NATIONAL RECONNAISSANCE OFFICE
14675 Lee Road
Chantilly, VA 20151-1715

14 August 2006

John Greenewald, Jr.

Dear Mr. Greenewald:

This is in response to your e-mail request, dated 13 March 2006, received in the Information Management Services Center of the National Reconnaissance Office (NRO) on 14 March 2006. Pursuant to the Freedom of Information Act (FOIA), you requested, "a copy of all documents pertaining to the first launch of a POPPY satellite, on Dec. 13, 1962."

Your request was processed in accordance with the FOIA, 5 U.S.C. § 552, as amended, and Section 502 of the Intelligence Authorization Act of 2003. A thorough search of our files and databases located four records consisting of 125 pages that are responsive to your request. Three records (29 pages) are being released to you in full and the other (96 pages) is being released in part.

Material withheld is denied pursuant to FOIA exemptions:

(b)(1) As properly classified information under Executive Order 12958, Section 1.4(c) and Section 1.4(g); and exemption (b)(3) which applies to information specifically exempt by statute, the National Security Act of 1947, 50 U.S.C. § 403-3(c)(7) which protects intelligence sources and methods from unauthorized disclosure;

As you are aware, the FOIA authorized federal agencies to assess fees for record services. Based upon the information provided, you have been placed in the "other" category of requesters, which means that a requester is responsible for charges incurred for the cost of search time exceeding two hours and duplication in excess of the first 100 pages of document reproduction in the processing of this request. In this case, no fees were incurred.

You have the right to appeal this determination by addressing your appeal to the NRO Appeal Authority, 14675 Lee Road, Chantilly, VA 20151-1715 within 60 days of the above date. Should you decide to do this, please explain the basis of your appeal.

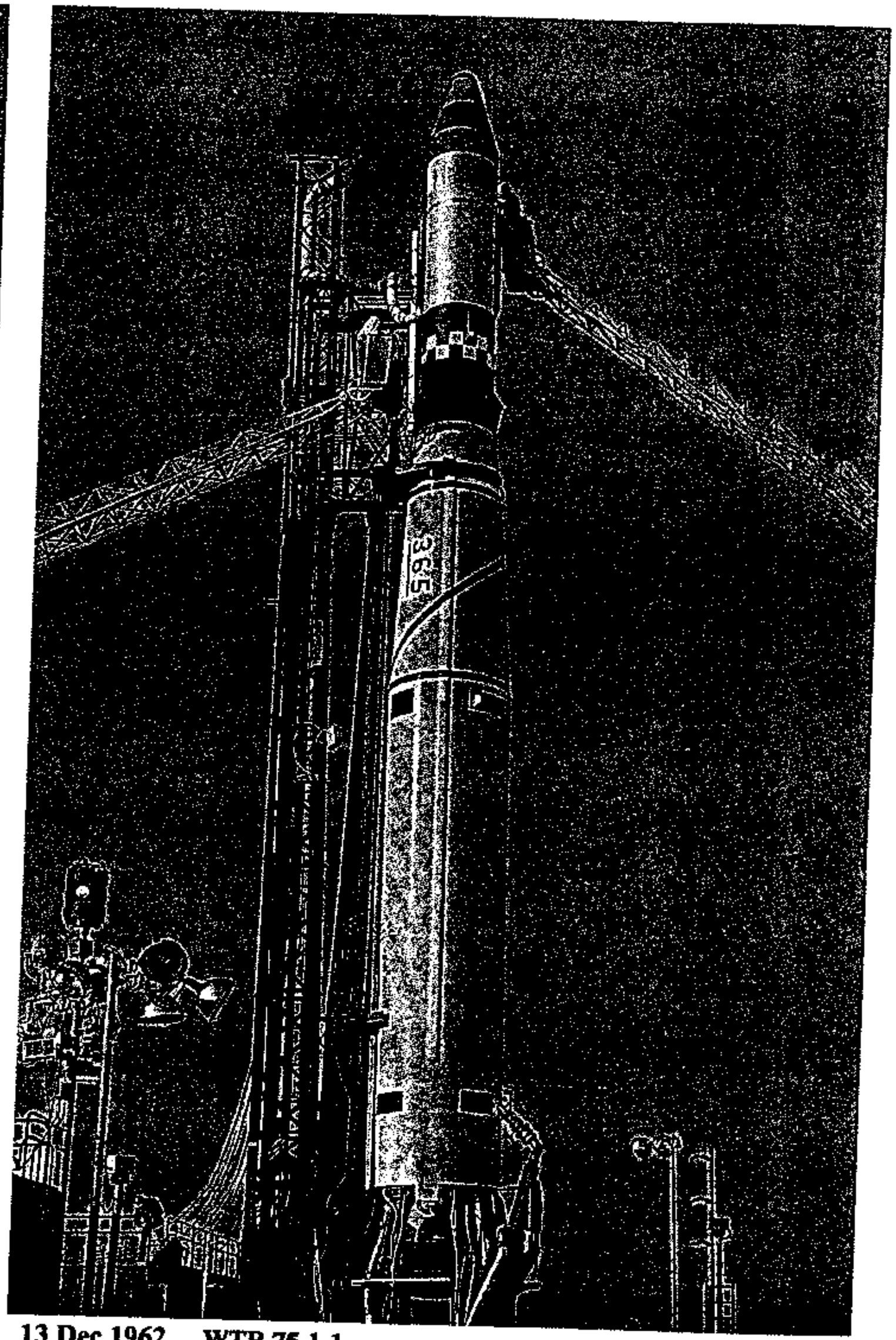
For reference purposes, your request was assigned case number F06-0034. If you have any questions, please call the Requester Service Center at 703-227-9326.

Sincerely,

Linda S. Hathaway
Chief, Information Access
and Release Team

Attachment:
1. History of the Poppy
   Satellite System (96 pgs)
2. Grab and Poppy Brochure
3. Thor 365 (NRL Composite 2)
   13 Dec 1962 WTR 75-1-1
4. Untitled photograph, Thor 365,
   13 December 1962

Thor 365 (NRL Composite 2)



13 Dec 1962 WTR 75-1-1

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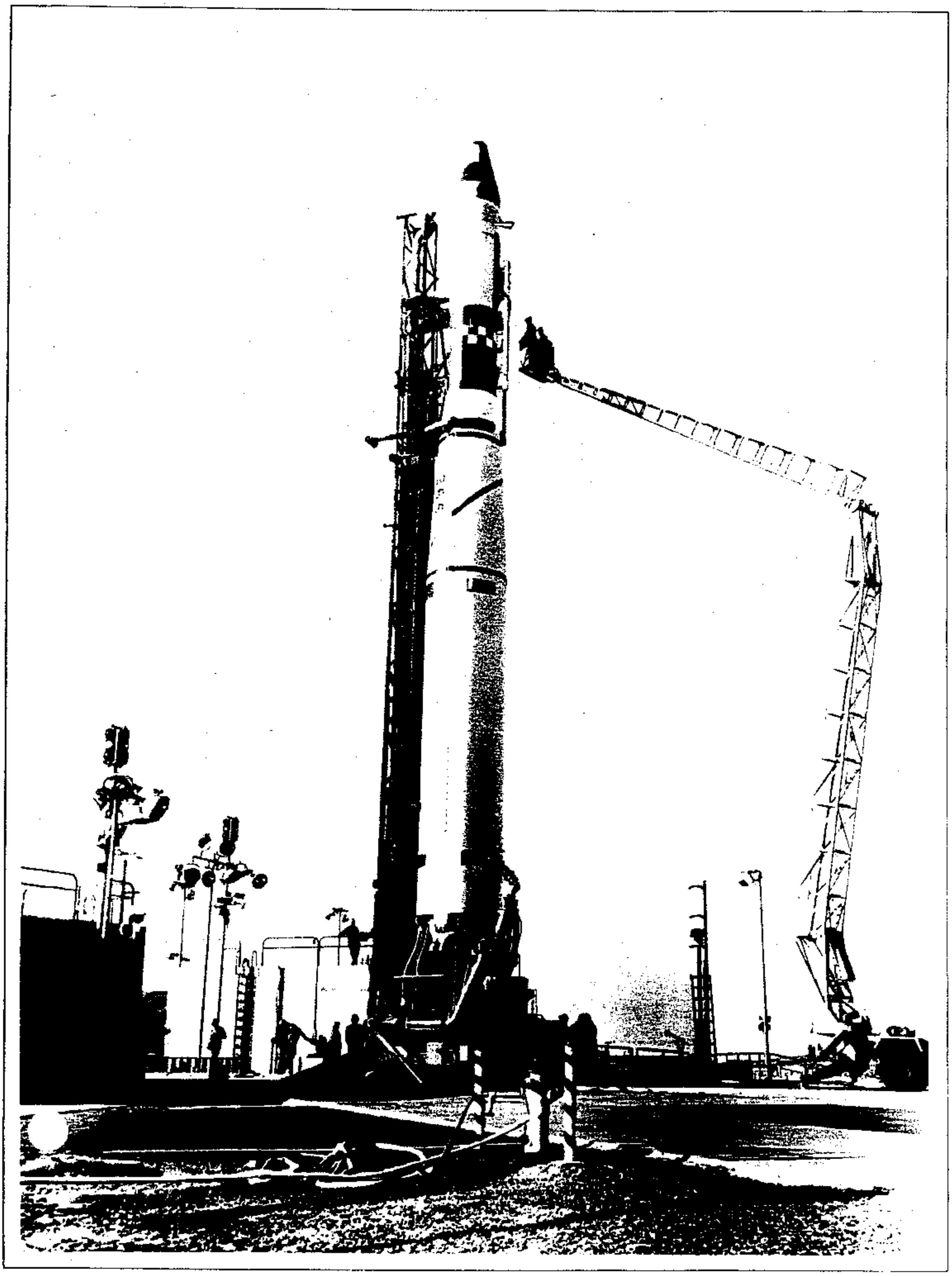

HISTORY OF THE POPPY SATELLITE SYSTEM

FOREWORD

This report describes the history of the POPPY project from its concept in 1958 through its termination on 30 September 1977. This history was compiled at the request of the Director, National Reconnaissance Office to the Director, Program C. Included in this report are the significant events during the nineteen years of the POPPY project, including the development and refinement of POPPY satellites, mission ground stations, ground readout equipment, analog analysis, and data processing. The impact of failures, problems and anomalies are evaluated. Successes of the POPPY project are measured against program objectives. Technical data, cost history, key contributions, a glossary of terms related to the POPPY project, and a bibliography are contained in annexes to the report.

Each of the chapters in the report is intended to be somewhat self-contained. Annex 1 contains a summary of mission characteristics and merges some information from the third through the seventh chapters in order to provide a chronological summary of the technological innovations in the order of the launches.

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I. CONCEPTION

During the second world war, lookouts on German submarines used a hand-held crystal video type radar receiver named ATHOSS to detect pulses emitted from search radar on allied warships and airplanes. This simple passive electronic countermeasure receiver enabled evasion before range had closed sufficiently for returning radar echoes to indicate the presence of the submarine to the searching warship or airplane. After the war, crystal video receiver technology was applied in the direction finding systems for use on American warships and airplanes because of its simplicity, its small size and wide open frequency detection characteristics. By the late fifties, a crystal video receiver was being fitted to type 8-A submarine periscope; the first three receiver prototypes were developed by the Naval Research Laboratory (NRL) in late 1957.

On 4 October 1957, the Union of Soviet Socialist Republics (U.S.S.R.) launched the first artificial satellite as part of the thirty-month International Geophysical Year. Thirty days later, the second Sputnik was launched with a live dog as a passenger.

About one month later on 6 December 1957, with the whole nation watching on National television, the United States (U.S.) attempted its first satellite launch on a totally new sophisticated Vanguard missile. The payload was the grapefruit sized Vanguard satellite - weighing three pounds. The missile lost thrust after 2 seconds and crashed in a huge ball of flames. The tiny satellite fell out of the nose fairing and rolled away. Its antennas were bent and broken and charred black from the fire - yet it was still transmitting its signal. This national embarrassment triggered a number of things. The immediate results were a presidential decision to task the Army team, under Dr. Wernher von Braun at the Redstone Arsenal, to launch a satellite on the existing ICBM called Jupiter C. Fortunately, these efforts did meet with success and on 31 January 1958, the U.S. placed its first satellite, Explorer I, in orbit. This satellite discovered the Van Allen belt. The Navy Vanguard team succeeded on Saint Patrick's Day, 17 March 1958, by placing Vanguard I in a highly elliptical orbit. This satellite, powered by solar cells, transmitted its signal for over six years. This stable orbit with constant transmission from the satellite permitted the first long term observation of orbital dynamics. This resulted in the discovery of the "pear-shaped earth" and initiated a series of sophisticated modeling efforts of the earth's gravity field which is so important for predicting satellite positions vs time and for ballistic missile accuracy.

But the Vanguard initial failure also had other longer range effects. It caused the nation to re-evaluate its position in the newly arrived space age. We felt threatened in that we seemed to be falling behind in this new high technology area. A frantic call went out to better educate more engineers and scientists in our colleges and universities. The gauntlet had been laid down and America would

respond with a tremendous effort and close that gap. In retrospect the Vanguard program with its spectacular failure but subsequent success and its tremendous technology advances may have been the best thing that could have happened to the infant U.S. space program.

Also, of much more specific value to the Navy was the fact that Vanguard had developed a technology base in satellite design at NRL which formed the foundation for the subsequent POPPY program.

These first space exploration successes stimulated the Advanced Research Projects Agency (ARPA) to solicit other DOD elements for proposals for space related projects. The Chief of Naval Operations (CNO) relayed the query to Navy scientific and technical organizations by asking, "All hands to consider how they could use space in their design ideas for the Navy."

NRL responded to the CNO query with the proposal to launch a satellite into a 500 NM circular orbit. The satellite would be equipped with an S band crystal-video receiver to detect signals of sufficient power density and would use an uncoded radar beacon to transpond them (pulse-for-pulse) down to cooperative ground stations for recording and subsequent analysis. The proposal was reviewed and approved through the Navy and DOD and was approved by the President in August 1959 as Project TATTLETALE.

A news leak about Project TATTLETALE in the New York Times lead to the immediate cancellation by the President and to a presidential order to tighten security. A special security system was then established by the Office of Naval Intelligence (ONI). Access was limited to individuals with a strict need-to-know and required the approval of ONI, ARPA, or the Office of the Special Assistant to the Secretary of Defense (Special Operations). Those individuals granted access were required to execute a project secrecy agreement.

NRL developed the concept and designed the ELINT satellite and ground readout equipment which was continued as the top secret Project Walnut. Additional security was provided by adding an NRL scientific cover experiment designed to telemeter measurements of solar activity in X-ray, Lyman-Alpha, and ultraviolet radiations above the earth's atmosphere. This cover experiment became the first of a series of SOLRAD satellite experiments designed and exploited by the Naval Research Laboratory. The cover name GRAB (Galactic Radiation and Background) was used for the intelligence and scientific satellite.

With the first launch pending, new importance was added to the project after the crash of a U-2 high-altitude reconnaissance aircraft in the U.S.S.R. on 1 May 1960. Subsequent cancellation of routine U-2 overflights ended the capability for deep interior surveillance of the U.S.S.R. Future overhead surveillance missions would require presidential approval.

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The first U.S. and reconnaissance satellite (photo or SIGINT) to become operational was successfully launched on 22 June 1960 from Cape Canaveral, Florida aboard a Thor-Able-Star. GRAB/Dyno 1, as this ELINT satellite was named, shared the launch vehicle with Transit 2A, the Navy's second navigation satellite. The purpose of the ELINT package, designated Dyno 1, was to collect ELINT data from the interior and infrequently covered maritime regions of the U.S.S.R. ELINT data is transponded by the Dyno 1 for a forty-minute period after interrogation. The mission ground station equipment was operated only when Dyno satellites were transmitting above their radio horizon; recorded data from the down link(s) on magnetic tape; and forwarded data recordings with collection logs to NSA via the Armed Forces Courier Service (ARFCOS).

The ELINT capability of Dyno 1 was successfully tested on 4 July 1960 at Wahiawa, Hawaii, well out of Soviet range. Tense political climate following the U-2 incident dictated that this satellite would be tasked only by specific presidential authority. Thus only 22 data collection passes across the SINO Soviet bloc were collected and processed during the three month useful lifetime of the GRAB/Dyno 1 satellite.

II. ORGANIZATION

Throughout its lifetime the POPPY project was managed, operated and supported by a number of DOD elements under overall Navy leadership. There were two distinct phases of organization, pre-NRO and the reorganization following establishment of the NRO in 1962. During both of these phases, multi-agency activities were coordinated by means of a Technical Operations Group (TOG).

A. PRE-NRO

Directorship of Project GRAB/Dyno (see Annex 3) was assigned to the Director of Naval Intelligence (DNI). The TOG acted as the steering committee or staff of the project director. The TOG members were drawn from designated DOD organizations and the National Security Agency (NSA). The participating organizations, their responsibilities, and the staff responsibilities of their representatives to the TOG were specified by the DNI.

1. The NRL developed the overall system concept; designed, constructed, deployed, and logistically supported electronic receiving, recording, and timing equipment at mission ground stations; designed, fabricated, tested, and calibrated the satellite systems from concept through launch injection into orbit, and provided engineering and technical direction through the operational exploitation phase; trained-mission ground station personnel; controlled the satellite prior to launch; monitored the launch; and monitored on-orbit performance of the satellite. The NRL member of the TOG was designated as the project technical representative/project manager until January 1971.

2. The Naval Security Group (NSG) directed and coordinated all mission ground station operations; acted as the focal point for all electrical communications associated with the operations of the project; provided sites, support facilities and operating and maintenance personnel at the [redacted] mission ground stations. The NSG member of the TOG was designated as the project operational representative.

3. The NSA authorized the allocation of service cryptologic personnel to man and operate the mission ground stations; processed all ELINT data recordings and disseminated the ELINT product; interpreted national intelligence collection and processing requirements and made tasking recommendations; and furnished the magnetic tapes for recording data at the mission ground stations. The NSA representative to the TOG was designated as an advisor to the staff.

4. The DNI had the authority to review and approve all aspects of the project. The Scientific and Technical Intelligence Center of ONI (STIC) provided intelligence requirements to the director; provided signal analysis support to NSA; monitored the signal analysis

program; and disseminated quality control technical data to mission ground stations. The STIC member of the TOG was designated as the product control representative.

5. [redacted]

6. [redacted]

7. The sites where dedicated GRAB/Dyno collection and processing and spacecraft commanding systems were installed in the pre-NRO period are as follows:

SITE	FUNCTION
[redacted]	

B. NRO PROGRAM C

Upon consolidation of all U.S. overhead reconnaissance projects into a National Reconnaissance Program (NRP) in 1962, DNRO established NRO Program C as the organizational component to continue operation and management of the Dyno satellites. By December 1962, the Byeman

Control System was implemented throughout the project to govern security procedures. [redacted] The DNRO reviewed the organization and responsibilities within Program C as proposed by the DNI in the time frame July 1962 through January 1963. The following changes and additions to organizational responsibilities were implemented:

1. The NRO provided funding to support Program C based on annual program budget submissions by NRL beginning with fiscal year 1963. The Consolidated Cryptologic Program (CCP) continued to support mission ground station personnel, magnetic tape, and data processing.

2. The DNI became designated as Director, Program C. The ONI provided a POPPY project director responsible for supervising and administering all aspects of the project subject to the approval of Director, Program C.

3. The NRO Deputy Director for Operations prepared routine tasking schedules for the operational control of POPPY satellites with technical support from the TOG. Routine tasking was directed by the NRO Satellite Operations Center (SOC) through NSG. NSA directed quick reaction tasking of POPPY satellites through NSG following tip-off of Soviet space or missile activity.

4. Program A of the NRP provided the launch vehicle, launch vehicle/satellite integration, and launch services. The NRO separately funded this support.

5. The Naval Research Laboratory was designated the technical director responsible for design, development, and operational support.

C. LATER CHANGES

Program C and the POPPY project organization functioned in the same general manner as established under the NRO for the next fourteen years. Changes subsequent to 1963 were the result of realignments within the Navy, changes in capabilities leading to added responsibilities, and changes in participation. Significant changes and associated factors were the following:

1. Starting in April 1963, the requirement for detecting, electrically reporting and logging new and unusual signals was added to the responsibility of mission ground stations. The resulting on-line manual analysis produced the earliest possible recognition of [redacted] after it was couriered back to CONUS for processing. Various site facilities were upgraded

[redacted]

2. In 1967, ONI became redesignated as the Naval Intelligence Command (NIC). COMNAVINTCOM retained the responsibility of Director, Program C.

3. [redacted]

4. [redacted]

5. [redacted]

6. [redacted]

7. [redacted]

8. [redacted]

9. [redacted]

10. On 30 September 1977, DNRO directed termination of the POPPY program [redacted]

III. SATELLITES

[redacted]

A. [redacted]

The GRAB/Dyno satellites were launched pickaback with other scientific and navigation satellites. Two of the five attempts to [redacted]

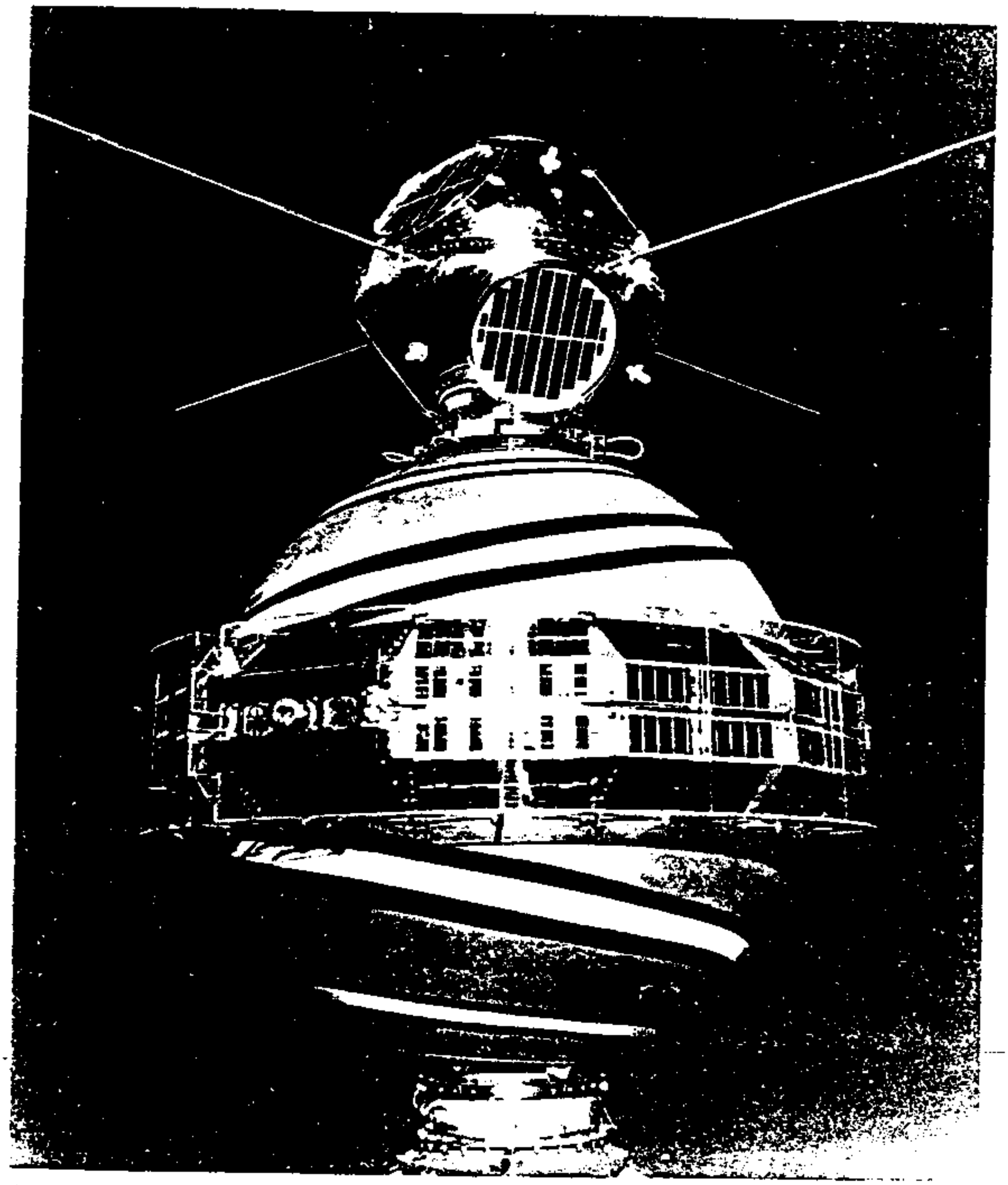
B. ORBITAL CHARACTERISTICS

[redacted]

C. PHYSICAL CHARACTERISTICS

The GRAB/Dyno satellites were of spherical configuration with a diameter of 20 inches. The first Dyno spacecraft weighed 42 pounds; later Dyno spacecraft weighed up to 55 pounds.

[redacted]



First U.S. SIGINT Satellite,
GRAB/Dyno 1 mounted above TRANSIT 2A

[redacted] The multiface satellite measured [redacted] across flats at [redacted] Spacecraft equatorial bands varied in size to accommodate [redacted] the increase in size and number of electronic and mechanical components necessary to satisfy the increasing mission requirements. [redacted]

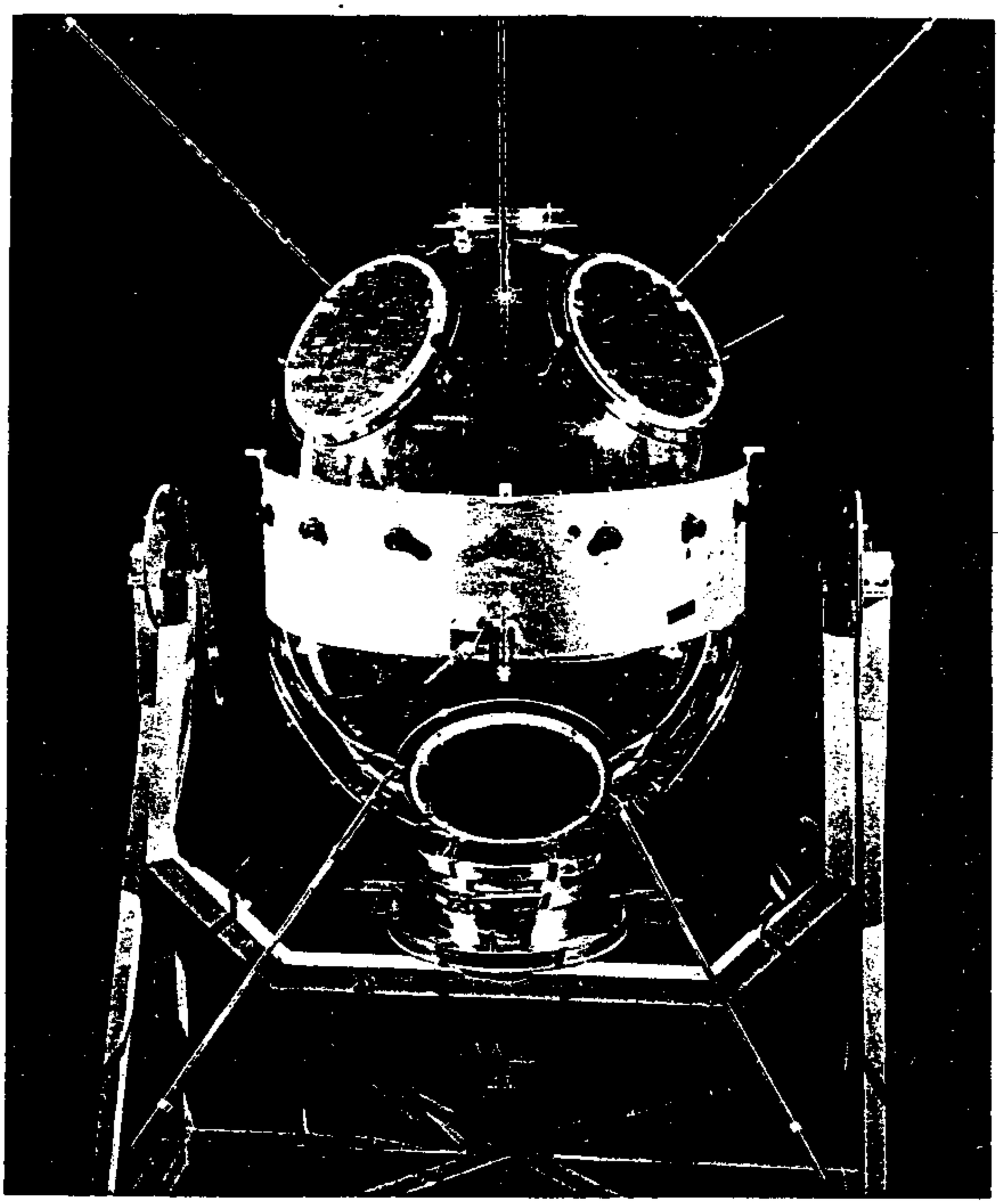
D. POWER

The first Dyno satellite was powered from a 12-volt storage battery consisting of nine D size cells in series. The battery was charged by silicon solar cells and was designed to provide useful life of one year in orbit. Six 9-inch diameter round patches of 156 cells were symmetrically located on the surface of the sphere so that approximately one watt of power would be available for any orientation of the satellite. In full sun, a single patch could provide about two watts of charging power to the chemical storage battery. From Dyno 2 onward, +12-volt and -12-volt storage batteries were included.

In the 24-inch diameter satellites, more solar cells of smaller size were placed on 11-inch diameter panels. The six symmetrically placed panels provided about four watts of charging power to an 18-cell, nickel-cadmium battery pack. (NOTE: 9-inch diameter solar panels were used with the 20-inch diameter satellite and 11-inch diameters with the 24-inch satellite.)

E. TELEMETRY

[redacted]



Typical 24" Diameter Spherical Satellite
with 9" high Equatorial Band

[redacted] The same antenna served for reception of the command signals. The multifaces used two such turnstile arrays, one for command reception and telemetry transmission, the second for ELINT data transmissions.

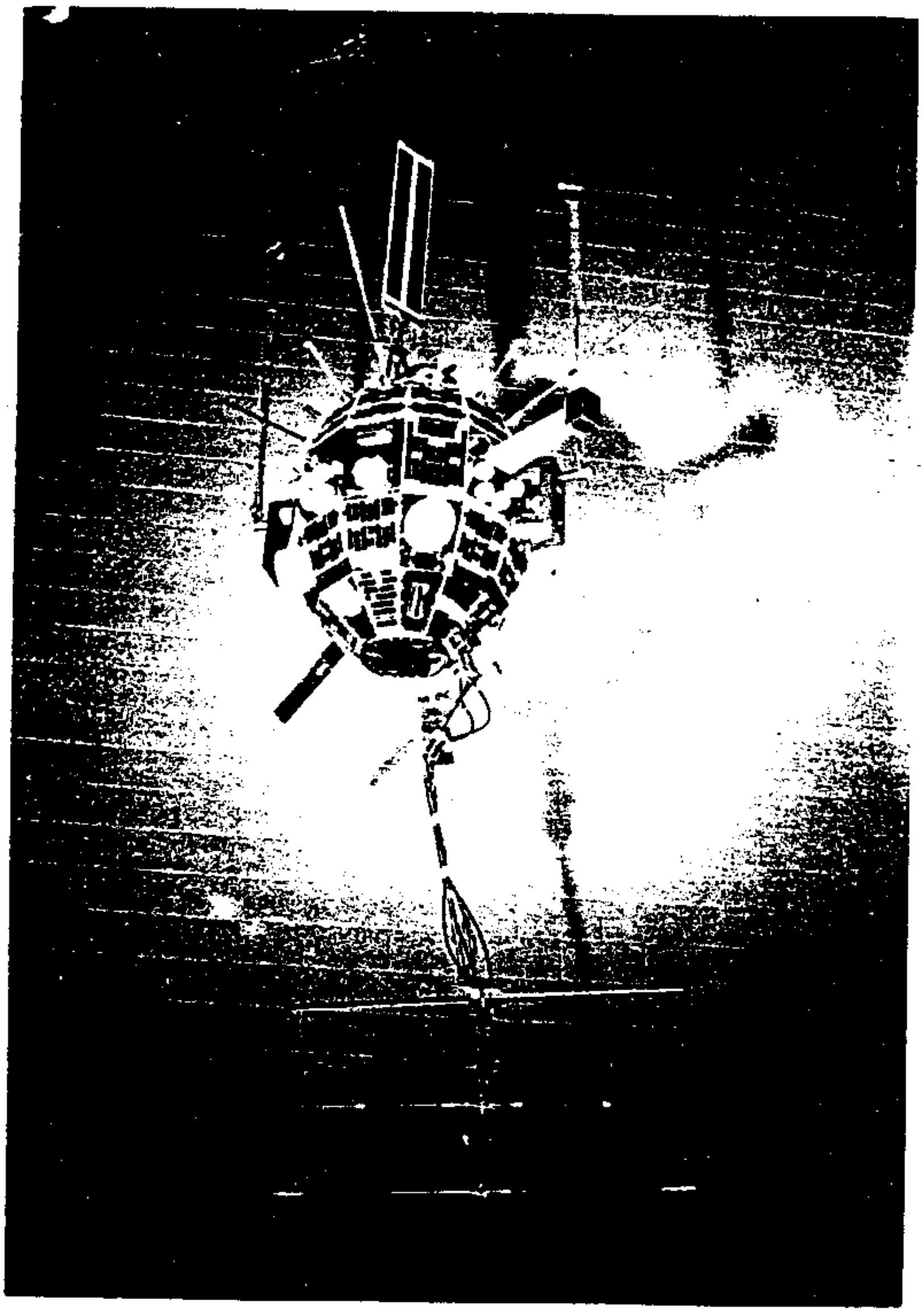
F. COMMAND

The command receiver in the GRAB/Dyno satellite was adapted from the system used with Vanguard. [redacted]

As command options increased to include more data receivers, data links, experiments, station keeping devices, etc. the basic command system was expanded [redacted]

G. ELINT COLLECTION

[redacted]

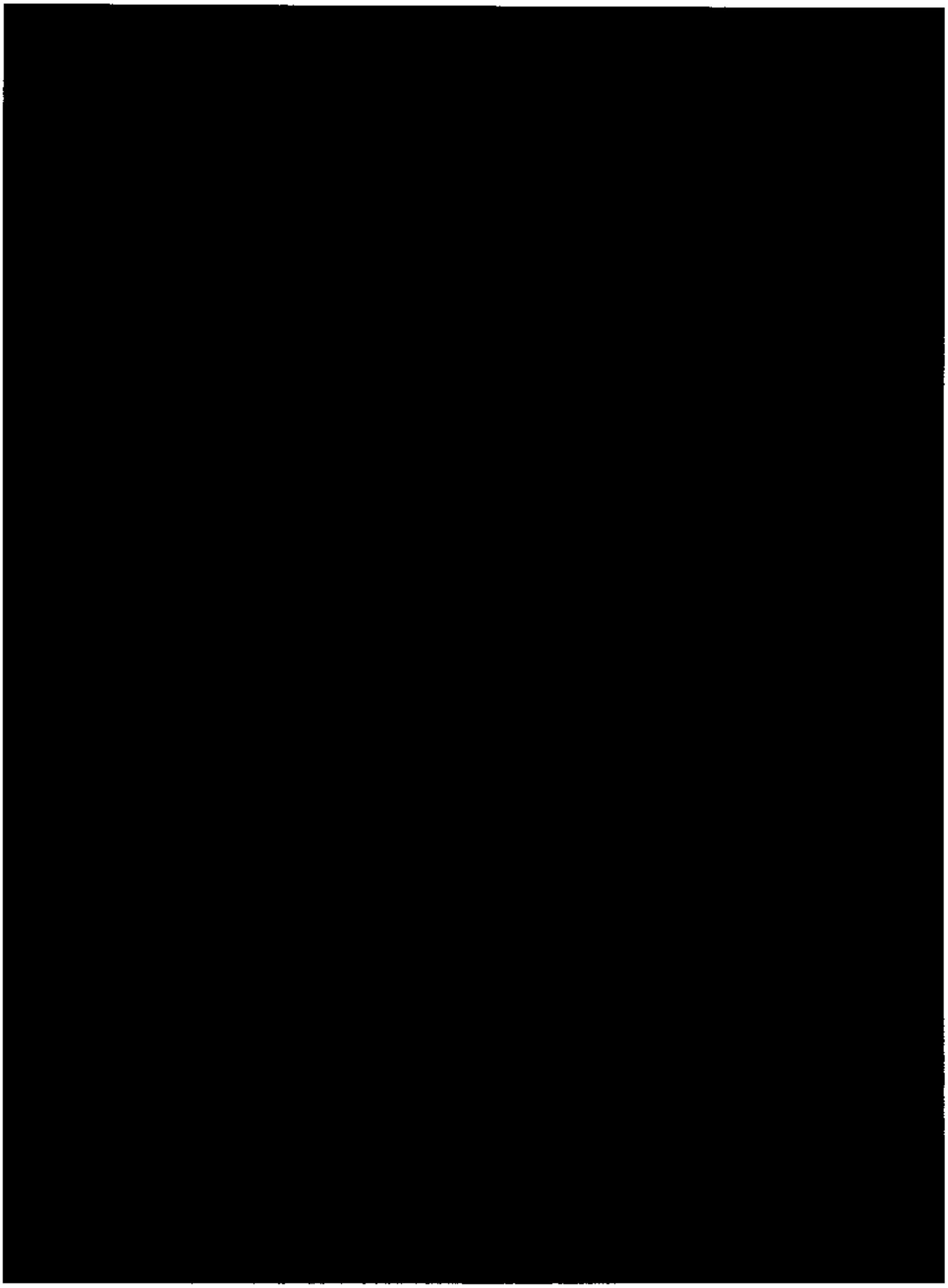


Typical 27" Multiface Satellite [redacted]

[redacted]

[redacted]

HANDLE VIA [redacted] CONTROL SYSTEMS JOINTLY



[redacted]

HANDLE VIA [redacted] CONTROL SYSTEMS JOINTLY

[redacted]

IV. MISSION GROUND STATIONS

[redacted]

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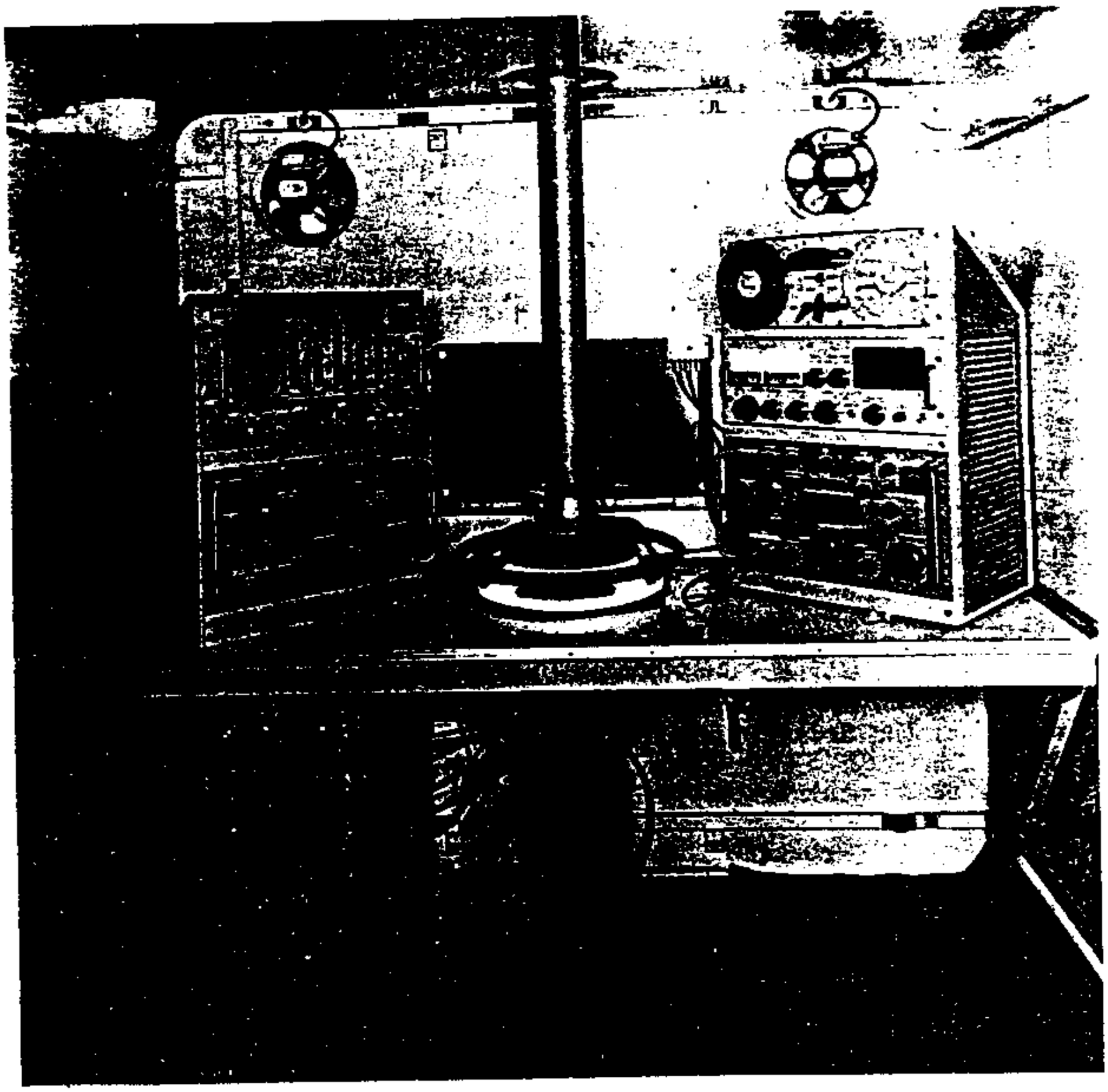
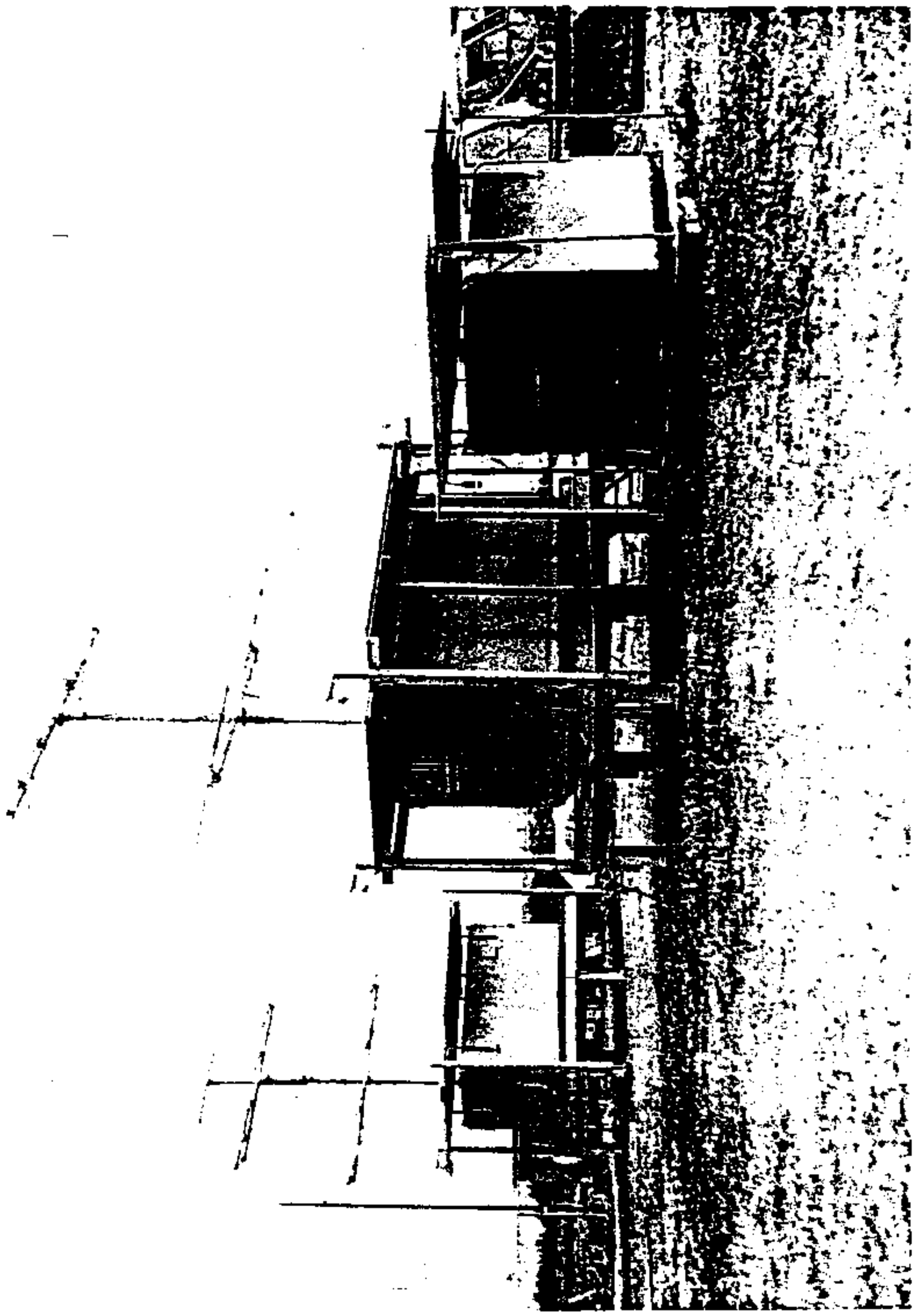
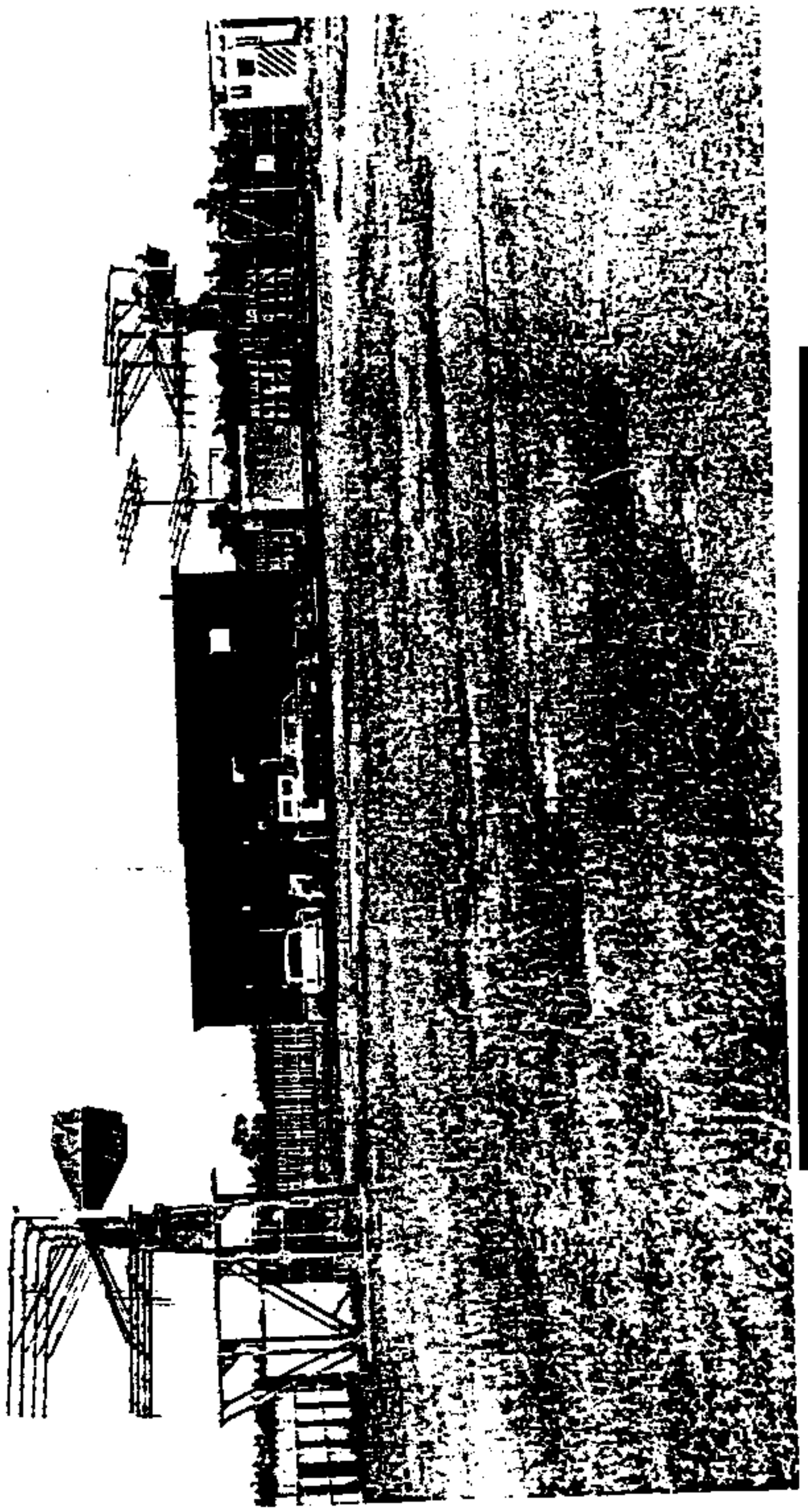


First Generation GRAB/Dyno 1
Receiving, Timing, and Recording Position inside ESV Hut



Typical Earth Satellite Vehicle (ESV Hut Installation)

[redacted]



[redacted]

worldwide service conditions, could be transported by helicopter, large aircraft, truck, rail, or ship. They were described as all-weather shelters constructed of lightweight rigid floor, roof, side-wall and end panels secured by two lifting-band assemblies. The panels were fire resistant and water proof. The ESV huts came equipped with two work benches, a spare parts cabinet, exhaust fans, a filtered air inlet, incandescent lighting, a power entrance and distribution cabinet, and an electric heater.

At NRL the ESV huts were fitted out for operations prior to deployment. NRL installed sheet-metal supporting racks to hold the electronic equipment, the necessary electronic equipment, an antenna mast, antennas, an antenna steering mechanism and brake assembly, and an air conditioner. The ESV huts were shipped as stand-alone assemblies requiring only minimal site support. At the mission ground stations, the ESV huts were placed on concrete pedestals, on pavement, or on elevated platforms equipped with carport-type canopy roof, provided with electrical power and they were ready to conduct operations. The ESV huts were only manned to prepare for and conduct scheduled collection operations. By 1962, in preparation for the first dual-satellite launch, each collection site was provided with two of the fully equipped ESV huts.

B. PERMANENT BUILDINGS

As the expanded exploitation and data collection roles placed increasing burdens on the site personnel, a move into permanent buildings was started in the early sixties when buildings housing the phased-out GRD-6 direction finding systems became available [redacted]. These wooden buildings were adequate to replace the ESV huts and provided the necessary space to install the growing number of bays of electronic equipment.

At other sites different buildings or parts of buildings were made available for the POPPY installation. [redacted]

V. GROUND READOUT EQUIPMENT

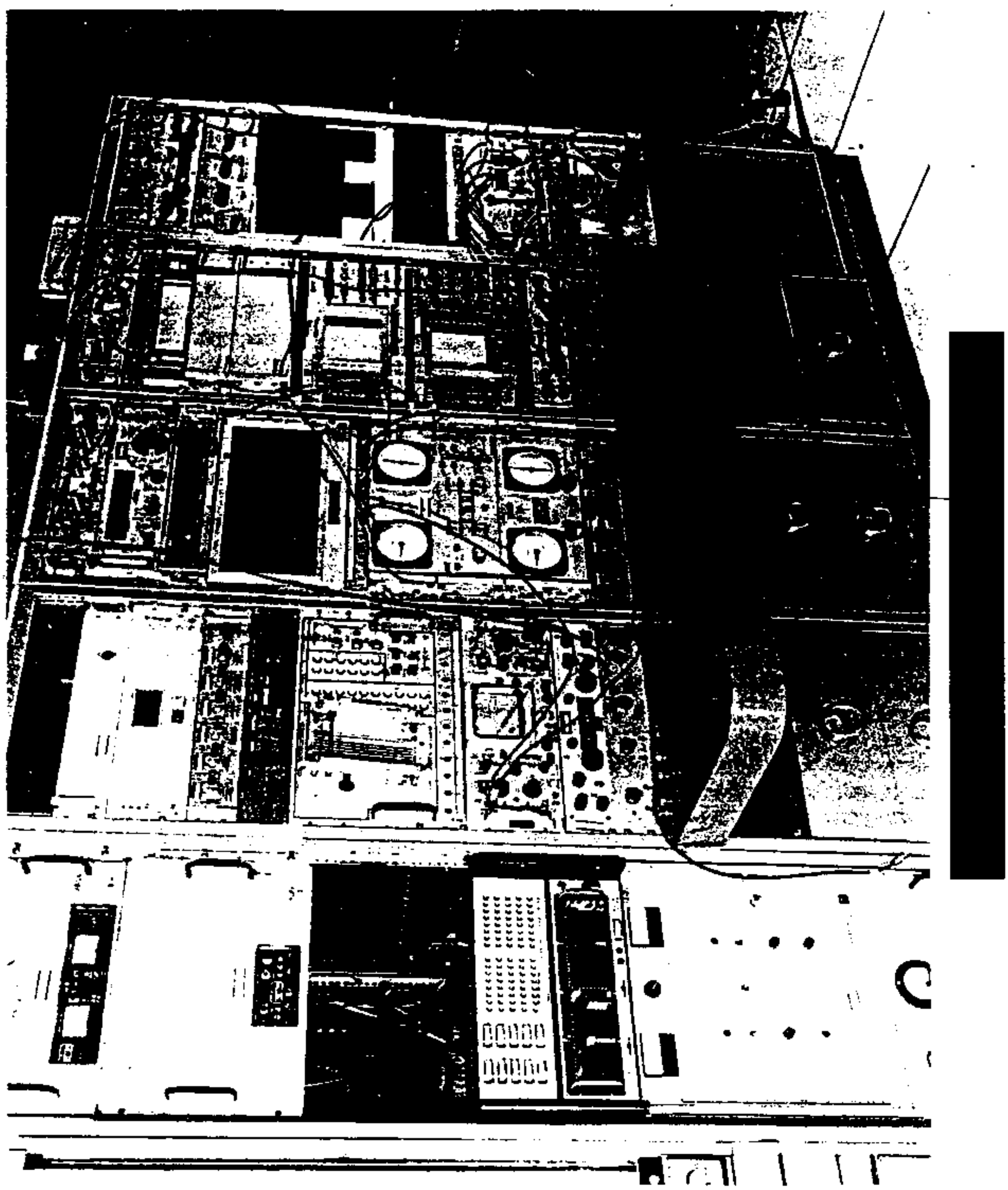
Mission ground station functions related to ELINT data collection included telemetry readout, satellite interrogation, and ELINT data monitoring and recording. [redacted]

A. TELEMETRY READOUT

[redacted]

B. INTERROGATION

[redacted]



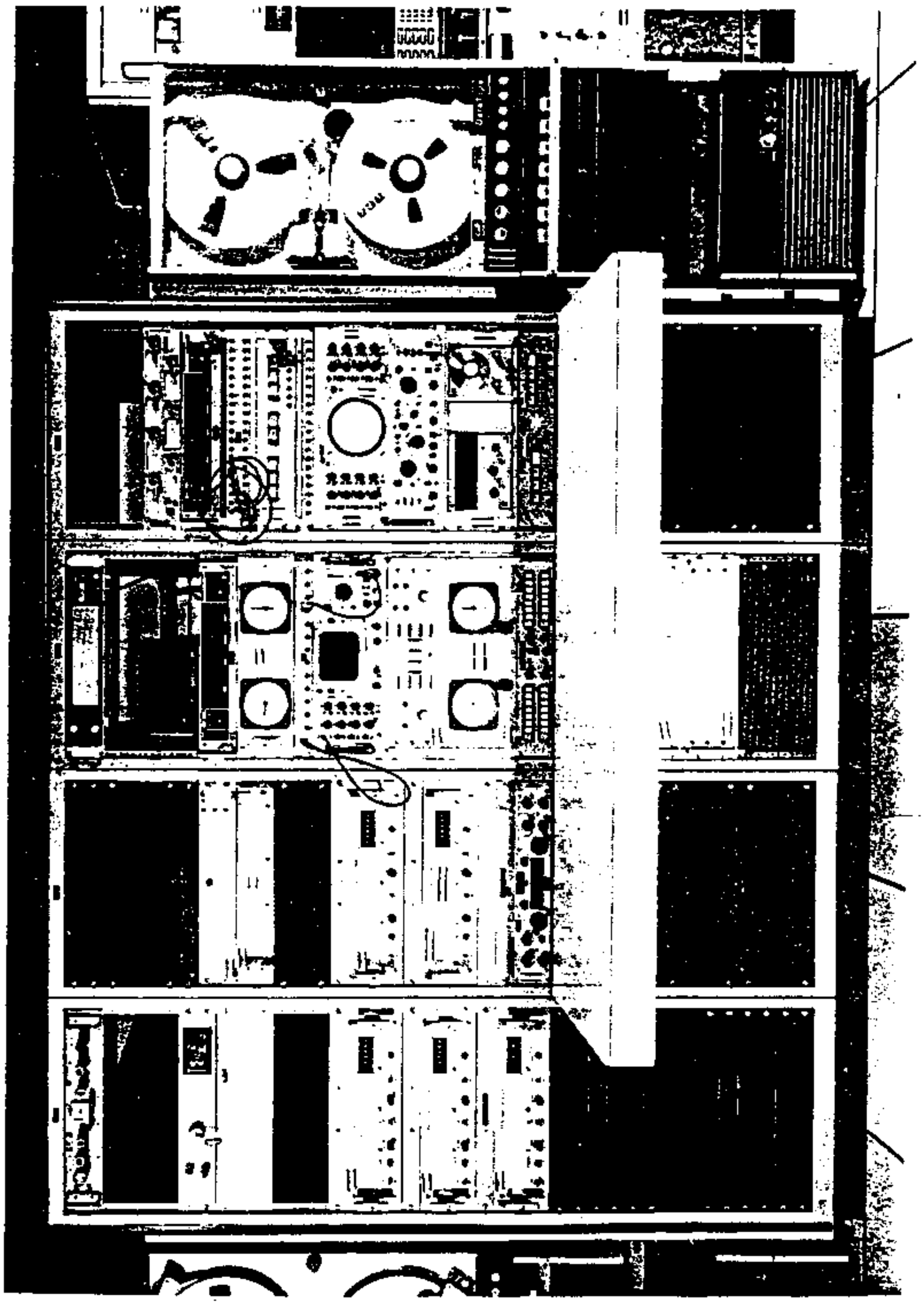
uninterrupted telemetry and data collection as the satellites passed at high elevation angles. These antennas were fed by 50-watt output command transmitters.

The interrogation position expanded into five bays of equipment manned by one operator. By 1967, the position included programmed command tone generators which read pre-punched cards prepared to implement the specific collection task groups authorized by the NRO Satellite Operations Center (SOC). [redacted]

All satellite interrogation except for ELINT data collection operations, (such as thrusting and power/attitude management, etc.) was performed at the NRL engineering ground station in [redacted]

C. ELINT COLLECTION

[redacted]



POPPY MGS Collection Position - 1972

[redacted]

VI. ANALOG ANALYSIS

[redacted]

[redacted]

[redacted]

Collection operators noted in their logs occurrences of NSA specified signals of high interest as well as new, unique or unidentified signals. After a pass, analog analysts played back the tapes at their analysis and quality-control positions and performed aural and visual scans of each of the recorded data links. Parameters of these signals of interest and unidentified signals were measured and tabulated. After verification of the parameters of unidentified signals, leading analysts prepared a daily signal of interest tipoff report for transmission to NSA and to other POPPY sites.

In the early seventies, pulse width selectors were added to the analog analysis positions to isolate and display the data collected from a single RF band in the satellite(s).

As the reliability in detecting and reporting signals of interest at the mission ground stations became established, the requirement for forwarding all analog tapes to NSA diminished to a requirement to forward only those tapes containing unidentified signals or tapes specifically requested by NSA. Recordings not forwarded were retained for a specified period, then degaussed and recycled.

VII. DATA PROCESSING

[redacted]

A. GRAB DATA PROCESSING

[redacted]

[redacted]

[redacted]

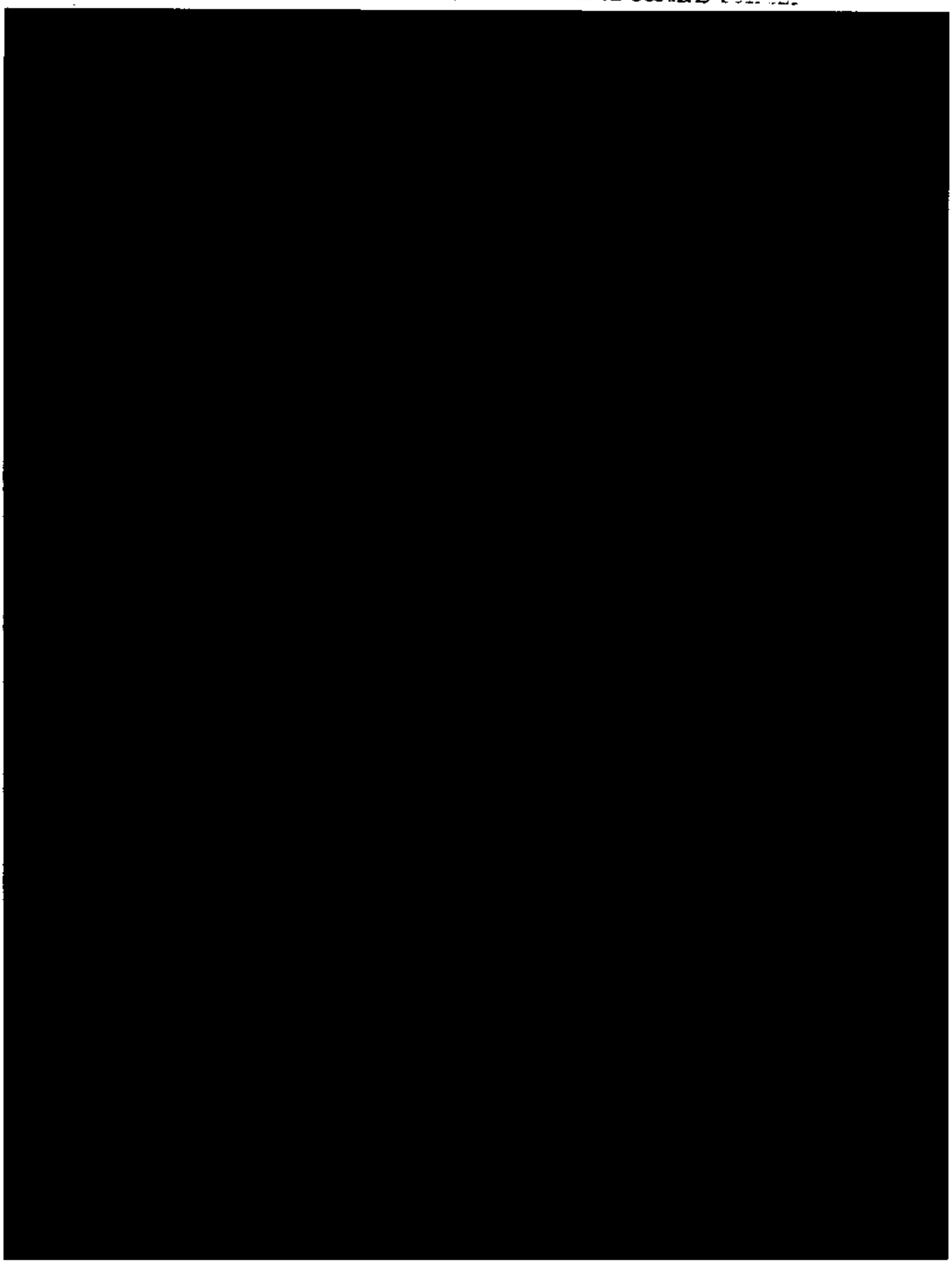
[redacted]

[redacted]

[redacted]

[redacted]

[redacted]



[redacted]

VIII. IMPACT OF PROBLEMS AND ANOMALIES

Most project problems and anomalies lead to technical innovations and have been mentioned in preceding chapters. A brief summary of other obstacles is provided in the following paragraphs in the launch chronology.

A. FIRST LAUNCH - GRAB/DYNO 1, 22 JUNE 1960

This mission was useful for ELINT collection for just ninety days. In addition to the short life, the need for Presidential authorization to interrogate the satellite was a constraint on the amount of data that was collected. The actual impact of these two factors was not overly important since stateside analog analysis and budding data processing capabilities were saturated by the amount of data collected. No anomalies were observed in the intercepted data. No problems were encountered in the interrogation of the satellite or in collection and forwarding of data tapes. Scientific cover experiment SOLRAD 1 was operational for 10 months and highly successful.

B. SECOND LAUNCH, 30 NOVEMBER 1960

The Thor rocket burned out 12 seconds early and was destroyed by Range Safety. Fragments landed in Cuba. The incident resulted in the prohibition of launch trajectories ideal for the desired 70-degree inclination and forced a dogleg injection effort on subsequent launches from Cape Canaveral, Florida. This failure resulted in a nine-month lapse in GRAB collection.

C. THIRD LAUNCH - DYNO 2, 29 JUNE 1961

This launch vehicle had three spacecraft stacked one on top of the other. Failure of separation system between the topmost pair caused Dyno 2 and State University of Iowa Dr. Van Allen's INJUN satellites to remain attached in orbit. Thus Dyno 2 was used on the odd days and INJUN used on the even days during the fourteen month Dyno 2 operational lifetime. The constraint of Presidential approval of interrogations was removed. [redacted] Time-sharing the satellite with INJUN precluded interrogation GRAB/Dyno 2 on half the potentially lucrative passes over the U.S.S.R.

D. FOURTH LAUNCH, 24 JANUARY 1962

The attempt was made to orbit a third ELINT satellite with the cover experiment SOLPAD 4A along with four other satellites. The

Thor-Able-Star launch vehicle exploded during launch due to a crack in the second stage engine. The impact of the loss of the satellite was a postponement of project intelligence collection activity.

E. FIFTH LAUNCH, 26 APRIL 1962

Another launch failure occurred in the program's first attempt from the Western Test Range at Vandenberg AFB, California. The ELINT package was the same type of configuration used on the prior attempt and SOLRAD 4B provided a cover experiment. The Scout rocket rose for slightly over two minutes and landed in the ocean within sight of the launch pad.

F. SIXTH LAUNCH - [redacted], 13 DECEMBER 1962

[redacted]

[redacted]

[redacted]

[redacted]

IX. PERFORMANCE VERSUS OBJECTIVES

Program objectives changed over the years, both in response to new intelligence requirements and as a consequence of the project's proven capabilities. [redacted]

A. GRAB/DYNO 1

[redacted]

B. GRAB/DYNO 2

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

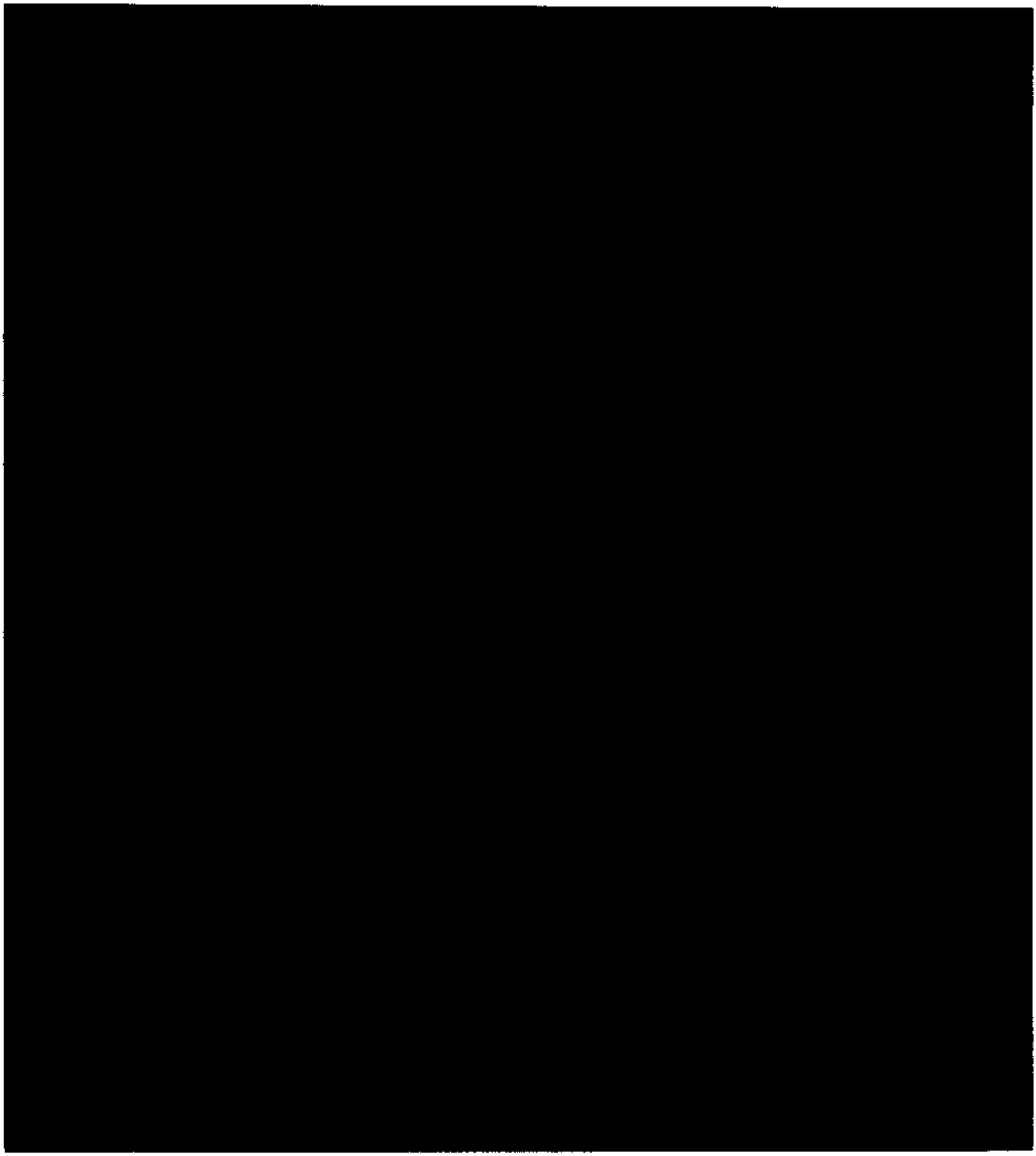
[redacted]

[redacted]

[redacted]

[redacted]

POPPY GROWTH



ANNEX 1

MISSION CHARACTERISTICS

FIRST LAUNCH

PROJECT NAME: GRAB (Walnut security clearance)

NRL MISSION: Pre-NRO Launch: Thor-Able-Star from Cape Canaveral, Florida on 22 June 1960

ORBIT: [redacted]

REMARKS: This was the first operational overhead intelligence satellite for the U.S.

GROUND STATIONS: [redacted]

SATELLITES: Dyno 1 Transit 2A (APL)

DIAMETER INCHES: 20

WEIGHT POUNDS: 42

NUMBER RF BANDS: 1

[redacted]

END OF LIFE: 9 September 1960

USEFUL LIFE: 90 days

INNOVATIONS: First U.S. satellite with an ELINT mission and first successfully launched U.S. intelligence satellite.

First U.S. pickaback launch.

[redacted]

ELINT receiver active for 40 minutes upon interrogation from the ground.

[redacted]-56105-78

[redacted]

SECOND LAUNCH

PROJECT NAME:	GRAB (Walnut security clearance)
NRO MISSION:	Pre-NRO
LAUNCH:	Thor-Able-Star from Cape Canaveral, Florida on 30 November 1960
ORBIT:	Not achieved
REMARKS:	Booster vehicle malfunctioned and was destroyed. Impacted in Cuba causing an international incident. Resulted in restrictions on all future launches from Cape Canaveral relative to acceptable launch azimuths.
SATELLITES:	Dyno Transit 3A (APL)
DIAMETER INCHES:	20
WEIGHT POUNDS:	40
NUMBER RF BANDS:	1
[redacted]	
INNOVATIONS:	None

THIRD LAUNCH

PROJECT NAME: GRAB (Walnut security clearance)

NRO MISSION: Pre-NRO

LAUNCH: Thor-Able-Star from Cape Canaveral, Florida on 29 June 1961

ORBIT: [redacted]

REMARKS: Pickaback with INJUN - failed to separate. This was the second separation failure of NRL Satellites. Design of these separation systems had not been an NRL responsibility but on all future launches NRL took the responsibility for separating their own satellites. There have been no subsequent separation failures [redacted]

GROUND STATIONS: [redacted]

SATELLITES: Dyno 2, INJUN (SUI) and Transit IIIB (APL)

DIAMETER INCHES: 20

WEIGHT POUNDS: 55

NUMBER RF BANDS: 2

[redacted]

END OF LIFE: August 1962

USEFUL LIFE: 14 months

INNOVATIONS: RF coverage extended to two portions of the spectrum.

[redacted]

[redacted]-56105-78

FOURTH LAUNCH

PROJECT NAME:	GRAB (Walnut security clearance)
NRO MISSION:	Pre-NRO
LAUNCH:	Thor-Able-Star from Cape Canaveral, Florida on 24 January 1962
ORBIT:	Not achieved
REMARKS:	No guidance on Able-Star stage
SATELLITES:	Dyno + 4
DIAMETER INCHES:	20
WEIGHT POUNDS:	55
NUMBER RF BANDS:	2
[redacted]	
INNOVATIONS:	Attempt to place five satellites into orbit using a single launch vehicle.

FIFTH LAUNCH

PROJECT: GRAB (Walnut security clearance)

NRO MISSION: Pre-NRO

LAUNCH: Scout from Vandenberg AFB, California on 26 April 1962

ORBIT: Not achieved

REMARKS: Scout was launched with no attitude control gas in the fourth stage.

SATELLITES: Dyno

DIAMETER INCHES: 20

WEIGHT POUNDS: 55

NUMBER RF BANDS: 2

[redacted]

INNOVATIONS: First project launch from Western Test Range.

SIXTH LAUNCH

PROJECT NAME:

NRO MISSION:

LAUNCH:

ORBIT: —

REMARKS:

GROUND STATIONS:

SATELLITES:

DIAMETER INCHES:

WEIGHT POUNDS:

NUMBER RF BANDS:

END OF LIFE:

USEFUL LIFE:

INNOVATIONS:

[redacted]

[redacted]

SEVENTH LAUNCH

PROJECT NAME: [redacted]

NRO MISSION:

LAUNCH:

ORBIT:

REMARKS:

GROUND STATIONS:

SATELLITES:

DIAMETER INCHES:

WEIGHT POUNDS:

NUMBER RF BANDS:

END OF LIFE:

USEFUL LIFE:

INNOVATIONS:

EIGHTH LAUNCH

PROJECT NAME:

NRO MISSION:

LAUNCH:

ORBIT:

REMARKS:

GROUND STATIONS:

SATELLITES:

DIAMETER INCHES:

WEIGHT POUNDS:

NUMBER RF BANDS:

END OF LIFE:

USEFUL LIFE:

INNOVATIONS:

[redacted]

[redacted]

NINTH LAUNCH

PROJECT NAME:

NRO MISSION:

LAUNCH:

ORBIT:

GROUND STATIONS:

SATELLITES:

DIAMETER INCHES:

WEIGHT POUNDS:

NUMBER RF BANDS:

END OF LIFE:

USEFUL LIFE:

INNOVATIONS:

[redacted]

[redacted]

TENTH LAUNCH

PROJECT NAME:

NRO MISSION:

LAUNCH:

ORBIT:

GROUND STATIONS

SATELLITES:

DIAMETER INCHES

WEIGHT POUNDS:

NUMBER RF BANDS:

END OF LIFE:

USEFUL LIFE:

INNOVATIONS:

[redacted]

BYE 56105-78

[redacted]

ELEVENTH LAUNCH

PROJECT NAME:

NRO MISSION:

LAUNCH:

ORBIT:

REMARKS:

GROUND STATIONS:

SATELLITES:

DIAMETER INCHES:

WEIGHT POUNDS:

NUMBER RF BANDS:

END OF LIFE:

USEFUL LIFE:

INNOVATIONS:

[redacted]

[redacted]

TWELFTH LAUNCH

PROJECT NAME: [redacted]

NRO MISSION:

LAUNCH:

ORBIT:

GROUND STATIONS:

SATELLITES:

DIAMETER INCHES:

WEIGHT POUNDS:

NUMBER RF BANDS:

END OF LIFE:

USEFUL LIFE:

INNOVATIONS:

[redacted]

ANNEX 2

COST DATA

FUNDING AUTHORIZED IN $MILLIONS

FISCAL YEAR	MISSIONS	ARPA/ NAVY	NRP[1]	CCP[2]	TOTAL
[redacted]					

FOOTNOTES ON FUNDING

[redacted]

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ANNEX 3

KEY CONTRIBUTORS

KEY MANAGEMENT POSITIONS/INCUMBENTS

Director, Naval Intelligence/Director, Project GRAB:

RADM L. H. Frost USN	August 1959 to September 1960
RADM V. L. Lowrance USN	September 1960 to July 1962

Director, Program C:

RADM V. L. Lowrance USN	July 1962 to June 1963
RADM R. L. Taylor USN	June 1963 to May 1966
CAPT M. H. Rindskopf USN	May 1966 to July 1966
RADM E. B. Fluckey USN	July 1966 to June 1968
CAPT F. Murphy USN	June 1968 to August 1968
RADM F. J. Harlfinger USN	August 1968 to July 1971
RADM R. K. Geiger USN	January 1971 to July 1975
CAPT R. T. Darcy USN	July 1975 to July 1977
RADM G. M. Yowell	July 1977 to Present

Director, Naval Security Group:

CAPT L. R. Shulz USN	June 1960 to July 1961
RADM T. R. Kurtz USN	July 1961 to December 1961
CAPT L. R. Shulz USN	December 1961 to January 1962
RADM T. R. Kurtz USN	January 1962 to August 1963
RADM R. E. Cook USN	August 1963 to July 1968

Commander, Naval Security Group Command:

RADM R. E. Cook USN	July 1968 to June 1971
RADM C. G. Phillips USN	June 1971 to August 1974
RADM G. P. March USN	August 1974 to September 1978

Naval Research Laboratory GRAB/POPPY Project Manager:

Mr. H. O. Lorenzen	August 1959 to February 1973
Mr. R. D. Mayo	February 1973 to Present

SIGNIFICANT EVENTS/INNOVATIONS AND KEY CONTRIBUTORS

INITIAL CONCEPT/SYSTEM PERFORMANCE REQUIREMENTS (NRL)

Mr. R. D. Mayo originated the concept of the Dyno ELINT satellite in early 1958. Messrs. H. O. Lorenzen and [redacted] expanded the concept and coordinated with other organizations to provided for multi-agency participation, the use of SIGINT stations for data collection, and forwarding of data to NSA for processing and product dissemination. RADM Reed of ONI advanced the NRL Proposal through the Navy, ARPA, DOD elements, and the executive branch to secure presidential approval.

SATELLITE DESIGN (NRL)

Mr. M. J. Votaw adapted the Vanguard design to accommodate Dyno and the Solar Radiation cover experiment. He also established the interface between Dyno 1 and Transit 2A for the first dual-satellite launch. Subsequently, Mr. E. L. Dix was the chief design engineer for the satellites. Mr. P. G. Wilhelm became responsible for the satellite technology from 1965 to present.

SATELLITE POWER SUBSYSTEM AND THERMAL DESIGN (NRL)

[redacted] supervised the overall design of the power subsystem with the solar cell array designed by Mr. J. Yuen and the power subsystem conditioning package designed by Mr. J. G. Winkler. Mr. R. [redacted] designed the thermal subsystem for all of the Dyno and POPPY satellites.

COMMAND AND TELEMETRY (NRL)

The command and telemetry subsystems for the first Dyno and the early POPPY satellites were implemented by Messrs. Dix and Wilhelm. Later refinements were made under the supervision of Mr. Wilhelm. These included improved telemetry and data link transmitters by [redacted] command and telemetry subsystem expansions and refinements by Mr. Winkler; on-board storage memory for engineering measurements and timed command activation by [redacted] and development of the PCM telemetry subsystem by [redacted]

The original interrogation and telemetry readout subsystems for the ESV huts were designed and implemented by Mr. Dix. These subsystems were later expanded and refined by Messrs. W. E. Withrow and A. Q. Tool as the transition was made into permanent buildings.

[redacted]-56105-78

ELINT COLLECTION (NRL)

[redacted]

SATELLITE STATIONKEEPING (NRL)

[redacted]

LAUNCH VEHICLE/SPACECRAFT INTEGRATION

[redacted]

SIGNAL LEVEL/PULSE WIDTH MEASUREMENT (NRL)

[redacted]

[redacted]

MISSION GROUND STATION OPERATIONS MANAGEMENT (NSG)

[redacted]

NSA DATA PROCESSING

[redacted]

ANALOG ANALYSIS

[redacted]

[redacted]

[redacted]

SYSTEM ENGINEERING AND INTEGRATION

Mr. L. M. Hammarstrom of HRB and, subsequently, NRL provided overall spacecraft/ground station engineering, integration, and testing functions 1964 through 1976.

GENERAL

The above names and contributions are representative of generations of talented and dedicated individuals from NRL, NSA, NSG, AFSS, ASA, CIA, HRB, ONI, Program C staff, Program A, NRO staff, and NAVSPASUR who developed, operated, supported and exploited the POPPY System.

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ANNEX 4

GLOSSARY OF POPPY-RELATED TERMS

TERM	EXPLANATION
Athos	- German-developed crystal video receiveer of WWII. Probably named after Mount Athos in northeastern Greece, home of celibate monks inhabiting 20 monastaries. One thousandth anniversary of founding of first monstary, Great Lavra, in 1963. Book on Athos monastaries published in Germany in 1943 (Moenchsland Athos by F. Doelger).
[redacted]	
GRAB	- Galactic Radiation and Background. Covername for Project Dyno ELINT satellites.
GREB	- Galactic Radiation Energy Balance.
[redacted]	
Reptile	- Unclassified name used at NSA for POPPY project.
[redacted]	
SISS ZULU	- Unclassified name used within the Naval Security Group to refer to the POPPY project.
SOLRAD	- Solar Radiation measurement packages carried along with ELINT payloads. This legitimate scientific payload formed excellent "cover story" for the Dyno ELINT payloads through the pre NRO period.
[redacted]	
Transit 2A	- Second Navy navigation satellite, shared launch vehicle with Dyno 1 on 22 June 1960. First successful dual-satellite launch.
Transit 4A	- Navy navigation satellite was the primary payload on the launch vehicle with Dyno 2 on 29 June 1961.
Walnut	- Name of security project for safeguarding details of the Dyno ELINT satellites. CANIS security cath.
[redacted]	

ANNEX 5

BIBLIOGRAPHY

REFERENCES

DNI Project Agreement (Security), 13 page working paper, annotated date of 1959

M. Votow (NRL) draft paper of January 1960: The Solar Radiation Satellite

[redacted] (STIC) Project Grab Processing Suggestions and Review of Intelligence Summary, dated 6 December 1960

Project GRAB Technical Operations Group letter G-52/00022-61/jmc of 18 January 1961: Status report on Project GRAB

NSA (COSA-5) Status Report of Analysis on Project GRAB I, dated 1 May 1961

DNI letter Op-922YB/mlk BYE-10613-63 of 21 January 1963: System POPPY; reassignment of responsibilities for

[redacted]

Department of the Navy document BYE-51900/69 of 2 December 1966: Navy Satellite Program C

[redacted]

COMNAVINTCOM memorandum Op-092/kfg BYE-66385/70 of 17 August 1970: Navy Ocean Surveillance Requirement

[redacted]

Director, Program C memorandum PM-16:RKG BYE-52238/71 of 6 May 1971: POPPY Growth; capabilities vs funding

OTHER SOURCES

DIRNAVSECGRU(COMNAVSECGRU) control and advisory messages to mission ground stations in BYECOM and SOCOMM communications channels

Mission Ground Station BYECOM and SOCOMM message traffic

NSA product reports

Mr. R. D. Mayo: video tape, notes, discussion

[redacted] binders of source material, notes

NRL technical satff

[redacted] original draft dated 15 June 1978 TS BYEMAN/TK/COMINT Jointly

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