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LEO SYSTEMS PROGRAM OFFICE

U.S. Navy/NRO Program C Electronic Intelligence Satellites (1958-1977)

3 SEPTEMBER 1998

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CL BY:	85831
CL REASON:	1.5(c)
DECL ON:	X1
DRV FROM:	NRO SCG 4.0 14 October 1995

~~SECRET~~

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PREFACE

~~(S/B)~~ Mission [redacted] has included [redacted] of satellites: POPPY, which was operational from 1962-77; [redacted] present. A progenitor, GRAB, preceded the NRP and was operational from 1960-62. GRAB and POPPY were ELINT search and technical intelligence collectors, directed against Soviet air and ballistic missile defense systems. POPPY Mission [redacted] was used in 1968-69 to demonstrate the potential for [redacted] by means of low earth orbit satellites. In 1970, the USIB added EOB production and ocean surveillance to POPPY mission guidance. [redacted]

~~(S/B)~~ A record of POPPY (Missions [redacted] is given in the *History of the Poppy Satellite System* (1978). The format was suggested by topics specified by the DNRO:

> ... program objectives, costs, contractors, mission launch and termination dates, significant problems and anomalies and their mission impacts, significant intelligence contributions, an overview of mission successes and failures, ground stations, key personnel, etc. [redacted] Cite 1354, 30 Sep 1977)

The 96-page report was prepared at [redacted] in a period of weeks, and it complied with the task, literally. Each topic was addressed in turn, beginning to end. The report records technology and techniques and their evolution. No particular effort was made to make the report lively or readable. Those significantly involved in conceiving, implementing, and supporting POPPY are mentioned only in an appendix, titled "Key Contributors."

~~(S/B)~~ In October 1996, Capt (now RAdm) Rand H. Fisher (then the LEO systems program manger) commissioned the history of [redacted] (Missions [redacted]. He suggested a chronological, event-driven narrative. What happens in the world, affects design. What is developed, affects operations. Key players should be identified and credited with their contributions as the narrative proceeds. Nor should the history gloss over pitfalls and false starts that are part of every real system development. We should tell about near misses and failures, as well as successes; disagreements, as well as agreements and compromises; losses and gains. The objectives were to satisfy the NRO requirement for a [redacted] history and edify those who get the chance to read it. The document was to be written for the men and women who work in our laboratories, industrial facilities, and ground stations and who want to know more about roots of systems they make happen and perform operationally.

~~(S/B)~~ While research and writing were underway, the scope changed — as a consequence of decisions, within the NRO and NSA, to accelerate consideration of POPPY for declassification and potential public disclosure. The operational systems [redacted] program management office of the LEO SPO, under the late [redacted] was tasked by the joint POPPY declassification integrated process team (IPT) to provide materials, including text, historical references, and artifacts. Accordingly, greater emphasis was placed on [redacted] precursors, particularly GRAB, which had been treated only cursorily in the 1978 POPPY history, and on identifying documents of potential interest to historians. The story of [redacted] turned into a story of [redacted] and predecessors and a supporting historical archive.

~~(S/B)~~ *U. S. Navy/NRO Program C Electronic Intelligence Satellites (1958-1977)*, a history of GRAB and POPPY, is provided herewith to support the POPPY declassification IPT. The first six chapters — distributed by the LEO SPO in January as *U.S. Navy Electronic Intelligence Satellites (1958-1962)* — have received minor corrections and additions resulting from further research. Some additional paragraphs are now unclassified, consistently with DCI approval, on 30 April 1998, of the SIGINT Committee's request to declassify specific aspects of GRAB for public disclosure as part of the Naval Research Laboratory's 75th anniversary celebration in June 1998.

EXECUTIVE OVERVIEW

(U) A U.S. Navy ELINT satellite system became operational in July 1960 and was operated until August 1962. The mission was to obtain information on Soviet air defense radars that could not be observed by Air Force and Navy ferret aircraft flying ELINT missions along accessible borders in Europe and the western Pacific.

(U) The system was proposed by the Naval Research Laboratory in the spring of 1958. In parallel with exploratory development by the NRL, the Office of Naval Intelligence obtained endorsements of Project Tattletale from elements of the executive and legislative branches. With positive recommendations from State, Defense, and CIA, President Eisenhower approved full development on 24 August 1959. By then, the project had been placed under a limited distribution security control system (Canes) with access limited to fewer than two hundred people in the Washington D.C. area. Development and interagency coordination proceeded as the GRAB (Galactic Radiation and Background) experiment.

(U) After NRL completed development of the GRAB satellite and a network of overseas ground collection sites, a first launch was approved by Eisenhower on 5 May 1960, just four days after a CIA U-2 aircraft was lost on a reconnaissance mission over Soviet territory. The GRAB satellite got a free ride into space on 22 June 1960 with Navy's third Transit navigation satellite. GRAB carried two electronic payloads, the classified ELINT package and instrumentation to measure solar radiation. The SolRad experiment was publicly disclosed in DoD press releases on this and subsequent launches. The cost to achieve an initial operating capability was [redacted] Four more launches were attempted, one of them successfully on 29 June 1961. Total cost of the program was [redacted]

(U) The Director of Naval Intelligence exercised overall control. Field sites were operated by elements of the Army, Navy, Air Force, and CIA. Data recorded on magnetic tape was couriered back to the NRL. Tapes were evaluated, duplicated, and forwarded to the NSA at Army Fort Meade, Maryland, and the Strategic Air Command at Offut Air Force Base Omaha, Nebraska, for analysis and processing. In searching the tapes for new and unusual signals, NSA found that the Soviets were already operating a radar that supported a capability to destroy ballistic missiles. The [redacted] SAC's processing was aimed at building the SIOP (single integrated operations plan), a responsibility of the Joint Strategic Targeting Staff at Offut AFB.

~~(S/B)~~ Shortly after the NRO was officially established as an operating agency of the DoD, the Navy ELINT satellite project and its multi-agency infrastructure were assimilated in the NRP as Program C (Navy) in July 1962. The GRAB successor, two-ball POPPY 1/Mission [redacted] was launched five months later and was followed, in the next nine years, by six more launches of three or four POPPY satellites at a time. Starting as an ELINT general search system, the POPPY mission gradually expanded, as capabilities improved, to encompass: general search, ABM search, technical intelligence, EOB production, and ocean surveillance.

~~(S/B)~~ Growing concern in the U.S. defense establishment about demonstrated abilities of Soviet fleets to project military power across seas and oceans, was registered in 1970 by the USIB's designation of ocean surveillance as a national intelligence objective. Pursuant to a study conducted by the Defense Science Board, POPPY was upgraded by NRO and Navy to become an interim ocean surveillance system. Meanwhile, NRO, Navy, and NSA conducted broader studies to determine an optimum system and concluded in 1972 that the POPPY technology, infrastructure, and operational concept should evolve to [redacted] POPPY operations continued at [redacted] MGSs until 1977, when [redacted]

DISTRIBUTION

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	V. Rose (8124 Support)	32
	[redacted] (5701.1)	33
	A. Collier (IPT Risk Assessment)	34
NSG	D. Walizer (OIC NSGCDET Potomac)	35
	K. Wickham (N1)	36

	R. Scherr (Archivist)	37
CNA	G. Federici (Director, IO&W)	38
	B. Wald (Consultant)	39
Spare	IPT Staff	40-50

TABLE OF CONTENTS

FIGURES

Chapter 1. ANTECEDENTS

(U) *Antecedents to surveillance from space in the 1950s were well publicized American and Russian participation in an international space program and parallel, covert U.S. efforts to gain more knowledge of new Soviet weapons and defenses. The Naval Research Laboratory participated in both endeavors.*

Vanguard

(U) In October 1954, planners of the International Geophysical Year, meeting in Rome, Italy, adopted an American proposition that artificial satellites could be placed in orbit above the Earth's atmosphere to observe extra-terrestrial radiation and geophysical phenomena. Proposals from the U.S. armed services circulated in the spring of 1955, and the U.S. National Security Council consented to the idea of a space program with a peaceful purpose, if it would not interrupt ballistic missile programs — a particular concern of Secretary of Defense Charles E. Wilson. An advisory panel of eminent scientists was formed by Donald A. Quarles, assistant secretary of defense for research and development (R&D), to evaluate the several proposals to achieve earth-circling satellites. In midsummer, the White House and Kremlin separately announced intentions to put satellites into orbit during the 18-month scientific program, to start in two years. International participation, down to the grass roots level, would be enabled by coordinated efforts to track the small, manmade objects in outer space, using both radio and optical equipment. The U.S. Department of Defense (DoD) committed technical skills, equipment, and facilities of the Army, Navy, and Air Force to build, launch, and operate a scientific satellite for the National Academy of Sciences. American universities and government laboratories submitted ideas for experiments to the U.S. national committee for the International Geophysical Year. Those selected were funded by the National Science Foundation.

(U) The Naval Research Laboratory (NRL) in southwest Washington, D.C., was selected by Assistant Secretary Quarles' advisory panel in late summer to develop the scientific satellite and a passive tracking system. Administrated by the Department of the Navy (DoN) through the Office of Naval Research, the Navy Lab had a solid track record, extending back to 1946, in investigating physical phenomena and properties of the upper atmosphere by means of sounding rockets that telemetered scientific measurements back to earth. SecDef Charles Wilson formally assigned overall technical responsibility for the National Academy satellite to the Navy on 9 September 1955. The Air Force would provide a launch site and support from the Patrick Air Force Base ballistic missile test center at Cape

Canaveral, Florida. The Army would build tracking stations and provide communication circuits. The Glenn L. Martin Company in Baltimore, Maryland, won a competed contract to develop a rocket, built to NRL's specification of major characteristics and required performance. Martin had previously manufactured for NRL the Viking sounding rocket, first fired in 1949. The Viking would be adapted as the first stage of a nonmilitary three-stage launch vehicle for scientific Project Vanguard. NRL's contract with Martin called for six test vehicles and six satellite launch vehicles, the expectation being that one in six attempts to orbit a satellite would succeed. In the same time frame, under a higher DoD priority, Martin undertook developmental work as prime contractor for the Air Force Titan intercontinental ballistic missile (ICBM). The first Vanguard test vehicle, a single-stage refurbished Viking, was launched in December 1956.

(U) The Russians were first in space. The Kremlin announced, on 26 August 1957, successful firing of an ICBM. Sputnik was launched on a modified ICBM from Tyuratam on 4 October carrying a scientific payload that transmitted for 23 days. On 3 November, Sputnik 2 went into orbit, with a live dog as a passenger, and transmitted for seven days. Plans were announced to begin lunar flights in two years. The space feats boosted Russian national pride and benefited the U.S.S.R. economically and politically, while the U.S. debated national priorities and capabilities in the news media and on Capitol Hill in Washington, D.C.

(U) Vanguard had completed three successful test vehicle firings, and the first launch of three live stages with a minimal four-pound spherical test payload was scheduled for December. As backup to Vanguard, ordered by President Eisenhower after Sputnik 1's triumph, the new secretary of defense, Neil H. McElroy, approved on 8 November an updated proposal from the U.S. Army Ballistic Missile Agency in Huntsville, Alabama, for two attempts to orbit a satellite using a modified Jupiter C intermediate range ballistic missile (IRBM). A 20-pound cylindrical Vanguard instrumentation package, designed to measure cosmic radiation and meteoric impact, was transferred from NRL to the Jet Propulsion Laboratory in Pasadena, California, for adaptation to a 31-pound, bullet-shaped satellite named 'Explorer'.

(U) While the U.S. scientific program was being augmented in response to Sputnik, the responsibility of DoD's director of guided missiles was expanded to include military space programs. Military operational requirements for satellites were under review by the Armed Forces Policy Council. The council was chaired by SecDef Neil McElroy and included the deputy secretary of defense, service secretaries, and service chiefs. Council member Adm Arleigh A. Burke, chief of naval operations (CNO), designated RAdm John E. Clark, director of the guided missiles division in the office of CNO, to speak for the Navy. Clark stated the Navy's operational requirements for reconnaissance/surveillance (most urgent), navigation, communication, and anti-submarine warfare detection satellites. He listed as common to all three services, requirements for a weather satellite, an electronic countermeasure satellite, and a nuclear armed missile space platform (Nov 57).

(U) At midday on the 6th of December, the U.S. failed its first attempt to orbit a test payload when the new Vanguard rocket lost thrust, tipped, and exploded seconds after liftoff from its launch stand at Cape Canaveral — to the dismay of millions of Americans tuned to live broadcasts. [The damaged 6.4-inch sphere is on exhibit at the Smithsonian Air and Space Museum near a full-scale Vanguard launch vehicle.]

(U) Undaunted by the Vanguard failure, NRL distributed 200 copies of an updated 121-page secret report of its collective vision for America's space program beyond Vanguard (10 Dec 57). Forty NRL contributors were guided by John P. Hagen, who directed Project Vanguard. Included among military, operational, and scientific satellites were systems designed for radio navigation, nuclear weapons test reconnaissance, electronic intelligence reconnaissance, communication, geophysics, solar physics, interplanetary and cosmic research, manned flight and biological experiments, lunar vehicles, and satellite launching vehicles and facilities. The report showed that most needs could be met by 300-pound satellites launched by an IRBM for the first stage (either Air Force Thor or Army Jupiter) and Vanguard hardware for upper stages. The post-Vanguard program was included as part of Navy recommendations, compiled by the Bureau of Ordnance, for the national satellite and space vehicle program (24 Dec 57). A month later, Capt Peter H. Horn, NRL's military director, forwarded a copy of the entire report directly to CNO Arleigh Burke (22 Jan 58).

(U) The Army delivered the birth of outer space exploration for the U.S. by its launch of Juno, a hastily modified Jupiter C, on 31 January 1958, carrying battery-powered Explorer into elliptical orbit. Anomalous scientific data, transmitted to the Vanguard Minitrack stations for nearly four months, contributed to James A. Van Allen's later discovery of the Earth's inner radiation belt, which interfered with his cosmic ray experiment at high altitudes. A second Vanguard attempt to orbit a minimal payload on 5 February again disappointed America, due to a control system failure a minute after liftoff.

(U) Military and intelligence potential of space-based systems quickly gained widespread appreciation in the DoD. Study efforts became projects. SecDef Neil McElroy formally established the Advanced Research Projects Agency (ARPA) to replace an ad hoc (guided missiles) group and oversee space-related research and development within the military departments (7 Feb 58). Under Roy W. Johnson, recruited from General Electric, ARPA was quickly staffed by civilians from the office of the secretary of defense (OSD) and military officers from the Army, Navy, Marine Corps, and Air Force. RAdm John Clark was reassigned from duty as OpNav's director of guided missiles to become ARPA's deputy director. ARPA backed a continuation of the Army Explorer project and funded full-scale development of an Air Force advanced reconnaissance system (Sentry).

(U) Among the needs for a satellite to support naval warfare was an electronic countermeasure satellite, an operational requirement that Navy shared with Army

and Air Force. The avionics division of the Navy Bureau of Aeronautics, which answered to ECM-related requirements other than shipborne configurations, requested by confidential letter that the NRL establish a new priority B problem: "To design, develop, and fabricate an Electronic Countermeasures Intercept System, subminiaturized, lightweight, for supersonic vehicles" (5 Mar 58). The ECM intercept system of the future was intended to cover 1000 to 10000 MHz (50 MHz to 50 GHz desired), be compatible with tri-service efforts in ECM and supersonic vehicle fields, be installed on either manned or unmanned vehicles, and automatically retransmit intercepted data to existing naval receiving stations. Equipment for evaluation was wanted by 1 January 1959. The new problem would supersede a long-standing project to develop wide open radar intercept systems for naval early warning aircraft (NRL Problem 54R06-17). On that same day, 5 March, the Army Explorer team's second satellite failed to attain orbit when the fourth stage did not ignite.

(U) The Vanguard team's third try with a test payload, on 17 March 1958, went according to plan. Solar powered Vanguard 1 was deployed in an elliptical orbit, transmitted its signal for seven years, and permitted the first long term observation of orbital dynamics, resulting in discovery of the Earth's oblateness and initiation of mathematical modeling of the Earth's gravitational field.

Electronic Countermeasures

(U) The confidential ECM task from BuAer was intended for (and had been invited by) NRL's third-echelon countermeasures branch, which developed equipment for conventional collection platforms to gather intelligence on signals from threat weapons systems. The branch had developed systems for use on naval ships, transportable equipment huts for deployments to friendly military installations adjacent to Communist-bloc borders, and miniaturized equipment for use on aircraft and submarines. ECM technology advanced by the branch included electronic signals intercept, direction finding, jamming, and deception techniques, including chaff and decoys. The countermeasures branch provided equipment, technical support, and technology transfer for various surveillance and reconnaissance platforms, via the Navy Bureaus of Ships and Aeronautics, the Air Force ECM wing in Biloxi, Mississippi, and the Central Intelligence Agency (CIA). Intercept equipment developed by the branch included antennas and receivers, recorders, and analysis devices. These equipments were often upgraded to exploit new technology and keep pace with the threat signal environment as it spread into higher regions of the radio frequency spectrum. Several generations of signal direction finding (DF) equipment had been developed for shore stations, ships, and aircraft, including long-range patrol planes and electronic signal ferrets.

[redacted]

(U) Howard O. Lorenzen, countermeasures branch head since 1950, had arranged after World War II, through wartime contacts in the British Admiralty, to borrow some captured German electronic equipment stored at the Admiralty's Signal and Radar Establishment in Portsmouth, England. Two devices were to prove especially fruitful: the Wullenweber goniometer and the Athos system's crystal video receiver.

(U) In 1957, at the back end of the Hybla Valley Coast Guard Communication Station in northern Virginia, the branch's DF section had erected a wide-aperture radio DF antenna, consisting of a 400-foot diameter ring of broadband sleeve antennas and an inner vertical reflector screen. The German goniometer, located in a small building in the center of the array, was used to accurately measure bearings of radio signals transmitted at high frequency (HF) from ships at sea. The Wullenweber technology was the basis for a collaboration between Howard Lorenzen and the new head of the Naval Security Group, Capt Bernard F. Roeder, a line officer with a sub-specialty in communications. Navy-funded project [redacted] would enable NavSecGru to intercept and determine the direction of HF radio signals, then fix a transmitter's position by correlating bearings reported from a net of [redacted] stations. A very small experimental remote array was being built about a mile east of the 400-foot array and would be connected to equipment in the same Wullenweber operations building. [In years to come, circularly disposed antenna [redacted]

(U) Research engineer Reid D. Mayo had been advancing wide-open crystal video receiver technology for shipborne and airborne ECM applications since 1949, based at the outset on the Athos warning system. Athos had been used by lookouts on German submarines to detect enemy airborne radar operating at ten-centimeter and three-centimeter wavelengths. The latest advance by Mayo's unit was the design of a [redacted] antenna/detector, sponsored by BuAer's avionics division for the Navy's two airborne early warning squadrons (NRL Problem 54R06-20). The [redacted] antenna would be used with airborne crystal video receivers to search for possible new radar signals from Soviet aircraft.

(U) Sputnik 1 temporarily diverted several members of the DF section, including Reid Mayo, to track its 20 MHz signal and help determine its orbit, using both bearing and Doppler measurements generated by the Wullenweber system at Hybla Valley. Mayo and his assistant, Vincent S. Rose, shifted in early December to a crash project, sponsored by the BuShips countermeasures branch, to develop a periscope-mounted spiral antenna, [redacted] that would be connected to crystal video receivers for collection of [redacted] radar signals within the periscope's line of sight. The systems section of Lorenzen's branch developed a similar configuration, with a vertical sleeve monopole antenna, to cover low to very high communication frequencies (15 KHz to 265 MHz). Following integration and testing at Kolmorgen Optical, Inc. in North Hampton,

Maine, Kolmorgen's modified periscope (type 8A) and NRL's intercept equipment were installed on the [redacted] to support its mid-January deployment to the [redacted] Reid Mayo and William Edgar (Ed) Withrow, also from the DF section, observed the installation, tested the ECM system, and participated in sea trials. They did the same, in February and March, for a second system on the [redacted] would operate in the [redacted].

(U) While Reid Mayo engineered the undersea project, his superiors were promoting applications of crystal video receiver technology in outer space. Howard Lorenzen, countermeasures branch head, and Louis A. Gebhard, superintendent of the radio division, had collaborated on a description of an electronic intelligence reconnaissance satellite, which was incorporated as a seven-page section in NRL's 10 December report to BuOrd on the post-Vanguard program. The system would be targeted on one radar employed in the Moscow defense complex, which was "out of range for ground-based sites and conventional airborne platforms," and utilize "a microwave antenna, a bandpass filter, a crystal detector, a simple video amplifier, a pulse stretcher circuit, a modulator, a tiny transmitter, and a telemetering antenna" (10 Dec 57, section 2.1.3.2). A four-pound battery would provide about 100-milliwatt average power for three weeks of intermittently operating a payload weighing about 27 ounces. Payload characteristics were compatible with the powerful [redacted]. The payload would be activated by radio command when above Moscow's radio horizon and would telemeter information to existing receiving stations within line of sight. Missions and payloads would expand as "as the load-carrying capacity increased." They had discussed the project in detail with cognizant personnel in the Office of Naval Intelligence and expected to be ready for launch "within about a year, assuming that appropriate priorities would be assigned." Since then, Lorenzen had encouraged Marion B. Pickett, his counterpart in BuAer's avionics division (AV-42), to support NRL's exploratory research, resulting in the 5 March priority B ECM problem request.

National ELINT Program

(U) ECM equipment was designed for tactical warfare and used to support operational commanders. Howard Lorenzen had been among the pioneers of after-the-fact analysis of countermeasures intercept data, and, to further this effort, he had helped organize an ELINT component of the joint communication and electronics committee in 1948 and chaired the ELINT sub-panel during the Korean War. By 1955, magnetic drum and magnetic tape recording technology and protocol had advanced to a point that electromagnetic signals of interest could be preserved on tape and then analyzed elsewhere in detail after the collection event. Recorders provided a technical means to support an urgent Air Force need to develop a Soviet radar order of battle. Accordingly, the National Security Council had directed and the DoD had implemented a loosely coupled national electronic intelligence (ELINT) program under the secretary of the Air Force (SAF) to fund and manage a

second tier of signals exploitation. SecDef Charles Wilson had assigned responsibility to the SAF and delegated to him authority to direct and supervise consolidated processing, analysis, and dissemination of ELINT data and to guide and coordinate ELINT activities of all agencies of the DoD (13 Jul 55). In his new office as SAF the following month, Donald Quarles had the responsibility to implement a national ELINT program.

(U) Pursuant to national and defense directives, the Army & Navy Electronic Evaluation Group, collocated with NavSecGru headquarters in northwest Washington, D.C., had been redesignated as the National Technical Processing Center (NTPC). The NTPC was administered by an ELINT coordinating group in the office of the assistant chief of staff for intelligence USAF (AFCIN-Z), jointly staffed by about a hundred personnel from the three military departments and CIA, and commanded by an Air Force lieutenant colonel. The services and CIA's office of ELINT were represented in AFCIN-Z's ELINT advisory board. U.S. ELINT objectives and general intelligence requirements were prepared by the AFCIN-Z, submitted by the SAF, and approved by the Joint Chiefs of Staff (JCS) as guidance for signals collection (recording) to operational forces equipped with ECM equipment. Operational commanders retained unabridged authority over integral ECM resources and freedom to exchange ELINT for mutual support. Recordings were couriered, as expeditiously as possible, to the NTPC.

(U) NRL's countermeasures branch participated in and supported the national ELINT program by serving on technical committees; developing intercept equipment; evaluating data acquired from ECM configurations installed on Navy, Air Force, and CIA platforms; and technically supporting the NTPC through the Office of Naval Intelligence. Within the DoN, developmental requirements came from elements of the office of CNO, sponsorship from material bureaus. In both cases, cognizance corresponded with the platform: shipborne, airborne, or shore-based. Development coordination across platforms and military departments was provided by the Office of Naval Research (ONR) in the Pentagon.

Chapter 1 References

13 Jul 55 SecDef (S) DoD Directive S-3115.2
Subj: National ELINT Program
Ref: NSCID 17, 16 May 55

Nov 57 RAdm John E. Clark statement to Armed Forces Policy Council, summarized in *The Navy in the Space Age*, pp. 41-42, dated 15 June 1959

10 Dec 57 NRL (S/restricted data) Report 5097, Ser 00808/RD (Rev. 2)
Subj: A Satellite and Space Vehicle Program for the Next Steps Beyond the Present VANGUARD Program (U)

24 Dec 57 BuOrd (S) letter to CNO, Ser 005029
Subj: [Navy's recommendations for the national satellite and space vehicle program]

22 Jan 58 DirNRL (S/restricted data) letter to CNO, 4140-16:JWS:eb, NRL Prob A02-88, Ser: 00821/RD
Subj: "A Satellite and Space Vehicle Program for the Next Steps Beyond the Present

VANGUARD Program"; transmittal of
Encl: NRL Report 5097, dated 10 Dec 57

7 Feb 58 SecDef (U) DoD Directive 5105.15
Subj: [Advanced Research Projects Agency]

5 Mar 58 BuAer (C) letter to DirNRL, Aer-AV-4212, 02982
Subj: Establishment of a Problem at the Naval Research Laboratory; Request for
Encl: (1) Confidential Problem Details [for TED Project Number NRL-AV-42004]

Chapter 2. TATTLETALE

(U) *The Naval Research Laboratory proposed development of a satellite system that could produce intelligence on Soviet air defense systems. Project Tattletale was successfully advanced by the Office of Naval Intelligence, over a nine-month period, through the DoN, intelligence community, and DoD.*

NRL's Satellite Proposal

(U) Upon return from temporary assigned duty to the [redacted] Reid Mayo took leave with his family in Grand Rapids, Michigan, to visit his wife's family. During the return trip, on the night of 28 March 1958, a late season snowstorm stranded the Mayos at a Howard Johnson's restaurant on the Pennsylvania Turnpike. While his wife and two children dozed, he began thinking about the work that awaited his return to the NRL. The periscope-mounted antenna project would be wrapped up in a couple months. Two airborne equipment problems were already on the books. Vanguard 1 had been launched on St. Patrick's Day (11 days ago) and was orbiting the Earth 11 times every day. In each cycle its altitude went from 400 to 2500 miles and back again. It was time to begin thinking of this new platform in earnest.

(U) Reid Mayo conceived of taking the S-band portion of his submarine ECM system to orbital altitude and thereby gaining access to air defense radar in the Soviet interior. He made preliminary detection-range calculations for the [redacted] radar on a paper placemat, concluding that intercepts from emitters at the radio horizon could be made at orbital altitudes up to 600 nautical miles. He presented the placemat and S-band concept directly to his branch head in NRL Building 56 at the first opportunity. An S-band receiver assembly, highly minitiaturized, could be packaged in a satellite the size of a fully instrumented 20-inch Vanguard. Here was a way to solve a significant intelligence problem: Did the Russians have different air defense equipment in the interior from what ferret aircraft saw on the borders? The idea was much more ambitious than the Lorenzen/Gebhard proposal several months ago, far less ambitious than BuAer's vision, but it could be done in the time frame initially suggested by NRL and stipulated by BuAer. Howard Lorenzen diverted section head James H. Trexler from his project, Moon Bounce, to help elaborate the space collection aspects; electronic scientist Bruce Wald from HFDF, to help on the concept of operations.

(U) Lorenzen arranged with BuAer's avionics division for Mayo to suspend work on the [redacted] antenna/detector and to concentrate on exploratory

development of electronics under BuAer's request for a wide-open ECM system for manned or unmanned vehicles, the initial effort to be centered on S-band. Reid Mayo hand-carried the completed problem acceptance form to the associate director of research for electronics, Allan H. Schooley, for signature. In accepting BuAer's problem of developing "Intercept Systems, lightweight, Subminiaturized for supersonic vehicles," NRL estimated the three-year cost at $487.9K (2 May 58).

(U) In addition to financial support from BuAer, ELINT community support and participation would be needed to operate the system and exploit collected data. The countermeasures branch prepared a top secret proposal for an electronic intelligence satellite designed to detect and transpond S-band radar signals from a small satellite in a circular orbit (6 Jun 58). Lorenzen submitted the seven-page proposal to the Office of Naval Intelligence (ONI), whose responsibilities included management of the Navy ELINT program and Navy participation in the national ELINT program.

(U) Research and exploratory development continued with the first increment of funds from BuAer. In the meantime, the countermeasures branch completed the first phase of the ECM project for BuShips. The type 8A ECM periscope configuration had been used successfully in the [redacted] One more submarine installation, NRL's third, had to be completed by June, followed by transition to industry for production versions (type 8B) (13 Jun 58).

(U) On 20 June 1958, only four months after being formally established, ARPA separately asked NRL to develop a U.S. space surveillance system (weapon system 434) that could actively detect and track all space objects deployed by the U.S. or other nations. The Navy Lab was selected because of its experience in developing the Minitrack passive satellite tracking system for Vanguard and its successful tracking of Sputnik satellites, using both passive and active techniques. Sputnik's 20 MHz signal had been tracked using the Wullenweber system at Hybla Valley, and active tracking had been demonstrated by a joint Army/Navy effort. A continuous wave (CW) transmission capability of the Army Signal Corps Signals Research and Development Laboratory in Fort Monmouth, New Jersey, had been used in conjunction with the NRL's reception capability at the prototype Vanguard Minitrack Tracking Station, [redacted] to skin-track the Sputniks. NRL proceeded to develop WS 434 SpaSur, a chain of transmitter sites and receiver sites, forming a CW electronic fence above the southern states, from coast to coast. [The Naval Space Surveillance Facility, headquartered at the Naval Weapons Laboratory in Dahlgren, Virginia, was formally established two years later and was assigned responsibility for operating the skin-track fence. Using both active and passive techniques, NavSpaSur would later play an essential role in producing ephemeris for systems that needed to determine satellite positions precisely for mission success.]

ONI's Staff Study

(U) RAdm Vernon L. Lowrance, a submariner and deputy director of naval intelligence for intelligence (DepDNI/Op-92B), ordered a staff study on NRL's proposal for an electronic intelligence satellite. Action fell to the operational intelligence branch (Op-922Y), then to the desk of Cdr Earle G. Hutchison, Jr., an intelligence specialist assigned as head of the branch's ELINT section (Op-922Y4) and appointed as the Navy ELINT coordinator. Hutchison served as the Navy member of AFCIN's special ELINT advisory board, and he chaired a Navy ELINT program review board, which guided Navy participation in the national program, including the NTPC. He also chaired the review board's technical guidance committee, and he invited committee members to help with the staff study.

(U) While the satellite project was being planned by NRL, Earle Hutchison had been revising and coordinating instructions that governed the Navy ELINT program and its management structure. His products, two OpNav instructions, had recently been signed out by the office of the CNO (30 Jun 58). The updates were stimulated by high-level scrutiny of the foreign intelligence community and the national ELINT program — triggered by the fact that the U.S. first learned Sputnik 1 was in orbit by a Kremlin announcement the day after the launch from Tyuratam, despite Russian disclosure of planned broadcast frequencies at 20 MHz and 40 MHz several days before.

(U) ELINT was under review by the U.S. Communications Intelligence Board, which established objectives and priorities for the foreign communications intelligence (COMINT) program. The National Security Agency (NSA), directed by LtGen John A. Samford USAF, was responsible for COMINT and for the cryptography that protected U.S. electromagnetic communications from foreign eavesdropping. Unlike ELINT, the cryptologic community was tightly coupled and highly structured. COMINT collection, in response to NSA tasking, technical guidance, and feedback, was performed by NavSecGru and its service counterparts, the Army Security Agency (ASA) and Air Force Security Service (AFSS). The service cryptologic agencies also participated in the much smaller national ELINT program. Although ELINT and COMINT were integrated at the unit level, they diverged upward. Thus, for example, NSG's shore-based and afloat units looked to two authorities: NSA for COMINT, AFCIN-Z for ELINT. Earle Hutchison's division head, Capt Charles M. Bertholf, assistant DNI for production (Op-922), served as the Navy member of an ELINT task force chartered to look at the relationship of ELINT to COMINT. The task force was chaired by CIA's deputy assistant director for collection/scientific intelligence, Philip G. Strong. The task force had concluded in June that it made sense to unify the two signals disciplines at the top and recommended that NSA's charter be expanded to encompass ELINT under guidance from an ELINT committee (ELCOM) of a joint intelligence board. The instructions crafted by Hutchison delineated the Navy infrastructure for ELINT, largely indifferent as to whether the superstructure was captained by AFCIN or DirNSA.

(U) Howard Lorenzen's first quarterly progress report on an intercept system for supersonic vehicles was forwarded by his supervisor, Superintendent Lou Gebhard, to BuAer's Marion Pickett. NRL reported completion of link analyses, submission of a related proposal to ONI, and completion of "a block diagram of a crystal-video intercept system which is capable of operating unattended" (23 Jul 58).

(U) The first Pentagon meeting of a working group to consider the proposal of the Naval Research Laboratory for an electronic intelligence satellite occurred on 28 July 1958. Organizations represented were ONI, ONR, BuAer, NRL, and NSG. ONI's Earle Hutchison chaired the meeting and set forth the rules. Based on an earlier recommendation from NSG's Cdr Frederick W. Hitz, Jr., 'Tattletale' would be used as an unclassified title for the top secret project. A tattletale repeats what it hears. Written materials would be confined to a Pentagon reading room requiring special clearance for access. NRL's Jim Trexler described the concept, using five large graphics referenced in the proposal. [redacted] from ONI's production division summarized what was known about Soviet air defense systems. ONR's Harris B. (Bob) Stone reported on WS 117L — an advanced, multi-mission, space-based reconnaissance project conceived by the RAND Corporation for the Air Force and under development by Lockheed Aircraft — which had received a good deal of discussion in newspapers and magazines as the 'spy in the sky satellite'. Referring to ARPA's progress report of 31 March, Stone pointed out that 117L had been funded with $233.7M through fiscal year 1959, whereas ONR had available about $100K that might be committed to the NRL effort. Actions were assigned to review the Lab proposal in detail and compare it with Army and Air Force approaches. Bob Stone agreed to visit two contractors working on WS 117L: Airborne Instrument Laboratory (AIL) in Mineola, New York, and Haller, Raymond, and Brown (HRB) in State College, Pennsylvania. Other members of the group would study the NRL proposal and prepare for a more detailed discussion at the next meeting. Paul J. Martin of the DepDNI's staff wrote the secret minutes for this and subsequent meetings.

(U) The working group met for a second time on 6 August. Two more organizations participated. The office of the assistant CNO for R&D (Op-91), a regular member of the Navy ELINT technical guidance committee, was represented by Capt Frank G. Marshall, Jr., a naval aviator who was the assistant to the systems planning branch head of Op-91. NTPC was represented for the first time, too, by Henry F. DeCourt. Bob Stone briefed on his visits to AIL on 1 August and HRB on 4 August.

~~(S/B)~~ The Sentry photoreconnaissance portion of 117L [redacted] AIL's Mark 1 Ferret ELINT system was initially to have been delivered to Lockheed next January for launch in August, but AIL's funding had recently been reduced from $8M to $3.5M. Hardware development was still in the breadboard stage. HRB was the intelligence member of

the 117L team and had been tasked to develop information for AIL and Lockheed on the expected ELINT environment for the period 1960-65. Most of this meeting was devoted to pros and cons of the two different concepts for ELINT from space. Bob Stone had already made arrangements to visit the West Coast 117L establishments during the third week of August and would provide more information next meeting.

(U) At the NRL, members of the countermeasures branch met with members of the atmosphere and astrophysics division on 14 August, a Thursday. Lorenzen asked for support in design, instrumentation, and testing of an ECM satellite. John T. Mengel, head of the radio tracking branch and responsible for Vanguard's Minitrack system, proposed a Vanguard liaison man to coordinate and expedite work among Vanguard elements that could be of help. John Hagen, division superintendent and Vanguard project director, asked for a day or two to consider feasibility and agreed to get back to Lorenzen no later than Monday. Hagen then furnished Robert W. Stroup, who was Vanguard's general coordinator and trouble-shooter.

(U) Representatives of ONI, ONR, BuAer, NRL, NSG, OpNav R&D, and NTPC gathered again in the Pentagon on 21 August. ONR's Bob Stone reported on his trip to California and visits to the Air Force Ballistic Missile Division in Inglewood and Lockheed Aircraft in Sunnyvale. WS 117L's cylindrical platform would measure 5 x 19 feet. The photographic capability was being developed by Eastman Kodak; infra-red, Aerojet General; and ground data processing, Philco. Batteries would provide 20 to 30 days of life. There would be some emphasis on biomedical experiments pertaining to manned space flight, and development of a capsule recovery capability would be attempted.

(U) The 117L/Sentry ELINT capability, code word 'Star', would first be included on the twentieth Thor-boosted firing in June 1960. The scope of 117L awed many of the working group participants. Knowing the funding profiles for Vanguard and WS 117L and that a single Douglas Thor launch vehicle would take $5M, Frank Marshall from ACNO (R&D) was totally skeptical of Howard Lorenzen's talk of costing out the NRL project in terms of hundreds of thousands of dollars. His own estimate, based on the empirical launch success probability of 1 in 6, was that it could take as much as $40M to get one satellite on orbit a year ahead of Lockheed's schedule. Was a one-year advance in the time-table for U.S. collection of Soviet S-band ELINT data worth that much money? Feasibility questions were raised by other members, and Howard Lorenzen accepted Op-91 action items for NRL to prepare a mission impact assessment of anomalous, non-circular orbits and an explanation for NTPC of methods to fix locations of intercepted radar signals.

(U) After discussion, the working group voted to go forward and settled on an outline for a concise written endorsement of NRL's proposal. Members were given drafting assignments from among five areas that would receive comment: statement of proposal, technical feasibility, operational feasibility, statement of

intelligence requirement, and, lastly, fiscal considerations. The group met again on 26 August, to review the joint product, compiled and edited by Paul Martin.

(U) NSG had identified three overseas naval ELINT stations suitable for Tattletale and urged participation by other services and agencies. To house receiving equipment, NRL had decided on transportable equipment shelters, which could readily be relocated to accommodate various orbital inclinations, changes in the status of host stations, or new targets. Shelters would be manned only during scheduled events. NTPC had estimated to ONI that a factor of ten to one could be used as the ratio between analysis time and collection time and that engineering feedback on the ELINT payload would be available within a few days after NTPC's receipt of the first recordings. ONI's basic and technical intelligence branch (Op-922G), located at the U.S. Naval Observatory (USNO) on Massachusetts Avenue, concurred in using the 10:1 ratio to program resources for a joint analysis effort. BuAer had budgeted for five satellites and ground equipment. ARPA would be solicited for launch vehicle funding.

(U) As part of the intelligence community overhaul the summer of 1958, operational and technical control of national ELINT intercept and processing activities were added to the NSA director's charter for cryptography and COMINT by the National Security Council's issuance of intelligence directive number 6 (15 Sep 58). Issued the same day, NSCID 1 established the U.S. Intelligence Board (USIB), chaired by Allen W. Dulles, long-standing director of central intelligence (DCI). Formed of intelligence heads of departments and agencies (CIA, State, Defense, and the three military departments), the USIB would guide and oversee operations of the foreign intelligence community.

(U) The decision to combine ELINT with COMINT at the national level was taken in stride by the naval intelligence community and would not affect its own internal bifurcation of ELINT. Airborne ELINT was collected by early warning (VQ) and long range patrol (VP) squadrons, under the auspices of the deputy CNO for air warfare (Op-05), whereas the head of NavSecGru, RAdm Bernard Roeder, was responsible to the deputy CNO for fleet operations and readiness (Op-03) through the head of the naval communications division (Op-30). Aside from compatibility in technology and personnel skills, the subordination of cryptology to communications served several purposes. NSG enforced communications security for naval communications, many naval SIGINT stations overseas existed as NSG departments of naval communication stations, and communications was a natural entry level for cryptology. Hence, even though the charter for a national ELINT program moved from Air Force to NSA, the Navy program would still need an ELINT coordinator in ONI. Both legs of the Navy ELINT program — ashore/afloat NSG and airborne VQ/VP — would continue to be supported by ONR as the ECM development coordinator, by NRL's countermeasures branch as the developer, and by Op-922G as the technical intelligence expert. ONI would continue to be a customer of Navy and national programs, collating ELINT with other intelligence for the DoN and for theater and fleet commanders. OpNav and operational

commanders, in turn, collated ONI's intelligence with own force dispositions and plans to form the complete picture.

(U) The working group finished its business at a sixth and final three-hour meeting in the Pentagon on 3 October 1958. NRL submitted papers on impact of elliptical orbits (Sep 58) and methods of fixing targets, and these were well-received by Op-91 and NIPC, respectively. The group then agreed to proceed with a low-key advance of the NRL proposal through the Navy and DoD chains. BuAer's money was being used in current fiscal year 1959, but ARPA funding would be sought for next fiscal year. Assuming favorable review by the ACNO (I)/DNI, the proposal would first have to be cleared through Frank Marshall's boss, ACNO (R&D) RAdm John T. Hayward (Op-91) — then approved by the CNO, the Navy secretariat, and ARPA. Marshall cautioned that it would be a hard sell, due to intensive television and news coverage of continuing Vanguard orbital injection failures, the latest public embarrassment just one week ago. Even if the project was approved, White House clearance would probably be needed for each launching — reconnaissance being an area of great international sensitivity. Despite these misgivings, the group refined and finalized the third draft of its positive endorsement of NRL's seven-page proposal, which stood on its own merits: Tattletale would perform a single function, be simple, provide an early capability, and be relatively inexpensive to develop.

(U) In six formal Pentagon meetings of the working group, totaling 15 hours, fourteen men had participated, three with records of perfect attendance, including Chairman Hutchison, NRL's Jim Trexler, and the recording secretary from Op-92B, Paul Martin. Hutchison submitted the final version of NRL's proposal for an electronic intelligence satellite, the group endorsement, and a one-page brief to the DNI, RAdm Laurence H. Frost, via DepDNI Vernon Lowrance. DNI Frost directed that a formal presentation be prepared, suitable for review by Adm Burke, and that a preliminary dry run first be conducted for elements of the office of CNO.

Preliminary Design

(U) The first increment of funding from BuAer had been received in May, but only $20K had been spent in fiscal year 1958, pending approval of Tattletale. Positive reception by the DNI was enough of a go-ahead to increase the pace of development. Lorenzen, Trexler, and Mayo had already reached oral agreement with five other branches, three of them in different scientific areas, for specific Tattletale development or testing work. Raymond B. Owens, who led the countermeasures branch's DF section and was Mayo's immediate supervisor, was an experienced project manager. Lorenzen assigned to him the task of reporting quarterly progress to BuAer and managing the schedule and apportionment of funds to the six cooperating NRL branches.

(U) Ray Owens immediately formalized in writing the previous oral agreements; requested Bob Stroup to be the single point of contact between the

Vanguard development team and the countermeasures branch; and solicited formal problem budget estimates (NRL Form A-1), titled 'Radio Astronomy Experiment', to supersede previous oral cost estimates. Owens requested that the Vanguard team consider classified: connection of the countermeasures branch to the radio astronomy experiment, frequency of the data link, and frequency and coding of the command link. (They would not be provided any specifics on the payload.) Owens then promulgated a tight development schedule, in the form of a confidential branch memorandum to the head of the electronics area, copies to John Hagen and Bob Stroup, summarizing responsibilities and calling for a prototype for electrical testing by 1 January, flight units available for operational use by about 1 April 1959.

(U) In October, Reid Mayo and Vince Rose refined detection range calculations for several types of Soviet early warning radar and determined data link transmission requirements. By the end of the month, they completed preliminary payload design. They collaborated on theoretical design of an RF band-pass filter-detector and provided technical content for a 16-page contract specification for an "omnidirectional microwave transistorized crystal-video radio receiving system ... suitable for mounting in a 20" metallic sphere" (4 Nov 58). Development of the satellite shell and framework, power supply, command receiver, transmitters, and downlink antennas had been allocated to other branches. Ground equipment needs were known, and two olive drab electronic equipment vans had been borrowed from the Army Signal Corps for evaluation.

(U) In preparation for the briefing to CNO, Reid Mayo oversaw the technical information division's (TID) preparation of 30 x 40-inch briefing boards, chiefly artistic conceptions of the collection architecture and components. Artist Nancy A. Monacelli rendered a view of a radio receiving hut in a pastoral setting, door open to reveal the electronic equipment inside. NRL's internal rehearsals were previewed by Lorenzen's superiors: Superintendent Lou Gebhard, Associate Director Allan Schooley, Director of Research Robert M. Page, and DirNRL Capt Peter Horn.

(U) Robert Page, who had specialized in development of radar for the Navy from 1934 until his promotion to director in 1957, was keenly interested in Lorenzen's latest project to go after systems in the Soviet heartland and somewhat disappointed that transmitted pulses would [redacted] — other than the spacing between them. Lorenzen was no stranger to mild criticism from Director Page — his first assignment at NRL, as a new-hire in 1940, had been to build receiver amplifiers, which turned out to be too noisy for use in Bob Page's classified project (called 'RAdio Detection and Ranging', for which Lorenzen was not yet then cleared). Capt Horn agreed to furnish the NRL command presence at the OpNav meeting.

(U) As the dry run approached, Lorenzen was anxious about the effect on the project of transfer of Vanguard to the National Aeronautics and Space Administration (NASA), which had been formed by law on 1 October 1958. Since

then, work had been suspended on satellite development efforts allocated to other branches. He wrote to Superintendent Gebhard that Tattletale's status was uncertain. He wanted reassignment of that work within NRL, a new coordinator from the cooperating division, and immediate commencement of technical liaison meetings.

Navy Review

(U) The first Tattletale presentation, the dry run, was conducted in the Pentagon on 25 November. The new DepDNI for intelligence, RAdm Allan L. Reed, conducted the briefing, supported by Earle Hutchison and Howard Lorenzen as briefers. Hutchison covered security and Tattletale's fit in the national ELINT program. (In this and subsequent briefings, Lorenzen or his deputy, Jim Trexler, briefed the concept of operations and technical aspects. Theoretician Bruce Wald was usually there for backup, to take notes, and to protect and help carry a bulky canvas bag filled with briefing boards. Attendance and results were noted on consultative services record forms by either Lorenzen or Trexler.) The audience of four dozen included a large ONI contingent, led by DNI Laurence Frost, and managers from offices of deputy CNOs — fleet operations and readiness (Op-03), logistics (Op-04), air warfare (Op-05), plans and policy (Op-06) — all but personnel (Op-01) and administration (Op-02). The briefing was classified top secret and lasted one hour. DNI Frost, who had a subspecialty in communications, inquired as to the radio frequency used to command the satellite. Addressing Frost as 'sir', Lorenzen responded that the DNI had no need to know that information. After a pause, Frost acknowledged that Lorenzen was right and enjoined him to remember that fact in subsequent briefings. The briefing team received general concurrence from the audience with encouragement to proceed as rapidly as possible. [Worth noting in regard to OpNav efforts to exploit this technology for the Navy, commencing ten years later, was the presence of future CNO Thomas H. Moorer, one of two rear admirals attending from Op-06.]

(U) The same team gave the presentation to chiefs of bureaus (Ships, Aeronautics, Supplies and Accounts, Yards and Docks, Medicine and Surgery), the chief of naval material, and staff members on 1 December. Not represented at the meeting were Personnel and Ordnance. The Navy bureaus were located at Main Navy, a set of World War II temporary buildings arrayed along Constitution Avenue between the Lincoln Memorial and 17th Street. The space outlook was improving, due to accomplishment of the first full-range firing of Convair's Atlas ICBM at Vandenberg Air Force Base (AFB) two days before, but the Soviets remained far in front and everyone in the room expressed interest in moving ahead with Tattletale. Absence of the ordnance chief forestalled an early opportunity for an interface with the ARPA-funded Transit satellite project, managed by BuOrd.

(U) The main event for NRL, an opportunity to state the case for an ECM satellite directly to the CNO, took place on 8 December. Allan Reed and Howard Lorenzen briefed Arleigh Burke and the senior admirals in OpNav, including Adm

James S. Russell (VCNO) and deputy CNOs. Burke judged that Tattletale was a very worthwhile project and volunteered to sign any papers appropriate to give his endorsement to ARPA. ACNO (R&D) John Hayward recommended to the CNO that a pitch be given to NASA, too. Reed agreed to follow through on Hayward's idea.

(U) Martin J. Votaw, an RF engineer, had developed electronics components for Vanguard's antenna array and spoke the same language as the countermeasures branch. He elected to remain with NRL rather than transfer to NASA and was reassigned from Vanguard to the applications research division of the electronics area. During the period of uncertainty, Mayo had continued informal discussions with Votaw on characteristics of a satellite needed to carry an ECM package and constraints on the payload. After being assigned by his division superintendent, Claude E. Cleeton, as coordinator of cooperative satellite development efforts supporting Tattletale, Marty Votaw met with six members of the countermeasures branch on 12 December. Lorenzen described the project and interest aroused in OpNav, the material bureaus, and CNO. Votaw showed a block diagram of the satellite assembly and described the status of components. Progress was better than expected. All agreed that the payload receiver was now the pacing item. Opening bids were scheduled to begin in three days. To expedite shock and vibration testing, Votaw agreed to provide a spherical structure in which the selected contractor could mount a prototype receiver.

Intelligence Community Review

(U) Before seeking ARPA or NASA sponsorship, DepDNI Reed needed the intelligence community to back the mission. ONI's representative to the USIB's critical collection problems committee got Tattletale on the agenda for an 18 December meeting at the CIA's administration building in Langley, Virginia. The briefing team — Reed, Trexler, Hutchison — addressed 17 people, representing State, OSD (special operations), JCS, Army, Navy, Air Force, CIA, and NSA. Trexler's technical portion elicited good questions from the committee chairman, Col R. R. Stewart USAF, and from CIA's assistant director for scientific intelligence, Herbert P. Scoville, Jr., a leading figure in CIA's participation in WS 117L. Also present for this briefing was [redacted] from NSA, on assignment to OSD's office of special operations (OSO). [redacted] would later facilitate communication between ARPA and CIA regarding project approval.

(U) USIB's critical collection problems committee was particularly interested in the potential intelligence to be derived:

SPECIFIC INTELLIGENCE WHICH
"TATTLETALE" CAN SUPPLY

1. INFORMATION CONCERNING CHARACTERISTICS AND LOCATION OF AIR DEFENSE EQUIPMENT
2. EVIDENCE OF NEW "S" BAND EQUIPMENT
3. INFORMATION CONCERNING LOCATION OF RESEARCH, DEVELOP-

MENT AND TESTING ACTIVITY
4. INFORMATION CONCERNING LOCATION OF ELECTRONIC MANUFACTURING AREAS
5. INFORMATION CONCERNING AMBIENT ELECTRONIC ATMOSPHERE WITHIN "S" BAND THROUGHOUT USSR

The receiver's instantaneous bandwidth would encompass a portion of S band used by several known types of Soviet air defense radar. Another briefing board depicted beam patterns and intercept geometry for two major early warning systems, GAGB (cosecant-squared) and Token (V-beam). In view of the purpose of these systems (defense against high altitude bomber penetration), Chairman Stewart requested an immediate briefing for his parent organization, AFCIN.

(U) Next day, a Friday, Col Stewart escorted RAdm Reed, Jim Trexler, and Cdr Hutchison to Pentagon Room 4A932. The audience would number over a dozen since Tattletale had attracted additional interest from CIA and several Air Force components, including guided missiles, advanced technology, and R&D. Aside from the festive mood of the Christmas season, the Air Force officers had a new achievement to celebrate. Using an Atlas booster, Vandenberg AFB had launched, the day before, an 8,800 pound ARPA/Lockheed Agena upper stage, which made an elliptical, though rapidly decaying orbit. Carried on the Agena was a battery-powered recorder and transmitter, now playing an American Christmas greeting to the world. Present for the briefing was BGen Robert E. Greer, whose staff had engineered successful Project Score, the first voice messages from space. Greer directed the Air Force Office of Guided Missiles, Pentagon counterpart to the Ballistic Missile Division in Los Angeles. The ARPA/Air Force Sentry project was represented by BGen H. A. Boushey, director of advanced technology (satellite systems) under the deputy chief of staff for development. The senior Air Force officer present, MGen H. E. Watson (AFCIN), showed great interest in Trexler's one-hour briefing on Tattletale. Trexler and Hutchison had ready answers for data-handling questions from George C. Miller, who was in CIA's office of ELINT and participated in AFCIN-Z. MGen Watson noted that no stabilization of the satellite was required and concluded that Tattletale's greatest strength was its simplicity.

(U) In the week before Christmas, 1958, roles and priorities of NASA and ARPA were clarified in the news media. NASA's administrator, Thomas Keith Glennan, announced that NASA's plans for weather and communication satellites and for manned platforms should support civilian, not military, endeavors. A few days later, at a DoD press conference, Director Roy Johnson announced ARPA's new Discoverer project, aimed at developing large satellites and launching rockets which might be used for any number of military missions and lead to manned satellites and warning systems, starting with a 1300-pound stabilized satellite in polar orbit. He informed the reporters and television camera crews that Discoverer, like Sentry, was a spin-off from WS 117L; that Sentry's position as the largest item and highest priority in ARPA's $460M budget for 1959 would now be taken by Discoverer; and that there was not enough money in his budget to sustain Sentry on its original

development schedule. Discoverer, like Sentry, would include tests for infrared detection, recoverables, and bio-medical experiments needed to develop a manned satellite (23 Dec 58).

(U) NRL's Vanguard team was now NASA's Vanguard division, located at the NRL until new facilities could be found. John Hagen continued as NASA's Vanguard project director and division chief, no longer as an NRL division superintendent. Lou Gebhard wrote a confidential letter to Hagen, asking that two former NRL engineers be allowed to finish five subminiature command receivers for Tattletale. He had arranged with the comptroller to reassign $15K to complete the work. Superintendent Gebhard closed with a security precaution: "The ECM nature of this project is considered Confidential. Operating frequencies and coding systems are considered Secret. The unclassified code name is 'Tattletale'" (29 Dec 58).

(U) Having passed scrutiny of the USIB committee and the AFCIN, arrangements were made to brief ARPA in the Pentagon after the holidays. The briefing was given on 19 January 1959 by Allan Reed and Howard Lorenzen, accompanied by Frank Marshall, representing the ACNO (R&D). Director Johnson was not present. ARPA's deputy director, RAdm John Clark, Col Dent Lay USAF, and five civilian members voiced appreciation of the project's simplicity. Clark suggested to Reed that, instead of relying on a CNO endorsement, he ask JCS to send ARPA a letter stating the project's urgency, which would then require ARPA to plan a priority program for Tattletale. James O. Spriggs, who was present for this meeting, had served with Lorenzen in NRL's countermeasures branch during the 1940s, and he became ARPA's primary point of contact with NRL for the Tattletale project. ARPA's Daniel J. Sullivan performed liaison with other offices and agencies.

(U) Next day, the 20th, Reed and Lorenzen briefed the Honorable Thomas S. Gates, Jr., secretary of the Navy, who gave his own approval and urged Reed to proceed on the course of negotiations with the JCS suggested by ARPA. The under secretary and the assistant secretary for R&D were not present, but their military aides were there and would brief them based on notes. [Again worth noting in regard to future events, was the presence of the aide to SecNav, Capt Noel A. M. Gayler, renowned as the World War II fighter pilot who was first to be thrice awarded the Navy Cross. Noel Gayler would become DirNSA in 1969, several months after CNO Thomas Moorer first saw evidence that satellite systems could identify and track Soviet warships.]

(U) Following through on the suggestion from DepDirARPA Clark, DepDNI Reed arranged a 29 January presentation for the JCS intelligence staff (J2). Reed introduced Jim Trexler, who briefed the project at a highly technical level. The head of JCS J2, MGen Robert A. Breitweiser USAF, closely examined the relationship of NTPC to Tattletale. Most of his questions were fielded by Earle Hutchison, backed up by Charles Bertholf on points related to restructuring of the national program

under NSA and ELCOM. The reception was good, and Trexler received suggestions for future missions, chiefly coverage of other targets.

(U) While progress was being made on the briefing trail, development proceeded at the NRL. In Marty Votaw's area, weight was allocated by ounces, power by milliwatts. The 20-inch spherical aluminum shell would have an internal framework very similar to the Vanguard design. The Army laboratory at Fort Monmouth, New Jersey, was developing a 24-volt power supply, consisting of silicon solar cells and nickel-cadmium storage batteries, for the mission data transmitter. Votaw had nearly completed design of the satellite antenna array for transmission and command reception. His second, Edgar L. Dix, had previously designed Vanguard's transmitter and was in charge of Tattletale's space and ground transmitters as head of the RF systems section. A 60-milliwatt tracking transmitter was under test, data transmitter under construction, payload timer designed, and command transmitters ordered.

(U) In Mayo's area, the payload antenna array was designed, a two-inch prototype antenna fabricated, and a payload antenna/receiver production contract awarded to the lowest bidder, International Telephone & Telegraph (ITT) Laboratories in Fort Wayne, Indiana. Paul L. Mast was the ITT project engineer. Mayo was evaluating two types of UHF ground receivers. The tape recorder had been selected and was under test by Donald B. Christman from the branch's signal processing section. Mechanical engineer Charles W. Price was in charge of procuring and fitting out equipment shelters. He was the branch's staff engineer, supported all of its projects, and had previously designed the mechanical structures employed in several generations of Trexler's massive Moon Bounce antennas. His design for Tattletale was tailored to its smaller scale and budget. Starting with a plywood model of the instrumented end of a receiving and recording equipment shelter erected in his office in Building 56, he developed the equipment layout in coordination with Mayo and tested and refined man-machine interfaces for ease of operation. When it came time to similarly configure the interrogation equipment shelter, Lorenzen assigned Ed Withrow to perform engineering liaison between Dix and Price. Applying the knowledge gained in this assignment, Withrow could then conduct the turnover for operational payload interrogation. The command and receiving antennas would be mounted on a mast installed on the shelter's roof and tilted upward at a 15° angle. To the bottom of the mast, protruding several feet into the shelter, Charlie Price planned to affix the steering wheel of a Mack truck, as part of a steering and braking mechanism to enable manual control of antenna azimuth.

(U) A consequence of the briefing for JCS J2 was that ONI was steered to the new USIB ELCOM. An ONI/NRL/NSG Tattletale team went to the CIA headquarters on 5 February. Lorenzen briefed an ELCOM audience of fifteen, emphasizing the mission and roles of collection sites and NTPC. Reed requested ELCOM's mission endorsement and provided a draft, which was quickly scanned by the chairman, Donald A. Borrman, and several committee members, including

CIA's George Miller and NSA's Robert E. Drake. The ELCOM agreed to take the matter under advisement and provide a response in two weeks.

(U) Lorenzen and Mayo participated in a review of the payload receiver design at ITT Laboratories in Fort Wayne on 9 February. Next morning, upon returning to Washington, D.C., they were met at Union Station, united with the briefing boards, and driven the few blocks to Capitol Hill, where the House Committee on Science and Astronautics was reviewing Navy space projects. The BuOrd Transit satellite, which would provide navigation data to fleet ballistic missile submarines, was the main item on the agenda. The session provided an opportunity for them to meet Richard B. Kershner, Transit's architect from Johns Hopkins University's Applied Physics Laboratory. ACNO (R&D) John Hayward conducted the Tattletale presentation. Lorenzen's charts and briefing of the Tattletale operational concept evoked great interest and cordial questions. Several committee members came up after the presentation to express particular enthusiasm for an economical project not costing tens of millions.

(U) A second meeting with the USIB ELCOM was held at the CIA headquarters on 19 February. Optimism prevailed due to a Vanguard satellite-launching vehicle success two days before. After some discussion of fine points and minor changes to the wording of ONI's draft, the ELCOM endorsed Tattletale. Through their representatives to the ELCOM, George Miller and Robert Drake, CIA and NSA were aboard.

Transit Interface

(U) On 9 March, the assistant SecNav (material), Fred A. Bantz, forwarded the Tattletale proposal and endorsements to ARPA for consideration. Howard Lorenzen and Earle Hutchison revisited ARPA in the Pentagon on 12 March, meeting with four civilian officials, one of whom, Jim Spriggs, had been present for the 19 January briefing. Lorenzen asked for a launcher. The ARPA representatives suggested merging the small Tattletale satellite with the larger Navy navigational satellite on a single launch. Lorenzen agreed to investigate the possibilities with BuOrd and Applied Physics Lab.

(U) Early next day, Lorenzen and Hutchison met with two representatives of BuOrd at Main Navy. The bureaucrats were in favor of the merger, expecting it would aid BuOrd's efforts to get additional launch vehicles for Transit (beyond three already programmed). They arranged a meeting at the Applied Physics Lab in Howard County, Maryland, for that afternoon, and Lorenzen got Marty Votaw to accompany him there. APL's Richard Kershner and Theodore Wyatt agreed that NRL's launch requirements for Tattletale appeared to be compatible with Transit, and Lorenzen figured he had his ride into space.

(U) The 18-month International Geophysical Year had been extended twelve months, to December 1959. The National Aeronautics and Space Administration

had been formed to take responsibility for America's nonmilitary space program, chiefly Vanguard and Explorer — partly because these highly visible projects did not receive high priority within the DoD. NASA had assumed operational control of the Vanguard scientific mission, tracking system, and launching facility at Cape Canaveral. After a string of four failures to orbit fully instrumented 20-inch spherical Vanguard satellites in 1958, Vanguard 2, launched 17 February 1959, had measured reflected earth radiation differences to map its cloud cover, transmitted for 18 days, and provided the first rough pictures from space. From Vanguard 2, ONR had derived a weather-forecasting project to record developing cloud formations, storm systems, and cloud cover images. Called TIROS (Television and InfraRed Observation Satellite), this project, too, had transferred to NASA and was being supported by the Army Signal Corps. NASA also requested NRL to propose an experiment to continuously monitor the complete spectrum of solar emission for a period of over a year.

(U) On 16 March, at NASA headquarters on H Street in northwest Washington, D.C., a Tattletale informational briefing was conducted by DepDNI Reed for NASA's senior management. Lorenzen's briefing emphasized the Vanguard technology transfer to Tattletale and was well received. Administrator Keith Glennan felt it was a worthwhile project, which, because of its military applications, should be sponsored solely by ARPA. Frank Marshall, present for the meeting, could report back to RAdm Hayward (Op-91) that NASA would be supportive and provide tracking data but would not fund any aspect of Tattletale.

(U) At its peak, NRL's Vanguard team numbered 180 personnel. All but a couple dozen of them transferred to NASA and became the nucleus of the Goddard Space Flight Center at Beltsville, Maryland, which became operational a year later and built and operated satellites. After three more launches, one successful, the Vanguard project was completed in 1959 for a total cost of $110M. Vanguard left a technological legacy that would enrich NASA and DoD space systems for years to come, particularly in rocketry, lightweight materials, miniaturized circuits, solar power, rechargeable batteries, thermal control, payload command, telemetry, and tracking. Vanguard rocket technology migrated to NASA's workhorse of the next decade, the Delta launcher, and to the Air Force's Thor Able Star. The satellite design evolved to scientific and military applications in Army and Navy space projects, gradually changing appearance and growing larger. The Army Explorer team, under Wernher von Braun, achieved four successes in nine launch attempts and would next year become the core of NASA's George C. Marshall Space Flight Center in Huntsville, Alabama, where NASA's launchers were developed. The International Geophysical Year had truly launched the space age.

(U) The same day, after the presentation at NASA headquarters, Lorenzen, Hutchison, and Wald went to the Pentagon for a working meeting hosted by ARPA. Richard Kershner and Theodore Wyatt from Applied Physics Lab reported on the launch compatibility of the two projects and technical feasibility of a dual satellite launch. BuOrd's representatives concurred. There remained a programmatic

problem, the need for clear lines for control and funding. From an organizational viewpoint the only thing Transit and Tattletale would have in common was backing from ARPA. Applied Physics Lab was developing Transit under BuOrd. The Navy Lab, under ONR, was developing Tattletale with mission sponsorship from ONI, programmatic oversight from ACNO (R&D), and funding from BuAer. Jim Spriggs favored funding and managing Tattletale by the ARPA/BuOrd mechanism already in place for Transit. The meeting concluded with the understanding that ARPA would answer the Navy's request for support of Tattletale with specific proposals as to what the Navy should do to join these projects.

Organizational Changes

(U) Implementing NSCID 6 of the previous September, SecDef Neil McElroy signed three DoD directives. The first (DoDD S-5100.20) established NSA as a separately organized agency of DoD, responsible for COMINT, ELINT, and other functional fields assigned by specific national and defense directives (19 Mar 59). For both COMINT and ELINT domains, DirNSA reported to the SecDef through the assistant to the secretary of defense (special operations). Subject to supervision of the director of defense research and engineering (DDR&E), DirNSA was empowered to conduct research and engineering to meet the needs of NSA and the departments and agencies and to coordinate related research, development, test and evaluation (RDT&E) conducted by others. The directive abolished the NTPC and the Electronic Intelligence Coordinating Group, whose assigned functions, records, facilities, and equipment were transferred to the NSA. Personnel moves would be mutually agreed between NSA and the military services. As a consequence of the directive and LtGen Samford's plan to establish an in-house ELINT organization, plans were being made to relocate NTPC to the NSA headquarters at Army Fort George G. Meade, Maryland. The second and third directives specified ELINT and COMINT definitions, policy, and responsibilities (19 Mar 59).

(U) In the light of NSA's responsibilities and authority for ELINT, Tattletale's planners in ONI, NSG, NTPG, and NRL reconsidered data handling. As a precaution against delay in reconstituting NTPC's capabilities at the NSA, analysis and data reduction would be performed by a task force type of operation with participation by NRL and NSA (NTPC). Technical support would be provided by ONI's basic and technical intelligence branch (Op-922G). They also perceived that new provisions for oversight of ELINT RDT&E called for project endorsements from DDR&E and DirNSA. Lorenzen briefed Tattletale to Hector Skifter and another official from OSD (R&E) on 30 March and, through their arrangements, to a dozen senior managers from OSD and NSA on 10 April — the 14th Tattletale briefing. Among those present at the Pentagon briefing for OSD (R&E) were several men who would influence the future of Tattletale: Herbert P. York of OSD (R&E); Graves B. Erskine, the assistant to the SecDef for special operations; Louis W. Tordella, deputy director of NSA; and [redacted] NSA representative to OSD's office of special operations (OSO). Lorenzen had known and worked on

various projects with the DepDirNSA from the time he was Lt Lou Tordella, serving with NavSecGru during World War II. Following this successful meeting, Lorenzen informed Jim Spriggs that NRL needed about $345K to finish two satellites and associated ground equipment.

(U) Since August 1958, the under secretary of the Navy, William B. Franke, had been leading a board appointed by SecNav Gates to tighten the DoN organizational structure. The board recommended upgrading the office of ACNO (R&D) to a new office of deputy CNO for development and merger of the Bureaus of Aeronautics and Ordnance into a single bureau. In this context, with several space projects underway and others on the drawing boards, CNO Burke charged the deputy CNO for air warfare (Op-05), VAdm Robert B. Pirie, with responsibility and authority to direct the Navy astronautics program, except R&D, making use of OpNav's existing organizational structure. An Op-05 letter, signed by VCNO James Russell, appointed Capt Thomas F. Connolly, assistant chief of BuAer, as senior member of "an ad hoc committee to recommend policy on the use of space and the science of astronautics" (3 Apr 59). The committee of fourteen naval officers and one marine — from OpNav, the material bureaus, the Pacific Missile Range, and NRL — convened at Main Navy and undertook a survey of uses of space projected by Army, Navy, Air Force, ARPA, NASA, and industry. Frank Marshall represented Op-91 and was junior only to Tom Connolly. NRL's representative was Capt Winfred E. Berg, an aeronautical engineering duty officer (AEDO) who had overseen Martin's development of Vanguard launch vehicles and the interface with Patrick Air Force Base and was now NRL's senior program officer for military application of satellites, including tracking. In this capacity, he oversaw SpaSur development and kept abreast of satellite projects, including Tattletale.

(U) In the quarterly assessment of progress at the NRL, one year after Mayo's initial conception, there appeared to be a chance of being ready in time for Transit's first launch. Prototype shells were expected from NRL's machine shop in two weeks. Equipment under qualification testing included tracking transmitters, command receivers, and command transmitters. Breadboards or prototypes were on hand for a patch of solar cells, a battery pack, the telemetry system, data link transmitter, payload timer, and payload receiver. An experimental ground receiving station had been set up on the roof of Building 56 and successfully used to collect and record signals from Vanguard 1 and 2. ACNO (R&D) Hayward requested of BuOrd that Tattletale be included in a 1959 Transit launch and identified Lorenzen as the NRL point of contact (20 Apr 1959). BuOrd's response was negative. An attempt to mate the two satellites, at this late date, would cause Transit's readiness for August launch to slip to December, could cause an additional delay of eight to ten months due to the Air Force Ballistic Missile Division's extremely difficult schedule for the ballistic missile test center at Cape Canaveral, and might incur additional costs to Transit of two to three million dollars. Any delay in Transit would adversely affect Polaris. Tattletale could go piggyback with the second satellite, scheduled for February-March 1960 (29 Apr 59).

(U) Before BuOrd's response arrived at Op-91, aviator and physicist John Hayward had received a third star and moved to his new assignment as the first DCNO for development (Op-07). His responsibility and authority included R&D in Navy astronautics. In the same month, RAdm Charles B. Martell reported for duty to the office of CNO, having completed his assignment as commander of cruiser division four. Previous to the sea tour, he had been DepDNI under fellow line officer Laurence Frost for 20 months. In the Pentagon, he was charged to direct a special group to plan the merger of BuOrd and BuAer.

(U) In May 1959, another change in the organizational structure of the office of CNO grouped communications and cryptology with general planning (Op-90), intelligence (Op-92), and long range objectives (Op-93) — all reporting to VCNO Russell (Op-09). The director of the naval communications division (Op-30) was redesignated as the 'director of naval communications and ACNO for communications' (Op-94). As a consequence, RAdm Roeder's title was changed to 'deputy director of naval communications for NSG/head of NSG office of CNO' (Op-94G). The organizational change was unrelated to Tattletale but considered favorable by NRL's countermeasures branch, since it brought into closer proximity the two rear admirals most actively supporting the project: Allan Reed (Op-92B) and Bernard Roeder (Op-94G).

Project Approval

(U) ARPA's two-month review of the DoN's formal proposal included coordination between staff members and their parent offices within OSD and the military departments. Issues surfaced regarding technical feasibility, security, and risk to two other ARPA projects, Transit and Samos (formerly named 'Sentry'). ARPA had worked closely enough with Tattletale and Transit to be comfortable with technical and interface questions. Issues regarding security were linked with Samos and more difficult to answer. In the year since Howard Lorenzen submitted the proposal for an electronic intelligence satellite, Tattletale had received a good deal of classified exposure, including ONI's staff study, briefings for the Navy and intelligence community, minutes of meetings, DoN's proposal, and the ongoing Navy survey of space and astronautics.

~~(S/B)~~ None of the written materials explained how intelligence could be derived from a simple transponder, whereas the ELINT component of Samos would [redacted] Duplication with Samos and the value of potential intelligence from Tattletale were challenged. There were fears, too, that Tattletale could jeopardize Samos. [redacted] More importantly, they would be forewarned of a U.S. capability before the advanced reconnaissance satellites had been launched. The possibility of completely covert detection would be lost, and the Russians might take steps to thwart or confuse it.

(U) Instead of resolving issues and concerns with originators, which would have required broader participation than the review thus far, OSO, ARPA, and ONI concluded that Tattletale had received wider discussion than was justified for a sensitive intelligence project. Accordingly, it was agreed that the director of ARPA would send a memorandum to the under secretary of the Navy expressly disapproving Tattletale. (This would also take care of concerns that the name 'Tattletale' was too suggestive of the system's nature.) The ARPA project would then go forward under a new security control system, called 'Canes', access limited to those who had an absolute requirement to know. ARPA agreed to provide $325K, augmenting $375K already provided by BuAer, to enable Transit pickaback launch of two units before Samos would be operational. In view of questions raised about intelligence value and the risk to Samos, higher level endorsements would be sought from the intelligence community, particularly the DCI as chairman of the USIB.

(U) On 2 June, John S. Patton of ARPA and [redacted] of OSO briefed CIA's Philip Strong on Project Canes, which would replace Tattletale, and solicited his support in securing the DCI's concurrence before requesting presidential approval. After being informed that names of those with a need to know must be recorded in ARPA, Strong requested and received permission to clear the assistant director/scientific intelligence, deputy directors for plans and intelligence, deputy DCI, and DCI. Next afternoon, Philip Strong and AD/SI Herbert Scoville briefed the proposal to the CIA's deputy director for plans, Richard M. Bissell, Jr., who was in charge of CIA's aerial and satellite reconnaissance programs. DD/P Bissell agreed to look into implications of Canes for these programs and advise the DCI. They decided that ARPA's director should send a written proposal to the DCI via the special assistant to the SecDef for special operations. Next morning, Philip Strong informed ARPA's John Patton of the need for a letter.

(U) On 8 June, [redacted] and Daniel Sullivan of ARPA delivered to Philip Strong a top secret, limited distribution letter from DirARPA Johnson to DCI Dulles, describing Project Canes in some detail and requesting DCI concurrence. A cover letter from Graves Erskine, assistant to the SecDef for special operations and head of OSO, urged approval because the project significantly could increase critical intelligence on Soviet defenses and technological development. Richard Bissell and Herbert Scoville discussed the project with Allen Dulles during the day. Strong delivered the ARPA letter and OSO cover letter to the director in his office that afternoon. Dulles indicated that, unless ARPA wanted a formal reply, he would simply convey verbal approval to Erskine when the USIB convened on the morrow. Following the exchange between Dulles and Erskine at the USIB meeting, Strong was advised by [redacted] that DCI concurrence with OSO's position "had been noted by memorandum on the OSO copy of the correspondence, and that no written confirmation from CIA would be necessary" (10 Jun 59).

(U) During the spring of 1959, the working committee on space and astronautics, led by BuAer's Tom Connolly, grew to twenty members (half of whom

were Navy captains) and received representations from industrial teams (Convair, Douglas Aircraft, North American Aviation, General Electric, Aerojet General, Boeing Aircraft, Lockheed Aircraft, RCA, United Aircraft, Martin, Goodyear Aircraft, Avco, and American Machine and Foundry). They visited the Atlantic Missile Range at Cape Canaveral (where they witnessed a Thor IRBM launch) and the Army Ballistic Missile Center's Redstone Arsenal in Huntsville, Alabama (where they were briefed by Wernher von Braun). Meetings were held with representatives of ARPA, NASA, ONI, CIA, NRL, the Army Guided Missiles and Space Division, Applied Physics Laboratory, ONR, and the Air Force Division of Advanced Technology. They solicited advice from a dozen Navy managers [including RAdm Thomas Moorer (Op-06C), who directed naval warfare simulation for the CNO].

(U) The committee compiled and coordinated a secret, two-volume draft report, running to a couple hundred pages, which Tom Connolly signed out on 15 June. The report described ongoing Navy projects (including Tattletale), resources, and involvement in space projects of other agencies and departments. Reconnaissance from space, which meant imagery, was a major interest. Discoverer's capsule recovery approach had overtaken Sentry, in terms of ARPA's priority and funding, due mainly to limitations on data transmission from space. Sentry, reduced in scope, had been renamed 'Samos' (a Greek island in the Aegean Sea) by ARPA that spring. (Air Force and Lockheed continued using 'Sentry' until mid-summer.) The Navy panel favored Samos over Discoverer, due to timeliness of data return, and recommended that the Navy support Samos in the areas of sensor development, data read-out and handling, and data interpretation. In particular, they sought direct involvement of the Naval Photographic Interpretation Center (NPIC), located at the Washington Navy Yard, and establishment of a joint command to coordinate tri-service participation. It was felt that the Navy's advanced telemetry techniques (in projects like Vanguard, Transit, Tattletale, TIROS, vertical space probes for imagery reconnaissance, and a solar monitoring satellite) could contribute to determining the optimum compromise between data complexity and transmission simplicity for Samos. (On the matter of film readout versus film recovery trade-offs and particular needs of Samos, the ad hoc committee had the benefit of counsel from AEDO Capt Robert C. Truax, a member from BuAer. As a veteran of the Army/Navy Project Orbiter team, which lost to Vanguard, Cdr Truax had been appointed early in 1956 as first director of the Air Force Reconnaissance Satellite Office in Los Angeles. After his office selected Lockheed as prime contractor for WS 117L, he had continued on as deputy director under a newly appointed Air Force colonel through ARPA's funding of Sentry for operational development. More recently, he served as a technical adviser on ARPA's Discoverer project, supporting DD/P Richard Bissell of CIA.)

(U) CNO Arleigh Burke's interest in space and the Connolly committee's work stimulated formation of new OpNav elements to monitor and direct space efforts for the DoN. DCNO (Air) Robert Pirie established an astronautics operations division (Op-54), a captain's billet, as program sponsor for space and responsible for formulating space policy, plans, and requirements. DCNO (Dev) John Hayward

assigned responsibility for Navy astronautics research, development, test and evaluation (RDT&E) to Op-76, headed by Frank Marshall, and established a space and astronautics branch (Op-761), headed by Cdr George Stephen (Steve) Morrison. This gave the office of CNO a modest organizational structure to coordinate and control space-related activities.

(U) The first meeting of a Tattletale technical operations group was hosted in the Pentagon by Frank Marshall and Steve Morrison in their new assignments in Op-76. Marshall had just completed his 10-week assignment to the ad hoc committee on astronautics. TOG participants were DNI Laurence Frost and his deputy, Allan Reed; Howard Lorenzen and Reid Mayo from NRL; Fred Hitz from NSG (now Op-94G); [redacted] from ONI; Haywood L. (Robbie) Robertson from ONI's basic and technical intelligence branch; Hank DeCourt, now with NSA; John J. Conlon from NTPC (which would move to NSA in two years or so); and [redacted] from NSA. Assigned roles and responsibilities fit the charters of the participating organizations. The technical operations group would meet monthly, sometimes more often, rotating the meeting place among the membership, which changed from time to time over the next three decades but always included NRL, NSG, and NSA.

(U) Howard Lorenzen learned at the TOG meeting that Capt Connolly's report on space and astronautics treated Tattletale as a project under development, whereas ARPA had formally killed it to limit knowledge of what was being done. ARPA, OSO, and ONI had placed all further discussion under a unique security control system to reduce risk of compromise. Tattletale had been too widely promulgated and too well received to be expunged from the report to the CNO, but its treatment there should begin a fade-out. At the NRL, Capt Winfred Berg, NRL's representative to Connolly's committee, loaned Lorenzen his copy of the final report for a quick review and comments. Lorenzen toned down ten passages pertaining to Tattletale, representing it as more of an idea than a project under development. He suggested deleting two figures, one depicting the satellite shell and interior, another illustrating the collection architecture. After coordinating his comments with Berg, Lorenzen submitted them in writing to RAdm Reed and provided a copy to Berg, who agreed to follow through on the modifications (1 Jul 59). DirNRL Peter Horn and Director Robert Page ordered that a scientific experiment derived from Vanguard be added as a second payload, thereby providing a legitimate, unclassified cover for the mission.

(U) Although the ostensible killing of Tattletale and new security control system silenced much of the opposition, Air Force concerns about the risk to Samos remained unanswered. Headquarters USAF still had access through its member of the USIB, MGen James H. Walsh, assistant chief of staff for intelligence. Notwithstanding the unresolved questions, DirARPA Roy Johnson sent to the secretary of defense a five-page covering brief for Canes, recommending that he sign an attached letter to the president. The Canes brief summarized the 9 March DoN

proposal and ARPA's planned support, acknowledged questions raised, and provided answers to most of them.

(U) With regard to the primary issue, Roy Johnson's letter conveyed the positions of CIA, OSO, and NSA:

> [The] intelligence community feels that this proposal is a complement to, and not a substitute for SAMOS because of this system's simpler mechanism and different orbit. Also, intelligence believes that the information obtained from the interior and isolated areas of the USSR by the two CANES flights will be of considerable utility in appraising the electronic results of SAMOS. ... Furthermore, the proposed project offers a partial back-up for the SAMOS electronics payload in event that the latter system is delayed or restricted for technical or other reasons." (10 Jul 59)

Johnson discussed the possibility of Soviet monitoring of the data link and stated the intelligence community's assessment "that a reasonable risk of exposure is warranted, in view of the urgently needed information which the system is intended to collect." He identified the tentative short title of the unclassified scientific cover as 'GREB' for "Galactic Radiation Experiment Background."

(U) The one-page letter to the president was a proposal by ARPA, in conjunction with the DoN, for "an interim electronic intelligence capability which can be accommodated in the Department of Defense's navigation satellite development program." Most of the text was aimed at overcoming opposition on behalf of Samos.

> The system, tentatively designated as Project CANES, has been coordinated with the Director of Central Intelligence, who has expressed his approval. It provides for a collection capability at an earlier date than that provided by SENTRY (recently redesignated as Project SAMOS). The planning envisions a completely covert program, thus avoiding political repercussions and undue publicity. Further, the system has several operational safeguards to reduce interference and to provide considerable flexibility for decision as to its use.
>
> The Department of Defense and the intelligence community believe that this proposal is a complement to, and not a substitute for the SAMOS satellite system, and that it offers an early opportunity to check assumptions relating to the latter system at very low cost. It also will provide a significant intelligence input.

The letter ended with a request for approval "to proceed with the technical development and planning" and an approval line for the president's signature. The new deputy SecDef, former SecNav Thomas Gates, signed and forwarded the letter on SecDef letterhead to the president on 13 July.

(U) On the same day, CNO Arleigh Burke released the amended Connolly study, specifically mentioning the OpNav organizational additions (Op-54 and Op-761) and approving its statement of classified (secret) Navy policy on the use of space:

> Highest priority within the Navy astronautic program will be given to immediate development of space vehicle systems to improve fleet capabilities in the fields of reconnaissance, communications, navigation, sea-launching and recovery of satellites, and meteorology. These will exploit the potentialities of U.S. command of the sea and will determine parameters of enemy capabilities.

> Basic and supporting astronautics research will be devoted to the ultimate development of an ECM satellite system and an anti-satellite weapon system, subject to the higher priority of the items in [the] paragraph … above.
>
> In support of the national space effort, the Navy will make available its outstanding capabilities in bio-medicine, astronomy, and environmental studies to achieve manned space travel, advanced space propulsion techniques, astronomy and space navigation, and maritime operations which will permit exploitation of the U.S. strategic command of the sea areas. (13 Jul 59)

(U) Project Canes — the beginning of "an ECM satellite system" — thus ranked lower in priorities to support naval warfare than "reconnaissance [imagery], communications, navigation, sea-launching and recovery of satellites, and meteorology." Yet only one of these missions — navigation — would achieve operational status before the ECM satellite. DCNO (Air) Robert Pirie effected distribution of the final report, "The Navy in the Space Age," and the CNO's acceptance letter (18 Jul 59).

(U) ARPA's Canes brief and letter to the president did not suffice to gain approval from the White House, where the review was coordinated by the president's national security adviser, BGen Andrew J. Goodpaster USA. Further questions were raised regarding some of the issues identified in the brief, particularly Samos, vulnerability of the data link to intercept (which had not yet been analyzed), and possible consequences of detection. Those involved were George B. Kistiakowsky, the president's science adviser and chairman of the president's science advisory committee (PSAC); Capt Evan P. Aurand, an aviator, the president's naval aide; LtCol John S. D. Eisenhower USA; and two members of PSAC. (Prior to Canes security control, ONI had, on 30 April, briefly described the classified Navy satellite in the annual Navy input to OSO for report to the president's board of consultants on foreign intelligence activities. Subsequent annual inputs contain no mention of the project, nor did the board of consultants participate in Canes review.)

(U) ARPA and ONI turned to NRL for an analysis of the technical part of the vulnerability problem, and Lorenzen asked Bruce Wald to provide one. Wald granted that an enemy informed of the system's characteristics could find and exploit the ELINT data link. On the assumption that U.S. ELINT equipment and techniques equaled the state of the art, his study assigned a life-time probability of 0.03 to the event that an unalerted enemy would discover the satellite transponder signal in the course of routine ELINT operations; 0.1, if he was suspicious and mounted a maximum effort. Weighing against the enemy were a previously

[redacted] Under these assumption, if the

payload was activated twice a day, the average aggregate transmission time per day would be [redacted]

(U) Other questions required inputs from DCI Dulles, Graves Erskine (OSO), DDR&E Herbert York, and Secretary of State Christian A. Herter. SecDef McElroy sent a letter to the President with a much broader perspective than the one signed by Gates, as follows:

AUG 18 1959

Dear Mr. President

We have re-examined, in the light of your questions, certain aspects of the CANES project sponsored by the Advanced Research Project Agency and recently proposed for development approval by the Department of Defense.

First, the members of the U.S. Intelligence Board, representing CIA, the State Department, Defense, and the three military departments, subscribe, with one exception, to the view that the intelligence to be gained from the project is well worth its relatively modest cost. The CANES device would transmit signals from Soviet radars and other electronic equipment operating anywhere in the USSR, whereas now, from either ground-based or airborne receivers, only those radars established near the Soviet borders can be heard and identified. Even though other much more comprehensive programs for electronic intercept from satellites are planned, including one, the Air Force SAMOS, which is scheduled to begin in 1960, the majority of Intelligence Board members feel that this early try is useful to the development of this new field of intelligence collection. They consider that CANES does not duplicate the larger SAMOS project and will in fact provide additional intelligence. They further feel that the risk of detection of the project by the USSR is slight.

The opposed view of the Air Force is that this project is duplicative in coverage to the already programmed SAMOS project; and that this project, programmed to be lofted in TRANSIT II, is contemporaneous with SAMOS. TRANSIT II is scheduled to be fired in March 1960 and to remain aloft one year. SAMOS vehicles are to start in April 1960. Thus for eleven of its twelve months' life CANES parallels and duplicates SAMOS. If CANES does not succeed in TRANSIT II and is lofted by TRANSIT III it would be scheduled well after the beginning of SAMOS.

As to the scientific view of the project, the Defense Director of Research and Engineering considers that, while the technical advancement represented by CANES is not very great and would not warrant the expense of a separate launching, it is well worth the much smaller cost of being included as a package in an already approved vehicle.

The possibility that the retransmitted signals from CANES would be detected and identified in the USSR has been examined with particular care. Detection by electronic search and intercept of the signals would require much more powerful and sensitive equipment than that normally used in intercept by this country, and even then the chances of hearing the briefly audible signals would be about one in a hundred. Unusual efforts are being made to hold knowledge of the project to a limited few, particularly the transmitting frequency to be employed. Administrative control will be vested exclusively in ARPA, and all construction, logistics, and operations in the project can be carried on exclusively within the Navy and within the National Security Agency. The Department of Defense considers, therefore,

that detection would be extremely unlikely.

In the event, however, that the device was detected and its general purpose ascertained, the Secretary of State believes that its employment would be very unlikely to harm the United States' relations with the Soviet Union.

The Secretary of State thus recommends that the project be approved with the proviso that periods during which the device obtains and transmits data be subject to approval by the President on the recommendation of the Secretary of State.

The project is therefore submitted again for your approval. I should be glad to answer any further questions you may have.

With great respect, I am

Faithfully yours,
/s/ Neil McElroy

/s/ DE
The President

The White House

(U) During reconsideration of the proposal in the White House, Andrew Goodpaster received an office memorandum from Dr. Kistiakowsky that moderated his previous opposition, in the light of more recent information.

> Since our last discussion of this matter, I had a briefing and two conversations with knowledgeable people. My present conclusion is that the project is of no overwhelming value, but may provide useful information, and since Project SAMOS will probably be delayed, this information will come at an opportune time. The project could not be embarrassing under the worst possible circumstances, i.e. some electronic breakdown, until the President issues a specific authorization, which could be postponed until the spring of 1960. When such authorization is given, the degree of conceivable embarrassment would be very slight, about commensurate with the value of the information obtained, and is not likely to happen in any case.
>
> The cost of the project apparently will be well below half a million, if the approval is given now, so that no air transportation of components is involved, etc. I understand these funds are available, but of course I can't be sure that it will not sprout new offshoots.
>
> My present position is a recommendation to approve, but not a strong one. I do not think that failure to grant approval will hurt our interests seriously. (20 Aug 59)

(U) Several additional precautions favored a positive decision on an interim space satellite ELINT capability. Presidential authorization would be required before launch. Initial testing would be conducted outside the range of Soviet reception capabilities. The data link might never be activated over the Soviet Union and, if so, only by White House approval. The system would include a capability to turn off the payload at a moment's notice. Four days later, on a Monday, the president approved Canes in a memorandum to SecDef McElroy.

~~SECRET~~

August 24, 1959

MEMORANDUM FOR
THE SECRETARY OF DEFENSE

I hereby approve the project recommended in your memoranda to me of 13 July and 18 August for inclusion of an electronic intelligence device in each of two planned satellite firings.

This approval highlights the need for a control organization within the Defense Department to provide effective and unified operational control and coordination of these and other satellite devices designed to serve operational purposes. I understand that you are studying this matter and I look forward to considering with you a plan for such an organization.

/s/ Dwight D. Eisenhower

(U) Two days later, in very general terms, without mention or allusion to any specific satellite or function from space, CNO Arleigh Burke personally conveyed his thoughts on the coming relevance of space for fleet operations to the Navy's senior admirals:

> 1. The use of satellites for Naval purposes is going to come about in a few years; also, the necessity for close coordination of things pertaining to Space with other Naval functions will become increasingly important.
> 2. I think it is time for each of the Fleet Commanders and possibly CINCLANT and CINCPAC to have a Space Section in their Staffs whose main function would be to ensure that the commands are fully cognizant of all Space activities and their influence upon war planning, readiness, et cetera. The initial staff sections need not be more than one officer but that officer should be very good and should be thoroughly briefed before he takes the job. There should be a system set up so these officers are kept fully cognizant of the rapidly changing Space picture. (26 Aug 59)

(U) ARPA was responsible for programmatic management of Canes, as an integral part of Transit, and funded BuOrd for two launch attempts. Augmenting BuAer's sponsorship of the unattended intercept system for supersonic vehicles, BuOrd formally tasked NRL to develop an ancillary payload for Transit and tasked Applied Physics Lab to develop the interface.

~~(S/B)~~ The Canes security control system protected continued development of the ELINT satellites and ground network, much of which would be close to [redacted] Canes access required approval of responsible officials of ARPA, OSO, or ONI. Those indoctrinated signed

a Project Canes Agreement, constituting an oath, which was dated and witnessed. ARPA's Daniel Sullivan provided Andrew Goodpaster with a list of 50 individuals initially cleared from ARPA, CIA, OSO, NSA, and DoN.

Chapter 2 References

2 May 58 DirNRL (C) letter to Chief, BuAer (Code AV-4212), NRL Prob R06-29, Ser 0865
Subj: Problem Assignment Request; acceptance of
Ref: (a) BuAer ltr Aer-AV-4212 Ser 02982 of 5 Mar 1958

6 Jun 58 NRL Radio Division Countermeasures Branch (TS) seven-page proposal
Subj: A Proposal for an Electronic Intelligence Satellite (C) [revised Aug 58]

13 Jun 58 NRL (C) Report 5155 (E. G. Becke, R. A. Carpenter, G. W. Kelly, Jr., R. D. Mayo, V. S. Rose, and W. E. Withrow)
Subj: A Very Wide Band Intercept Equipment (U)

30 Jun 58 CNO (S) OpNavInst 003430.2A, issued by DCNO (Fleet Operations and Readiness) (Op-03), Ser 007603P92
Subj: U.S. Navy ELINT Program
Encl: (1) Current U.S. Navy ELINT Capability
(2) Time schedule for objective achievement
(3) OPNAV Organization for ELINT Program Coordination
(4) List of key ELINT Commands

30 Jun 58 CNO (C) OpNavInst 03430.1C, issued by ACNO (Intelligence) (Op-92), Ser 029345P92
Subj: ELINT Program Review Board and ELINT Technical Guidance Committee; establishment of.

23 Jul 58 DirNRL (C) letter to Chief, BuAer (Aer-AV-42), Ser 01259
Subj: Intercept System, Lightweight, Subminiaturized for Supersonic Vehicles; BuAer Project No. AV-42004, NRL Problem 54R06-29; quarterly progress report on; forwarding of
Encl: (1) 4 copies of subject report 5430-95A:HOL:as of 8 July 1958

Sep 58 NRL (TS) study report to Op-91 (for John P. T. Pearman, operations analysis)
Subj: Effect of Elliptical Orbits on the Performance of the NRL Reconnaissance Satellite

4 Nov 58 NRL (C) Specifications for Omnidirectional Microwave Transistorized Crystal-Video Radio Receiving System, Stub Requisition #54-0718-9
Add: 22 Dec 58 Addendum

23 Dec 58 Washington Post article, Edward Gamarekian, staff reporter
Subj: Spy-in-Sky Project's Fate Obscured By New Discoverer Satellite Plan

29 Dec 58 NRL (C) letter to Chief, Vanguard Division, NASA, NRL 5400-54:LAG:pk, Ser 02118
Subj: [Development of five subminiature command receivers]

19 Mar 59 SecDef (S) DoD Directive S-5100.20
Subj: The National Security Agency

19 Mar 59 SecDef (S) DoD Directive S-3115.2
Subj: Electronics Intelligence (ELINT)

19 Mar 59 SecDef (S) DoD Directive S-3115.4
Subj: Communications Intelligence (COMINT)

3 Apr 59 CNO (FOUO) letter to Capt Thomas F. Connolly via Chief, BuAer, Op-507/who, Ser 7055P50

Subj: Establishment of ad hoc committee to recommend policy on the use of space and the science of astronautics

20 Apr 59 CNO (S) letter to ChBuOrd, Op-91C11/orw, Ser 00182P91; copies to NRL, ONR, Op-92
Subj: Combination of TRANSIT and TATTLETALE Payloads; investigation of (C)

29 Apr 59 ChBuOrd (S) letter to CNO (Op-91), Rez-IGP:vc, Ser 00932; copies to NRL, ONR, CNO (Op-92)
Subj: Combination of TRANSIT and TATTLETALE Payloads; investigation of (C)

10 Jun 59 CIA Dep AD/SI (collection) (TS/LIMDIS) memorandum for the record, TS 116329
Subj: Project CANES

1 Jul 59 NRL Code 5430 (S) letter and (U) cover memo to DepDNI
Subj: Connolly Report on Space and Astronautics

10 Jul 59 DirARPA (TS/special handling) letter to SecDef
Subj: Request approval of an electronic reconnaissance satellite project (CANES) (TS)
Encl: SecDef (TS/special handling) letter to President
Encl: (TS) Project CANES Agreement

13 Jul 59 CNO (S/U, upon removal of enclosure) letter to Distribution List, Op-05G3/ghl, Ser 0027P05G
Subj: Report of Ad Hoc Committee on Astronautics, promulgation and implementation of (U)
Encl: (S) CNO Ad Hoc Committee on Astronautics Secret report, "The Navy in the Space Age" of 15 Jun 1959

18 Jul 59 CNO (S/U, upon removal of enclosure) letter to Distribution List, Op-054B/ce, Ser 001P54
Subj: Report of Ad Hoc Committee on Astronautics; distribution of (U)
Encl: (S) CNO Ad Hoc Committee on Astronautics' Secret Report, "The Navy in the Space Age" of 15 Jun 1959

18 Aug 59 SecDef (TS/special handling) letter to President
Subj: [Submission of Project Canes for approval]

20 Aug 59 Dr. Kistiakowsky (S) memorandum to General Goodpaster
Subj: Project CANES

24 Aug 59 President Eisenhower (TS) memorandum for SecDef
Subj: [Canes approval]

26 Aug 59 CNO (S - Personal) memorandum for Op-03, Op-06, Op-01, Op-09; copies to Op-09, Adm Wright, Adm Pelt, Adm Hopwood; OP-00/rer, Op-00 Memo 00471-59 — declassified Nov 93 IAW OPNAVINST 5513.16
Subj: Use of satellites for Naval purposes

Chapter 3. PROJECT GRAB

(U) *An experiment to measure solar radiation was incorporated as a cover for the Navy's electronic intelligence satellite. Army, Navy, Air Force, CIA, and NSA planned classified mission operations. Efforts were coordinated by means of a multi-agency technical operations group.*

Galactic Radiation Background

(U) While the ARPA/DoN project was being considered in the White House, DepDirARPA John Clark directed that innocuous names be used for all intelligence satellites; publicly emphasized Discoverer's role in paving the way to manned space flight; and directed the Air Force Ballistic Missile Division to rename Sentry as 'Samos'.

(U) In collaboration with NRL, NSG prepared a top secret description of Project GRAB (Galactic RAdiation Background), "a U.S. Navy electronic satellite experiment," that revealed nothing about its actual purpose. "The object of this project is to determine the average galactic radiation background at 1200 angstroms. By extrapolating the results, a prediction for noise levels at any frequency can be determined" (Aug 59). The project was classified top secret, but the acronym 'GRAB' could be used in unclassified correspondence. The paper included a concept of operations, identified seven monitoring stations, and specified roles of participating organizations: NRL, NSG, CIA, ASA, AFSS, NSA (NTPC), and BuOrd. (ARPA and ONI were not mentioned.) NSG would "provide headquarters organization for directing all operations" and "directive services to all stations involved." NSG G52, led by Fred Hitz, was responsible for overseeing and supporting all of NSG's ELINT operations and also ran a 10-week training school at headquarters (relocated to Pensacola, Florida, in 1963) that produced several dozen new ELINT operators each year. G52's four-page paper constituted the charter for GRAB operations management for the next two years. The head of NSG, Bernard Roeder, approved distribution of 15 copies to operational elements.

(U) Unbeknownst to NSG, BuOrd would not be long in the picture. Effective 1 September 1959, BuOrd and BuAer were consolidated to form a new Bureau of Naval Weapons (BuWeps). Charles Martell had completed his work and was reassigned to Op-07, where, as ACNO (Dev)/Op-07B, he functioned as principal executive to the DCNO (Dev), John Hayward, and was responsible for managing the organization that discharged the CNO's duties relative to R&D (previously in Op-

91). This included assigning developmental requirements to the Navy bureaus and monitoring their satisfaction.

(U) NRL's new military director, Capt Arthur E. Krapf, instructed well-known members of the countermeasures branch to stay clear of any aspect of the project visible to the press or public. Printed material was minimized. Lorenzen's countermeasures branch (radio division) was and would remain organizationally isolated from Votaw's satellite techniques branch (applications research division). To maintain a wall between them, the two branches were neither mentioned nor included in the distribution list for the same piece of unclassified correspondence. Each branch developed its own vocabulary to refer to what was common between them.

~~(S/B)~~ ITT Laboratories had gotten NRL's approval for production versions in June, and, under project engineer Paul Mast, had delivered two flight-qualified receiver systems and a final report (21 Sep 59). Comprising antennas and filter-detectors, a detector bias box, and video amplifier, the systems weighed 20 ounces and consumed 50 milliwatts, both figures well within the allocated budgets. The response of the filter-detectors was [redacted] and out-of-band rejection was [redacted] with [redacted] Transistors were used for the video amplifier, but transistor technology for RF amplification had not yet been developed. Fortunately, calculations showed that the achieved detection sensitivity [redacted] was sufficient for the target radars and planned orbit. The antenna array, incorporating six equally spaced monopoles on a sphere, provided uniform omnidirectional coverage for any polarization, so satellite attitude would not matter.

(U) In Building [redacted] which housed the countermeasures branch, Vince Rosa performed the integration and test of the payload subsystem within a powered test satellite shell before delivery of the payload components to Marty Votaw's satellite techniques branch in Building [redacted] For security, movements of equipment between Buildings [redacted] for system integration and testing, were made under cover of night. Daytime visitation between the two branches was discouraged (to forestall curiosity and questions from those uncleared, including visitors to either branch).

(U) The operational concept for GRAB matured in 1959 through informal arrangements forged by the technical operations group (TOG) with organizations that provided representation and would have operational roles. NSG's Fred Hill chaired the TOG. The mission profile was modest. The satellite was to be placed in a 500-mile circular orbit. The first payload would be simple.

(U) Fed by an omnidirectional antenna array, the wide-open receiver would detect the business end of a radar's pulses from the main beam. Any air-search radar in the GRAB satellite's swiftly advancing 5000-mile intercept swath that transmitted detectable pulsed signals would paint the satellite with a burst of pulses on each rotation, until satellite elevation got above the radar's vertical beamwidth, then again as the satellite descended. For the targeted radars, this could provide minutes of intercept — a dozen or more scans! [redacted]

[redacted]

Earth satellite vehicle shelter huts would be deployed to U.S. signals intelligence (SIGINT) stations already situated on the [redacted] Host site technicians would operate and maintain electronic equipment installed in GRAB huts to track the downlinks and collect synthetic transponded pulses whenever the satellite passed overhead with its payload turned on. Data tapes and collection logs would be forwarded from remote sites, via the Armed Forces Courier Service, to NRL; then checked, dubbed, and couriered to the Naval Security Station on Nebraska Avenue for analysis by the NTPC detachment of NSA's new ELINT division, within the office of collection and signal analysis (COSA). [redacted] The satellite field-of-view (FOV) progression, geography, and any gap in the intercept duration would give a rough idea of a signal's source on earth.

(U) The satellite would be controlled by ground command. A dual interrogation/receiving hut, called the GRAB calibration hut, would be deployed to a naval communication station on the island of Oahu, Hawaii, for initial on-orbit checkout (later repositioned at the NRL site in Hybla Valley, Virginia). An interrogation hut, for mission operations control, would be deployed to a site in Europe. The Transit project would provide a ride into space with launch support from the Air Force Ballistic Missile Division. This was the area of greatest concern. (The first attempt to orbit a Transit satellite had failed on 17 September 1959.) Operation and maintenance (O&M) costs were to be distributed in the budgets of the project elements, represented in the TOG, whose roles accorded with their national or defense charters.

~~(S/E)~~ In October, traveling eastward around the world, Lorenzen and Mayo used 35 millimeter slides of the Tattletale briefing boards to brief the command of each host SIGINT station: [redacted] Their objective was to inform the command about the project and plans for training and logistics support, establish the command's ability to handle the hut and equipment when they arrived, locate a mutually agreeable site, and determine suitable electrical power connections. Security was emphasized, but the requirement for signed and witnessed oaths had been waived by ONI, because of risk in carrying the classified paperwork. Instead, Lorenzen later identified those who received the full GRAB briefing (16 in all) in a memorandum report to the TOG (15 Feb 60). At some stations the unclassified GREB brief on the scientific experiment was given to personnel designated by the officer in command (seven altogether). There was only one hitch in the site visits. Word of prior agreement between NSG's Roeder and

the acting commander of the AFSS, MGen John B. Ackerman, had failed to reach the station in [redacted]. Five officers of the [redacted] near [redacted] were prepared only to listen to the briefing and report details to regional headquarters [redacted] where a decision would be made. Because of the extreme heat, they suggested equipping the hut with a sun shade above the roof and an air conditioner. Lorenzen promised to follow through on coordination with AFSS, and Mayo entered in a stenographer's pad the site layout and power information needed to plan installation.

(U) The TOG reaffirmed that the Air Force site covered critical segments of passes over the areas of interest and dispatched a delegation to AFSS headquarters at Kelly AFB in San Antonio, Texas, where, on 16 December, Lorenzen briefed the new commander, MGen Lewis, and four colonels on his staff. (Project security agreements were executed.) The presentation was well received, particularly GRAB's mission aspects, and several issues were resolved. After the meeting, six other officers and one civilian were given the unclassified GREB cover brief. Nearly a month later, on 12 January 1960, Col James S. Novy of AFSS headquarters went to Frankfurt, Germany, and briefed the AFSS European commander, BGen Richard P. Klocko, and a staff colonel. The circuit was then complete, and deployment was scheduled.

Realignment of Military Space Efforts

(U) ARPA's role in overseeing DoD's space-related R&D for the past eighteen months was diminishing. Each service pursued its own projects — Army communications, meteorology, and mapping; Navy scientific research, space surveillance, navigation, electronic intelligence, and communications; Air Force reconnaissance, early warning, and boosters — with its own resources (largely derived from missile programs) and funding from ARPA or NASA. The CIA had projects, too, interwoven with Air Force projects. Herbert York of OSD advocated putting like things in one organization. On 23 September 1959, SecDef Neil McElroy had approved York's plan to reassign responsibilities for space efforts. ARPA would be subordinated to the office of DDR&E, which Herbert York headed, and would continue to manage acquisition of the Agena upper stage for multiple users and Discoverer's public aspects. The Air Force would be responsible for development, production, and launching of military space boosters and for integration of payloads as might be developed by it or other services. Air Force would also acquire Midas early warning (infrared) and Samos reconnaissance (electronic imagery and signals) systems. The Transit and SpaSur projects would transfer to Navy, the Courier communication satellite to Army.

(U) Once started, ARPA's descent accelerated. Before Neil McElroy left office in December, decisions had been made to reassign Agena and Discoverer to the Air Force, along with Samos and Midas. These assignments of responsibility for control of operational space systems development entailed transfers of funds. By the time the Honorable Thomas Gates changed offices in the Pentagon, from DepSecDef to

SecDef, 85% of ARPA's $487M budget for fiscal year 1960 had been moved to the Air Force budget.

(U) The Pacific Missile Range, headquartered at the Naval Missile Center, Point Mugu, California, conducted test and evaluation of naval guided missile weapons systems and provided range support for launch operations at the Naval Missile Facility Point Arguello and at Vandenberg AFB. As a consequence of DoN consolidation of aeronautics and ordnance in September, responsibility for the range was reassigned from BuAer to BuWeps. Tom Connolly, who had been selected for promotion to rear admiral, was transferred to BuWeps in December 1959 to become assistant chief for the Pacific Missile Range and astronautics under the BuWeps assistant chief for program management. His astronautics hat included a project office for Transit. In this capacity, Connolly stayed abreast of GRAB engineering development at the NRL.

(U) To help cover cost growth, due to rework for the cover experiment and expansion of the ground network, Connolly provided Lorenzen with $50K from his own PMR and astronautics budget and pressured three other organizations (BuWeps assistant chief for aircraft, ONR, and NRL) to come up with the same amount. When RAdm John Clark was reassigned from ARPA to command carrier division 16 the same month, RAdm (select) Connolly became the senior naval officer assigned full-time to space-related activities, although at BuWeps he was somewhat in the shadow of RAdm William F. Raborn, Jr., whose project he supported. Raborn, the BuWeps director of special projects for the past four years, was charged with developing the submarine-launched fleet ballistic missile, Polaris, derived from the Army Jupiter IRBM but solid-fueled. Transit would provide the navigation data needed to target Polaris. Raborn had implemented a totally new management tool called 'PERT' (progress evaluation reporting technique), which encompassed all elements of his program management responsibility.

(U) Hidden behind Transit and GREB, the Navy ELINT satellite and ground network received relatively little exposure. As ARPA scaled down, responsibility for administering the Canes security control system was transferred to ONI. The DNI assumed overall responsibility for security and data dissemination. An initial task was to consolidate ARPA, OSO, and ONI lists of those who had been cleared. In metropolitan Washington, D.C., fewer than 200 people, distributed among departments and agencies, had been administered the Canes oath of secrecy and indoctrinated. Most were senior officials. Of 78 cleared active duty military personnel, 32 were flag officers. Leading figures among those cleared were:

White House: President Eisenhower, Andrew Goodpaster, George Kistiakowsky, and four others

State: Secretary Herter, Homer Cummings (director of intelligence), and five others

Defense: Secretary Gates, Deputy Secretary James H. Douglas, Jr., Assistant Secretary Franklin B. Lincoln, Graves Erskine (OSO), DepDDR&E John H. Rubel, and 19 others

Army: Gen Lyman L. Lemnitzer (chief of staff), MGen John Willems (ACSI), and four others

Navy: Secretary Franke, Under Secretary Bantz, ASN (R&D) James H. Wakelin, Jr., CNO Burke, VCNO Russell, DCNO (Dev) Hayward, and 64 others

Air Force: Under Secretary Joseph V. Charyk, LtGen Roscoe C. Wilson (DCS Dev), MGen Walsh (ACOS intelligence), and four others

CIA: DCI Dulles, DDCI LtGen Charles P. Cabell USAF, DD/P Bissell, AD/SI Scoville, and 12 others

NSA: Director Samford, Deputy Director Tordella, Assistant Director (Production) RAdm Thomas R. Kurtz, Jr., and 27 others

ARPA: Director Johnson, Deputy Director Clark, BGen Austin W. Betts USA (Johnson's successor), and 25 others

APL: Richard Kershner and Theodore Wyatt

GRAB Engineering Development

(U) The scientific instrumentation package was called 'Galactic Radiation Energy Balance' experiment — 'GREB', for short — which became the satellite's public name. This gave the visibility and publicity to NRL's Herbert Friedman and his associates, whose equipment had previously made brief excursions into space on sounding rockets and had been carried, more recently, by Vanguard and Explorer satellites. GREB would measure solar radiation — of interest to the Navy due to its effect on HF communications propagated via ionospheric reflection. Radiation measurements would be multiplexed on sub carrier oscillators with health and status indicators and telemetered continuously on the radio frequency prescribed for satellites of the International Geophysical Year (108 MHz), thus providing a tracking signal for NASA's Minitrack system. (The names 'GRAB' and 'GREB' and their expansions were often confused, even at the NRL.)

(U) The GRAB satellite needed redesign to accommodate the scientific package. Marty Votaw was the chief design engineer, and he adapted the Vanguard design to accommodate both payloads. Electronics technician Joseph Y. Yuen provided Dr. Friedman's instrumentation with 12-volt power from the satellite's main bus. Ed Dix reworked the critical space-to-ground command and telemetry interface, including space and ground components. To conserve power, Dix incorporated a circuit and motor that [redacted] — long enough, even for anomalous orbits, to contain any swath across the target region. Dix's first assignment to electronics engineer Peter G. Wilhelm, who joined Votaw's branch in December, was to test the payload timer.

(U) As project engineer, Reid Mayo coordinated overall engineering development for Lorenzen, and he was directly responsible for the classified GRAB payload and collection equipment. Looking ahead, he had already received an ITT proposal for a follow-on [redacted] system (3 Dec 59). With advice and support from several branch engineers, Mayo designed the ground collection configuration, which consisted of two Yagi antenna arrays mounted on a rotatable mast, two

converters and general purpose radio receivers (R-390A/URR), a digital time generator, a microphone, and a switchable Magnecord PT-6 magnetic tape recorder. A sample of telemetry and mission data would be stored on quarter-inch tape running at 7.5 inches per second. Collection time would be recoverable from time of day (updated every second) and a one-kilocycle reference tone on another recorder channel. Before and after a pass, the operator would use the microphone to voice collection particulars on the time track. Charlie Price was in charge of GRAB equipment layout, ergonomics, installation, and deployment. After experimenting with the two vans loaned by the Army, he procured nine lightweight Helicop-Huts from Craig Systems, Inc., of Lawrence, Massachusetts, with accessories (work benches, spare parts cabinet, exhaust fans and filtered air inlet, lighting, heater, power hookups, and lifting and tie-down slings). Seven huts (6.8 x 8.5-foot, outside) were fitted out for receiving, one for interrogation, and one larger hut for dual use. The Army Signal Corps provided, on a one-year loan basis, seven receivers to help equip the huts. Empty, the collection huts weighed 950 pounds; 2600 pounds, when outfitted with equipment, manuals, spare parts, and tools.

(U) Two-thirds of the way through the fiscal year, funds were running out before the work was done. ARPA, now an element of DDR&E, was directed by BGen Austin Betts, who had been the Army's Pentagon spokesman in October 1957 for the successful effort to backup the Vanguard rocket with a modified Jupiter and also collaborated on the Jupiter-Polaris technology transfer. Nevertheless, the climate was not good to solicit ARPA for additional money for the Navy project. In open testimony before the House Committee on Science and Astronautics (25 Jan 60), SecDef Thomas Gates reported that transfers of space-related procurements from ARPA to the Air Force were completed, those to the Army and Navy still pending. Testifying before the same committee next day (26 Jan 60), DDR&E York had stated that the remaining systems would probably be transferred during the later part of this fiscal year, but he had gratuitously belittled both Vanguard and Transit and recommended turnover of the Army Ballistic Missile Agency to NASA. Next year's budget for missiles was $2.41B; for NASA, $802M; for ARPA programs, $215M. Missiles, the highest priority, included Air Force Atlas and Titan ICBMs, Army Jupiter IRBM and Nike-Zeus anti-ballistic missile, and Navy Polaris IRBM. On 18 February, Tom Connolly submitted to DirARPA Betts the Navy plan for executing the Transit program and requested immediate transfer of Transit from ARPA to the Navy.

(U) In early March, Reid Mayo estimated a $175.2K shortfall. Transit and GRAB were in uncertain status, and this was a time to keep a low profile. A letter was sent to apprise BuWeps of the need for more money (11 Mar 60). The team at NRL was encouraged by news of a Thor Able Star launch at Cape Canaveral on 13 April 1960 that successfully orbited Transit 1B. The countermeasures branch completed a 116-page, illustrated instruction manual for the radio receiving huts (Apr 60); a 48-page version for the interrogation hut (May 60). (A manual was not needed for the dual hut, which NRL would operate and maintain, first in Hawaii, then in Virginia.) [redacted] GRAB sites were quietly established by Charlie Price's two-

man installation crews at selected stations around the world in preparation for a summer launch. The [redacted] hut, for initial testing, was shipped to Oahu.

Launch Approval

(U) In April, an overflight of south central U.S.S.R. by a CIA-sponsored, Lockheed jet-powered, high altitude aircraft (U-2) provided the U.S. foreign intelligence community with film that yielded evidence of huge fixed-array radars in various stages of construction on the western side of Lake Balkhash, [redacted] By this time, the Samos schedule had been lengthened about half a year. Writing to the president on behalf of DCI Dulles, Secretary of State Herter, and himself, SecDef Gates reported that "technical development of Project CANES has now been completed" (27 Apr 60). He requested approval to launch the satellite from the Atlantic Missile Range with Transit 2A and test the transmitter over Hawaii two weeks after launch. "Thereafter, if found to be operational, we further propose to activate the transmitter from time to time as intelligence requirements dictate, on a carefully thought-out basis. In no event will the transmitter be activated operationally before June 20, 1960." Postponement of operations over Soviet territory until the fourth week of June ruled out any chance of embarrassment during an East-West summit conference, scheduled to begin 16 May in Paris.

(U) On the 1st of May, four days after the SecDef's request for Canes launch approval, a U-2 was lost over the Soviet Union during a mission to photograph installations [redacted] On 5 May, during the week of U.S. insistence that the missing aircraft had wandered off course while measuring weather conditions, President Eisenhower initialed the SecDef's letter request for the Canes launch and signed his approval "with proviso that periods of activation over the Soviet Union are subject to further approval by the President" (5 May 60).

(U) The U.S. now had four intelligence satellites under operational systems development — Discoverer, Samos, Midas, and Canes (GRAB) — all targeted against the [redacted] Soviet bloc. As yet, none were on-orbit, but Eisenhower's termination of aerial reconnaissance reinforced the foreign intelligence community's expectations for the satellites. DCI Allen Dulles knew that Canes had been developed for little more than the cost of a single U-2, and he observed that it was a remarkable coincidence, to have lost the U-2 and, in less than two months, have in the wings an alternate system. The dramatic sequel to loss of the U-2 promoted future U.S. reliance on satellites as a safe technical means of collection.

(U) On 11 May, Soviet Premier Khrushchev announced that the American spy plane was brought down over central Russia by a 65-foot Soviet rocket. Western newsmen were shown large sections of wreckage from the U-2. The Paris summit collapsed at the opening session when Khrushchev refused to attend unless Eisenhower formally apologized for the U-2 overflight. The captured American

pilot was put on public trial in Moscow as a spy trained by the U.S. Air Force, paid by the CIA, and deployed from a secret Air Force base.

(U) On 9 May, SecDef Gates had signed a letter to SecNav Franke transferring to the DoN administrative and technical responsibilities for Transit, including associated ancillary payloads. On 17 May, ARPA transferred Transit's remaining $6.6M for the fiscal year to the DoN, where it was assigned to BuWeps (20 May 60). From this amount, needed mostly for launch costs, RAdm Connolly was able to provide NRL with $172K to finish GRAB. NRL's development, space and ground, was completed for a total cost of $1.1M spread over three fiscal years. BuWeps was assigned program management control and responsibility for budgeting for Transit and ancillary payloads for fiscal year 1961 and beyond.

(U) As of this transfer, from the perspectives of OpNav and the Navy secretariat, Project GRAB's fit within the DoN's management structure was normalized:

DCNO (Dev)/Op-07: developmental requirements and coordination with OSD

BuWeps assistant chief for PMR and astronautics: programming and budgeting, launch requirements coordination with Air Force

DNI/Op-92: intelligence coordination within Navy and national program

CNR: development coordination within Navy and across departments

DirNRL: development, deployment, training, data processing support

HdNSG/Op-94G: direction of operations, project communications, coordination with service and national cryptologic agencies

(U) For safe handling and a low profile, two fully tested, 42-pound satellites were readied for transport in a private station wagon, which its owner, Ed Dix, would drive to Florida, accompanied by Mayo and a muscular escort. The launch date was approaching, and spirits were high. Before departing ONI to take command of cruiser division 3, RAdm Allan Reed received a farewell by a delegation from NRL and was presented with a polished aluminum, scaled model of the satellite he had advanced through the DoN, intelligence community, OSD, and White House. He would have to hear about its fate, one way or another, through the news media. There was a change at NSG, too. Capt Lester R. Schulz, a special duty officer for cryptology, relieved RAdm Roeder as head of NSG that same month.

Chapter 3 References

[Aug 59] (TS) paper
Subj: Project GRAB

21 Sep 59 ITT Laboratories (C) letter to NRL (attention Code Number 5430)
Subj: [Contract] NOnr 2788(00)X
Encl: Countermeasures Laboratory (C) Final Report Omnidirectional Microwave Transistorized Crystal-Video Radio Receiving System (Sep 59)

3 Dec 59	ITT Laboratories Defense Electronics Laboratory, (U) Bid No. 95290 Subj: A Preliminary Draft of a Technical Proposal for an L-Band Omnidirectional Transistorized Crystal-Video Radio Receiving System
25 Jan 60	(U) Statement of the Secretary of Defense Thomas S. Gates, Jr., Before the House Space Committee
26 Jan 60	(U) Statement of the Director of Defense Research and Engineering Doctor Herbert F. York Before the Committee on Science and Astronautics, House of Representatives, on the Department of Defense Research and Engineering Program
15 Feb 60	H. O. Lorenzen (S) memorandum, copy 3 of 3 Subj: Visit to ELINT Sites by H. O. Lorenzen and R. D. Mayo
11 Mar 60	DirNRL (U) letter to ChBuWeps, NRL Prob 54R06-29, Ser 2305, copies to CNO (Op-76), CNO (Op-92B), ONR Subj: Satellite experiments; cost of
Apr 60	NRL (FOUO) Instruction Book No. 25 Subj: Instructions for Assembly, Installation and Maintenance of Radio Receiving Huts
27 Apr 60	SecDef (TS/special handling) letter to President Subj: [Request for Canes launch approval] Add: President's proviso; dated 5 May 60
May 60	NRL (S) Instruction Book No. 28 Subj: Instruction Manual for Radio Control Hut
20 May 60	CNO (Op-76) (C) letter to ChBuWeps, Op-761C/rwb, Ser 011P76, copies to ASN (R&D), BuShips, SP, NRL, Op-00 [CNO], Op-09 Subj: Ancillary Payloads of Project TRANSIT; assignment of responsibilities for (C)

Chapter 4. GRAB 1

(U) *Artificial earth satellites proved to be a safe means to gain access to denied areas. The potential value of data collected by GRAB 1 was perceived by the U.S. foreign intelligence community. Volume and density overwhelmed existing U.S. analytical capabilities and stimulated development of computer-aided approaches at the NRL, NSA, and Air Force Strategic Air Command.*

Collection

(U) During integration and testing in Vanguard facilities at Cape Canaveral, Marty Votaw's team discovered a cracked solar cell and two open circuits on the primary satellite. The payload in the alternate passed testing by Reid Mayo and Vince Rose, and the backup became GRAB 1. On the gantry at launch pad 17B, GRAB 1 was affixed to the top of the 36-inch Transit sphere and readied for launch by mechanical engineer Louis T. (Jack) Ratcliffe and engineering technician Roy A. Harding. The last steps were to attach four elements of a turnstile antenna array for satellite communications and to secure them upright for launch. After Aerojet General's Able Star launch crew joined two halves of the payload fairing and mated it to the upper stage, assembly was complete, The booster was then fueled, and the hours of countdown began.

(U) A Thor Able Star launch vehicle (#283) lifted off from Cape Canaveral at 1:54 A.M., Wednesday, 22 June 1960, and headed south by southeast. The second-stage Able Star separated from the Thor booster off southern Florida, fired for seven minutes, coasted over Brazil to higher altitude, then fired again for a few seconds to circularize the orbit. Separated by spring action, the launch payload made a slightly elliptical orbit. Covert Canes/GRAB 1, publicly known as GREB, was ejected from Transit during the first orbit, its turnstile antenna deployed; its tracking and telemetry signal acquired and recorded by NASA's Minitrack stations in the Americas. The DoD news release of that day stated that a solar radiation measurement satellite had been launched with Transit 2A. The piggyback launch of two satellites was treated as a space first for the U.S., with Transit, BuWeps, and Applied Physics Laboratory receiving most of the publicity. In the Washington, D.C. area, Tom Connolly was the senior Navy spokesman to the press (23 Jun 60). Scientific spokesmen were Richard Kershner from Applied Physics Lab and Herbert Friedman from NRL.

(U) Following Transit 2A's initial on-orbit operation, ACNO (Dev) Charles Martell envisioned "new horizons in sea power" as a result of "taking space to sea."

> Mobility is a prime factor used by the Navy to exercise control of the seas. To be useful to the Navy, space technology must be able to go to sea. Just as the aircraft was developed as a fundamental element of sea power, space systems must be designed for fleet use. Space technology is new and growing rapidly. The Navy has made its first use of two experimental Transit satellites. Many other systems will follow for the Navy intends to develop fully this new discipline. (1960)

He suggested three objectives for naval space technology: tactical applications, small satellites, and reliability.

(U) Telemetry engineer John J. (Jack) Over, Jr. monitored GRAB 1's health and status from telemetry data recorded by NASA's Minitrack station at [redacted] All readings were nominal. Without fanfare a five-man team soon traveled from Washington, D.C., to NavCommSta [redacted] where the calibration hut had been shipped. Unpacking, installing, powering, and testing the electronic equipment took a few days. Crowded inside the 6 x 11-foot hut the evening of 5 July, the team acquired the tracking signal on orbit number 199. Ed Dix activated the mission downlink on the second, breathing-suspended try. (Perhaps the first command sequence also took, and the ground receiver may not have been tuned just right to detect the response.) The pass was manually tracked in azimuth, receivers manually tuned to compensate for Doppler shift of the radio frequency and polarization changes of the very low power signals, and recorded.

(U) After just a few minutes of collection, Dix reset the ELINT payload, lest it get away still transmitting. The team members — Howard Lorenzen, Reid Mayo, Ed Dix, Ed Withrow, and Vince Rose — were the first to hear a medley of radar signals detectable by a wide-open receiver in outer space. Different tones and their periodicity were produced by the intercepted radars' PRFs, beamwidths, and scanning patterns. (That same day, by coincidence, the USIB issued a national requirement for satellite SIGINT collection — prompted by U-2 pictures of the arrays at Lake Balkhash and expected capabilities of Samos (5 Jul 60).) In two nights, 15 passes were plotted, successfully interrogated once or twice, and recorded on quarter-inch tape for evaluation back at the NRL. Encased in a 20-inch sphere with six panels of solar cells, GRAB 1 was now ready to search for Soviet S-band radar signals with enough power for military applications.

(U) Fred Hitz at the NSG headquarters supervised GRAB operations management for the TOG. Each proposed mission was designated by orbit number and planned in terms of geographic coverage, targets, and the duration of collection enabled by sites covering different, overlapping segments of the pass. For GRAB's 340 x 570-mile orbit at 66.7° inclination, composite periods of visibility ranged from 21 to 43 minutes.

~~(S/B)~~ [redacted] Naval Security Group Activity (NSGA) [redacted] had been selected as the GRAB interrogation site. Key attributes were its proximity to the region of interest, continuous communication channels with NSG headquarters, and safe distance from the border with [redacted] The radio control hut was known locally as the 'triggering hut'.

The radio receiving hut was deployed close to the border at NSGA [redacted] Due to heightened White House concern about operational security, as a consequence of the U-2 shoot-down, the GRAB payload would not be interrogated on consecutive days, [redacted] Thus, even if the Soviets detected the short 138.06 MHz command transmission from [redacted] or intermittent ELINT data transmissions at 138.57 MHz, subsequent detections would not reveal a periodicity suggestive of collection from space.

(U) For phase I of collection (engineering-evaluation), one NRL representative had been dispatched to each receiving site. Host station technicians were shown how to operate and maintain the GRAB equipment, interpret schedules from NSG, acquire the telemetry signal, track passes, and collect data. In the [redacted] encountered too much electromagnetic interference from a local Air Force early warning radar and had to be relocated eastward to NavCommSta [redacted] where it was manned by NSG. Lorenzen, Mayo, Rose, and Withrow traveled from Hawaii to the interrogation site in [redacted] The payload would be interrogated on passes bound northeast or southeast for collection over [redacted] Mission operations began on 9 July. Data collected was much denser than the Hawaii passes, more a cacophony than a medley. Field assessment — termed 'forward area analysis' — was limited to counting how many bursts could be distinguished aurally during each minute of downlink reception (a difficult task for NRL's inexperienced field representatives).

(U) When ARPA was eliminated from the Transit management structure, effective 9 May, a protocol for fulfilling the 5 May White House requirement for presidential authorization to activate Canes over the Soviet Union had not yet been established. Whereas the satellite was moving at four miles per second, a top secret, limited distribution schedule for collection phase I took two weeks to travel the four miles from NSG headquarters on Nebraska Avenue to the White House on Pennsylvania Avenue. Op-76's space program branch head, Capt Steve Morrison, worked the high-level interfaces. By the time chop chains at OSO, CIA, State, and Defense had rendered the schedule into a form suitable for the eyes of the president, the first phase of collection, 9-21 July, was almost over. SecDef Gates, with the concurrence of CIA and Secretary of State Herter, sent a letter to President Eisenhower, reporting successful testing in Hawaii and requesting permission to "trigger Project CANES on 12-15 passes over the Soviet Union during the course of a two- to four-weeks period of time" (20 Jul 60). President Eisenhower initialed his approval on 25 July. On 28 July, Andrew Goodpaster added a qualification that a phone-check with State, CIA, and himself must be made before each turn-on. By then, NRL's field team had returned from overseas and tapes and logs for eleven missions over the Soviet Union were en route via courier to the NRL. The intended tasking interface, which followed the protocol established for U-2 missions, was implemented for collection phase II, which commenced in August. Schedules prepared by NSG and submitted by Steve Morrison to the White House specified mission number (orbit), interrogation time, end of collection, and monitor stations. Perhaps NRL's jumping of the gun for phase I went unnoticed in the

White House, for the SecDef's quarterly status report on military space projects (Discoverer, Samos, Midas, Transit, Courier, and SpaSur) was sent to the president at the secret level (no special handling required), hence made no mention of Canes (18 Aug 60).

(U) The summer of 1960 marked a post-Vanguard high for missile and space-related activities under the purview of CNO Arleigh Burke and DCNO (Dev) John Hayward. Communication Moon Relay had been inaugurated between Washington, D.C. and Hawaii, enabling transmission of messages and facsimile images four to eight hours per day. NavSpaSur was operating continuously, observing all earth satellites, and issuing orbital predictions from its control center at Dahlgren, Virginia. Transit and GRAB/GREB satellites were operating successfully on orbit. The nuclear ballistic missile submarine U.S.S. George Washington launched two Polaris missiles from the ocean depths on 20 July 1960, just three and one-half years after program start.

Engineering Evaluation

(U) Don Christman and Elizabeth R. Wald from the countermeasure branch's signal processing section evaluated the tapes from Hawaii. Audio output of the tape from the first collection, three and one-half minutes long, was fed into a Sanborn chart recorder. [redacted] PRFs were measured and bursts associated by means of NRL's audio-frequency spectrograph filter with graphical output on chemically treated electro-sensitive paper (Jan 58). [redacted] The yield was somewhat higher on other tapes sampled. Starting early August, packages from the SIGINT stations began arriving at the NRL. When some of the tapes were screened aurally, members of the signal processing section were [redacted] NTPC's ELINT analysts would be hard pressed to exploit the GRAB-take using earphones. To get a better understanding of density and differences among sites, charts were produced that showed burst counts per minute as passes progressed from west to east. The numbers came from the forward area analysis of [redacted] missions in [redacted] The density charts showed a dramatic [redacted] drop as the satellite crossed [redacted] and [redacted] was several times more dense than Hawaii.

(U) GRAB 1 operated nearly three months, through 20 September, and failed, during phase III, to respond to repeated interrogations from the [redacted] site and Hybla Valley starting 28 September. Cause of the failure could not be determined. Only 22 ELINT missions had been successfully executed, but these proved enough to accomplish the objective. The Army Signal Corps granted NRL's request to permanently retain the seven R-390A receivers for future missions.

(U) Seven reels of tape were examined in more detail, to evaluate the payload and collection performance of individual sites. Among signals recognized were Soviet early warning, height-finding, and shipborne types. Unrecognized signals

included several with fixed beams and low PRF rates, several others with high PRF. Preliminary results were appraised at the NRL by Hank DeCourt, deputy chief of NSA's advanced signals analysis division (COSA-5); Robert D. Misner, who headed the countermeasure branch's signal processing section; and Bill Howe, now with the Naval Scientific and Technical Intelligence Center (NavSTIC, formerly ONI's basic and technical intelligence branch) at the USNO. They noted that both beams of the [redacted] were clearly distinguishable and might be exploited to determine locations. The big surprise was the amount of data. Attempting to explain it, they concluded that the instantaneous detection bandwidth might be wider than advertised and that either the power of Soviet emitters was greater than previously known or the collection sensitivity was higher than thought possible. They did not yet grasp that the volume simply reflected the magnitude of the Soviet air defense system.

(U) Continued evaluation and dialogue among scientists and engineers at the NRL confirmed that the payload had performed as specified. The data was strictly main-lobe, potential value of the huge volume already collected was evident, and other satellites were in the pipeline. Since the state of the art of ELINT analysis was inadequate to prosecute GRAB data, Bob Misner began devising a process aimed at transforming the magnetic record into a format that could be handled by machine computation. His team assembled an assortment of analysis equipment, some of it one of a kind. The quality of the field recorder did not permit a perfectly uniform time base during playback, but ten tapes were dubbed, using the once-per-second 24-hour time code to get an average playback velocity of 7.5 inches per second.

(U) Beyond dubbing the other 80 tapes collected, at the rate of four per hour, and sending either originals or dubs to NSA (NTPC) for manual analysis, Misner envisioned a processing program in three phases. First, all the magnetic tapes must be transformed to visual records, with optimum signal-to-noise ratio, timing accuracy, dynamic visual range, frequency accuracy, and manual readability. He assigned an interim effort to his own section, because of experience and unique equipment that would take about $100K and three to four months to duplicate elsewhere. He estimated three and one-half hours to transform each tape and expected that his people would saturate resources NSA could put on the next two phases. COSA-5's analysts would transfer the visual record to computer format, probably punched cards, by laborious manual interpretation, estimated at 20 hours per tape. They would then perform machine computation of the required parameters, which should present no problem, other than programming a computer.

(U) In the meantime, when GRAB tapes were played back at the NTPC, COSA-5's analytic resources were overwhelmed. Pleas to turn the gain down could not be accommodated since it was already fixed for main lobes only. Analysts discovered [redacted] Samples of

unusual signals detected by aural screening were displayed on an oscilloscope, filmed at ten inches per second, then measured with the help of a film comparator. Among the analysts who attempted to dig out and log individual signals was Air Force Sergeant Winterbottom. The information would be particularly significant to the Strategic Air Command. In the event of nuclear war, SAC's Stratojet (B-47) and Stratofortress (B-52) bombers would encounter Russian air defense forces that had already brought down a smaller U-2 target at a higher altitude.

(U) Reporting to the president on the results of the first launch and ongoing efforts "to develop processing and analytical techniques," SecDef Gates stated: "There is no apparent duplication in this effort with other collection systems in the ELINT field" (12 Oct 60). The DoN's proposal for a second launch of a similar device had received concurrence from CIA and State, and Gates respectfully requested "approval to proceed with the development and planning of this follow-on project."

(U) The TOG generated a three-page Project Canes report, providing specifics of the ELINT payload failure, project engineering accomplishments, and:

ELECTRONIC INTELLIGENCE RESULTS

The following summarizes results of analysis thus far conducted on [redacted] radar signals received:

[redacted]

It is envisioned that refinements in future satellite analysis techniques and read-out equipment ultimately will provide a complete and timely picture, on a continuing basis, of the [redacted] radar defense system, in the same manner as current weather information is promulgated. The intelligence value of such data is obvious in evaluating the strength and weaknesses of the [redacted] defense system. (13 Oct 60)

ONI produced five copies, one for the White House, where it was attached to the SecDef's letter request. President Eisenhower signed his approval on 17 October.

(U) Canes/GRAB remained completely invisible in the SecDef's quarterly progress report on military space projects, but GREB received a first mention: "TRANSIT 2A carried pick-a-back fashion an auxiliary satellite, GREB to determine effects of the ionosphere in a study of solar radiation. Separation of the satellite successfully occurred at time of injection into orbit" (24 Oct 60). At this time, ONI's list of those presently cleared for Canes in the D.C. area numbered only 177 persons, mainly due to attrition at ARPA. In contrast, a USIB summary of intelligence community billets cleared for aerial and satellite reconnaissance information from other systems indicated Talent clearance for 6,189 billets; Talent-Keyhole, 1,431, with authorization pending for 1,508 more (19 Oct 60).

(U) The month after GRAB 1 stopped operating, the Kremlin warned against U.S. military espionage from space and announced its intention to protect the Soviet Union "against any encroachments from outer space as successfully as it has done with respect to air space" (Oct 60). The warning raised the possibility that GRAB's mission data link may have been detected. The countermeasures branch reassessed the probability that an uninformed enemy could have detected the signal, taking into account the actual orbit, 0.8% duty cycle, data link characteristics, and observed data density. The likelihood was far too low for concern. More likely, the Soviets were alerted by years of implications of covert aspects of ongoing space projects in the open literature and recent successful launches of Discoverer. At any rate, Soviet SIGINT satellites, operational within a couple years, were probably already on the drawing boards, and the Kremlin's opposition to space encroachment soon faded. The following year both the U.S.S.R. and the U.S. supported the United Nations resolution that "outer space and celestial bodies are free for exploration and use by all States in conformity with international law and are not subject to national appropriation" (20 Dec 61).

Analysis

(U) Room [redacted] of Building [redacted] became the GRAB analysis laboratory. A tape [redacted] Bob Misner redirected Bruce Wald from work on automated

signal processing for the Navy [redacted] system, asking for software and techniques to process the GRAB burst records on NRL's Narec computer.

(U) As Misner's section continued working on new analysis and processing methods, intelligence byproducts were fed to [redacted] of NavSTIC for validation. Howe wrote a summary for the TOG and provided a copy to Hank DeCourt of NSA COSA-5 (6 Nov 60). Howe's view of the signals that Misner's people did not recognize, was that they emanated from [redacted] As expected, [redacted] Soviet S-band early warning radars were intercepted. Contrary to expectations, [redacted]

(U) High signal densities had been experienced in airborne collection efforts and processed by purely manual techniques, but the volume of signal data from GRAB was [redacted] greater than anticipated (based on NRL's forward area analysis). Hank DeCourt had started several analysts on an accurate count of illuminations per minute, expecting results within 10%. COSA-5 Chief John E. Libbert, formerly of NTPC, supported automation of the entire analytical process, particularly for the known, common signal types that appeared to comprise about 95% of the S-Band data. If these could be automatically located and identified, then analysts could concentrate on unusual signals.

(U) With the exception of Misner's team, most of NRL's participants in Project GRAB had been busy preparing for the second launch. At Cape Canaveral on 30 November 1960, the repaired, originally primary GRAB/GREB satellite got a free, afternoon ride with Transit 3A. The Thor booster burned out 12 seconds before scheduled separation of the second stage, turning the launcher into an unguided missile with a trajectory toward the eastern end of Cuba. The range safety officer initiated an automatic sequence to destroy the rocket. Reportedly, debris rained down on the countryside, and fragments as large as 20 kilograms crashed against a hillside ten miles from the center of Holguin, Cuba's third largest city, but no one was injured. State and Defense spokesman announced U.S. concern and investigations underway, but the incident was treated as a deliberate provocation of imperialism and created an opportunity for Fidel Castro to berate the U.S. in international political forums and news media. State's announcement that the rocket had been intentionally destroyed, due to malfunction, was interpreted as deliberate aiming and explosion over Cuba. A mockup of a Thor IRBM, stenciled 'USAF', was paraded through the streets of Havana as the cow-killing, cow-eating Pentagon rocket. The near-miss prompted tighter constraints on launch azimuths from the Cape. Dogleg injections would be required thereafter.

(U) The launch failure refocused the TOG on data already collected and the problems encountered by COSA-5's detachment on Nebraska Avenue. It was recognized that the analysis effort had been underestimated [redacted] NavSTIC had two goals: quickly get a usable product from all 22 GRAB 1 missions — to help the DNI and ONI advance the project — and develop a few techniques to practically demonstrate the system's real capability. [redacted] viewed automation as being too distant to yield results that might influence programmatic decisions and collection design. As a parallel effort to the density study, he suggested that NTPC filter out signals with common, mid-range PRFs, then concentrate on the remainder, estimated at one-fourth, which should be logged by characteristics and tabulated. To demonstrate the potential, he asked for a joint effort to prosecute all signals collected on a single mission, using manual analysis techniques.

(U) Former DNI Laurence Frost had been promoted to vice admiral and appointed as DirNSA in November. (His primary mission was damage control attendant to defection of two NSA employees to the Soviet Union in June.) The new DNI, RAdm Vernon Lowrance, had commissioned ONI's staff study on Tattletale when he was DepDNI two years ago. Lowrance tasked intelligence specialist Capt Frederick N. Welden, head of ONI's operational intelligence branch (Op-922Y), to follow in RAdm Allen Reed's footsteps as the Canes project advocate in the intelligence community. In collaboration with Howard Lorenzen, Fred Welden began compiling a comprehensive briefing package (addressing the objective of the project and sponsorship, mission and objectives of the system, history, costs, security, technical aspects, project status and organization, operations to date, problem of data analysis and results to date, and concept of future programs, including requirements, magnitude, schedules, and funding). Before the package was completed, ONI and NRL learned that preliminary reports of GRAB 1 results were enough to justify the system. NRL received formal notification that this "tremendously successful project will be continued" in the form of a weapons task from BuWeps (14 Dec 60). The DoN provided $3M for fiscal year 1961.

(U) Design and development of the next satellite was well underway. The ELINT payload would include [redacted] crystal video receivers and an antenna array designed and specified by Reid Mayo and Vince Rose. The receivers were assigned [redacted] Pete Wilhelm worked the necessary changes to the ELINT data transmitter. For components, Mayo had a correspondence and dialogue going with ITT and three other vendors. To improve ELINT data quality, Don Christman was investigating the latest commercial instrumentation recorders.

(U) A five-hour presentation for the TOG and elements of NSA was conducted at the NRL by Howard Lorenzen on 9 January. Technical briefings were given by Reid Mayo and Vince Rose (payload and field collection), Marty Votaw (satellite), Ed Withrow (interrogation), Bob Misner (data processing), and Bruce Wald (computer programs). Existing and future hardware were covered. Most of the interest was in Misner's area.

(U) A precision test tape had been processed through his interim system, [redacted] Visual records had been completed for 35 reels of tape, enabling burst counting and characterization by PRF. [redacted] per second. Fortunately, [redacted] in individual equipments. Signals could be isolated by uniformity of PRF and scan across an intercept. Burst sorting by scan rate was still a manual process, based on the paper records, but Bruce Wald expected to automate this process within six weeks. Parallel generation of digital data from analysis of strip-film records would be a second source of input for scan-rate sorting and location fixing programs. COSA-5's optical method provided slightly more accurate measurements of PRF and illumination time, but processing a reel of tape took three times longer than NRL's graphical method. In order to eliminate tape fluttering, the major source of error in measurements, Misner advocated upgrading to a recorder with one-half inch tape, seven channels, and a 60-kc reference tone. His long-range goal was to measure [redacted] and he envisioned the possibility someday of [redacted]. His section was integrating a commercial graphic-to-digital readout device with the GRAB analysis configuration and had started development of a family of spinning magnetic heads of different sizes and a versatile tape transport mechanism that could use them.

(U) ONI's Fred Welden submitted comments on COSA-5's analysis program to Fred Hitz for TOG consideration. Welden acknowledged that ONI had also underestimated the impact of mass data on limited capabilities to process, analyze, and provide quick reference and feedback. He recommended that the TOG investigate and report to DirNSA and DNI as to whether there was a drastic need for money, people, equipment, and more outside R&D. His closing summation assessed GRAB 1, relative to its mission objective:

> It is already obvious that the results from GRAB will have a direct and significant bearing on the consolidated targeting and war planning effort at Omaha as well as upon strike force tactics, weapons, and EW hardware. We owe it to national security to release our tentative results — to the extent they are valuable and of reasonable reliability — as soon as we can, subject to DNI and DirNSA approval. (10 Jan 61)

(U) The TOG met at the NTPC and reviewed processing and analysis operations. GRAB's data density passed the critical level, beyond which, analytical capabilities became overloaded. A demonstration of the potential would help justify development of new tools, and the TOG committed to identify every signal on one mission, stipulating 1 March as the report date. For this effort, John Libbert agreed to send some analysts to NRL on temporary assignment. The TOG chairman, Fred Hitz, submitted a first formal GRAB status report to DNI Lowrance. The density problem was paramount, "although with the number of approaches being attacked by NRL, NSA and CIA, multi-fold acceleration of analysis is inevitable" (18 Jan 61). Specific recommendations identified higher level needs where the DNI's influence could help. White House modification of operational

security restrictions could permit the ELINT collection schedule to be completed faster. DirNSA's support was needed to get computer time and additional equipment and personnel for COSA-5. Technical and intelligence coordination with Samos and similar reconnaissance satellite projects (Discoverer) ought to be established, but responsibility for raw data analysis or processing should not be delegated to another agency (SAC), pending development of satisfactory techniques and necessary security controls. To assist development of analysis and processing techniques, data was needed on U.S. radars.

Data Reduction

(U) Howard Lorenzen initiated discussions with NSA's deputy director regarding use of computers to automate data reduction and exploit signals. Lou Tordella brought in two experts, mathematician Bassford C. Getchell from the techniques group of the office of production and [redacted] from the office of machine processing. Lorenzen envisioned that GRAB data could be used to generate locations for SAC; provide technical information on new, possibly well-hidden signals and their country of origin; and provide early warning information by monitoring signal activity levels. He described the data reduction process and showed them a sample paper-tape record of compressed GRAB data. The four men converged on a team approach. NSA would develop a machine process that automatically converted GRAB analog tapes to digitally formatted tapes, thereby eliminating the tedious transformations from magnetic tape to paper (or film) records, then from visual records to punched paper tape (or cards) for input to a computer. In the interim, NRL would furnish NSA with manually generated digital data. NSA would [redacted] techniques already tried by NRL.

(U) Pursuant to the Tordella/Lorenzen agreement and TOG deliberations, a working meeting was conducted by Hank DeCourt at the NSA on 24 January 1961 to plan the joint effort. In addition to COSA-5, NSA's offices of production (PROD) and machine processing (MPRO) were represented. Bob Misner and Bruce Wald were there from NRL. To improve collection, NRL was fitting the huts with seven-channel instrumentation type recorders (Consolidated Electrodynamics Corp. Type GR-2500). NSA would need to acquire a recorder to play one-half inch tapes and a pulse-width separator [redacted] Joseph M. Struve was leading development of NSA's Audico (automatic digital conversion) process. Use of computer equipment was arranged by Raymond B. Potts, who led COSA-5's technical planning staff. Bob Misner had some doubts about Audico feasibility, due to GRAB's low and unsteady signal-to-noise ratio. Bruce Wald would oversee NRL's production of interim burst records for input to computers. John Conlon would do the same for signal logs generated at the NTPC. Bassford Getchell would guide programming of computers for signal formation, parameter measurement, and location. The scholarly mathematician left no doubt accuracy was paramount when he stated criteria for the emitter location effort, including data quality (NRL),

ephemeris accuracy (NASA), and benchmarks (ONI). Wald would continue work with NRL's Narec computer for signals search. Results of the ongoing exhaustive analysis of one mission at the NRL would provide a sample of the system's capability and would serve also as a sort of ground truth with which to evaluate machine processing efficiency and calibrate parallel efforts.

(U) The 1 March target date for reporting initial results became inviolate when Vernon Lowrance sent a letter to DirNRL Arthur Krapf, requesting that NRL make a maximum effort to meet the requirements for development of both analysis and data processing techniques. The DNI commended Howard Lorenzen and his colleagues to the DirNRL and stated that the project had "reached an advanced stage and promises results which will have significant impact upon U.S. intelligence. ... The first formal status report on the project has just been completed; I will arrange that you see it, together with CNO action on it" (27 Jan 61).

(U) Toward the goal of identifying every signal on a single mission, GRAB 1's [redacted] orbit had been chosen for its night-time transit from west to east over the [redacted] NRL checked the quality of data tapes from overlapping collection sites and retained the best data for each time segment. The data was dissected at the Navy Lab by a team of men and women from NSA (NTPC), NRL, and NavSTIC and reported as a joint TOG product [redacted]

(U) While the joint analysis effort was underway at the NRL, managers at the NSA prepared a set of rules for a cooperative SAC effort. SAC could disseminate results of its own analysis internally, subject to approval of DNI Lowrance, who exercised "responsibility and control of product dissemination and all security

aspects of the project" (13 Feb 61). SAC would be provided with analysis standards by NSA and the TOG, and SAC's technical capability to process GRAB data would first be assessed by NSA and other project personnel. NSA would then task SAC on a task contract basis, avoiding duplication of effort except for sample checks on quality. Any plans by SAC to go beyond the basic rules for participation would have to be submitted to NSA for approval by both NSA and TOG before execution. A TOG delegation traveled to Omaha, Nebraska, for a visit to Offutt AFB on 15 March, where it met with members of the 544th Reconnaissance Technical Group (SAC), commanded by Col Donald H. Ainsworth USAF.

(U) The TOG delegation, led by NSA, with representation from ONI, NSG, and AFCIN, discussed SAC's request for regular receipt of Canes tapes. 544th RTG's special projects section had six standard manual analysis positions that could be operated around the clock, not as many good analysts as COSA-5. Special equipment and procedures were used to handle [redacted] but they were inadequate for handling the density problem encountered in the Canes tapes. Datatron 220, IBM 7090, and IBM 704 computers were available, but SAC was holding Canes under extremely tight security and had not yet cleared programmers. They would need Audico equipment and an estimated six months to program the computers to support the effort. Canes information would be an input to SAC's Finder complex, used for production of the Soviet radar order of battle and expected to be operational in three months.

(U) GREB, renamed 'Solar Radiation I' by Marty Votaw (5 Oct 60), operated for ten months of the one-year design lifetime. A magnet on its X-ray detector successfully deflected the Van Allen radiation, and the first clear view of the solar X-ray spectrum was acquired at all altitudes. Data was recorded at NASA's Minitrack stations and sent to NRL for analysis. Herbert Friedman found that solar flares produced ionospheric disturbances, such as sudden short wave fading and cosmic noise absorption. In addition to its value for pure research into the nature of the sun, the data would be used to predict propagation conditions for HF communications. NRL eventually built satellites dedicated to solar radiation measurement and related experiments, and their nickname, 'SolRad', was applied retroactively to the progenitor, GREB.

Chapter 4 References

Jan 58	NRL Report 4671 (R. D. Misner) Subj: An Instantaneous Sound Spectrograph
23 Jun 60	Washington Post article, Charles Corddry (UPI) Subj: Piggy-Back Satellites Hailed as Big Space Gain for U.S.
5 Jul 60	USIB-D-33.6/8 Subj: Intelligence Requirements for a Satellite Reconnaissance System of which SAMOS is an Example
20 Jul 60	SecDef (TS/special handling) letter to President Subj: [Request for Canes testing over Soviet Union]

	Add: President's approval, dated 25 Jul 60 Add: BGen Goodpaster's annotation, dated 28 Jul 60
18 Aug 60	SecDef (S) letter to President, SecDef Control No. S-736 Subj: [Progress on Military Space Projects during March, April, and May 1960] Atch: (S) Summary
5 Oct 60	DirNRL (U) letter to ChBuWeps, 5170-83:MJV:js, NRL Prob R06-29, Ser 10105 Subj: Satellite Telemetry from Hawaii [request for collection]
12 Oct 60	SecDef (TS/special handling) letter to President Subj: [Request for approval of Canes follow-on] Add: President's approval, dated 17 Oct 60
13 Oct 60	TOG (TS/LIMDIS) report Subj: Project CANES
19 Oct 60	DCI (declassified, formerly TS/TK) memorandum for BGen A. J. Goodpaster Subj: Proposed Additional Billets for the TALENT-KEYHOLE Security System Atch: (A) (declassified, formerly TS/TK) Summary of United States Intelligence Board Talent-Keyhole Billets
24 Oct 60	SecDef (S) letter to President, SecDef control No. S-901 Subj: [Progress on Military Space Projects during June, July, and August 1960] Atch: (S) Summary
Oct 60	U.S.S.R. International Affairs Subj: Space Espionage Plans of International Law
6 Nov 60	W. E. W. Howe (NavSTIC) (TS/LIMDIS) report Subj: Project GRAB (U) Review of Intelligence Summary beyond that Already Reported
14 Dec 60	BuWeps (C) WEPTASK Assignment to NRL, Ser 042770, WEPTASK No. RTPA 30009/566 1/F019-02-009 Subj: Satellite Applications; Applications of Satellites to Scientific Research in Support of Navy Research and Development Problems (U)
1960	RAdm C. B. Martell observation, quoted in 1983 *Navy Space Chronology*, p. I-1
10 Jan 61	Capt F. N. Welden (TS/LIMDIS) letter to Cdr F. W. Hitz (TOG chairman) Subj: Comments on NSA (COSA-5) "Status Report on Analysis Program for Phase II of Project GRAB" of December 1960
18 Jan 61	TOG (TS/LIMDIS) letter to DNI, G-52/00022-61/jmc Subj: Status Report on Project GRAB (U) Encl: (1) NSA (COSA-5) Status Report on Analysis Program for Phase II, dated 1 Dec 60 Encl: (2) TOG Comments
27 Jan 61	DNI (S) letter to DirNRL, Op-922Y/Mlk, Ser 0023-Y-61 Subj: Special Projects; assistance for
13 Feb 61	NSA (S) paper Subj: Suggested Home Rules for Cooperative SAC Effort
1 Mar 61	TOG (TS/LIMDIS) Report on Project CANES Initial Intelligence Results Encl: (TS/LIMDIS) Summary of Intelligence Derived
20 Dec 61	United Nations General Assembly, Resolution 1721 (XVI) Subj: [Space Law]

Chapter 5. GRAB 2

(U) *Data collected by GRAB 1 supported SAC's mapping of the Soviet air defense system and aided the foreign intelligence community in assessing [redacted] military radar development. Other systems, employing diverse technologies, were coming on line and providing more data for SAC and NSA.*

Air Force and CIA Projects

(U) During the late 1950s, in parallel with scientific project Vanguard, numerous classified studies and projects sponsored within the Air Force or CIA, some jointly, aimed to exploit space for vital information on Soviet strategic weapons, air defense systems, industrial capacity, and transportation systems. Lockheed, developer of the U-2 spy plane for the CIA, was the primary contractor for both CIA film recovery and Air Force film readout, infrared detection, and electronic reconnaissance payloads to be carried on the Lockheed Agena upper stage, which the Air Force would boost into space on a Convair Atlas or a Douglas Thor. Subcontracts were awarded to other companies for specific payloads.

(U) Following Project Score's successful three-day Agena voice transmission for Christmas 1958, the multi-mission Discoverer and Samos projects suffered repeated launch failures or on-orbit failures, but each failure provided valuable lessons. Discoverer 13 was successfully launched on a Thor Agena A from Vandenberg AFB on 10 August 1960. Next day, backup ship-based recovery of its floating capsule was accomplished near Hawaii. Air recovery was accomplished, as intended, by an Air Force Flying Boxcar (C-119) on battery-powered Discoverer 14, launched a week later, and photo intelligence from the CIA's recoverable film payload, CORONA, became a national capability.

~~(S/B)~~ [redacted] were precursors to signals collection for intelligence purposes. Beginning in June 1961, the Lockheed Agena platform that hosted CORONA, Discoverer biomedical, [redacted] Starting with vacuum tube technology and battery power, the [redacted] and elaborated and refined by Lockheed and its payload subcontractors throughout the 1960s. The recorded ELINT data was analyzed initially by SAC and NSA. By the turn of the

decade some of these evolved technologies would also become primary candidates for a passive ELINT ocean surveillance system requested by the DoN.

(U) After the GRAB and CORONA successes, SecDef Thomas Gates commissioned a special panel to investigate the unsuccessful Samos project and related efforts. In accordance with the panel's recommendations and approval by the National Security Council, management of research, acquisition, and operations of Air Force missile and space systems related to reconnaissance were consolidated. Air Force management offices in the Pentagon and engineering and operations offices in the field (primarily Los Angeles and Sunnyvale, California) would report directly to Under Secretary of the Air Force (SAFUS) Joseph V. Charyk, who had served on Gates' panel, along with George Kistiakowsky (White House science adviser) and DepDDR&E John Rubel.

(U) On the last full day of the Eisenhower administration, DepSecDef James Douglas signed a memorandum to the secretaries of the military departments and DirNSA with several provisions for control of the intersection of intelligence with space. The secretary of the Air Force would assume responsibility for the reconnaissance program and report on it directly to the DepSecDef. All DoD elements engaged in development of COMINT or ELINT applications of satellites should cooperate closely with DirNSA, either directly or through the office of DDR&E. DirNSA would, "in turn, provide guidance concerning COMINT and ELINT requirements and will render technical assistance within his capability" (19 Jan 61).

DoD Space Directive

(U) Robert S. McNamara had been persuaded by President-elect Kennedy to resign his presidency of Ford Motor Corporation and head the DoD. McNamara's previous involvement with the Pentagon was limited to two years as an Army officer in the supply system of the Army Air Corps during World War II, but his academic background in statistical control techniques and tenure at Ford provided the experience and will to develop a rational, missions-oriented budgeting process for the $50B annual defense outlay. Roswell L. Gilpatric, a member of Kennedy's pre-inaugural advisory committee on the defense establishment and former SAFUS, was appointed deputy secretary of defense. The McNamara revolution in defense budgeting and procurement was sustained throughout the Kennedy and Johnson administrations. All problems would be approached in a logical, analytical way. Quantitative methods of systems analysis (developed by the RAND Corporation for the Air Force) and operations research (developed by ONR for the Navy) provided the tools for planning and decision making. Most importantly, the thousand or so DoD program elements would be aggregated, budgeted, and procured according to major DoD missions — ranging from strategic retaliatory forces to retired pay — instead of along the Eisenhower administration's breakdown mated to the organizational structure of the military establishment and uniform expenditure categories (procurement, O&M, military personnel, etc.). The R&D

mission for weapons systems would incorporate top-level decision points at key milestones derived from the process of mass production invented by Henry Ford and widely used in industry. Procurement decisions would be based on cost-effectiveness analysis.

(U) Space systems R&D was a prime target for reform. In his seventh week in office, McNamara signed DoD Directive 5160.32 on development of space systems, including "satellites, anti-satellites, space probes, and supporting systems therefor" (6 Mar 61). Scope and funding of preliminary research by the military departments and DoD agencies would henceforth be subject to approval of DDR&E. Proposals for further development would be submitted to the DDR&E for review and endorsement. RDT&E of DoD "space development programs or projects, which are approved hereafter, will be the responsibility of the Department of the Air Force." Exceptions would be made by the SecDef or DepSecDef "only in unusual circumstances." A cover letter from SecDef McNamara to the service secretaries and others indicated future roles of other services would be limited to space systems operations and generation of requirements for new equipment.

> This assignment of space development programs and projects does not predetermine the assignment of operational responsibilities for space systems which will be made on a project by project basis as a particular project approaches the operational stage, and which will take into account the competence and experience of each of the services and the unified and specified commands.
>
> We [SecDef McNamara and DepSecDef Gilpatric] recognize that all the military departments, as well as other Defense agencies, may have requirements for the use of space equipment. The directive expressly provides that they will continue to conduct preliminary research to develop specific statements of these requirements, and provides a mechanism through which these requirements may be fulfilled. (6 Mar 61)

(U) At the beginning of March, Charles Martell had been promoted to vice admiral and assigned as DepDDR&E for administration and management. He had been among those naval officers to see the directive coming. So had Tom Connolly at the BuWeps. Working with ASN (R&D) James Wakelin, DCNO (Dev) John Hayward, ACNO (Dev) Martell, and their Army counterparts on formation of a joint DoD space agency (as a military equivalent of NASA), he had seen their efforts rebuffed by DDR&E York and the Air Force secretariat, who favored the "scientific community & private industry" model of development over the "material bureau & government laboratory" arrangement used by Navy. The issue was industrial versus in-house R&D. Two prime examples of the differences were Army Air Corps versus Navy developments in radar during World War II; Air Force versus Army developments in ballistic missiles in the 1950s. Army and Navy maintained that their approach was consistent with congressional mandates.

(U) At lower levels, the DoD space directive took many DoN managers by surprise. Reactions ranged from indifference — on the parts of those who did not foresee roles of satellites in navigation, communication, passive and active surveillance, geodesy, meteorology, oceanography, and time synchronization — to disappointment, from those who did, and fear that system development under the new industrial procurement construct would not be affordable. Scientists and

engineers at the NRL were baffled that the emerging technology would now be controlled (and probably stifled) at the highest level of the DoD bureaucracy.

(U) Tom Connolly and DNI Lowrance arranged for the new secretary of the Navy, John B. Connally, Jr., to be briefed on GRAB. Uniformed Capt Fred Welden from ONI gave the classified briefing, using NRL's briefing boards and technical backup from Reid Mayo. Learning that the SecDef had not yet been exposed to the project or results, SecNav Connally scheduled an appointment and personally escorted the briefing team to McNamara's office. Informed of the architecture, organization, initial results, and plans for the next launch by articulate Fred Welden, McNamara commended the Navy project, saying that it would be marvelous if we could some day reconstruct the entire cost aspects of this program and all the performance aspects and see just how cost-effective it has been. Before discussion could proceed any further, the SecDef took a phone call from his wife. Afterward he complained that last week he could phone her, but she could not reach him, this week just the opposite. He asked John Connally whether they could use NRL's technological expertise to make the Pentagon's telephone system work. The meeting ended on that jocular note. The post-mortem with the SecNav established that NRL would gather data for a cost-effectiveness analysis.

(U) The general counsel of DoD soon began coordinating a new draft DoD directive (5160.34) on reconnaissance, mapping, and geodetic programs, to be signed by DepSecDef Gilpatric (28 Mar 61). Air Force would develop and operate all DoD reconnaissance satellites and develop processing equipment. Army would establish and manage a single geodetic and mapping program for the services and DoD, providing specifications for satellite systems to be developed and operated by Air Force. Other than satellite systems for mapping and geodesy, Air Force would be responsible for aerial systems; Army, ground-based; Navy, ocean areas. Under Herbert York's concept of like things in one organization, the Air Force had air and space; Army, land; Navy, water. [As it turned out, Army Project ARGON relied on CIA's CORONA technology for spaceborne geodesy.]

(U) Draft DoDD 5160.34 was unclassified and did not mention a role for NSA in the development of reconnaissance satellites and processing equipment in the SIGINT domain, but parallel correspondence between SAFUS Charyk and DirNSA Frost established that NSA would participate in planning and execution of the ELINT capability in Samos.

(U) After digesting approved DoDD 5160.32 and its perceived impact on Navy space systems then in R&D, Tom Connolly of BuWeps tried to forge a balanced perspective as the beginning of a Navy proposal that the directive be reconsidered. He prepared a thoughtful 13-page confidential memorandum for the Navy secretary, which included his supposition that the directive was motivated by perceptions of "problems of unwise duplication, waste, or mismanagement of space projects" within the DoD. Although Connolly's perspective was space, his field of

view was limited to projects among the three services initially funded by ARPA, and he insisted that, "Such problems did not exist, nor were they brewing."

(U) Connolly likened Air Force and Navy roles in national security and mutual pursuit of the "best weapon systems to achieve it;" cautioned SecNav Connally against those who would let the Navy's "strength lapse and have the Navy become a comfortable, old-fashioned girl concentrating on limited or conventional war;" praised the Air Force's ability to acquire "absolutely top-drawer caliber" talent from the scientific community; contrasted Air Force investment in think tanks and industry with the DoN's in-house R&D by government civil service scientists and engineers; and hoped that the nation's wisdom in choosing a mix of sea-based and land-based weapon systems would be applied to military space as well. He chastised himself for not having been sufficiently aggressive on behalf of the Navy and urged that the DoN "take time out for honest self-examination," including assessment of the current situation and recommendations on "sound ways to correct, eliminate, realign, establish and strengthen elements of the Navy that determine its strength and overall usefulness to the nation — now and in the future" (11 Apr 61).

(U) The din raised by an abortive CIA-sponsored invasion of Cuba, six days after Tom Connolly sent his memorandum, stifled any chance for it to stimulate reconsideration of the DoD directive. The Second Fleet had no role in planning or supporting the assault by Cuban exiles at the Bay of Pigs, but, when it happened, all U.S. ships nearby, including auxiliaries transiting the Caribbean, went to general quarters with all hands manning battle stations. OpNav concentrated on contingency planning. RAdm Connolly, an aviator, was immediately transferred from BuWeps to command carrier division 7. America became preoccupied with the CIA's Cuban fiasco and negotiation with Castro for return of captured exiles. The Pentagon began developing comprehensive contingency plans for amphibious and airborne invasion of Cuba. No evidence is readily available on SecNav Connally's reaction to Tom Connolly's memorandum, but the future Navy strategy regarding affordability of space systems would be to press for jointness and funding under the DoD general support program element (i.e., defense overhead), which would not affect the DoN's budget for procurement of ships, aircraft, and weapons needed to control the seas, protect the shipping lanes, and respond to crises worldwide.

Readiness Review

(U) As an extremely covert space program already established, Canes/GRAB was not immediately affected by the new policy on space systems development. The GRAB TOG was preparing for launch of a [redacted] collector. NRL's unique Gerber machine had been further modified to speed production of digital data. NTPC's Sergeant Winterbottom earned respect from all participants for his perseverance in operating the Gerber oscillograph to measure distances, hour after hour, day after day. Measurements of signal and calibration marks, along with

Rayspan calibration and tape speed control settings, were automatically transferred to punched paper tape. The Gerber output was fed into NRL's Narec computer, programmed for this effort by Bruce Wald. The computer combined the numbers to produce a record of time of occurrence and PRF of each burst. A record could be printed and graphically displayed by the Narec computer, both as histograms and burst plots. If the selected time increment approximated the scan period, the bursts formed a line. By varying the time increment, the program could be used to search for associated bursts. The objective was to determine optimum selection parameters for machine processing at NSA. Paper tape records of burst data were couriered to the NSA, to support development of scan-sorting and location-fixing programs.

(U) A TOG readiness review was conducted on 2 May. The countermeasures branch had fielded teams to upgrade the huts for improved habitability and data quality. Except for [redacted] sites, huts were being equipped with sun protection and air conditioning. Fifteen members of NRL received launch assignments, Ed Dix leading those from the satellite techniques branch; Reid Mayo, countermeasures. NavSTIC's [redacted] had assigned some people, including Robbie Robertson and Ethel M. Smith, to gather information on [redacted] requested by NSA.

(U) COSA-5 reported NSA/NRL progress on GRAB 1 tapes (1 May 61). Primary emphasis was on NSA's Audico I/Bogart program. The Audico servo control feature used the 1-kc component of the GRAB time channel as a reference to regulate tape playback speed, but tape flutter and low signal-to-noise ratio were problems. Audico output consisted simply of numbers representing time between successive pulses (or noise spikes) in machine units, each count representing 67 microseconds. Machine processing equipment included a Bogart computer built for NSA by Sperry Rand, an IBM 704 computer, and IBM 727 magnetic tape drives. The Bogart computer would be used [redacted] (collected eight months ago), results of Bogart processing of NRL's burst records were not yet satisfactory as compared to ground truth from manual analysis. An IBM 704 computer program was being developed [redacted] SAC's Capt Donald Wagner USAF had provided a formula used with airborne collectors for back-plotting on height finders, but Bassford Getchell found it unusable for GRAB. [redacted]

(U) ONI was responsible for disseminating results and had not much new to convey since the 1 March report. Reality was far short of the vision conveyed to the White House last October. In view of SAC's urgent need, Fred Welden and [redacted] placed highest priorities on immediately transforming all magnetic records to computer format (NRL), completing computer programs for locations (NSA), and turning over Bruce Wald's process to NSA. They gleaned a set of action items for NSA and NRL from discussion during TOG meetings and other interactions and

correspondence. The actions were transformed into a set of nine questions that DNI Lowrance submitted to his former boss, VAdm Frost, now in his sixth month at the NSA. On 5 May, DirNSA Frost forwarded ONI's questions by memorandum to the chief of COSA, Herbert L. Conley. In response, Conley reported status of standardization, equipment, programming, and personnel. William D. Wray, chief of PROD's techniques group (PROD-03), was in charge of GRAB processing. In all, 52 NSA personnel were cleared for the project. Members of COSA, MPRO, and PROD-03 were working with NRL on data reduction and processing. Hank DeCourt, LCdr [redacted] Joe Struve, and Bassford Getchell were most actively involved with NRL. The need was recognized to standardize calibration tapes and data formats used by manual and machine processing elements, both at the NSA and NRL.

(U) COSA-5 was reluctant to expend more effort on manual generation of digital data, and Herbert Conley stated NSA's processing philosophy:

> This gets into the most critical question of the moment: that is, should we reexamine our objectives with regard to the processing of the tapes from the first GRAB shot? Our efforts have been aimed heavily at developing techniques and methods to process all signals from all tapes and locate as many as possible. The SAC request and the present ONI questions would suggest that we might consider adding additional resources to the effort to obtain partial and piece meal results in advance of more complete solution. If this decision is made, than it may be advisable to expand the "Gerber approach." We will discuss this with ONI. (11 May 61)

Usable with either Audico or manually generated digital data, a PRF-sorting program was operational and a scan-sorting program was written and debugged. NavSTIC had been asked for information on PRF and scan stability that would guide Bogart processing thresholds. Benchmark locations, to verify a computer program for V-beam location, had been requested from SAC.

(U) Participants at the NSA and NRL stayed on course and worked harder, both in processing of GRAB 1 and preparation for GRAB 2. By the end of May, Bruce Wald and Bassford Getchell established a common language format for digital tapes. NRL distributed to participating stations an addendum to cover the upgrade of receiving huts, including the new GR-2500 tape recorder and a solid state digital time code generator (Jun 61).

(U) In June, ONI received a summary of SAC's initial results in processing data from GRAB 1, based on the first 92 minutes of data (two missions) made available to SAC. By consistency in [redacted]

(U) Growing Air Force interest in the project was evidenced by new requests for clearance. In late June, the TOG endorsed and forwarded, for DNI's approval, requests to clear three Air Force officers assigned to NSA; three, SAC; four, AFCIN; one, AFSS. Three among them were general officers. In the same time-frame, NSA submitted clearance requests for fifteen more civilians, ranging from GS-4 to GS-14, and one Army specialist. As NSA's in-house ELINT resources increased, NTPC was winding down.

Launch

(U) For the impending launch, news reporters keyed on two worldwide firsts. Three satellites would be lofted on a single rocket. Transit carried a Martin-built atomic battery for auxiliary power. Ready for processing or not, a partly successful Thor Able Star launch took place at Cape Canaveral the night of 29 June 1961. Transit 4A achieved its intended orbit. The GREB satellite remained attached to a scientific satellite, developed for Professor Van Allen's research project at the State University of Iowa, due to human error in the sequence of ground commands. Electromagnetic interference ruled out concurrent operation, and an agreement was reached to operate GRAB/GREB [redacted] Injun, [redacted] The constraint of prior White House approval of each GRAB interrogation had been removed. Orbiting 475 x 540-miles at 66.8°, GRAB 2 began collecting on 15 July.

(U) Stimulated by SAC's success on the Tokens, NSA PROD-03 formed a task group, led by Walter G. Deeley and supported by NavSTIC's analysts, to locate [redacted] total. The Audico interface was still unproved, but Bogart processing of the [redacted] were disseminated in NSA's first [redacted] product report on data from GRAB 1 (20 Jul 61).

~~(S/B)~~ When GRAB 2 data tapes arrived and were dubbed at the NRL, NSA could not keep up. Discussion in the TOG revealed that analytical resources were being spread too thin. Starting in June, COSA-5 had an influx of data tapes derived from [redacted] Preparations were being made to process ELINT data from Samos, expected in January 1962. The volume from GRAB promised to grow, too. The next two satellites, scheduled to go within eight months, had identical coverage, a [redacted]

(U) Fred Hitz had been reassigned from NSG headquarters to command NSGA [redacted] His place in the TOG was taken by Cdr Franklynn R. Sperberg, who had field experience in GRAB operations from his previous tour of duty as officer-in-charge of a station overseas. ONI's Fred Welden was being relieved as Op-922Y in July. His successor, Capt Donald Mac Showers, had been, in 1957-60, the first officer-in-charge of the U.S. Navy Field Operational Intelligence

Office (NFOIO) at Fort Meade, Maryland. Lorenzen sent Showers three copies of a program outline for three heavier and larger GRAB satellites next year, proposing that it be used to guide planning by Op-07 and BuWeps (18 Aug 61).

~~(S/B)~~ Each satellite in the follow-on series would include [redacted] ELINT detection bands. Because useful location information from [redacted] was thus far limited to [redacted] other methods of measurement were being considered. Based on [redacted] techniques employed in NavSpaSur, NRL was investigating "a satellite based system which will [redacted] determine the [redacted] (18 Aug 61). NSA did not favor incorporating [redacted] with GRAB, due to the necessity of completely reworking space and ground instrumentation. [NRL did not pursue [redacted] much beyond the engineering model stage, [redacted]

(U) A major reorganization of NSA was effected in August. Operational groups, corresponding to targets, were established and assigned alphabetic codes. Herbert Conley became chief of A-Group (targeted on European Communist and Warsaw Pact countries). Designation of his former office of collection and signal analysis was changed from 'COSA' to 'C-1', now under John Libbert. Designation of Libbert's former advanced signals analysis division was changed from 'COSA-5' to 'C-15', with Hank DeCourt as chief. Joe Struve became chief of a special projects division (C-14), responsible for machine processing of ELINT data. DirNSA Frost and DNI Lowrance had agreed that A-Group could redirect scheduled GRAB 2 collection when quick reaction was required, in response to [redacted] For this purpose, Joe Struve arranged an interface between NSG's Frank Sperberg and NSA's Walt Deeley from A-3.

(U) Mac Showers agreed to query SAC on its GRAB processing techniques, and CNO (Op-92) sent a message to that effect on 24 August. The response, from CincSAC's deputy director of intelligence, Col [redacted] USAF, included a statement of SAC's processing philosophy that differed markedly from NSA's:

> SAC's primary objective when processing GRAB-1 ELINT data is to select, from the total data available, that intelligence which is of immediate value to the current SIOP. Obviously the most valuable intelligence to be gleaned from such data consists of the type and location of radars considered pertinent to the [redacted] defense structure. ELINT signals, the significance of which cannot be determined due to certain missing parameters or the inability to locate the source, contribute less to the development of the SIOP. Based upon this premise, only those ELINT signals considered truly significant, and which can be located with an acceptable degree of confidence, receive maximum attention and processing. This is not to say that all other signal intercepts are ignored. During the film readout any intercept which appears unusual, regardless of whether or not it can be located, will be recorded and analyzed. (25 Aug 61)

SAC had by then received tapes for 21 GRAB 1 missions (all those for which ephemeris was available) and had processed significant portions of them. Results far surpassed those at the NRL and NSA to date:

[redacted]

Attachments included a handbook of operating procedures, [redacted] a computer program, and listing of radars located. Copies of the letter and attachments were sent also to Headquarters USAF and NSA. Assessing the information, the TOG concluded that SAC had mounted a massive manual analysis effort, mainly optical methods, aimed at developing the radar order of battle as quickly as possible. Their brute force techniques, although sound and productive, did not advance the machine processing efforts being emphasized at the NSA and NRL and were not applicable to all types of equipment.

(U) After comparing collection times on NSG's GRAB 2 mission tasking with sample times of arrival of dubbed tapes at the NSA, Walt Deeley concluded that quicker access to tapes of potential interest (due to proximity with events known from other sources) would be gained if NSA did the dubbing. A-3's interest reinforced a belief in Joe Struve's area that less tape handling would avoid tape stretching that distorted time relationships for Audico. During TOG discussions, Deeley suggested NSA take over the tape dubbing function. Both NRL and C-15 (manual analysis) opposed processing work with original tapes (one-millimeter Mylar) because of their fragility and because NSA did not have equipment that could produce usable dubs. In consultation with [redacted] and NSA C-15's representative to the TOG, [redacted] Howard Lorenzen drafted a letter aimed at getting more resources for NSA's analysis effort and improving coordination between manual analysis, under John Conlon, and the machine processing element. Prepared as a formal letter from DNI Lowrance, addressed to the TOG and to DirNSA Frost, the draft went no farther than Mac Showers' office due to disclosure of an impending national program that would consolidate all satellite reconnaissance systems under CIA and Air Force management.

Chapter 5 References

19 Jan 61 DepSecDef (S) memorandum for SecArmy, SecNav, SecAF, DirNSA, copy to ChJCS and others, Ser 106654
Subj: Development of Advanced Intelligence Collection Program

6 Mar 61 SecDef DoD directive 5160.32
Subj: Development of Space Systems

6 Mar 61 SecDef (U) memorandum for secretaries of military departments, DDR&E, ChJCS, ASDs, general counsel, assistants to SecDef
Subj: Development of Space Systems
Encl: DoD Dir. 5160.32

28 Mar 61 GenCoun, DoD (U) draft DoDD 5160.34
Subj: Reconnaissance, Mapping and Geodetic Programs

11 Apr 61 BuWeps (RAdm Connolly) (C) memorandum for SecNav
Subj: Space and the Navy's Future

1 May 61 NSA COSA-5 (TS/LIMDIS) report to TOG
Subj: Status Report on Analysis of Project GRAB 1

11 May 61	Herbert F. Conley (TS/LIMDIS Sensitive) letter to Adm L. H. Frost Subj: GRAB Processing
Jun 61	NRO (U) addendum to Instruction Book No. 25 Subj: Description and Maintenance Instructions for Modernized Radio Receiving Huts
20 Jul 61	[redacted]
18 Aug 61	DirNRL (classified) proposal to Op-922Y Subj: Solar Radiation Satellites in FY-62
18 Aug 61	NRL (S) Report by Space Surveillance Branch and Satellite Techniques Branch of Applications Research Division Subj: A Satellite Surveillance System
25 Aug 61	CincSAC (TS/LIMDIS) letter to CNO thru HqUSAF Subj: GRAB-1 Processing (U) Atch: (TS/LIMDIS) report GRAB-1 ELINT Processing with six attachments

~~SECRET~~

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Chapter 6. NATIONAL PROGRAM

(U) *The GRAB project became assimilated in a national program led by the Air Force in response to indications the Russians were developing an anti-ballistic missile/anti-earth satellite capability. The second successful GRAB payload observed different portions of the spectrum and enabled NSA to characterize a powerful, new system probably located at the* [redacted]

National Funding

(U) The Gilpatric/McNamara reformation of space systems development was being extended to the intelligence arena in 1961, as forecast by the DoD general counsel's draft directive of 28 March. The SecDef signed a top secret memorandum that informed John Connally and other service secretaries of the collateral designation of the SAFUS as the SecDef's assistant for reconnaissance, as well as the plan to consolidate all DoD "satellite or overflight photographic reconnaissance, mapping, geodesy, and electronic signal collection programs" (6 Sep 61). Attached, for guidance, to the memorandum was a letter from DepSecDef Roswell Gilpatric, to outgoing DCI Allen Dulles. The letter reported Gilpatric's agreement (apparently verbal) with the DCI, concurred in by the acting DCI, Gen Charles Cabell, "with respect to the setting up of a National Reconnaissance Program (NRP)" and to establish "on a covert basis a National Reconnaissance Office to manage this program" (6 Sep 61). The office to be formed (by mid-1962) would be jointly directed by the CIA's deputy director for plans and the SAFUS, as special assistant for reconnaissance to the SecDef, with authority delegated by the DepSecDef. NRP management would respond solely to USIB requirements and priorities for photographic and electronic signal collection. The two NRO directors (Richard Bissell and Joseph Charyk) would control — without intervening reviews or approvals — reconnaissance system project directors in the field. A chart attached to the agreement showed a joint organizational structure for management of the NRP, down to directorship of the Samos project, in both its actual (covert NRO) and apparent (overt Air Force) manifestations. The NRO directors (CIA DD/P and SAFUS) would be supported by a special staff, overtly identified as the Office of Missiles and Space, Office of the Secretary of the Air Force (SAFMS). The special staff (SAFMS) had already been formed within the Air Force secretariat, to support Under Secretary Charyk's control of Samos, and staffed by members of the former Air Force offices of guided missiles and advanced technology (satellite systems), which had been directed by brigadier generals. (The agreement made no mention of the two operational systems, GRAB and CORONA — probably because Samos was expected soon to relieve both of them.)

(U) Electronic signal intercept and processing fell under the purview of NSCID 6, which assigned NSA responsibility for national COMINT and ELINT intercept and processing. DirNSA Frost objected to Gilpatric's plan for joint CIA/Air Force direction of all overhead electronic signal collection. Eugene G. Fubini, an intelligence expert in the office of DDR&E, was appointed to look into the matter, in coordination with the affected organizations.

(U) Gene Fubini solicited representation from DDR&E, CIA, NSA, SAFMS, ONI, and Army ACSI. DNI Lowrance assigned action to intelligence specialist Mac Showers, who headed ONI's operational intelligence branch. Showers assigned two TOG members to Fubini's group: [redacted] of NavSTIC and Frank Sperberg, who coordinated GRAB operations from NSG headquarters. Herbert Conley was the senior representative from NSA. Walt Deeley was the recording secretary.

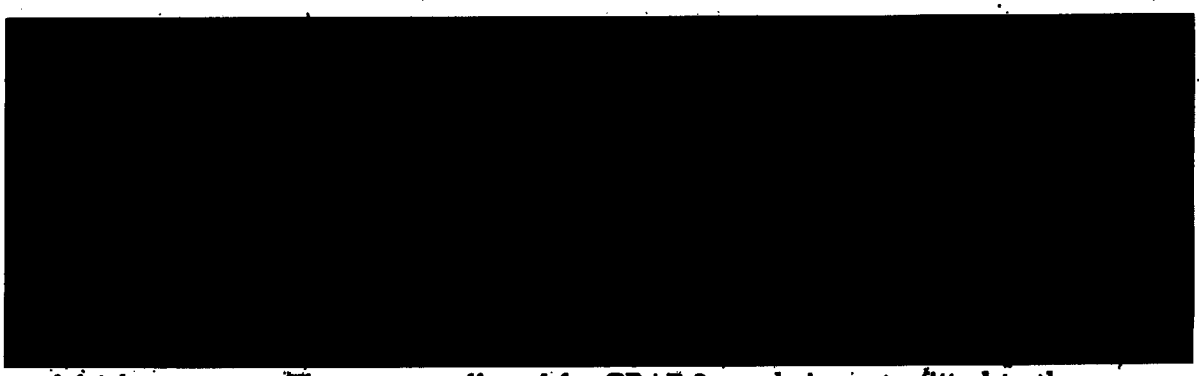
(U) The meetings chaired by Gene Fubini disclosed the rationale for a nationally funded program. The radars photographed by U-2 at Lake Balkhash were part of an emerging Soviet defense against Polaris ballistic missiles and SAC's budding Atlas ICBM capability. More suspect sites under construction had been found by the CIA's CORONA system. A crash program, similar to the Manhattan project, was needed to detect, analyze, and counter signals from these radars and to find other ABM sites in the Soviet Union. The NRP would fund additional photo and ELINT satellites needed for this purpose. All aspects of the program would be placed under extremely tight security, top secret codeword, with separate control systems to cover technology and product, access to technology limited to those planning and implementing the systems.

(U) Neither the office of DDR&E nor SAFMS were well informed about Canes/GRAB, and SAFMS challenged its continuation in the national program. The project had strong representation, though, not only from Conley, [redacted] Sperberg, and Deeley, but from CIA's Harold W. Willis, who had been a Canes participant since well before the first launch. His office had also helped advance analysis techniques.

(U) By way of a tutorial for Gene Fubini's group, NSA issued its second product report on Canes, the result of collaboration by NSA, ONI, and SAC (19 Sep 61). This included results from NSA's manual analysis and processing (semi-automatic and automatic) on GRAB 2 data plus results from further analysis of GRAB 1 data by NavSTIC, SAC, and NSA.

(U) The case for Canes was further buttressed by NSA's revelation of the dawn of automated processing of ELINT pulse data, in a five-page report filed as a memorandum for the record (12 Oct 61). For GRAB 2, analog tape playback speed was regulated by the 60-kc reference tone, which ran the Audico clock. The critical part was manual adjustment of threshold to fit the incoming signal level, which required considerable operator experience to attain satisfactory performance. Audico pulse times were written to an IBM 727 digital tape drive. An IBM 704 computer

[redacted]



and fairly accurate. The process effected for GRAB 2 was being retrofitted to the GRAB 1 data. The analog/digital conversion would be harder since the original recorders were of low quality and the 1-kc timing tone was not suitable to run the Audico clock. Routines were nearly complete to convert outputs of Bausch and Lomb film processing and the Gerber process to a format usable by the scan-sorting program. Equipment had been ordered to enable the signal conversion branch of C-13 (communication intelligence division) to take over the dubbing task from NRL.

(U) Working in concert against the understood defensive threat and focused mainly on the covert electronic signals collection aspects of the Samos [redacted] projects that were being optimized against it, the group soon agreed to distinguish between ELINT collection and processing, allocate space-based collection to the SAFMS, allocate processing to NSA or organizations designated by NSA or authorized by USIB (i.e., SAC), and utilize "resources of all other components of the U.S. Government engaged in electronic signal intelligence activity" as feasible. (This opened the door to participation in the national program by elements supporting Canes.) The group specifically exempted "present approved collection and processing programs" (i.e., Canes, [redacted] from the new construct through 1962.

(U) Absent SAFMS support for the current fiscal year, DCNO (Dev) Hayward had approved diversion of a Thor Able Star procured for Transit to GRAB's next launch, two months hence (29 Sep 61).

(U) The concise written product of Fubini's multi-agency group was attached to a top secret memorandum from DepSecDef Gilpatric to the service secretaries and others, which approved for implementation within the DoD its determinations and assignments of responsibilities. The forwarding memorandum equated the SAFMS with "that activity for which the Under Secretary of the Air Force has been designated as my [SecDef] Assistant for Reconnaissance" (20 Oct 61)

ABM Threat

(U) The ABM threat aroused participants in the GRAB project to action. NavSTIC's [redacted] likened the developments to a new division in the Soviet Army of electronic warfare. In the national ELINT domain, Howe was

acknowledged as an expert. He had participated in the national ELINT program since its inception. He crafted Navy inputs to the national program through the USIB structure, and he reviewed inputs from other departments and agencies. His work ranged from broad mission objectives down to detailed technical requirements on priority and accuracy of individual parameters, and his view encompassed all systems and users. In his requirements work, he continued placing search first, now primarily ABM; radar order of battle, second. Howe interpreted national requirements for the GRAB project, which would need to be reoriented accordingly.

(U) The new threat and measures to combat it warranted tighter security, and the ONI replaced Canes with the Hold control system, which required new indoctrination. Those who executed the secret Hold security agreement then read a two-page description of the Hold Program, as follows:

TOP SECRET
SPECIAL HANDLING
HANDLE VIA HOLD CONTROL SYSTEM
THE HOLD PROGRAM

Project HOLD is an ELINT collection system, utilizing an earth satellite as the collector. The program is sponsored by and carried out under the auspices of the United States Navy. The Director of Naval Intelligence has been appointed Project Director and given overall responsibility for the project by the President of the United States. A Technical Operations Group (TOG), composed of representatives of the Office of Naval Intelligence, the Naval Security Group, the Naval Research Laboratory, and the National Security Agency, exists to advise the Project Director in all phases of Project HOLD.

To date, two ELINT satellites have been placed in orbit under this project. The first successfully collected ELINT data in the megacycle range [redacted] over [redacted] the Soviet Union, [redacted] The second is currently collecting ELINT data [redacted] over the same general areas.

[redacted]

Project HOLD was originally designed to test the feasibility of ELINT collection by satellite. The feasibility has been proven beyond doubt, and in addition a large volume of operational intelligence has been provided. Most significant, perhaps, is the ability to collect ELINT information in areas of the [redacted] which are completely inaccessible to all other collection systems.

Dissemination of HOLD information (either information regarding the program itself, or intelligence information which might reveal the satellite intercept source) is made only to persons who have been officially briefed on and cleared for access to Project HOLD. The briefing and clearance alone do not have the effect of authorizing free and unlimited access to HOLD information. The divulging of any individual fact concerning Project HOLD will be determined by two criteria, both of which must be met. These are:

(a) the recipient must have received this briefing and have been cleared for access to HOLD, and

(b) he must have a valid and demonstrable need to know the individual fact to be divulged.

Each person who is briefed on this problem is individually responsible for maintaining the security thereof, and for ensuring that both of the above criteria are met prior to divulging any information concerning this project to another. By executive order of the President of the United States, the Project Director is responsible for determining who shall obtain clearance for HOLD. (dated when executed)

(U) Mac Showers continued as the DNI's representative to the TOG, but he was engaged more fully in a reorganization of Op-922 occasioned by activation of the Defense Intelligence Agency (DIA) at the beginning of October. As a consequence, 350 ONI personnel and attendant functions in the Pentagon were being transferred to DIA. His own operational intelligence branch, Op-922Y, was lightened and renamed 'composite support branch'. The ELINT section (Op-922Y4) was redesignated 'fleet support section', and Showers now drew his support for GRAB/Hold from a special projects section (Op-922Y3) in the Pentagon, as well as from NavSTIC at the USNO.

(U) Following a TOG meeting on 27 October, naval officers and civilians continued discussion of the possibility that an ABM signal, if detected by GRAB, would be recognized in the data. How would PRF and scan sorting work on a signal whose parameters were unknown? Highly skeptical, [redacted] was asked to amplify his comments regarding NSA's processing difficulties in a summary report to the project director through the TOG chairman. NSG G52 typed and submitted Howe's report to the DNI, copies to Sperberg and Lorenzen.

(U) On the positive side, the report acknowledged the engineering accomplishment:

NSA has in their machine work, accomplished a tremendous breakthrough in reduction of the analog data automatically to hard copy in a small sampling of GRAB II take, which is really a milestone in ELINT processing. (30 Oct 61)

Howe lauded individuals who had made tremendous contributions to the achievement: Mrs. [redacted] (manual processing), LCdr [redacted] general guidance and interpretation), Mr. Deeley and Mr. Struve (general management). He noted, though, that NSA had as yet produced only two final intelligence product reports from the GRAB data, and he identified obstacles to further productivity:

The NSA manual-processors are entirely involved in analyzing Air Force input which is more difficult to analyze. The automatic output of NSA is stalled due to difficulty in obtaining qualified operators for the AUDICO equipment. ... the task group that Mr. DEELEY had available in mid-1961 is no longer available to GRAB. The turnover in mathematicians working on computer programming has been severe. Furthermore, reorganization within NSA and a general lack of ELINT appreciation outside of C15 has inhibited results further. ... No current manual processing of interesting portions of the data is under way, such as investigation of missions such as those when [redacted]

[With regard to ELINT appreciation and search for unusual signals, Howe would soon be proven wrong, to his delight.]

~~(S/B)~~ [redacted]

(U) [redacted] assured DNI Lowrance that his "comments do not reflect upon the many faithful and diligent NSA workers who have in many cases, worked unrewarded overtime on the task. We admit the problem is difficult. Nevertheless, we must all do more or consider abandoning the GRAB project entirely." His personal despair of squeezing any more effort out of NSA was reflected in a set of recommendations for additional low-key efforts by NRL and ONI.

(U) After receiving a copy of [redacted] report, Howard Lorenzen turned to Bob Misner (who was closer than [redacted] to hardware, software, and personnel in C-14) for an assessment of the status of processing. Regarding Audico threshold levels, Misner favored experimenting with a fixed setting, pending some future development of computer-controlled adjustable settings. A few runs should determine an optimum level to get most of the signal and little of the noise. Based on ongoing dialogue with Joe Struve and [redacted] he did not believe that Audico was a problem anyway. The disruption in processing was due to C-14's upgrading to a more powerful IBM 7090 computer. Misner accepted [redacted] word that Audico was 90% effective and suggested asking [redacted] to commit to a date when the new 7090 software would be debugged and operational.

Future Program Committee

(U) A GRAB research planning group (BuWeps, NRL, NSA, NSG, NavSTIC), chaired by Howard Lorenzen, met for a second time at the Navy Lab on 2 November and began to consider an ambitious development schedule, stimulated by the ABM threat and NSA's interest in the possibility of a two-satellite GRAB configuration. With BuWeps paperwork in progress to transfer $1.5M to NRL for fiscal year 1962 (14 Nov 61), the countermeasures and satellite techniques branches would be able to do their parts. The chief obstacle was a launch vehicle, cost of which was retained in the BuWeps budget for transfer to Air Force. Samuel H. Hubbard of BuWeps favored the new joint Air Force/NASA Scout booster, even though it was still an untried system and had a current lift capability of only 60 to 80 pounds, because the cost per shot was about $1M compared to $5M for a single Thor Able Star. Either a dual-satellite launch would have to wait until the Scout matured to its eventual lift-off capacity of 150 pounds, or two Scouts would be needed. Howard Lorenzen, Reid Mayo, and Bruce Wald went to the NSA on 9 November to discuss with Bassford Getchell, [redacted] NSA's suggestion for two-ball GRAB and a means to get more [redacted] data than was being provided by NASA.

(U) A pair of GRAB satellites [redacted]

[redacted] NSA planned to seek SAFMS support for a two-ball launch. Provided that ephemeris accuracy could be improved sufficiently and a suitable launch vehicle found, Lorenzen agreed to incorporate NSA's objectives in the long-range development schedule. The first priority was to accomplish complete coverage of the radio frequency spectrum for [redacted]

(U) An NRL/NSA committee (Bruce Wald, Bassford Getchell, [redacted] was formed to investigate the ephemeris problem. Wald set up a 14 November meeting with two members of NRL's computing team for Minitrack and NavSpaSur. After this productive session and further research, they visited NavSpaSur on 20 November and were ready to write their report for the TOG. The report assessed all existing U.S. space surveillance assets and concluded that orbital elements "from SPASUR appear to be the best for NSA's purposes" (4 Dec 61).

(U) SAC's director of intelligence, BGen Robert N. Smith USAF, sent DirNSA Frost a copy of the 544th RTG's latest version of GRAB location techniques, used for [redacted] The locations were considered [redacted] for assisting in defining the operational intelligence required for SAC and SIOP planning" (6 Dec 61). SAC was now using, with very limited success, [redacted] on both GRAB 1 and GRAB 2 data. Minimally, [redacted] Refinements would continue.

(U) Encouraged by SAC's progress and assured by the NRL/NSA report to the TOG on potential ephemeris accuracy, the GRAB research planning group concluded that [redacted] could succeed against single beam radars. The group, renamed 'future program committee', recommended Navy programming reorientation for that objective and NSA advocacy in DoD for a suitable launch vehicle (19 Dec 61).

~~(S/B)~~ In early December, NSG headquarters was alerted by message reports from Navy SIGINT stations in [redacted] of anomalies in both tracking and ELINT signals from GRAB 2. NRL's satellite and payload engineers studied the messages, analyzed most recently available recordings of ELINT and telemetry data, then conducted experimental tests at Hybla Valley. Modulating tones for the telemetry were inoperative, leaving the carrier for tracking but ending collection of SolRad data. The upper band of GRAB 2 [redacted] had failed in early December. The lower band [redacted] had lost some sensitivity, but there was no reason to expect early failure. [Although ELINT

collection continued, SolRad's demise marked the end of the useful lifetime in unclassified tables of launch histories.]

(U) TOG review disclosed that sailors who interrogated payloads, received little in the way of guidance on their duties. Those trained by NRL, trained their successors. There was no set procedure for reporting anomalies. Another GRAB launch was scheduled in a month, and the TOG agreed that the situation should be remedied before then. NRL's Ed Withrow provided the technical content, which NSG transformed to a set of standard operating procedures for interrogation, including failure reporting (Jan 62).

(U) Lorenzen submitted a plan for the future program to the TOG, aimed at [redacted] per satellite, with slight overlap, commencing in the final quarter of 1962. Further tailoring the program to the [redacted] awaited outcome of NSA's proposal to Dr. Charyk (16 Jan 62). In the meantime, CIA and SAFUS were realigning their projects under the joint management concept, in accordance with the September DepSecDef/CIA agreement and SecDef announcement.

(U) On the morning of 24 January, a Thor Able Star lifted off from Cape Canaveral carrying three satellites for NRL's experiments, along with two others. The smallest, SurCal 1, at 9 pounds, was designed as a space object to calibrate the NavSpaSur fence, [redacted] A low frequency trans ionospheric experiment, to study ionospheric effects on very low frequency (VLF) propagation, was carried on a 60-pound satellite (LOFTI 2A). GREB 4, at 55 pounds, carried SolRad 4A and GRAB. Injun 2, at 59 pounds, carried another of Van Allen's payloads. A 36-pound Army communication satellite completed the assemblage, called 'Composite I', nicknamed 'Buckshot'. The first stage Thor went well. The second stage separated on schedule a few minutes later but exploded before reaching sufficient velocity to attain orbit and fell into the sea.

Follow-On Program

(U) As work proceeded on building more ELINT satellites at the NRL, a proposal for a Navy satellite program was prepared by ONI's Mac Showers with inputs from Lorenzen's future program committee. The requirements context, crafted by [redacted] identified additional suspect ABM sites at [redacted] ONI staffed the proposal with Op-76 and BuWeps.

(U) The name 'Dyno' was assigned to the two-ball follow-on and used in a letter from RAdm Kleber S. Masterson, deputy chief of BuWeps, to the DNI. BuWeps was in somewhat of a bind in the current year, in regard to its support for Transit and Dyno. The two systems were no longer launch-compatible. The Thor Able Star diverted from Transit to Dyno, had left a gap in the inventory. BuWeps'

request to SecNav for emergency funds was under consideration. A feeler to NASA was so far unanswered. The BuWeps letter summarized BuWeps' launch support to date and provided a Dyno launch schedule and budget through fiscal year 64, aimed at two launches per year. Subject to CNO and DoD approval, Dyno funding to NRL would be $2.325M in the current year; [redacted] in FY63; [redacted] in FY64. Fiscal year cost of five Thor Able Star launches, retained in BuWeps' budget, would be, respectively, $3.825M, [redacted] To help execute the program, ChBuWeps requested DNI's agreement that:

a. A Bureau of Naval Weapons Representative be appointed officially, as an associate member of the Technical Operations Group for Project DYNO.
b. Program Requirements, having been approved by the Project Director, will be forwarded in writing to the Bureau of Naval Weapons for implementing action.
c. The Project DYNO briefing team be expanded to include a representative of the Bureau of Naval Weapons to provide information that is of a program nature. (21 Mar 62)

Sam Hubbard became the BuWeps fiscal representative to the TOG. In some future correspondence, GRAB 1 and 2 were renamed as 'Dyno 1' and 'Dyno 2'.

(U) Whether or not Bill Howe's 31 October report to the DNI found its way to NSA is not clear, but subsequent events show that C-15's analysts had continued attacking the backlog. GRAB 2 had been tasked for three missions on [redacted] when, as it happened, Russian cosmonaut Gherman Titov was in uncertain recovery while the world anxiously awaited news. C-15's manual analysis of tapes for two of these missions discovered [redacted] was in the field of view.

~~(S/B)~~ The two intercepts were extensively analyzed and compared at the NSA and the NRL over a period of several months. [redacted] was photographed, studied, and compared with other groups. NRL developed a simulator to test payload reaction to such a signal and to explore tighter pulsing patterns that might yield those observed. NSA disseminated joint results as [redacted]

(U) Preliminary reports of the analysis stimulated intelligence community inquiries regarding the Navy's capacity for increased production, which ASN (R&D) James Wakelin and the new DCNO (Dev), VAdm William Raborn, investigated in the context of fabricating unclassified satellites. ONI updated the classified description of the Navy satellite program to point out that one of the startling contributions of the program has been discovery of a new radar system thought to be part of the anti-ballistic missile complex of the Soviet Union.

(U) DCNO (Dev) Raborn's Polaris missiles were among the weapons that might be thwarted by a Soviet ABM system, and he now had responsibility for developmental requirements to be answered by the material bureaus. The BuWeps assistant chief for RDT&E queried DirNRL as to NRL's capacity to maintain "engineering excellence" for an expanded program involving "as many as five COMPOSITE type launch operations per year ... possibly twenty (20) satellites of the Solar Radiation, LOFTI and SURCAL types ... without adding new facilities ... on a continuing basis by 1 January 1963" (3 Apr 62). ChBuWeps sent to DirNRL a task and project order for $576K to cover long-lead items (10 Apr 62). (Although BuWeps aggregated this amount with the FY62 $1.5M previously provided for GRAB, this money was allocated directly to Marty Votaw's branch and accounted for, within NRL, separately from funds allocated to Mayo's Problem 54R06-29.)

(U) GRAB's fifth launch vehicle, a Blue Scout, was BuWeps-funded, procured by the Space Systems Division of the Air Force Systems Command, and scheduled for a West Coast launch. To conduct pre-launch checkout of the satellite and support launch vehicle integration, NRL got the use of building 517 at the Naval Missile Facility Point Arguello [later Vandenberg South]. The rocket was launched from Point Arguello on 26 April and landed in the ocean, in sight of the launch pad, barely three minutes later due to loss of attitude control.

(U) Disappointment over the Scout failure and two previous Thor Able Star failures was reflected in NRL's response to BuWeps. Claude Cleeton, superintendent of the applications research division, prepared the NRL reply:

> ... within over-all Laboratory commitments and without adding new facilities and personnel two launches a year of the COMPOSITE type would be reasonable. At least a six months lead time is essential. ... By January 1963 the capability to support four launches a year of the COMPOSITE type could reasonably be provided. This capability is limited by the ability to recruit and train personnel and assumes an early determination to proceed ...
>
> This laboratory has enthusiastically supported the satellite development for the Solar Radiation and LOFTI programs based on the need for new information in these areas and the excellent results of the first satellite in each program. The vehicle failures for SR 2, SR 4A, LOFTI 2, and SR 4B place both programs in a precarious position. The reliability of the Thor Able Star was barely acceptable, and the recent shift to the Scout vehicle while it is in the development stage appears to be even less acceptable. For the Laboratory to build up the enthusiastic support of a large effort on satellite development the productivity of scientific information must be greatly improved. Plans for NRL satellites on Scout vehicles should be deferred until the Scout has demonstrated improved reliability. The accelerated program can be accomplished using known techniques and existing hardware only if every effort is expended toward the early procurement of Thor Able Star vehicles for COMPOSITE type launches. (Apr/May 62).

Lorenzen received the TOG's concurrence that they forego a second Scout launch of GRAB planned for July and go directly to a Dyno two-ball launch with Thor Able Star later in the year.

~~(S/B)~~ NSA had concluded that GRAB 2's ABM-related signal was compatible with what might be expected from [redacted] photographed

[redacted] The TOG recognized that location-fixing methods in use or foreseen for the follow-on program would be unable to resolve the question. ChBuWeps funded NRL with $50K to resume study of localizing radars by means of [redacted] (2 May 62). (Again aggregated with previous funding for GRAB, the money went directly to Roger L. Easton's Problem R02-39).

~~(S/B)~~ Meanwhile, a Samos [redacted] Agena ELINT satellite had reached orbit as Talent Keyhole Mission [redacted] scanned portions of S [redacted] bands, and recorded measurements of [redacted] pulses detected in its [redacted] lifetime. Like GRAB, the Samos data was analyzed by the special projects section of the 544th Reconnaissance Technical Group at the SAC and by the advanced signals analysis division (C-15) of the office of collection and signal analysis at the NSA — to identify signals and determine Samos antenna footprints for each signal of interest. Another Thor Agena launch was scheduled for June. (Samos Project 101 film readout had been proven on orbit the previous year but terminated due to CORONA's better resolution of imagery.) CIA had by now lost its senior leadership on participation in the national reconnaissance program. In addition to DCI Dulles, the Bay of Pigs had also claimed Gen Charles Cabell (after nearly nine years as deputy DCI) and DD/P Richard Bissell. The SAFMS refined the management construct for the NRP. The new DCI, John A. McCone, signed an agreement with DepSecDef Gilpatric on 2 May 1962 that the NRP would be directed by a single individual (to be mutually agreed upon by the SecDef and the DCI), instead of by the CIA DD/P and SAFUS jointly. The Air Force would manage NRP programming and budgeting for both DoD and CIA projects, and the CIA would be responsible for procurement secrecy and delegation of security responsibility within the CIA, DoD, and industry by means of its Byeman control system.

~~(S/B)~~ Within the Byeman control system, which superseded Hold, Dyno was renamed 'POPPY'. DCNO (Dev), ChBuWeps, DNI, and CNR accepted DirNRL's assessment that NRL could support four launches per year, starting calendar year 1963. ASN (R&D) James Wakelin submitted for SecDef Robert McNamara's consideration a SecNav proposal for additional POPPY satellites to "expedite further coverage of the Soviet ABM system as well as other Soviet R&D and operational electronics" (21 May 62). An attempt to launch a pair of ELINT satellites could be made each quarter during 1963 and 1964. With a .65 probability of launch success on the recommended Thor Able Star and one-year satellite design lifetime, this should achieve continuous coverage from two pairs for two years. For FY63, [redacted] had already been apportioned for POPPY development and launch; FY64 [redacted] Additional funds would be needed for four more pairs of satellites, four launchers, ground site upgrades, and data reduction and processing.

~~(S/B)~~ On 25 May, DirNSA Frost and Under Secretary Charyk agreed on terms of NSA participation in the NRO, including NSA's responsibility for analysis and reporting of SIGINT data collected by satellites and reassignment of the chief of NSA's advanced signals analysis division, Hank DeCourt, to Charyk's office. (Since

DeCourt was a naval reserve cryptologist with the rank of lieutenant commander, this move was considered a plus for the future of Navy ELINT satellites.)

~~(S/B)~~ SecDef McNamara soon signed DoD Directive TS5105.23 (14 Jun 62), which established the National Reconnaissance Office (NRO) as a DoD operating agency to manage the NRP. Joseph Charyk (SAFUS and SAFMS) was designated covertly as the director, NRO. His staff — formerly the SAFMS, now the Office of Space Systems, Office of the Secretary of the Air Force (SAFSS) — became the covert NRO staff in Pentagon room 4C1000, former home of the Air Force Office of Guided Missiles. The objections of the DirNSA notwithstanding, the DoD directive made no mention of a role for NSA. DirNSA Frost was replaced, two years early, by LtGen Gordon A. Blake USAF at the end of the month. [The distinction established by Fubini's working group — NRO collection and delivery of electronic signal data, exploitation by "NSA or other user" — was subsequently ratified by agreement of DCI McCone and DepSecDef Gilpatric during DirNSA Blake's watch (13 Mar 63). The term 'other user' referred to SAC.]

Project Results

(U) GRAB 2's useful operational life extended to [redacted] when data became too sparse to make regular collection worthwhile. Through [redacted] the payload was tasked occasionally to check its status. During the fourteen months of regular tasking, the [redacted] as their intercepts diminished and finally ended altogether. [redacted] turned out to be the last survivor, hence most powerful in the lower band, which included [redacted] early warning radars.

(U) [redacted] intercepted a new signal that SAC's analysts initially judged to be an ABM radar, because of its power. The report drew a lot of interest. Comparison by SAC/CIA/NSA/NavSTIC of intercept data on this unidentified signal from [redacted] GRAB 2, yielded a multi-mission, comprehensive characterization of [redacted]

~~(S/B)~~ [redacted]

(U) GRAB's contributions to U.S. knowledge of Soviet air defense radars were reflected in changes in the DCI's estimates regarding the chance of successful U.S. attack by manned bombers. Before GRAB:

> 14. We believe that the Soviets will continue to improve the overall capability of their large and complex air defense establishment. Despite these improvements, the Soviets probably will still not achieve within this time period [through mid-1965] a high degree of assurance in dealing with a large-scale sophisticated attack by manned bombers armed with high-yield nuclear weapons. They would probably expect to destroy a significant number of the attackers, but, given the increasing complexity of the air defense problem, we doubt they will be confident of the extent to which they could reduce the weight of any given attack. (29 Mar 60)

After GRAB:

[redacted]

(U)

[redacted]

(U) GRAB's engineering legacy was on a par with its intelligence results. Existing ECM technology was readily exportable to space applications. Feasibility of intelligence collection by satellite was demonstrated. A platform in outer space could collect as much as all the platforms in its field of view — at a fraction of their cost and at no risk to personnel. The output, initially overwhelming, stimulated invention of machine processing of digitized data using commercial computers. Relatively sophisticated space and ground equipment could be operated by soldiers, sailors, airmen, and civilian technicians. All elements of the intelligence community, agencies and departments, could participate in collection, processing, and exploitation of the information derived. Intelligence could partner with science, without reducing effectiveness of either payload. Three years after transfer of NRL's Vanguard team to NASA, DoN had resurrected an in-house capability for

quick response production of small satellites and ground equipment to meet multiple defense needs.

~~(S/B)~~ Funding for Navy ELINT satellites averaged [redacted] per year for fiscal years 1963-69 — nearly as much each year as spent on GRAB development in five years with five launch attempts. Launch costs were retained in the Air Force budget (Program A). National funding brought multiple satellites in each launch and more payload receivers and downlink transmitters, steadily expanding the radio frequency coverage throughout the decade. Technological advances, along with increasing NRO efforts to define and implement more ambitious space collection concepts and on-orbit measurements, led to sophisticated tasking and collection procedures and satellite support functions. NRL applied new technology in design and development of satellites, payloads, and ground equipment. By whatever name — Tattletale, Canes, GRAB, GREB, SolRad, Hold, Dyno, POPPY — the project was a success and had only just begun.

Chapter 6 References

29 Mar 60 DCI (TS#0035857) National Intelligence Estimate Number 11-3-60 — Approved for release as sanitized by CIA Historical-Review Program, Sep 96
Subj: [redacted] Air Defense Capabilities Through Mid-1965

6 Sep 61 DepSecDef (TS special handling) letter to DCI
Subj: Management of the National Reconnaissance Program
Atch: (TS special handling) chart Single Management for National Reconnaissance Program (TS)

6 Sep 61 SecDef (TS) memorandum for SecArmy, SecNav, SecAF, DDR&E, ChJCS, and GenCoun
Subj: Assistant for Reconnaissance (TS)

19 Sep 61 [redacted]
Subj: [GRAB 1/2 results]

29 Sep 61 CNO (S) letter to ChBuWeps, Ser 00281P76
Subj: COMPOSITE I

12 Oct 61 NSA (TS/LIMDIS) memorandum for the record
Subj: NSA Processing of Project GRAB Data

20 Oct 61 SecDef (TS) memorandum for the SecArmy, SecNav, SecAF, DDR&E, ChJCS, GenCoun, DirNSA, and Special Assistant for Reconnaissance to the SecDef
Subj: Space Vehicle Electronics Intelligence Program
Atch: (TS) Space Vehicle Electronic Signal Collection Responsibilities and Resources
Tabs: (A) (TS) Implementation of Collection Responsibilities
(B) (TS) Implementation of Processing Responsibilities

30 Oct 61 W. E. W. Howe (TS/LIMDIS) letter to Project Director, Project GRAB, G52/000393-61/jmc
Subj: Processing problems with GRAB data; amplification of (U)

14 Nov 61 BuWeps (C) WEPTASK Assignment to NRL, Ser 06101, WEPTASK No. RTSA 50003/652-1/F019-02-009, /s/ 9 Nov 61
Subj: Satellite Applications; Applications of Satellites to Scientific Research in Support of Navy Research and Development Problems (U)
Add: ChBuWeps (U) project order PO-2-0061 to DirNRL (RDT&E, N 1962) [$1.5M]

6 Dec 61 NRL/NSA Committee (S/LIMDIS) memorandum for TOG
Subj: Orbital Elements

8 Dec 61 CincSAC (TS/LIMDIS) letter to DirNSA, copies to ONI and HQ USAF, S-0002-G
Subj: (C) Transmittal of Documents Defining Technical Procedures for Obtaining Radar Locations
Atch: (TS/LIMDIS) GRAB Location Techniques, prepared by Special Projects Branch of the Defense Analysis Center, 544th Reconnaissance Technical Group (SAC), Offut AFB, Nebraska

19 Dec 61 TOG (S) report
Subj: Report on Future Program Committee
Encl: (1) (S) Report by Wald and [redacted] on Tracking Systems

Jan 62 NSG (TS/LIMDIS) Standard Operating Procedure No. 2
Subj: Interrogation

16 Jan 62 H. O. Lorenzen (TS) letter to Chairman TOG
Subj: Future Program

21 Mar 62 ChBuWeps (S/LIMDIS) letter to DNI, copy to CNO (Op-76), RTOS-1-SHH, Ser 00704
Subj: Project DYNO; information concerning (U)
Encl: (1) (S/LIMDIS) Project DYNO Launch Schedule
(2) (S/LIMDIS) Project DYNO Funding FY 1962 Through 1964

3 Apr 62 ChBuWeps (C) letter to DirNRL, RTOS-1-SHH, Ser 05375
Subj: Navy Astronautics Program Support Requirements (U)

10 Apr 62 ChBuWeps (C) WEPTASK Assignment to NRL, Ser 05768, WEPTASK No. RTOS 200 16/6521/F019-02-009, /s/ 6 Apr 62
Subj: Satellite Engineering Functions Development (U)
Add: ChBuWeps (U) project order PO-2-0061 to DirNRL (RDT&E, N 1962) [$576K]

Apr/May 62 DirNRL (C?) letter to ChBuWeps, 5100-33:CEC:wdw, Ser ?
Subj: Navy Astronautics Program Support Requirements

2 May 62 ChBuWeps (C) WEPTASK Assignment to NRL, Ser 06838, WEPTASK No. RTOS 30013/6521/F019-02-004, /s/ 2 May 62
Ref: NRL Proposal, "A Localization System using Satellites" of 24 November 1961. (S)
Title: Surveillance Satellite Study (U)
Add: ChBuWeps (U) project order PO-2-0061 to DirNRL (RDT&E, N 1962) [$50K]

15 May 62 [redacted]

21 May 62 ASN (R&D) (TS/LIMDIS Special Handling Required) letter to SecDef
Subj: Project POPPY (TS)
Encl: (1) (TS/LIMDIS SHR) Frequency Coverage Plan for Four Dual-Satellite Events
(2) (TS/LIMDIS SHR) Program Costs
(3) (TS/LIMDIS SHR) Summary of Launch Vehicle Considerations

14 Jun 62 SecDef (TS) DoD Directive TS5105.23 [Superseded 27 Mar 64]
Subj: National Reconnaissance Office

17 Jul 62 [redacted]

31 Oct 62 DCI (TS#0037584) National Intelligence Estimate Number 11-3-62 — Approved for release as sanitized by CIA Historical-Review Program, Sep 96
Subj: Soviet Bloc Air and Missile Defense Capabilities Through Mid-1967

13 Mar 63 DepSecDef/DCI (TS/BYE-[redacted] Agreement Between the SecDef and DCI on Management of the National Reconnaissance Program

~~SECRET~~

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Chapter 7. PROGRAM C

(U) *The Cuban missile crisis overshadowed the ABM/AES threat and engendered requirements for national tasking, increased collection, and faster results. Solitary GRAB satellites were succeeded by a pair, then triplets in a single orbital plane. Overseas sites began sending [redacted] messages. Data from the triplets enabled NSA to characterize [redacted] ABM-related systems.*

[redacted]

(U) DoD Directive TS5105.23 of 14 June 1962 was prescribed by SecDef McNamara to be the sole non-compartmented identification of the National Reconnaissance Office and the National Reconnaissance Program. Although the directive officially established the NRO and NRP, it did not disclose much about either of them. Participants in the Navy ELINT satellite project understood that the NRO's orientation was hardware — launchers and satellites — and that future programming and budgeting would be a responsibility of SAFMS, instead of Chief, BuWeps; launch planning interface from Air Force, instead of BuWeps. There was some talk of supporting the Navy project by excess capacity in Thor Agena launchers used with polar orbiters. To forestall detailed West Coast planning in this direction, DNI Vernon Lowrance sent to DNRO Joseph Charyk a specification of orbital requirements, stressing the 500-mile orbit at 70° and the compatible network of ground sites (7 Jul 62).

~~(S/B)~~ POPPY would include two new collection sites, as replacements for

[redacted]

[redacted] NRL relocated the GRAB equipment and trained, respectively, airmen and soldiers in operation and maintenance.

~~(S/B)~~ DNI Lowrance informed the director of NSG, RAdm Thomas Kurtz, of increased requirements for the project:

> Project POPPY is entering a new phase of operations beginning in November when the first two-ball satellite will be launched in orbit. [redacted] This will be the first launch for the Navy under the auspices of the National Reconnaissance Office and it is desired to maintain the same high degree of performance we have had in this program in the past. (20 Jul 62)

Two huts and double the personnel would be required at each site. The DNI conveyed concerns about retaining experienced operations personnel and requested that NSG coordinate with NRL to prepare new standard operating procedures for the two-hut configuration. DirNSG Kurtz assigned action on these matters to Frank Sperberg. NSG's detailers at BuPers were cued on the desire to transfer [redacted] GRAB personnel to sites where the follow-on system would be operated and to rotate experienced operators among the sites.

~~(S/B)~~ [redacted] — a new concept for improving POPPY production for the radar order of battle — was just emerging. The President's science advisory committee (PSAC) had recently reviewed machine processing capabilities and location finding methods in NSA C-1, the office of collection and signal analysis. During C-1's briefing on POPPY, Richard L. Garwin from IBM had noticed and asked the reason [redacted] on different payloads. He was informed that it enabled [redacted] and confirmed the [redacted] In a subsequent, written critique of the briefing, Garwin had suggested that [redacted] Dick Garwin later discussed this idea in sessions with NSA mathematicians and scientists. The approach, agreed to by NRL and NSA C-1, was to capitalize on a small degree of [redacted]

Program Structure

~~(S/B)~~ A few days after the DNI defined POPPY's orbital requirements, the NRP structure became much clearer, when the DNRO defined his new organization functionally in a Byeman memorandum. The NRP element became defined by four sub-elements: Programs A, B, C, and D:

- Program A funded NRO booster/satellite integration and launch, as well as overhead reconnaissance studies and projects sponsored by the Air Force (which included current SIGINT Missions [redacted] and future

SIGINT Missions [redacted]. Program A was managed by an extension of the SAFMS — designated as the Office of Special Projects, Office of the Secretary of the Air Force (SAFSP). The SAFSP was headquartered at the Los Angeles Air Force Station, where it was hosted by the Air Force Space and Missile Systems Organization (SAMSO), formerly the Ballistic Missile Division. SAMSO's deputy commander for satellite programs, BGen Robert Greer, covertly managed Program A as the director, SAFSP.

- Program B funded aerial (U-2) and satellite photo (CORONA) reconnaissance projects sponsored by the CIA and was managed by CIA's new directorate of research under DD/R Herbert Scoville.
- Program C funded continuation of the Navy ELINT satellite project, which was placed under the Byeman security control system for protection of technology, capabilities, and even the confidential project name, 'POPPY', and [redacted] (Since 'POPPY' was classified, the name 'Dyno' continued in occasional use at the NRL and NSA as an unclassified nickname for POPPY and GRAB.) POPPY was designated as 'Mission [redacted] in the Talent Keyhole security system established for broader release of locations from satellite systems. DNI Vernon Lowrance, who directed project GRAB, covertly managed the Program C sub-element. (Apart from the NRP, [redacted]
- Program D funded Air Force strategic aerial reconnaissance over denied areas and was covertly managed by SAC. SAC also processed data from the ELINT satellites.
- Funded covertly by Program A for NRO support, SAMSO procured boosters and launched satellites for Programs A, B, and C and operated the orbiting collectors for Programs A and B by means of several Air Force remote tracking stations, collectively called the Air Force Satellite Control Facility (AFSCF) and linked by communication with Lockheed's Satellite Test Center in Sunnyvale, California. .(Actual launch operations at the Atlantic Missile Range would continue to be conducted by civilian launch crews under the direction of the USAF Space Systems Division's 6555th Aerospace Test Wing at the Cape Canaveral Air Force Station; Pacific Missile Range, the 6595th Aerospace Test Wing at Vandenberg AFB.) For unclassified launch coordination correspondence, POPPY was designated as Program [redacted]

~~(S/B)~~ ACNO (I)/DNI Vernon Lowrance, a Pacific combat veteran with 32 years of naval service, mainly in submarines, informally assumed his directorship of Program Charlie. His first task was to realign the Navy ELINT satellite project as an element of the covert DoD operating agency, the NRO. Mac Showers had orders to

report to CincPacFlt as assistant chief of staff for intelligence in August, so the realignment was conducted by his relief as Op-922Y, Capt Frank M. Murphy, and his deputy, Capt Edward E. Kerr. On 10 September 1962, DNI Lowrance informed DNRO Charyk by letter of agreed-to roles and responsibilities for the POPPY project. As a program director's staff, the DNI used a multi-agency technical operations group (TOG), which acted for the DNI through the DNI's POPPY project director, double-hatted as head of Op-922Y (composite support branch). Comprised of specialists in intelligence requirements, satellite instrumentation, missile rocketry, orbital requirements, field station operations, and signal processing, the TOG was structured according to the roles of the participants:

- DNI provided a project director from ONI (Frank Murphy and alternate Edward Kerr) and a product control representative from NavSTIC. STIC's representative [redacted] informed the DNI's project director of intelligence requirements that might affect design, sent quality control data to field stations, and monitored and supported NSA's analysis program.
- Chief, BuWeps provided the project fiscal representative (Sam Hubbard). BuWeps prepared and submitted the budget, disbursed project funds to NRL, and submitted expenditure statements to DNI.
- DirNSA provided an adviser to the TOG. NSA processed collected data and developed the ELINT product; disseminated product according to initial agreement of the DNI and DirNSA; translated national intelligence requirements into technical ELINT requirements; recommended operational tasking of the satellite; and provided magnetic tapes to the field sites on a continuing basis. (As chief of C-1, John Libbert was NSA's primary spokesman. TOG meetings were attended by Joe Struve, chief of C-14, and John Conlon, deputy chief of C-15.)
- DirNRL provided the project technical representative. The Lab developed overall instrumentation concepts and the satellite; developed, installed, and logistically supported ground equipment; trained site personnel for on-orbit interrogation and collection; controlled the satellite prior to launch; coordinated launch vehicle/satellite integration, prepared the satellite for launch, and monitored launch. (Howard Lorenzen was and would continue to be, for another decade, the POPPY technical director and central figure. Reid Mayo was the project engineer and alternate TOG member.)
- DirNSG provided the project operational representative (Cdr Frank Sperberg, who had previously led the NSG detachment at [redacted] NavSecGru directed and coordinated field station operations, including issuance of project plans, operational directives, and tasking requirements; acted as the DNI's focal point for all project electrical communications; interrogated the payload at NSGA [redacted]

- [redacted]
- The Army Security Agency collected data at Army Security Station [redacted] and provided an individual authorized to act for the ASA in coordination with the project director. The ASA was headquartered in Arlington, Virginia. (Civilians [redacted] and [redacted] represented ASA.)
- The Air Force Security Service collected data at the USAF Security Service Station [redacted] and the USAF Security Service Station [redacted] and provided an individual authorized to act for the AFSS in coordination with the project director. The AFSS was headquartered at Kelly AFB. (Except for occasional TOG meetings held at AFSS headquarters, uniformed representatives flew from San Antonio to D.C. for the monthly TOG meetings.)

National Tasking

(U) When the DNI first formally delineated the Program Charlie infrastructure, in order to inform the DNRO, regular tasking of GRAB 2 had ceased [redacted] and the next launch was several months away. The TOG and its ELINT resources were unable to contribute to U.S. efforts in a pending direct confrontation with the U.S.S.R. in the North Atlantic, which immediately overshadowed the defensive ABM threat. In the summer and early fall of 1962, the U.S. intelligence community was gathering information on a military buildup in Cuba, by means of human intelligence derived from interviews of Cuban refugees, ONI's analysis of shipping traffic, CIA U-2 photo reconnaissance, and COMINT from NSG's spy ships.

(U) The National Photographic Interpretation Center's analysis of film from a SAC-piloted U-2 mission on 14 October provided the first clear indication that offensive missile sites were being constructed in Cuba. Follow-on U-2 overflights (one of which was downed by a SAM) and targeted, low-altitude penetrations by Navy, Marine Corps, and Air Force planes, provided photographic evidence that the Soviets were rapidly establishing a significant military presence in Cuba, including medium and intermediate range surface-to-surface missiles, Ilyushin-28 bombers, MIG-21 fighters, SA-2 Guideline batteries, missile guidance and target tracking radars, Komar guided missile patrol boats, and military personnel. Navy VP squadrons, ships, and SIGINT stations detected more than a dozen potential Communist-bloc arms carriers in the North Atlantic bound for the Caribbean Sea.

(U) To eliminate the threat of attack by Soviet missiles with nuclear warheads launched from Cuba, President Kennedy, acting through the SecDef and JCS, relied firstly on America's overwhelming superiority in sea power. The Second Fleet quarantined Cuba, interdicted and inspected ships with cargos destined for its ports, hounded Russian attack submarines in the North Atlantic, patrolled Cuban shores with carrier-based planes, and was ready to launch a Marine Corps amphibious assault on the island. Suspected arms carriers turned back from the apparent naval blockade, but the Soviet Union and Cuba continued the confrontation in diplomatic channels and public forums. Contingency plans were implemented. Army airborne, infantry, and armored divisions moved to staging areas in the southeastern United States. Air Force tactical wings patrolled offshore and stood ready to strike targets in Cuba and support the Army divisions. Strategic retaliatory forces, including Navy Polaris submarines, Army Jupiter IRBMs, Air Force Thor IRBMs, and SAC's bombers and Atlas ICBM squadron, were targeted for nuclear attack on Soviet cities and military installations. The sudden storm abated after Premier Khrushchev publicly agreed on 28 October to withdraw the disputed weapons in exchange for President Kennedy's lifting of the naval blockade and assurance that the U.S. would not invade Cuba.

~~(S/B)~~ [redacted] cleared its own decks for future action. An NRO mission operations directive for Mission [redacted] informed the DNI that an NRO operations center had been formed and would be the "focal point for centralized control for all approved operations of Mission [redacted]" (6 Nov 62).

A Pair

~~(S/B)~~ In NRL's countermeasures branch, Reid Mayo and Vince Rose had spent the summer developing and testing payloads, designed against [redacted] radars. The band that produced ABM [redacted]

(U) The payload doubled the hardware configuration of GRAB 2. Neither satellite would carry a scientific experiment, but the payload electronics and antennas still needed more space than a 20-inch sphere could provide. Within the satellite techniques branch, across the mall in Building [redacted] Jack Ratcliffe's structures design section stretched the sphere 3.5 inches by placing an aluminum band between two hemispheres. A completely assembled satellite weighed 55 pounds.

(U) Charlie Price managed procurement from Craig Systems and fitting out of a second receiving hut for each site overseas and two interrogation huts. Since Consolidated Electrodynamics had ceased production of the Datatape GR-2500

recorder, Don Christman procured the follow-on GR-2800 instrumentation recorder, which was completely transistorized and employed FM amplification for improved signal-to-noise ratio. To simplify maintenance and logistics support, some of the previously deployed GR-2500s would be moved, leaving only one of the two types installed in both primary and secondary huts at each site. The new 6.7 x 11.5-foot huts were shipped in October and November, and installations were accomplished by three two-man teams covering two or three sites each. Electronic warfare conferences and liaison took Howard Lorenzen to London, Paris, and Frankfurt during the same time-frame, so he worked into his schedule visits to [redacted] sites. Between Lorenzen and Price, who led the [redacted] region, all field participants had the opportunity to discuss the expanded project, new program structure, and new security control system. NavSTIC's Robbie Robertson accompanied Lorenzen to the [redacted] European sites.

~~(S/B)~~ The DNI was responsible to the DCI for managing the Navy allocation of Byeman and Talent Keyhole billets. During the fall of 1962, each naval command with a role in the POPPY project corresponded with Op-922Y to get approval of Byeman billets by function and clearances for incumbents. Since marriage to a foreign national precluded Byeman access, some of the GRAB veterans were lost to POPPY and returned to conventional ELINT. Those approved were read into the Byeman [redacted] compartment. Byeman control officers were collaterally assigned by each command. NRL's Byeman control center, a windowless vault, was established in Building 43, the administration building, at the other end of the mall from Lorenzen's building and overlooking the Potomac River. Cdr John T. Geary, an engineering duty officer, was NRL's first BCO (12 Dec 62). [A decade later, during initial development of the [redacted] system, Capt Geary would be NRL's military director.]

~~(S/B)~~ Marty Votaw coordinated West Coast launch schedules for Program [redacted] with a launch control officer at Vandenberg AFB, an Air Force major, and worked the POPPY/Agena interface directly with Lockheed Missiles and Space Company. He also established a permanent NRL facility, Building 660, at Point Arguello for a cost of [redacted] The pair of POPPY satellites, Mission [redacted] was included in a Thor Agena launch from Point Arguello on 13 December 1962. [redacted]

NRL's engineering evaluation discovered some occurrences of [redacted], so these would not be tasked at the same time.

~~(S/B)~~ After coordinating with DirNSA Blake, DNI Lowrance responded to DNRO Charyk by letter that the TOG would "meet with the Deputy Director for Operations NRO, as required, to prepare routine tasking schedules" (21 Jan 63) and

would conduct operations to fulfill mission requirements from the NRO's satellite operations center (SOC). The DNI's letter also summarized his formal agreement with the previous DirNSA (Laurence Frost), whereby NSA A-41 could redirect NSG-scheduled POPPY interrogation and collection tasks when quick reaction was required, in response to [redacted] space or missile activity. This five-page letter, which reiterated and superceded the September description of roles and responsibilities, was essentially the POPPY charter until a new one was drawn up eight years later. The POPPY operations coordinator, Cdr Frank Sperberg, was reassigned from NSG to the NRO SOC in the Pentagon, where the first order of business was to form an organization. Before long, the SOC outgrew its space in room 4C1000 and relocated to [redacted].

(U) NSG headquarters continued as the tasking interface to the sites, project communications center, and formulator of standard operating procedures. These functions were performed by a special operations branch (G524), consisting of two officers, LCdr Robert A. Horan and Lt Andrew N. Michael, and three enlisted men, who worked in a vault. Standard operating procedures for the two-hut configuration had been issued to host stations (1962). NSG's collection tasking messages to individual sites and their reports of results were flagged [redacted]

~~(S/B)~~ With significant improvement in design reliability and redundancy, Mission [redacted] was tasked operationally for [redacted] months. Both primary and secondary receiving huts were equipped with four R-390A receivers, for reception of the tracking signal, [redacted] ELINT data links [redacted], and a time broadcast. A 30-foot whip antenna for receiving radio time signals was erected between the huts. [redacted] used Moscow's time broadcast to set their Astrodata time code generators. Collection operators patched one ELINT receiver to each of two earphones. Both huts were equipped with the latest five-inch cathode-ray oscilloscope (Tektronix Type RM-561) to aid RF tuning. Spaced 100 to 150 feet apart, the two huts were linked by intercom. The new configuration was documented by NRL in a second addendum to the instruction book (Feb 63). Collection operators noted [redacted] during announced periods of Soviet [redacted]

~~(S/B)~~ Portions of the [redacted] and [redacted] This [redacted] and NSA's initial checkout [redacted] The drivers were Bassford Getchell and [redacted] from C-1's technical planning staff, Joe Struve and [redacted] from special projects (C-14). The Bogart and IBM 704 computers had been eliminated from the processing configuration. Although some controversy remained over amplitude threshold settings for Audico, Struve and [redacted] were satisfied with improved Audico resolution and output, which now went directly to an IBM 7094 computer system. Bob Misner encouraged the Audico developers and phased out NRL's interim process for digitizing [redacted] data. Over time, NSA

[redacted]

(S/B) NSA disclosed that average [redacted]

some of these location estimates. Both satellites were still healthy when retired because of the elliptical orbit and availability of more capable successors. No ABM signals were found by Mission [redacted], but some of the [redacted] exhibited [redacted]

Field Sites

~~(S/B)~~ POPPY's geographic coverage greatly favored western to central U.S.S.R, compared to [redacted] because of placement of the interrogation capability at [redacted] which permitted collection on about [redacted] of the daily orbits. There was growing interest in [redacted] The U.S. [redacted] the TOG got authorization from DirNSG Thomas Kurtz and ACNO (Comm) Bernard Roeder to deploy interrogation huts to [redacted] in preparation for the next launch. Ed Withrow undertook this task with support from Charlie Price and branch technicians. [redacted] The POPPY huts were sited a couple miles from the communication station, adjacent to a small NSG operations building for an [redacted] version that NRL had first installed experimentally at Hybla Valley in 1958.) The fenced site, nicknamed [redacted] was the first to have both interrogation and collection capabilities. When NSG phased out the [redacted] a few years later, POPPY inherited the wooden building.

~~(S/B)~~ Even though POPPY was not operational during the Cuban missile crisis, the TOG participants perceived that product latency was the chief defect in the concept of operations. [redacted] between data collection and NSA's issuance of reports, due to collection at remote sites, Byeman handling requirements, analog tape shipment to Fort Meade via bi-weekly courier runs, and the tremendous amount of work performed by NSA for tape handling, analog/digital conversion, location processing, output evaluation and correlation, and hard copy issuance of results. NSA also manually analyzed signals of interest on analog tapes, which was [redacted]

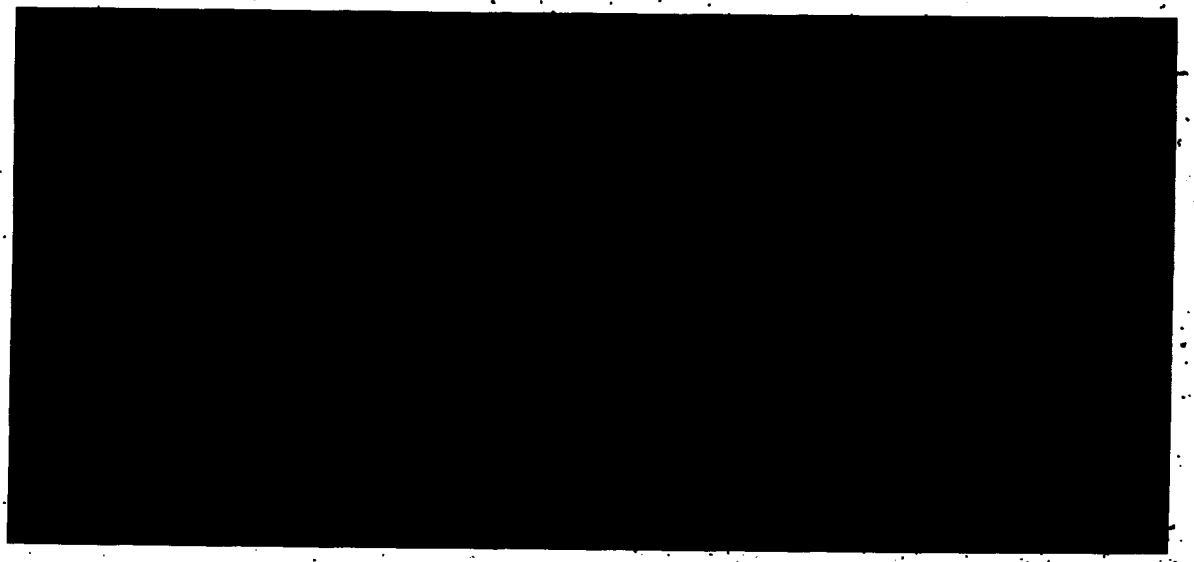
~~(S/B)~~ The latency problem was addressed, starting in April 1963, when NSG alerted site collection operators to detect, log, and report electrically those signals having PRFs [redacted] or any other characteristics which may be considered unusual. NSA provided sites with ELINT training tapes, working aids, and electrical feedback on signals reported. NRL committed to provide additional equipment for sites to analyze recorded data and measure signal characteristics. As the quality gradually improved, NSA would be able to prioritize its own analysis and processing according to Byeman [redacted] reports from the sites. These coordinated actions were planned and implemented through the multi-agency TOG.

A Triplet

(U) The satellite techniques branch had implemented a new, larger satellite design on [redacted] satellites shipped to the West Coast for launch in June. Two 24-inch hemispheres were separated by a 3.5 inch band. Charging power in sunlight was doubled to a range of five to nine watts, depending on solar aspect, by using smaller solar cells and increasing the total area by 50%. Consumption during mission operations averaged [redacted] Weighing 85 pounds, each also carried a scientific experiment: SolRad 6 on one, a radiation counter called 'Dosimeter' on the other. The third satellite was a 20-inch stretched sphere at 60 pounds.

~~(S/B)~~ On 15 June 1963, the first triplet of POPPY satellites, Mission [redacted] was launched, along with several unrelated satellites, into a 95 x 495-mile orbit and lived for about six weeks — as the orbit rapidly decayed into the atmosphere. The Agena D had failed to ignite on its second, circularizing burn. Covering portions of the [redacted] this mission did yield one significant piece of intelligence: [redacted] intercepts enabled NSA's correlation of a [redacted] The radar was suspected to have [redacted]

~~(S/B)~~ [redacted]



(U) Joseph Charyk had resigned as SAFUS/SAFMS in March 1963 to head Comsat, a corporation formed to develop commercial communication satellites. Comsat recruited Marty Votaw for an executive position. Just before departing the NRL for greenet pastures, Votaw vented his spleen, in writing, regarding "the extremely poor performance record on [Agena] vehicles 2351 and 2353," requested a change in vehicle trajectory "to provide a perigee of 125 nautical miles even if the restart fails again," and reiterated required launch parameters for individual satellites scheduled for Agena 2354. Signed by DirNRL Capt Bradley F. Bennett on 16 August, Votaw's letter was sent to Capt Edward Kerr, head of ONI's composite support branch. ONI was now directed by an intelligence specialist, RAdm (select) Rufus L. Taylor. (His predecessor, Vernon Lowrance, had returned to the silent service at the beginning of July as deputy commander and future commander of submarine force Atlantic Fleet.)

~~(S/B)~~ As the TOG planned for the next mission, DNI Rufus Taylor and ONI's POPPY project director, Edward Kerr, complained to their associates in the NRO that Program C funds were being wasted by malfunction of two Lockheed Agenas in a row. Brockway McMillan had relieved Charyk as SAFUS and DNRO. BGen John L. Martin, Jr. directed the NRO staff. Relative to other NRP satellites of that era, the [redacted] lifetime of POPPY 2 seemed like a ripe old age. As of the death of [redacted], the average useful lifetime of [redacted] SIGINT missions — all battery-powered — that were successfully launched in 1963, was [redacted] But the point was well taken. Longer lifetimes were being built into future SIGINT satellites. [The first Mission [redacted] satellite — [redacted]

(U) Ed Dix succeeded Marty Votaw in August 1963 as NRL's chief builder of satellites and point of contact for Program [redacted] launch coordination with Lockheed and Vandenberg AFB. To support the countermeasures branch and other

customers, the satellite techniques branch had 15 professionals and 25 technicians, distributed in six sections. Section heads (grades GS-13 or lower) were Pete Wilhelm (systems design), Robert S. Rovinski (structures design), James G. Winkler (telemetry systems), Patrick H. Cudmore (RF systems), Albert P. Canal (power sources), and Ralph M. Gran (ground instrumentation). Of 18 small satellites built to date, ten had carried ECM payloads and were funded by the countermeasures branch. A former Air Force lieutenant colonel had privately informed Howard Lorenzen that the SAFSS valued NRL, more than anything else, for its cost basis. Program C's relatively small budget was often cited to gain negotiating leverage against defense aerospace contractors.

Transmission Security

~~(S/B)~~ On a Monday morning the last week of August 1963, Howard Lorenzen, Reid Mayo, and Bruce Wald drove to NSA for a two-hour "general discussion concerning problems related to Future encryption of data from Satellites in the [redacted] [POPPY] program, possibly beginning with [redacted] (26 Aug 63). The meeting was conducted by [redacted] from the encipherment area of NSA's office of R&D (R-13). In attendance were one other encryption expert from R-13 and three members of C-13 (COMINT division and signal conversion branch). The NRL team [redacted] After a long discussion of synchronization problems, Bruce Wald posed the question, "Whether or not it would be feasible, if [redacted] declined to go along with that approach. This meant that the [redacted] as well and that [redacted] Bruce Wald agreed to analyze impact on electrical power and [redacted]

~~(S/B)~~ The countermeasures branch had three members dedicated to POPPY: Reid Mayo was both project engineer and ground collection engineer; Vince Rose, payload; Ed Withrow, payload interrogation. They were supported by branch engineers, scientists, and technicians who had their own projects, by the branch engineering staff under Charlie Price, and by NRL's engineering services division. With POPPY 3 under test, POPPY 4's RF bands then being negotiated, field analysis positions to be developed, and [redacted] needing serious consideration, the workload promised to grow. Up against the limits of overtime for his branch and unable to acquire more civil service engineers within authorized ceiling points,

Howard Lorenzen recognized the need for on-site contractor support. He discussed the situation with Fred Welden, who had retired from naval service, joined the civil service, and was now employed as a senior advisor on naval intelligence in the countermeasures branch. The budget was adequate and some space could be found for a few people, but they would need approval and guidance from the NRO to get a contractor cleared for Byeman [redacted]

(S/B) Fred Welden requested DNI Rufus Taylor's permission and support for including a contractor on the NRL team. The two of them secured DNRO Brockway McMillan's permission for NRL to acquire Byeman engineering support services and the promise of his support for additional ceiling points (for government civilian personnel) in Reid Mayo's area. Welden brought word back to Lorenzen that the DNRO had offered the advice not to use the same contractor for both space and ground segments and that the DNI had made this a rule. Welden now undertook the task to find a suitable contractor.

(U) Retiring RAdm Thomas Kurtz had been relieved on 23 August by Capt Ralph E. Cook, an electrical engineer and cryptologist, who would remain at the helm of NavSecGru for eight years. Ralph Cook had recently concentrated on communication security: two years as head of the crypto engineering branch at NSG headquarters and, after being promoted to captain, nearly three years as head of the COMSEC operations department.

~~(S/B)~~ When DirNSG Cook [redacted] and Hybla Valley, he tasked NSG's crypto engineering branch to prepare a letter to the DNI aimed at defining Program C's requirements for a [redacted] At a TOG meeting on 7 November 1963, much of the discussion was devoted to the [redacted] stimulated by Capt Cook's direct interest. His representatives asked whether Program C required [redacted] NRO's Frank Sperberg sided with NRL on the [redacted] due to his field experience [redacted] where standard ELINT positions had failed to find the [redacted] NRL's position was that Mission [redacted] NSG responded that LCdr Ashbacher would be tasked to [redacted] of other missions at various altitudes. After acknowledging that the system [redacted] Reid Mayo attempted to end the discussion by suggesting that full disclosure of the POPPY capability would answer the Russians for their overflights of our aircraft carriers and operation of spy trawlers off our shores. (He did not mention that he had asked for [redacted] work in a 1 October supplemental funding request to the NRO.) NSG pressed for specifications for a [redacted] Thinking it unlikely that NSA would create a [redacted] Mayo indicated he could, if tasked, undertake a technical

study of [redacted] of the POPPY system and feasibility of improving the security.

~~(S/B)~~ Rather than wait for a formal request from NSG, Mayo began a DirNRL letter to DirNSG that included Bruce Wald's analysis of four years ago. After working most of the day, recognizing that his typewritten draft was too defensive regarding the [redacted] issue and that he was not clear enough about the topic to give the letter a subject line, he went to the boss for guidance and was relieved of the chore. Howard Lorenzen took up his ball-point pen and wrote six pages on a yellow legal pad, mostly a review of relevant events for the past five years, including [redacted] He enclosed a new chart from Bruce Wald that depicted probability of [redacted] and ended with:

> From the inception of this project NRL engineers have faced the reality that with the increased number of satellites in orbit and realizing that ELINT capabilities throughout the world are improving slowly but steadily, [redacted] would be required. Since NSA is recognized as the authority in this field a review of the present state of the art was requested by NRL. Mr. [redacted] of the [redacted] area of NSA led the discussion and furnished the following summary of engineering state of the art.

The draft ended there, pending receipt of a task from NSG, which never came. The matter was put aside as NRL's engineers and technicians took station for another launch.

Another Triplet

(U) NRL participants noted shorter haircuts and much greater attention to detail by the Douglas (Thrust Augmented Thor) and Lockheed (Agena D) teams at Point Arguello during the next attempt, which succeeded on 11 January 1964. One of the satellites carried SolRad 7A plus its classified payload.

~~(S/B)~~ Another POPPY triplet, Mission [redacted] was injected into the nominal orbit, nearly circular at 500 miles. In collaboration with payload technician Vince Rose, Robert E. Eisenhauer from the systems section had designed an experiment that distinguished the two different [redacted] and another that detected [redacted] As a first step toward attaining constant aspect of ELINT antennas to earth, [redacted] and the payload remained useful for [redacted] years.

(U) The gravity-gradient stabilization experiment (GGSE) was managed by mechanical engineer Robert T. Beal, who worked in the satellite structures design section. The stabilizing mechanism was developed by General Electric and consisted [redacted]

[redacted]

~~(S/B)~~ POPPY 4 payload definitions were still in flux, even though satellites were already being assembled in Building [redacted] A target launch date of November 1964 had been based on a set of four satellites [redacted] that ITT's Paul Mast had proposed to Vince Rose in July 1963. [redacted] (Commercial transistors for RF amplification were available in 1964, [redacted] Since then, Reid Mayo had been informally negotiating the RF band plan with NRO's [redacted] In response to the need for greater [redacted] Mayo had provided in August a two-page description of primary and alternate sets of [redacted] collection bands for each of two 24-inch diameter satellites, still within scope for schedule and budget. The [redacted] naturally suggested to NSA the desirability of [redacted] as well. After Mayo and Vince Rose worked the possibilities and redesign with the satellite techniques branch, Mayo submitted an informal commitment on Christmas eve that all four satellites would be 24-inch stretched spheres, [redacted] It was clear, by late March, that the [redacted] POPPY 4 would not be ready to ship until February 1965.

~~(S/B)~~ The formal announcement of a slip was not greeted as warmly as the informal increases in scope. When ONI's Edward Kerr questioned NRL on what could be done to meet the original target date, Howard Lorenzen responded with a memorandum that offered three satellites and fewer collection bands all around. The slip stood. Refinements in band widths, allocations to individual satellites, and assignments of primary or alternate status continued throughout the year, driven by new information on target signals, characteristics of delivered components, and Vince Rose's art of antenna selection and placement on the stretched spheres.

~~(S/B)~~ The thrust-augmented Thor Agena D launch of the POPPY 3 triplet had [redacted] Targeted for [redacted] collection at [redacted] and lasting [redacted] days [redacted] had been developed [redacted] by HRB-Singer. [redacted] HRB was located in State College, Pennsylvania, a five or six-hour drive from the NRL.

[redacted] and planning for the shared Ageria ride provided additional exposure to NRL and had led to discussion with Fred Welden, then to correspondence with Howard Lorenzen, on the possibility of an engineering support role in POPPY.

(U) After negotiations and paperwork were completed, the ONR contracting officer issued a fixed price contract to HRB for "technically qualified services ... to programs in the countermeasures field of research being directed by the Naval Research Laboratory" (1 Mar 64). For a total price of [redacted] NRL would receive on-site services of two engineers for one year and 30 days of support from a third, HRB-resident engineer. The price included expenses of relocation to Washington, D.C., and travel to field stations. In March, HRB sent technician James N. O'Connor, an Army veteran, followed two weeks later by research engineer Lee M. Hammarstrom, to work in Mayo's section at the Lab. Both helped design and develop three bays of analysis equipment and a tape recorder that would be assembled and tested at the NRL and then deployed to sites as they became established in permanent buildings over a period of several years. [The two men would enter the government civil service in the early 1970s and contribute to several generations of space-based systems.]

~~(S/B)~~ The NRO got a new charter as a DoD operating agency solely under the SecDef by DepSecDef Cyrus R. Vance's approval of revised DoD Directive TS5105.23 (27 Mar 64). DNRO Brockway McMillan would keep the DDR&E and the assistant secretary of defense (comptroller) personally informed on status of NRP-funded projects and establish requirements interfaces with the USIB, JCS, DIA, and NSA — which indicated intense military interest in the output of photo and SIGINT satellites. The realignment had no effect on POPPY. The POPPY TOG continued to be the forum for participating intelligence organizations — CIA, NSA, NRO, ONI, NSG, ASA, AFSS — to suggest and negotiate requirements that affected design and operations. DIA did not participate directly, but its chief of staff, RAdm Allan Reed, was periodically updated on new developments in the project he had steered through initial approval four years ago, by intelligence specialists Fred Welden from NRL and Rufus Taylor (DNI). Other Tattletale associates with connections to POPPY were ACNO (Comm) RAdm Bernard Roeder and ACNO (Dev) RAdm Noel Gayler.

~~(S/B)~~ [redacted]

~~(S/B)~~ Program C's request for [redacted] for digitization, to be split evenly between space and ground segments, had not been granted. Instead, a feasibility study was required:

MEMORANDUM FOR DIRECTOR, PROGRAM C

SUBJECT: Feasibility Study on [redacted] of POPPY [redacted]

Previous studies furnished by your office have indicated generally the [redacted] However, in view of my responsibility for the security of all (S) NRO programs and in the event that future operations call for additional [redacted] it is requested that Program C conduct a feasibility study directed toward possible [redacted]

The study should include the following group of options:

a. Use on present POPPY configuration.

b. [redacted]

c. [redacted]

d. [redacted]

Consideration for each of the options should include, but not be restricted to:

a. Minimum degradation of the data.

b. Minimum band-width and power requirements.

c. Cost estimates for development, procurement and operations.

It would be helpful if the study could be completed by 1 June 1964 so that, if needed, development of long lead-time items can be authorized.

Brockway McMillan
Director
~~(S)~~ National Reconnaissance Office

(24 Apr 1964)

~~(S/B)~~ DNI Taylor gave Howard Lorenzen a copy of the DNRO's request, which he sanitized and brought back to the NRL. Whereas Reid Mayo was in schedule difficulty and showed no enthusiasm [redacted] Bruce Wald viewed the prerequisite digitization as an opportunity to improve PRI measurement accuracy, [redacted] allow for field processing, and eliminate Audico at NSA. The problem dovetailed with his work on automating the [redacted] location system. Moreover, Wald saw some possibility of tying this effort to his ongoing doctoral studies in electrical engineering at the University of Maryland, so he volunteered to conduct the study.

~~(S/B)~~ Technical information and consultation on [redacted] equipment was provided by John Boyd of NSG headquarters and [redacted] of NSA. Wald completed a seven-page, single-spaced working draft within a month, following the outline suggested by DNRO McMillan. His investigation concluded that "No [redacted] equipment exists or is likely to exist prior to [redacted] that is satisfactory for

use in the present POPPY configuration from the standpoints of power consumption, [redacted] bandwidths required, and data degradation" (May 64). The most nearly suitable [redacted] was scheduled for completion in January 1965, but it had an enormous power drain of [redacted] and employed [redacted] which solved the [redacted] problem but entailed an unacceptable bit error rate for POPPY data rates. These problems could be cured by rebuilding the [redacted] with integrated electronics units to achieve a total power consumption of [redacted] which could be supported by the POPPY power supply of the future [redacted] average), and employing periodic automatic [redacted] envisioned for mid-1965 and beyond would be able to deliver [redacted] but its allocation for ELINT payload functions might also profit from a [redacted] Wald advocated a joint NRL/NSA six-month study followed by a 30-month development effort commencing July 1964, for which he included a schedule of milestones and cost ranges for components. NRL would be responsible for digitizing the data path, space to ground, and requisite upgrades in data transmission and collection, for a total cost of [redacted] for development and production. Wald guessed that the [redacted] modifications could commence in mid-1965, after experience with the original production units, at a development cost of [redacted] Cost of integration and electromagnetic compatibility would be estimated after satellite [redacted] designs were complete. NSA would be responsible for actually costing, scheduling, and implementing the [redacted] modifications.

(U) Bruce Wald's informal proposal circulated in the community, but the complete package was not approved and funded for implementation. The growth trend in solar array and battery storage technology would eventually accommodate power-hungry [redacted] Nevertheless, the discussion highlighted the advantages of digitization for its own sake, and Bruce Wald had identified several milestones that could be reached in small steps under approved budgets in the years to come.

Analysis and Processing

~~(S/B)~~ NSA C-14 and C-15 continued making good use of the [redacted] Mission [redacted] data. A series of [redacted] intercepts of [redacted] signals during [redacted] enabled John Conlon's analysts to [redacted]

~~(S/B)~~ POPPY 3's modest [redacted] provided the opportunity for further development of the [redacted] concept by [redacted] In May 1964, at its ground readout site in Hybla Valley, Virginia, NRL collected data for NSA from the [redacted] NSA C-14 initially focused on [redacted] data from [redacted] as compared to coordinates derived from photo reconnaissance. [redacted] coverage aided locations

of the [redacted]
control [redacted]

~~(S/B)~~ In the winter of 1964-65, POPPY 3 produced intercepts from [redacted]. A low [redacted] was detected on [redacted] and eventually correlated by NSA with [redacted]. The second generation [redacted] was intercepted on 5 February 1965. The same signal was collected later that month by [redacted], specifically designed for [redacted].

Chapter 7 References

7 Jul 62	DNI (flimsy, classification not marked) letter to DNRO Subj: Orbital Requirements for POPPY Satellite
20 Jul 62	DNI (flimsy, classification not marked) letter to DNSG Subj: Project POPPY; increased requirements for
6 Nov 62	DNRO (TS/B) memorandum for DirPrgmA, DirPrgmC, DirNSA, DirNSG, DirNRL, copies to HQ COMOR, DirDIA, BYE 4337-62 Atch: Mission Operations Directive Mission [redacted]
12 Dec 62	DirNRL (S/LIMDIS) letter to CNO Op-922Y3, 5430-147:HOL:rbm, Ser 001043 Subj: Special Control Officers, designation of
1962	NSG (Op-94G/G54) (S/B - codeword) Standard Operating Procedures for System POPPY Data Collection, BYE-3997-62, revised July 1965
21 Jan 63	DNI (TS/B - codeword) letter to DNRO, copies to DirNSA, DirNSG, DirNRL, OIC NavSTIC, BYE-10613-63, Op-922YB/Mlk Subj: System POPPY; reassignment of responsibilities for (TS) Ref: NRO directive Mission Operations Directive [redacted], BYE-4337-62, dtd 6 Nov 62 Ref: DNRO memorandum subj: "Organization and Functions of NRO (S)", dtd 23 Jul 62 Ref: DNI letter subj: "Project POPPY; assignment of responsibilities for (TS)," dtd 10 Sep 62
Feb 63	NRL (C) Instruction Book No. 25 Addendum 2 Subj: Description of Radio Receiving Facilities Hut Modernization No. 2
26 Aug 63	R. J. Schron (TS/B - codeword) Memorandum for the Record Subj: [redacted]
1 Mar 63	ONR (U) Contract No. Nonr-4447(00)(X) issued to HRB-Singer, Inc., Science Park, P.O. Box 60, State College, Pennsylvania Subj: Contract for research in the field of countermeasures
27 Mar 64	SecDef DoD Directive TS 5105.23, TS 047-64 Subj: (S) National Reconnaissance Office
24 Apr 64	DNRO (S) memorandum for DirPrgmC, BYE 22795-64 Subj: Feasibility Study on [redacted] of POPPY [redacted]
May 64	Bruce Wald (TS) Technical Memorandum (working draft) Subj: [redacted]

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Chapter 8. OTHER PROGRAMS

(U) *Recognition by the foreign intelligence community that satellites were an effective means of technical collection was followed by a community quest for cost-effective systems. Programs and technologies began competing. Competition fostered ideas for improved capabilities and increased technical oversight to evaluate them.*

Cost-Effectiveness

~~(S/B)~~ An effort to evaluate NRP systems against other technical means began in January 1965. CIA's [redacted] chaired a SIGINT working group to develop a yardstick applicable to electronics, communications, and telemetry signal collectors. Among the participants were Howard Lorenzen from NRL, Gene Fubini from DDR&E, [redacted] from the NRO staff, and [redacted] who had left NavSTIC [redacted] ago to take a senior position on the staff of the Army ACSI. (BGen Charles J. Denholme USA expected his senior scientific adviser to lead the way to Army's exploitation of overhead ELINT capabilities.) As an input to the working group, Howard Lorenzen prepared a page-long summary of advantages of satellite collection for the national ELINT program — stated in general, qualitative terms and without mention of specific systems. Discussions and papers provided NRL with its first comprehensive exposure to other overhead collection concepts and the infrastructure of the NRO, including the SAFSS and SAFSP. NRP-funded electronic signals collectors provided ELINT, COMINT copy, [redacted] but most of them had ELINT search, technical intelligence, or radar-order-of-battle production missions. From overhead ELINT collection, NSA processed [redacted] weekly, [redacted] of them from POPPY, and issued reports [redacted] with significant intelligence value [redacted] from time of intercept to publication. [redacted] perspective came to reflect the predominance of ELINT.

~~(S/B)~~ The overhead ELINT systems complemented one another operationally. [redacted]

[redacted] The system provided initial detection and determined [redacted] or rough location. The chief criticism was that it did not presently provide adequate accuracy of fixes and must await evaluation of the [redacted] into POPPY 4. The new [redacted] baseline was two [redacted] a launch every other year, which made POPPY the most expensive system on a per-launch basis, about average on a per-satellite basis.

~~(S/B)~~ The Samos project had terminated a couple years ago, but its ELINT collection technology had migrated to Missions [redacted] Probability of detection for these [redacted] collectors was [redacted] but mission planning was critical in terms of geographic access and RF coverage capabilities. Often based on [redacted] for payload design or tasking or for searching previously recorded data, [redacted] employed individually distinct [redacted] One of the positive results of POPPY participation in the working group was that the TOG was sensitized to Air Force appreciation of [redacted] This perception would be reflected in ongoing design work for POPPY 5.

~~(S/B)~~ [redacted]

~~(S/B)~~ [redacted]

[redacted]

~~(S/B)~~ At the beginning of spring, [redacted] group briefly celebrated the newest addition to the family of operational collectors when the [redacted]

(U) Four scientific satellites shared the ride on 9 March 1965, resulting in another world record for number of satellites, eight, launched on a single booster. Each of the four classified satellites was a stretched sphere, formed of two 24-inch hemispheres and a 6.5-inch equatorial band, and weighed over 100 pounds. Pete Wilhelm designed a commandable micropound thruster, which could change the momentum of a completely stabilized satellite, but Bob Beal's [redacted] did not work as planned — the satellite flew with an [redacted] to [redacted] Station-keeping maneuvers could not be executed, [redacted] The previously successful [redacted] system was used again on one of the satellites. Another carried SolRad 7B.

~~(S/B)~~ NRL submitted to ONI ten copies of a technical description for Mission [redacted] (17 Mar 65). All huts were now equipped with GR-2800 recorders, and the seven surplus GR-2500 recorders were being reconditioned at the NRL for use in quality control (analog analysis) positions. By [redacted] operations at [redacted] and [redacted] would be conducted in permanent buildings. At [redacted] the POPPY project got the use of a wooden [redacted] building when the successor [redacted] installation was completed. At [redacted] one quarter of the administration building (formerly a [redacted] made of concrete block and mortar with a gray stucco finish) was made available. New collection antennas on towers were trained in azimuth by a motor drive system remotely controlled by collection operators inside the buildings.

~~(S/B)~~ To power bigger payloads with [redacted] and achieve longer useful operational lifetimes, Pete Wilhelm was redesigning the solar array structure for the [redacted] series to support a peak load of [redacted] watts. Wilhelm governed the electrical power budget himself and would oversee on-orbit power management. Reid Mayo and Vince Rose were designing payloads for POPPY 5 with the objective of increasing [redacted] They were working with satellite engineers on designs for several new payload experiments, including [redacted] and [redacted] for these experiments would be effected by using [redacted] to represent ones in a [redacted] By memorandum to Raymond Potts, who had succeeded John Libbert, Mayo invited NSA to specify [redacted] NSA responded by message with [redacted] ending with [redacted] and above) and thanked "NRL for the chance to participate in the early design of [redacted]

~~(S/B)~~ [redacted] group concluded that satellites were superior, in many ways, to conventional means of collection and (with mild criticisms noted above) endorsed all approved programs. The final results of the detailed cost-effectiveness methodology succeeded in focusing community attention on space-based ELINT, but, apparently, the results were not acceptable to the DCI. Retired VAdm William Raborn, renowned for applying systems analysis techniques to manage the successful Polaris missile program and Navy development, had succeeded John McCone as DCI at the end of April 1965. The USIB committee on overhead reconnaissance (COMOR) established a task force to more rigorously evaluate and compare overhead collectors. The objective was to assist the DCI/USIB in planning a balanced program for the next five years. DNI Rufus Taylor, who controlled Navy representation to the USIB structure (now through the deputy director of DIA), suggested that Lorenzen be appointed as the Navy member of the cost-effectiveness task force (CETF). The DirNRL, Capt Thomas B. Owen, concurred. Army ACSI Charles Denholme appointed scientific adviser [redacted] The task force would meet, off and on, for over a year.

~~(S/B)~~ The NRO's senior management structure was expanded to readmit the CIA when DCI Raborn reached agreement with DepSecDef Cyrus Vance on a joint organization and sharing of responsibilities (13 Aug 65). The NRP would be responsive solely to intelligence requirements of the USIB, which was chaired by the DCI. NRO would have the status of a separate agency of the DoD, be staffed by DoD and CIA personnel, and would implement the NRP for the SecDef. The SecDef would choose the director; the DepSecDef would concur in the DCI's choice of a deputy; and the SecDef would review the NRP budget as the final approval authority within the executive branch. An NRP executive committee (ExCom) — consisting of the DepSecDef, DCI, and special assistant to the president for science and technology (S&T) — would guide and participate in the formulation of the NRP through the DNRO. The DNRO would sit with the ExCom (but not vote) and sit with the USIB on NRP matters. (The USIB was now composed of DDCI, DirNSA,

DepDirDIA, State's director of intelligence and research, assistant to director FBI, and Atomic Energy Commission's director of intelligence.)

~~(S/B)~~ SecDef McNamara appointed Alexander H. Flax, the Air Force assistant secretary for R&D, as NRO director two months after the Vance/Raborn agreement. DCI Raborn chose James Q. Reber, former chairman of COMOR, as the NRO's deputy director. These checks and balances worked for more than a decade, and NRO finally had a charter that protected the interests of the parties. [The policy changes were at too high a level to affect the POPPY project directly, but USIB's committee structure would constrain ocean surveillance efforts in 1969-70 and ExCom's oversight role would affect and delay decision making on the [redacted] baseline during the Nixon and Ford administrations in the 1970s.]

Collection Upgrades

~~(S/B)~~ Based on lessons learned during engineering evaluation and ground receive path calibration for the [redacted] (POPPY 4), several upgrades to collection equipment were underway at the NRL, all of them aimed at improving data quality for NSA's [redacted] processing. Charlie Price's unit undertook replacement of ground antennas that tracked in azimuth only with Scientific-Atlanta antenna arrays that tracked in azimuth and elevation. Starting with [redacted] next year, all sites would be upgraded before next launch. Ed Withrow's new interrogation antennas and five racks of equipment would be installed at [redacted] and the [redacted] operation would be phased out in the spring of 1966. Mack J. Sheets of NRL designed adaptive, [redacted] Sheets had previously been the design consultant on the GRAB receiver/recorder interface. Jim O'Connor developed an automatic polarization selection feature. HRB's Mark J. Van de Walle and Paul A. Oesterling incorporated both of these innovations in a second-generation receiver developed at the NRL. With the new solid-state receiver and GR-2800 tape recorder, standard deviation of [redacted] measurement on test data was reduced from [redacted] to [redacted]

~~(S/B)~~ Howard Lorenzen, Reid Mayo, and Bruce Wald spent the Tuesday afternoon of 18 October in room 219 at the NSA with two key men. Joe Struve managed processing of overhead ELINT data. [redacted] on loan to NSA from the [redacted] was the chief architect of NSA's [redacted] and [redacted] signal [redacted] processing. NRL wanted to improve the quality of POPPY output for both of Struve's customers: electronic orders of battle (EOBs) and technical intelligence. Using a chalkboard, Wald drew and explained his architecture for digitizing POPPY data in the field and how NSA would incorporate the field-digitized tapes in its internal processes, which he identified and added to the flow chart. The concept would capitalize on the better [redacted] of solid state receivers with [redacted]. (Lead analyst John Conlon had urged field digitization four years ago, but the enabling technology was not then available.)

Both digital and analog tapes would be couriered to NSA. Analog tapes would continue going through the Audico process for parallel processing, until Joe Struve was satisfied that the field digitizer was as good or better than Audico. The group converged in principal on technical advantages but recognized a problem in the need for a field computer for quality control. As a matter of policy, SIGINT stations were not equipped with computer systems, due to their expense and difficulties of logistics support and maintenance. DirNSG Ralph Cook had already concurred with NRL's endeavor to get a small computer for one or more NSG sites, but the funding problem remained to be solved.

(U) The countermeasures branch had acquired a new talent in August 1964 when Fredrick V. Hellrich joined NRL, fresh out of Penn State's graduate program in electronic engineering with a specialty in ionosphere research. His resume had been selected from a large pile by Reid Mayo as best fitting the unit's need for a digital systems engineer. Awaiting clearance for the compartmented project, Fred Hellrich had performed design work in several less sensitive areas, including a filter to multiplex timing signals to three channels of the data recorders. In November 1965, Hellrich made his first trip to an overseas field site, as a member of a receiver installation team led by Mayo.

~~(S/B)~~ Engineering models of the new receiver design were field-tested at the site in [redacted] After the installation was completed and tested, team member Lee Hammarstrom took advantage of the better data and some capabilities in [redacted] new analog analysis position to conduct an experiment of his own design. He wanted to demonstrate the potential to reduce data in the field and improve [redacted] timeliness. The [redacted] of Mission [redacted] was then too widely [redacted] Petty Officer Johnny D. Martin, at the end of a pass. [redacted] were sent over Teletype to NSA for processing in the IBM 7094 system, and the [redacted] result, poor though it was, [redacted] Bruce Wald was already designing a system that would convert analog data to digital format in real time as the data was being collected in the field. He expected to complete an engineering breadboard by next summer. Fred Hellrich became Wald's understudy on the digitization project.

~~(S/B)~~ BGen James T. Stewart, newly assigned director of the SAFSS (NRO staff) in the Pentagon as of July 1965, visited the Navy Lab several times that year to see hardware and facilities. He was accompanied by Cdr [redacted] an intelligence specialist who succeeded cryptologist Frank Sperberg to the Navy billet in the NRO SOC. DirSAFSS Stewart was informed that POPPY had intercepted [redacted] Mission [redacted]

pointing the way to [redacted] coverage of Soviet [redacted] and [redacted] in Mission [redacted]. Stewart also toured the site at Hybla Valley. There he could hear for himself what was, at the same time, POPPY's main strength and drawback: [redacted] that a processing trade-off existed between completeness and quality. He was informed of NSA's gibes about [redacted] and joint efforts with NSA at data reduction.

Cost-Effectiveness Task Force

~~(S/B)~~ In the new year, Howard Lorenzen continued representing the Navy in the cost-effectiveness task force, but he tapped his branch for support in fulfilling his own action items to provide information and review CETF materials. He exchanged misgivings with [redacted] about cost-evaluating NRP electronic signals collectors in isolation from other collectors: SIGINT stations, [redacted] transportable vans, ferret aircraft, SIGINT ships, [redacted] It was this comparison that made the satellites stand out. Air Force representatives to the CETF were supported by [redacted]

~~(S/B)~~ The COMOR generally focused on aerial and overhead photographic missions, rather than signals collection, and its predilection was reflected in a tendency of the CETF to favor the spatial domain over the frequency domain. Early on, the focus became even narrower as a decision was reached to concentrate on large Soviet land-based radars fully operational and widely deployed, perhaps because they were targets for both photo and ELINT satellites. Photo determined where they were; ELINT, when they became operational and what they did. [redacted] expressed reservations with the flowdown of USIB requirements, particularly with the CETF's emphasis on the EOB, SAC's requirement that [redacted] and the corresponding neglect of "mobile targets and the smaller tactical radars of concern to Navy and Army" that were not contained in the EOBs (7 Jul 66).

(U) Whereas [redacted] reported to the Army ACSI, Howard Lorenzen was pretty much on his own at this point. Intelligence specialist Rufus Taylor had been selected for a third star, was serving as DIA's deputy director, and was slated to become deputy DCI. (The former DDCI, Richard Helms, had already succeeded VAdm Raborn as DCI at the end of June.) Taylor's successor as ACNO (I)/DNI, after a two-month gap, was RAdm Eugene B. Fluckey, who had just reported to the office of CNO on 8 July, fresh from command of Submarine Force, Pacific Fleet. Submariner Gene Fluckey was one of America's WWII heroes (medal of honor, four Navy crosses) and, as a captain, had served on the staff of the National Security Council six years ago, but he had no experience with the systems being evaluated by the CETF, nor with the program structure.

~~(S/B)~~ The COMOR's abbreviated cost-effectiveness metrics did not satisfy any of the systems' representatives in the CETF. Each system was measured primarily for its potential EOB contribution. All other missions were grouped under [redacted] Little or no credit accrued to POPPY for detecting new signals. The Air Force's [redacted] missions received no visibility whatsoever. The successful [redacted] launch of [redacted] had turned into a mishap when neither payload could be operated. After [redacted] scheduled for [redacted], there would be only [redacted] NRP [redacted] missions, [redacted] carried on the same [redacted]

~~(S/B)~~ Each system had its own criteria, tailored to missions and capabilities, and all of the competing systems wanted to be responsive to USIB requirements and to look good. The participants knew that the COMOR's findings would be reflected in future ExCom decisions on NRP programming and budgeting. The CETF estimated what percent of data collected was usable for EOB location — a measure of system efficiency that favored collectors [redacted] Lorenzen viewed most of the effectiveness metrics as sub-optimizations. It seemed to him the less a system could do, the higher it would score. He and [redacted] were dissatisfied with the amount of technical information available on [redacted] particularly on planned upgrades and future systems, and with West Coast re-engineering between meetings. [redacted] pleaded repeatedly on behalf of the Army ACSI that efforts be made to evaluate the systems "on what they HAVE accomplished rather than what they may hypothetically do."

~~(S/B)~~ NSA's office of ELINT would have been the logical source of information on what the ELINT collectors were producing, but, apparently, NSA was not solicited for performance information on the overhead systems. As a result of an organizational change, the divisions in C-Group that analyzed and processed overhead ELINT data had been redesignated as divisions in an office of special projects (K-4/SP). Ray Potts, the chief of K-4/SP, had earlier provided equipment for the initial NRL/NSA collaboration on machine processing of GRAB data. As a veteran of Audico and member of C-Group (machine processing), he had led analog to digital conversion for the early Program [redacted] payloads that [redacted] Conversant with raw data from all the overhead ELINT collectors, he was regarded as a hardware man and the agent for bringing powerful, state-of-the-art computers to the ELINT domain.

~~(S/B)~~ K-4/SP was staffed by about 240 personnel and had acquired a CDC 6400 computer system, which would more than double its processing capacity. As the threat signal environment continued to evolve, ELINT payloads were being

manufactured by [redacted] different R&D entities, distributed among [redacted] programs, and built at the rate of about [redacted] Most of the tapes came to NSA, some to SAC, and processing/analysis had to take into account each payload's electronics, data formats, orbital characteristics, calibration data, malfunctions, and any peculiarities logged during ground collection. The task was rather like painting a landscape while seated on a moving train.

~~(S/B)~~ Within K-4/SP, [redacted] was responsible for production of technical intelligence reports derived from all ELINT collectors (K-44). His deputy, John Conlon, focused on POPPY. [redacted] and Conlon had moved, almost as a team, from employment in NRL's radio division III (aircraft) until 1954, then to the Army & Navy Electronic Evaluation Group — which became the NTPC the following year. Both made the move from NTPC to NSA's new advanced signals analysis division, successively redesignated as COSA-5, C-15, and K-44.) Joe Struve managed signal location reports (K-46). Another division conducted quality control (K-45), and C-Group continued to run the Audico digitizer and manage production control (C-46). Struve and Conlon usually attended TOG meetings. Lorenzen asked Joe Struve for an updated assessment of POPPY's emitter location accuracy, as compared to EOB coordinates for [redacted] NSA's results from Mission [redacted] showed that [redacted] More and longer [redacted] intercepts resulted from [redacted], but improvements in data quality would be needed to sustain accuracy. Hoping to offset the COMOR's preoccupation with EOB production, Reid Mayo asked John Conlon to screen the POPPY output for [redacted]

~~(S/B)~~ Increasingly partisan efforts at the Navy Lab and discussion at TOG meetings sought ways to alter the CETF's logic so that measurements would be made along the same lines the TOG strove for performance gains: on-orbit lifetime, geographic access, RF range and instantaneous coverage, passes collected, [redacted] detected, SOIs and intercepts, and ELINT technical reports issued by NSA. NRL's mutations did not endear Lorenzen and his associates to CIA, Air Force, and [redacted] participants, and some previously cordial relationships were strained as the study wore on in the summer of 1966. With POPPY 5's [redacted] slated for a winter launch, the follow-on baseline had been halved to [redacted] and the fiscal year 1967 budget reduced by [redacted] POPPY no longer had a strong advocate in ONI. After a brief two months in the Pentagon, DNI Gene Fluckey had yet to engage in directorship of Program C. Edward Kerr had departed a year ago, and cognizance for POPPY had dropped one echelon to Op-922Y3 (special projects section).

Electronic Warfare Division

(U) CETF diminution became more bearable to the countermeasures branch, when DirNRL Tom Owen and acting Director of Research Schooley lifted it to the

second echelon of the NRL organization (29 Sep 66). Answering to increased ECM development needs related to the war in Vietnam, the electronic warfare division (NRL code 5600) was established effective 12 September. Each of four branches had a primary R&D focus. The space technology branch, under Jim Trexler, concentrated on [redacted] and communication applications. [redacted] HFDF recording and processing development was attended to by the intercept and signal processing branch, headed by Bob Misner. The [redacted] antenna/receiver configuration and direction finding systems for ships and aircraft were developed by the emitter location branch, under Mack Sheets. Defensive electronic warfare, under Lynwood A. Cosby, developed airborne and shipborne equipment for conducting ECM and countering hostile ECM. Sponsorship for various electronic warfare projects came from ONR, naval systems commands, other military departments, and national or defense agencies. Only ONI and NSG had significant visibility into all endeavors in NRL's electronic warfare division. Reid Mayo's section was buried in Trexler's space technology branch, its project never named in a public fashion.

(U) Superintendent Lorenzen and the division staff moved across the mall to larger offices in Building [redacted] which freed up some office space in Building [redacted] Underlying the division's organizational structure was a team approach to every project, with Lorenzen allocating resources according to need and priority, reminding his associates now and then that the squeakiest wheel gets the grease. Lorenzen reported to Claude Cleeton, associate director of research for electronics, as did William R. Faust, superintendent of the applications research division (NRL code 5100). Bill Faust's division included the satellite techniques branch (5170), which supported several space projects. Ed Dix had followed Marty Votaw to Comsat in June, and the branch was now headed by Pete Wilhelm, as much at home in Lorenzen's division as he was in Faust's.

(U) The satellite techniques branch had grown to 54 personnel, 40 of whom were professionals. Section heads (grades GS-12 or GS-13) were John S. Poole (systems integration), Bob Rovinski (structures design), Frederick W. Raymond (applied physics), Jim Winkler (telemetry), Leonard E. Hearton (RF systems), and Bob Eisenhauer (digital systems).

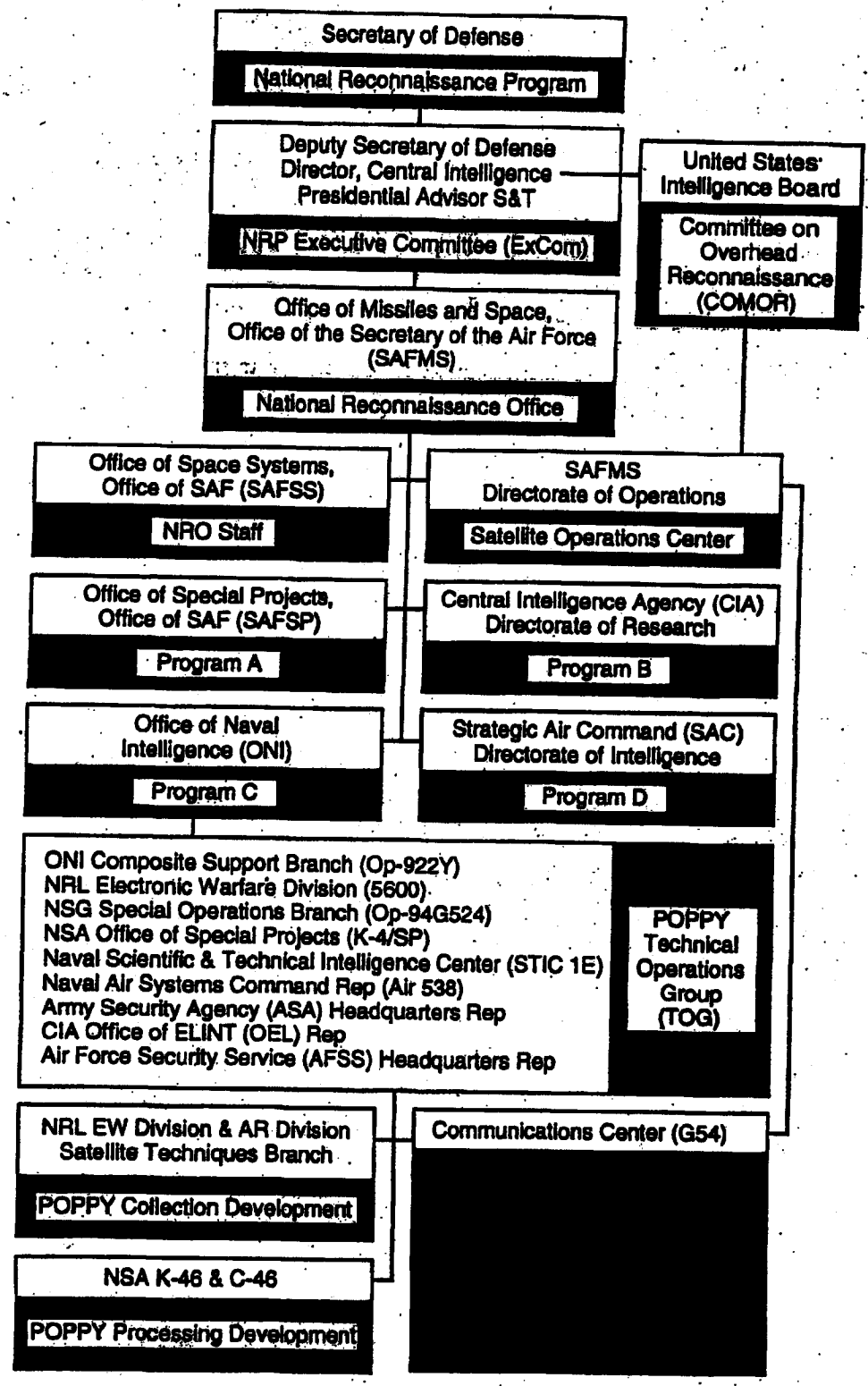

Figure 1 ~~(S/B)~~ Program Structure, White & Black (1966)

Chapter 8 References

17 Mar 65 DirNRL (TS/B - codeword) letter to DNI (Op-922Y3), 1050:TFC:wcb, BYE 27212-65
Subj: Mission [redacted] technical description of
Ref: DNI letter Op922Y3/bmb, BYE-19721-64, dated 21 April 1964
Encl: (TS/B - codeword) 27-page Technical Description for Mission [redacted]

13 Aug 65 DepSecDef and DCI (TS/B) agreement, BYE 5678-65
Subj: Agreement for Reorganization of the National Reconnaissance Program
[redacted]

7 Jul 66 Army Member Comments on CETF D-4/1 of 22 June 1966

29 Sep 66 NRL (U) Notice 5400
Subj: Organizational Changes in the Research Department

Chapter 9. ABM/AES THREAT

(U) *When the USIB reemphasized the need for intelligence on the Soviet Galosh and Gammon ABM/AES systems late in 1966, all programs were challenged to respond. The overhead community deliberated over proposals from government and industry. Results determined collection architecture for the remainder of the decade and well into the next.*

PSAC Concern

~~(S/B)~~ Proceedings of the USIB COMOR's CETF were disrupted and the reins gradually restored to the NRO, after the PSAC registered concern that signals from photographed ABM radars were not being collected by ELINT payloads designed solely for that purpose and asked for an explanation. [redacted] intercepts were believed to have a [redacted] function, and a few were correlated with POPPY intercepts as well, including the most recent ones from Missions [redacted] in 1965. On [redacted] radar at [redacted] was again intercepted by POPPY [redacted] No other NRP system had yet detected this [redacted] signal. Significance of the Soviet ABM defensive threat was reemphasized when, on 18 November, the USIB identified Soviet ABM/AES radar signals as the top SIGINT priority. Overhead ELINT systems were tasked in concert to collect the target signals.

~~(S/B)~~ Col Thomas O. Haig USAF of the NRO staff coordinated preparation among the programs for a response to the PSAC. His team briefed a PSAC panel on Monday, 6 December. Representatives of Programs A and B briefed capabilities of [redacted] CIA's [redacted] speculated that the Soviets refrained from operating their ABM radars when U.S. satellites were in view. Howard Lorenzen gave the Program C portion, which included EOB-related statistics that had been gathered for the CETF. He emphasized NSA's POPPY [redacted] distribution on [redacted] and similar [redacted] but with larger confidence ellipses, on Soviet air defense radars operating in S-band (2 Dec 66). After the briefings were delivered, panel members invited the NRO to identify what it might do to be more responsive on the ABM problem. When the group convened next day, SAFSP presented potential improvements to [redacted] for ABM signals search.

(U) Sitting next to Air Force Assistant Secretary Alexander Flax and having only some ideas, nothing in writing, Lorenzen informed him that the staff had not alerted the Navy to have a proposal ready. Flax assured him that he would be asked for contributions.

~~(S/B)~~ During that week, in response to Reid Mayo's request, NSA completed its tabulation of day-by-day counts of [redacted] Soviet signal types and [redacted] signal for periods each day when POPPY had the [redacted] These results, although interesting, had no bearing on the ABM problem and were soon set aside.

(U) Lorenzen and Mayo went to the Pentagon at the end of the week, at the request of [redacted] SAFSS technical adviser. They were invited to brainstorm a proposal to make their system more responsive and present it to him on Monday. Over the weekend, ideas were exchanged and briefing boards prepared at the NRL, addressing increased [redacted] coverage and on-line data sorting for Mission [redacted] Lorenzen gave a ten-minute pitch to [redacted] and several others in his office at the appointed time. [redacted] had noncommittally observed that the charts looked good, when he was called to join Col Haig's group ready to enter Flax's office. As Lorenzen and Mayo departed with the classified charts, intending to return to the NRL, a chance encounter in the hallway provided another opening. Inquiring what the chart case was for and learning that Lorenzen felt that the Lab was not welcome on the team effort, perhaps due to its obstinacy on the CETP, MGen James Stewart invited him to an office where they could talk.

~~(S/B)~~ After hearing NRL's response to the ABM problem, DirSAFSS Stewart escorted Lorenzen to the DNRO's office, interrupted SAFSP's pitch, and recommended to Alexander Flax that he hear Howard's proposal right away. Lorenzen asked for [redacted] and a seven-week launch delay for enhanced ABM radar signal detection, including modifications to several RF bands to enable [redacted] processing, completion of upgrades to ground receivers and recorders to improve data quality, on-site analog/digital conversion, and deployment of a computer system to a POPPY field site for ABM signal isolation. NSA's Ray Potts (K-4/SP) was there to discuss processing for Mission [redacted] and he objected, on principal, to a computer at an overseas site. Despite this obstacle, Flax was obviously enthused about the collection enhancements, and he spurred the West Coast delegation to more timely action, saying that he could not go back to PSAC with only this token. Collection sites in the [redacted] were already in permanent buildings. Flax and Stewart agreed with Lorenzen that the site in [redacted] would provide the most coverage of the Saryshagan

missile testing complex and several other suspected ABM sites. The total cost was less than uncertainties in costing other proposals under consideration, and Lorenzen received a tentative go-ahead that day.

~~(S/B)~~ The TOG closed the loop with K-4/SP as soon as possible. The computer was needed to provide quality control for analog/digital conversion and digital recording backup functions. Without a computer to read back digital tapes at the site, bad tapes might be shipped for weeks before a problem was discovered at the NSA. The computer would be used to write tape headers and trailers and pack several passes on a single tape, thus reducing expenditures. Moreover, the computer could quickly find signals associated with the highest priority ABM radars [redacted] The total equipment cost, about [redacted] and benefits had been discussed in the TOG. A computer engineer from HRB would be resident on site to teach maintenance and operation. NRL would provide logistics support. Ray Potts withdrew the objection to a computer in the field. On 21 December, NRL was formally notified that its plan had been approved at the December meeting of the ExCom and authorized a three-month slip in launch of POPPY 5 to complete the changes. On the same day, Mission [redacted] yielded the [redacted] intercept. Before the end of the month, Fred Hellrich had an approved purchase order for a computer, priority Brickbat .01.

ABM/AES Technical Committee

~~(S/B)~~ Late in December, DNI Gene Fluckey sent word to Lorenzen that his community service was again required on a committee to review proposals to be made to the PSAC panel. Appointed government members of the ABM/AES technical committee were [redacted] (chairman), Howard Lorenzen (NRL), [redacted] (NSA R&D), Thomas Haig (SAFSS), [redacted] (NRO SOC), Hal Willis (CIA office of ELINT), and Maj [redacted] (SAFSP). DNRO Flax had reported the specifics of the POPPY upgrade to the PSAC — as a first step in the NRO response.

~~(S/B)~~ In less than two months, these seven men would prepare the complete response and define overhead ELINT architecture for the next ten years. The SAFSP provided special consultants from [redacted] The committee reviewed proposals from Byeman industry, including [redacted]

[redacted]

(U) Starting on 4 January 1967, Lorenzen devoted nearly six weeks to committee work in the Pentagon and filled a steno notebook with notes and diagrams. He was in the unique position among committee members of being both a system developer and a reviewer (a conflict of interest in the eyes of some of the presenters). On the same date, DirNRL Tom Owen submitted to DNRO Flax, via DNI Gene Fluckey, a proposed optimization of Mission [redacted] for the ABM/AES problem, detailing the band plan for four-ball coverage of the targets and an accelerated schedule (4 Jan 67). The DNRO agreed to a four-ball baseline and requested detailed design planning and scheduling.

~~(S/B)~~ The ABM/AES committee proceeded with an intensive review of what was known about Soviet strategic defenses and of capabilities of present and proposed ELINT systems, including satellites, aircraft, [redacted] The committee recognized that POPPY had the potential to do a better job of location than anything else flying, and Lorenzen was keen on identifying new capabilities that might be incorporated with POPPY 7 — still in the conceptual stage.

~~(S/B)~~ DepDirNSA Tordella had been present for the PSAC/NRO meetings on 6-7 December, and NSA's analysts had since determined why ABM signals intercepted by POPPY and [redacted] These shortcomings could be addressed in payload design and processing. [redacted] reported that overhead ELINT data was now processed for location [redacted] after collection, the typical data backlog being about [redacted] Next fiscal year, Ray Potts planned to add nearly a hundred people to the overhead ELINT system processing and analysis office (K-4/SP).

~~(S/B)~~ To assess probability of ABM signal detection, [redacted] formed an NSA/SAFSP/CIA subcommittee and enlisted the aid of mathematician [redacted] from [redacted] Lorenzen found that [redacted] initial calculations were favorable to POPPY: [redacted] to accomplish an ABM intercept. During subsequent meetings, as more information came in from NSA about operating characteristics, parameters, and duty cycles, the probability subcommittee's target models became more conservative. [redacted] probabilities for all ELINT collectors fell accordingly. Under assumptions for BMEW radars' operating characteristics and a [redacted] confidence level, the Program [redacted] would need [redacted] depending on [redacted] to detect and recognize a signal [redacted] (Payloads [redacted] were

not significantly upgraded for the ABM/AES mission.) Despite the fact that most of the BMEW signal intercepts to date had been made by POPPY, [redacted] evaluation echoed the CETF and NSA's processing difficulties: "For [redacted] the [redacted] (Jan 67). According to [redacted] probability model, POPPY 5 would need [redacted] to accomplish a BMEW signal intercept, [redacted] for [redacted] Newly proposed [redacted] would need only [redacted] days in either case. The committee projected a cost of [redacted] for an improved series of Mission [redacted] and ground upgrades at [redacted] with a first launch in 18 months.

~~(S/B)~~ [redacted] working papers contained a brief sketch of a [redacted]

[redacted]

~~(S/B)~~ [redacted] idea contained the germ of a new solution to the ABM problem, developed under the stewardship of the technical committee and guidance from DNRO Flax. [redacted]

U.S. gold flow problem. (France was leading a growing trend among foreign banks to exchange dollars for U.S. gold reserves at $32 per ounce.). The cost for a first phase was estimated to be between [redacted] and [redacted] depending on implementation.

~~(S/B)~~ The committee gave a preliminary presentation to the director of Program A's [redacted] Col David D. Bradburn, on 27 January. Lorenzen briefed preflight POPPY 5 and projected POPPY 6 and 7. The level of interest in the proposed [redacted] program — from CIA, NRO, and NSA — had grown to a point that [redacted] decided, after this meeting, to reduce the briefing team to Programs A and B. Lorenzen informed DNI Fluckey (6 Feb 67) that neither Navy nor Army, which had been assigned responsibility within DoD to coordinate ABM threat assessment, would be represented in the ABM/AES committee's final presentations to the PSAC. He sought, unsuccessfully, to inject Flax's Navy counterpart, ASN (R&D) Robert A. Frosch, in the proceedings. Lorenzen wrapped up his committee work after participating in [redacted] dry-run presentation for DNRO Flax on 10 February. The systems' presentation was divided into present systems [redacted]

~~SECRET~~

[redacted] Program [redacted] (POPPY) was covered with present systems, briefed by SAFSP's Maj [redacted] The advanced program was briefed by CIA's Hal Willis.

~~(S/B)~~ The PSAC endorsed and the ExCom approved SAFSP's Program [redacted] small detachment that K-4/SP would establish there in mid-1967. Ongoing [redacted] collection payload developments were placed on SAFSP's back burner, [redacted]

~~(S/B)~~ ABM [redacted] or ELINT directed coverage/technical intelligence objectives were assigned to Missions [redacted] in the 1968-70 time-frame: [redacted] These payloads were developed by Byeman contractors represented to the ABM/AES committee for integration with the antennas and tape recorders on [redacted] To process data expected from POPPY/[redacted] starting late spring, and [redacted] later, NSA K-4/SP would add a CDC 6600 system to its computer complex and agreed to furnish blank digital tapes for [redacted] [As it turned out, the first ABM [redacted] satellite with a [redacted] receiver, [redacted] was completed by [redacted] quickly enough for launch on [redacted], eight months ahead of the committee's schedule.]

~~(S/B)~~ [redacted]

~~(S/B)~~ Sponsored by both NRO (collection) and NSA (processing), the primary solution to the ABM problem turned out to be [redacted]

companion. Following ExCom approval, DNRO Flax assigned the [redacted] at the [redacted] was selected as the prime contractor for Program [redacted] a year later. A mission ground station (MGS) was established as [redacted] [The first [redacted] became operational, with a broader mission, as Mission [redacted] that NRO would initiate studies for an ocean surveillance system. By then, [redacted] had been transferred to the [redacted]

Chapter 9 References

2 Dec 66 NRL briefing for PSAC Panel, BYE-51900-69 (update)
Subj: Navy Satellite Program C

9 Dec 66 [redacted]

[redacted] DirNRL (TS/B) letter to DNRO via DirPrgmC, 5600:HOL:sr, BYE 26900-67
Subj: Mission [redacted] proposed revision for

Jan 67 [redacted] (S/special handling) paper
Subj: Preliminary Probability Evaluation

6 Feb 67 H. O. Lorenzen paper
Subj: Suggested Talking Paper for RAdm Fluckey
Encl: Background for RAdm Fluckey

~~SECRET~~

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Chapter 10. ABM SEARCH

(U) *As part of the response to the ABM/AES threat, Program C was authorized to modify one series of satellites for increased coverage and to equip one ground station with a computer system. The payoff was immediate, and the system began* [redacted]

System Upgrade

~~(S/B)~~ Meanwhile, as the ABM/AES core group completed its broad-stroke ELINT architecture for the present and advanced programs, NRL was moving in high gear on its present program. On behalf of the NRO, the Air Force Space Systems Division [redacted] made available directly to NRL an additional [redacted] to fund the ABM upgrade [redacted] Reid Mayo was overseeing implementation, negotiating a contract extension with HRB-Singer, and preparing design, schedule, and costing information for follow-on missions.

~~(S/B)~~ Due to the urgency of the ABM/AES problem, Mayo enclosed with the POPPY 6 plan and schedule to DirPrgmC Fluckey an initial design concept and accelerated schedule for POPPY 7 (7 Feb 67). Both missions would [redacted] Broader [redacted] bands above this region would be distributed among the payloads with incidental [redacted] coverage. The proposal, when it reached the NRO, was evaluated by the directorate of engineering (SAFSS-7), headed by William Boenning. He asked Reid Mayo to provide two sets of cost estimates, one predicated on immediate go-ahead for POPPY 7, the other based on waiting a year for authorization, until just prior to launch of POPPY 6 (as was the custom for POPPY approvals). Mayo prepared detailed cost breakdowns for both missions and the different lead times, which DirNRL Tom Owen submitted directly to DNRO Alexander Flax (6 Mar 67). An immediate start would permit assembly-line production of [redacted] satellites and save [redacted] In response on 21 March, [redacted] authorized NRL to proceed on POPPY 6 only but to commit [redacted] for purchase of long-lead items on POPPY 7. Final approval was withheld, due to the need to weigh alternative methods of improving the NRO's collection capability for ABM/AES SIGINT.

~~(S/B)~~ The satellite techniques branch relocated the command and telemetry readout site at Hybla Valley, Virginia (now Huntley Meadows Park), to the [redacted]

[redacted]

The electronic warfare division quickened development of upgrades underway and ideas still on the drawing boards. Collection capabilities [redacted] were established in permanent buildings by Charlie Price's crews. With rigorous technical oversight from electronics engineer George E. Price (Charlie's son and the first second-generation member of NRL's electronic warfare division), production versions of solid-state receivers, true to the performance of engineering models developed at the NRL, were fabricated by HRB at State College, Pennsylvania, and deployed initially to [redacted]. HRB also fabricated the analog/digital data system (A/DDS), designed by Ronald L. Smith from Bruce Wald's section, [redacted] Terry W. Fisher, new to Mayo's section, designed and implemented a [redacted] digital recording system, using an Ampex BTM-9 recorder, to produce tapes for NSA. [redacted]

(U) Fred Hellrich was the architect for the computer configuration, which would enable quality control checks of digital data tapes, data packing, and the beginning of efforts to process data in the field. When news of the ExCom approval came in December, every computer on a production line in the U.S. was spoken for. Hellrich had reviewed the trade magazines and scoured the computer industry for a small general purpose machine, found one already assembled at the Systems Engineering Laboratory (SEL) plant in Plantation, Florida, and used the Brickbat .01 priority to persuade SEL's customer to defer to NRL's need and take delivery of another SEL 810A six months later. The computer word size was 16 bits, and the memory capacity was 16K words. Input/output peripherals included a Teletypewriter, paper card reader and punch, paper tape reader and punch, line printer, and magnetic tape transports. Tape drives were procured from Ampex. After a pass, the SEL 810A configuration would be used to check the digital recording for parity errors and write the tape header and trailer. It could also be used — in the event the BTM-9 recorder failed or was taken off line for preventive maintenance — to record digitized data directly from the A/DDS. NSA C-46 specified the digital tape format required for its CDC computers and information needed on tape headers and trailers. When Fred Hellrich's funds ran out in the spring, Howard Lorenzen got him another [redacted] from RAdm Mac Showers, DIA assistant chief of staff for plans and programs, to complete the computer system. For software development, Hellrich turned to HRB, which had helped develop the [redacted] concept. At State College, mathematician Robert E. Daniels wrote most of the initial processing programs deployed with the SEL 810A and was still writing FORTRAN code on the flight to [redacted] in May.

~~(S/B)~~ Launched 31 May 1967 on a Thor Agena D, Mission [redacted] remained operational for nearly [redacted] Pete Wilhelm, chief satellite design engineer, developed the new POPPY multifaceted solar array structure employed on [redacted] the satellites, which measured 27 inches across a 12-sided equator and weighed 162

to 222 pounds. [redacted] at 109 pounds, continued the stretched spherical design used previously on POPPY 4 and had to be power-managed through much of its operational lifetime. [redacted] employed different methods of three-axis stabilization, both designed by Bob Beal. Sufficiently long periods of stability at proper aspect were achieved to execute [redacted] facility and initiate station-keeping [redacted]. These experiments led to a new and reliable configuration, used with POPPY 6 and thereafter, a single boom with a damper for pitch and roll, a motor-driven flywheel for yaw. George E. Flach derived the flywheel design from a prior implementation in NASA's Nimbus meteorological satellites.

~~(S/B)~~ Bob Eisenhauer had included experiments to measure [redacted] in a selectable receiver of [redacted] John Poole designed an experiment to measure [redacted] in a selectable receiver of [redacted] Vince Rose incorporated a [redacted] (Army's [redacted] had pushed for the coverage, and it proved successful on the first pass collected.) [redacted] USIB mission guidance was expanded, from the usual [redacted] detection of technological changes, to include the requirement to search for and locate ABM-associated signals in the [redacted] range.

(U) The payload engineering evaluation and ground receive path calibration, directed by NRL teams deployed to the field sites, was disrupted and lengthened to four weeks by turmoil and tragedy that followed Israel's preemptive air strikes on Syria, Egypt, and Jordan, the 5th of June. Three days into the war in the Middle East, while monitoring communications of the Sinai combatants, SIGINT ship U.S.S. *Liberty* was devastated by repeated and prolonged attacks from Israeli aircraft and motor torpedo boats. Sixth Fleet aircraft flew over the area in time to prevent total loss of the ship and crew. Nearly every career sailor or officer at the three Navy stations mourned friends among *Liberty's* dead or wounded, mainly communication technicians from NavSecGru's radio and linguistic branches.

Operations

~~(S/B)~~ In his first month as director of NRL, Capt James C. Matheson, signed out the final Byeman technical description for Mission [redacted] (23 Jun 67). On [redacted] after NRL teams completed engineering evaluation and departed the field sites, intercepts and parametric measurements were made from Missions [redacted] on an ABM-like signal, which NSA later correlated with the [redacted] ABM. A [redacted] was first intercepted [redacted] (Emissions from the second [redacted] on the [redacted] had been collected by ferret aircraft nearly two dozen times in the past three years.)

~~(S/B)~~ The first tapes from Mission [redacted] had arrived at NSA C-46 on 15 June. The quick results on suspected ABM-related targets and quality of Mission [redacted] data across the spectrum prompted NSA to seek NRO reconsideration of the [redacted] plan for the next mission. [redacted] now chief of NSA's R&D division for satellite projects (R-83), arranged a meeting. He and [redacted] went to the NRO on 17 July to meet with Bill Boenning, [redacted] of the NRO; Reid Mayo, John Poole, and Vince Rose of NRL. [redacted] made the case for reconfiguring POPPY 6 [redacted], and POPPY ought not dedicate its capabilities to the ABM problem. The consensus of those assembled was sufficient to proceed on this engineering change. Accordingly, Mayo prepared a revised prospectus, which DirNRL Jim Matheson submitted to DNRO Flax ten days later (27 Jul 67). There were some objections to NRL's cancellation of [redacted] and follow-on discussions of ways and means to restore it, including [redacted], but the basic plan was recapitulated and affirmed in a letter to DirNRL Matheson (copy to DirPrgmC Fluckey), prepared by Bill Boenning and signed by the new director of the NRO staff, BGen Russell A. Berg USAF (5 Sep 67).

~~(S/B)~~ The RF coverage and data density from Mission [redacted] earned for POPPY the reputation of a [redacted], which would stick. In the summer of 1967, with [redacted] satellites on orbit, NSA was receiving about [redacted] POPPY analog tapes per week (representing [redacted] of collected data) plus packed digital tapes [redacted] from Mission [redacted] Data from [redacted] was processed only by SAC. "Turn down the gain!" was no longer a laughing matter in NSA's around-the-clock processing complex. From this time on, an unworkable POPPY backlog would accumulate, and it was reduced intermittently by winnowing instead of processing. About half the passes collected in the field were actually processed at the NSA. Many of the passes overlapped between sites, providing some data duplication, and not all payloads, equator crossings, bands tasked, sites, times of day, and days of the week were equally

productive, of course; but a good deal of work went into planning and collecting a single pass, there was little tolerance for collection failure at a site, and it was not good for morale when the analog backlog listing was shortened by selecting blocks of tapes to be degaussed and recycled. To alleviate these problems, NSA proposed to NRO that geographical coverage be reduced, by phasing out and putting on standby, and that the remaining analog sites — — be digitized (28 Sep 67).

~~(S/B)~~

~~(S/B)~~ The — in general, the land-based early warning radars that answered SAC's need to maintain the Soviet EOB and distributed in Talent Keyhole channels. Years of experience showed that signal contamination and attendant inaccuracies resulted from relaxed processing criteria. NSA continued to rely on its manual analysis effort to handle the more interesting and exotic signals, residue. Field site analysis and quality control eventually became reliable to the point that analog tapes were forwarded to NSA only if they contained signals or were specifically requested by NSA's analysts.

(U) Howard Lorenzen took the deputy DirNSA, Louis Tordella, to Germany in the fall, to see firsthand the experimental processing in action. NavSecGruAct With a complement of 116 personnel, including six

officers, the station had two missions conducted in separate operations buildings: classical ELINT and Siss Zulu. [redacted] The Siss Zulu site was managed, operated, and maintained, on a watch-standing basis, by three dozen cleared personnel, including one officer, Lt(jg) Ronald L. Potts, two senior chiefs (one for operations, one for electronic equipment maintenance), and a contracted civilian technical representative of NRL, senior research engineer Richard L. Wales from HRB.

~~(S/B)~~ In the Siss Zulu (POPPY) operations room, the A/DDS battery of little red lights, the 'cherry picker', was excited when [redacted] Operational availability was excellent, except for occasional outages of the BTM-9 digital recorder — necessitating use of the SEL 810A and its tape recorders in the backup configuration, until the BTM-9's failed diodes could be isolated and replaced. There were large stacks of line printer listings of [redacted] being analyzed and annotated with computations, remarks, and connecting arrows. But [redacted] had made no contribution to isolation of ABM-related signals. The process was initiated at [redacted] during EE&C in the summer of 1967, was in full swing when Tordella and Lorenzen visited, and was abandoned there early in 1968 as being not very productive while being very tedious and machine time-consuming. There was little to show for the effort: some [redacted] charts, its drawbacks including:

- [redacted]
- [redacted]
- [redacted]

~~(S/B)~~ [redacted] DepDirNSA's visit, POPPY sites were tasked for [redacted] on-line detection of ABM/AES-related radar signals [redacted] POPPY collection operators

[redacted]

SORS

~~(S/B)~~ A SIGINT overhead reconnaissance subcommittee (SORS) had been chartered (effective 1 July 1967) as a permanent subcommittee of the DCI/USIB SIGINT committee — to advise, assist, and, as directed, act for the SIGINT committee in all matters pertaining to SIGINT overhead reconnaissance. Representation to the SORS included CIA, State, NSA, NRO, DIA, Army, Navy, and Air Force. The chairman was CIA's [redacted] who had seen Jim Trexler's Tattletale presentation at CIA headquarters back in early 1959 when he represented NSA to the USIB's critical collection problems committee. Army ACSI was represented by [redacted] NSA's charter member of the SORS was John Libbert, another veteran of Tattletale and GRAB. Military members were at the O5/O4 level.

~~(S/B)~~ Chaired by [redacted] the SORS met at the Navy Lab on 13 December and was briefed by NRL and NSA representatives on POPPY, results against the ABM/AES mission, and plans for follow-on missions. NRO SOC's [redacted] arranged for a repeat of the briefing for DirSAFSS Russell Berg and staff members later in the month, emphasis on six months worth of accomplishments since launch of [redacted]

~~(S/B)~~ The [redacted] ABM [redacted] radar signal had not yet been detected when the SORS was briefed. [redacted] later, POPPY [redacted] the first collection of the [redacted] highest on the list of national ELINT priorities. Recognition of the POPPY share would await NSA's analysis and processing, since the AFSS collection site at [redacted] then had no analysis capability. On [redacted] the signal was again collected [redacted] providing the first publicized information on [redacted] As soon as the tapes arrived [redacted]

~~(S/B)~~ POPPY [redacted] sometimes to influence design, more often for tasking (including POPPY itself), mostly to search through archives of previously collected data. Intercepts from NRP systems, [redacted] and classical ELINT systems enabled NSA to complete the [redacted]

(U) NSA disseminated results to the ELINT and electronic warfare communities by ELTs and updates to the ELINT parameters limits (EPL) lists. ELTs and the EPL informed the community, not only what was known on each signal,

but what remained to be discovered. This technical information constituted the detailed tasking for ELINT collectors; formal tasking simply listed SOIs by their ELINT notation. All ELINT managers had to read the daily message traffic, to stay abreast of the state of information.

~~(S/B)~~ [redacted] reported an [redacted] detection of [redacted] (then [redacted] The analog SOI [redacted] report was followed by a message 19 days later that described the [redacted] Due to the rudimentary state of tools at the site, this first operationally significant location took about 700 man-hours of work on signal isolation, digital data analysis, and orbit-making.

~~(S/B)~~ The manually intensive process was applied next to [redacted] intercepts of [redacted] and results were reported in Talent Keyhole channels to NSA (attention [redacted] and John Conlon), information copies to NSG, NRL, and the Naval Intelligence Command (NIC, formerly ONI). Over time, interactive software programs, written by HRB-Singer and field sites to iteratively isolate a signal from the recorded data, would become the computer-aided manual system (CAMS). With such tools the initial [redacted] step became superfluous. All that was needed to guide CAMS processing was the collection operator's [redacted] that a [redacted] analog measurement of the parameters, and time of intercept (TOI). The digital pulse data tape made for NSA would then be read by the SEL 810 configuration, reformatted to fit its smaller (octal) word size, and written to another tape drive. The SOI could then be extracted cleanly and completely, [redacted]

(U) On a couple occasions, HRB's software shipments included new routines added at the last minute and unaccompanied by descriptions of purpose or instructions for use. Utility would be ascertained in the field by reading source code and experimentation. In January, [redacted] Petty Officer Charles Joerger spent two weeks at HRB's plant in Pennsylvania to complete a software catalog, including brief configuration identifications and a configuration status accounting protocol geared for changes originating at multiple sites. For the first few years, expediency overruled configuration control, and neither HRB nor field sites had compunctions about modifying others' software and sending source code and configuration update on the next courier run. Those involved considered that the level of configuration management was appropriate for the project's R&D status and the high priority that USIB and SORS placed on results.

Chapter 10 References

[redacted]

Subj: [redacted]

7 Feb 67 DirNRL (S/B) letter to DirPrgmC, 5600-RDM:jch, BYE-26904067
Subj: Program "C" MISSIONS [redacted] (TS)
Encl: (1) Detailed Design Plan for MISSION [redacted] (C)
(2) MISSION [redacted] Design Concept Proposal (C)

6 Mar 67 DirNRL (S/B) letter to DNRO, 5000-RM:bdk, BYE-26906-67
Subj: Detailed cost breakdown for Missions [redacted]
Encl: (1) Monthly expenditure-rate and Funding Summary Table
(2) Mission [redacted] Cost Comparison - TABLE I
(3) Program/FY Costs - TABLES II & III
(4) Program Cost Details Based on [redacted] (Accelerated Program)
(5) Program Cost Details Based on [redacted] (Present Program)

23 Jun 67 DirNRL (TS/B) letter to CNO OP-922Y3, 1050:RBH:wcb, BYE-26910-67
Subj: Technical Description for Mission [redacted] forwarding of
Encl: (1) Copies 1 through 10 of Technical Description for Mission [redacted]

27 Jul 67 DirNRL (TS/B) letter to DNRO, 5600-114:RDM:sr, BYE 29611-67
Subj: Mission [redacted] modifications, schedule and design plan for

5 Sep 67 NRO Staff (TS/B) memorandum for DirNRL, copy to DirPrgmC, BYE-52635-67
Subj: POPPY Mission [redacted]
Atch: Mission [redacted] Frequency Bands

28 Sep 67 NSG (S/B - codeword) message to NRO, info CNO, NSG, USAFSS, ASA, CIA, 281908Z Sep 67, Cite NSA SPO 1637-7
Subj: Project POPPY Resource Adjustment

21 Feb 68 [redacted] (TS/TK) message to NSA (Attn: [redacted] and John Conlon), 211639Z Feb 68
Subj: [redacted] Feedback in NSA (TS/TK) message 042017Z Mar 68]

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Chapter 11. SHIPBORNE EMITTER LOCATION

(U) *The Soviet Union accelerated development and production of combatant and auxiliary ships in its Baltic and Black Sea shipyards during the 1960s. The new warships included cruisers, frigates, and destroyers armed with guided missiles; missile-equipped helicopter cruisers; and nuclear submarines armed with ballistic missiles. Out-of-area deployments of the emerging world class fleet increased dramatically, particularly in waters adjacent to nonaligned nations.*

~~(S/B)~~ *Supporting the national intelligence objective to detect technological changes in* [redacted] *military radar development, POPPY Mission* [redacted] *data was used by NSA to detect new modes of* [redacted] *radars, as well as to discover and provide technical intelligence on signals from new landbased and shipborne radars. Of significance to the U.S. Navy, POPPY field sites began generating and reporting locations* [redacted]

Navy Space Program Review

(U) The DoN redesignated its material bureaus as systems commands in 1966. The Naval Air Systems Command, responsible under the chief of naval material (CNM) for procuring and supporting aircraft for the Navy and Marine Corps, included a small space systems division (Air 538) to sponsor exploratory development, mainly by NRL. NavAir brought to the attention of VAdm Thomas Connolly, DCNO (Air), the need for comprehensive review of space-related projects of potential value to the Navy. Tom Connolly remained a strong advocate of space systems, but his own plate was full with development of the next carrier-based multi-mission fighter (which would turn out to be his namesake, the Grumman F-14 Tomcat). He suggested to ACNO (Dev) Noel Gayler (Op-07B) a working conference to bring together all the experts the Navy had invested in space over the past nine years. Gayler proposed a new Navy space review, an update to Connolly's 1959 report on space and astronautics, in a 3 August memorandum for Adm Thomas Moorer, who had taken office as CNO the first of the month. Following Gayler's staff coordination within OpNav and DDR&E, the task went to RAdm William N. Leonard, assistant director for operational test and evaluation in the office of DDR&E. Gayler would be unable to participate himself, since he had orders to Offutt AFB, Nebraska, where he would be deputy director, joint strategic target planning staff. (Coincidentally, Capt Gayler's boss in 1959, SecNav Thomas Gates, had created the JSTPS in his position as SecDef in 1960, in order to reconcile Navy and Air Force doctrines of nuclear deterrence.)

~~(S/B)~~ Within NavSecGru, 'Siss Zulu' was used as an unclassified covername for POPPY, chiefly with regard to organization, billets, budgeting, and logistics. The NSG headquarters element responsible for routine POPPY tasking and project communications (G524, or G52 Charlie) was headed by LCdr Floyd H. Heindl, who represented NSG in the TOG. Discussion by the TOG disclosed that only a few shipborne emitters were on [redacted] Over the years, signals from about 20 [redacted] in GRAB/POPPY data. Many had, for a time, been designated as SOIs, until they became well known through various collectors, their modes of operation and parametric ranges fully documented. These included a few families of signals, indistinguishable one from another unless the antenna was sighted. In response to a TOG request, Floyd Heindl tasked NSG's Siss Zulu sites [redacted] to report detection of Soviet shipborne emitters, on a basis not-to-interfere with the national mission (14 Aug 67).

~~(S/B)~~ There were obstacles at the sites. NRO's tasking of RF bands was optimized for USIB objectives and afforded few collection opportunities for [redacted] months of this effort, POPPY averaged [redacted] per week. Particulars on each one were Teletyped in SOI format, Byeman channels, to NSG, NRL, and NIC.

(U) William Leonard was charged by the VCNO to conduct the space review and report on Navy requirements and potential use of space systems; capabilities of current and projected DoD space programs and their adequacy for Navy use; and suggested solutions (programmatic, technical, organizational, and fiscal) to provide operating forces with usable system capabilities. The two-week conference was hosted by the NRL, commanded by Capt Jim Matheson. Participation included 24 full-time members and 15 part-time members. The billet of OpNav program sponsor for space (Op-54) had been disestablished several years ago, but Tom Connolly provided two representatives to the Leonard committee from Op-05. NavAir, which had instigated the review, was represented by Robert F. Speaker and Joseph Kay of Air 538 (both of whom would be plank owners when the DoN consolidated management of space projects in a single office a few years hence).

(U) VAdm Connolly gave the keynote address at the 26 September 1967 kickoff meeting, reiterating the themes in his 1961 memorandum for the SecNav on space and the Navy's future. The proceedings addressed navigation, ocean surveillance (overhead and acoustic sensors), meteorology and oceanographic application, all

sensor military reconnaissance, communications, and fleet security. Although the space age had dawned nearly ten years ago, Transit (officially renamed the Navy Navigation Satellite System) was the only operational space-based system that supported the fleet. Sponsorship of Applied Physics Laboratory's broader space physics program had been transferred from the Navy to NASA years before. NRL's space applications division, represented at the conference by Superintendent Bill Faust, built and operated satellites for several active research projects, including space technology experiments, measurement of solar X-rays (SolRad), calibration of NavSpaSur's fence (SurCal), time transfer and navigation (Timation), and HF wave propagation for HFDF calibration.

(U) The Navy Space Program Review (1967) concluded that great technical potential was at hand, the DoN must move boldly to translate space policy to fleet needs, and commitment to space exploitation was imperative (17 Nov 67). The chief finding was that the DoN must work more closely with the Department of the Air Force to define requirements for space-based systems to support military operations. Another consequence of the review was the upgrade of Op-76 to flag rank. Directorship of the Navy space programs division would go to RAdm William J. Moran in November 1968 upon completion of his assignment in North Vietnam's Gulf of Tonkin as commander, anti-submarine warfare group 3. The final report to the CNO was reviewed and released by RAdm Vincent P. dePoix, Op-07B and acting DCNO (Dev). [In his next assignment, as deputy DDR&E, Vincent dePoix would chair a DoD-wide steering group to oversee DDR&E's overhaul of defense system acquisition policy, including space systems development.]

(U) Ocean surveillance by overhead means was on the agenda, but this topic received little visibility in the report. Soviet naval activity in the Mediterranean Sea doubled in 1967 from the previous year, but the U.S. defense establishment did not have a high regard for the capability of Soviet fleets to project military power across seas and oceans. The prevailing view was reflected in a contemporary assessment by SecDef McNamara:

> Soviet developments in strategic weapons such as anti-ballistic missiles give evidence of a continuing search for security through more advanced arms. But the military applications of Soviet power, such as recently increased naval activity in the Mediterranean, appear to be primarily diplomatic gestures. In that specific case it may be aimed at redressing political losses sustained from Moscow's inability to prevent Israeli victory over the Arabs. Soviet naval craft in the Mediterranean, including missile cruisers and submarines, have effectively shown the flag, but they have done so without the base structure and support facilities that would be necessary for sustained military operations. (1968)

~~(S/B)~~ A Byeman compartment of the Navy Space Program Review included representation from Navy participants in POPPY. Bob Speaker of Air 538 was [redacted] NIC was represented by LCdr Frederick W. Glaeser, an avionics duty officer. NavSecGru and the office of ACNO (communications and cryptology) (Op-94) were represented by GRAB veteran Capt Frank Sperberg, now assigned to NSG headquarters as coordinator for Project Bullseye (GH). RAdm Leonard, who previously commanded carrier division 14,

was keenly interested in keeping track of Soviet warships, and he submitted a separate Byeman supplement report to CNO Moorer with a succinct recommendation: "Request the conduct of tests by the NRO to evaluate satellite use for passive detection, classification and localization of ships at sea" (6 Nov 67). Subsequently, ACNO (intelligence) Gene Fluckey (Op-92) assigned action to Capt Lloyd William (Bill) Moffit, who reported to the Pentagon on 17 November for duty with the Naval Intelligence Command as the assistant for intelligence systems requirements and support (NIC-2). Moffit and his staff, including Fred Glaeser, commenced discussion with the NRO SOC and the USIB SIGINT committee's SORS.

SIGINT Capabilities

(U) SIGINT ship U.S.S. *Pueblo* was attacked, boarded, and captured intact by North Korean air and naval forces on 23 January 1968 before the Seventh Fleet could react to radioed SOSs. Some crew members, who would be brutalized in captivity, had just reported aboard after completing tours at activities hosting Siss Zulu sites — like Petty Officer James A. Shepard from [redacted] By the turn of the decade, all the SIGINT ships, whose [redacted] electronic surveillance positions were operated by naval communication technicians in response to NSA tasking, would be decommissioned. [redacted] As was the case with the CIA's U-2s, numerous downings with loss of crews of Navy and Air Force planes on intelligence missions in or near [redacted] air space, and the U.S.S. *Liberty*, the *Pueblo* incident heightened the intelligence community's enthusiasm for national capabilities that were now perceived as a safe and very productive technical means of collection.

(U) A week after the *Pueblo* capture, America received even more of a jolt when, on 30 January, Vietcong and North Vietnamese army units attacked more than 100 cities in South Vietnam during the Tet holiday truce. As U.S. and South Vietnamese troops rallied and proceeded to crush the Tet offensive, the TOG, now under Lloyd Moffit's direction, reached agreement that the site [redacted] should be digitized and equipped with a computer installation [redacted] NIC submitted a message proposal to that effect, seeking NSA's concurrence, on 21 February. NSA K-4 was satisfied with the quality of digital tapes coming from [redacted], the gain in efficiency, and improved accuracy. Occasional errors in tape headers or trailers would be correctable, as soon as HRB deployed tape editing software. NSA positively endorsed the NIC proposal on 15 March and recommended to the NRO that [redacted] be digitized, as well.

(U) U.S. SIGINT capabilities were being reviewed in 1967-68 by the Eaton committee (named after its chairman, who had no role in the foreign intelligence community), which had been chartered by the SecDef to look at both NSA and NRO. Robert McNamara had resigned on 29 February after the last Vietcong Tet offensive

remnant was extinguished in Hue, South Vietnam, but the Eaton committee's mission continued under SecDef Clark Clifford. ACNO (I) Fluckey decided that CNO Moorer should be refreshed on Navy participation in the NRP before a Wednesday working lunch on 3 April with Fredrick M. Eaton.

(U) Capt Frank Murphy, deputy ACNO (I), walked with Howard Lorenzen to the CNO's office. They were trailed by Fred Welden and Reid Mayo, sharing the weight of a chart case. After the bag was unpacked and a pedestal erected, Mayo began the briefing. When the distribution of field sites was shown, Adm Moorer suggested adding one on the [redacted] where the Seventh Fleet (which he had commanded four years ago) was charged to cover a very large area with few aerial reconnaissance assets that could be deployed there — as he put it, with very few eyeballs. Before Mayo could finish the presentation, an alarm and light flashed an anticipated summons for the CNO to join a JCS session. The NRL team packed the charts but waited alone in the aide's office, on the chance there might be a little more time before Mr. Eaton arrived. When Moorer returned, he asked if they could brief him more quickly and less formally than by the briefing boards (of the same sort he had seen in Lorenzen's Tattletale presentation a decade ago). He was shown a three-ring binder by Mayo, which he thumbed through at his desk while conversing. When they got to the topic of signal geolocation, he was more intrigued by the possibility of locating ships in motion than the fact of locating antennas imbedded in concrete. He commented that the White House people were saying that results from satellite photo reconnaissance took a few days or a week, and he asked how fast this program could respond. Mayo's ensuing recital of factors that affected processing timeliness and trade-offs with accuracy, was interrupted by the aide's announcement of Mr. Eaton's arrival. Moorer ended the discussion by directing his aide to arrange a monthly briefing memo on the POPPY program, a quarterly briefing on progress, and a visit to the NRL to see the next POPPY satellites during construction.

(U) Beyond digitizing the site at NavCommSta [redacted] subject to SAFMS go-ahead, NRL planned to install solid state receivers at [redacted] before the end of the year, but available funds would stretch no farther. NRL so advised NIC the day after the briefing for CNO. A resource adjustment for [redacted] only was approved by the SAFMS (11 Apr 68). Action at the NRL was assigned to Fred Hellrich.

[redacted]

~~(S/B)~~ The three Navy sites had reported during February, [redacted] intercepts of Soviet shipborne emitters. The TOG asked NSA for a summary on shipborne SOI [redacted] Pursuant to the Leonard committee's request and bolstered by these results and interest from the CNO, NIC succeeded in arranging a special task that would apply to POPPY only. The NRO SOC authorized one [redacted]

[redacted] for an engineering evaluation of the potential capability to locate ships [redacted] Although this was a not-to-interfere task, NSG's director, RAdm Ralph Cook, urged personnel at [redacted] to give it everything they had. Mayo traveled to the POPPY site in [redacted] to participate.

(U) Reid Mayo was a frequent and most welcome visitor. He would come to the sites and tell the sailors what the nation needed and what they could do to help, and it would be as though he were coming directly to them from the CNO or the DirNSA. Mr. Mayo would listen and act on their needs for equipment or technical information or logistics support or even a water cooler. At any hour he might be found sitting the collection or analysis positions with the sailors or perched on a stool between passes, and they would talk with him about ELINT as though the signals were mutual acquaintances.

~~(S/B)~~ On this trip, Mayo informed site personnel of the CNO's interest and was delighted to learn that the first [redacted] signal had already been produced and reported (collected 11 days after the CNO was briefed in the Pentagon on the possibility): a [redacted] Sea. Petty Officer David Miner had operated the SEL 810A configuration used to isolate and geolocate the signal.

~~(S/B)~~ [redacted]

~~(S/B)~~ Widely dispersed and readily processible [redacted] intercepts of landbased [redacted] benchmarks for location accuracy assessment and for training watch-standing digital analysts and were being reported to NSA.

~~(S/B)~~ Results of the engineering evaluation of ship location feasibility were inconclusive. During the authorized period, spherical [redacted] was experiencing voltage problems, due to a low sunlight phase, and producing much less data than multiface [redacted] Mayo suggested that processing techniques be developed for [redacted]

[redacted] shortened. The refurbished U.S.S. *New Jersey* was being deployed to Vietnam for bombardment of enemy supply routes, and NRL's electronic warfare division was fitting the battleship with ECM equipment, including repeater jammers for guided missile defense. There were fears in OpNav of vulnerability to suicide missions from North Vietnamese fast attack craft, [redacted]

(U) While participants at the NIC headquarters in the Pentagon perused message traffic during May, hoping for indications of Soviet [redacted] they were apprised of an urgent operational need for a different form of intelligence much farther south. ComSixthFlt, citing his own limited reconnaissance assets and other priorities for their employment, complained of inadequate photo intelligence on targets assigned to Sixth Fleet in CincEur's contingency plans for the European region (23 May 68).

~~(S/B)~~ After Mayo's visit and revival of [redacted] intensity of the not-to-interfere effort increased. [redacted] collection operators and analog analysts, already looking for Soviet shipborne emitters for RAdm Cook, [redacted] for Adm Moorer. The main emphasis was on the [redacted] operations chief, Raymon B. Kargle, that these [redacted]

~~(S/B)~~ In the meantime, the NRO SOC, directed by Col Edwin F. Sweeney USAF, was not receptive to Lloyd Moffit's requests for a second chance, under better conditions, for the feasibility test. The RF spectrum had to be collected in accordance with USIB priorities, and coverage requirements were methodically allocated to on-orbit assets. [redacted]

Thus, POPPY still bore the brunt of monitoring [redacted] Moffit was also informed that the NRO would shortly promulgate policy guidance for use of NRP systems, reemphasizing that their function is to address national requirements.

(U) ASN (R&D) Robert Frosch devoted the afternoon of 22 July 1968 to Superintendent Howard Lorenzen. For each major technology area (moon relay, HFDF, tactical ECM, satellite), the assistant secretary was briefed by key personnel of each participating branch on missions, organization, and resources. He toured the electronic warfare division's spaces in Buildings [redacted] the satellite techniques

branch, Building [redacted]. A 30-minute briefing in secure conference room [redacted] of Building [redacted] was placed last on the agenda so that Frosch could dwell on NRL's classified satellite project as long as he might wish. Director of Research Alan Berman was present for the briefing, and Associate Director Claude Cleeton gave the introduction. The group learned from Reid Mayo of the first few manpower-intensive locations of shipborne emitters. Whether or not a second engineering evaluation was authorized, a modest capability was becoming evident. On the [redacted] floor, Pete Wilhelm showed Frosch and Berman the beginnings of the [redacted] of satellites and described latest innovations in on-board memory, stabilization, thrusting, and attitude sensing.

~~(S/B)~~ In the second week of August, Capt Lloyd Moffit spent two days at [redacted] which was planning expansion of its Byeman control center to encompass the entire building (quadruple its allocation a year ago). Tension in [redacted] was high due to Red Army maneuvers along the Soviet border with [redacted] data, but Moffit was favorably impressed with results against targets on the high seas. Several more [redacted] As a naval aviator with extensive combat and photo reconnaissance experience, Moffit was familiar with the [redacted] — the newest and most capable surface ships in the Soviet fleets. Work had started on [redacted] Experience, on-the-job training, and software improvements had reduced days of interactive processing on each signal to hours, but there remained a trade-off between timeliness and accuracy. Study of [redacted] had shown that use of ephemeris based on NavSpaSur's observations at the time of intercept improved [redacted] — which entailed a wait of three or four days for contemporaneous ephemeris to solve and report [redacted]

~~(S/B)~~ In his covert role as the POPPY project manager for the ACNO (I), Moffit added his encouragement to Cook's and Mayo's and requested standard installation and operating procedures to use in guiding other sites. Moffit planned to visit [redacted] where Dick Wales, reassigned from [redacted] in June, would soon be training sailors in digital maintenance and computer operations and would field test NRL's second A/DDS and computer installation in time for launch of POPPY 6 a year hence.

~~(S/B)~~ After Capt Moffit's departure, the timeliness potential was demonstrated once, on 13 August, by a mid-day rehearsed team effort that electrically reported a [redacted] after signal uptime — which included [redacted] that sneaker-clad Seaman A. R. Walters needed to get the message pouch to the communications center in the other building but not the [redacted] the O-brancher (communications operator) poked the Teletype machine. Not until POPPY

processing was automated four years later would this kind of timeliness be bettered routinely and automatically.

~~(S/B)~~ . Before heading for [redacted] Lloyd Moffit visited the Sixth Fleet intelligence staff (N2) at Gaeta, Italy. Much of the photo intelligence on contingency areas in the [redacted] and others [redacted] aligned with them, was three to five years old, completely out of date, and relatively useless. VAdm David C. Richardson (ComSixthFlt) wanted updated photographs covering specific targets within these areas, refreshed every [redacted] for his own use and for training strike forces. Moffit informed him of NIC's objective, being worked through the USIB committees, to establish target folders, similar to the SIOP, for ComSixthFlt, CincLantFlt, and CincPacFlt.

~~(S/B)~~ On 16 August, Fredrick Eaton submitted his report on U.S. SIGINT capabilities to DCI Richard Helms. With respect to ELINT, the report suggested that the USIB and NRO were focused on ABM/AES targets and that the armed service's capabilities in electronic warfare had been dangerously weakened by NSCID 6's centralization of ELINT under NSA. On 22 August at the NSA, John Libbert updated Howard Lorenzen, Reid Mayo, and Army ACSI's [redacted] on the status of overhead SIGINT projects. He anticipated NRO ExCom approval of operational development for the [redacted] (ABM/AES project, later [redacted] NSA must provide its best and most competent talent to the most important program. Therefore [redacted] would go to the West Coast and join an NRO/NSA system project office (SPO) at [redacted] Ray Potts offered to realign and strengthen K-4/SP's lines of communication with the Navy program to make up for the loss, and he suggested interfaces with R-8 (system planning) to consider adapting [redacted] technology to POPPY, specifically use of a [redacted] Five days later, Reid Mayo and Lee Hammarstrom returned to NSA to pursue the subject and meet [redacted] replacement. Ray Potts indicated that the [redacted] was far downstream, since phase II approval was limited to launch of two [redacted] satellites by [redacted] He agreed to arrange a detailed technical briefing on [redacted] said that he would talk privately with Howard Lorenzen about his decision to go to El Segundo. He gave [redacted] a strong vote of confidence on location accuracy, and Hammarstrom recommended that some specific task be assigned to the site.

~~(S/B)~~ On returning to the Pentagon at the end of August, Moffit conveyed POPPY status and VAdm Richardson's concern about imagery in his trip report (Sep 68) to RAdm Frederick J. Harlfinger, II, the new ACNO (I), ComNavIntCom, and DirPrgmC. In hopes of expediting the process of developing target folders for Sixth Fleet, arrangements were being made by NIC-3 (intelligence operations coordination) to brief the COMIREX (USIB committee on imagery requirements and exploitation) in two weeks. Moffit also read the promised policy guidance from the NRO. DepSecDef Paul H. Nitze, in his capacity as the DoD member of the NRO ExCom, had informed the service secretaries of the requirement to deal with the NRO on satellite-borne earth sensing activities, including "feasibility studies,

potential application studies, developments, tests, uses, plans for symposia and conferences, and papers and presentations" (23 Aug 68). The NRO would refer collection requirements to the DIA for submission to the USIB. To ensure wide distribution within the military departments, Nitze had attached to his memorandum a non-compartmented, paraphrased version of the guidance.

~~(S/B)~~ The DepSecDef's memorandum inadvertently stimulated additional interest from senior Navy managers. On separate occasions in September, Lloyd Moffit and Howard Lorenzen briefed Adm Bernard A. Clarey (VCNO) and SecNav Paul Ignatius on overhead systems, POPPY, and initial results against Soviet [redacted] was attracting Navy interest, too. ACNO (I) Harlfinger informed SecNav Ignatius that the VCNO had designated Capt Thomas L. Dwyer to coordinate ocean surveillance matters within OpNav. Like his predecessor, Gene Fluckey, Fritz Harlfinger was a submariner. Until a month ago, he commanded the South Atlantic Force, headquartered in San Juan, Puerto Rico. Prior, he served as assistant director for collection at the DIA, where he knew POPPY as a [redacted] ELINT collector and modest contributor to the EOB (which was under DIA's purview).

~~(S/B)~~ Reid Mayo and Lee Hammarstrom received the [redacted] briefing and documentation from NSA's [redacted] (R-84) on 16 September. The prospective [redacted] to include [redacted] Two days later, following through on Hammarstrom's earlier recommendation, NSA asked [redacted] forth. The process was iterative and time-consuming.

[redacted]

~~(S/B)~~ Meanwhile at [redacted] a couple tracks had been plotted on [redacted] and a query had been sent to NSG headquarters regarding earlier [redacted] family. Based on a 22 September intercept during the 6683rd orbit of Mission [redacted] POPPY reported the first [redacted]

(U) Days-old intelligence on a [redacted] went unremarked, for the intelligence community's focus was on Central Europe. The Red Army's August maneuvers had masked the beginning of a sweep west across Czechoslovakia by Soviet armored divisions. By the end of September, the Prague leadership was intimidated, the movement toward liberal reform reversed.

~~(S/B)~~ [redacted]

(U) [redacted] deployment stimulated the intelligence community to take a closer look at the [redacted] USIB member Thomas L. Hughes, State's director of intelligence and research, brought the matter to the attention of Secretary of State Dean Rusk:

[redacted]

[redacted]

~~(S/B)~~ During the fourth week of November 1968, the latest POPPY results became more visible. In his windowed office in Building [redacted] near the front gate of the NRL, Howard Lorenzen received an update on Tuesday morning from Reid Mayo and [redacted] Siss Zulu officer, Lt Ron Potts. The superintendent was heartened that the investment in a computer was paying off, and he scheduled appointments for them two days hence with the Op-09 ocean surveillance coordinator, Capt Tom Dwyer, a veteran in electronic warfare, and DIA's Mac Showers, long-time supporter of GRAB and POPPY. An impromptu exchange with Mayo's branch head, Jim Trexler, in a nearby office produced a comprehensive understanding of the complex [redacted]

~~(S/B)~~ On Wednesday, Reid Mayo, Ron Potts, Dick Wales (visiting from [redacted] Lee Hammarstrom, and several others from NRL went to NSA for a tour of ELINT analysis and processing complexes. K-4/SP was being reorganized by Ray Potts, to create divisions dedicated solely to data from the [redacted] of [redacted]

- [redacted] under John Conlon, was responsible for [redacted] and [redacted]
- [redacted] under Col John O. Copley USAF, was responsible for [redacted]
- [redacted] was staffed by two dozen NSA civilians, led by Charles Cram, and was responsible for POPPY/[redacted] (Program [redacted] had just one veteran of the GRAB era, [redacted] who had participated since the launch of GRAB 2.

[redacted] chief Charles Cram conducted a technical interface meeting. [redacted] the ASA station at [redacted] was planned, and he had proposed internally that the POPPY collection equipment be [redacted], provided that the Navy pay for digitization. Reid Mayo regarded this sort of horse trading as unseemly, particularly since NSA was the greatest beneficiary of digitized data. Cram acknowledged the point and agreed to furnish [redacted] with virgin tapes for digital recording, to reduce the high incidence of parity errors experienced with heavily used tapes.

~~(S/B)~~ [redacted] that started with the [redacted] but Ray Potts (who was not present for this meeting) had ruled against broader dissemination, due to the absence of confidence ellipses in the message reports. Debate with K-4/SP's mathematicians on error modeling foundered on insufficient knowledge of ephemeris uncertainty all around, and the visitors agreed to pursue this question with NavSpaSur. A degree of skepticism had set in at NSA since [redacted] earlier vote of confidence, due to several recent priority-precedence messages from [redacted] reporting that the [redacted] Not until this meeting — when NSA's participating elements were informed by Ron Potts of algorithms used in the field and on details of determining [redacted] locations — did [redacted] head of operational ELINT in A-Group, regard them seriously enough to later query [redacted] characteristics. Unidentified signals expert Kenneth J. Gallagher (K-461) remained skeptical: [redacted] collection with reports of visual sightings. [redacted] The information resulted in NSA's deletion of [redacted] from the EPL and cessation of ELINT community tasking for the signal. On a visit to [redacted] two months later, [redacted] personnel that his office had been able to reconstruct that [redacted]

~~(S/B)~~ RAdm Showers was informed Thursday morning about field capabilities to detect, classify, and geolocate radar signals [redacted] At his referral, the same information went next to RAdm Francis J. Fitzpatrick, ACNO (communications and cryptology) and commander, Naval Communications Command; then to his assistant for cryptology, Capt Chester G. Phillips. For these discussions, a simple world map, a commonplace feature on walls of executive offices of that era, was the only prop, and there was no script. Tracks were drawn with a finger or pointer, ships and radars and parameters were identified verbally, missile and ABM sites and test centers were pointed to and their associated systems named. ACNO (Comm) Fitzpatrick sent Reid Mayo and Ron Potts to the office of the ACNO (I), where the process was repeated. RAdm Harlfinger interrupted Potts' tracing of ship tracks in [redacted] to say that the CNO needs to hear this. His deputy, Frank Murphy, recommended that the Director, Program C himself inform Adm Moorer, so the two visitors spent the afternoon at Harlfinger's conference table producing a point paper.

(U) The NSG commander and assistant commanders received the wall map briefing from Lt Potts at NSG headquarters on Nebraska Avenue at the end of the

week, 22 November, as part of the agenda for a regular weekly briefing in the CNSG's conference room. After ascertaining that Rear Admirals Showers, Fitzpatrick, and Harlfinger were abreast of recent results, CNSG Cook asked for a system concept to exploit the technology for Navy support. Floyd Heindl arranged for recording of a two-hour briefing for the operations and logistics & material departments that afternoon.

~~(S/B)~~ On Monday, the POPPY system point paper for CNO was reviewed and rearranged by Lloyd Moffit, Chet Phillips, Cdr H. C. Quitmeyer (Op-76C), Fred Glaeser, and two members of the Naval Intelligence Processing System Support Activity (NIPSSA), Edward L. Barker and Charles A. Trombley. Reid Mayo amended figures in the cost section. The paper became a three-page NIC-2 memorandum for CNIC Harlfinger (25 Nov 68). Ed Barker, NIPSSA's technical director, agreed to provide [redacted] with weekly, couriered printouts of dated [redacted] and these helped further [redacted] development. Later that day in the Pentagon, Chet Phillips updated ACNO (Comm) Fitzpatrick and CNSG Cook, and they discussed Navy exploitation of the operational capability now being demonstrated.

~~(S/B)~~ In a meeting at the NRL, Richard J. Anderle of the Naval Weapons Laboratory was read into the Byeman control system and briefed on criticality of knowledge of [redacted] and confidence regions. Within a year, orbit prediction software written by NSGA [redacted] was replaced with a Brouwer-Lyddane model fitted to the POPPY orbit by Dick Anderle's team at Dahlgren. In another year, with support from NRL's Fred Raymond and HRB's Thomas F. Lawton, Richard H. Smith, Jr. of NavSpaSur in Dahlgren, Virginia, would lead production of extended-theory ephemeris elements tailored to the exacting needs of POPPY and furnished daily to NSA and digitized sites. The TOG, too, was pleased at the payoff. Digitization of [redacted] and of the Army station at [redacted] urged by Army ACSI, ranked first and second on the TOG's list of priorities.

(U) NRL's Charlie Price, who handled facilities for the division, undertook deployment of additional air conditioning capacity for [redacted] which would end frequent BTM-9 digital recorder outages and free the computer for processing. Reid Mayo's section had grown to [redacted] government civilians, responsible for payload and ground segment development and for O&M support to the sites. There were another nine vacancies to be filled, chiefly in Fred Hellrich's unit, when ceiling points and qualified personnel could be found. Personnel shortages and digitization had induced a significant degree of reliance on HRB-Singer, which now provided [redacted] full-time personnel. In NRL Building [redacted] HRB men supported ground systems R&D; another, logistic support. At the main plant in State College, Pennsylvania, [redacted] people performed software development; [redacted] hardware production. [redacted] others were at overseas locations. HRB's [redacted] was managed by Eugene C. DeMark. Mayo was designated as scientific officer on the ONR contract.

~~(S/B)~~ Agreements were reached at the HRB plant among Dick Wales, Bob Daniels, Michael D. Keebaugh, Joseph L. Riale, and William W. Bickham, Jr. on prioritization of software problems and enhancements, as well as allocation of work to HRB and [redacted] (represented by Ron Potts). Applying a Taylor series for a function of two variables, Bill Bickham had worked out the mathematical equations for a non-linear programming gradient-search algorithm and was now writing the FORTRAN code for emitter location (EMLOC). His product would reduce [redacted] computation time, for a good signal, from a typical [redacted] Computer scientist Earl D. Lybarger from HRB had begun a 20-month tour at [redacted] in October and was already writing a program to [redacted] and [redacted] which would be used by the digital analyst on watch to identify candidate [redacted] lessened reliance on [redacted] and was a first step toward automatic [redacted] tailored to target signals. Lybarger was also investigating [redacted] which might halve the time needed for signal isolation.

~~(S/B)~~ Adm Waldemar F. A. Wendt, commander in chief, U.S. naval forces Europe, and his deputy, RAdm Joseph B. Tibbetts, were wall-map briefed at his headquarters in London by Ron Potts on the first Monday in December. At Wendt's suggestion, the staff cryptologist and director, NavSecGru Europe, Capt John A. Skinner, directed NSGA [redacted] as one of his administratively subordinate commands, to begin electrically sending [redacted] reports to CincUSNavEur N2 (intelligence) [redacted] Toward the end of 1969, after an extensive period of evaluation, the N2 (which was not Byeman-briefed into the POPPY technology and techniques) began incorporating, without attribution, [redacted]

OpNav Action

(U) Ocean surveillance needs had come to the attention of the PSAC. RAdm Evan Aurand, director of the long range objectives group in the office of CNO (Op-93), was appointed by CNO Moorer to serve as the Navy liaison officer to the PSAC's naval warfare panel. (Moorer himself had directed Op-93 six years ago.) As was the case for the ABM/AES threat, the PSAC took an analytical approach to the problem, reviewing requirements, deficiencies, alternative solutions, specific programs, and projects in the study phase. Within the office of CNO, assignments to provide information were given to elements under fleet operations and readiness, development, intelligence, ASW programs, and the Navy space program; under CNM, NavAir participated (3 Dec 68). RAdm Bill Moran, an aviator, had just taken his new position as director of the Navy space program division in the office of CNO (Op-76). He inherited an office and budget already committed to exploratory development of an [redacted]

[redacted] For Op-76, the PSAC naval warfare panel provided another forum to advocate development of the Program 749 concept. Similarly, Op-92 advocated ELINT satellites. Radar would detect iron on the water; ELINT could determine whether it was friend or foe. The technologies were already available; the hard part, for OpNav, was to get funding to implement them.

~~(S/B)~~ ACNO (I) Harlfinger sent CNSG Cook a formal letter statement of the need for a "Program C facility" [redacted] (30 Dec 68), to be included in the system concept. (The terms 'Program C' and 'Program Charlie' were used as cover names in unclassified correspondence, to refer to DoN participation in the covert NRP. Such correspondence contained no association with NRO, space, or SIGINT.)

~~(S/B)~~ NIC conducted the ocean surveillance presentation for CNO Moorer on Wednesday of the second week in the new year. Lloyd Moffit's compartmented, scripted briefing covered Program C's mission, elements, organizations, technology, national tasking, reporting, and potential use against the Russian naval threat. The director of the Navy space program, ACNOs (intelligence, communications & cryptology, long range objectives), VCNO, CNO, and the Navy secretariat were aboard, and all the elements were now in place to begin a concerted OpNav effort to exploit the particular technology, under the umbrella of the PSAC panel's broader ocean surveillance requirements analysis. Several fundamental questions needed answering in detail. What could POPPY do to aid in meeting the world-wide threat to U.S. naval forces? What area of the threat can be addressed by POPPY? What can be done to bring POPPY to bear on these threat areas? What are proper areas for future POPPY employment to support naval operations. ACNO (I) Harlfinger agreed to form an executive tactical operating group (ExTOG) to address the CNO's questions and develop future plans. After the meeting, Adm Moorer wrote a personal letter to the project officer at [redacted] expressing his interest and expectations for "important contributions in the future. I look forward with great pleasure to hearing of further progress in your work" (8 Jan 69).

~~(S/B)~~ The ExTOG first met on 6 February. The group consisted of seven rear admirals from OpNav, two captains, and three civilians. Among the flag officers were Vincent dePoix (Op-07B), William Leonard (prospective Op-07B), Fritz Harlfinger (Op-092), Bill Moran (Op-76), and Evan Aurand (Op-93). (Two others, J. E. Dacey and M. D. Carmody, were from fleet operations and readiness, later surface warfare). Civilian members Howard Lorenzen and Reid Mayo informed the group of technical capabilities, recent successes in locating Soviet combatants at sea, and future plans for launches and site digitization. DirPrgmC Harlfinger disclosed the goals of soliciting USIB approval for use of POPPY for ocean surveillance, employment of the system [redacted] ground site in [redacted] and investigating alternatives to sites on foreign soil. Members took assignments to gather details for future meetings, every other month. Harlfinger submitted a report of the first meeting to CNO Moorer via VCNO Clarey (24 Feb 69).

~~(S/B)~~ Fred Glaeser of NIC-2 authored a letter that the Navy SORS member, LCdr Judson K. Cokefair, signed and submitted to the chairman (8 Feb 69). The letter informed the SORS that the U.S. Navy was responsible to the JCS for ocean surveillance, pointed out that "greatly increased Soviet naval activity in many areas of the world has in turn increased the Navy's Ocean Surveillance responsibilities on a world-wide basis," summarized [redacted] performance on Soviet shipborne emitters, and asked the SORS to approve and forward to the USIB, via the SIGINT committee, the Navy's request for tasking, through the NRO, all NRP ELINT systems for ocean surveillance. The NRO member attributed the POPPY results to luck and strongly opposed NIC's request. The NSA member, John Libbert, was unable to corroborate the performance summary, since [redacted] Chairman [redacted] ended an unproductive debate on 19 February by asking Judd Cokefair to arrange a briefing on the Navy position a month hence.

Chapter 11 References

14 Aug 67 — NSGC (S/B - codeword) message to Siss Zulu sites, 141810Z Aug 67, Cite G52C/807-67
Subj: [Not-to-interfere tasking for basic Soviet shipborne emitters]

6 Nov 67 — Senior Member, Navy Space Program Review (1967) (TS/B) letter to CNO, BYE-23081/67
Subj: Supplement Report

17 Nov 67 — DCNO (Dev) letter for CNO
Subj: A Report to the Chief of Naval Operations on Navy Space Program Review by The Ad Hoc Working Group

[redacted]

23 May 68 — ComSixthFlt message to CNO, 231350Z May 65
Subj: [Photo intelligence deficiencies]

23 Aug 68 — DepSecDef memorandum for SecArmy, SecNav, SecAF, BYE-73268-68
Subj: Department of Defense Satellite-Borne Earth Sensing Activities

Sep 68 — Trip Report Captain L. W. Moffit 10-30 August 1968
Encl: (2) (TS/B - codeword) Program "C" and Related Items of Interest, NavIntCom-2, BYE-64668-68

[redacted]

4 Nov 68 — Director of Intelligence and Research (S) letter to the Secretary, RSE-159
Subj: Growth of the Soviet Mediterranean Squadron

25 Nov 68 — NIC-2 (TS/B - codeword) memorandum for CNIC, NAVINTCOM-2/hs, BYE-64699/68
Subj: Ocean Surveillance with the POPPY ELINT Satellite System

1968 — Robert S. McNamara, *The Essence of Security: Reflections in Office* (New York, Evanston, and London: Harper and Row, 1968), p. 16

3 Dec 68 — Navy Liaison Officer, Naval Warfare Panel (S) memorandum for distribution list, Op-93/afc, Ser 00133P93

Subj: PSAC Naval Warfare Panel, 5 December 1968, agenda and briefing responsibility (U)

30 Dec 68 CNO (Op-92R) (U) letter to CNSG
Subj: [redacted]

8 Jan 69 Adm Thomas H. Moorer (U) letter to Lt Ronald L. Potts
Subj: [Siss Zulu]

8 Feb 69 Navy Member SORS (TS/B - codeword) letter to Chairman, SORS, NIC-230/kfp, BYE 65614-69
Subj: [Tasking of NRP Systems for Ocean Surveillance]

24 Feb 69 ACNO (I) (TS/B - codeword) memorandum for CNO via VCNO, Op-092/kfp, BYE-65622/69
Subj: Report on Meeting of Executive Tactical Operating Group (EXTOG)

Chapter 12. MULTIPLE MISSIONS

(U) *Capabilities of overhead systems were applied to a number of national intelligence problems: general and ABM search, technical intelligence, and EOB production. Seeking to obtain timely and accurate information on the disposition and movements of Soviet fleets, the DoN endeavored to get the USIB to recognize ocean surveillance as a national intelligence objective. Tasking constraints provided an impetus for development of dedicated resources.*

Processing Priorities

~~(S/B)~~ Work at [redacted] on Soviet naval targets remained on a not-to-interfere basis. In December, after the [redacted] cancellation, NSA specified priorities for POPPY field processing, initially [redacted] and two T (temporary) signals yet to be correlated with antennas. NSA soon also evaluated previously reported [redacted] and provided technical feedback, including [redacted] determined by K-46 on the same intercepts. The feedback [redacted] of selected signals produced more accurate results than could be obtained by [redacted] implemented a numerically scored quality rating, based on [redacted] were reported only if the signal was of high interest. HRB's Bob Daniels was looking into probabilistic theory of confidence ellipses, but, in the meantime, the [redacted] benchmarking and quality ratings gave Ray Potts enough confidence to begin including results of field analysis in NSA's reports.

~~(S/B)~~ [redacted]

candidates, including several from POPPY, and the [redacted] would remain the highest priority until its detection years later, first by conventional systems, thereafter by overhead. (One of [redacted] candidates turned out to be a variant [redacted]

~~(S/B)~~ NSA's regional director for Europe, BGen Philbin USA, visited [redacted] in early February, guided by John Skinner [redacted] DirNSAEur and DirNSGEur were informed of priorities and [redacted] They asked about potential system changes that could improve productivity and received some recommendations, chiefly tasking changes, more satellites, and more [redacted] — supported by computations and illustrations in a techniques manual prepared for CNSG Cook (3 Feb 69). Philbin emphasized the need to stay abreast of [redacted] NSAEur was added to the POPPY Talent Keyhole reporting distribution. [redacted] locations of the [redacted]

~~(S/B)~~ Results of field processing appeared in NSA's ELTs and ELOs. Stephen Roman was [redacted], responsible for analysis, location, and dissemination of POPPY end product. He submitted to the TOG an agenda for site visits to be made by himself and [redacted] deputy chief of the division. They would brief on the K-4/SP reorganization, POPPY accomplishments over the years, new SOIs, and forthcoming Mission [redacted] They would become informed on site operations, equipment, and analysis techniques. The planned itinerary included, in sequence, [redacted] none of which had been visited by K-Group representatives since 1966; return to NSA for debriefing; then schedule a visit to [redacted]. NSG added Lt Andy Michael (G524B) to the team.

~~(S/B)~~ During a stopover at [redacted] on 4 February 1969, the team paid a courtesy call on Capt Fred Hitz, director for NSA [redacted] The father of the GRAB operations management protocol was briefed on current POPPY operations and technological improvements, emphasis on development of [redacted] location techniques for ocean surveillance, and ongoing efforts to secure funding to digitize [redacted] During the 18-day trip, the team spent several days in the reconditioned building of each [redacted] site:

- In the [redacted] personnel were interested in their chances of getting a computer system to locate [redacted] Lt Michael advised that the NRO comptroller was trying to find [redacted] for this purpose.
- At the [redacted]/POPPY operations building near Army Security Station [redacted] requests were received and endorsed for supervisory and analysis personnel to make 10-day visits to [redacted] for familiarization in analysis techniques and exchange of ideas.
- At [redacted] NavCommSta [redacted] the operations building and all hands were nearly ready for installation of the SEL 810 computer system, due to arrive two weeks hence. NRL had just completed installation of a second-generation interrogation antenna, controllable in both azimuth and elevation.

~~(S/B)~~ During the [redacted] tour, there was hopeful talk of assigning an NSA representative to each site, but nothing ever materialized. Along the same line, NSG had established two Siss Zulu analyst billets in K-46 and incumbents would be recycled to field sites. Team reports constituted a mini-IG for POPPY operations with constructive recommendations, including a shopping list for facilities, physical security devices, equipment, billets, documentation, and procedural enhancements. [redacted] and Steve Roman committed to meet these needs:

> In our view, the cost of the POPPY Project is more than adequately justified by its inherent intelligence production potential. This potential could be more fully realized by improving or correcting the conditions noted in this report. K46 intends to proceed accordingly, and will take whatever action is necessary to implement the recommendations contained in this report through NSG, NRL, NAVINTCOM, or on our own. (28 Apr 69)

Andy Michael recommended that similar site visits be instituted on a regular basis (3 Mar 69).

NSG Special Operations Division (G54)

~~(S/B)~~ CNSG Cook had moved Siss Zulu to the second echelon, establishing a headquarters special operations division (NSG G54), focal point management for Siss Zulu. G54 was an O5 billet, which would be occupied that summer by Cdr Ross W. Olson. In the meantime, Floyd Heindl's relief, LCdr Lloyd H. McGraw, acted as division head. G54 was responsible for interfacing with tasking authorities (NSA and an NRO SOC detachment being established at Fort Meade); with NSA's technical ELINT organization (data exploitation and feedback to sites); with NRL (satellite anomalies and site upgrades); and with NIC and DIA (exploiting satellite data for Navy needs). President Nixon had taken office the previous month and was intent on winding down the war in Vietnam. Budgets were tight due to the war. Operations would terminate at the last Air Force POPPY site, [redacted] at the start of the new fiscal year in July — to offset CCP funding of a computer system for the Navy site in the northern Pacific. The administration's perspective on overhead systems was not clear. A new DNRO, John L. McLucas,

was soon to be sworn in. DNRO Alexander Flax had been supportive of POPPY, but his influence was already diminished and the Bureau of the Budget, under new management, had set its sights on Program C. NIC referred the budget examiner, Charles Sorrels, to NSG's Lloyd McGraw. Sorrels had gotten the impression that the NRO needed POPPY to keep the Navy happy and had concluded that the Program C sub-element might well be cut from the NRP budget. His perspective was fiscal, but he understood that NRO's primary ELINT mission was to [redacted] and he knew that newer Air Force systems were flying and in the pipeline for just that purpose.

~~(S/B)~~ Recognizing that the budget examiner's impressions of mission priorities were out of date, McGraw arranged for Sorrels to visit [redacted] where he was briefed the better part of the morning on capabilities, tasking, and results. He kept returning to the concept of [redacted], which he found difficult to appreciate, having expected something more esoteric. Efforts at explanation and diagram failed, until, in a hallway enroute to the operations floor, an analogy was hit upon. Lt Potts pinched the arm of the activity's commanding officer, a lieutenant commander, and the CO pinched Sorrels' arm — which did the trick. On the operations floor the NRP budget examiner was briefed by the watch supervisor, Petty Officer Lloyd C. (Red) Fraser, and he witnessed a live pass as sailors commanded the satellites, tracked downlink signals, collected data, and made log entries of SOIs detected on-line. He then saw a watch analyst dissect a technical SOI in the off-line analysis room while the analog chief, Ronnie Brooks, explained the [redacted] patterns on dual beam oscilloscopes, and functions of the test oscillators, audio spectrum analyzer, oscillograph, brush recorder, and special stop watches. In the computer room he witnessed successful post-pass digital processing for [redacted] and listened, above the line printer clatter, to explanations of each step by the leading digital analyst, Petty Officer James M. Arnold. Questions regarding maintenance and logistics support of the electronic equipment and computer system were answered by Senior Chief Paul L. Lenker, who also described some modifications he had made to Ampex tape drives. Manually maintained [redacted] files and ship tracks penciled on maps were explained by Petty Officer William T. Chumbley. These events were somewhat staged, in that the briefing and pass demonstration were timed for payload tasking conducive to productivity, and this fact was acknowledged to the visitor. Had he arrived earlier or later, the pass may have preceded the viewgraphs. The command sent its required message report of the visit to NSG headquarters, and Lloyd McGraw continued the dialogue with Charles Sorrels. [The Bureau of the Budget never again raised its axe over POPPY and, in fact, became too zealous an advocate. A challenge from the successor Office of Management and Budget (OMB) to the DoD in 1973 would nearly scuttle [redacted] before it got off the breadboard stage — in favor of sustaining the less costly POPPY system.]

~~(S/B)~~ The system concept document for [redacted] was available for review as OpNav prepared to state the need for support from NRP systems. [redacted]

[redacted] expanded ELINT mission to include [redacted] production, and [redacted] appealed to many reviewers in OpNav and NavIntCom. There was some fantasizing about having such a capability at the Battle of Midway. Reviewers at the NRL and the NSG noted [redacted] and the amount of intercept time it would take with [redacted]

~~(S/B)~~ While NSG and NRL prepared to support NIC's briefing to SORS, an indirect testimonial was received on POPPY's contributions to the ABM problem from one of [redacted] payload subcontractors. The draft of a proposal to SAFSP from [redacted] began:

> Within the overhead program, the general belief has existed that intercept of radar main-beams is a venture with low probability of success. This long accepted assumption should be seriously challenged [redacted]

[redacted]

Navy Request to SORS

(U) A NIC presentation was given to the SORS during a Wednesday morning meeting in room 7Z24 at the CIA headquarters in Langley, Virginia, on 19 March 1969. Chairman [redacted] stated the concerns: competition with the principal responsibility (ABM), resource constraints, doubts about current systems' capabilities, and incompatibility with systems' design characteristics tailored to produce intelligence from denied areas. The Navy presentation was conducted by Lloyd Moffit, who introduced his team. Lloyd McGraw and Fred Glaeser took notes.

~~(S/B)~~ Reid Mayo briefly described future capabilities related to the forthcoming September launch of POPPY 6 and ongoing upgrades to ground systems, including digitization for [redacted] which had just been authorized by former DNRO Flax (7 Mar 69). [redacted] Ron Potts briefed with viewgraphs for three-quarters of an hour on POPPY [redacted] signal identification and reporting procedures, basis and method for location finding, types of emitters located, [redacted] tasking constraints, and factors affecting location accuracy. Two examples of tasking inefficiencies were cited: [redacted] had failed over a year ago, one [redacted] Lee Hammarstrom pointed out that [redacted] processed every intercept of SOIs designated for location finding by

NSA; cited ABM firsts in two published reports each from CIA, NSA, and DIA, to show that POPPY was fulfilling its ABM search mission; and suggested that opportunities for increasing shipborne emitter intercepts could be increased by modifying existing task groups. While he had the floor, he used a new metric developed by himself and Tom Lawton — a product of [redacted] — to extol the merit of [redacted] To put the metric's very large numbers in perspective, Hammarstrom mentioned that [redacted] operations with [redacted] POPPY [redacted] in 1968 [redacted] could deliver in a search mode in a full year of continuous operation. A group of personnel from Program [redacted] was in attendance, awaiting its turn on the SORS agenda, and the metric provoked a lively and heated exchange, which ended only when Moffit unplugged the overhead projector and reiterated the OpNav position to the SORS chairman.

~~(S/B)~~ [redacted] informed Lloyd Moffit that he should not ask the SORS to cover the waterfront, he had to be more specific and say just what he wanted. He indicated that an ocean surveillance requirement needed careful statement, including comparison between accuracy produced and required. NSA's Ray Potts interjected that K-46 had recently processed data corresponding to [redacted] locations, [redacted] of which went through the system, [redacted] which required manual interface. K-46 and [redacted] results on known benchmarks typically agreed to [redacted] Hammarstrom mentioned that accuracy would be further improved by the forthcoming [redacted] model, and Ron Potts added that [redacted] was now [redacted] error by correcting for differences in [redacted]

~~(S/B)~~ [redacted] contended that SORS needed more time to act and a detailed mission statement: accuracy desired and accuracy usable, priority by ship class, reporting timeliness, signal targets, and whether processing was to be done by field sites or NSA. He was concerned with long range impacts and interference with approved missions, including the implicit need to design payloads and general processing for ship emitters. Moffit asked whether the request would be forwarded to the SIGINT committee and USIB. (Since VAdm Vernon Lowrance, former DNI and DirPrgmC, was the Pentagon's member of USIB, for he was now in his third year as deputy director of DIA, NIC would welcome a change in venue to the USIB.) [redacted] responded that the USIB was already alerted and that the Navy first needed SORS approval, which could be approached in three steps: settle for a provisional capability now, establish and define specific longer term goals, and determine trade-offs on system design. He suggested reworking the memo request of 8 February, which was too open-ended; taking six to nine months to define specific goals; and then working longer term problems and definitions. The NRO member, [redacted] added that simple task group changes could be accommodated for POPPY, [redacted] of other systems simply would not support a worldwide ocean surveillance mission, but that Program [redacted] was coming [redacted] NSA's John

Libbert suggested that the SORS endorse continued R&D, more definition of the Navy need, allowance for some interference with the primary mission to expose possible problems, and Navy efforts to get specific authorization for a worldwide system. Moffit questioned the route such efforts should take: SIGINT committee? USIB? The CIA member [redacted] responded that the SORS needed time to consider that question. [redacted] opined that there was a narrow line between being an NRP resource provider and consumer (alluding to Moffit's dual role as spokesman for Program C and naval intelligence). He offered to work closely with Program C to develop an approach. [redacted] exclaimed that the line ought to be wide and ended the meeting on that note.

(U) After the meeting, Col Lew Allen, Jr. USAF of the NRO engineering directorate asked Reid Mayo for a tour of NRL's facilities and a chance to see the space hardware. It was arranged that he would see the same demonstration then being prepared for a forthcoming visit to the NRL by CNO Moorer.

~~(S/B)~~ The briefing on POPPY was well received, but neither the oblique criticism of [redacted] nor Moffit's request, during the discussion, to task all overhead systems to support the Navy were appreciated. POPPY already had its priorities. Coverage by [redacted] Systems other than POPPY were [redacted] Existing data handling and processing capabilities could not support a worldwide requirement for timely reporting. The SORS had asked Navy to say just what it wanted. The Navy really wanted general recognition of ocean surveillance as a national intelligence objective, not just a Navy responsibility to the JCS. It was becoming clear to Lloyd Moffit that the weekly SORS meeting was not the right forum.

Ocean Surveillance Capability Proposal

~~(S/B)~~ Concluding, during a post-mortem of the SORS briefing at the NSG headquarters, that the Navy need could not compete with higher national priorities for use of satellites and convinced that POPPY technology was affordable and effective, CNSG Cook directed McGraw and Potts to transform the manual on ship location techniques into a concept proposal. After agreeing on an outline and writing assignments, the two officers typed each day, until quitting time approached; reviewed each other's work; and used scissors and scotch tape to merge the drafts. Telephone conversations with Reid Mayo resolved questions on technical feasibility and cost estimates. The paper (titled 'The Development of an Ocean Surveillance Capability') was completed in March.

~~(S/B)~~ Before the paper was finished, as if to reinforce Cook's conclusion on priorities, [redacted] reporting for all POPPY collection sites was reinstated [redacted] At the end of the month, NSA issued a positive progress report

on Mission [redacted] that may have reinforced SORS reluctance to endorse diversion to ocean surveillance. Particularly supportive of continuing the search mission was an enclosure titled, [redacted] as follows:

> A great deal of the success achieved against the Soviet ABM effort can be attributed to the collection and processing efforts of POPPY. The success of the POPPY vehicles in detecting those signals can in turn be directly attributed to the [redacted] capability designed into the system from its inception and the demonstrated capability that [redacted] intercept does give a high probability of intercept of new emitters in the R&D testing phase. Stated in the most direct terms, all of the ABM signals detected by SIGINT satellites were detected first by POPPY.
>
> Past successes of notable interest are listed below by signal: (31 Mar 69)

There followed the particulars of POPPY firsts on every signal in the [redacted] By this time, NSA had produced [redacted] from Mission [redacted] data.

(U) CNO Thomas Moorer visited NRL Building [redacted] on 8 April 1969 to see pre-flight satellites and discuss their potential utility to the Navy. Several key figures in the effort to exploit space-based systems were present for a meeting in Room [redacted] including RAdm Evan Aurand, director of the long range objectives group (Op-93); RAdm Bill Moran (Op-76), RAdm Tom Owen, chief of naval research (CNR); RAdm Ralph Cook (CNSG); Capt Wendell J. Furnas and Charles Trombley (NIPSSA); Capt Moffit, who represented ACNO (I) Harlfinger; and NRL managers, including Capt Jim Matheson, Director of Research Alan Berman, Associate Director Claude Cleeton, Fred Welden, Reid Mayo, and Pete Wilhelm. DirNRL Matheson welcomed the visitors to his command. Fred Welden, standing in for Howard Lorenzen, previewed the agenda, informing the CNO that the briefing and tour would deal primarily with space hardware developed at the NRL. Moorer responded that he was glad to be there and wanted to hear about everything.

~~(S/B)~~ Reid Mayo described the POPPY system, operational highlights, and imminent coverage of [redacted] where the computer installation was just being completed that month. [redacted] potential capability to locate [redacted] intercept, was of particular interest to naval aviators in this group (Moorer, Aurand, Moran, Moffit). Mayo informed the CNO of recent approval to digitize [redacted] — which had been funded by NSA (18 Mar 69) through the NRO, following unsuccessful efforts to obtain [redacted] from the NRO — and the likelihood that the [redacted] operation would be terminated next year. NIPSSA's Charlie Trombley briefed on POPPY's shipborne-emitter locations, including a plot of the [redacted] six months ago, and favorable after-the-fact comparison with all-source information in NIPSSA's data base.

~~(S/B)~~ Discussion fully informed the CNO of difficulties in applying NRP capabilities to Navy needs. It was agreed that NIC would coordinate with DIA to press the issue in the USIB (meaning that CNIC Fritz Harlfinger should talk with DepDirDIA Vern Lowrance). CNO Moorer was anxious about digitizing [redacted] (due to the [redacted], and he asked why he was

not informed of difficulties on funding. He enjoined the group to get out of the nickel seats and put an Old Granddad label on the system, leaving no doubt that he was in earnest. Bill Moran assured him that everything that could be done, was being done. Ralph Cook interjected that a proposal for dedicated satellites had been prepared and would shortly be sent out for technical coordination with NIC and NRL. During Pete Wilhelm's guided tour of Room 409, which included introductions to key personnel, the CNO and his party were shown the four assembled 220-pound [redacted] (POPPY 6), then being tested, and five smaller NRL satellites that would go on the same launch. The tour ended with a live demonstration of real signals transponded from [redacted] so the visitors could hear and see the same cacophony downlinked many times each day to the [redacted] collection sites [redacted]

~~(S/B)~~ Next morning, some of the NRO managers overseeing Program [redacted] development took a closer look at the NRL and POPPY. Included were Bill Boenning and Col Lew Allen from the NRO staff; Col Dave Bradburn, director of [redacted] and LtCol [redacted] project director for [redacted] Mayo covered the NRL overview, pointing out that the total annual effort on POPPY had grown to [redacted] man-years. Because the last known exposure of POPPY to [redacted] had been the ABM/AES technical committee over two years ago, Mayo presented updated versions of charts used to brief the PSAC panel at that time. He conveyed, but did not quantify, improvements in EOB accuracy at closer spacing, due to better timing. Regarding the [redacted] capability for ABM signals, he acknowledged that results had been modest and the capability was not being tasked operationally. Pete Wilhelm briefed on the schedule for the forthcoming Thorad Agena D launch and space technology, with emphasis on new techniques being employed in the [redacted] Bradburn and [redacted] departed after the briefing, but Wilhelm took Bill Boenning and Lew Allen to see the space hardware and chambers used for testing, including anechoic, thermal-vacuum, system test temperature, and vibration. Allen was particularly interested in the gravity gradient stabilization technology, micro-thrusters, [redacted] and he commented that NRL's resources and expertise were far greater than he had known. During the walk-through, Mayo informed the colonel of interest from Navy's senior management in new capabilities for tracking Soviet warships.

~~(S/B)~~ That day, 9 April, was a long one for Reid Mayo. NSA was next on the schedule. [redacted] brought eight members of A and B groups to the NRL for an afternoon discussion of POPPY's operational ELINT results and ship tracks. Afterwards, Mayo briefed historical highlights of intelligence contributions to members of the electronic warfare division and the satellite techniques branch. [redacted] arrived at 6 P.M. with [redacted] from the Army Missile Command's Redstone Missile Intelligence Directorate, Huntsville, Alabama. Bachman's interest was solely in Soviet missiles, and his appreciation of ELINT and [redacted] depended on their contributions to intelligence on ABM and SAM systems. As midnight approached, the three men were converging on a vision of future

complementary uses of [redacted] POPPY and [redacted] tuned Program [redacted] against the missile threats.

~~(S/B)~~ While Reid Mayo and Pete Wilhelm were informing the CNO and intelligence community of POPPY capabilities, Howard Lorenzen was informing major European commands. He returned in time to participate in a briefing on 14 April for several members of the office of DDR&E who were studying the Program 749 satellite radar concept. Lloyd Moffit discussed Navy needs. Lloyd McGraw covered ship location and [redacted] by means of the viewgraphs prepared by Ron Potts for the SORS meeting. Next day, DNRO John McLucas visited NRL Building [redacted] In attendance were the director, BGen Russell Berg, and several members of the NRO staff, including engineering director Bill Boenning, [redacted] and technical adviser [redacted] Representing OpNav were ACNO (I)/DirPrgmC Harlfinger and Lloyd Moffit. [redacted] represented Army ACSI. DirNRL Matheson conducted the briefing. Lorenzen briefed the history; Mayo, POPPY achievements and Mission [redacted] objectives; Hammarstrom, digital systems; Wilhelm, evolution of space hardware and techniques and the need for additional engineering equipment at [redacted] (an item in NRL's budget proposal for FY70). Before departing, the visitors saw the live demonstration and heard the voice of POPPY. [redacted] was disappointed that there had been no opportunity to voice a reclama on closure of [redacted] the sole Army site and the only one he had ever visited.

~~(S/B)~~ Nine days after the CNO's visit to the NRL, CNSG Cook sent the development proposal under a Byeman cover letter (17 Apr 69) to CNIC Harlfinger and DirNRL Matheson (by protocol, but intended for Howard Lorenzen — who had tried, in vain, to get an advance copy from McGraw while the proposal was still a draft). NSG proposed a dedicated ocean surveillance system based on POPPY technology: [redacted] to maximize collection at the sites; payload design-optimized and simplified for intercept of Soviet shipborne emitters; retention of [redacted] regions; and [redacted] billets per site. (A development cost of [redacted] had been estimated but was omitted from the final proposal.) Implementing action items were identified for NSG, NRL, and NIC.

(U) On 18 April, the Building [redacted] briefing and live demonstration were presented for members of the Navy secretariat, including Under Secretary John W. Warner and ASN (R&D) Robert Frosch. NIC was represented by Harlfinger and Moffit, who attested to the quality of information provided thus far and the potential for worldwide support to the fleet. With a go-ahead to formalize the operational need as a necessary prelude to exploiting the technology, Moffit set his staff in NIC-2 to work with the ExTOG on a formal statement of Navy requirements to use national systems for ocean surveillance. Five weeks later, SORS member Judd Cokefair submitted letter requirements for tasking national assets (23 May 69). In case of challenge to his credentials, he was armed with a letter on CNO letterhead:

From: Chief of Naval Operations
To: Navy Member SIGINT Overhead Reconnaissance Subcommittee
LCDR J. K. COKEFAIR

1. As Navy member of the SIGINT Overhead Reconnaissance Subcommittee (SORS) you are directed to request from SORS, at the earliest opportunity, authority for Navy to task through appropriate channels the NRP ELINT satellites for ocean surveillance support.

/s/ T. H. Moorer (23 May 69)

(U) Unable to find an opening in his workday schedule, VCNO Bernard Clarey went to NRL Building [redacted] early on 27 May and, starting at 0730, received from Claude Cleeton, Reid Mayo, and Pete Wilhelm nearly the same briefing and live demonstration provided to the CNO seven weeks ago. NIPSSA was not represented to brief ship tracks, so Mayo showed the message report of the very first [redacted] location, the one that [redacted] which was a bit of an embarrassment, but the visitor was pleased it could be done at all and there was no need to apologize. Adm Clarey graciously observed that the [redacted] to the sea and that the [redacted] Near the conclusion of the meeting, the VCNO echoed the CNO, saying that we have got to get this out of the nickel-dime stage, perhaps a first indication that DoN would need to transition from R&D status to operational systems development [which would start in three years].

(U) Lorenzen and Moffit had recognized a hole in NSG's proposal. The paper did not address how the system would be funded, and there were no action items in this regard. Systems with national missions were funded through the SAFMS. Nor could a system designed uniquely to support the Navy stand a chance of being funded by the DoD's general support program element, managed by the OSD. OpNav sponsors of ships, aircraft, and weapons were not likely to give up the equivalent of a couple 4000-ton frigates to fund NRL's development of less than a ton of classified space hardware. The proposal was circulated, read, and commented upon. Fred Welden advocated a more substantial role for NIC in evaluating and disseminating data to the fleet. Pete Wilhelm preferred beefing up [redacted] to NSG's proposal for a new site in [redacted] NIC convened a meeting of the ExTOG on 18 June to discuss NSG's proposal. The OpNav managers focused on those aspects that did not entail a [redacted] outlay for [redacted] satellites and two launchers, namely, ground sites, equipment, and billets.

~~(S/B)~~ Near the end of June, as the turn of the fiscal year approached, Pete Wilhelm learned that the NRO intended to defer FY70 funding for three items associated with [redacted] A/D systems for [redacted] facilities test equipment and fabrication for [redacted] and operational field assistance for [redacted] These items had made it through the programming and budgeting cycle and were included in the Air Force appropriation for the new fiscal year, but the NRO staff was not convinced of their need. Therefore, [redacted] informed DirPrgmC by letter that the items were deferred, pending further discussion and justification. Program C's purchasing power was based on [redacted]

[redacted]

Special Navy Tasking

(U) Starting late June (finishing the end of October), the major elements of NIC headquarters relocated from the Pentagon's 5th floor to leased office space at the Hoffman Building in Alexandria, Virginia. ACNO (I)/CNIC Harlfinger remained in the Pentagon, his OpNav code having been changed to Op-092 (indicating that he reported to the VCNO, Op-09). During this time of transition, Op-092 and NIC continued efforts to get intelligence community recognition of ocean surveillance as a national objective and to plan special tasking for [redacted] The campaign was boosted by a complaint from the command of the Army officer who had represented the president, nine years ago, in tasking GRAB. Gen Andrew Goodpaster (CincUSEurCom) cited [redacted] region, and he stated the need for all-source location information on units of the [redacted] (26 Jun 69). Within NIC, the CincEur letter was referred to NIPSSA's technical director, Ed Barker.

~~(S/B)~~ Following validation of the [redacted] situation by NIPSSA and NIC, CNO Moorer sent a memorandum to the SecNav, informing him of capabilities of the POPPY system (22 Jul 69). SecNav John H. Chaffee, in turn, sent a memorandum to the DepSecDef, informing him of the CNO's concern and the demonstrated capabilities of POPPY to support the U.S. Navy against the Soviet threat (24 Jul 69).

~~(S/B)~~ NIC's Fred Glaeser, in coordination with NSG's Lloyd McGraw, obtained authorization from the SORS and directed [redacted] to use, for a two-week period, suitably tasked [redacted] and ordinarily [redacted] to locate elements of a Soviet [redacted] naval surface force [redacted] and report intercepts to CincUSNavEur. This was first of a series of one-time special surveillance tasks authorized by the SORS to track specific Soviet [redacted] No changes were made, though, to the NRO detachment's formula for relative frequency of activating RF bands, which permitted collection of the target signals [redacted]

~~(S/B)~~ POPPY promptly demonstrated that mistakes could be made — and corrected. The digital analyst on a mid-watch located one of the Soviet warships, a [redacted] Thus POPPY missed the opportunity to correctly report to CincUSNavEur in London the [redacted] A corrected version was sent by day-workers after morning audit of the intercept report package and recall of the watch supervisor and digital analyst for questioning by the senior chief and lieutenant.

~~(S/B)~~ Another two-week special task was requested by NIC and authorized by the SORS for a second, anticipated [redacted] POPPY had continued tracking the ship [redacted] since its previous deployment and had already provided the first overhead intercept and [redacted] Using an average of four Mission passes per day, [redacted] were tracked as they [redacted] was used extensively by NSG and NIC in the early 1970s to brief POPPY and the potential for ocean surveillance by ELINT satellites. Experienced naval line officers receiving this briefing noted that [redacted] navigator fixed his ship's position by means of celestial navigation. In between times, as the navigator relied on dead reckoning, [redacted]

(U) On 15 August, NSG and NRL representatives went to the Hoffman Building in Alexandria, Virginia, to discuss a field site for the [redacted] region. NIC's Lloyd Moffit conducted the meeting, assisted by Fred Glaeser. With the Army site definitely scheduled for closure, its equipment would be available by mid-1970. An additional [redacted] would enable digitization. [redacted] had been Lloyd McGraw's idea. [redacted] was one of NavSecGru's pillars, [redacted] for communications intercept and now a [redacted] of the [redacted] network at the operations site near [redacted] Infrastructure was in place to support and administer a Siss Zulu field site. Its [redacted] latitude would permit [redacted] more visibility per day than [redacted] Wilhelm pointed out that command and telemetry functions had become more complex in the [redacted] He explained that his branch needed access to a complete ground configuration — for testing and on-orbit payload support and diagnostics functions — and NRL did not have the resources to establish a detachment in

[redacted] or go back and forth every time an anomaly was reported. Mayo fully and singularly appreciated both points of view — operations and engineering — but saw no way to reconcile them. To break the deadlock, Moffit suggested that a case might be made for two sites, offering the starting logic that different equipment configurations would be needed for operations and engineering, even if there were only one site. A consensus was not reached, but Moffit concluded that both options should be pursued. Wilhelm and Mayo considered this approach whimsical, since neither option was yet funded. On that same day, SAMSO's [redacted] finalized the basic MIPR of [redacted] for FY69, which reflected the [redacted] deferral pending resolution of the [redacted] issue (15 Aug 69).

~~(S/B)~~ NRO's Bill Boenning visited [redacted] on 5 September 1969, toured the facility, and listened to Pete Wilhelm's justification for new equipment and software to support in-flight calibration, diagnose payload anomalies, and measure performance. Payload receivers tended to drop pulses as they aged, and Mission [redacted] was already [redacted] beyond its [redacted] design life. Cross-talk situations were voltage-dependent, and voltages changed with age and available sunlight. NRL had no ready means to monitor these payload conditions or to verify site reports of possible payload data problems. Larger, more capable POPPY 6 satellites were already at Vandenberg AFB being readied for launch. Boenning offered to support an NRL reclama of the deferred funding. Reinstatement would enable [redacted] to collect, digitize, and evaluate ELINT data and to acquire on-site contractor support from the Bendix Field Engineering Office. Howard Lorenzen prepared a request to [redacted] that the deferral be reconsidered before Bill Boenning departed the NRO to rejoin NSA (12 Sep 69). Facility modifications for an expanded laboratory area and Byeman vault would be paid for by Navy MilCon funds.

First Priority

~~(S/B)~~ Mission operations were not perturbed by deliberations in Washington, D.C. ABM-associated radars were still designated for [redacted] reporting and for inclusion in [redacted] messages to NSA. The USIB had affirmed that ELINT [redacted] was the first priority for ELINT collectors; EOB and ELINT surveillance stood second. A Mission [redacted] pass collected by the Army in [redacted] provided the first indication that the [redacted] was operational and enabled NSA to determine that its function [redacted]

~~(S/B)~~ [redacted]

[redacted]

~~(S/[redacted])~~ First intercepted by [redacted] and reported as unknown, an [redacted] was judged to be friendly by NSA's technical ELINT analysts under [redacted] due to the [redacted] The Air Force site at [redacted] had reported numerous intercepts in the first half of 1968, until advised that the signal was of no interest. Based on a [redacted]

~~(S/B)~~ [redacted] became a high priority target, second only to [redacted] signals. POPPY locations and analyses provided the major inputs for determining its operating characteristics [redacted] deployments to [redacted] sites. POPPY discovered and was the primary source of intelligence on this most significant addition of the decade [redacted] inventory. [redacted]

~~(S/B)~~ The new Soviet threat signal was a major operational highlight when [redacted] was visited by [redacted] who directed NSA's participation in NRO's [redacted] COMINT and ELINT systems from the office of R&D. [redacted] an electrical engineer, was more interested in technology than in signals, particularly in Lt Potts' account of interactive processing software and TDOA processing techniques, [redacted] were discussed at length. The visitor took the time to describe [redacted] There was some discussion of [redacted]

methodology projected to a [redacted] and of pros and cons, but the site personnel did not really comprehend an ELINT system designed mainly [redacted] which they considered the most significant characteristic exhibited by a radar signal and the key to its function). [A few years hence, as chief of W-Group in NSA's office of production, [redacted] would be the primary architect in defining an NRO/NSA management construct for [redacted]

NavSecGru Buildup

~~(S/B)~~ NSG's special operations division (G54) was joined in September by newly commissioned mustang Lt(jg) James B. Morgan, who would manage tasking and coordinate site operations. Jim Morgan had been a SIGINT ship and submarine rider; [redacted] had taught non-Morse collection and ELINT; had just completed a three-year tour of duty at NSGA [redacted] (where he had been recruited by McGraw); and was responsible, which he later regretted, for disposing of [redacted] GRAB/POPPY files after satellite interrogation operations had ceased there in [redacted] ["I can hardly tell you how much and how often I have wished that I had saved some part of this incredible archive!" (Jan 94)]. After a one-day visit to [redacted] he needed no time at all to get up to speed as Ross Olson's operations officer, and he quickly became the D.C. area champion of the POPPY field sites. As a prime example, Morgan used the [redacted] radar and NSA's earlier direction to the site -- Stop reporting this signal! -- to shame NSA's ELINT analysts into tempering their sometimes curt technical feedback on [redacted] from analog analysis. Morgan also championed sites' efforts to acquire frequency synthesizers, which Steve Roman (K-462) also endorsed. [redacted]

(U) One of Ross Olson's duties was to establish Siss Zulu officer billets for the Navy sites as they were being digitized and find qualified junior officers (JOs). NavSecGru was given the pick of the graduating classes at the Officer Candidate School in Newport, Rhode Island, and sought promising officers with technical degrees. The first recruit was Ens Robert E. Lentz USNR, who had majored in engineering electronics at the University of Maryland. In this direct recruitment, NSG G54 was breaking new ground. Special duty officers for cryptology were generally made, not born. With rare exceptions, naval cryptologists were former line officers who had been assigned shipboard duties related to naval communications, took a shore tour at a naval communication station or security group activity that provided exposure to the cryptologic community, applied for and were accepted for augmentation to special duty officer (cryptology), then continued their careers with tours at Navy SIGINT ships or stations, cryptologic units afloat, NSA or NSG headquarters or regional offices, and naval or joint staffs. The Siss Zulu pattern would be: headquarters orientation for ensigns, with exposure to NSA,

NRL, NIC, and NavSpaSur; one or two site operations tours; postgraduate school; then acquisition or operations management. Not then fully comprehended was that at the fourth rung, the O4 or O5 would be too specialized to be a good candidate for command of a typical NSG activity or department, which conducted cryptologic missions in numerous areas, such as Morse and non-Morse communications, linguistics, HFDF, radar signals, instrumentation signals, SIGINT communications, and general service communications security. Not many of those officers who climbed the Siss Zulu ladder would stay long enough with the Navy to reach O6. A similar difficulty was already being encountered by enlisted personnel. Other than a few billets at NSA and NSG headquarters, the only stateside tour for Siss Zulu technicians [redacted] Competitive exams for promoting communication technicians contained no questions derived from Siss Zulu operations and maintenance. [A naval supply corps officer working with G54 and field sites in the mid 1970s would observe that SecGru eats its young.]

(U) Five months after submitting his proposal for an ocean surveillance capability to ComNavIntCom and DirNRL, CNSG Cook received a letter response from ACNO (I) Harlfinger. The ExTOG's report had "indicated that ComNavSecGru should proceed with Program "C" planning in accordance with the concept paper, especially concerning [redacted] (15 Sep 69). The letter was mute on the subject of dedicated or additional satellites, but it stated the need, without elaboration, for an "engineering and technical training site at a location such as [redacted]" CNSG was assigned responsibility to "initiate preliminary action regarding the establishment of the additional sites required," followed by specific guidance referring only to [redacted]. Lloyd McGraw assumed, correctly, that NRL had injected into the ExTOG's deliberations and Harlfinger's letter the bare statement of need regarding [redacted] and, incorrectly, that DirNRL Matheson, who received a copy of the letter, would take action. The mention of training was an invitation for NSG to participate with NRL at [redacted] but the idea went no further. Before the end of the month, [redacted] authorized SAMSO to release funding for the initially deferred POPPY requirements related to [redacted]. An opportunity was missed for Navy participants to address the possibility of a joint NSG/NRL facility, and a consensus never did form on a consolidated program support facility for Program C.

~~(S/B)~~ In September, CNSG Cook reported to CNIC Harlfinger by message that POPPY-derived Soviet shipborne emitter reports had established the potential capability of POPPY against naval targets. To lighten the analysis workload, in the face of a pending launch, analog reporting requirements to OpNav were being reduced to a weekly count of recognized Soviet shipborne radars. Location finding and ship tracking at [redacted] continued; soon also, [redacted] POPPY operations at the AFSS site in [redacted], had already terminated, and operations at the AFSS site in [redacted] would cease next month, leaving [redacted] sites: one Army [redacted] Navy [redacted]

~~(S/B)~~ Except [redacted], reliance on analog [redacted] had diminished. [redacted] maintained an interactive processing guideline for each family of target signals that specified a sequence of computer programs, control parameters, and decision criteria. A guideline constituted a template for associating [redacted] Guidelines were updated to reflect software changes or changes in signal characteristics, either observed or promulgated in NSA's ELTs and EPL changes. Data was still stored on magnetic tape and intermediate results written to tape, but computer programs were now accessed from a 1.5 megabyte movable head disk, the size of a washing machine. On a well-behaved signal type, an expert digital analyst (like Petty Officers Jim Arnold or Dave Miner at [redacted] Lane K. Snodgrass at [redacted]) could perform the requisite steps and be ready to prepare a first [redacted] report [redacted]. Except for the computer-aided location feasibility check, [redacted] remained a manual function.

(U) Pursuant to CincEur's request for all-source location information on Soviet warships [redacted], NIPSSA's Ed Barker had collaborated with NFOIO at Fort Meade on a statement of need applicable to [redacted] area of responsibility. After coordinating the draft with NRL and NIC, Barker sent it and a copy of the CincEur message to [redacted] intelligence officer on 19 September. In a background cover letter, he noted that VAdm Richardson's interest had been aroused by Howard Lorenzen's visit to [redacted] in the spring and had stimulated the chain of events leading to this draft. Some thought a requirement should originate with NavEur, but Ed Barker recommended [redacted] with NavEur endorsing.

A Quadruplet

~~(S/B)~~ After agreements on primary radar targets were reached between NRL and NSA's Ken Gallagher, NSG G54 issued initial collection tasking for the first five orbits of Mission [redacted] The four 27x34-inch multiface satellites were launched the last day of September on a Thorad Agena D. All satellites were stabilized in three axes and equipped with fore and aft microthrusters for station-keeping. With two [redacted] Bob Eisenhauer [redacted] (Eisenhauer had previously proven the [redacted] as an engineering experiment on [redacted] with ground readout at [redacted] only. The engineering

data had contributed to an NRO-funded redesign of gravity gradient stabilization mechanisms for POPPY 6.)

~~(S/B)~~ [redacted]

apiece. Nothing out of the ordinary was observed in data collected by the sites on the first five revolutions.

~~(S/B)~~ The TOG reviewed NRL's report of the engineering evaluation and noted one concern. On 4 October, the Agena D had apparently exploded, scattering debris but [redacted] All subsystems operated properly, but [redacted] NRL expected to complete its analysis and distribute a final update of preliminary technical descriptions in a month or so (10 Dec 69). There were no constraints on collection tasking, which commenced in [redacted] but there were several new issues before the TOG related to processing and reporting. NSA had expanded its [redacted] processing complex, which now included one CDC 6400, three CDC 6600s, and a dozen smaller slaved computers, but [redacted] processing could neither [redacted] processing. Pending completion of [redacted] software upgrades, NRL was asking for copies of data tapes containing certain signals [redacted] that were germane to the electronic warfare division's investigation of Soviet [redacted] and might be analyzed at HRB or [redacted] NSA was looking askance at [redacted] reporting of shipborne intercepts directly to CincUSNavEur. More alarming, NSA's system planning office (N-1) was considering closure of [redacted] due to waning importance of its classical ELINT operation, which accounted for about a third of the activity's personnel.

[redacted]

~~(S/B)~~ The new SORS chairman, CIA's Charles W. Cook, and two officials from DDR&E (Messrs. Whitt and Fisher) visited [redacted] on 31 October 1969, as part of an assignment from DCI Richard Helms to investigate whether intelligence had become a one-way street. Dr. Cook explained the role of SORS in the USIB organization and stated that, with regard to POPPY, SORS evaluated requirements and passed appropriate guidance to the NRO. His committee welcomed submission of requests for special tasking, and these requests could be accommodated within current national requirements — without the need for excessive lead time. During a live demonstration with month-old POPPY 6, the visitors split up and addressed questions to watch operators and enlisted function heads. Then they were briefed all afternoon and into the Friday evening on POPPY capabilities and products — both

land and sea. Charles Cook was puzzled on discovering that field processing priorities, specified by NSA, did not exactly dovetail with a list of location priorities for Mission that the SORS had issued on 27 August. Following the SORS list had specified [redacted] He was reassured to learn that reported all these signals, except , which had not yet been detected. Much of the ensuing discussion was devoted to the quest for Square Pair. In light of the possibility that this high priority SIGINT target might have characteristics similar to a friendly military radar that analysts ignored, Mr. Whitt proposed a 24-hour stand-down of NATO military radars and said he would pursue his idea with the USIB committees.

(U) Charles Cook's team next visited VAdm David Richardson on his [redacted]

~~(S/B)~~ Richardson was asked by one member of the DCI/DDR&E team why was not making use of the POPPY data. The commander became exasperated on hearing their account that a [redacted] not only that data was available and not automatically reported to but being generated routinely by sailors at a SIGINT station while his senior officers were fussing with a requirements letter.

~~(S/B)~~ On Friday, 7 November 1969, Howard Lorenzen met privately with VAdm Noel Gayler, who was one week into his fourth month as director of NSA. Lorenzen had sought this meeting to discuss several issues regarding POPPY Gayler checked into the points raised during their discussion and wrote Lorenzen a personal letter a week later. reporting of shipborne intercepts to CincUSNavEur would not be curtailed. The CCP would continue funding several elements of including SIGINT research projects, and such operational tasks as are

mutually agreed. NSA would furnish copies of specified POPPY data tapes, provided that NRL coordinate its requests with similar ones from NavSTIC, so that tapes could be retrieved and duplicated more efficiently. Ray Potts had welcomed the offer of computer programming support, was already making arrangements with Lorenzen's office, and was also looking at the make-up of the NSA team in charge of POPPY tasking and processing. Gayler acknowledged that the final point, the question of the future of [redacted] was more complex, but that he had "no intention of replacing the [redacted] POPPY interrogation site with no site at all" (14 Nov 69). [Todendorf's viability would be an issue for six more years.] In tandem with DirNSA Gayler's response, Ray Potts proposed that NSG, NRL, and NSA embark upon a team effort to establish a more totally integrated processing concept, aimed at eliminating redundancy between field and centralized processing (14 Nov 69). With existing technology, the obvious split would be between tactical and technical intelligence. Fred Hellrich represented NRL on the team effort; Bob Lentz, NSG. The first product embarked upon was a complete description of processing flow in the automatic [redacted] system.

~~(S/B)~~ Navy interest in ocean surveillance prompted another meeting at the NRL, the afternoon of 13 November. The NRO was represented by its deputy director, Robert F. Naka, and Capt Robert K. Geiger USN, a new member of the NRO staff. The Navy was represented by Bill Moran (Op-76) and Lloyd Moffit (NIC-2). DirNRL Matheson welcomed the visitors and previewed the informational briefing requested by Moffit. Reid Mayo briefed on history and how POPPY worked. HRB's Johnny Martin briefed on software techniques. DepDNRO Naka was not receptive to the notion of additional ground sites at [redacted] Concerned about gold flow, he queried Mayo on the number of men used at each site and challenged NRL to reconfigure the system without overseas sites. Capt Geiger disclosed that the NRO planned to phase out the Thor booster in two years, Titan IIID would become NRO's workhorse, and there would be room for a POPPY pair to share a ride with [redacted] or other NRP systems. The meeting yielded no action items regarding improved ocean surveillance support.

~~(S/B)~~ The information on the Titan IIID went straight to Pete Wilhelm, who would need to restart his planning for the [redacted] Action on Robert Naka's suggestion fell to Lee Hammarstrom, who subsequently sketched to scale an architecture of POPPY [redacted]

The configuration would cover most of [redacted] and adjacent waters. Hammarstrom's draft concept of operations stopped at the point he noted that the chief technical problem would be to devise an on-board timing system that could meet the [redacted] budget. [redacted] years later, when technology had caught up with the vision, the [redacted] architecture would be selected by the DNRO and DirNSA as the follow-on to Missions [redacted]

~~(S/B)~~ Following Charles Cook's visit to [redacted] first to take the heat was the staff cryptologist, who had been ignorant of the POPPY system. [redacted]

Richardson's ire had been transmitted to OpNav as well, then back down the chain. In the aftermath of the [redacted] incident, the Navy's senior cryptologist, Ralph Cook, saw to it that [redacted] was added to Talent Keyhole distribution for Soviet warship locations in the [redacted] This initiated reporting of overhead data to a fleet commander.

~~(S/B)~~ Early on a Monday morning, 15 December 1969, Lloyd Moffit briefed the [redacted] commander on his flagship on POPPY capabilities (and limitations) and coordinated with Staff [redacted] the draft requirements for use of reconnaissance satellites for surveillance in the [redacted] After being signed by [redacted] the final requirements letter was sent by courier to the CNO in Washington, D.C., via CincUSNavEur in London, where the letter was endorsed by Adm Wendt. Moffit then also, on 17-18 December, completed theater coordination in Stuttgart, Germany, by briefing CincEur's intelligence staff, headed by RAdm (select) John L. Marocchi (deputy director intelligence, CincUSEurCom) on POPPY capabilities and [redacted] requirement. Materials were left for John Marocchi to brief Gen Goodpaster. (Ron Potts, who assisted Moffit at [redacted] and CincEur, returned to [redacted] and summoned extra effort to earn [redacted] forgiveness.)

Technical Intelligence

~~(S/B)~~ During their [redacted] orbit on [redacted], Mission [redacted] intercepted [redacted]

~~(S/B)~~ Soviet shipborne radars provided opportunities to produce technical, as well as [redacted] ELINT. [redacted]

over a period of weeks, POPPY had provided intelligence [redacted] An ELT and EPL update were promptly issued by NSA. Other collectors, including [redacted] would later provide the [redacted] invisible to POPPY's [redacted] that enabled [redacted]. In the late 1970s, using the [redacted] message reports as a guideline, [redacted] technical representative [redacted] tuned the [redacted] processing system to enable MGSs to automatically process this signal in [redacted]. The effort paid a large dividend. [redacted] would be included in the electronic fit of the Soviet navy's [redacted]

~~(S/B)~~ During NRL's engineering evaluation [redacted] Reid Mayo had told the sailors at [redacted] that the vice chief of naval operations, Adm Bernard Clarey, jumped up and down in excitement when he saw the message report of their [redacted] locations had been running only [redacted] due to [redacted] and [redacted] The pace soon picked up — [redacted] — due to new [redacted]

~~(S/B)~~ For 1970, a formal land EOB production requirement was added to the Mission [redacted] guidance from the USIB, and [redacted] fell off the list of processing targets for the [redacted] Weekly analog counts of [redacted] intercepts continued, averaging [redacted] Subsequent land EOB results included [redacted]

western Pacific region the overriding priority was the Vietnam War. Among [redacted] contributions was discovery, by locations of [redacted]

~~(S/B)~~ Support to the Navy continued as a lesser priority. By 1970, the major [redacted]

~~(S/B)~~ [redacted]

~~(S/B)~~ NSA had completed a description of Westbend's automatic processing flow, to support NSG/NRL/NSA evaluation of processing concepts (15 Jan 70). Ray Potts' team approach was now being applied to technical intelligence by Howard Lorenzen, who hosted a first multi-mission ELINT technical exchange meeting — focus on POPPY. A group of nearly three dozen overhead ELINT managers met in room [redacted] of NRL Building [redacted] on 3 February 1970. [redacted] chief John Conlon and [redacted] chief John Copley were supported on Missions [redacted] by [redacted], and in-house contractors. [redacted] chief Charles Cram and deputy [redacted] were supported by NRL and HRB for Mission [redacted] NSA's system planning office was represented by Bill Boenning (N-13) and [redacted] SAFSS, by [redacted] who had succeeded Boenning as NRL's engineering point of contact; [redacted] by Maj John M. O'Connell, acquisition manager for Program [redacted] Lorenzen conducted the briefing portion and stated the objective, exchange of information on technology, techniques, and high priority targets. Reid Mayo briefed on the POPPY concept, historical achievements, and Mission [redacted] capabilities. Evolution of spacecraft techniques and hardware was briefed by Pete Wilhelm; ELINT payloads, Vince Rose; site data processing, Lee Hammarstrom. The group then looked at hardware, toured facilities, and discussed

approaches to common objectives, including the hunt for [redacted]. An isolated [redacted] was the subject of an intensive archive search through recorded data collected from the area since [redacted] by Mission [redacted] and since [redacted] by Mission [redacted]

(U) On 11 February 1970, an interagency ELINT RDT&E coordinating group reviewed capabilities at the NRL. Representing the Army Security Agency was Edwin A. Speakman, who had been Howard Lorenzen's supervisor, twenty years ago, as previous head of the countermeasures branch, and had been the first chairman of the joint communication and electronic committee's ELINT sub-panel, a forerunner of the national ELINT program. Army ACSI was represented by [redacted] whose transfer to ONI from NRL's radio division in February 1949 had freed a ceiling point that allowed Lorenzen to hire Reid Mayo. [redacted] had been ONI's representative to the ELINT sub-panel when Lorenzen was chairman during the Korean War. Technical director Stirling Thrift from DCNO (Dev) had been a member of NRL's radio division during World War II. The Air Force member, Col [redacted] had been a captain on SAC's intelligence staff when manual analysis of NRL's dubbed GRAB tapes started there ten years ago. Representing NSA's R&D directorate, [redacted] had a finer grasp of modern, automated ELINT data processing than anyone present. Art Thom, also from NSA, had helped formulate ELINT requirements for WS-117L when he was a senior analyst at the Air Force Technical Intelligence Center at Wright-Patterson AFB near Dayton, Ohio. Other organizations represented were CIA, DIA, and the Army's Missile Intelligence Directorate at the Redstone Arsenal. It had been a reunion of old friends and pioneers in ELINT, and the chairman of the group sent a letter of appreciation to the director of NRL for the "pleasant and productive" visit, expressing gratitude "to Mr. Lorenzen and the personnel of the EW Division for arranging an outstanding program of presentations and demonstrations" (11 Mar 70).

~~(S/B)~~ At the time of the review, Mission [redacted] had reached its zenith as a [redacted] technical intelligence collector. [redacted] on-orbit failures in the command and telemetry subsystems of [redacted] were discovered during field sites' payload interrogations on [redacted] became an emergency ward where the satellite techniques branch strove, pass after pass, to bring [redacted] back to life. Surviving [redacted] collectively covered more than [redacted] coverage was limited to [redacted] of this range. Mission [redacted] and [redacted]

Chapter 12 References

3 Feb 69 NSGA [redacted] (TS/B - codeword) manual, RLP:wr, BYE-57169-69
Subj: Shipborne Emitter Location Techniques

3 Mar 69 Lt A. N. Michael, G524B (TS/B - codeword) trip report, BYE-52,310-69
Subj: TAD to NSAAL [redacted] in connection with POPPY ops

~~SECRET~~

[redacted]
Subj: [redacted]

[redacted]

Subj: [redacted]

[redacted]

31 Mar 69 NSA (S/B - codeword) report, NSG BYE 81185-69 (revising 31 Mar 69)
Encl: (TS/TK - codeword) POPPY Success against [redacted] Signals of Interest

17 Apr 69 CNSG (TS) letter to CNO and DirNRL, NSG-0354/jfd, Ser 198,008-69
Subj: Concept Paper on the Development of an Ocean Surveillance Capability
Encl: (TS/TK - codeword) The Development of an Ocean Surveillance Capability, dated Mar 69, TCS-198,001-69

[redacted] K46 [redacted] (S/B - codeword) letter to K4/GP, copies to K4 elements, A67, NIC, NRL, NSG, Lisbert, Boeing, [redacted] NSA, BYE-18434-69
Subj: Trip Report (4-22 February 1969)

23 May 69 CNO (TS/B - codeword) letter to Navy Member SORS, Op-092/kfp, BYE-65659/69
Subj: [Directive to request SORS authority for Navy tasking]

23 May 69 Navy SORS Member (TS/B - codeword) letter to SORS Chairman, Op-094/kfp, BYE-65659/69
Subj: [Requirement for tasking NRP ELINT resources]

26 Jun 69 USCINCEUR message, 261931Z Jun 69
Subj: [redacted]

22 Jul 69 CNO Memorandum to SecNav, BYE 65694/69
Subj: POPPY System

24 Jul 69 SecNav memorandum to DepSecDef, BYE 65692/69
Subj: Use of the Poppy ELINT Satellite System for Ocean Surveillance

[redacted]

[redacted]

[redacted] DirNRL (TS/B - codeword) letter for DNRO [redacted] via DirPrgmC (Attn: Capt Moffit), 5610-69:HOL:mab, BYE-51905-69
Subj: [redacted]
Ref: [redacted]

15 Sep 69 CNO (Op-092) (S/NOFORN) letter to CNSG, copies to ComNavComumCom, ComNavFacEngCom, ComNavIntCom, and DirNRL, OP-092R/kfp, Ser 00509P09
Subj: Development of Program "C" for Ocean Surveillance (U)

14 Nov 69 VAdm Noel F. Gayler (S) letter to Howard Lorenzen
Subj: [Issues Regarding Processing of POPPY Data]

[redacted] NSA (S - codeword) message to NSG & NRL, info CNO, DNRO, SOC, 141952Z Nov 69, Cite [redacted] 1630
Subj: Processing System Technical Exchange/Evaluation

10 Dec 69 NRL (TS/B) Program "C" Technical Description of Mission [redacted] BYE-51912-69, cy 13 of 14

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[redacted] [redacted]
Subj: [redacted]

15 Jan 70 NSA (TS/B - codeword) [redacted] Automatic Processing System, NSA BYE 18072-69, cy 1 of 2

11 Mar 70 ERG Chairman [redacted] (NSA) (U) letter to DirNRL
Subj: Letter of Appreciation

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Chapter 13. OCEAN SURVEILLANCE AUGMENTATION

(U) *The DoD conducted an in-depth study of ocean surveillance and recommended, as an interim solution, that existing systems be augmented. Following USIB validation of the requirement, the overhead community began exploring longer term solutions.*

Quick Response Tasking

(U) At the end of December 1969, DDR&E John S. Foster, Jr. had requested the Defense Science Board (DSB) to appoint a DSB task force, chaired by Charles M. Herzfeld, to conduct an eight-month study of the ocean surveillance problem and programs. The committee began gathering information, and several members were briefed at the NRL on 12 March 1970. Reid Mayo found them to be supportive and ill-informed about POPPY. At the NSG headquarters, Lloyd McGraw drew their attention to the year-old proposal for a dedicated capability, but the committee's stated interest was in exploiting data from existing systems, not in developing new ones. Still, there was something to be salvaged in the concept of augmenting NSG's existing sites and building two new ones.

~~(S/B)~~ The archival search task sponsored by NSA [redacted] had continued throughout February and March, culminating in two ELTs that reported probable discovery of the [redacted] Since the contributing Mission payloads were unable [redacted] was then tasked [redacted] Preliminary but decisive results were available [redacted] signal remained unknown. POPPY fared no better in the quest. [redacted] latest candidate (based on a single line of position cutting across [redacted] for a [redacted]

~~(S/B)~~ On the same day, 2 April, that K-46 resolved the [redacted] signal, the SORS received a POPPY update from NIC, NRL, and NSG in room [redacted] of NRL Building [redacted] The new Navy SORS member, Cdr Fred A. Hull, was among ten representatives of CIA, NSA, NRO, Army ACSI, NIC, and AFCIN (DIA and State did not show). The SORS heard NRL briefings (Lorenzen, Wilhelm, Mayo,

Hammarstrom) plus Jim Morgan's half-hour explanation of last summer's track of [redacted] as seen from Mission [redacted] and the U.S.S. [redacted] The chart showed a fairly solid POPPY track during a [redacted] special tasking period of [redacted] passes per day — after which collection opportunities were halved, processing priorities readjusted, and POPPY hits became sporadic [redacted] During discussion, SORS Chairman Charles Cook validated a quick response tasking protocol, whereby the Navy member could submit a tasking requirement by message addressed to the chairman for action, for information to each other SORS member, NRL, and NSG. Unless the chairman received adverse comment from an addressee, he would direct the NRO SOC and NSA to adjust priorities for collection and processing during the requested time frame. [redacted] the office of CNO requested tasking and priority field processing by [redacted] in support of CincLantFlt and CincUSNavEur requirements associated with major Soviet surface force deployments in the [redacted] later, CNO informed SORS that "initial deployments were coincident with initiation of major [redacted] which are currently underway" and requested similar adjustments for [redacted] support of CincPacFlt (21 Apr 70).

[redacted]

(U) [redacted]

~~(S/B)~~ [redacted]

(U) [redacted]

[redacted]

~~(S/B)~~ [redacted]

SecNav Proposal

~~(S/B)~~ Aside from the impact of [redacted] of Soviet naval strength, [redacted] heightened DoD interest in ocean surveillance. Lloyd Moffit's time was increasingly being taken by matters in the Pentagon. The de facto position of POPPY project manager was assumed by a fellow aviator, Capt William G. Jensen, who had been Moffit's deputy in NIC-2 since January. At a 30 April meeting of the TOG, chaired by Bill Jensen, [redacted] of NSA K-46 reported that VAdm Gayler (DirNSA) was very interested in POPPY for ocean surveillance. NSG reported that the Herzfeld committee had unanimously approved the concept of [redacted] duplicate POPPY sites and was now looking into processing concepts, including additional SEL 810 computers for ocean surveillance. NRL suggested shifting to a larger computer and automating the processing. The Army member reported that nothing was definite on the future of [redacted] and that NSA had stated to DoD that the site should remain active.

~~(S/B)~~ The USIB's issuance of new mission guidance for overhead ELINT was a disappointment to OpNav. A 32-page requirements document, with needs projected through 1974, had been in the review cycle for many months and did not mention ocean surveillance or specific Soviet shipborne emitters (11 May 70). Emphasis was on scientific and technical intelligence measurements. A full page was devoted to each ABM radar [redacted]. The prevailing argument continued to be that the need for access to denied areas merited expensive NRP systems, whereas all nations enjoyed free access to the world's oceans.

~~(S/B)~~ NSG G54 recommended by message to the NRO SOC that [redacted] be tasked on each pass [redacted] collection. Tasking modifications were authorized by the NRO detachment at Fort Meade. Resulting field locations at [redacted] This endeavor stimulated the NRO to update the

[redacted] to include some new quick response tasking message types. The effort was completed the next month and approved by SAFSS Deputy Director (satellite operations) Edwin Sweeney (15 Jun 70). At a 22 May TOG meeting, [redacted] a cryptologic duty officer, was introduced as Charles Cram's replacement as chief of NSA K-46. [redacted] presented the K-4 view on both [redacted] POPPY operations should be sustained at both sites until other means of [redacted] coverage become available.

~~(S/B)~~ Lloyd Moffit was reassigned from NIC headquarters in the Hoffman Building back to the Pentagon, where he served as executive assistant to ACNO (I) Harlfinger. In the midst of staffing a [redacted] proposal to augment POPPY for ocean surveillance, he arranged a Navy helicopter trip from the Pentagon to [redacted] on 27 May for DNRO McLucas, DepDNRO Naka, RAdm Harlfinger, Bob Geiger, Bill Jensen, and himself. The group toured the recently upgraded facility and witnessed scripted, interactive SEL 810 processing of a tape that had been collected at [redacted] a demonstration of [redacted] POPPY data and a hint of what could be done with a more powerful computer.

~~(S/B)~~ The DoN reiterated its need to DepSecDef David Packard, who, as a member of the NRO ExCom (along with the DCI and president's adviser for S&T), provided NRP oversight for the SecDef.

MEMORANDUM FOR THE DEPUTY SECRETARY OF DEFENSE

Subj: Use Of POPPY Elint Satellite System for Ocean Surveillance

1. Recently the Chief of Naval Operations forwarded to me a memorandum in which he expressed his concern with the increased threat to the Nation, and to the Navy, posed by the Soviet fleet. I share his concern, and concur in his belief that the Navy must be able to locate, identify and track all Soviet Naval units, especially all missile delivery platforms and threats to our seaborne strategic deterrent forces. This is vital to our strategic warning and defense. The threat posed by the Soviet Navy is of such significance today that surveillance of these type platforms must now be recognized as a national requirement, and the use of national overhead reconnaissance assets should be utilized, where capable, to respond to this requirement.

2. As you may recall. I addressed the problem of the Soviet threat in my memorandum to you on 24 July 1969, particularly with regard to the utilization of National Reconnaissance Program resources to provide meaningful information relative to this threat. At that time, I expressed my support of the National Reconnaissance Program, while informing you of the demonstrated capability of the Navy sponsored NRP POPPY Elint satellite system to provide ocean surveillance information. I informed you of my intention to task POPPY, on a non-interference basis, for collection against the Ocean Surveillance requirement, and requested your support for continuation

of this time proven and economical program.

3. Experience gained during the past year has permitted the Navy to define a specific proposal for NRP support to Ocean Surveillance within existing national constraints. This proposal herewith attached establishes a requirement for collection of electromagnetic signals associated with Soviet Naval forces, utilizing the POPPY asset of the National Reconnaissance Program, without interfering with existing USIB requirements. It requires dedicated military analysis centers, located with existing or planned POPPY ground sites, in order to process and disseminate ocean surveillance information of tactical value to the operational commanders without interruption of processing in support of existing national directives.

4. I have prepared detailed requirements, and a breakdown of fiscal and personnel resources required to implement this proposal, utilizing the POPPY system on a non-interference basis with national tasking. There are no satellite system costs attendant with the adoption of this specific proposal.

/s/ John H. Chaffee (11 Jun 70)

~~(S/B)~~ SecNav Chaffee proposed development of regional ocean surveillance processing centers to exploit POPPY data. An enclosure to his memorandum detailed a plan for a new collection site at [redacted] and, conditionally, [redacted] facilities upgrades for [redacted] processing capabilities for all sites; and [redacted] additional CCP billets. Estimated NRP cost for facilities and equipment was [redacted] more, if NavCommSta [redacted] went forward in the Congress).

~~(S/B)~~ The NRP did not have [redacted] to spare. DepSecDef Packard forwarded the SecNav proposal to the directors of DIA, NRO, and NSA, soliciting ideas for more effective or lower cost approaches. The director of DIA, LtGen Donald V. Bennett USA, positively endorsed the Navy need and proposal. DirNSA Gayler assigned to K-4 the task of preparing the NSA response.

~~(S/B)~~ Detailed planning and authoring of the enclosure to the SecNav proposal had been conducted by Ross Olson and his crew in NSG G54 with the knowledge of [redacted] (NSA K-46). Everything in NSG's package was off the shelf: [redacted] capabilities at each existing site and dedicate the new equipment and [redacted] additional personnel to ocean surveillance. The bulk of new billets and investment cost would be for new sites at [redacted] neither of which would support [redacted] production. K-4 simply whittled down NSG's approach, endorsing additional [redacted] capabilities for the existing sites and a second SEL 810A for [redacted] only, for a total NRP cost of [redacted] and [redacted] additional CCP personnel. (Cutting from [redacted] new billets would save nearly [redacted] per year.)

~~(S/B)~~ Another way to lighten the burden on the NRP, while defending the proposed capabilities, was to fund new facilities and upgrades through the Navy MilCon budget. The DoN allocated [redacted] in 1970-71 for new facilities at NavCommStas [redacted] and to establish a new collection site for the [redacted] at NSGA [redacted] site. (The fate of [redacted] depended on congressional deliberations.) These would be the first permanent buildings designed specifically for POPPY operations, built in accordance with detailed requirements and equipment layouts prepared by Charlie Price of the NRL in collaboration with Reid Mayo's section and with NSG G40 (logistics and material). All previous POPPY buildings had been adapted from their original purposes, running from phased out (pre[redacted] DF systems to barracks. Emergency military construction projects would be implemented by the Naval Facilities Engineering Command (NavFac), including NavFac's engineering field divisions and resident officers in charge of construction at the host naval installations.

(U) Whatever the scope, most of the action entailed by the upgrade would fall on NSG (facilities and manpower) and NRL (equipment and software). Bill Jensen (NIC-2) and his staff were preoccupied with NIC's larger goal of creating all-source intelligence fusion centers to serve the theaters and fleets, particularly with establishing a prototype fleet ocean surveillance information center (FOSIC) at CincLantFlt headquarters in Norfolk, Virginia. Fred Hull was reviewing the bidding on Navy requests for special tasking, now up to 30 days at a time, and SORS responses. CNSG Cook sent to the CNO, via the ACNO (Comm) and VCNO, a letter recommending that responsibility for managing Program C be reassigned from ComNavIntCom to ComNavSecGru. At the Pentagon, Capt Chet Phillips, a cryptologic duty officer, kept Cook's letter in his two-drawer safe, instead of forwarding it up the chain to the CNO — due to ongoing discussion concerning reorganization of the naval support elements. As former CO of NavCommSta [redacted] Phillips had direct experience with the Program C organization and operations. In his Pentagon assignment, as director of the cryptology division under ACNO (Comm) Fitzpatrick, he advised on cryptologic matters and participated in OpNav planning. Naval intelligence, communications, and cryptology would most likely be grouped next year in a single command support programs directorate under RAdm Harlfinger. In light of the pending reorganization, the matter of directorship of Program C needed to be rethought.

USIB Mission Validation

(U) The Navy was undergoing a change in top leadership as well. Nominated by President Nixon in April, Adm Moorer became JCS chairman on 1 July and could no longer function as the Navy's chief advocate. His relief as CNO, Adm Elmo R. Zumwalt, Jr., previously commanded U.S. naval forces in Vietnam and shared Moorer's appreciation of tactical intelligence and his conviction that space-based surveillance must be an element of America's response to the Soviet Union's modernization, expansion, and use of its four fleets. He knew that the battle would

be up-hill, for DCI Helms did not regard the Soviet navy as a serious threat to supremacy of U.S. naval forces.

~~(S/B)~~ As the DoN observer on the USIB, ACNO (I) Harlfinger used the [redacted] demonstration and high-level DoN and DoD interest to buttress the Navy position. Strong support was provided by the Navy's senior special duty officer for intelligence, RAdm Mac Showers, now serving as DIA's chief of staff. DIA was already funding NIC's detailed analysis and reconstruction of [redacted] for which POPPY was a major contributor. Showers had arranged for DirDIA Donald Bennett to be briefed on POPPY at the NRL on 1 July by Lloyd Moffit and Howard Lorenzen's team. DIA and the SORS had been taking a close look at POPPY productivity. Since launch of POPPY 5 three years ago, NSA K-46's data processing isolated an average of [redacted] intercepts per week. Over the past 18 months of an intensified EOB production effort by K-46, less than [redacted] of these, averaging [redacted] met DIA's EOB criteria for reporting in ELOs. POPPY EOB production [redacted]. POPPY-derived ELTs were issued at a rate of [redacted]. Whether the shortfalls were in the data or the data processing, it could hardly be argued that Mission [redacted] should be dedicated to search, technical intelligence, and EOB. The POPPY evaluation working group was chaired by CIA's SORS member, [redacted] who viewed the program as a candidate for phase-out after launch of Mission [redacted], by which time [redacted] would be operational.

~~(S/B)~~ In July 1970, the USIB granted authority for the general employment of Missions [redacted] for ocean surveillance in support of U.S. fleet commanders. NSG immediately promulgated and implemented the protocol and format for POPPY [redacted] at the secret level, [redacted] eyes only. This was the first instance of overhead data reported to tactical commanders outside Talent Keyhole channels. Information included [redacted] when known. No ELINT information could be included, but two years later, with the approval of NSA, NSG expanded the human-readable [redacted] format to include reporting of time of [redacted]

~~(S/B)~~ [redacted] soon informed NSGA [redacted] by message that [redacted] was usually alerted to the possibility of [redacted] deployments by very limited [redacted] and communications traffic analysis but that "in each case [redacted] reporting has been the valued source confirming suspected movement" and, in every case, the demonstrated [redacted] of POPPY had reinforced his "confidence in your reporting to the extent that on several occasions [redacted]

Ocean Surveillance Task Force

(U) In the course of studying ocean surveillance capabilities in the spring and summer of 1970, members of the DSB task force visited NRO, NSA, DIA, NIC, SAFSP, NSG, and NRL, soliciting information and ideas. Community sessions were held and proposals heard at the naval base in San Diego, California, homeport of the First Fleet. Commanded for three years, until September 1969, by VAdm Bernard Roeder and now commanded by VAdm Isaac C. Kidd, Jr., First Fleet conducted exercise operations to ready Pacific Fleet warships for combat operations in Southeast Asia. The exercises emphasized the paramount importance of electronic warfare, thus providing an ideal background for investigating satellites as the newest addition to the arsenal.

~~(S/B)~~ By August, Charles Herzfeld was focused on Program C's potential to provide tactical support to the fleet, was aware of conflict over tasking priorities, and had returned to the NRL several times with different members of the task force. Visits were followed by written questions requiring written responses to the DSB via NIC-2. After weighing alternatives proposed by NavSecGru (duplication of existing analog/digital capabilities and two new sites), NSA (some duplication at existing sites only), NavIntCom (intelligence fusion centers), and NavResLab (expanded RF coverage in POPPY 7 and automated processing), the Herzfeld committee solidly endorsed NRL's proposal for a [redacted] processing upgrade, believing that this would essentially eliminate the conflict over tasking. The only question was whether the relatively modest improvements should be provided from intelligence resources or Navy funds.

~~(S/B)~~ Program C elements of OpNav, NSA, NIC, NSG, and NRL were energized, actively involved, and not always in step in their efforts to improve POPPY support to ocean surveillance. DNRO McLucas asked DirPlgmC Harlfinger to examine new alternatives to the June SecNav proposal and submit a recommendation. On 10 August, the DNRO acknowledged overlap of national and tactical requirements in a letter to the SecNav and suggested that a single Navy black project office be established to manage Navy efforts. (This would require several months of deliberation within OpNav.)

~~(S/B)~~ USIB's July statement of ocean surveillance requirements indicated that, under peacetime conditions, [redacted] A wartime/peacetime distinction did not go far enough for OpNav strategists, who were thinking in terms of cold war brushes with the Soviets, preparedness, defense conditions, and contingency planning for abrupt transition from limited war to hot war. On behalf of the CNO, ACNO (I) Harlfinger elaborated the general need for increased support from NRP systems and stated more stringent requirements.

MEMORANDUM FOR THE DIRECTOR, NATIONAL RECONNAISSANCE OFFICE

Subj: Navy Ocean Surveillance Requirement

1. The United States Intelligence Board recently approved a statement of the requirement for ocean surveillance to be performed by SIGINT satellite systems. This statement of requirement is general in nature, and does not delineate fully the requirement, which is predicated by the necessity of providing Command with information which is essential to the successful prosecution of its missions. The timely collection, processing and dissemination of ocean surveillance information provides Command with strategic warning through indications of changes in normal patterns of activity, and provides information necessary for planning and conducting naval operations. In order to assist the National Reconnaissance Office in planning for support of this requirement, the following additional detail is provided.

2. The ocean surveillance requirement is bounded by limits which dictate locating and reporting on the position of threat emitters within [redacted] of friendly forces within [redacted] and locating and reporting of all shipborne emitters within [redacted], to an accuracy of [redacted] The requirement for timeliness of reporting is governed by an interplay of four variables; viz., proximity of own forces to area of interest, geographic area, political climate, and platform.

/s/ F. J. Harlfinger (17 Aug 70)

An attached table with weights for each possibility under the four variables, enabled computation of acceptable location error and timeliness for any naval warfare scenario. Proximity was in terms of distance between a threat and a U.S. carrier strike group or major amphibious force. Geographic areas were prioritized: [redacted] Navy's general surveillance requirement of [redacted] contrasted with USIB's peacetime [redacted] and Navy's most stringent requirement of [redacted] contrasted with USIB's [redacted] The critical differences, in both scenarios, were in the timeliness domain.

~~(S/B)~~ At Bill Jensen's request, Lee Hammarstrom, Fred Hellrich, and George Price had elaborated NRL's approach to an ocean surveillance upgrade and coordinated with NSG's Lloyd McGraw and Jim Morgan to prepare a Program C staff study. G54 personnel had been unaware of the extent to which [redacted] template processing for known signals had obviated the need for [redacted] As an alternative to another analog analysis position, the sites could be equipped with perishable data extractors, which would [redacted]

[redacted] Neither [redacted] would need a second SEL 810 or additional billets if they were equipped with the data extractor. An existing computer van with a SEL 810A configuration could be deployed temporarily to [redacted] for ocean surveillance augmentation and be replaced in two years by a high-speed SEL 86 computer that employed a 32-bit word size and had a memory capacity of 48K words. A SEL 86 configuration with a 6-megabyte movable head disk for permanent file storage and two 3-megabyte fixed head disks for interim data storage would be capable of handling all time-critical emitters, including [redacted] Cost of the upgrades for the [redacted] Navy sites would be [redacted] from the NRP and [redacted] more CCP billets for [redacted] POPPY operations at [redacted] had terminated on [redacted] freeing a collection system for the [redacted] After [redacted] became equipped with the SEL 86 configuration, its SEL 810 could be redeployed to [redacted] A new facility for operations and training could be constructed there for [redacted] in Navy MilCon. NRP cost for equipment moves and refurbishment would be [redacted] For [redacted] more, both [redacted] could be equipped with the SEL [redacted] configuration. Each satellite of Mission [redacted] would be able to collect exploitable Soviet shipborne emitters and be fitted with [redacted] data transmitters, allowing [redacted] RAdm Harlfinger signed a cover letter to forward the Program C staff's recommended alternative to DNRO McLucas, copies to DirNSA, DirDIA, DirNRL, and CNSG (17 Aug 70). Two days later, Harlfinger authorized the three fleet Cincs to advise POPPY field sites directly of targets of special interest.

(U) DDR&E Foster informed CNO Zumwalt of the DSB task force and its recommendations, reporting that Charles Herzfeld "was very impressed, as I have been, with the potential of Program "C" to provide tactical support to the Fleet for ocean surveillance" (19 Aug 70). On the question of funding responsibility (left open by Herzfeld), he opined, "Because the referenced Program "C" improvements provide an important and, essentially, a unique Naval capability, it would appear that the improvements should be funded promptly from Navy resources."

[redacted]

~~(S/B)~~ During that summer, new approaches to ocean surveillance were stimulated by the Herzfeld committee's far-reaching study, the USIB requirement, and NRO's support. SAC was preparing to train air crews on visual techniques for ship identification. [redacted] proposed expanding Program [redacted] Col Edwin Sweeney, new director of the NRO staff, had tasked SAFSP to conduct a trade-off study of alternative systems for ELINT surveillance of the oceans, addressing capabilities of present systems, new systems in the pipeline, a longer range solution, and a processing and reporting system. Col Sweeney was familiar with all the ELINT collectors, having served previously as director of the NRO SOC. SAFSP was now considering a [redacted] concept for a new system that would employ a [redacted] to

distinguish ocean surveillance and land intercepts, even to switch to ocean data only. Named [redacted] the concept was already circulating on the West Coast. [redacted] had been recruited by [redacted] upon his retirement from the Navy the previous year and was now working in [redacted] on the [redacted] operations concept.

~~(S/B)~~ The [redacted] architecture drew interest on the East Coast, particularly from NSA K-4 and N-1, who were preparing a response to the Program C staff study on ocean surveillance augmentation (which was of course consistent with the Herzfeld's committee's conclusions, since NRL's engineers were the major contributors to both efforts). NSA concurred with use of POPPY as an "interim solution to the ELINT portion of the ocean surveillance problem" and supported perishable data extractors but disagreed with a new site at [redacted] since "an optimized system [redacted] is pending near future." Nor did NSA agree with shifting to a more powerful SEL 86 computer at [redacted] — on the grounds that it was being sought for an impossible goal, the processing of [redacted]

~~(S/B)~~ Apparently, the gathering of facts for a response to Program C established several unrelated points:

- K-4's [redacted] from overhead data,
- A-Group was not receiving reports on [redacted] from [redacted]
- [redacted] like other [redacted], would be incapable of prosecuting [redacted]

The response reached a [redacted] If [redacted] processing was abandoned (it was reasoned), then an additional SEL 810 should suffice. It was proposed that NSA and NIC "work together to expedite the interim solution and provide the necessary direction to the design of an optimized ELINT ocean surveillance system [redacted]" (4 Sep 70). Whether a consequence of inadequate background research and staffing or bad editing, no one in the chop chain caught the gaffe on [redacted] DirNSA Gayler signed the memorandum for ComNavIntCom Harlfinger, and it was sent to Capt Bill Jensen, copy to DNRO McLucas and elements of NSA. At NIC, as part of preparation to staff a reclama, Fred Glaeser sent copies of VAdm Gayler's memorandum to Reid Mayo at the NRL and Lloyd McGraw at the NSG headquarters.

(U) Ocean surveillance was a national intelligence objective now, and SAFSP had proposed a second approach from space. In his advocacy of a dedicated system, CNSG Cook was further heartened when the door seemed to open for the DoN to develop one. DepSecDef David Packard signed a new directive on space systems

development, canceling and superseding the directive of 1961. As part of the overhaul and streamlining of DoD's acquisition policy, led by DepDDR&E VAdm Vincent dePoix's steering group, space systems acquisition responsibilities would be aligned with those for weapon systems acquisition. The Air Force retained responsibility for the Defense Support Program (DSP) satellites for missile launch early warning (infrared). Military departments, subject to approval of the OSD, could pursue departmental needs for space systems, including "unique surveillance (i.e., ocean or battlefield)" needs. DDR&E would "monitor all space technology activity to minimize system technical risk and cost, to prevent unwarranted duplication, and to assure that a space program assigned to one department meets the needs of other departments (8 Sep 70)." Based on the recommendation of DNRO McLucas, DepSecDef Packard approved the Program C ocean surveillance augmentation three days later.

~~(S/B)~~ On 22 September, an NSA/NSG/NRO SOC/NRL meeting was held in the Pentagon, to discuss trade-offs related to satellite separation and establish a consensus for POPPY. During this meeting, the subject of NSA's response to NIC's revised proposal came to the fore when someone from NSA K-4 deemed Program C a weak contender for ocean surveillance. NSG representatives became irate about slipshod staffing on [redacted] the rationale in VAdm Gayler's memorandum applied to Missions [redacted] which could not [redacted] POPPY had reported [redacted] until NSA's change in processing priorities bumped them off the list. Lee Hammarstrom (also mindful that the [redacted] markedly reduced opportunities) urged NSA representatives not to settle for an additional SEL 810, which would only [redacted] processing capacity, whereas a SEL 86 could potentially increase productivity by a factor of [redacted]. Adopting the tone of a peacemaker, but actually intending to make more trouble, Lt(jg) Morgan from NSG G54 said he saw merit in NSA's advocacy of [redacted] — because of the opportunity to [redacted]

~~(S/B)~~ At the same time, Bill Jensen and Reid Mayo were meeting in [redacted] office on the subject of a second-generation computer. [redacted] was called in to referee the meeting on satellite spacing, which he did. The Program C budget would be augmented to support implementation of the Herzfeld committee's recommendations (coinciding with Program C's) at a cost of [redacted] which covered: priority data extractors for the [redacted] digitized sites, a SEL 86 configuration for development and one for deployment to [redacted] software development, system deployment, and one year of O&M support. The [redacted] did not concur with NSA's request that the money be passed to NRL through NSA. [SEL 86 systems were budgeted for [redacted] in fiscal year 1972, but they did not survive a mandated cost reduction.]

(U) Later, Reid Mayo worked out his distress over the growing disharmony in a memorandum to file that regretted NSA's reassignments of several key men to work on other projects. Joe Struve had pioneered Audico and led machine processing for nearly six years. [redacted] had devised location algorithms and

had been a stimulator and collaborator on every NRL improvement in data quality and the digital domain. John Conlon had participated in Mayo's project from the beginning in 1958, was stunned at NTPC by the GRAB data density in 1960, and, in spite of it and its exponential growth with each new mission, led production of technical intelligence for eight years. These men were no longer in the picture. Senior managers Gayler, Tordella, and [redacted] were still within reach for Lorenzen, but at the day-to-day management level, where continuity was needed, NSA had brought in new elements and changed the guard.

(U) CNSG Cook and the DirNRL, Capt Earle W. Sapp, soon received a memorandum from CNO Zumwalt regarding another recommendation from the DSB ocean surveillance task force: the need for [redacted] of satellite data in [redacted] to eliminate as much as [redacted] communications delay in getting [redacted] to the Navy (24 Sep 70). Action at the NRL was assigned to Lee Hammarstrom, who began investigating. A satellite communications project office (PME-116) had been established in 1966 at the Naval Electronic Systems Command (NavElex) headquarters and charged with developing shipboard terminals to operate in conjunction with leased communication satellites and a joint tactical satellite communications (TacSat) project. An initial operating capability was achieved in 1969 with Air Force/Hughes TacSat 1 positioned over the Pacific to support operations in Vietnam. RAdm Moran's Navy space programs division (Op-76) had recently coordinated fleet-wide technical communication requirements with the staff of ACNO (Comm) Fitzpatrick. In coordination with the military satellite office of the Defense Communications Agency, the DoN was now preparing a proposal to the DoD for a fleet satellite communications (FltSatCom) architecture, based on the TacSat success in the Pacific and the global requirement.

~~(S/B)~~ In the early fall [redacted] tracked [redacted] on a [redacted] visibility was reached, the track ended. Arrangements were made to collect data at [redacted], and the ships were located several times in the [redacted] was able to resume tracking on the return voyage, when [redacted] voyaged throughout the [redacted] The incursion buttressed the stated need to extend POPPY coverage to the [redacted] and further validated NSG's plan to establish a site [redacted]

~~(S/B)~~ The DNRO summed up the decisions regarding ocean surveillance augmentation and mended divisions within Program C in a fresh delineation of roles and responsibilities:

~~SECRET~~

MEMORANDUM FOR THE SECRETARY OF THE NAVY

SUBJECT: Augmentation of POPPY Facilities for Ocean Surveillance

REFERENCE: BYE 61524/70, 11 June 1970, Use of POPPY ELINT Satellite System for Ocean Surveillance

I agree with you that the threat posed by the Soviet Navy is of such growing significance that surveillance of Soviet naval activity should be provided by available national assets where applicable. After discussion of this matter with the Deputy Secretary of Defense, I have asked our NRO Staff to program for the augmentation of POPPY ground facilities so as to provide additional ocean surveillance support to the Navy. Admiral Harlfinger, Director of Program C of the NRO, has prepared a modified augmentation plan, in coordination with NSA and my Staff, which provides an interim capability based on a shared processing concept proposed by NSA.

This interim ocean surveillance capability (TAB A) can be accomplished by augmenting [redacted] the present POPPY facilities and installing a new facility at [redacted] construction is included in the Navy FY 1970 authorization. Any other construction involved would be subject to the CCP processes with Navy funding. NSA will cooperate with the Navy in programming for any required additional CCP manpower billets. The NRO will provide funds for the necessary equipment to include O&M costs. NSA, as the agency responsible for processing and analysis of overhead ELINT data, will exercise technical direction in a coordinated NSA, NRO, NRL effort providing for equipment acquisition, readiness, and installation.

I believe the above arrangements should provide an adequate interim ocean surveillance capability which is cost effective and responsive to your needs. In addition, we are working on other systems to more effectively satisfy the problem in the future.

/s/ John L. McLucas (7 Oct 70)

~~(S/B)~~ On 8 October, representatives of the ExTOG received a briefing prepared by [redacted] for the U.S. Navy at the direction of DirSAFSS Sweeney. This comprehensive briefing addressed the ocean surveillance requirement (both USN and USIB versions), capabilities of current systems [redacted] capability, a mission trade-off study, data handling (read-out, processing, and reporting), conclusions, and recommendations.

~~(S/B)~~ [redacted]

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[redacted] recommended tasking current systems for ocean surveillance and quick response processing, approving a [redacted] (depending on criticality of response time), and performing a detailed trade-off study of a new ocean surveillance system concept for a long-term solution. Navy representatives invited refinements aimed at meeting the timeliness and geographic coverage requirements stated in Harlfinger's letter of 17 August. DirSAFSS Sweeney sent the briefing charts to CNO Zumwalt, copy to RAdm Harlfinger, requesting comments and recommendations, specifically "reaffirmation of the Navy requirement for ocean surveillance that was provided to us by the Director, Program "C"" (16 Oct 70).

~~(S/B)~~ Five miles south of the Pentagon, at the Hoffman Building in Alexandria, program manager Bill Jensen chaired a first POPPY augmentation meeting on 16 October, attended by representatives of NRL, NSA, NSG, and HRB. He attributed past differences to inadequate coordination among NIC and their offices during this year of high-level interest and attendant turmoil. There would be regular augmentation meetings in his office, which he would chair. Working groups were established on computers, data extractors, and [redacted] In this endeavor, Jensen was aided by Ed Dix, who, after five years with COMSAT, had returned to Program C as a consultant on the program manager's staff. NSA was quick to appreciate opportunities to exploit non-ship targets with a more powerful field computer and came to closure with NRL on selection of an SEL 86 configuration. At [redacted] for Program C, to add [redacted] for procurement, deployment, and support of the new equipment and software (14 Oct 70).

Cost Overrun

~~(S/B)~~ Four months into FY71, Pete Wilhelm had to prepare a written request from the DirNRL to DirPrgmC to secure additional Program C funding from the NRO for completing the [redacted] satellites (POPPY 7). Demand from NASA's Apollo moon-exploration program had inflated the cost of required space components by [redacted] compared to the [redacted] The [redacted] malfunction had consumed resources in the satellite techniques branch at an unbudgeted cost of [redacted] firstly to isolate the failure (a stuck relay switch for a [redacted]), secondly to determine possible causes, finally to try to overcome it, albeit unsuccessfully — apprehensive all the while that [redacted] might suffer the same malfunction. The [redacted] failure-analysis effort stimulated [redacted] worth of new precautionary redundancy in the [redacted] Finally, new payload capabilities related to ocean surveillance for Navy and signal-level measurement for NSA would cost [redacted] to implement. A [redacted] cost overrun, in a climate where the Navy had struggled for over half a year to win a modest ocean surveillance processing augmentation of [redacted] was a heavy burden to drop on NRL's senior management. DirNRL Earle Sapp verified there was no other recourse and signed the request to DirPrgmC Harlfinger (26 Oct 70).

~~(S/B)~~ On the same day, a Monday, that Capt Sapp signed the letter, Pete Wilhelm and Reid Mayo joined Bill Jensen to brief the NRO staff. About fifteen viewgraphs were used to summarize the status of POPPY 7, budget deficits, and a proposal for an R&D payload planned for the next launch. It was requested that the presentation be reduced to writing for complete evaluation. This was accomplished the following week and forwarded by DirPrgmC Harlfinger to DNRO McLucas (5 Nov 70).

~~(S/B)~~ At a higher level, the NRO ExCom, via the DepSecDef, was aware of the Navy need and the capability of at least one NRP system to support it. An ocean surveillance requirement was validated by the USIB. The need was elaborated by the CNO (Op-092). Now the action was on NRO to determine what needed to be done, how well, and by what means. On 6 November 1970, DNRO John McLucas, DepDNRO Robert Naka, and Capt Bob Geiger of the NRO staff briefed the CNO and his senior staff on existing and projected capabilities of NRO systems that might be applied to collect information on the Soviet navy. NRO wanted to respond to Navy and other needs using POPPY and other technology and Program C and other NRP resources and assets. The DNRO offered to conduct a test [redacted] other NRO systems, to determine their suitability for ocean surveillance support. CNO Zumwalt's position was that the numbered fleets need support from overhead systems to perform their mission, and the DoN would utilize and support the NRO as necessary to meet this need.

(U) Bob Geiger was a Naval Academy graduate (1948), had flown Navy patrol planes (VP 21), received a master of science degree in aeronautical engineering from MIT, became designated as an aeronautical engineering duty officer (AEDO), completed several tours as an AEDO, then served with the SAFSP in El Segundo, California, and was now attached to the SAFSS in the Pentagon, where his responsibilities (shared with [redacted] included coordination with NRL on systems in preflight status. At SAFSP from January 1966 through October 1969, Geiger had served as assistant deputy director for advanced plans, then as deputy director for programs under BGen John Martin, and his successor, BGen William G. King. Geiger's current assignment as officer-in-charge, Navy Space Projects Activity, Washington, D.C., was the billet for the senior naval officer assigned to the SAFSS. CNO Zumwalt was favorably impressed with Geiger's experience and familiarity with the Air Force, space technology, defense aerospace industry, and nationally funded systems. These struck him as ideal qualifications for the current Navy need and motivated him to suggest reassignment from the Air Force secretariat to form the covert project office suggested by John McLucas several months ago.

(U) Citing the SecDef's recent ruling on space system development, the VCNO, Adm Ralph W. Cousins, requested the chief of naval material (CNM), Adm Jackson D. Arnold, to establish a Navy space project within the Naval Material Command (NavMat); designated Capt Geiger to be its manager and assume directorship of Program C; requested RAdm Harlfinger to assist CNM in the transfer of Program C responsibilities from NIC-2; and assigned Op-07 responsibility for

coordinating ocean surveillance requirements within OpNav (18 Nov 70). As the senior AEDO in the Navy, Adm Arnold welcomed Capt Geiger back to his own community after a five-year absence and issued a notice to establish a Navy space project (25 Nov 70). NavAir would provide Geiger with office space, administrative and security support, and an initial staff from Air-538, including one naval officer and three civilians. The notice designated Robert Speaker as deputy program manager and tasked Geiger to promulgate a charter by 5 January 1971.

~~(S/B)~~ On 10 December, Bill Jensen conducted a TOG meeting in the Hoffman Building, numbering about twenty persons from NIC, NRO, NSG, NSA, NRL, CIA, and HRB. His agenda was limited to reports on topics of current interest: Program C organizational changes (Bob Geiger), [redacted] of Mission [redacted] for signal level measurement (Ed Dix), payload status and improvements in ground receiver sensitivity (NSG), [redacted] (Tom Lawton), [redacted] (NSA), and [redacted] and a limited analytical capability for the [redacted] ((George Price). [redacted] would begin operations in its new building [redacted] move would be completed the [redacted] beyond its design life, Mission [redacted] was totally inoperable and no further tasking would be issued. The [redacted] of Mission [redacted] were getting close enough in orbit to raise concerns about [redacted] Reid Mayo answered a series of questions from Bob Geiger related to the development status of Mission [redacted] The target launch date was November 1971, but a definitive schedule awaited decision from the NRO on the budget deficits, inputs from NSA and NRO on final band definition, and decisions from NRL's senior management on resources. Capt Jensen closed the meeting with thanks to those assembled for past support and assured Capt Geiger that his new organization could count on the same level of support. After twelve years under ONI/NIC, control of the Navy ELINT satellite project passed to NavMat, but Geiger had stated that he foresaw "little change in the responsibilities of agencies and activities now associated with the POPPY program" (11 Dec 70).

~~(S/B)~~ DirNSA Noel Gayler spent the afternoon of 12 December at the NRL, reviewing all electromagnetic intelligence projects assigned to the electronics, general sciences, and oceanology areas. Director Alan Berman acknowledged that the Laboratory's talents were balkanized among many divisions that did not interact with one another and that there were few opportunities to couple research endeavors into more system-oriented objectives. He had expressed these concerns in a letter to Howard Lorenzen the previous day, along with an invitation to head up a new space applications division (11 Dec 70). Gayler acknowledged a similar problem at the NSA, with respect to non-COMINT missions, and the need to consolidate management of functions involving about one thousand personnel. Lorenzen was absent that month, attending meetings at the Naval Postgraduate School in Monterey, California, so his branch heads and section heads briefed the projects assigned to the electronic warfare division. Reid Mayo covered POPPY and conceded that the Laboratory was now on probation, due to the cost overrun.

~~SECRET~~

~~(S/B)~~ Although his appointment as program director was not yet official, DirPrgmC Geiger was the recipient of the [redacted] response to the cost overrun, forwarded by a cover letter signed by DNRO McLucas, which stated:

> The increased costs of the POPPY Project identified in the referenced documents are exceedingly difficult to defray. Reasons for the additional costs in some instances are obvious; however, there appears to be a need for more stringent management and fiscal control. I recommend you place immediate emphasis on corrective procedures to reverse the present trend of increased cost growth. (17 Dec 70)

To offset the increase, NRO disapproved an NRL R&D payload slated for launch with POPPY 7, slipped [redacted] to the next fiscal year, and deleted funding for advanced [redacted] suggesting that sponsorship should be sought from NSA vice NRO. DepDNRO Naka sent Geiger a request for status reports on technical, schedule, and financial aspects of Program C, due by the 20th of each month for the previous month, commencing immediately (23 Dec 70). Bob Geiger forwarded the NRO message to the NRL, where Reid Mayo accepted responsibility to compile the reports in the format specified.

Chapter 13 References

21 Apr 70 CNO (TS/B - codeword) message for OpCen (CIA), info SSO DIA, DirNSA, APSSO USAF, State RCI, SSO ACSI DA, NRL, CNSG, 212122Z Apr 70
Subj: Tasking Requirement [redacted] support to CincPacFlt]
Ref: (a) CNO 091700Z Apr 70 [redacted] support to CincLantFlt, CincUSNavEur]

11 May 70 USIB (TS/TK - codeword) TAB D, TCS-032-70, USIB-SC-10.9/43
Subj: USIB Guidance for Overhead Collection and Processing of ELINT

11 Jun 70 SecNav (TS/B - codeword) memorandum for DepSecDef, BYE 61524/70
Subj: Use of the POPPY Elint Satellite System for Ocean Surveillance
Encl: Proposal for Ocean Surveillance POPPY Processing Centers Utilizing POPPY ELINT Satellites

[redacted]

17 Aug 70 CNO (Op-092) (TS/B- codeword) letter to DNRO, Op-092/kfg, BYE 66385/70
Subj: Navy Ocean Surveillance Requirement
Atch: (U) Locational Accuracy and Reporting Timeliness Criteria

17 Aug 70 DirPrgmC (TS/B - codeword) memorandum for the DNRO, copies to DirNSA, DirDIA, DirNRL, CNSG, BYE 66387/70
Subj: Proposal for POPPY Support to Ocean Surveillance
Encl: (1) (TS/B - codeword) POPPY Support to the Ocean Surveillance Requirement

19 Aug 70 John S. Foster (DDR&E) (TS) memorandum for Adm Zumwalt (CNO)
Subj: Exploitation of Program "C" for Ocean Surveillance

4 Sep 70 DirNSA (TS/B - codeword) memorandum for CNIC, copies to Dir, NRO, ADP, P04/SPO, K4, K46, NSA-BYE-19291-70
Subj: Proposal for POPPY Support for Ocean Surveillance

8 Sep 70 SecDef (U) DoD Directive 5160.32
Subj: Development of Space Systems

24 Sep 70 CNO (TS/B - codeword) memorandum for CNSG, copy to DirNRL, reference CNO Action Sheet 489-70, BYE 66418/70
Subj: DSB Ocean Surveillance Task Force Recommendation #5.6

7 Oct 70 DNRO (TS/B - codeword) memorandum for the SecNav, copies to DepSecDef, DDR&E, DirNSA, DirPrgmC, BYE 13243-70
Subj: Augmentation of POPPY Facilities for Ocean Surveillance
Atch: TAB A, POPPY Proposal

[redacted]

16 Oct 70 DirSAFSS (TS/B - codeword) memorandum for CNO, copy to DirPrgmC, BYE 13256/70
Subj: Ocean Surveillance
Encl: (TS/B) Presentation to U.S. Navy, Capabilities and Limitations of SIGINT Satellite Systems in Support of Navy Ocean Surveillance, 8 October 1970, by National Reconnaissance Office Staff

26 Oct 70 DirNRL (TS/B) letter to DirPrgmC, 5170:PGW:lpl, BYE-51916-70
Subj: Revision of FY-71 NRL Budget for Mission [redacted]

5 Nov 70 DirPrgmC (TS/B) letter to DNRO, Op-923E/rh, BYE 66449/70
Subj: Program C [redacted] Budgetary Status; information concerning
Encl: (1) Revisions in Mission [redacted] Budgetary and Technical

18 Nov 60 CNO/VCNO Action Sheet 768-70 to CNM, Op-07, Op-092
Subj: Navy Space Project; establishment of

18 Nov 70 CNO/VCNO Action Sheet 769-70 to CNM, Op-07, Op-092, BYE 61592/70
Subj: Navy Space Project; supplemental information

25 Nov 70 NavMat (FOUO) Notice 5430 to distribution, NavMatNote 5430, MAT011:ATC
Subj: Navy Space Project (PM16); establishment of

11 Dec 70 Manager, Program C (TS/B - codeword) letter to distribution (CNSG G54, NRL Code 5614, NRO SOC, NSA K4/SPO, CIA OEL/GSD)
Subj: POPPY Technical Operations Group (TOG) meeting; report of
Encl: (1) List of Attendees
(2) TOG Agenda

11 Dec 70 Alan Berman (U) letter to Howard O. Lorenzen, 4000-274:AB:sor
Subj: [Reorganization]

17 Dec 70 DNRO (TS/B - codeword) memorandum for DirPrgmC
Subj: Program C [redacted] Budgetary Status
Ref: DirPrgmC memorandum for DNRO of 5 Nov 70, BYE-66449-70, same subject
Atch: Fiscal Status — Program C

[redacted]

Jan 94 James E. Morgan personal letter to Capt Rand H. Fisher
Subj: [Promotion and Assignment as Program Manager]

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Chapter 14. AUTOMATION AND FLYOUT

~~(S/B)~~ *Navy, NRO, and NSA developed an ocean surveillance architecture. The POPPY technology and infrastructure were* [redacted] *POPPY continued its multiple missions until retirement in 1977.*

Reorganizations

~~(S/B)~~ In a first stage of reorganization at the NSA, DirNSA Gayler established W-Group, successor to K-4 and responsible for non-COMINT production. The new chief of W (K-4), [redacted] provided NavSecGru with a prioritized list of target signals for POPPY (13 Jan 71). [redacted] remained the top priority for both sets of field analysis capabilities: [redacted] There followed a mix of [redacted] emitters, including the [redacted] family. In a second stage of reorganization, N-1 (system planning) would be merged into W-Group. Responsibility for the entire non-COMINT organization would be assigned to [redacted] who would manage both planning (including tasking) of systems and exploitation of data collected by them. In this role, [redacted] became NSA's primary spokesman regarding NRO's ELINT, telemetry, and [redacted]

(U) The Program C cost overrun for fiscal year 1971 had some additional repercussions at the NRL. Communication with NIC-2 and SAFSS over increased cost, closer SAFSS scrutiny of monthly financial status reports compiled by the NRL comptroller, and some finger-pointing over inadequate coordination on new capabilities, had involved NRL's senior management. Monthly internal management reviews of Program C-funded activities began on 17 November 1970, with a presentation for DirNRL Earle Sapp and NRL's top civilian, Director of Research Alan Berman. Monthly written status reports were now required, due the second Thursday of each month. The first two reviews were conducted in Building [redacted] which housed most of the electronic warfare division and had drafting tables and work benches aplenty but no conference room. (Mayo's section occupied the Building [redacted] For the January 1971 review, Dr. Berman suggested a change in location to a conference room in the special security officer's vault, which was in Building [redacted] — home of NRL's directorate and administrative staff. The director of research took an active interest in the mission, particularly in capabilities against [redacted], and he had supported Howard Lorenzen's request for additional personnel resources to

enable Mayo's section (in Jim Trexler's branch) to become established as a separate, third-echelon branch.

(U) At the NRL, the satellite platform had now eclipsed the electronic warfare mission and would become the basis for a new, first-echelon space science and technology area. Following through on his pre-Christmas letter to Howard Lorenzen, Alan Berman initiated a restructuring of Laboratory elements engaged in research related to space and electromagnetic intelligence (19 Feb 71). The electronic warfare division (NRL code [redacted] was disestablished. The two [redacted] related branches, under Bob Misner and Mack Sheets, shifted to the communications sciences division (where Dr. Bruce Wald would become division superintendent the following year). Part of the staff, two other EW branches, and two branches from other NRL divisions joined a new tactical electronic warfare division (code 5700), whose research supported aircraft, surface ships, and submarines. Jim Trexler's space technology branch became part of a new space systems division (NRL code 7900), that consolidated most of NRL's on-going space projects, including a data systems branch, a navigation branch, and Pete Wilhelm's satellite techniques branch, which supported all of them. Howard Lorenzen agreed to exchange his superintendence of electronic warfare for that of space systems, due the opportunity to more closely align efforts under Mayo and Wilhelm and Dr. Berman's suggestion that Lyn Cosby take the tactical electronic warfare division. Cosby had long led the division's development of ECM equipment for naval aircraft, particularly for defense against guided missiles, which Lorenzen then considered the Laboratory's most vital support to U.S. Navy aviators at war in Vietnam.

(U) Reid Mayo's space applications branch in Building [redacted] moved across the mall to Building [redacted] just between Lorenzen's Building [redacted] and Wilhelm's Building [redacted] As with all branch heads at the NRL, Mayo now had monthly access to the director of research in a private two-hour meeting. The new branch had its own administrative officer, Loretta Harding, and a secretary. Working space remained tight, the typical allocation for a GS-11 in Fred Hellrich's ground systems section being 50 to 60 square feet. By contrast, Vince Rose's flight systems section enjoyed the luxury of occupying, in a new high-bay area (room 120), a payload laboratory that included an anechoic chamber, environmental test equipment, and automated test systems.

(U) CNO Zumwalt established the OpNav office of command support programs (Op-094), effective 15 March 1971, with RAdm Harlfinger as its director. The offices of ACNOs for intelligence and for communications and cryptology were disestablished and made into divisions of Op-094. Harlfinger continued as CNIC four more months until RAdm (select) Earl F. (Rex) Rectanus was assigned to wear three hats: CNIC, director of command support programs' intelligence division (Op-942), and CNO's assistant for intelligence (Op-009). ComNavCommCom Fitzpatrick was designated as director, communications division (Op-943); CNSG Cook, director, signals exploitation and security division (Op-944). Both of the latter officers would

soon move to new assignments — Francis Fitzpatrick, as JCS director of communications-electronics (J-6); Ralph Cook, as chief of NSA/CSS Pacific.

~~(S/B)~~ The site at NavCommSta [redacted] was digitized by the end of [redacted] 1971, and a new Siss Zulu operations building would be ready for occupancy in [redacted] CincPacFlt now received POPPY [redacted] reporting support from [redacted] sites. [redacted] known [redacted] had responsibility for coverage of [redacted] both focused on [redacted] The POPPY site at [redacted] between [redacted] was particularly adept in picking [redacted] results of which flowed to [redacted] — now commanded by VAdm Evan Aurand (ComThirdFlt), who had been present at the NRL, two years ago, when Adm Moorer spurred the effort to digitize [redacted] and had been President Eisenhower's naval aide when White House approval was needed to turn on the GRAB payloads. Before the end of the year, [redacted] would also be locating ABM, [redacted] radars in the [redacted] Soviet Union.

Program Agreement

~~(S/B)~~ In the spring, Bob Geiger, accompanied by LCdr [redacted] of the NRO SOC, visited [redacted] received the standard briefing from Lt(jg) Bob Lentz, the Siss Zulu project officer, and witnessed pass operations. [redacted] were still operational, [redacted] were being operated around the clock. Technical support was provided by Johnny Martin from HRB. Of particular interest in recent production on [redacted] were locations of multiple sets of [redacted] Production of [redacted] and Siss Zulu personnel were looking forward to launch of POPPY 7 later in the year.

~~(S/B)~~ [redacted] had initially detected the [redacted] Yet POPPY's [redacted] at [redacted] surprised the intelligence community to the extent that Program B's photo satellites were tasked to confirm the reports. During the period [redacted]

~~(S/B)~~ At the NRL, the satellite techniques branch had been designing the next generation POPPY satellite for launch on a Martin Marietta Titan IIIB, in accordance

with last year's budget guidance from the SAFMS and a recent reaffirmation (19 Apr 71). The POPPY 5-7 multiface design could not withstand vibration from 10 Gs of Titan thrust (as compared to 4.5 Gs from a Thorad). The Titan's lift-off capacity permitted a sturdier and heavier drum-shaped design and [redacted] capabilities, but the projected cost had grown to [redacted] per year for [redacted] From the perspective of the [redacted] office, this represented a doubling of the POPPY baseline of the mid-1960s, [redacted] per year, a launch every other year. The budget approval for FY72 deferred all funding [redacted]

~~(S/B)~~ To offset a perception of unwarranted cost growth, DirPrgmC Bob Geiger solicited NRL and NSA for measures of growth in capabilities and performance. Graphs that showed growth in number of satellites per launch, [redacted] number of ground sites digitized, number of intercepts reported by NSA, and ELTs issued by NSA were far steeper in their upward trends than the graph on cost growth. Over the eight-year period, NSA's location accuracy attributed to POPPY went from [redacted] NRP costs per collection operation and emitter location had plummeted. W-Group Chief [redacted] provided a letter testimonial on POPPY achievements in search, ABM search, and technical intelligence, calling particular attention to its ability to determine [redacted] Geiger sent the graphs and letter to DNRO John McLucas (6 May 71). A contemporaneous EOB study conducted by DIA's deputy director for collection and surveillance and NRO's deputy director for analysis showed that NSA's [redacted] processing of POPPY data was now effective against [redacted] Among ELINT collectors, POPPY [redacted]

~~(S/B)~~ In a community effort to establish a management construct for POPPY, NRO was represented by DirPrgmC Geiger; NRL, by Howard Lorenzen; NSA, by [redacted] NSG, by Lloyd McGraw; and CIA, by [redacted] Geiger held a working conference with Lorenzen, McGraw, and [redacted] on 26 May. He suggested that they establish high-level agreement among the principals and leave the details to lower level agreements that PM-16 would negotiate with each participating organization. This approach was tried but found to be lacking, since each organization wanted to have a say on roles and responsibilities of the others. Mutually satisfactory understandings were reached and reflected in a management agreement, by which PM-16 secured ratification of its charter for POPPY, as well as the roles of the participating organizations, as follows:

NRO/NSA/CIA/USN
MANAGEMENT AGREEMENT FOR THE POPPY SYSTEM

I. PURPOSE:

The purpose of this agreement is to define the organizational responsibilities and the lines of authority associated with the management of the POPPY System Project.

II. BACKGROUND:

The Navy Space Project (PM-16) was established by the Chief of Naval Operations under the Chief of Naval Material. The Manager, Navy Space Project, is also the Director of NRO, Program C. As the Director, Program C, he is supported by elements of the National Security Agency, the Central Intelligence Agency, and the United States Navy in fulfilling his responsibilities under the National Reconnaissance Program.

III. RESPONSIBILITIES:

The Director, Program C is responsible to the Director, National Reconnaissance Office, for the overall management of the POPPY Project. The Director, National Security Agency, is responsible for the processing, analysis, and reporting of POPPY collected data. The Director, Central Intelligence Agency, is responsible for the administration and [redacted] The Director, Naval Research Laboratory, is responsible to the Director, Program C, for the engineering and technical support in the design, development, fabrication, test, and on-orbit operation of the system. The Commander, Naval Security Group Command, while functioning in support of the NRO, exercises for the Director, Program C, in-flight operational control of the POPPY system, executing the tasking directions of the NRO and processing priorities of NSA.

/s/
John L. McLucas
Director
National Reconnaissance Office

November 5, 1971

Noel Gayler
Vice Admiral, USN
Director
National Security Agency
17 October 1971

Carl E. Duckett
Deputy Director for
Science and Technology

16 July 1971

Robert A. Frosch
Assistant Secretary of
the Navy
(Research and Development)
June 25, 1971

Attached, as part of the agreement, were five pages of detailed, specific responsibilities of DirPrgmC, DirNRL, CNSG, DirNSA, and DCI for support of the POPPY system, and these summarized roles established under ACNO (I) directorship during the previous decade. Operations at the [redacted] had terminated a year earlier, leaving [redacted] operational Navy sites and one under development and [redacted] — all supported by NRL.

Continued Development

~~(S/B)~~ Most of the POPPY ocean surveillance upgrade remained to be done, including completion of a new collection site at [redacted] development of priority (or perishable) data extractors (PDE), preliminary design of automated processing for [redacted] and ephemeris improvement studies with the Naval Weapons Laboratory. To reduce meetings, Bob Geiger consolidated the ocean surveillance augmentation committee and its working groups with the TOG, which he chaired. Over a half-year period, Reid Mayo had instigated sufficient changes in content and format of the schedule portion of monthly status reports required by NRL and NRO that one mid-month set of milestones charts now sufficed for both,

and it was made an enclosure to monthly TOG minutes that DirPrgmC forwarded by memorandum to both directors (plus DCI, DirNSA, and CNSG). George Price had completed semi-automation of collection [redacted] and now had the lead on PDEs, scheduled for installation at Navy sites in the fall and winter. Development of a POPPY automated processing system was being managed by Fred Hellrich (hardware) and Lee Hammarstrom (software). The next launch would be in December. Integration and testing of the satellites and ground equipment was underway at the NRL and [redacted] Final plans were being coordinated with other organizations for launch operations and EE&C. Field sites were being primed for O&M responsibilities. CNO Zumwalt had asked DNRO McLucas for a contingency plan, to be implemented in the event of launch failure. In response to PM-16's request, NRL had outlined a minimal [redacted] for each Scout launch. The outline had to be elaborated. Design and identification of long-lead items for [redacted] was the primary focus of design teams under Pete Wilhelm [redacted] satellites) and Reid Mayo (ELINT payloads and ground upgrades).

~~(S/B)~~ The NRL team delivered a [redacted] presentation to the NRO on 10 June — with mixed results. DirPrgmC Geiger informed Lorenzen that the briefing was very well received but that the NRO needed "alternatives to the [redacted] proposals to reduce costs" (14 Jun 71). He requested specific options, including launch intervals shorter than the nominal two years, offset by two vice four satellites per launch. He challenged NRL regarding cost-effectiveness of several of NRL's proposals, including a shift to a larger, [redacted] Geiger invited Lorenzen to "exercise a broad range of options in arriving at alternatives for Mission [redacted] so that the proposed payload will retain the basic [redacted] characteristics and at the same time employ only those features which are most cost effective."

~~(S/B)~~ Bob Geiger had two goals — sustain the present system and develop an ocean surveillance capability — but not enough money to accomplish both on the scale envisioned. NRL had learned — from the new DirSAFSS, Col Dave Bradburn, during the 14 June briefing for the NRO — of an SAFSP decision, three months earlier, to revert to the McDonnell Douglas Thorad booster, necessitating structural redesign. Faced with reduced capabilities or only one pair of satellites, Pete Wilhelm accepted Geiger's invitation to be innovative in reducing costs.

(U) Atlas F ICBMs were designed for a lob trajectory, but Wilhelm calculated that the missile had nearly enough power to make orbit. What was needed, was a controllable upper stage to take the four satellites from 100 miles, achievable by the ICBM, to 500 miles; circularize the orbit; and dispense the satellites, [redacted] in their operational orbit. The cost part of the analysis, potentially a significant savings, derived from the fact that SAC had a surplus of Convair's Atlas F ICBMs, which were being replaced by Boeing's Minuteman. An upper stage for the missile could be developed for a fraction of the cost of a Thorad

Agena. With a [redacted] could be carried on a satellite dispenser, the entire configuration weighing under [redacted] pounds and form-fitted to the Atlas F. Geiger got a hearing from SAFMS McLucas and his staff. DirSAFSS Bradburn objected that the Atlas F ICBM could not meet the requirements and ended the meeting. Before departing, Wilhelm offered the colonel his notes and figures, recommending that he have them analyzed on the West Coast. In a week, Dave Bradburn acknowledged that he stood corrected. On 3 August, Pete Wilhelm took Col Bradburn and a small party, including Charles Sorrels of the OMB staff, on a guided tour of his facilities at [redacted] where the satellite [redacted] and the NRL, where it would be built. Geiger received permission to proceed but was disappointed to find that the comptroller would credit the cost savings to SAFSP's launch support line, rather than his program.

Automated Processing

~~(S/B)~~ [redacted] reported to CNO Zumwalt that [redacted] had established [redacted] reporting as a full fledged source of ocean surveillance information [redacted] and recognized POPPY as a valuable intelligence source at a time of decreasing conventional reconnaissance assets.

~~(S/B)~~ After the POPPY management agreement had been signed by DirNSA Noel Gayler on 17 October, PM-16 entered into negotiations with NSA, regarding automation of processing at [redacted] to improve volume and timeliness of reporting. NSA was willing also to support advanced priority data extractors, which could serve Project [redacted] and ocean surveillance. [redacted] was in favor of incorporating [redacted] capabilities. It seemed likely that HRB would do the PDE and automated processing work, and an NRL contract was already in place; but DirNSA was responsible for processing, analysis, and reporting, and there were differences between NSA W-Group and NRL on required capabilities.

~~(S/B)~~ DirNSA Gayler, advised by [redacted] was altering the intelligence community's perception of NSA's proper role in overhead SIGINT missions in the fall of 1971. A revision of the SIGINT directive (NSCID 6), then being staffed, specifically addressed DirNSA's relationship to SIGINT activities of the DNRO, a subject not mentioned in either the NRO charter of 1964 or the 1965 agreement on reorganization. It did so in the context of new guidance from President Nixon that

charged the foreign intelligence community, under DCI Helms, to improve efficiency; gave new visibility to tactical and timely intelligence at the national level; reaffirmed the NRO management structure; and directed establishment of a "unified National Cryptologic Command," under DirNSA (5 Nov 71).

~~(S/B)~~ NSA W-Group's greater influence was evident, as well, in the greater level of detail in SORS mission guidance for Mission [redacted] (scheduled for December launch), which specified target regions, target emitters, areas of interest, and the [redacted]

~~(S/B)~~ To support development of a POPPY automated processing system (PAPS), NRL wanted NSA's algorithms used in the CDC 6600 computers; any other candidates for evaluation; and NSA's processing assistance, during forthcoming EE&C for Mission [redacted], to determine [redacted] NSA's W-Group wanted technical oversight responsibility for PAPS development. DirPrgmC Geiger accepted W-Group Chief [redacted] position that greater participation by NSA in development of software deployed to ground stations was desirable, but he was concerned about difficulty in reaching agreement at lower levels on objectives and technical approaches.

~~(S/B)~~ Mission [redacted], last and best in the POPPY series, was launched on 14 December. The four 27x34-inch satellites would fly [redacted] As in all previous launches, Reid Mayo and Vince Rose supported pre-launch activities at Vandenberg AFB. Mayo left immediately after the successful Thorad Agena D launch and separation, arriving at [redacted] in time to witness telemetry collection on the [redacted] POPPY 7 provided RF coverage, [redacted] and its employment had been suggested by [redacted] in order to support [redacted] needs as well as a [redacted] requirement. Coverage on [redacted] was distributed among [redacted] Innovations included a [redacted] capability and [redacted]

[redacted] Bob Eisenhauer had equipped each satellite with [redacted] of [redacted], to store measurements pertinent to spacecraft attitude or other telemetry data. To support the user community, NRL issued a Talent Keyhole technical description (23 Mar 72). [redacted]

~~(S/B)~~ PAPS development was well underway before a Program C/NSA agreement was reached to resolve NRL/NSA differences as work proceeded. A memorandum of understanding (MOU) was signed (1 Feb 72) by DirPrgmC Geiger and by [redacted] chief of NSA W-8 (system planning). Terms of the MOU accorded with the POPPY charter and provided for:

- DirPrgmC to exercise overall management, including direction, scheduling, and finance.
- NRL to administer the contract with HRB and deploy/install the system.
- NSA to "provide technical guidance for software development" and "provide a limited number of programmers/system analysts to HRB Singer Corp. to assist in the contract efforts," both to "provide technical assistance" and "gain experience in joint design and usage of operational software."
- "Major differences in technical approach or direction will be resolved by the Director, Program C in combined meeting with cognizant NSA and NRL representatives."
- NSA to lease an SEL 86 system to HRB; NSA and NRO Program C to pay equal shares of software development costs.
- NSA and Program C to "jointly develop funding requirements in FY 73 and beyond."

~~(S/B)~~ By the end of the month, after a year of studies, the decision was made by NRO and Navy to terminate [redacted] and, instead, for [redacted]

~~(S/B)~~ Operational elements of Program C were informed of the future architecture for Mission [redacted] at a first POPPY operations seminar, hosted by RAdm Chet Phillips and conducted at the NSG command headquarters the week of 13-17 March. Goals were to foster program-wide dialogue, improve operational performance, and involve field personnel in program planning. Over [redacted] people participated, including members of NavResLab, NavIntCom, NavSecGru, NavSTIC, NSA, CIA, [redacted]

~~SECRET~~

[redacted] HRB-Singer, NRO SOC, NavSpaSur, PM-16, NOSIC, PacFlt, and [redacted] Each Navy field site sent one officer and one enlisted representative. Competing objectives for a system whose collection capability continued to dwarf its processing capability were revealed in briefings and discussions thoughout the week:

- To fulfill POPPY's promise of [redacted] — as employed, for example, in ocean surveillance support to U.S. fleets — CNSG Phillips urged better dialogue among acquisition managers, engineers, tasking authorities, operators, and consumers.
- DirPrgmC Bob Geiger emphasized the importance of NRO support to the military services' intelligence requirements and promised that the character of Mission [redacted] would be changed to provide even greater emphasis on ocean surveillance.
- Cdr John Brent Streit of PM-16 disclosed that the [redacted]
- Superintendent Howard Lorenzen attributed POPPY's success to the multi-agency team effort and spirit that had been created at its inception and sustained as it evolved.
- John F. Doheny, chief of NSA's office of [redacted] ELINT (W-24), affirmed NSA's support for ocean surveillance but urged that such efforts not be emphasized to the point of jeopardizing the continuity of [redacted] POPPY-derived intelligence on [redacted] To heighten appreciation of the value of field reporting of [redacted] W-24 had reinforced its technical feedback program. He summarized significant POPPY contributions to knowledge of high interest signals during the past year. John Conlon of W-24 then previewed NSA's forthcoming, detailed processing, analysis, and reporting requirements for [redacted] based on USIB SORS guidance and tailored to POPPY [redacted] (The Navy and SORS lists had only [redacted] Three W-24 analysts addressed specific radars for which continued POPPY prosecution was essential: [redacted]

- [redacted] chief of NSA's office of operational ELINT (W-41), reviewed [redacted]
- NRL's Lee Hammarstrom and HRB's Dick Wales discussed the SEL 86 architecture and software to be used with it. Interfaced with a priority data extractor, the system would be designed to automatically process [redacted] radar signals.
- Lt Richard L. Haver of NavSTIC praised POPPY's exploitation of [redacted] for [redacted] naval emitters and revealed NavSTIC's interest in broadening this effort to include [redacted] NavSTIC had just published at the secret level an interim version of a [redacted] which incorporated sanitized POPPY information.
- [redacted] of NSA briefed on W-41's efforts to [redacted] POPPY was one of the most valuable current sources.
- NSA's Ken Gallagher (W-241) emphasized that [redacted] in the field. With respect to routine forwarding of all digital tapes by the next available courier, he disclosed that his office was considering the pros and cons of having field sites retain the tapes for a period of time sufficiently long to enable NSA to task additional field processing based on review of field reporting and collateral information.
- LCdr Isaiah C. (Ike) Cole of NSG G54 discussed communication channels available for disseminating POPPY product from field sites to Navy users.
- The seminar afforded [redacted] members of NSA direct exposure to representatives of the remote field sites, [redacted] Against the backdrop of briefings and discussions of inadequacy of present analysis and processing capabilities to fully exploit the POPPY data, both at the NSA and in the field, and the tension between [redacted] there was general acknowledgement that collection tasking could be made even more productive against targets of highest interest by taking into account [redacted]

Lloyd McGraw's division (G54) prepared a 102-page seminar report, which was distributed to the participating organizations and to NSG's directors for the Pacific, Atlantic, and Europe. A cover letter from CNSG assessed the value of the event:

> The Seminar was highlighted by uniformly outstanding briefings and presentations covering a wide range of subjects, and by the overall strong participation by individuals representing the field stations as well as the management organizations in the Washington, D.C. area. Significant problems regarding Project operations (personnel, training, tasking, processing, equipment) were discussed in great detail and actions for solution and improvement were identified in many instances. It was unanimously agreed that this first POPPY Project Operations Seminar had been extremely useful and informative, and it was strongly recommended that they be scheduled periodically, preferably on an annual basis. (12 Apr 72)

~~(S/B)~~ NSA encountered difficulties in carrying out its part of the PAPS agreement, particularly in logistically supporting the SEL 86 computer system at [redacted] and in finding personnel who were both qualified and willing to assist in the efforts at HRB's plant. A fundamental technical difference between NSA's [redacted] project office and NRL's space applications branch was whether PAPS should be patterned after [redacted] (NRL's position); or designed, like [redacted] to [redacted] (NSA's position). NRL's Lee Hammarstrom observed that NSA's goal far exceeded the capabilities of even the large multi-processor [redacted] at NSA. Each of NSA's CDC 6600s quadrupled the processing capacity of the SEL 86. Lines of technical communication between R&D elements of NSA and NRL had been weakened by migration of NSA's [redacted] processing brain trust to [redacted]

Matters were not helped at all by PM-16's role as a management buffer between NSA and NRL. Superintendent Lorenzen could no longer go directly to DirNSA Gayler or DepDirNSA Tordella on Program C matters. Geiger's responsibility to resolve differences on technical approach or direction became more of a burden than he and [redacted] had anticipated.

~~(S/B)~~ The technical approach issue was finally resolved in favor of doing a small part of the job very well to begin with, evaluating the capabilities and limitations, and then adding capacity over time. The PAPS development was completed in six months by veterans from NRL (Fred Hellrich, Lee Hammarstrom) and HRB (Gene DeMark, Dick Wales, Bob Daniels, Mike Keebaugh, Bill Bickham, Earl Lybarger, Joe Riale). PAPS was deployed [redacted] in September for installation and initial checkout by a four-man team from HRB, headed by Dick Wales. While the [redacted] installation was in progress, [redacted] and Bob Geiger agreed that NRL would provide logistics support for the SEL 86 systems at HRB and [redacted] and that a follow-on PAPS software maintenance contract would be administered by the [redacted] ground systems division, headed by [redacted] from NSA. In mid-October [redacted] began discussing with Lee Hammarstrom the turnover of responsibilities from NRL to the SPO.

~~(S/B)~~ On Tuesday, 14 November 1972, DNRO John McLucas visited [redacted] while touring facilities in Europe. His party included Superintendent Howard Lorenzen (NRL), RAdm Chet Phillips (CNSG), BGen Dave Bradburn (DirSAFSS), Capt Bob Geiger (DirPrgmC), [redacted] (NSA W-8), [redacted] (NSA's commander of MGS [redacted], and several others. The visitors were briefed by the Siss Zulu project officer, Lt(jg) Bryant Fred Booth, who was assisted by the site technical representative, George Price from NRL. The DNRO personally operated PAPS, expressed amazement at its flexibility and ease of manual operation, and used it to [redacted] after the end of a Mission [redacted] pass, [redacted] In its automatic [redacted] scheduled to go on-line the following July, PAPS would be able to process [redacted]

~~(S/B)~~ During ensuing discussion and tour of the operations spaces, CNSG Phillips asked DNRO McLucas to support a follow-on system with enough satellites to provide [redacted] coverage (a key factor in RAdm Cook's original proposal). He cited the personnel management problems of maintaining staffing, morale, and experience at [redacted] POPPY sites with long periods of [redacted] each day. With only [redacted] operational, [redacted] for example, was busy for a [redacted] On-line production was then idle for [redacted] resumed their [redacted] revisits [redacted] The Siss Zulu watch structure had to be integrated with the command watch structure, which was geared to 24-hour operations and took into account other military requisites, including security, military and professional training, administrative and personnel support, chain of command, and command functions. The DNRO referred this matter to Bradburn and Geiger for follow-up action. The visitors took note that the entire operation (satellite commanding, collection, analysis, processing, reporting) was carried out by watch-standing sailors, costing NSG an average of [redacted] per man year. This contrasted sharply with [redacted] disclosure of the average cost of [redacted] per man year for contracted personnel at the [redacted] which the DNRO's party had just visited.

SALT

~~(S/B)~~ After a Strategic Arms Limitation Treaty (SALT I) was concluded between the U.S. and U.S.S.R. in May 1972, the USIB formed a steering group on monitoring strategic arms limitations and subsequently requested NRO participation and assistance in assessing signal power-measuring [redacted] (28 Nov 72). DNRO McLucas tasked DirSAFSS Bradburn to handle the steering group's request, and Bradburn turned to [redacted] for technical support. [redacted] compiled an assessment of component uncertainties affecting measurements of

[redacted] for NRO's operational satellites that performed ELINT missions.

~~(S/B)~~ An NRO [redacted]

~~(S/B)~~ Col John E. Kulpa, Jr. USAF of the NRO staff convened a group of expert engineering personnel to validate the draft study (Power Measuring Capabilities) and fill in gaps [redacted] Representing the [redacted] Reid Mayo supported John Kulpa, as did [redacted] Mayo updated the assessment of POPPY to reflect improvements in Mission [redacted] formulation, in terms of component uncertainties and their sums (instead of a [redacted], actually understated capabilities [redacted]

Operations

~~(S/B)~~ Productivity from POPPY had [redacted] after the initial operating capability (IOC) for Mission [redacted] Validation of the ocean surveillance requirement and augmentation did not detract from and perhaps intensified other national intelligence objectives. Competing against other tasking priorities specified for RF collection and for signal processing, each in accordance with USIB mission guidance, at its peak in [redacted] POPPY's production against Soviet [redacted] ships averaged something over [redacted] per week from all [redacted] of operational satellites. Following an analysis effort at the NOSIC in the spring of

1973 by an NSG team led by Lt Jim Morgan, two radars were added to the [redacted] family. On a 30-day temporary duty assignment from [redacted] Jim Arnold successfully tackled the [redacted] radar. He was succeeded by Red Fraser, also from [redacted] whose 30-day task added the [redacted] radar. Two more additions came without special effort, the [redacted]

~~(S/B)~~ VAdm Frederick Harlfinger, director of Navy command support programs (Op-094), received a glowing assessment of the results of the POPPY augmentation program from CNSG Chet Phillips. PAPS II had been operational at [redacted] for over a month and now provided the capability to automatically process [redacted] intercept. Due to improvements in the [redacted] were reaching Navy users with an average [redacted] from message date time group. The longest delays were now due to [redacted], due for deployment in a few more months. The next objective was to automate [redacted] As a result of continued coordination with the NRO SOC, ocean surveillance tasking was [redacted] that specifically provided for in SORS mission guidance, which provided "for good Ocean Surveillance coverage without detracting from the other missions of the system" (23 Aug 73).

~~(S/B)~~ In [redacted] located and measured the [redacted] In September 1974, [redacted] was first to locate and report the new [redacted]

~~(S/B)~~ In [redacted] after nearly six years of community dialogue on viability of NSGA [redacted], a decision was reached to [redacted] The National SIGINT Operations Center (NSOC), headed by [redacted] positively assessed the utility of the current POPPY intercepts compared to other SIGINT systems. The director of Program C, Capt Robert T. Darcy, tasked the TOG to conduct a POPPY continuation study. The TOG chairman, LCdr Ron Potts of the [redacted] formed a working group, which met between monthly TOG meetings, to determine the level at which POPPY operations could and should be sustained [redacted] Fred Hellrich represented NRL; Cdr Ike Cole, NSG; [redacted] NSA; [redacted] the Program C staff; CWO [redacted], NSOC. Using Byeman communication channels, LCdr Jim Morgan of NSG G54 consulted with Siss Zulu project officers at the POPPY sites and with Lt Bob Lentz at NSGA [redacted] Recommendations of the continuation working group were to:

- Terminate POPPY operations at [redacted] including operations, maintenance, communications, a training school, and a software support group.

- Transfer the [redacted] collection system to the new [redacted] MGS at [redacted]
- Provide PAPS software [redacted] to be used with [redacted] processing equipment.
- After POPPY IOC [redacted] terminate operations at [redacted] and transfer equipment to the NRL (for use of components in [redacted] or for spares).
- Terminate operations at [redacted] and transfer equipment to the NRL.
- Work manning with Siss Zulu personnel and NavPers.

DirPrgmC Bob Darcy approved the recommendations, which were fully implemented by NRL, NSG, and HRB by the spring of 1976 within a total POPPY budget of [redacted] for that fiscal year. With closure of [redacted] and [redacted] next year's budget was reduced to [redacted]

~~(S/B)~~ [redacted]

- [redacted]
- [redacted]
- [redacted]

~~(S/B)~~ Nearly 15 years after its first launch, the POPPY project ended in 1977. [redacted] the acting DNRO, Charles Cook, directed phase-out of POPPY operations by the end of the fiscal year (1 Aug 77). The next day, DirPrgmC RAdm Grover M. Yowell directed cessation of POPPY operations. DNRO Hans Mark terminated the Poppy project and wrote the epitaph:

> The termination of the POPPY Program effective 30 Sep 77 closes a long and distinguished chapter in the history of overhead reconnaissance, a chapter that began under Navy auspices even before the NRO was established.' (30 Sep 77)

~~(S/B)~~ The NRL continued to perform power management functions at its [redacted] facility, to sustain [redacted] Mission [redacted] operational capability in case of recall to service. At Mr. Mayo's request, the [redacted] transmitted [redacted] when [redacted] commanded them off, one by one. He had always remembered [redacted]

Chapter 14 References

13 Jan 71 NSA (TS/B - codeword) Memorandum for NSGC, NSA-BYE-18043-71
Subj: Revised SOI List for Local Location Processing
Ref: BYE-1471-70, SORS 10/96/21, 17 November 1970
BYE-1457-70, SORS 10/47/24, 27 August 1970

19 Feb 71 NRL (U) Notice 5400
Subj: Laboratory Organizational Changes

19 Apr 71 DirPrgmC (S/B) message for DirNRL, 191645Z Apr 71, Cite [redacted]58-071
Subj: [Retransmittal of DNRO request for detailed [redacted] design and briefing]
Ref: DNRO message for DirPrgmC, Cite 0507

6 May 71 DirPrgmC (TS/B/TK/C - codeword) memorandum for DNRO, PM-16:RKG, BYE 52238/71, cy 5 of 6
Subj: POPPY Growth; capabilities vs funding
Encl: (1) POPPY Growth
(2) Chief, NSA W (TS/B/TK/C - codeword) memorandum for DirPrgmC
(3) Mission Costs per Collection Operation
(4) NRO Costs/Emitter Location

6 Jun 71 DIA/NRO (TS/B/TK/C - codeword) study
Subj: EOB Satisfaction by Satellite Collection

14 Jun 71 DirPrgmC (S/B - codeword) message for NRL, 141550Z Jun 71, Cite [redacted]100-71
Subj: Alternatives for Mission [redacted]

5 Nov 71 NRO/NSA/CIA/USN (TS/B - codeword) Management Agreement for the POPPY System, BYE 13192-71
Atch: Specific Responsibilities in Support of the POPPY System

5 Nov 71 President Nixon (TS/B/C) memorandum for SecState, SecTreasury, SecDef, Attorney General, DCI, Dir S&T, ChJCS, ChPFIAB, ChAEC; copies to DirOMB and assistant to the President for national security affairs
Subj: Organization and Management of the U.S. Foreign Intelligence Community

1 Feb 72 DirPrgmC/NSA (S/B - codeword) Memorandum of Understanding for Software Development
Subj: [SEL 86 PAPS Development]

29 Feb 72 DNRO (TS/B - codeword) message for DirPrgmC; info DirPrgmA and DirNSA, 292206Z Feb 72, Cite [redacted]0263
(Retransmitted as DNRO message for DirPrgmC; info DirCIA Reconnaissance Programs, DirPrgmA, DirPrgmD and DirNSA, 031504Z Mar 72, Cite 0263)
Subj: Ocean Surveillance System
Ref: CNO/DNRO Meeting of 19 February 1972

23 Mar 72 NRL (TS/TK) Technical Description of Mission [redacted] TK-206000-72

12 Apr 72 CNSG (TS/B - codeword) letter to distribution, NSG/G54/mlk, BYE-52,383-72
Subj: POPPY Project Operations Seminar - 1972
Encl: (1) POPPY Operations Seminar Report
(2) POPPY Operations Seminar Critique Sheet

28 Nov 72 USIB Steering Group on Monitoring Strategic Arms Limitations (TS/B/TK/C - codeword) memorandum for DNRO, SA/SALT-79/72, BYE 112255/72
Subj: Request for NRO Assistance in Assessing US Intelligence Collection Capabilities

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4 Dec 72	Col John E. Kulpa, Jr. (TS/B) internal memorandum for BGen Bradburn Subj: Capability of Overhead ELINT Systems to [redacted] ABM Radars
23 Aug 73	CNSG (S/B - codeword) memorandum for Director, Command Support Programs, NSG/G54/mlh, BYE-38416/73 Subj: POPPY Ocean Surveillance
1 Aug 77	DNRO (S/B - codeword) message for Director, Program C, 011659Z Aug 77, Cite [redacted] 10221 Subj: Poppy Operations
30 Sep 77	DNRO (S/B - codeword) message for DirPrgmC, 302116Z Sep 77, Cite [redacted] 1354 Subj: [POPPY History]

Appendix A. LAUNCH HISTORY

Name	Mission	Payload #/Cover	Size	Bands (GHz)	Launch	Orbit	Life
GRAB 1	ELINT	SolRad 1	20 in, 42 lb		6/22/60, 0554Z Cape Canaveral Thor Able Star	330 x 565 nm 66.7° 101.6 min	3 mo
GRAB	ELINT	SolRad 2	20 in, 40 lb		11/30/60, 1950Z Cape Canaveral Thor Able Star	Failure	0
GRAB 2	ELINT	SolRad 3	20 in, 40 lb		6/29/61, 0423Z Cape Canaveral Thor Able Star	475 x 540 nm 66.8° 103.8 min	14 mo
GRAB	ELINT	SolRad 4A	20 in, 55 lb		1/24/62, 0930Z Cape Canaveral Thor Able Star	Failure	0
GRAB	ELINT	SolRad 4B	20 in, 55 lb		4/26/62, 1049Z Point Arguello Blue Scout	Failure	0
POPPY 1		PL 120 PL 121	20 in, 55 lb 20 in, 55 lb		12/13/62, 0407Z Vandenberg AFB Thor Agena D	124 x 1500 nm 70.3° 116 min	
POPPY 2		PL 110/SolRad 6 PL 112 PL 130/Dosimeter	24 in, 85 lb 20 in, 60 lb 24 in, 85 lb		6/15/63, 1429Z Vandenberg AFB Thor Agena D	95 x 495 nm 69.9° 94 min	
POPPY 3		PL 124/SolRad 7A PL 135 PL 134/GGSE 1	24 in, 89 lb 20 in, 65 lb 20 in, 84 lb		1/11/64, 2007Z Vandenberg AFB TAT Agena D	490 x 506 nm 69.9° 103.4 min	
POPPY 4		PL 141/SolRad 7B PL 142 PL 143/GGSE 2 PL 144/GGSE 3	24 in, 103 lb 24 in, 106 lb 24 in, 122 lb 24 in, 129 lb		3/9/65, 1830Z Vandenberg AFB Thor Agena D	490 x 506 nm 70.1° 103.6 min	

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Name	Mission	Payload #/Cover	Size	Bands (GHz)	Launch	Orbit	Life
POPPY 5		PL 151 PL 152/GGSE 4 PL 153 PL 154/GGSE 5	24 in, 109 lb 27 in, 182 lb 27 in, 162 lb 27 in, 222 lb		5/31/67 Vandenberg AFB Thor Agena D	500 x 508 nm 70.0° 103.3 min	
POPPY 6		PL 161/GGSE PL 162/GGSE PL 163/GGSE PL 164/GGSE	27 in, 235 lb 27 in, 223 lb 27 in, 247 lb 27 in, 236 lb		9/30/69, 1340Z Vandenberg AFB Thorad Agena D	491 x 506 nm 70.0° 103.5 min	
POPPY 7		PL 171/GGSE PL 172/GGSE PL 173/GGSE PL 174/GGSE	27 in, 271 lb 27 in, 271 lb 27 in, 282 lb 27 in, 282 lb		12/14/71, 1213Z Vandenberg AFB Thorad Agena D	530 x 540 nm 70.0° 104.9 min	

Appendix B. FUNDING [redacted]

~~(S/TK)~~

FY	Missions	Navy[1]	CCP[2]	NRP Prgm C[2]	Other[3]	Total
1958		.2				.2
1959		.225				.225
1960	GRAB 1	.465			.325 ARPA	.79
1961	Failure & GRAB 2	3.025				3.025
1962	2 Failures	[redacted]				[redacted]
1963	[redacted]				[redacted] Prgm A	
1964				[redacted]	[redacted] Prgm A	
1965					[redacted] Prgm A	
1966						
1967					[redacted] Prgm A	
1968						
1969			[redacted]			
1970		[redacted]			[redacted] Prgm A	
1971						
1972			[redacted]		[redacted] Prgm A	
1973						
1974						
1975						
1976						
1977						
Total:		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

NOTES

[1]Free ride with Navy Transit on first three launches.

[2]CCP funding for NSA and sites' operation and maintenance was distributed in the budgets of NSA, NSG, ASA, and AFSS. It is unlikely that portions allocable to GRAB and POPPY can be determined since (a) sites were elements of SIGINT stations with multiple missions and (b) NSA's NTPC, COSA-5, and successors (C-1, K-4/SP, W-Group) analyzed and processed data from all ELINT and TELINT systems.

[3]Program A funded Air Force launch vehicle procurement, integration, and launch operations, starting with FY63. Estimates of [redacted] per launch do not take into account that some of these were shared with other satellites.

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Appendix C. BIBLIOGRAPHY

Robert L. Perry, *Origins of the USAF Space Program 1945-1956, Volume V of the History of DCAS* (AFSC Historical Publications Series 62-24-18, 1961), declassified 27 March 1975

Samuel A. Tucker (editor), *A Modern Design for Defense Decision; A McNamara-Hitch-Enthoven Anthology* (Washington, D.C.: Industrial College of the Armed Forces, 1966)

Ronald L. Potts, (TS/B - codeword) [redacted]

Constance McLaughlin Green and Milton Lomask, *Vanguard — A History* (Washington, D.C.: National Aeronautics and Space Administration, 1970)

Naval Intelligence Command, (S) [redacted] (U) (Alexandria, Virginia: 1 February 1971)

[redacted] (TS/B/TK/COMINT) *NSA in Space* (NSA: April 1975), NSA-BYE-19385-75

[redacted]

Ronald L. Potts, (TS/B/TK/COMINT - codeword) [redacted]

Louis A. Gebhard, *Evolution of Naval Radio-Electronics and Contributions of the Naval Research Laboratory* (Washington, D.C.: NRL Report 8300, 1979)

David K. Allison (interviewer), (TS/B - codeword) *An Interview with Reid Dennis Mayo June 4, 9 and 24, 1981* (Washington, D.C.: NRL, June 1981), BYE-58,045-81

David K. Allison (interviewer), (S/B - codeword) *An Interview with Howard O. Lorenzen September 21, 22, 1981* (Seattle, WA: NRL, September 1981, printed 17 March 1997), 8013-BYE-0008-97

Robert Hess (supervisor), James G. Wilson (compiler) et al, (S) *Navy Space Chronology* with (TS/B - codeword) Appendix H *ELINT Satellites* (Washington, D.C.: SPO, 1983)

Lorenzo J. Abella and M. Bruce Hollinger, *Navy in Space: Past, Present and Future* (Dahlgren, Virginia: Navy Space Command, 1983)

Alfred Price, *The History of US Electronic Warfare, Volume II, The Renaissance Years, 1946-1964* (The Association of Old Crows: Port City Press, 1989)

Thomas C. Hone, *Power and Change, The Administrative History of the Office of the Chief of Naval Operations 1946-1986* (Washington, D.C.: Naval Historical Center, Department of the Navy, 1989)

Dino A. Brugioni, *Eyeball to Eyeball, The Inside Story of the Cuban Missile Crisis* (New York: Random House, 1990)

[redacted]

Vincent S. Rose, (S/B - codeword) A History of Antenna Development (U) (Washington, D.C.: NRL Naval Center for Space Technology, 1992), BYE-62044-92

David D. Bradburn, John O. Copley, Raymond B. Potts and [redacted] (TS/B/TK/COMINT) *The*

Valerie Neal, Cathleen S. Lewis and Frank H. Winter, *Spaceflight: A Smithsonian Guide* (New York: Macmillan, 1995)

David van Keuren (interviewer), unedited (S/B) transcript of interviews with Peter G. Wilhelm, February 22, March 13 & 29, April 12, May 5 & 25, and June 23 1995 at the Naval Research Laboratory, Washington, D.C.

Kevin C. Ruffner, ed., *CORONA: America's First Satellite Program* (Washington, D.C.: CIA, 1995)

Capt Wyman H. Packard USN (Ret), *A Century of Naval Intelligence* (Washington, D.C.: Office of Naval Intelligence and Naval Historical Center, 1996)

Gary A. Federici et al, (TS/B/TK/COMINT) *From The Sea To The Stars: A History of U.S. Navy Space and Space-Related Activities* (Alexandria, Virginia: Center for Naval Analyses, 30 June 1997), BYE 057784/97

Curtis Peebles, *The Corona Project: America's First Spy Satellite* (Annapolis, MD: Naval Institute Press, 1997)

Dwayne A. Day, John M. Logsdon and Brian Latell (eds), *Eye in the Sky: the story of the Corona spy satellites* (Washington and London: Smithsonian Institution Press, 1998)

Appendix D. ACRONYMS AND ABBREVIATIONS

(U)

A-Group	(NSA group targeted on) EurCom and Warsaw Pact
ABM	Anti-Ballistic Missile
ACNO	Assistant Chief of Naval Operations
ACOS	(Air Force) Assistant Chief of Staff
ACSI	(Army) Assistant Chief of Staff for Intelligence
A/DDS	(POPPY) Analog/Digital Data System
AD/SI	(CIA) Assistant Director, Scientific Intelligence
AEDO	(Naval) Aeronautical Engineering Duty Officer
AES	Anti-Earth Satellite
AFB	Air Force Base
AFSCF	Air Force Satellite Control Facility
AFSS	Air Force Security Service
[redacted]	
ARPA	(DoD) Advanced Research Projects Agency
ASA	Amy Security Agency
ASN	Assistant Secretary of the Navy
[redacted]	
BTM	Buffered Tape Memory
BuAer	Bureau of Aeronautics
BuOrd	Bureau of Ordnance
BuShips	Bureau of Ships
BuWeps	Bureau of Naval Weapons
C	Confidential
CAMS	Computer Aided Manual System
C-1	(NSA) Office of Collection and Signal Analysis
C-14	(NSA) Special Projects Division
C-15	(NSA) Advanced Signals Analysis Division
CCP	Consolidated Cryptologic Program
CDC	Control Data Corporation
CETF	(USIB COMOR) Cost-Effectiveness Task Force
[redacted]	
CIA	Central Intelligence Agency
[redacted]	
CNIC	Commander, Naval Intelligence Command

~~SECRET~~

CNM	Chief of Naval Material
CNO	Chief of Naval Operations
CNR	Chief of Naval Research
CNSG	Commander, Naval Security Group Command
CO	Commanding Officer
COMINT	Communications Intelligence
COMIREX	(USIB) Committee on Imagery Requirements and Exploitation
COMOR	(USIB) Committee on Overhead Reconnaissance
COMSEC	Communication Security
COSA	(NSA office of) Collection and Signal Analysis
COSA-5	(NSA) Advanced Signals Analysis Division
CSS	Central Security Service
CW	Continuous Wave
DCI	Director of Central Intelligence
DCNO	Deputy Chief of Naval Operations
DCS	(Air Force) Deputy Chief of Staff
DDCI	Deputy Director of Central Intelligence
[redacted]	
DD/P	(CIA) Deputy Director, Plans
DDR&E	Director of Defense Research and Engineering
DEFSMAC	Defense Space, Missile, and Astronautics Center
DF	Direction Finding
DIA	Defense Intelligence Agency
[redacted]	
DNI	Director of Naval Intelligence
DoD	Department of Defense
DoDD	Department of Defense Directive
DoN	Department of the Navy
DSB	Defense Science Board
DSP	Defense Support Program
DTG	Date-Time-Group
ECM	Electronic Countermeasures
EDL	(Sylvania Electronics Systems) Electromagnetic Development Laboratory
EE&C	Engineering Evaluation and Calibration
ELCOM	(USIB) ELINT Committee
ELINT	Electronics Intelligence
ELO	ELINT Operational Report
ELT	ELINT Technical Report
EOB	(DIA) Electronic Order of Battle
ERP	Effective Radiated Power
[redacted]	
EW	Electronic Warfare
ExCom	(NRO) Executive Committee

ExTOG	(Navy) Executive Tactical Operating Group
FOSIF	Fleet Ocean Surveillance Information Facility
FOUO	For Official Use Only
FOV	Field of View
G524	(NSG) Special Operations Branch
G54	(NSG) Special Operations Division
[redacted]	
GHz	Gigahertz
GRAB	Galactic RAdiation Background, or Galactic Radiation and Background
GREB	Galactic Radiation Experiment Background, or Galactic Radiation Energy Balance
HF	High Frequency
HFDF	High Frequency Direction Finding
HRB	Haller, Raymond, and Brown; HRB-Singer Corporation
[redacted]	
ICBM	Intercontinental Ballistic Missile
IOC	Initial Operating Capability
IRBM	Intermediate Range Ballistic Missile
ITT	International Telephone & Telegraph
JCS	Joint Chiefs of Staff
JO	Junior Officer
JSTPS	Joint Strategic Target Planning Staff (Offutt AFB)
K-4	(NSA) Office of Special Projects
[redacted]	
KHz	Kilohertz
[redacted]	
LDO	Limited Duty Officer
LIMDIS	Limited Distribution
[redacted]	
MIPR	Military Interdepartmental Purchase Request
MHz	Megahertz
[redacted]	
MOU	Memorandum of Understanding
MPRO	Machine Processing
NASA	National Aeronautics and Space Administration
NavAir	Naval Air Systems Command
NavFac	Naval Facilities Engineering Command
NavSpaSur	Naval Space Surveillance
NFOIO	Navy Field Operational Intelligence Office (Fort Meade, Maryland)
NIC	Naval Intelligence Command
NIPSSA	Naval Intelligence Processing System Support Activity
NMFPA	Naval Missile Facility Point Arguello (later VAFB South)
NOSIC	National Ocean Surveillance Information Center (Suitland, Maryland)

~~SECRET~~

NPIC	Naval Photographic Interpretation Center, National Photographic Interpretation Center
NRL	Naval Research Laboratory
NRO	National Reconnaissance Office
NRP	National Reconnaissance Program
NSA	National Security Agency
NSCID	National Security Council Intelligence Directive
NSG	Naval Security Group
NSGA	Naval Security Group Activity
NSOC	National SIGINT Operations Center
O&M	Operation and Maintenance
ONI	Office of Naval Intelligence
ONR	Office of Naval Research
OSD	Office of the Secretary of Defense
OSO	Office of Special Operations, Office of the Secretary of Defense
[redacted]	
PAPS	Program Automated Processing System
PDE	Priority (or Perishable) Data Extractor
PM-16	(Naval Material Command) Navy Space Project Office
PMR	Pacific Missile Range
PPS	Pulses Per Second
PRF	Pulse Repetition Frequency
PRI	Pulse Recurrence Interval
PROD	(NSA office of) Production
PSAC	President's Science Advisory Committee
R&D	Research and Development
R&E	Research and Engineering
RAND	Research And Development
RDT&E	Research, Development, Test and Evaluation
RF	Radio Frequency
RTG	(SAC 544th) Reconnaissance Technical Group
S	Secret
S-band	1550-3900 MHz
SAC	(Air Force) Strategic Air Command
SAFMS	Office of Missiles and Space, Office of the Secretary of the Air Force
SAFSP	Office of Special Projects, Office of the Secretary of the Air Force
[redacted]	
SAFSS	Office of Space Systems, Office of the Secretary of the Air Force
SAFSS-7	SAFSS Engineering Directorate
SAFUS	Under Secretary of the Air Force
SAM	Surface to Air Missile
SAMSO	(Air Force) Space and Missile Systems Organization
SEL	Systems Engineering Laboratory

[redacted]

SIGINT	Signals Intelligence
SIOP	Single Integrated Operations Plan
SOC	(NRO) Satellite Operations Center
SOI	(NSA) Signal of Interest
SORS	(USIB/NFIB SIGINT Committee) SIGINT Overhead Reconnaissance Subcommittee
SOSUS	(Navy) Sound Surveillance System
SPASUR	Space Surveillance
SPO	System Project Office
SPR	Seconds Per Revolution
SR	SolRad, Solar Radiation
STIC	(Navy) Scientific and Technical Intelligence Center
[redacted]	
TID	(NRL) Technical Information Division
TIROS	Television and InfraRed Observation Satellite
TK	Talent Keyhole
[redacted]	
TOG	(Program C) Technical Operations Group
TS	Top Secret
U.S.	United States
USAF	United States Air Force
USIB	United States Intelligence Board
USN	United States Navy
U.S.S.R	Union of Soviet Socialist Republics
VCNO	Vice Chief of Naval Operations
VHF	Very High Frequency
VLF	Very Low Frequency
VP	(Navy) Long Range Patrol Squadron
VQ	(Navy) Early Warning Squadron
WS	Weapon System

[redacted]

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Appendix E. INDEX OF NAMES

(U) This index is limited to unclassified names directly associated with Tattletale/Canes/GRAB and successor projects and to selected page references that identify the entry or its relationship to these projects.

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