIFIED.)

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Notes

[1](C) "Space Surveillance Sigint Program, Final Summary Report of Development Status," 1 Apr 1968.

[2](C) "Space Surveillance Sigint Quarterly Report," 1 July 1967, 1 Oct 1967, and 1 Jan 1968.

[3](C) "Space Surveillance Sigint Quarterly Report," 1 Oct 1967 and 1 Jan 1968; (C) "Space Surveillance Sigint Program, Final Summary Report of Development Status," 1 Apr 1968.

[4](C) "Space Surveillance Sigint Program, Final Summary Report of Development Status," 1 Apr 1968.

[5](U) *Ibid.*

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Abbreviations and Acronyms

ARPA	Advanced Research Projects Agency
BMEWS	Ballistic Missile Early Warning System
BOB	Bureau of the Budget
CCP	Combined Cryptologic Program
CCPC	Critical Collection Priorities Committee
COC	Combat Operations Center (NORAD)
DSIF	Deep-space instrumentation facility (NASA)
GMIAC	Guided Missile and Astronautics Intelligence Committee
GMIC	Guided Missile Intelligence Committee
IDA	Institute for Defense Analysis
KYMTR	Kapustin Yar Missile Test Range
MCA	Military Construction Army
NSASAB	National Security Agency Scientific Advisory Board
O/M	Operation and maintenance
OSO/OSD	Office of Special Operations/Office of the Secretary of Defense
PERT	Program evaluation review techniques
SCAs	Service cryptologic agencies (Army, Navy, Air Force)
Spacol	Space collection
Spadats	Space Detection and Tracking System
SSSPB	Space Surveillance Sigint Planning Board
TTMTR	Tyura Tam Missile Test Range
USAECOM	U.S. Army Electronics Command
USIB	United States Intelligence Board

~~SECRET~~

[redacted]