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NATIONAL RECONNAISSANCE OFFICE

14675 Lee Road
Chantilly, VA 20151-1715

10 February 2016

This is in response to your letter dated 22 June 2015 and received in the National Reconnaissance Office (NRO) on 29 October 2015. Pursuant to the provisions of Executive Order 13526, you appealed the NRO's 12 June 2015 release determination in response to your request for Mandatory Declassification Review of "*The SIGINT Satellite Story*."

As the NRO Appellate Authority, I have determined that some of the information withheld in the initial 12 June 2015 release no longer requires protection. Much of this information that is now available for release relates to program declassification determinations that post-date the 12 June 2015 document release (please see the NRO public website at www.nro.gov for additional information in this regard). The newly-treated document, as included in this package, reflects these updates.

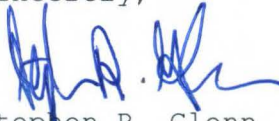
With regard to information that is withheld in the revised treatment, I am upholding the initial determination that these portions of the document remain currently and properly classified under the provisions of Executive Order (E.O.) 13526, Sections 1.4(c) and 1.4(d). To the extent that the classified information in the responsive documents is over 25 years old, I have determined that it qualifies for continued classification under E.O. 13526, Section 3.3 (b)(1). In addition, the names of NRO or NSA employees and/or information related to NRO or NSA/CSS functions and activities remain exempt from public release in accordance with E.O. 13526, Section 3.5(c). The withholding statutes in this case are Section 6, Public Law 86-35 (50 U.S. Code 3605) (NSA) and 10 U.S.C. § 424(NRO).

Per E.O. 13526, Section 5.3(b)(3), and the Information Security Oversight Office Directive #1, you may appeal this decision to the Interagency Security Classification Appeals Panel (ISCAP). Your appeal should be addressed to:

Executive Secretary, ISCAP
c/o Information Security Oversight Office
The National Archives Building
700 Pennsylvania Avenue, NW, Room 100
Washington, D.C. 20408

If you have any questions, please call the Requester Service Center at 703-227-9326 and reference case number E16-0008.

Sincerely,

A handwritten signature in blue ink, appearing to read "S.R. Glenn", with a stylized flourish at the end.

Stephen R. Glenn
Director, Information
Management Services Office

Enclosure:

The SIGINT Satellite Story NRO approved for release 8 February 2016

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The SIGINT Satellite Story

by

Major General David D. Bradburn, US Air Force (Retired)

Colonel John O. Copley, US Air Force (Retired)

Raymond B. Potts, National Security Agency (Retired)

EO 13526 3.5(c)

National Security Agency (Retired)

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December 1994
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10320 Initials fd

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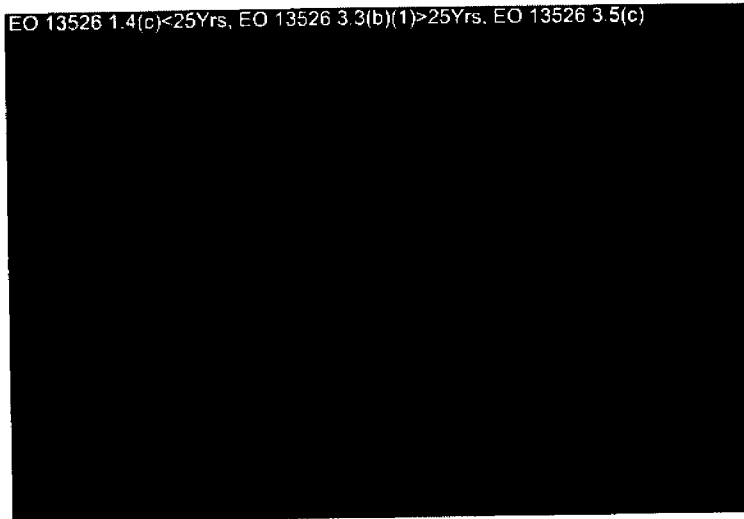
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Dedications

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To my dear wife, Bertha, whose strength and gentleness and thoughtfulness have been my great joy in life. During the events described in the book she sent me off to work happy and secure, looking forward to each day. And in the writing of this history, she is again doing that. This is for Bertha.

David D. Bradburn

To my wife, Theresa, and my daughters, Denise and Diane, who for over 35 years have accepted, without question, the strange hours, mysterious trips, unintelligible telephone calls, and all the other incomprehensible aspects of my behavior that have been an everyday occurrence since I was assigned to the WS-117L Satellite System Office in Inglewood, California, in January 1958. Their support, with only meager knowledge of where I was or what I was doing most of the time, has made an absorbing and challenging program a most enjoyable and rewarding experience.

John O. Copley

To my wife, Betty Jean, who worked with me putting in many extra hours during the early days of this program. She and my children, Stephen and Theresa, made many sacrifices and provided much needed support during the mid-1960s and early 1970s when my dedication to this program required long hours and extensive travel. A special thanks to Dr. Louis Tordella, Deputy Director of NSA, without whose trust and support many of the accomplishments and successes would not have been possible.

Raymond B. Potts

My contribution to this book, which has been a pleasant cap on my NSA career, is dedicated to my dear wife, Jane, who gave so much love and support to me throughout all our years; this was in addition to the hard work demanded by her own career and our family, Peggy, David, and Cyndy, and all this was done without getting back the satisfaction of knowing much of what my work was about.

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Dedications

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Preface

This history was undertaken at the request of Jimmie D. Hill, who maintained a continuing interest and provided moral support and advice as the work went along. The real instigator was Col James C. Fitzpatrick, USAF (Retired), who suggested the idea and showed us how it was done for the preceding volumes on the CORONA, GAMBIT, and HEXAGON imaging systems. Also, Col Frederic C. E. "Fritz" Oder, an old boss on the WS-117L project, who had a major role in the earlier histories, gave his advice at every turn, which really helped in getting started.

Early on, we decided to write a single volume that would cover all the SIGINT satellite projects up to 1975. This was around the time the writers were retiring or moving to new jobs out of the SIGINT satellite business. It was also the time the main SIGINT satellites were all in place, the early versions. So we were writing about an entire set of satellites and we were writing about our own experiences. We decided to organize the book into introductory material, a series of project histories, and some summary material. This plan let us show how each satellite came into being and then show how the whole set worked together. It also allowed for themes about management and results to be summarized at the end after the examples have been given.

Our reader could be an NRO manager, a Congressional staff member, or a family member of a long-time NRO or NSA government SIGINT satellite project participant. We have tried to explain the usually threatening SIGINT business to the non-expert. We owe a big debt to R. Cargill Hall, of the Office of History, United States Air Force, for acting as our professional advisor on methods and as our constant reviewer and editor during the writing process. He gave us his valuable piece, "On Writing History," and other references on clear writing. He also kept on his "non-SIGINT-expert" hat and kept challenging us to write for such people. If we have succeeded, it is Cargill Hall's digs in our ribs that we have to thank for it!

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The team was organized with the help of EO 13526 3.5(c) of EO 13526 and Judy Colbert, Jane's secretary. We shared the EO 13526 office for the first few weeks of the project and got well started. Then we moved the Los Angeles operation across the hall to offices in The Aerospace Corporation, with the help and support of EO 13526 3.5(c) who was our senior administrator for the nearly five years of the project. EO 13526 3.5(c) and then EO 13526 3.5(c) acted as our primary management authorities in The Aerospace Corporation, giving us help and encouragement when it was most needed. EO 13526 3.5(c) was our secretary in the early days, and EO 13526 3.5(c) came in later as our secretary and team helper. Near the end of the project EO 13526 was our word-processing expert and thus made another major contribution. EO 13526 3.5(c) took over as our secretary for the last two years of the project and, in spite of lots of changes going on in the company and in the industry generally, provided a serene place for us to do our work, kept the project on track, and kept us paid and happy!

Our technical editor EO 13526 3.5(c) came on board for the last year of the project and was a professional from the start, so the other members could concentrate on getting the story together while EO 13526 polished the results.

Our technical artist, EO 13526 3.5(c) was the newest member of the team and a great addition, working with EO 13526 and the team and getting our ideas for the graphic materials online and onto paper.

EO 13526 3.5(c) of NPIC, acted as our scout and contact, helping us to set up the very helpful and good working relationship with our publisher. So did Director Leo Hazlewood EO 13526 3.5(c) who became the primary person responsible for finishing the publishing job. Also at NPIC, editor EO 13526 3.5(c) and senior designer EO 13526 3.5(c) provided invaluable support during the publication process.

At NSA, we would like to thank some people whose invaluable support made this history possible:

VAdm William O. Studeman, USN, Director of the NSA, who provided support from the start of this effort.

VAdm John M. McConnell, USN, Director of the NSA, who continued that support.

George R. Cotter, NSA Senior Scientist, who provided senior staff support.

David W. Gaddy, NSA Chief of the Center for Cryptologic History, who provided frequent guidance and whose staff provided day-to-day support.

David A. Hatch, NSA Director of the Center for Cryptologic History, who replaced Dave Gaddy and continued the outstanding support.

Henry F. Schorreck, NSA Historian, who provided valuable data.

Thomas R. Johnson, NSA Historian, who provided valuable support.

EO 13526 3.5(c) [REDACTED] NSA Administration, who provided valuable support.

EO 13526 3.5(c) [REDACTED] NSA Administration, who provided much needed support in sending and receiving controlled material.

EO 13526 3.5(c) [REDACTED] NSA Archives, who made a laborious search of the archives to obtain the photographs used in this history.

EO 13526 3.5(c) [REDACTED] NSA, who provided the valuable *RUFFER History* EO 13
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs [REDACTED]

EO 13526 3.5(c) [REDACTED] NSA, who provided valuable assistance in gathering processing data.

EO 13526 3.5(c) [REDACTED] NSA, the expert who provided all the data on the COMINT target development and mapping satellites.

Dr. David vanKeiren, NRL Historian, who found and provided photographs for Chapter 3.

As the book went together, we interviewed many people, each of whom typically gave a morning or an afternoon for the purpose. Those people included the Directors of SAFSP now living: MGen John L. Martin, Jr., Gen Lew Allen, Jr., and BGen William G. King, Jr., all of whom generously also acted as members of our review group ("Red Team") in March 1994. We thank each of our interviewees separately for their time and the chance to renew old friendships: Joe Amato, George Barthel,

James V. Boone, Julian Caballero, [redacted] EO 13526 3.5(c), EO 13526 3.3(b)(1)>25Yrs, EO
Robert E. Conley, George Cotter, [redacted] EO 13526 3.5(c) (who participated by
mail), [redacted] EO 13526 3.5(c), EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4 Eugene G. Fubini,
[redacted] EO 13526 3.5(c) Robert J. Hermann, Jimmie D. Hill,
[redacted] EO 13526 3.5(c) MGen John G.
Kulpa [redacted] EO 13526 3.5(c) MGen John B. Marks, John N. McMahon,
[redacted] EO 13526 3.5(c), EO 13526 3.3(b)(1)>25Yrs LtCol John
M. O'Connell, Col Frederic C. E. Oder, [redacted] EO 13526 3.5(c)
[redacted] EO 13526 3.5(c)
[redacted] EO 13526 3.5(c) Navy Capt Frank Sperberg, [redacted] EO
[redacted] EO 13526 3.5(c) Charles C. Tevis, [redacted] EO 13526 3.5(c), EO 13526 3.3(b)(1)>25Yr
[redacted] EO 13526 3.5(c) (Donald Wagner, Albert D. Wheelon, and [redacted] EO 13526 3.5(c), EO 135
II. Joe Amato, Julian Caballero, Bob Hermann, Jimmie Hill, John
McMahon, and Bud Wheelon also came back to help on the Red Team in
March 1994.

RAdm Robert K. Geiger joined our Red Team in March 1994 and
added a valuable dimension to our Navy story.

Sanford Evans and Bob Gaylord of The Aerospace Corporation
brought their insights to the Red Team in March 1994.

We used a number of good histories, which are listed in the refer-
ences. The ones that were especially useful were:

- *NSA in Space*, April 1975, BYE-19385-75 (TS/B/TK/COMINT).
This is an excellent history, giving many details and facts about
all the projects for the same time period as our history.
- *RUFFER History*, prepared by NSA, R321 Program Office,
30 September 1990, NSA 86594-90.
- *History of the POPPY Satellite System*, BYE-56105-78, thought-
fully furnished to us by Jim Morgan of Program C.

[redacted] EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs

[redacted] EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs thoughtfully furnished by
Julian Caballero of Program B.

The NRO staff pitched in right from the start. Sharilyn Watts and EO 13526 3.5(c) helped us find files for building our chronology. As we got going, EO 13526 3.5(c) SAFSS Policy, was our main source of support in Washington. When we needed to have a meeting or get something done, we just asked EO 13526 3.5(c) and it was done. Helping EO 13526 3.5(c) was EO 13526 3.5(c) who prepared materials for our reviews and briefings. EO 13526 3.5(c) came on the scene during the last year, when we were arranging for reviews by the first four former Directors of the NRO, a big job. He made all that come together and helped to set the stage for some historic meetings.

The writing was done in a matrix. Each writer wrote about what he knew best—for example, all processing by one author, all intelligence results by another. This led to chapters with multiple contributors. We hope this approach helps the book to be objective, even though we are writing as participants and not as historians going back to find out what happened. We started with the idea that NRO management was good. We ended with the idea that the creation of the office of the DNRO was the defining event that led to the results. This came out of the work and was a consensus among those interviewed.

Our approach was to read, collect information, interview widely, write, and ask some senior people—our Red team—to review the book. This was done in March 1994. On this team were the first four Directors of the NRO, Joseph V. Charyk, Brockway McMillan, Alexander H. Flax, and John L. McLucas, whom we had not previously interviewed. These four also came to a first-of-a-kind Round Table meeting on 26 May 1994 at which Louis W. Tordella, the distinguished Deputy Director of NSA from 1958 to 1974, and Julian Caballero, the distinguished Director of CIA's Program B at the time of his retirement in 1993 and a veteran of the EO 13526 3.3(b)(1)>25Yrs from 1965, also took part. This turned out to be the high point of the work for the writing team and was well documented by video and still photography, thanks to the good work of EO 13526 3.5(c) EO 13526 3.5(c) of the NRO Video Productions Center.

This has been a satisfying job, with many rewards in sharing experiences and in planning and carrying out the work. The authors hope this book will be of use and interest to all who can share it.

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Preface xv

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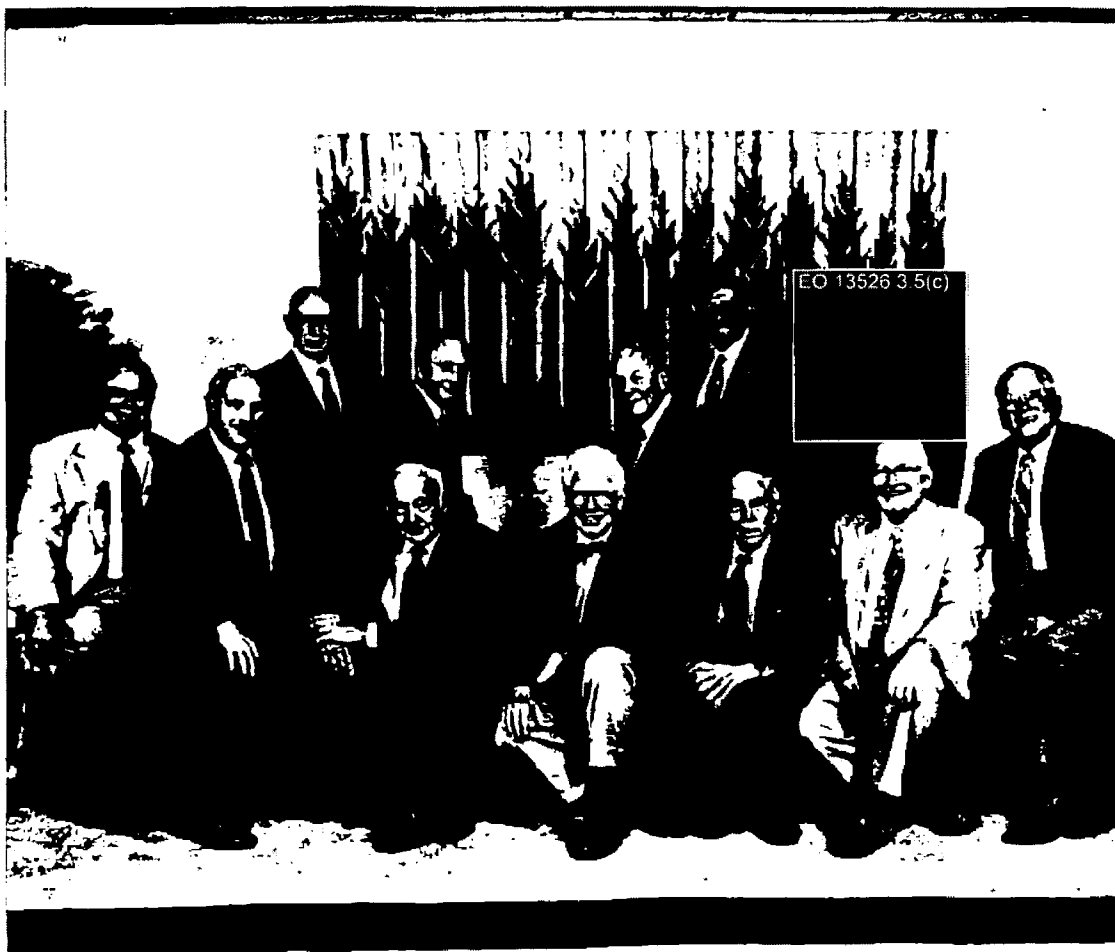


The first four Directors of the National Reconnaissance Office

Clockwise from left: Joseph V. Charyk (1961-63), John L. McLucas (1969-73),
Brockway McMullan (1963-65), Alexander H. Flax (1965-69).

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Preface xvii



Round Table principals, 26 May 1994

Front row (left to right): R. Cargill Hall, Raymond B. Poits, Joseph V. Charyk, Brockway McMillan, Alexander H. Flax, John L. McLucas, Col John O. Copley.
Back row (left to right): MGen David D. Bradburn, Jimmie D. Hill, Louis W. Tordella, Julian Caballero EO 13526 3.5(c)

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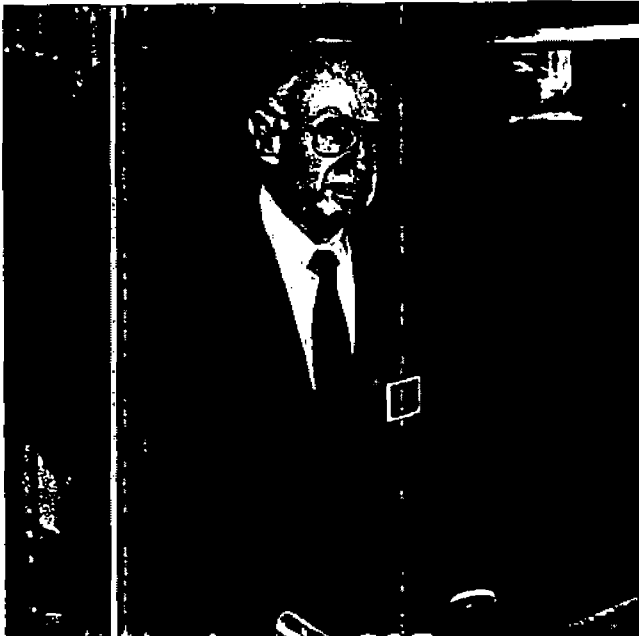
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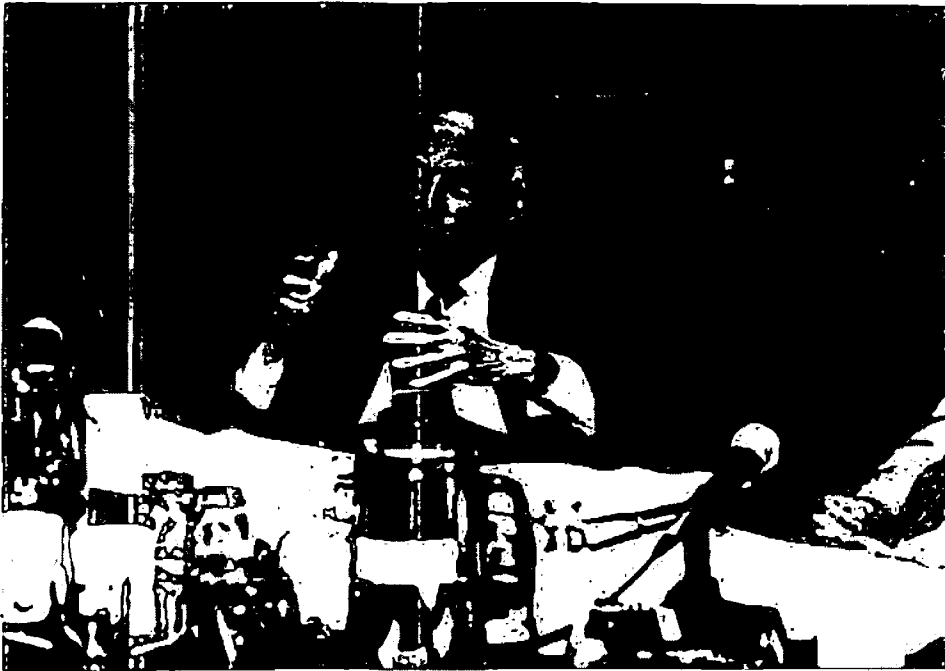


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Writing team

Front row (left to right): authors Raymond B. Potts, Col John O. Copley,
MGen David D. Bradburn ~~EO 13526 3.5(c)~~ Back row (left to right):
technical editor ~~EO 13526 3.5(c)~~ historian/advisor R. Cargill Hall.

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Delivery of final draft to NPIC publications team, 14 July 1994

Left to right: EO 13526 3.5(c) senior designer; EO 13526 3.5(c) editor,
EO 13526 3.5(c) Chief, Editorial Production Branch; EO 13526 3.5(c) Chief,
Publications Graphics Branch; EO 13526 3.5(c) NPIC Special Control Officer;
EO 13526 3.5(c) Chief, Graphics and Publications Division; MGen David D. Bradburn;
Col John O. Copley; Raymond B. Potts; EO 13526 3.5(c) project
technical editor; EO 13526 3.5(c) project technical artist.

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Preface xxxi

Introduction

The way the United States perfected and used space technology to solve intelligence problems is an important story; this remarkable technology helped ensure that the Cold War never turned "hot." In parallel with the crucially important development of ballistic missiles for our defense, there was the equally urgent program to develop reconnaissance satellites to provide advance warning of enemy military activity. Information about military, industrial, and political activities in the Soviet Union was the key to providing the United States with a survivable nuclear retaliatory force. The story of the photo reconnaissance satellites has been told in the three previous volumes in this series. This new story involves the challenge of collecting electronic signals being radiated from the Soviet Union using satellites in Earth orbit, some as high as geosynchronous altitude; sending those signals back to Earth; sorting and analyzing those signals with computers and with people; and providing to our national leaders the information needed to give our country a valuable advantage in confronting the threat of Soviet Communism during the most perilous times of the Cold War. The story now to be told is about the US SIGINT satellites.*

* When an intercepted electronic signal is from the transmitter of a radar set, the information collected is called electronic intelligence, or ELINT; when the intercepted signal is for written or spoken communications, the information collected is called communications intelligence, or COMINT; and when the intercepted signal is from telemetry, the information being collected is called telemetry intelligence, or TELINT. These three applications are collectively called

Early History

During World War II, lookouts aboard surfaced German submarines used hand-held crystal-video radar receivers called ATHOS to detect pulses emitted by search radars on Allied warships and aircraft. This type of receiver consisted of a tuning coil and capacitor to select the approximate radio frequency to be received; a crystal diode, usually of silicon, that acted as a one-way gate, or rectifier, and produced an audible sound; and a simple amplifier that broadcast the "detected" sounds over a headset or loudspeaker. After the war, this same technology was adopted and applied in the direction-finding systems of American warships and airplanes because of its simplicity, small size, and "wide-open" frequency-detection characteristics.

Sputnik I, the world's first artificial satellite, inaugurated the Space Age on 4 October 1957. On 22 June 1960, another satellite, built by the US Naval Research Laboratory and containing an ATHOS-type receiver in low Earth orbit, became the first US military satellite designed to intercept signals from Soviet radars. This marked the beginning of a concerted campaign by the United States to develop

signals intelligence, or SIGINT. Prior to 1958 the term SIGINT was used to mean COMINT alone, and both were often written with only the first letter capitalized. In 1958, when ELINT was put under control of the National Security Agency, SIGINT came to mean both COMINT and ELINT. In the 1960s, TELINT came into use and was included under the term SIGINT.

satellites for signals intelligence (SIGINT) to listen to and record radar, communications, and telemetry signals coming from the Soviet Union, and to transmit that data to US intelligence agencies.¹

The SIGINT satellite history is part of the larger story of the use of reconnaissance satellites by the United States to provide crucial early warning of a Soviet surprise attack on this country, and to attempt to solve the larger riddle of the Cold War--what was the Soviet Union up to? Predicting the quick appearance of long-range rockets armed with nuclear bombs, Arthur C. Clarke described the potential strategic nuclear dilemma as early as 1946: "A country's armed forces can no longer defend it; the most they can promise is the destruction of the attacker."²

The problem foreseen by Clarke became a reality. Attacked with nuclear weapons, a country would have no time to mobilize its forces, much less to build new weapons for them. For the next 45 years, the secrecy of the Soviets, their explicit threats to the non-Communist world, and their eventual possession of nuclear weapons and intercontinental delivery systems occupied the attention of every US President and dominated every major foreign and domestic decision made by the United States. For American leaders, the central question became: How do we prevent the Soviets from mounting a surprise nuclear attack against us? Although Clarke had described both the nuclear dilemma and the potentials of satellites by 1946, his writing remained obscure and was not influential at the time.

Within the United States, a scientific and engineering team at the RAND Corporation contributed to the determination that an Earth-orbiting satellite could be built that would have utility for reconnaissance. The RAND work culminated with a 1954 report, Project FEED BACK, that provided the rationale and the engineering calculations that prompted the United States to proceed with reconnaissance satellite development programs.³ On the basis of the RAND studies and its own in-house work, the US Air Force in 1955 issued contracts for development of military reconnaissance satellites. When the Soviets launched Sputnik I in October 1957, these projects were already in existence, awaiting only the additional impetus that the Space Age would provide.

After Sputnik, the Air Force reconnaissance satellite work, based in Los Angeles at the Air Force's Western Development Division (WDD), was accelerated and placed under a succession of different management arrangements. It was placed first under the Advanced Research Projects Agency (ARPA), then under the Air Force Ballistic Missile Committee (AFBMC),*⁴ and finally, in late 1960 at Presidential direction, under direct management of the Secretary of the Air Force. This decisive move resulted in clean, short

* The ballistic missile programs under development at the Air Force Ballistic Missile Division (AFBMD) in Los Angeles were conducted under a streamlined management process called the Gillette Procedures, which provided for an Air Force Ballistic Missile Committee (AFBMC) and an Office of the Secretary of Defense Ballistic Missile Committee (OSDBMC) to expedite program decisions. The Air Force reconnaissance satellite project, then called SAMOS, was briefly placed under these Gillette Procedures and managed at the Air Force Secretarial level through the AFBMC, which was called the BMC for Space when in session for these programs.

decision lines for these important projects. Within two years, by May 1962, this same central authority was extended to cover Navy and Central Intelligence Agency (CIA) satellite projects, when Under Secretary of the Air Force Joseph V. Charyk, reporting to the Secretary of Defense, became the first Director of the National Reconnaissance Office (NRO). The NRO would play a central, crucial role in satellite reconnaissance for the remainder of the Cold War.

Mission Requirements

Considering the prospect of a nuclear war with the Soviet Union, United States leaders in the 1950s had to know two things. First, what were the Soviets doing in their strategic missile programs? They had already demonstrated a nuclear capability with an atomic detonation in 1949 and a fusion-weapon test in 1953. Could they launch a nuclear weapon on a rocket over intercontinental distances? Second, how effective might Soviet defenses prove to be against US forces? Could the Soviets detect and shoot down US long-range bombers? And could the Soviets counter the developing US missile capability?

Conventional intelligence sources in the 1950s collected bits of data on both of these concerns; spies, or human intelligence, were effective in some areas but encountered significant problems because of the strict security rules inside the Soviet Union. One early attempt to reach deep into the Soviet land mass was by Jim Trexler of the US Naval Research Laboratory (NRL). He pioneered work on

and tests of intercepting radar signals using the Earth's largest satellite, the Moon. He was successful in the late 1950s in collecting intercepts from Soviet EO 13526 (the NATO designator) early warning radars on NRL's 60-foot parabolic reflector antenna in Maryland, and then, with better reception, on the National Radio Astronomy Observatory's 150-foot reflector in West Virginia. He proposed building a 300-foot and, at one time, a 600-foot "big dish" to collect weaker Soviet radars.⁵ In the early 1960s NSA built a special antenna feed for and successfully tested the 1,000-foot-diameter antenna at Arecibo Ionospheric Observatory, Puerto Rico, intercepting EO 13526 3.5(a), E and other signals.⁶ This technique also allowed radars to be located with an uncertainty of 50 miles using multiple intercepts on separate days.

Listening to radio communications, or COMINT, was somewhat easier. The Soviets used short-wave radio bands extensively for communications, and the US military intercept stations, expanded from their World War II numbers, heard many Soviet-Union-wide operational military, industrial, and research networks, yielding some understanding of the Soviet threat. US strategic planners, though, needed more specific data on the exact locations and capabilities of Soviet military and industrial installations. Attempts to take pictures with balloon overflights proved generally unproductive, and conventional aircraft reconnaissance was limited to flights around the periphery of the Sino-Soviet bloc of states. For that reason, in November 1954 President Dwight D. Eisenhower approved development

of the U-2, a highly secret high-altitude reconnaissance aircraft, which was rapidly engineered and put into use in 1956.



Dwight D. Eisenhower

Eisenhower came to believe that the U-2 could overfly parts of Soviet airspace at will. But this would have represented a clear violation of international law, unless the leaders concerned had agreed to such flights. On 21 July 1955, Eisenhower proposed to Soviet leader Nikita Khrushchev that the United States and the Soviet Union provide "facilities for aerial photography to the other country" and conduct mutually supervised reconnaissance overflights.⁷ Before the day ended, Khrushchev rejected the plan, which came to be known as the Open Skies doctrine, as an American attempt to "accumulate target information." Eisenhower said later, "We knew the Soviets wouldn't accept it, but we took a look and thought it was a good move."⁸ The Soviets were thus forewarned of our U-2 flights and the groundwork was beginning to be laid for the use

of reconnaissance satellites. Eleven months later Eisenhower approved the first U-2 overflight of the Soviet Union.⁹



Joseph V. Charyk

Beginning with the first operational flight in July 1956, US analysts found in the U-2 data an extensive Soviet air-defense system being built to counter US strategic bombers and reconnaissance flights, including the U-2 itself. They also saw research and development (R&D) installations for long-range missile systems and, eventually, operational missile sites. Soviet short-range missiles had already flown that same year. Soon, near Sary Shagan, U-2 cameras photographed what appeared to be Soviet antiballistic missile (ABM) R&D facilities. Because it had a great effect on major US resource decisions on its own ABM, intercontinental ballistic missile (ICBM), and countermeasures techniques, the "ABM problem" became the US's top intelligence priority, and eventually became the main focus of effort for SIGINT satellites.

US reconnaissance satellites, the successors to the U-2s, were developed expressly to provide visual and electronic access to the Soviet Union. The very first SIGINT satellites, launched in 1960, were intended to detect and locate air defense radars, to determine the electronic order of battle (EOB, which listed the types and locations of Soviet defense system radars), and thus to assist American bombers to pass through Soviet defenses to military targets in the event of war. The US Intelligence Board (USIB)* had not yet begun to issue formally documented requirements, but the US military and intelligence organizations perceived the nations of the world aligning themselves with one or the other of the superpowers, each with its respective spheres of influence. Thus, the US Air Force Strategic Air Command (SAC) wanted details on Sino-Soviet targets for attack, data on radars and antiaircraft weapons, technical information for design of electronic countermeasures, and exact locations of Soviet defensive installations in order to plan their aircraft penetration routes. The US Navy wanted to determine the threat from Soviet surface ships and submarines, and the US Army and NATO commanders were concerned about Soviet and Warsaw Pact air and ground forces.

Another driving force in the early development of SIGINT satellites was the electronic and rocket engineer's new

technical ability to build more and more sophisticated intercept and recording equipment in lighter packages, place these packages in satellites that circled the Earth, and do really useful reconnaissance jobs for significant durations of time in the vacuum of space. Technology indeed moved rapidly in the 1950s. The transistor, which would replace the cumbersome electronic vacuum tube as an amplifier of weak signals, was invented at Bell Telephone Laboratories in 1948.¹⁰ The first "junction transistor" appeared in 1951. By 1960, solid-state electronics began revolutionizing radio and data processing, the two fields on which SIGINT was based. Electronic hardware suddenly could be designed and built in ever smaller sizes and operated on lower power and would produce much less heat during operation. These advances, coupled with the new advances toward long-range rockets for military purposes, provided both the technology and the lifting capability to make possible the design and launch of SIGINT satellites.

US military reconnaissance satellites, already well along in planning when Sputnik I was launched—and in some cases, even with hardware under development (the Air Force's Advanced Reconnaissance System, Weapon System 117L [WS-117L] was an example)—would number among the pioneers of orbiting artificial satellites. For its reconnaissance satellites, the Air Force developed a general operational requirement and very specific technical specifications based on intelligence data, as it did for all its weapons systems. Nevertheless, construction of WS-117L and the other early SIGINT

* The United States Intelligence Board (USIB) was established by President Eisenhower on 15 September 1958 to establish priorities for US intelligence activities. It was chaired by the Director of Central Intelligence, with members from the Department of Defense, Department of State, the Federal Bureau of Investigation, and other government agencies.

satellites turned on issues of what instrument might work, and, among those that did, which might be most useful as preliminary collectors of the needed data. At the time, ELINT seemed to be easier to try than COMINT, although COMINT was in the minds of some from the very beginning. Soon, feedback and crossfertilization networks developed among the groups building, using, and analyzing the ELINT data, from which new priorities would be set. The era of SIGINT satellites was starting and would enjoy many and varied forms and successes. The formal USIB requirements for the intelligence data these systems collected would come later.

Imaging and Signals Intelligence Space Systems

The major effort within the US satellite reconnaissance program in the 1960s and 1970s featured overhead visual imaging systems, which produced information not obtainable any other way. (CORONA, GAMBIT, and HEXAGON, the early film-based satellite systems, have already been well documented in this series of histories.) But there were important intelligence questions that could not be answered with pictures alone. The first question involved determining the location and characteristics of Soviet radars that could detect American strategic bombers. The second involved the performance capabilities of Soviet missiles—ICBMs and ABM systems. These two problems led the list of reasons favoring SIGINT satellites that could listen to and record the signals of Soviet radars, radio communications, and telemetry systems.

A SIGINT satellite system had many of the same elements as an imaging satellite system, but with important differences. Instead of a camera and film, a SIGINT satellite mounted antennas, receivers, and, sometimes, tape recorders. Instead of sending its information down on film in a reentry vehicle, a SIGINT satellite transmitted its findings by radio link in realtime or shortly after passing over the target area. On the ground, instead of a photo-processing laboratory, technicians used a SIGINT processing system, usually computerized and immensely complicated, to translate the raw electronic signals into intelligence listings and reports for release to analysts. The targets of the SIGINT systems were the actual radio signals radiated by Soviet transmitter equipment, which meant that the satellites had to be in the right place, looking in the right direction, tuned to the right frequency, at the very time the Soviet transmitters were on the air. This was an entirely different game from the photo-collection business, but one with the potential to get different and extremely important information. A number of different types of SIGINT satellites were employed to gather this vital information.

First launched on 22 June 1960 in a 70-degree-inclined, circular orbit about 500 miles above the Earth, the Navy's POPPY satellites searched for the main beams of Soviet scanning radars and provided wide-area coverage of and locations for radars on the surface of the Earth. POPPY satellites acted as "repeaters," encoding each radar pulse as it was received and then retransmitting the pulse stream in realtime to US-manned ground

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stations located around the periphery of the Soviet Union. EO 13526 1.4(c)<25Yrs, EO 13526 3.3 EO 13526 1.4(c)<25Yrs, EO 13526 3.3(b)(1)>25Yrs

The SIGINT satellites most nearly like the photo satellites in their appearance and orbits were the WS-117L family, the Lockheed Agena-based low-orbiters called SAMOS F-1, 698BK, MULTIGROUP, and STRAWMAN. Starting with SAMOS F-1 on 31 January 1961, these satellites orbited at about 275 miles in 67-degree-inclined, circular orbits and searched for Soviet radars of all types, attempting to intercept the Soviet radars from high overhead and from a direction the Soviet radars were not "looking" (i.e., the "side-lobes" of the enemy radar antenna patterns). They operated by reading in and recording the radar information while over the Soviet Union, and reading out that data, by playback of onboard tape recorders, when they passed over the ground tracking stations of the US Air Force Satellite Control Facility (AFSCF) stations in California, New Hampshire, and Hawaii. These satellites, developed by the Air Force, were the first successful orbital collectors of the EOB for SAC. They provided ELINT technical performance details and locations of radars that could threaten our strategic bomber forces. Phased out in 1972, these low-altitude satellites were conceptual pioneers, succeeded by more powerful vehicles in different Earth orbits.

A variety of small electronic boxes were attached to the Agena SIGINT and photographic satellites. These boxes, sometimes with antennas of various

sizes—special kinds of SIGINT collectors and experiments—were called AFTRACK payloads, due to their positioning on the aft rack of the Agena launch vehicle. The first, named SOCTOP, designed to detect tracking of the host vehicle by Soviet radars, was launched on 10 August 1960 on DISCOVERER 13, a CORONA photo mission that had a one-day mission life and was the first to achieve successful reentry of a photo payload from orbit. From this beginning, a single day of operation, came a succession of these small SIGINT payloads, for many different purposes, usually designed and flown on short notice for little cost, each remaining attached to the host satellite and usually operating for the life of the host satellite.

EO 13526 1.4(c)<25Yrs, EO 13526 3.3(b)(1)>25Yrs

The launch rate of AFTRACK payloads peaked in the 1960s. By the 1970s, all the AFTRACK payloads were "vulnerability"-type payloads, used for detection of hostile radar activity. EO 13526 1.4(c)<25Yrs, EO 13

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EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs

remain motionless over one point above the Earth's equator; and near-polar orbits, which would allow reconnaissance satellites to cover the whole Earth in successive passes as the Earth rotated beneath it, each pass occurring at the same local time of day on the ground.¹¹ These near-polar, sun-synchronous orbits were chosen for the photo satellites so that the target areas could be viewed in sunlight. Low-orbiting SIGINT satellites, which did not need to have their targets in sunlight, used lower inclination (about 67 degrees), non-repeating Earth orbits to get the best coverage of the target areas over a period of days or weeks. At the geosynchronous equatorial orbit (22,000 miles high), perceived by Clarke as the orbit most suitable for relaying of communications from one point on the Earth to another, SIGINT satellites became signal interceptors.

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 1.4(c)<25Yrs

In 1945 Arthur C. Clarke described two key types of Earth satellite orbits: the high, geosynchronous orbits suitable for communications, where the satellite's orbital motion coincided with the Earth's rotation and would enable the satellite to

* The term "geopositioning" here means "determining the location of a radar on the surface of the Earth." One method is by geometric reconstruction using the direction of arrival of the signal at a single intercepting satellite, whose location and orientation must be accurately known. The other method is "time difference of arrival" (TDOA), which depends upon knowing the exact location, but not the orientation, of two or more intercepting satellites and determining the location by measuring the difference in times of arrival of a particular signal as it takes different paths to the intercepting satellites and then to the receiving station.

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EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 135

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs

By 1975, the US employed ~~EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs~~ SIGINT low-orbiters, POPPY ~~EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs~~ and ~~EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs~~ high orbiters ~~EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs~~

~~EO 13526 3.3(b)(1)>25Yrs~~ Collectively, they represented an extraordinary, complementary set of reconnaissance satellites.

SIGINT Data Processing and Exploitation

Just as solid-state electronic technology changed the capabilities of SIGINT satellites dramatically, the computer revolution that began in the 1950s, and that is still underway, changed the capabilities of computer processing, almost day to day. The capability to process SIGINT information was especially powerful and quick to develop, because the SIGINT satellites collected electrical signals that, with proper coding, were in a form that computers could work on directly. From 1960 to 1975 the multiplying effect of improved satellite collectors and improved computer processors would provide a many-fold increase in operational capabilities. Developing the processing methodology was the key. (See Appendix A for a discussion of NSA's role in computer evolution.)

It is fairly easy for a trained photo analyst to recognize missiles and radar structures if the photograph is taken by a

properly focused camera with sufficient magnification on a clear day, with observable shadows. Likewise it is easy for the signals analyst or linguist to analyze an electronic signal if the signal structure is known and the signal is collected by a properly tuned receiver with sufficient sensitivity and no interference. Unfortunately, the SIGINT analyst usually encounters noise interference, competing signals on the same frequency, and little or no knowledge of the characteristics of any newly detected signal. Noise or interference impedes signal processing and analysis in much the same way as cloud cover impedes analysis of photo data. The denser the cloud cover in photographic data, or interference in SIGINT data, becomes, the more difficult it is to process or analyze the information: sometimes, analysis is impossible.

Multiple electronic signals intercepted at the same time by SIGINT collectors appear much the same as multiple exposures on a photographic print. Or perhaps a better description would be multiple transparencies of different pictures stacked one on top of the other. Analysis of any one signal or picture is virtually impossible until the competing signals or overlapping pictures are separated out, or, as it is termed by analysts, "deinterleaved."

Analysis of complex, structured signals such as telemetry or multichannel communications requires EO 13526 1.4(c)<25Yrs
EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)
EO 13526 1.4(c)<25Yrs, E before the data can be analyzed or processed. This is very much like the adjustment process required to successfully view a television picture. The

proper channel must be selected, the horizontal synchronization must be established, and the vertical hold must be set to prevent the picture or frames from rolling.

Encryption of electronic data to disguise their real information content introduces another major problem for the SIGINT processor and analyst. Encryption adds keying material, known only to the users, to the clear or unencrypted data, thus producing enciphered data for transmission. Anyone gaining unauthorized access to the encrypted data cannot read it without a major effort to remove the encrypting-key algorithm, thus permitting one to decipher the data. Solving encryption problems is much more difficult than, but is similar in some respects to, the problems faced by photo analysts when camouflage paint or nets have been used to hide an object from view.

Before electronic signals can be machine processed, extensive manual analysis of the captured signals is needed to clearly define the characters that are to be recognized, identified, and codified in special-purpose equipment or in computer software. This manual analysis involves listening to the signal, making signal measurements (often from hardcopy graphic representations of the signal), and developing an understanding of the signal structure (e.g., pulsewidth, type of modulation, pulse repetition rate). As a major designer, developer, and user of the latest in computer technology, the National Security Agency (NSA), established by President Harry S Truman in 1952 to exercise technical and operational control over US COMINT and communications security

EO 1.4.(c)
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activities, eventually employed computers to improve decryption and for handling and screening extremely large volumes of ELINT, COMINT, and TELINT data collected from all sources, including reconnaissance satellites.

Beginning in the 1960s, ELINT data were processed to provide EOB of Sino-Soviet radars for the nation's strike forces in the Single Integrated Operating Plan (SIOP) and for distribution to the military intelligence community. NSA eventually provided direct reporting of the location of threat emitters to the field within hours of their intercept. ELINT data were also used to tip-off other intelligence collection activities. The technical analysis of ELINT allowed assessments of weapon and radar system capabilities to be made and electronic countermeasures to be designed.

COMINT data, often used by NSA linguists fluent in the native language of the target nation, provided databases on that nation's economic capabilities, such as manufacturing, technical level of competence, number and types of resources (both civil and military), and personal data on key people. Most important, COMINT

provided indications of target country political and military intentions, including military planning, deployment of troops, policy positions, and threats. NSA frequently applied special processing techniques to decrypt enciphered communications of target countries.

TELINT processed by NSA was furnished to the CIA, the Air Force System Command's Foreign Technology Division (FTD), the Army Missile Command (AMC) and other Intelligence Community customers, which analyzed the data to deter-

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c), EO 13526 3.3(b)(

By 1975 these intelligence products were being rapidly and routinely reported throughout the Intelligence Community. They represented an enormous capability to collect, sort, and distribute information that could hardly have been imagined as the story began in World War II, or even by the start of the satellite era in 1960. The NRO and the NSA, the satellite operator and the processor of the SIGINT information, respectively, were the organizations that made these things happen.

* TELINT processing was the responsibility of NSA, although this assignment of responsibility was not accepted by the CIA for a long time—until the early 1970s—because of CIA's interest and early involvement
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, E

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Development of SIGINT EOB operational capability

Year	SIGINT Satellite	Accuracy of Location (Miles)	Radar Locations Produced Per Year	Time From Intercept, To Delivery, To User
1960	POPPY	400-8,000	—	1-2 months
1961/62	698BK	EO 13526 1.4	EO 13526 1.4(c)<	EO 13526 1.4(c)<25Yrs, EO
1964/65	698BK			
	BIRD DOG			
	POPPY			
1966/67	698BK			
	SETTER			
	POPPY			
1968/69	THRESHER			
	REAPER			
1973/75	EO 13526 1.4(c)<			

The above chart of improving EOB capability over the years is typical of the kinds of improvement also made in ELINT and telemetry technical analysis, and large-volume COMINT reporting.

Chapter 1 References

1. *History of the POPPY Satellite System*, BYE-56105-78, pp. 1-3.
2. Clarke, Arthur C., *RAF Quarterly*, March 1946, pp. 61-69. Republished in John Wiley, *Ascent to Orbit*, 1984.
3. Davies, Merton E. and William R. Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related US Space Technology*, Santa Monica, CA: the RAND Corporation, 1988, pp. 57-58.
4. Martin comments, SIGINT Satellite History peer review, March 1994.
5. NRL Memorandum Report 1418, 20 May 1963.
6. EO 13526 3.5(c) "Extending the Radio Horizon for Intercept Purposes by Using the Moon as a Reflector," *NSA Technical Journal*, Vol. X, No. 2, spring 1965.
7. "Statement on Disarmament, 21 July," *The Department of State Bulletin*, Vol. XXXIII, No. 841, 1 August 1955, p. 174. Abel, Elie, "Eisenhower Calls Upon Soviet Union to Exchange Arms Blueprints," *The New York Times*, 22 July 1955, p. 1. See also John Prados, *The Soviet Estimate: US Intelligence Analysis and Russian Military Strength*. New York: The Dial Press, 1982, pp. 31-32. The term "Open Skies doctrine" was coined later by the popular press and applied to Eisenhower's statement on disarmament.
8. Parmet, Herbert S., *Eisenhower and the American Crusades*, New York: The MacMillan Company, 1972, p. 406. Rostow, W. W., *Open Skies: Eisenhower's Proposal of July 21, 1955*. Austin, TX: University of Texas Press, 1982, pp. 7-8.
9. Ambrose, Stephen E., *Ike's Spies: Eisenhower and the Espionage Establishment*, Garden City, NY: Doubleday & Co., 1981, p. 266 and pp. 31-34. Quoted in R. Cargill Hall, *The Air Force and the National Security Space Program, 1946-1988*, USAF Historical Research Center, 1988. (TS/TK)
10. *Encyclopedia Americana*, "Transistor," point contact.
11. Davies and Harris, pp. 15-17. See also Arthur C. Clarke, "A Short Pre-History of Comsats, Or How I Lost a Billion Dollars in My Spare Time," in *Voices from the Sky: Previews of the Coming Space Age*, New York: Harper & Row, 1965, pp. 119-128.
12. Lew Allen comments, SIGINT Satellite History peer review, March 1994.

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Early SIGINT Satellite Organization, Development, and Evolution

WS-117L Under ARDC and ARPA

In March 1946 MGen Curtis E. LeMay, the first Army Air Forces Deputy Chief of Staff for Research and Development, asked the Project RAND team, then part of Douglas Aircraft Company in Santa Monica, California, to prepare a quick engineering study on Earth satellites.^{1*} The resulting report, issued on 2 May 1946, was titled *Preliminary Design of an Experimental World-Circling Spaceship* and identified as missions the following: satellites to guide missiles, satellites as the missiles themselves, satellites as "observation aircraft," satellites for attack assessment, satellites for weather reconnaissance, and satellites for communications.² This RAND report was an important first step in demonstrating an independent competence in space technology for the Army Air Forces (to become the US Air Force in 1947) and in putting the Air Force on the track toward using Earth satellites for reconnaissance.³ In April 1951 RAND issued an encouraging progress report and received authority from Headquarters, US Air Force, to place subcontracts for detailed subsystem studies.⁴ In May 1953, believing that these studies would lead to hardware development, MGen Donald N. Yates, Air Force Deputy Chief of Staff for

Development, approved a request from planners at Headquarters, Air Research and Development Command (ARDC), in Baltimore, Maryland, to take responsibility for "active direction" of the RAND study by 1 June 1953.⁵

In the summer of 1953, LtCol Victor L. Genez, ARDC Director of Intelligence, was briefed on this study by personnel of the RAND "satellite office" at their facility in Santa Monica. Genez returned to Baltimore convinced that an immediate effort should be made to orbit an Earth satellite, even if a specific reconnaissance system was not yet available.⁶ In December 1953 ARDC established Project 409-40, "Satellite Component Study," and in January 1954 established Project 1115 under a formal R&D system number, Weapon System 117L. At that time, pending completion of the RAND report, no funding was made available.

In March 1954 RAND published its report "Project FEED BACK." This comprehensive and far-sighted study asserted that satellites for reconnaissance of the Earth were feasible and recommended that the US Air Force should initiate a development program immediately.⁷ In May 1954, with FEED BACK published and based on the premise that feasibility of hardware development had been demonstrated, Headquarters US Air Force (with the

* In November 1948, Project RAND was separated from the Douglas Aircraft Company and became the RAND Corporation, an independent nonprofit corporation, in Santa Monica.

approval of the Office of the Secretary of Defense (OSD)), authorized ARDC to initiate the necessary studies to implement Project 1115, the Advanced Reconnaissance System (ARS). Shortly thereafter, Detachment 1, ARDC, was created at Wright Air Development Center (WADC), Wright-Patterson Air Force Base (AFB), Ohio, to accomplish this task.

Maj Quentin P. "Q" Riepe, then assistant librarian at WADC, read the Project FEED BACK report as soon as it was received at WADC and immediately became interested in the idea. He began lobbying for implementation of the recommended developments. His obvious enthusiasm was rewarded in the summer of 1954 with his assignment as Chief of Detachment 1 at Wright-Patterson. Shortly thereafter, he was joined by LtCol William G. King, Jr., the former Chief of the Airborne Guided Missile Office at WADC. King had also read the Project FEED BACK report and became equally enthusiastic after he was briefed on the subject by the RAND team. With King now the leader and Riepe as his deputy, this small, closely knit team of "space cadets" included Capt William O. (Bill) Troetschel; Lt James (Jim) Coolbaugh; Lt Jack Herther; Fritz Runge (who came to the WS-117L staff as the only civil service member); and LtCol James (Jim) Seay. They set out to convince the Department of Defense (DOD), the Intelligence Community, and, through the Executive Branch, the President of the United States, that reconnaissance satellites were actually feasible and could provide needed surveillance of the interior of the Soviet Union so important to the defense of this country. This was a vision

that not many people yet shared, because the first Atlas missile had yet to achieve a successful flight, and data about the Soviet ICBM program remained sketchy at best.

Unbeknownst to King and Riepe, President Eisenhower had already triggered events in a related arena. when, on 27 March 1954, he asked some of his top scientific advisors, including James B. Conant and James R. Killian, Jr., to develop a solution to the problem of surprise attack by the Soviets. The probability of such an attack was increasing at an alarming rate, given the Soviet determination to develop nuclear weapons and delivery systems, possibly including missiles. Eisenhower asked Killian to chair a Technological Capabilities Panel (TCP) to study surprise attack and the US ability to meet it. The panel operated with three project committees, one on offensive forces, one on defensive forces, and one on intelligence. Edwin H. "Din" Land, the founder of Polaroid, chaired the Intelligence Committee, known as Project 3. On 24 November 1954, during TCP deliberations, President Eisenhower approved the development of the U-2 high-altitude reconnaissance aircraft; Richard M. Bissell, Jr., of the CIA was placed in charge of this highest priority project. On 14 February 1955 Killian and Land briefed President Eisenhower on the specific technological options that could alleviate uncertainties of strategic intelligence. These included systems for aerial overflight by aircraft or balloon and, somewhat farther in the future, satellite reconnaissance systems.⁸

On 27 November 1954, three days after the Killian Panel presented its interim report to the President, ARDC issued System Requirement (SR) 5, calling for development of a satellite reconnaissance system. Indirectly, the Killian Panel was possibly a stimulant to this effort to define the Air Force's formal requirements for a reconnaissance satellite system.⁹ On 16 March 1955, Headquarters USAF, endorsed SR 5 by issuing General Operational Requirement 80, which included Appendix 80-2, reaffirming the need for an electronic intercept capability as part of the WS-117L ARS.

With this clear authority to proceed, the ARDC Detachment 1 "space cadets" offered system study contracts to four of the major contractors who had been involved in component studies for RAND. Three companies accepted: Glenn L. Martin Company, Baltimore, Maryland; Radio Corporation of America (RCA) at Camden, New Jersey; and Lockheed Aircraft Company, Burbank, California. Bell Telephone Laboratories, Whippany, New Jersey, was also solicited but declined to participate. Some of the ongoing component studies that had been initiated by RAND were also continued. One of these, with the Ampex Company in Redwood City, California, was a small tag-on to the RAND studies aimed at developing a wide-band video recorder for photo missions. Ampex was spending a great deal of company money to develop the recorder for domestic TV use and this seemed like a great way to "get in on the act." Capt Bill Troetschel of ARDC Detachment 1 had

another use in mind: magnetic-tape recording of wide-bandwidth ELINT for technical analysis.¹⁰

The Air Force was not the only service interested in outer space. In April 1955 the Naval Research Laboratory (NRL) in Washington, DC, proposed a "Scientific Satellite Program" for the International Geophysical Year, to be known as the Vanguard Program. When this was approved in August 1955 the US was well on its way to establishing the principle in international law of "Freedom of Space."¹¹ The Vanguard activity looked attractive to Howard Lorenzen and his electronic payload development team, also at NRL. Just as WS-117L looked to the Atlas as a booster, the NRL electronics group saw the Vanguard as an excellent way to boost a small ELINT payload into orbit. Although there was no military mission involvement in the Vanguard Program, Lorenzen began some electronic intercept system studies, which led to a later Navy proposal for an ELINT satellite payload.

In the meantime, in Ohio, King and his Detachment 1 team were on the briefing trail. In the fall of 1955 they briefed, among others, Gen Curtis E. LeMay at SAC headquarters on the reconnaissance satellite. They took along Maj Sidney Greene, who had a contract with the University of Iowa to investigate ways to put a grapefruit-sized payload on the Moon. LeMay sat in the front row, a participant recalled, chomping his cigar, and at the conclusion asked, "How did you get TDY money to tell me this crap?"¹² This was a response typical of senior people

who received briefings in these "pre-Sputnik" days. Most were skeptical, even Gen LeMay, who 10 years before had kicked off the RAND satellite studies when he was the first R&D Director for the Army Air Forces under Gen H. H. "Hap" Arnold. BGen (later advanced to Gen) Bernard A. Schriever, first Commander of the Air Force's Western Development Division (WDD) in Los Angeles, convinced LeMay that the "space cadets" were developing a viable program. Six years later, in 1961, when LeMay became Air Force Chief of Staff, he was a strong advocate for Air Force space reconnaissance programs.¹³



BGen Bernard A. Schriever

Shortly after the LeMay briefing, BGen Schriever requested a briefing at WDD because of concerns at the national level (ICBM Scientific Advisory Group) that an Air Force space program would compete for boosters with the missile program. King's boss at Wright Air Development Center (WADC) was BGen Howell M. Estes, who had become unhappy with the satellite effort partly because of its cool

reception at higher levels and partly because of bad public relations, including a letter from Governor Harold Stassen of Minnesota complaining that his constituents did not want a space satellite "spying on their activities." Stassen had been advised on overflight risks precedent to development of President Eisenhower's "Open Skies" proposal of 1955 by Col Richard Leghorn, who was familiar with RAND's studies on the political risk of high-altitude overflight.¹⁴ As a result, Estes insisted that King develop a script for the briefing in Los Angeles and told him to give it verbatim. King was more than surprised when, looking out over the audience, he saw LGen Donald S. Putt, Deputy Chief of Staff for Development, Headquarters US Air Force. During this briefing, which took place in September 1955, BGen Schriever turned to Simon Ramo of the Ramo-Wooldridge Corporation, technical staff for the ballistic missile program, and asked, "What do you think, Si?" Ramo is said to have replied, "Let's do both space and missile work in Los Angeles, so we can avoid interference with the missile programs." Schriever took Ramo's advice. This was a vital decision, as it separated the satellite work from the Air Force's regular development chain of command at WADC and placed it under the special team established in Los Angeles in 1954 to develop the country's ballistic missiles.¹⁵

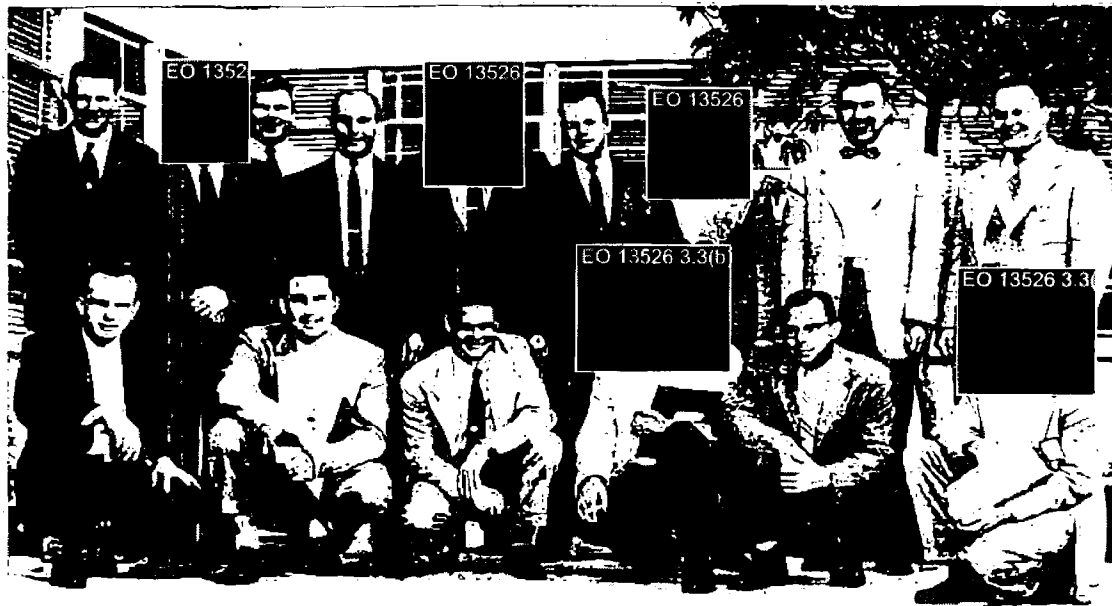
In October 1955, at Schriever's request, Air Research and Development Command (ARDC) leader LGen Thomas S. Power directed the transfer of the WS-117L Program Office from Wright-Patterson AFB in Ohio to the WDD in Inglewood, CA. The move took place in January 1956.

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Schriever picked Commander Robert C. Truax, a member of his staff and that year President of the American Rocket Society, to be head of the WS-117L Program Office. LtCol King stayed at Wright-Patterson as Project Officer for the SNARK guided missile project.

In November 1955 a Source Selection Board chaired by the WS-117L Office chose the Glenn L. Martin Company, RCA, and Lockheed to compete for a reconnaissance satellite development contract.

From 12 to 20 March 1956 (after the move to WDD), a joint ARDC/Air Materiel Command (AMC)/WDD/WADC contractor evaluation board met at WADC and recommended that Lockheed be selected for the WS-117L development contract. Subsequently, on 2 April 1956, WDD published the WS-117L Advanced Reconnaissance System Development Plan, calling for R&D funds in the amount of \$7.0 million for FY56, \$32.1 million for FY57, and \$75.6 million for FY58. On 24 July 1956 Headquarters USAF approved



Advanced reconnaissance system management transition planning meeting, Inglewood, California, 27 November 1956

Back row (left to right): Capt William O. Troetschel, USAF, Wright Air Development Center (WADC), Ohio; ~~EO 13526~~ WADC; 1st Lt John C. Henther, USAF, WADC; LtCol William G. King, Jr., WADC; ~~EO 13526 3.3(b)~~ Intelligence and Electronic Warfare Laboratory (IEW Lab), Rome Air Development Center (RADC), New York; Capt James Suttie, USAF, IE&W Lab, RADC; ~~EO 13526 3.3(b)~~ IE&W Lab, RADC; Capt James S. Coolbaugh, USAF, WADC; Capt Frank Jasen, USAF, WADC. Front row (left to right): Fritz Runge, WADC; Capt Richard P. Berry, USAF, RADC; Cmdr Robert C. Truax, USN, Western Development Division, Air Research and Development Command, Inglewood, California; ~~EO 13526 3.3(b)~~ WADC; LtCol George P. Jones, USAF, Air Force Cambridge Research Center, Massachusetts; ~~EO 13526 3.3(b)~~ RADC.

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the plan, but the DCS/D Development Directive, published 3 August 1956, allocated only \$3.0 million for FY57. This low level of funding was continued until the launch of Sputnik on 4 October 1957.

Based on this initial funding approval, on 29 October 1956 the Air Force awarded contract AF 04(647)-97 to Lockheed to proceed with initial system development studies. Secretary of the Air Force Donald A. Quarles, who wanted the International Geophysical Year satellites to be first into orbit, insisted that this was to be for engineering studies only and that "no tin would be bent." By the summer of 1957, a total of \$10 million had been allocated and Quarles had relented enough to allow mockups to be constructed. It was anticipated that \$35 million might be available in 1958. The first launch would not be before 1961.

FY57 funds were sufficient to initiate studies in all the subsystem areas, including Subsystem F (S/S F), the electronic reconnaissance, or "ferret," system. An excerpt from the introduction to the winning S/S F proposal of the Airborne Instruments Laboratory (AIL), Mineola, Long Island, New York, dated April 1957, shows that this new job was taken seriously: "The contractor who develops the ferret portion of the 117L system assumes a responsibility to the country that cannot be lightly considered. In many ways this is an ideal vehicle: if the designer does not make the most of the unique opportunities afforded to him, he will have failed." The proposal described the three essential elements of an effective reconnaissance system: knowledge of the intelligence

requirements; ability to develop the collection system including limitations and growth potential; and the ground data-handling necessary to provide a useable product. Based on their experience in building many electronic-warfare systems for the government, Winfield "Win" Fromm and his AIL team knew that past collection systems had sometimes been built without processing capability or, in some cases, knowledge of intelligence requirements. The early SIGINT satellite programs were to be helped and shaped by these insights.

Following the Soviet launch of Sputnik I, the WS-117L Program received a great deal of national attention as the US scrambled to counter the Russian successes in space. President Eisenhower faced the problem of gaining control over the rivalry among government agencies seeking to lay claim to one or another area of space operation and reducing, if possible, the media speculation about their efforts. On 7 February 1958, he formed the Advanced Research Projects Agency (ARPA) to undertake basic research and to direct R&D projects within the Department of Defense (DOD), as assigned to ARPA by the Secretary of Defense. As its main job, ARPA was to oversee all US military space programs from the DOD level.¹⁶

In the spring of 1958, ARPA Director Roy W. Johnson issued an invitation to all military organizations to propose satellite systems whose development would further their goals. The Chief of Naval Operations (CNO) relayed the query to all Navy scientific and technical organizations, asking, "All hands consider how they could

use space in their design ideas for the Navy." Howard Lorenzen at NRL proposed an ELINT system to the CNO that was a very straightforward extension of existing airborne ELINT systems. This became the DYNOW program that flew piggyback with early Navy TRANSIT satellites and became the first US satellite ELINT system.

The ARPA space era commenced officially in Los Angeles on 30 June 1958 with ARPA Order 9-58, which said that Secretary of Defense Thomas S. Gates, Jr., had assigned responsibility for WS-117L to ARPA under DOD Directive 5105.15. The Air Force Ballistic Missile Division (AFBMD), successor to WDD, was to submit a Development and Financial Plan as soon as possible. This directive was followed by an 18-month period of continuous change, indicative of the national uncertainty in the arena of satellite reconnaissance policy. During this period funding fluctuated wildly, responsibility for WS-117L was transferred by ARPA from AFBMD to ARDC then finally to US Air Force Headquarters.

To remove "weapon system" from the designation and suggest a purely defensive system, in 1959 the program identifier was changed from WS-117L to SENTRY. This effort was then divided into DISCOVERER (scientific research system, Thor boosted), MIDAS (IR system, Atlas boosted), and SENTRY (reconnaissance system, Atlas boosted). All of these programs were to be developed at the DOD SECRET security level. This included the scientific aspects of DISCOVERER, although this program was actually the

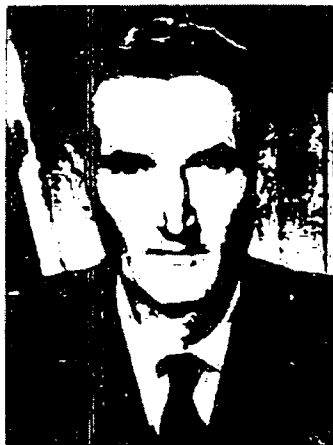
cover effort for the covert CIA CORONA Photo Recovery Program, which had been approved by President Eisenhower in early February 1958.* On 6 August 1959, to provide additional security for the SENTRY Program, it was redesignated SAMOS, in order to "... identify reconnaissance program with an innocuous name that does not, repeat not, have mission association."¹⁷ The name SAMOS was actually selected by ARPA Director Admiral John Clark, in reference to the Greek island of the same name. Most people thought the new name was an acronym for "space and missile observation system," and the attempt to choose a name without mission association was not successful.^{†18} There were several reprogramming actions, driven by problems in the SAMOS photo payload, Subsystem E (S/S E), development, particularly the tradeoffs between read-out and recovery type systems. Since the ferret system was always considered essential but not as important as the photo system, it neither attracted the attention nor suffered quite the wild variations that plagued the photo programs.

* A contributing reason for approving the CORONA program was that review suggested WS-117L was too elaborate, too complex to achieve an early operational capability, which was not a high priority (in the Air Force). This led to more focused programs that were less ambitious and more likely to provide early, useful data. See Joseph V. Charyk comments, SIGINT Satellite History Round Table, 26 May 1994.

† Samos is a Greek Island where the astronomer Aristarchus lived (310-230 B.C.), referred to by Archimedes and Plutarch. He hypothesized that the heavens of the "fixed stars" remain at rest, and the Earth revolves in an oblique circle about the Sun, while it rotates, at the same time, about its own axis. The interpretation of SAMOS as an acronym for "space and missile observation system" was originated by the press and became the accepted interpretation among the uncared population in and around the Pentagon and Washington. Within the cleared circles, it became a joke, as an acronym for "same old SENTRY."

Evolution of the National Reconnaissance Office (NRO)

Suite 4C1000 in the Pentagon became the location for some of the most secret and important activities in the US satellite reconnaissance programs. At the time of the Sputnik I launch, 4C1000 was occupied by the Air Force Office of Guided Missiles (AFCGM), headed by BGen Robert E. Greer,



BGen Robert E. Greer

whose responsibility was primarily the development of air-launched guided missiles.*¹⁹ The AFCGM staff also served as the secretariat for the AFBMC (a part of the special arrangements for managing the Air Force ballistic missile programs in Los Angeles), an activity that provided Greer's staff with insight into missile and space developments. In the Pentagon, most other R&D staff work was the responsibility of the Air Force Deputy Chief of Staff for

* 4C1000 was an executive-level conference room used by the senior Air Staff and the Air Force Secretaries for many conferences. Greer's AFCGM offices adjoined this conference room. When SAFMS was established, they simply annexed the 4C1000 conference room and that door became the entrance to the reconfigured suite.

Development, LGen Roscoe C. Wilson. As ballistic missiles achieved operational status, they became the responsibility of AFCGM. When the MX-770 became the Atlas and deployment to operational sites began in 1958, LtCol Edwin J. Istvan became the Atlas project officer in AFCGM. Later, he and Greer calculated that an entire Atlas sustainer stage could be placed in low Earth orbit to counter some of the bad publicity engendered by the Soviet lead in space. They obtained President Eisenhower's approval to install a payload playing Christmas carols and a Presidential greeting (plus telemetry). Thousands of listeners around the world heard the message and the carols during the satellite's brief three-day lifetime. This became project SCORE, an Atlas-B ICBM launched into low Earth orbit on 18 December 1958.²⁰ Due to the extreme secrecy of the arrangements, this probably qualifies as the first operational "black" payload. With the successful launch of project SCORE, emphasis in AFCGM gradually shifted from missiles to boosters, then to the satellites boosted by the missiles.

On 26 May 1960, in the aftermath of the 1 May 1960 shootdown of F. Gary Powers' U-2 over the Soviet Union, an event that involved terminating all *aerial* overflights of Soviet territory, President Eisenhower asked his new science and technology advisor, George B. Kistiakowsky, to form an ad hoc group and assess the nation's defense intelligence requirements, the ability of the SAMOS Program to meet them, and the Defense Department plans for employing the system.²¹ On 10 June 1960 Eisenhower gave the job formally to Secretary of Defense Thomas Gates, Jr., who appointed a committee consisting of

Under Secretary of the Air Force Joseph V. Charyk, the Deputy Director of Defense Research and Engineering John H. Rubel, and science advisor Kistiakowsky.

The findings of this group were presented to and approved by the President at a meeting of the National Security Council on 25 August 1960. Among the actions ordered were that "... this (reconnaissance) program be managed with the directness that the Air Force has used on occasion, with great success, for projects with overriding priority. This can best be accomplished by direct line of command from the Secretary of the Air Force to the general officer in operational charge of the whole program ...," and that "... the so-called F payloads for gathering electromagnetic intelligence should be given lower priority than that assigned to photography."²² This action was implemented on 31 August 1960 when the SAMOS Project Office was established at AFBMD, El Segundo, California, with BGen Robert E. Greer in charge, reporting directly to Under Secretary Charyk.²³

The Pentagon office, 4C1000, became the home of the Air Force Office of Missiles and Space (SAFMS), headed by BGen Richard Curtin, who had served at AFBMD in Los Angeles and in the office of the Deputy Chief of Staff for Development in Washington. Curtin's mission was to provide direct staff support to Charyk and function as the Washington staff for Greer. The 4C1000 staff served the vital function of providing liaison to other military organizations involved in military space programs.

On 6 September 1961, the National Reconnaissance Program (NRP) was formally established, with Charyk named "Assistant for Reconnaissance" to the Secretary of Defense, in charge of Air Force Satellite Reconnaissance Programs, and Richard M. Bissell, Jr., CIA Deputy Director for Plans, in charge of the CIA programs. The staff in 4C1000 became the Office of Space Systems (SAFSS), continuing to support Charyk as Under Secretary of the Air Force and Greer as the Director of the Air Force Office of Special Projects (SAFSP). Greer's earlier title, "Director of the SAMOS Project Office," had been dropped in favor of the less revealing "Director of Special Projects."²⁴ On 2 May 1962 Charyk was designated Director of the National Reconnaissance Office (DNRO) on the basis of a DOD/CIA agreement, signed by Roswell Gilpatric, Deputy Secretary of Defense, and John A. McCone, Director of the CIA (DCI).²⁵ This agreement established a single Director of the NRO, responsible directly to the DCI and the Secretary of Defense for management of the entire NRP. It also established the NRO itself and designated the Under Secretary of the Air Force as the Director. This was made effective within the DOD on 14 June 1962.²⁶ On 23 July 1962 Charyk established the internal NRO structure and responsibilities. He also arranged for participation within the NRO by the CIA, the National Photographic Interpretation Center (NPIC), the National Security Agency (NSA), the Navy, and the Army through provision of qualified personnel

* Since the NRO was a covert ("black") facility, in the overt ("white") world it was known as the Office of Space Systems, Office of the Secretary of the Air Force (SAFSS), and the DNRO, a "black" title, was known in the "white" world as (and actually was) the Under Secretary of the Air Force (SAFUS).

from those agencies and services to serve full-time tours on an interagency exchange basis. Charyk designated the Air Force NRO projects as Program A, the CIA projects as Program B, the Navy projects as Program C, and the overhead covert aircraft (U-2 and SR-71) as Program D.²⁷ LtCol Ed Istvan inherited the Electronic Systems position on the NRO staff in 4C1000 and handled all SIGINT matters until his retirement in 1963. Although the NRO was to face many reorganizations in the years to come, the stage was now set for the development of a series of satellite reconnaissance programs that were to become indispensable to the security and defensive preparedness of the United States.

Evolution of the National Security Agency (NSA)

NSA can trace its earliest beginnings as a national organization to a proposal in 1943 to merge the Army and Navy radio-intelligence units. These Army and Navy intercept organizations dated back to the early 1930s, when they were separate groups, usually competing vigorously for the collection and processing of diplomatic traffic.²⁸ Their merging was "delayed until the cessation of hostilities [in World War II] because of the inevitable disruptions which occur as a result of major reorganizations."²⁹

* Japanese PURPLE is one example. In the areas of Japanese or German Army and Navy traffic, little cooperation was possible because of the easily recognized distinctive characteristics of the respective opponent Service traffic. Post-World War II, the common or centrally controlled supply of (Russian) communication security doctrine made traffic source recognition quite difficult and a cooperative attack (AFSA, then NSA) feasible and desirable.

Also during World War II, the Army/Navy Radio Intelligence Coordinating Committee was established under the Joint Military Chiefs of Staff. This group, set up by a purely verbal "gentleman's agreement," later became the Army/Navy Communications Coordinating Committee of the Army/Navy Communications Intelligence Board. In 1945 the Department of State was added, because much of the COMINT collected during the war involved diplomatic targets, and the group was formalized as the State/Army/Navy Communications Intelligence Board (STANCIB).

In early 1946 Gen Hoyt S. Vandenberg and Adm Thomas B. Engles of STANCIB met with J. Edgar Hoover to arrange for FBI membership in STANCIB.³⁰ On 13 June 1946 the US Communications Intelligence Board (USCIB) was established to replace STANCIB and to carry out the same functions: to coordinate, develop policy for, control, and assign requirements for COMINT.³¹

In 1947 President Harry S Truman signed Public Law 253, "The National Security Act of 1947," which created the Secretary of Defense as a cabinet post over the National Military Establishment and the three "co-equal" Secretaries of the Army, Navy, and Air Force. The 1947 Act also established the National Security Council, the National Security Resources Board, and the CIA. The first Secretary of Defense was James V. Forrestal. During this period Congress also established an executive organization study group, and President Truman appointed former President Herbert Hoover its chairman. The Hoover

group produced 19 reports, which included 196 recommendations, in two years. In 1949, by an amendment to the 1947 Act, DOD, destined to become a large and powerful institution, was formally created.³²

The CIA, established by the National Security Act of 1947 from the Central Intelligence Group (CIG), was the successor to President Roosevelt's World War II quasi-military Office of Strategic Services (OSS), which was organized and led by intelligence coordinator, collector, and analyst William J. Donovan. CIA's responsibilities were defined in Secret NSC directives. The first DCI, Admiral Sidney W. Souers, had already been heading the CIG since January 1946. In 1947, the second DCI, Air Force Gen Hoyt S. Vandenberg, began to influence COMINT planning as a member of USCIB, although there were very few formal procedures for intelligence collection or reporting at that time. Adm Roscoe H. Hillenkoetter and, in the early 1950s, Gen Walter Bedell Smith, former Chief of Staff to General Eisenhower during World War II, continued to strengthen the role of the CIA in the Intelligence—and especially the COMINT—Community.³³

In the years after World War II, traditional turf battles between the Army and Navy intensified when the new Air Force, the State Department, and the new CIA were added to the list of intelligence contestants who would be involved in COMINT activities. In 1949, based on recommendations by several joint service committees and discussions with the members of the USCIB, Secretary of Defense Louis A. Johnson established, by executive order, the Armed Forces Security Agency

(AFSA). This put all COMINT under one military organization consisting of the Army and Navy radio intelligence groups as well as the new Air Force's own Air Force Security Service (AFSS). The Air Force had been created mainly from the Army Air Forces, so the Army's Signals Intelligence Service also had a piece split off to form AFSS. But AFSA only made matters worse: CIA and State were cut out of COMINT and the military services were subordinated to a new agency.

On 24 October 1952, having received much criticism of AFSA, President Harry S. Truman signed an Executive Directive^{*} making COMINT a national, not just a military, effort; this Directive changed the name of AFSA to the National Security Agency (NSA) and gave to the Director of the NSA, who reported to the Secretary of Defense, technical and operational control of all communications intelligence resources as well as responsibility for all "communications security" activities.[†] This Presidential directive, like the earlier AFSA, was resisted at first by the Army, Navy, and Air Force because it placed NSA firmly in control of their COMINT activities. From the CIA perspective, the new plan effectively took the CIA out of the COMINT chain by making COMINT a business of the DOD. There was also a process in which the Secretary of State and the Secretary of Defense, as a "Special

* President Truman sent a memo dated 24 October 1952 to Secretary of State Dean Acheson and Secretary of Defense Robert A. Lovett outlining the mission of NSA: on the same day National Security Council Intelligence Directive No. 9 was issued, assigning NSA the COMINT mission for the US Government.

† Communications security is defined as making US military and other high-level government communications secure from unauthorized readers.

Committee," coordinated on sensitive national security matters and at times kept out the DCI and CIA. After the 1952 decision, in spite of resistance and with some exceptions, the bulk of the COMINT remained under NSA.³⁴ On 4 November 1952, LGen Ralph J. Canine, US Army, was named the first Director of NSA and it was under his strong leadership that NSA became a truly national communications intelligence and communications security organization.³⁵

On 10 July 1953 newly elected President Dwight D. Eisenhower, following the lead of his predecessor, Harry S. Truman, once again called upon former President Herbert Hoover (under Congressional mandate of PL 108) to study the complete reorganization and streamlining of the Federal Government after 20 years of Democratic control. This second Hoover Commission operated for two years, studied 60 agencies, and made 314 recommendations to Congress, many relative to reducing costs. A special task force, headed by General Mark W. Clark, investigated all the intelligence activities of the government and was charged to make appropriate recommendations. On 25 May 1955 two reports were submitted. An unclassified report recommended that President Eisenhower appoint a committee of private citizens to report to him periodically on foreign intelligence activities; this was to become the President's Board of Consultants on Foreign Intelligence Activities (the Killian Board). A classified intelligence annex called for expansion of the COMINT effort "during an era when not only our national security but our national survival as well may depend on

adequate intelligence." The Intelligence Task Force also observed that the "national interests will be better served, and more economical and efficient operation will result, if ELINT is placed under NSA."³⁶

On 13 July 1955 Secretary of Defense Charles E. Wilson issued DOD directive S-3115.2, on ELINT. Although the Hoover Commission had recommended that ELINT be assigned to NSA, this directive assigned implementation responsibility in the ELINT field to the Secretary of the Air Force, pending the issuance of further recommendations by the USCIB and the Joint Chiefs of Staff.³⁷

President Eisenhower's Executive Order of 6 February 1956 established the President's Board of Consultants on Foreign Intelligence Activities (the Killian Board, later the President's Foreign Intelligence Advisory Board (PFIAB)), chaired by Dr. James R. Killian, President of Massachusetts Institute of Technology, to review and make semiannual reports on the foreign intelligence activities of the government. In its report of 24 October 1957, the board recommended that the functions of the USCIB and the Intelligence Advisory Committee be combined into a single body, the US Intelligence Board (USIB), and that this new board be chaired by the DCI.³⁸

While considering the Killian Board recommendations in February 1958, President Eisenhower requested USCIB to look again at ELINT management. Responding to his memorandum the board established a special ELINT task force, the



Louis W. Tordella

"Strong Committee," with retired US Marine Corps BGen Philip G. Strong, then of the CIA, as chairman.³⁹ Other members on the committee were Robert F. Packard, State Department; Louis W. Tordella, formerly Chief of NSA's Office of Analysis, then DOD Office of Special Operations, and soon to become Deputy Director, NSA; Col Russell H. Horton, US Army; Capt Charles M. Bertholf, US Navy; and Col Linscott A. Hall, US Air Force. The committee studied the US ELINT organizational structure and submitted its report on 11 June 1958. The Strong Committee concluded that there should be a single national operational and technical authority to direct and control all US ELINT activities and noted it was "logical, desirable, and feasible" that a single national authority direct and control both the COMINT and ELINT activities of the US Government, to wit, NSA.⁴⁰ The President approved these recommendations, and on 15 September 1958 this action was directed by NSC Intelligence Directive (NSCID) No. 6. Also issued on

this date were NSCID No. 1, which created the US Intelligence Board and incorporated USCIB's COMINT/ELINT responsibilities into overall responsibility for national intelligence requirements and also described the national responsibilities of the DCI, including his chairmanship of the USIB; NSCID No. 5 dealing with the CIA; and NSCID No. 7 for Critical Communications.⁴¹

Secretary of Defense Neil McElroy signed the implementing directives for NSCID No. 6 on 19 March 1959 (DOD S-3115.4), officially assigning NSA operational and technical control of ELINT. NSA had no organization at that time to accept this responsibility for ELINT except for the National Technical Processing Center (NTPC), which had been formed previously from the World War II Army-Navy Electronics Evaluation Group. NTPC processed ELINT and TELINT collected from conventional military ground and airborne sources. CIA continued to operate the U-2 and to provide data (selected on CIA's determination of need-to-know) to members of the Intelligence Community.⁴²

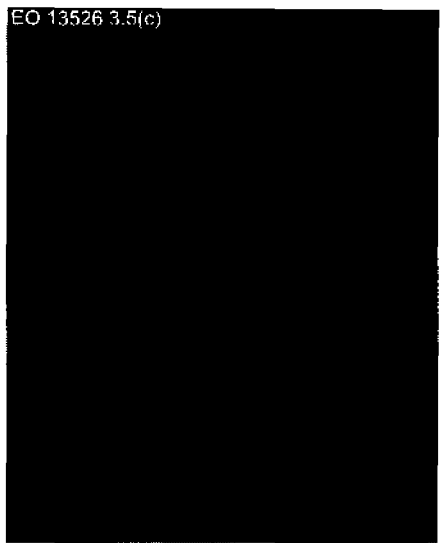
At this time (the late 1950s), some NSA personnel in the ELINT processing organization, the Soviet and European collection organization, and the R&D organization had become aware of the ELINT satellite work in the Navy and the Air Force. Those NSA employees who used the U-2 photography to verify and collate SIGINT intercepts were among the first to be exposed to the possibility of satellite reconnaissance. Some with Navy contacts learned of the NRL effort to orbit the

DYNO satellite and the Navy's plans to use NSA's cryptologic stations on the periphery of the Soviet Union and China for reading out the data. Some in NSA R&D were tracking the RAND Corporation "Project FEED BACK" work for the Air Force and thereby learned of the WS-117L Reconnaissance Satellite Program Office and its activities. These individuals became aware that the satellite program had been well underway in the Air Force before NSA received clear responsibilities for ELINT in 1958.

Many ELINT policies had already been initiated, plans developed, responsibilities assigned, and close working relationships established in the Air Force ELINT satellite programs before NSA became involved. In 1955, DOD Directive 3115.2 had given responsibility for ELINT to the Air Force. In March 1955 the Air Force had started design studies for WS-117L. On 29 October 1956 the Air Force awarded contract AF 04(647)-97 to Lockheed Missiles and Space Division (LMSD) as prime contractor for the WS-117L program. This contract included development of processing equipment for ELINT data located at the Vandenberg Tracking Station and the Satellite Test Center in California.⁴³ Because of progress made in these early activities, NSA had difficulty being accepted as a contributing team member. These difficulties were compounded by security rules and the limited distribution of NSCID No. 6 and the DOD implementing Directive S-3115.2 (Rev).

NSA personnel had also begun to look at the possible use of satellites for COMINT. In August 1959 NSA issued a pioneering

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"Study Report on COMINT Collection from Satellite Vehicles," TECHDOC No. 33.144, which showed that the "basic philosophy and some of the equipment of Subsystem F, the ELINT reconnaissance portion of the WS-117L program, is generally adaptable to the requirements of COMINT data collection." An article by EO 13526 3.5(c) that summarized the report concluded that the then-imminent low-orbit satellite system was technically capable of COMINT collection and suggested that higher altitude COMINT satellites would be most practical, should be very specialized and not duplicative, and "based on careful consideration of the value of the expected end-product."⁴⁴

At the crucial meeting of President Eisenhower and the NSC on 25 August 1960, which resulted in the formation of what would become the NRO reporting directly to the Under Secretary of the Air Force, Eisenhower also authorized another evaluation of all US intelligence agencies. On 15 December 1960 a "Joint Study Group Report on Foreign Intelligence Activities of the United States Government,"

the Kirkpatrick Report, was issued. Chaired by Lyman B. Kirkpatrick, Inspector General, CIA, this group had studied the most effective and efficient use of intelligence resources. The group recommended that DOD unify ELINT resources under the operational and technical control of the Director of NSA and that DOD strengthen NSA control over the service cryptologic agencies. As had the Kistiakowsky survey earlier, it also "cautioned about military domination of the intelligence process."⁴⁵

Resolution of NRO and NSA Roles and Missions

Both the NRO and the NSA were formed for the same basic reason: to consolidate fragmented national intelligence efforts to face the challenges of a rapidly expanding Cold War. It was soon apparent that the NRO charter to develop and operate reconnaissance satellites, including SIGINT satellites, would overlap the NSA mandate (NSCID No. 6) to control all national SIGINT efforts.

On 18 January 1961, two days before Eisenhower left office, the NSC recommended approval of a revised NSCID No. 6, "Communications Intelligence and Electronic Intelligence," proposed by the Secretary of Defense, in regard to collection and processing of COMINT and ELINT. Though never issued, this revision specified that "only the Secretary of Defense may exercise or delegate authority to perform these functions within the Department of Defense."⁴⁶ This would

enable the Secretary of Defense to control SIGINT activities, roles, and missions, and the revision was resisted at NSA.

Infighting and power struggles ensued. On 17 February 1961 NSA Director VAdm Laurence H. Frost sent a memorandum, "Development of Advanced Intelligence Collection Programs," to the new Secretary of Defense, Robert S. McNamara, citing NSA's responsibilities and authorities to task COMINT/ELINT resources, especially satellites. Frost also asserted that NSA had approval authority over military research and engineering programs involving COMINT/ELINT. Frost's memo pointed out the unique authority of the Director of NSA in COMINT/ELINT operational planning and collection tasking. It was intended to assert NSA's authority over COMINT/ELINT satellites.⁴⁷ Frost's memo did not lead to any changes within the Office of the Under Secretary of the Air Force (later the NRO), nor did the USIB change any of its then-current delineations of existing roles and missions. However, the Under Secretary of the Air Force (later Director, NRO), Joseph V. Charyk, sent a memorandum on 21 March 1961 to NSA Director Frost inviting NSA to work with and assist the Air Force in planning and executing the national satellite reconnaissance program. Frost accepted the invitation in memorandum N1093, dated 31 March 1961.⁴⁸ This exchange strengthened the DNRO's hand, but more work would be needed to define NRO and NSA roles.



Eugene G. Fubini

With the 6 September 1961 agreement between CIA and DOD to establish a National Reconnaissance Program (NRP), Secretary of Defense Robert S. McNamara turned to the interagency tension in the SIGINT area. On 7 September 1961, to provide an arbitrator for some of the SIGINT trouble spots, he appointed Gene Fubini, from the office of the Deputy Secretary of Defense for Research and Engineering (DDR&E), to examine all matters pertaining to SIGINT satellite programs. Fubini formed a study group to attack the problem, with himself as chairman. The group met first on 14 September 1961. Included were Herbert L. Conley of NSA as alternate chairman, Walter G. Deeley of NSA as recorder, Howard C. Barlow of NSA, LtCol Edwin J. Istvan of SAFMS, Howard A. Stadermann of DDR&E, Cmdr Frank R. Sperberg (OP94G), William E. W. Howe from Navy (ONI), Maj Abram V. Rinearson, III, of Army, and Harold Willis, CIA.

The Fubini group produced a blueprint, "Space Vehicle Electronic Intelligence Program Responsibilities and

Resources," which was approved by Roswell Gilpatric, Deputy Secretary of Defense, on 20 October 1961. This document required the Air Force and NSA to work together to support the Air Force responsibility for development and operation of SIGINT satellite collection systems. In turn, NSA assumed the responsibility for processing and analysis of SIGINT satellite-collected data and provision of results to the Intelligence Community. Technical Instruction 1301 was provided to the NRO by NSA in 1963 to establish data formats, information requirements, and procedures. This arrangement continued essentially unchanged until the 1972 revision of NSCID No. 6 when NSA was given the responsibility for payload tasking while the NRO retained satellite technical tasking to maintain vehicle integrity.

To further strengthen the ties between NSA and the NRO, a meeting was held on 25 May 1962, and was attended by DIRNSA Frost, Deputy Director of NSA Louis Tordella, and Herbert Scoville, Jr., Deputy Director for Research, CIA. The purpose of the meeting was to further clarify the NSA and NRO roles in responding to national requirements as determined by the US Intelligence Board (USIB). They agreed to cooperate in the implementation of a collection and processing program based on stated USIB requirements.⁴⁹ In response to paragraph 2b of this agreement EO 13526 3.5(c) of NSA's ELINT processing organization, who had become a chief architect of NSA participation in satellite ELINT, moved over to the Pentagon SAFMS staff in June 1962. He was to assure that NSA recommendations were fully available to NRO planners at

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EO 13526 3.5(c)

all times. EO 13526 3.5(c) proved to be an invaluable asset in planning and executing a system approach to determining and reconciling SIGINT collection and processing developments.

After more months of discussions, mostly between DOD and CIA, another agreement between the DCI and Secretary of Defense on the roles and relationships of CIA and NRO operations was signed on 2 May 1962. On 13 March 1963, still a third agreement was issued: "AGREEMENT BETWEEN THE SECRETARY OF DEFENSE AND THE DIRECTOR OF CENTRAL INTELLIGENCE ON MANAGEMENT OF THE NATIONAL RECONNAISSANCE PROGRAM." The agreement stated, in part: "To carry out his responsibilities as Executive Agent for the National Reconnaissance Program, the Secretary of Defense will establish as a separate operating agency of the Department of Defense, a National Reconnaissance Office, under the direction, authority and control of the Secretary of Defense." With respect to SIGINT, this

agreement said the NRO should provide for "... decommutation, conversion, technical correction and reconstruction of the collected electronic signal data to yield a usable collection product, and delivery of such collection product in proper format together with associated data necessary for exploitation to NSA or other user."⁵⁰ The definition of how SIGINT should be handled was essentially in place.*

A major reorganization of the NRP occurred in 1965 with the formation of the NRP Executive Committee (ExCom) composed of three high-level officials—the Deputy Secretary of Defense, the Director of Central Intelligence, and the President's Science Advisor—with sole authority to approve or modify the NRO budget. This arrangement gave the DNRO a needed management mechanism, especially with respect to issues involving the CIA. In 1967 and 1968 the Eaton Committee under DCI Richard Helms made another study of US SIGINT, and in 1972 NSA and NRO roles and missions were modified to give NSA a little more control over satellite collection. Most of the time, though,

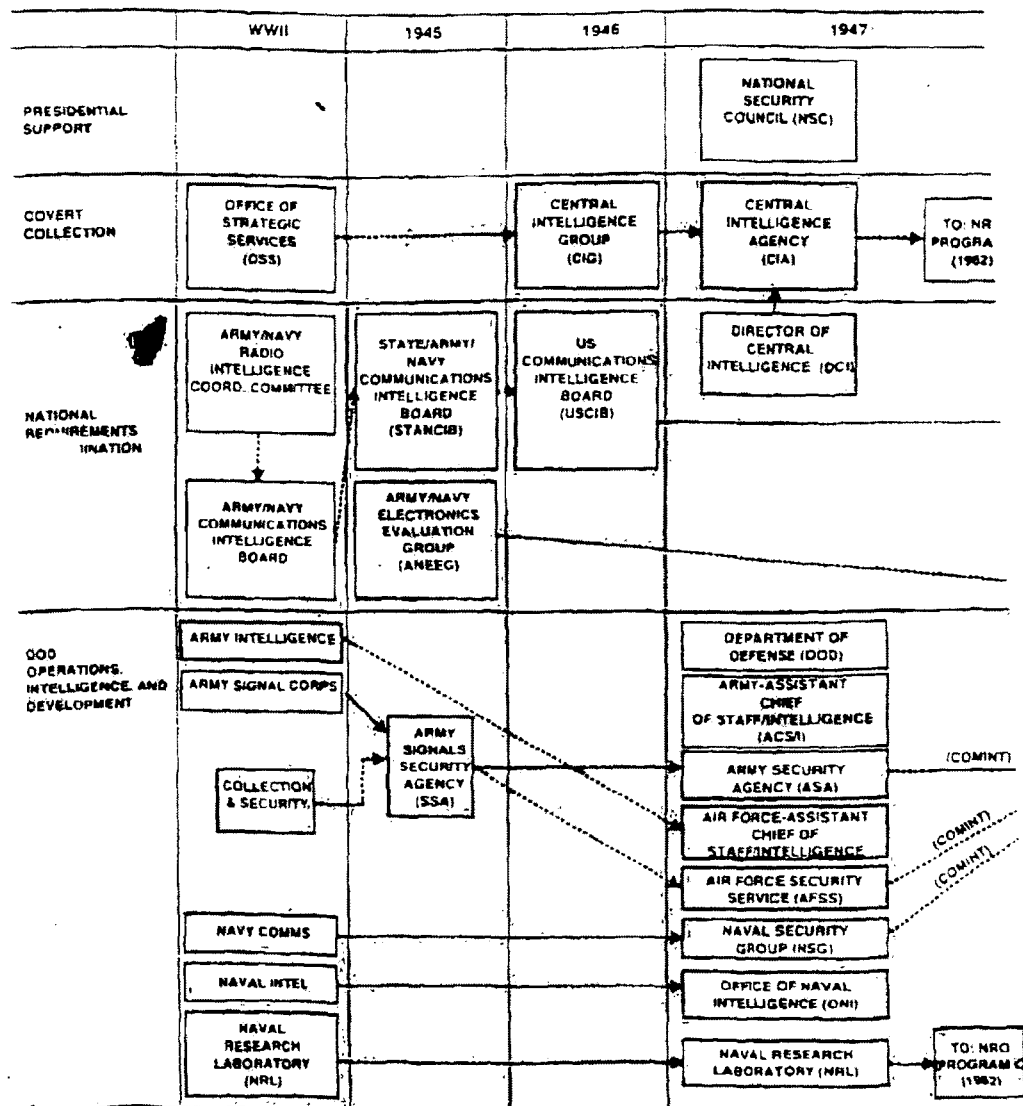
* To carry out the necessary liaisons among the Intelligence Community members and the NRO, especially on the subject of national requirements, special committees came into being. The earliest forerunner of this kind of coordination of operations was the "Special Committee" of the Secretary of Defense and the Secretary of State in the early 1950s; this arrangement did not include the DCI or the CIA. In 1958, with the formation of USIB out of the earlier USCIB, COMINT was made the responsibility of the SIGINT Committee of USIB, and thus moved to a position of relatively less importance in the intelligence world. In the early 1960s all SIGINT satellite requirements were made the responsibility of the USIB's Committee on Overhead Reconnaissance (COMOR). In 1963 this responsibility was placed under the COMOR SIGINT Working Group (CSWG). In 1967 the CSWG became the SIGINT Overhead Reconnaissance Subcommittee (SORS) of the SIGINT Committee of the USIB, an arrangement that has continued for many years.

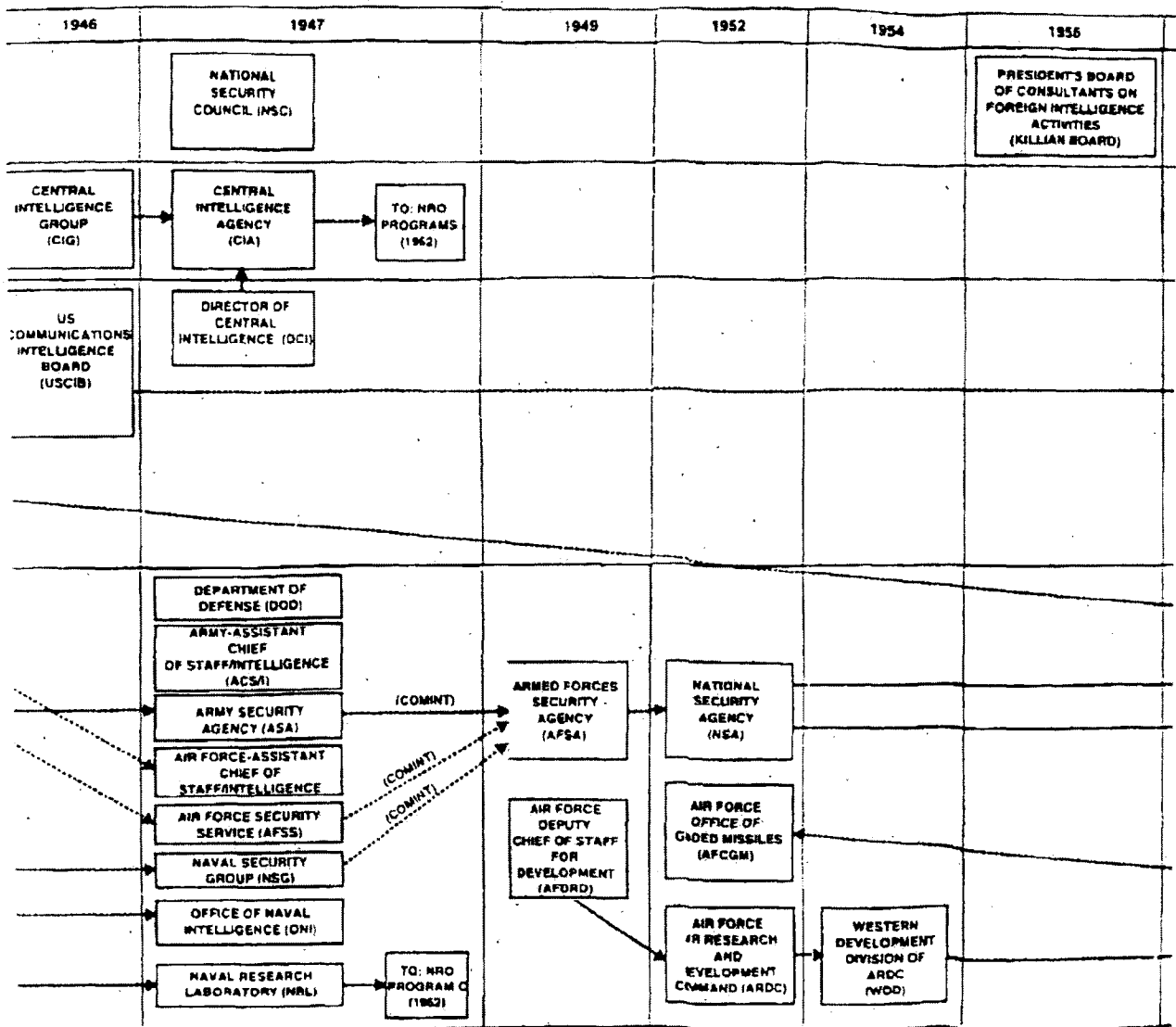
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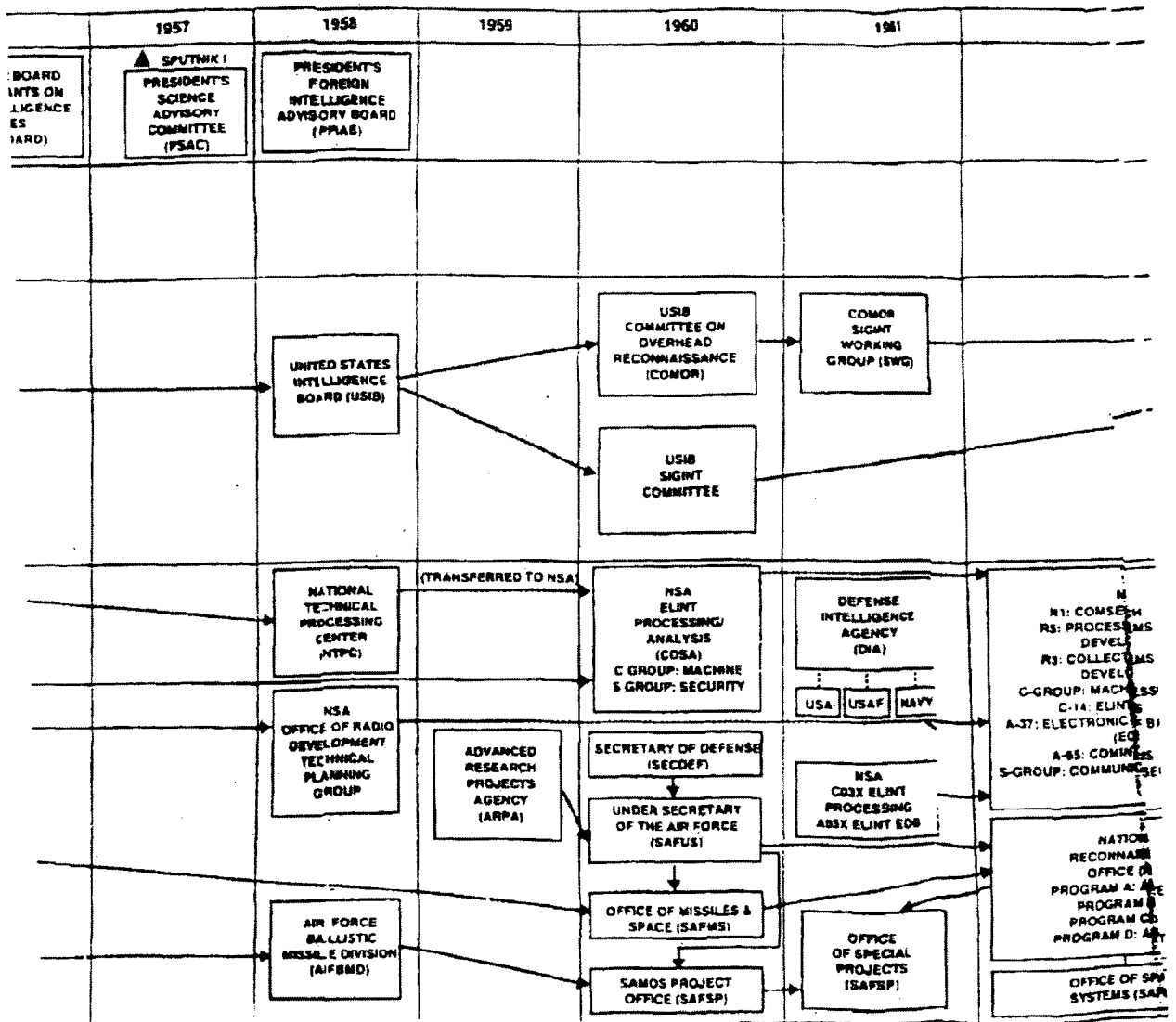
especially at the working level, there was so much enthusiasm for what was being done in the new era of space SIGINT that institutional prerogatives were forgotten. The next chapters detail the systems that were built and operated with this team spirit.*

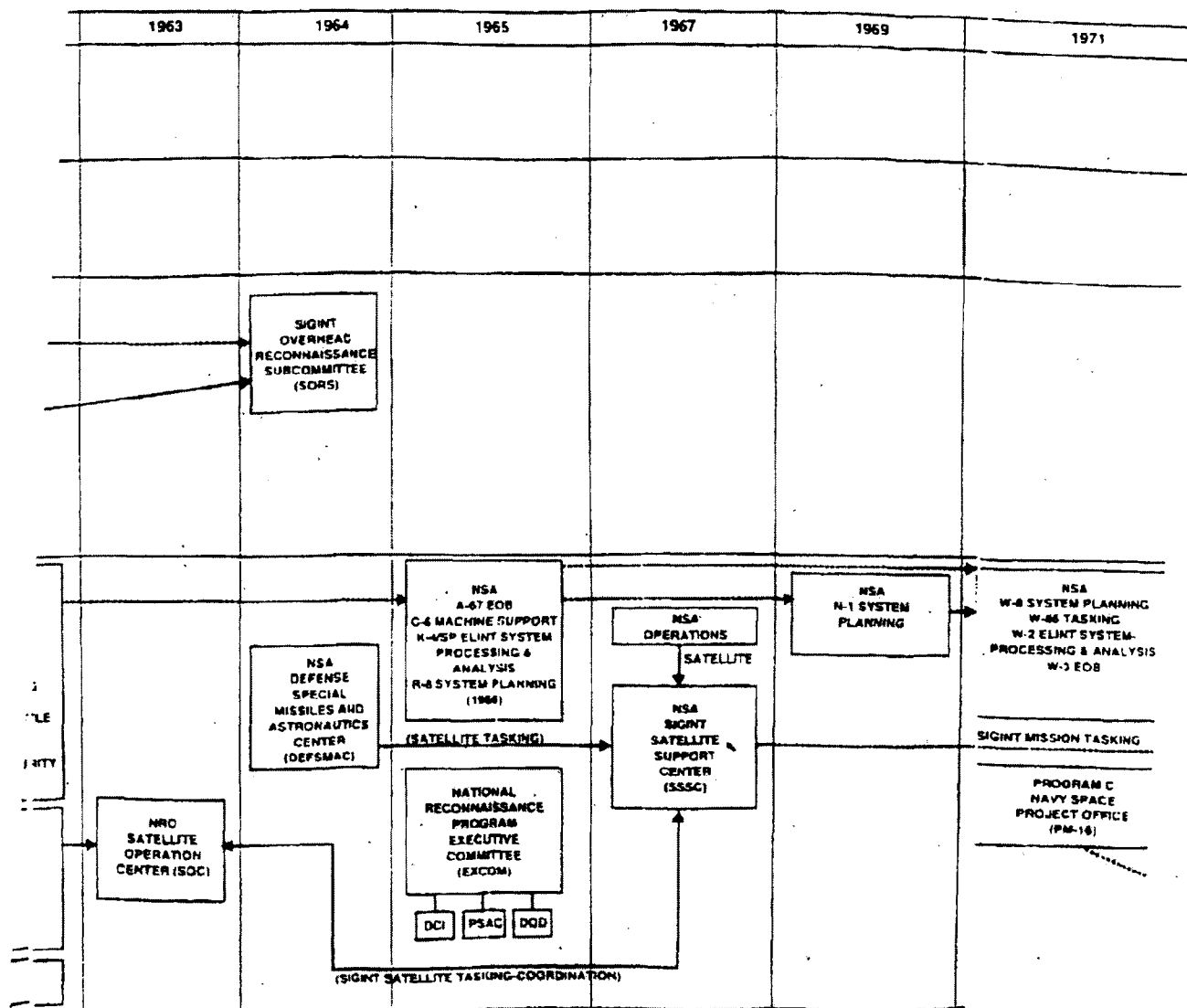
* Appendix E contains the full text of documents referenced in this chapter.

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Chapter 2 References

1. LeMay, Curtis E., with MacKinlay Kantor, *Mission with LEMAY: My Story*, Garden City, NY: Doubleday & Co., Inc., 1965, pp. 399-400.
2. Douglas Aircraft Company (Santa Monica Plant, Engineering Division), "Preliminary Design of an Experimental World-Circling Spaceship," Report No. SM-11827, 2 May 1946. Quoted in Merton E. Davies and William R. Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related US Space Technology*, Santa Monica, CA: the RAND Corporation, 1988, pp. 8 and 9.
3. Davies, Merton E. and William R. Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related US Space Technology*, Santa Monica, CA: the RAND Corporation, 1988, p. 18.
4. *Utility of a Satellite Vehicle for Reconnaissance*, The RAND Corporation, R-217, April 1951 (Group 3 review, 30 April 1971) (C).
5. Letter from MGen D. N. Yates, DCS/D, USAF, to CG, ARDC, "Project FEED BACK," 22 May 1953.
6. Memo for the Record, Lt Col V. L. Genez, D/I, Deputy for Development, ARDC, "Conference with RAND Corporation re: FEED BACK Program," 13 August 1953.
7. Lipp, James E. and Robert M. Salter (editors), *Project FEED BACK Summary Report*, The RAND Corporation, R-262, Vol. I, 1 March 1954 (Group 3 review, 1 March 1974) (C).
8. Davies and Harris, p. 61.
9. Davies and Harris, p. 61.
10. William O. Troetschel interview, 27 March 1991.
11. Hall, R. Cargill, *The Air Force and the National Security Space Program*, Chapter 1, p. 28.
12. William G. King interview, 17 September 1991.
13. King interview.
14. Davies, Merton E. and William R. Harris, Research Note N-1532, July 1987.
15. King interview.
16. DOD Directive 5105.15, 2/7/58.
17. MSG CITE DEF 963459 from ARPA SGD CLARK, 062217Z August 1959.
18. Martin comments, SIGINT Satellite History peer review, March 1994.
19. Martin comments, SIGINT Satellite History peer review, March 1994.
20. TRW Systems Group, *TRW Space Log*, 1970-71, 1972, p. 85.
21. Memo, BGen A. J. Goodpaster, "Memorandum of Conference with the President, May 26 1960, Others Present: Dr. Kistiakowsky, Mr. Gordon Gray, Gen. Goodpaster," 31 May 1960 (S/TK).
22. Memo from James S. Lay, Jr., Executive Secretary NSC, to Thomas S. Gates, Jr., SECDEF, "Reconnaissance Satellite Program," 1 September 1960 (S/TK).

23. SAF Order No. 116, "Director of the Samos Project Office," from Dudley C. Sharp, SAF, 31 August 1960.
24. Memo from Robert S. McNamara, Secretary of Defense, to the Secretaries of the Army, Navy, and Air Force, et al., Subject: "Assistant for Reconnaissance," with attached agreement "Management of the National Reconnaissance Program," 6 September 1961 (~~SAFK~~).
25. Charyk memo, 8 March 1963.
26. DOD Directive TS5105.23, 14 June 1962.
27. Memo for Record, Col Paul E. Worthman, 8 March 1963, with attached draft "A Summary Review of the National Reconnaissance Office," 15 February 1963, prepared for Joseph V. Charyk's report to Gilpatric and McCone.
28. Louis W. Tordella comments, SIGINT Satellite History peer review, March 1994.
29. Burns, Thomas L., United States Cryptologic History, Series V, Volume 1, *The Origins of the National Security Agency, 1940-1952*, NSA Center for Cryptologic History, 1990, and *Reference Guide to Selected Historical Documents Relative to the NSA/CSS 1931-1985*.
30. Minutes, STANCIB meetings, 20 February, 27 February, and 12 June 1946.
31. Burns.
32. *IEEE Spectrum*, February 1986, p. 8, and *Encyclopedia Americana*.
33. Burns, pp. 19, 39-41, 45, and 49-57.
34. Tordella comments, SIGINT Satellite History peer review, March 1994.
35. Tordella comments, SIGINT Satellite History Round Table, 26 May 1994.
36. Hoover Commission Report, Report on Intelligence Activities in the Federal Government, Appendix I, Part 1. "Report of Survey of the National Security Agency" from the NSA Historical Collection: Series VI, C.1.7, 25 May 1955 (~~TS~~). The report was prepared by a Task Force that included Gen Mark W. Clark, Chairman; Adm Richard L. Connolly, USN (Ret); Ernest F. Hollings, Lt. Governor of South Carolina; Henry Keanns; Edward V. Rickenbacker; Donald S. Russell; and MGen James G. Christiansen, USA (Ret), Staff Director.
37. NSA Historical Collection: Series XII, H.30. (~~S~~)
38. Killian Board Report, "The Report from the President's Board of Consultants on Foreign Intelligence Activities," 24 October 1957, from *The Killian Board for the President and the National Security Council*, NSA Cryptologic Archival Holding Area: Accession No. 7507N.
39. King interview, 17 September 1991.
40. Strong Committee Report, "Report of the USCIB ELINT Task Force," 11 June 1958, from the Strong Committee to the USCIB, NSA Q4 Office.
41. NSCID No. 5, No. 6, and No. 7, NSA Historical Collection, Series V, A.28.
42. Tordella comments, SIGINT Satellite History peer review, March 1994.
43. *USAF Space Programs 1945-1962* (~~S~~) and *NSA in Space*, April 1975, BYE-19385-75, p. 6 (~~TS/B/TW/C~~).

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44. ~~EO 13526 3.5(c)~~ "COMINT Satellites—A Space Problem" *NSA Technical Journal*, Vol. IV, No. 4, pp. 39-48, October 1959 (S).
45. NSA History Collection Series VI, C.1.32, (TS), and R. Cargill Hall, *The Air Force and the National Security Space Program 1946-1986*, draft, p.42 (TS). Kistiakowsky, p. 384; Welzenbach history; see Prados pp. 122-124.
46. NSA Historical Collection: Series V, A.28. (TS)
47. NSA Cryptologic Holding Area: Accession No. 2852. (TS)
48. *NSA in Space*, BYE-19385-75, p. 70 (TS//B//TK//C).
49. Memorandum of Agreement Concerning NSA Participation in the (S) National Reconnaissance Office, 25 May 1962, signed by Louis W. Tordella, Herbert Scoville, Jr., and Joseph V. Charyk.
50. AGREEMENT BETWEEN THE SECRETARY OF DEFENSE AND THE DIRECTOR OF CENTRAL INTELLIGENCE ON MANAGEMENT OF THE NATIONAL RECONNAISSANCE PROGRAM, 13 March 1963, signed by John A. McCone, Director of Central Intelligence, and Roswell Gilpatric, Deputy Secretary of Defense. (Supersedes DOD-CIA NRO agreement, 2 May 1962.) (TS) ~~EO 13526 3.5~~

3 The Navy Program (Program C)

The DYNO Concept

The Navy SIGINT Satellite Program, conceived in early 1958 by personnel of the Naval Research Laboratory (NRL), combined the NRL's long experience in the fields of radar and electronic intercept systems with the more recent space experience gained through their development of the Vanguard Satellite Program. Thus, Navy personnel could take full advantage of a call in early 1958 from the newly formed Advanced Research Projects Agency (ARPA) for military space-related projects. The Chief of Naval Operations (CNO) relayed the query to all Navy scientific and technical organizations, asking, "All hands consider how they could use space in their design ideas for the Navy."¹

This call struck a responsive note with Reid Mayo, an engineer in Howard Lorenzen's electronics group at the NRL. Mayo proposed that a crystal-video receiver, such as the ones they were installing in submarine periscopes, be mounted in a Vanguard-type satellite in orbit around the Earth. When connected to an appropriate antenna on the satellite, such a receiver could "see" (intercept) the "main beam" from radar antennas on Earth whenever the antennas were pointed at the satellite. He further reasoned that if this signal were sent from the crystal-video receiver to a transmitter on the satellite, it could be



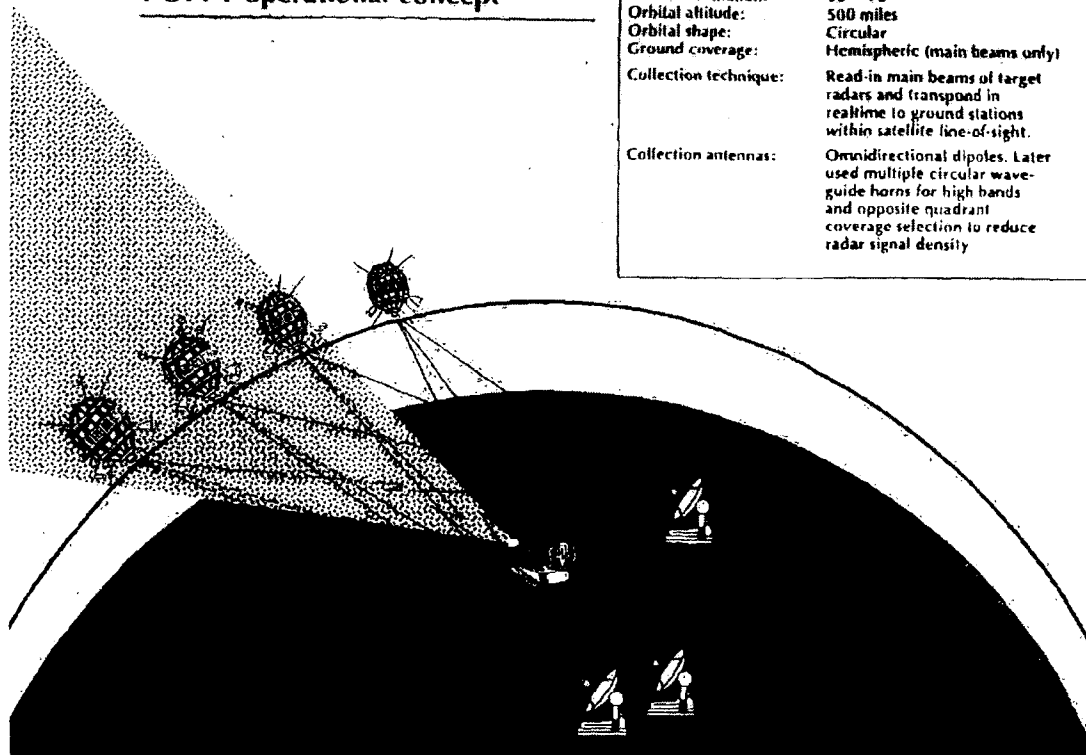
Howard Lorenzen

returned to any ground station in view of the satellite or, in other words, to a ground station with a line-of-sight path to the satellite.²

By the late 1950s, the US intelligence services responsible for intercepting hostile (primarily Soviet) radio and radar signals had established a ground network of intercept stations ringing the Soviet Union on all sides except the Arctic north. It was possible, by locating satellite data-receiving equipment at intercept stations in countries such as EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4 to see a satellite at a 67-degree-inclined, 500-mile-altitude orbit, for many hours every day.³ At the same time, the satellite could see the main beam signals from the radars in the Soviet Union. This concept of realtime "transponding" of radar signals

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POPPY operational concept



Project POPPY

Orbital inclination:	66° - 70°
Orbital altitude:	500 miles
Orbital shape:	Circular
Ground coverage:	Hemispheric (main beams only)
Collection technique:	Read-in main beams of target radars and transponders in real-time to ground stations within satellite line-of-sight.
Collection antennas:	Omnidirectional dipoles. Later used multiple circular waveguide horns for high bands and opposite quadrant coverage selection to reduce radar signal density

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to peripheral listening posts became the foundation of the Navy satellite program, starting with GRAB/DYNO, POPPY^{EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs}



Reid Mayo

The response to the ARPA request, sent by NRL to the CNO in March 1958, featured a "transponder" designed by Mayo and his fellow engineers of Howard Lorenzen's electronics group. The transponder was mounted in a spherical satellite, 20 inches in diameter, designed by engineers of the Vanguard Program Office under the leadership of Marty Votaw. The receiver section of the transponder, the ELINT system, utilized six monopole antennas deployed around the surface of the sphere in such a way as to provide omnidirectional coverage of all radar beams impinging on the satellite. Each of these antennas was connected to a single crystal-video receiver consisting of a filter to determine the frequency coverage and a detector and amplifier with adjustable sensitivity. The receiver system was adjusted to assure that it was

sensitive only to the main beam signal from each radar as the radar looked in the direction of the satellite. The time between looks would determine the rate of rotation, or "scan rate," of the radar. This adjustment



Marty Votaw

also provided a "threshold" to mask out lower power signals that could cause interference to the desired main beam intercepts. Since the satellite was not stabilized in any plane, great care was taken to assure that regardless of the direction of arrival, all pulses would be received with the same amplification. At the output of the receiver, each pulse was "stretched" to a length of 450 microseconds, permitting it to be transmitted to the ground stations by a narrow-bandwidth transmitter connected to an omnidirectional turnstile antenna. In that way, any ground station in line of sight could receive the signals, but they were almost impossible to detect by an adversary if the satellite downlink frequency was not known with great accuracy. This technique provided a great deal of security from Soviet intercept (but not as great as standard encryption could).⁴

In addition to the transponder, the satellite contained a power system consisting of a storage battery plus six 9-inch-diameter round patches of 156 solar cells located symmetrically on the surface of the sphere, so that one watt of power would be available for any orientation of the satellite. A telemetry system provided engineering data on the status of the satellite as well as the state of commanding of the transponder. The command system consisted of a receiver and decoder that translated tones transmitted from the ground command station into relay closures, controlling such functions as "data link on/off" and "timer start" to turn on the transponder. The command system shared the turnstile antenna with the data link transmitters and could receive commands whenever it was in view of a ground station having a command transmitter.⁵

The Naval Research Laboratory (NRL) proposed to place this satellite in a 67-degree-inclined, circular orbit, at an altitude of 500 miles, as an added payload along with the much larger TRANSIT IIA navigation satellite. According to the plan, it would be launched from the Cape Canaveral Air Force Station in Florida. Ground stations to receive the data transmitted from the satellite were to be located at Intelligence Community intercept sites in

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EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c) The

ELINT mission was very straightforward: to intercept and identify known types of radars in the Soviet Union and to discover and describe new types of radars not previously intercepted by peripheral ground, sea, and airborne means. A further ELINT goal was to locate these radars as accurately as possible.

To utilize the facilities of the existing ground intercept sites, maintain security, and minimize interference with ongoing activities, the DYNO ground stations were installed in self-contained transportable shelters known as Earth satellite vehicle (ESV) huts. These were lightweight, aluminum structures designed for worldwide service conditions. All equipment was installed at NRL and the huts were shipped as essentially standalone facilities, transportable by helicopter, aircraft, truck, rail, or ship. Once at the sites they were mounted on concrete pedestals, pavement, or on elevated platforms equipped with carport-type canopy roofs. All that was required was electrical power and they were ready to go! Multielement Yagi antennas (similar to those used for commercial television reception) were installed on the roof of each hut and were rotated manually from inside the hut to point in the direction of the satellite. Standard military vacuum-tube radio receivers (R-390/URR) with crystal-controlled converters were used to tune in both the radar signals transponded from the satellite and the telemetry signals containing the satellite's status. A two-track magnetic-tape recorder was provided for recording the intercept data. One track contained the radar signals, and the other track contained both the operator's comments prior to turn on of the intercept receiver and a digital representation of time during the intercept period. A chart recorder was installed to indicate the strength of the signal from the satellite as well as the state of the equipment on the satellite. A 250-watt transmitter provided the ability to send commands, in the form of audio tones, to the satellite via a second Yagi antenna mounted on the ESV mast along

with the receiving antenna. The plan was to deploy these transportable ground stations to ground sites operated by the Naval Security Group (NSG), headquartered in Washington, DC. ⁶

According to the NRL plan, these ESV sites would be manned and operated by NSG while the funding for operation would be provided as part of the Consolidated Cryptologic Program through NSA. In order to obtain adequate coverage of the Soviet Union it was also proposed to locate some of the huts at stations manned by the Army, Air Force EC 13526 1-1. Furthermore, the data, collected on magnetic tape, would be forwarded through the Armed Forces Courier Service to the National Technical Processing Center (NTPC) at Headquarters, NSG. This center was shortly to be relocated and integrated into NSA in accordance with National Security Council Directive No. 6 (NSCID-6) dated 15 September 1958, which assigned responsibility for national ELINT data processing to NSA. In 1959, NTPC was moved to the NSA operations building at Fort Meade, Maryland, where it became part of the fledgling ELINT organization with the office symbol COSA-5. Here the data would be interpreted and distributed to intelligence users as required.

On 29 July 1958 the National Aeronautical and Space Act became law, and on 10 October 1958 the National Aeronautics and Space Administration (NASA) commenced operation, charged with responsibility for all of the national non-military space programs. Vanguard fit this category and was officially assigned to NASA early in 1960. The DYNO

program was directly impacted by the departure from NRL of Marty Votaw and other spacecraft designers along with the Vanguard program. Most importantly for this story, the Navy, though it retained responsibility for the TRANSIT and DYNO military programs through the Applied Physics Laboratory (APL) at Johns Hopkins University, Baltimore, Maryland, now found it necessary to find a military booster. The Thor missile, with a second stage added in a configuration called Thor/Able-Star, was the booster selected. This combination could launch the DYNO satellite as a piggyback payload on the much larger TRANSIT satellite. Ed Dix of NRL took over design of the DYNO satellite and coordinated the launch efforts at Cape Canaveral.

Howard Lorenzen, along with Jim Trexler of NRL, worked on this new plan and coordinated with other organizations to provide for interagency participation, the use of SIGINT stations for data collection, and forwarding of the data to NSA for processing and product dissemination. With Lorenzen's and Trexler's support, the Office of the Director of Naval Intelligence (DNI) undertook the task of obtaining program approval through DOD, ARPA, and the Executive branch of the government.

GRAB/DYNO-1 Development

RAdm Allan Reed of the Office of Naval Intelligence (ONI) shepherded the NRL DYNO proposal through the Navy, ARPA, DOD elements, and the Executive branch to obtain final approval by President Eisenhower in August 1959.

The DYNO program was to be conducted at the DOD SECRET security level under the code name TATTLETALE.⁷

The DNI, who was designated as the DYNO program manager in August 1959, formed a Technical Operating Group (TOG) to function as the steering committee. The TOG consisted of representatives from NRL, NSG, NSA, and the ONI Scientific and Technical Intelligence Center (STIC) at Suitland, Maryland. The NRL member of TOG was designated as the project manager/technical representative. NRL was responsible for the overall system concept as well as satellite and ground station development and support; in addition, NRL provided engineering and technical direction through the operational exploitation phase, training of mission ground station personnel, and launch/on-orbit monitoring of spacecraft status and data quality.

The NSG member was designated the project operational representative. NSG was responsible for directing and coordinating all mission ground station operations (including commanding the satellite operations); it acted as the focal point for all electrical communications associated with the operations of the project; and it provided sites, support facilities, and operating and maintenance personnel at the NSG mission ground stations.

The NSA member of the TOG was designated the advisor to the staff. NSA authorized the allocation of service cryptologic personnel to man and operate the mission ground stations; it also processed all intercept data and disseminated the

ELINT product to the Intelligence Community. With this responsibility, NSA also interpreted national intelligence collection and processing requirements, made recommendations for commanding satellite collection periods (tasking), and furnished the magnetic tapes for recording data at the mission ground stations.

The STIC member provided intelligence requirements to the director, provided signal analysis support to NSA, monitored the signal analysis program, and disseminated quality control technical data to the mission ground stations.⁸



William E. W. Howe

The TOG initially met at NSG Headquarters at the Naval Security Station in Washington, DC. Early members of the group were Navy Capt Fred Weldon of OP-94, representing the DNI; William E. W. Howe, a senior analyst from STIC; EO 13526 3.5(c) Chief of COSA-5 (ELINT Processing Organization), NSA; Howard Lorenzen, DYNO Program Director at NRL; and Cmdr Frank R. Sperberg, representing NSG.

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DYNO-1 was designed to receive in the radio frequency range of [REDACTED] MHz. This was the most densely populated range of frequencies and covered a variety of radar types, including derivatives of many widely used US, West European, and Soviet World War II "S-band" early warning and search radars. In the more recent JAN Electronic Warfare Frequency Channel Designators, these radars are designated "E-band." Since no formal national requirements for satellite ELINT collection had yet been established, it was up to the TOG to determine the collection requirements for this first satellite ELINT mission. Intelligence Community representatives felt that intercepts from this frequency range, which contained many descendants of World War II prototypes, would yield a very productive harvest of significant radar information. The success of DYNO-1 proved this to be a very accurate prediction.

The initial mission ground stations for DYNO were located at [REDACTED]

[REDACTED] All the stations had the ability to collect data, but only [REDACTED] could transmit commands to direct the satellite when to turn on and off. Whenever the collection system was turned on, all the sites within range could receive the data. NRL also maintained an engineering

data readout and interrogation site at Hybla Valley, Virginia, [REDACTED]

Unfortunately, the DOD SECRET security system did not provide adequate security protection for the TATTLETALE program, and shortly after program approval in August 1959, *The New York Times* printed a complete program description. Given President Eisenhower's intention of achieving "Open Skies" through a national policy stressing peaceful uses of space, it was necessary to cancel the program at the DOD SECRET level to avoid any further disclosures that could lead to unwanted international repercussions. To ensure no further disclosures of this kind, the program was reclassified as TOP SECRET, and security control was to be exercised by the ONI under the WALNUT security system. Access required the approval of ONI, ARPA, or the Office of the Special Assistant to the Secretary of Defense for Special Operations and was limited to individuals with a strict need-to-know. Those individuals granted access were required to execute a project secrecy agreement.¹⁰

Additional security was provided by adding an NRL scientific experiment as a cover. The experiment was designed by Marty Votaw to telemeter measurements of solar activity in X-ray, Lyman-Alpha, and ultraviolet radiation above the Earth's atmosphere. This cover experiment became the first of a series of SOLRAD satellite experiments designed and exploited by the NRL. The cover name GRAB (galactic radiation and background) was used for the combined DYNO intelligence mission

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EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs



Top Secret
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and SOLRAD scientific mission. In the classified world the first satellite became known as GRAB/DYNO-1, but in the unclassified world it was simply GRAB-1.¹¹

GRAB/DYNO Program Launches

On 22 June 1960 the first US SIGINT satellite, GRAB/DYNO-1, was launched from Cape Canaveral, Florida, by an Air Force Ballistic Missile Division (AFBMD, at El Segundo, California) team headed by Maj James S. "Jay" Smith with Maj David D. Bradburn as guidance officer. The Air Force team was supported by a Space Technology Laboratories (STL) launch vehicle integration team headed by Adolf K. "Dolf" Thiel. The GRAB/DYNO-1 spacecraft, a piggyback payload attached to TRANSIT IIA and the whole mounted on a Thor/Able-Star booster, attained a 330-by-565-mile orbit, inclined at 66.7 degrees to the equator, with an orbital period of 101.6 minutes. Although DYNO did not separate from the TRANSIT IIA, this caused no problems since the two satellites had no common command or data links.¹²

Following the shootdown of F. Gary Powers' U-2 on 1 May 1960, President Eisenhower directed that no reconnaissance overflight of the Soviet Union could collect intelligence information without his specific permission. Because of this strict limitation, at the President's direction, the DYNO payload could be turned on for only EO 13526 3.3(b)(1) periods during the EO 13526 lifetime of the satellite. On 4 July 1960, exactly four years after the first U-2 mission, the payload was turned on and the

ELINT capability of GRAB/DYNO-1 was checked out at Wahiawa, Hawaii, well out of Soviet ground station range.¹³



Adolf K. Thiel (center) and Capt David D. Bradburn (right) pictured with Werner Von Braun and model of Thor/Able launch vehicle, Inglewood, California, 1958

Despite the limited tasking, the collection technology of the satellite and the functions of the mission ground stations were clearly demonstrated. Processing and analysis of data received from the first DYNO SIGINT satellite system, and the following POPPY satellites, was an interesting and challenging adventure. In the beginning, the best "all source" estimates of the signal environment and the volumes of data available for analysis were far short of reality. The real magnitude and complexity of the processing and analysis job was not understood until the first satellite was on-orbit, collecting data. Each successive satellite had new and/or expanded capabilities and presented new challenges. For the first few years, the development of the processing systems ran behind the power curve. Frequently, processing was planned and developed based

on poor estimates of expected data. Processing systems then had to be modified, or sometimes actually invented, to handle the data collected by satellites already on-orbit. Fortunately, the early satellite collection systems were fairly simple and had short operational lives. This allowed for an evolutionary development of ground processing and analysis systems and for feedback to the design of the satellite collection system, which did result in later successful total collection/processing systems.

Processing consisted of manual analog data analysis performed at NSA by the personnel of the former NTPC, which was now COSA-5, the ELINT processing group at NSA, Fort Meade, Maryland. EO 13526 3.5(c) was in charge of ELINT processing at NSA and directed the DYN0 processing effort. Technical advice and recommendations were provided by Bill Howe, STIC EO 13526 3.5(c) supervised the manual analog analysis effort with major assistance from EO 13526 3.5(c) and EO 13526 3.5(c) both of whom supervised a number of military and civilian analysts. This group provided technical feedback to the mission ground stations to assist them in evaluating their operation. This manual data analysis allowed the determination of radar characteristics of pulse repetition frequency, scan rate, and radio frequency band. A very rough approximation of location could be determined by comparing the first and last time the radar was intercepted at different ground stations and noting signal up and down times.¹⁴

Soviet early warning radars were found to be numerous and extremely powerful. Signal density was more than four times greater than anticipated. This highlighted the need for some form of automated data processing. Howard Lorenzen, NRL DYN0 Program Director, knew that computer processing could be used very effectively for this type of data, and early in 1961 he approached Louis W. Tordella, the Deputy Director of NSA, for assistance in developing such a capability.

Tordella asked EO 13526 3.5(c) and EO 13526 3.5(c) both of whom had been involved in development of missile and space processing, to join them to discuss the problem. Earlier, in April 1960, EO 13526 3.5(c) had published a technical article, "Determination of Missile and Earth Satellite Trajectories from Radar Observations." This article was an unclassified mathematical treatment of the determination of orbital plane and the least squares estimate of position, subvehicle point, and predictions, including perturbations due to Earth oblateness.¹⁵ Lorenzen showed the assembled group a roll of visacorder paper, a tracing showing a longitudinal analog presentation of a few minutes of GRAB/DYN0 collected data. EO 13526 3.5(c) were given the job of automating this data reduction and processing.¹⁶ NRL developed the original analog-to-digital converter to convert the analog signal into digital format for input to the NSA BOGART computer.*

* BOGART was a special-purpose computer designed by NSA and built by Engineering Research Associates (ERA), later UNIVAC, in St. Paul, Minnesota, for efficient data conversion and formatting. It was a 24-bit machine using diode/magnetic-core logic, with memory cycle time of 20 microseconds and IBM 727 magnetic tape for storage and input. BOGART led to the design of UNIVAC and Control Data Corporation's (CDC) commercial computers.

EO 1.4.(c)
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DYNO-1, operating on frequencies
between EO 13526 3.3(b)(1)>25Yrs, EO intercepted
EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)
Only a few unidentified radar types were intercepted, which indicated the accuracy of US intelligence regarding high-power Soviet emitters. Altogether, 612 emitters were identified, 42 of which were located approximately and correlated to known installations.¹⁷

On 30 November 1960 the second GRAB/DYNO was launched using essentially the same configuration as GRAB/DYNO-1. Unfortunately, the Thor booster burned out 12 seconds early and was destroyed by the range safety officer. Fragments landed in Cuba and killed a cow in a farmer's field.¹⁸ This incident was memorialized as, "The herd shot round the world" (a takeoff on Ralph Waldo Emerson's heroic line, "... and fired the shot heard round the world"). The incident resulted in the prohibition of any future launch trajectories that passed over the land mass of Cuba, thereby causing subsequent launches to include a dogleg in the launch sequence in order to obtain the desired 67-degree orbital inclination.

Since this required more booster energy, it resulted in a reduced payload weight capacity.*

The third launch, designated GRAB/DYNO-2, occurred 29 June 1961. It consisted of GRAB/DYNO-2 from NRL, and INJUN, sponsored by Dr. James Van Allen of the State University of Iowa. The two smaller satellites were connected together and mounted on top of the larger TRANSIT IIIB satellite. It was launched by a Thor/Able-Star booster from Cape Canaveral. An orbit 475 by 540 miles was achieved, inclined 66.8 degrees with a period of 103.8 minutes. Separation from the TRANSIT IIIB occurred, but the INJUN and GRAB/DYNO-2 failed to separate from each other. Because the two satellites shared common up- and down-link radio frequencies, it was necessary to operate the two satellites on alternate days, thereby cutting the collection time in half.¹⁹

In 1961, because of the apparent worldwide acceptance of overflight by peaceful satellites, the requirement for Presidential approval of each reconnaissance collection period (read-in) had been lifted.[†] However, operating at EO 13526 3.3(b)

* The possibility of any accident involving Cuba was given an "extreme" review before the launch. Only when "somewhat simplified and somewhat biased analyses" showed an extremely low probability was the flight authorized. Fortunately, the consequences were not major. See Joseph V. Charyk's comments, SIGINT Satellite History Round Table, 26 May 1994.

† The decision for special security for satellite programs was in part to avoid international reactions to what some would claim were "non-peaceful applications." It was believed the Soviets understood and supported the concept since otherwise they would be forced politically to protest. It would clearly add problems to their own efforts to develop such capabilities. Special security helped both efforts. To President Eisenhower, the results of the F. Gary Powers shootdown and the impact on the summit meeting in Paris were especially sensitive. See Joseph V. Charyk's comments, SIGINT Satellite History Round Table, 26 May 1994.

EO 1.4, (c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, I

GRAB/DYNO-2 col-
ul data. The alternate-
ed for this in part, and
rcept radio-frequency
he balance.²⁰ Since the
national requirement
collection had been
Intelligence Board
d 5 July 1960). To
ent to search for new
particularly those
BM network, the
EO 13526 3.3(b)(1)>25

EO 13526 3 3(b)(1)>2 [REDACTED] were selected by the Technical Operating Group (TOG) for GRAB/DYNO-2 collection. To identify the frequency band of the intercepted signals, a different-length stretched pulsewidth was used on the down-link transmissions for each band. On subsequent launches, when more than two bands were intercepted, a separate pulsewidth would be assigned to each band. The satellite continued to operate until EO 13526 3 3(b)(1) [REDACTED] although the lower band gradually lost sensitivity as the mission progressed.

Although DYNO-2 ELINT collection results were sparse compared with DYNO-1, the gradual loss of sensitivity in the lower band demonstrated the extremely high power radiated by the EO 13526 3.3(b)(1)-25 early warning radar, which was the only signal that could be received near the end of the mission. Earlier, in the low band, a signal called EO 13526 (US ELINT designator) was intercepted and classified as the first Soviet ABM-type radar. Also intercepted were the EO 13526 1.4(c)<25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

Magnetic tapes with data from this flight were sent to NSA where, in addition to analog analysis, a new analog-to-digital converter called AUDICO, capable of digitizing data with a time interval accuracy of 67 microseconds for each count or machine unit, was used to prepare the data for computer processing. These out-

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

AUDICO runs. Short-term tape-speed variations were a problem. Comparisons with analog analysis did not produce very satisfactory results.²² Quality-control efforts instituted in the conversion process and at the collection sites helped improve this situation. Deinterleaving and scan-sort techniques and programs were continually improved over the years and were

applied to processing all ELINT data collected by POPPY and all other SIGINT satellite systems.

Early attempts to identify radar locations from the GRAB single-satellite system were very crude. EO 13526 1.4(c)<25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)

EO 1352 did not produce very accurate or useful locations.

Because of political pressures within the Intelligence Community and lack of confidence within NSA, the US Air Force Strategic Air Command's 544th Reconnaissance Technical Group (RTG) was provided copies of the GRAB/DYNO-1 tapes, thus duplicating processing as a backup.²³ SAC processing at this time was primarily visual analysis of the filmed version of the stream of intercept pulses. Late in 1961 EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)

During this same period NSA developed a EO 13526 3.5(c) location system called EO 13526 3.3(b)(1) Radars with stable rotation rates lent themselves to this technique of analyzing their rotation rate doppler. With this technique a location was iteratively determined that yielded the best fit to the observed sequence of scan periods by the method of least squares. But the EO 13526 3.3(b)(1) system also produced unreliable results with large uncertainty in the radar location.

The satellite ground stations were improved along with the satellites on-orbit. The first change was transfer of the EO 13526 3.3(b)(1)> ground station in the EO 13526 3.3(b)(1)>25Yrs. EO 13526 3.5(c)

EO 13526 3.3(b)(1)>25

The fourth launch occurred from Cape Canaveral on 24 January 1962 using a Thor/Able-Star booster, and it was intended to launch five satellites into orbit using a single booster. The launch was unsuccessful when the guidance system on the Able-Star upper stage failed.²⁶ When the National Reconnaissance Program (NRP) was formed on 16 September 1961, the Navy ELINT program was made part of the NRP and redesignated as the POPPY project. Thus, the launch was assigned the name POPPY-1.

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The fifth launch, POPPY-2, on 26 April 1962 was from Vandenberg AFB in California and used a Scout vehicle as a booster. These changes were made to avoid the launch sequence dogleg necessary at Cape Canaveral and to provide a dedicated launch vehicle for the DYNOSAT satellite. In this way, the near-polar orbit most suitable for reconnaissance could be selected. This launch, too, was a failure: because of a procedural oversight, the Scout fourth stage contained no attitude control gas, and the entire system plunged into the Pacific Ocean within sight of the launch pad.²⁷

The POPPY Project

On 23 July 1962 the Director of the NRO (DNRO), Joseph V. Charyk, formally established NRO Program C as an organizational component to continue operation and management of the POPPY ELINT satellites. The Director of Naval Intelligence was designated to continue as Director, Program C, and funding formerly provided by ARPA and the Navy was transferred to the National Reconnaissance Program (NRP) as of fiscal year 1963. The Navy Bureau of Weapons (BUWEPS) provided a fiscal representative to the Technical Operating Group (TOG) who was responsible for preparing the annual budget, disbursing funds to the NRL, and submitting records of expenditures to the Director, Program C. NSA continued funding, through the Consolidated Cryptologic Program (CCP), for manning and support of mission ground stations, magnetic-tape costs, and NSA processing and analysis. The Air Force's Program A was assigned

the responsibility for launching Program C satellites and for launch vehicle/satellite integration.²⁸



Capt. Frank R. Sperberg, USN

In 1962 the President's Foreign Intelligence Advisory Board (PFIB) concurred in DNRO Charyk's recommendation that "... all satellite projects of the NRP should be handled in the same manner by a single operations unit of the NRO staff."²⁹ The Satellite Operations Center (SOC), in room BD944 of the Pentagon, commenced operations in April 1962, primarily to direct operations of the photographic satellites of Programs A and B. To assure coordination of NSG tasking of the POPPY satellites with US Intelligence Board (USIB) requirements, the Director of Program C transferred Cmdr (later Capt) Frank Sperberg, USN, from the NSG Operations Center to the NRO offices in the Pentagon to work with the SOC personnel. Sperberg's primary responsibility was to assure that commanding of the POPPY system was responsive to requirements as initially stated by both the USIB's Overhead

Reconnaissance (COMOR) and SIGINT Committees. USIB direction was further clarified in the spring of 1963 when the SIGINT Overhead Reconnaissance Subcommittee (SORS) of the COMOR was formed to consolidate the responsibility for all satellite SIGINT requirements. The Operations Center for translating the SOC interpretation of these instructions into actual commands to the POPPY network remained at NSG Headquarters.³⁰

By December 1962 the BYEMAN security system was completed for Program C, whose ELINT satellites were designated as the POPPY series. The BYEMAN EO 13526 compartment, formed by combining the codename from EO 13526 3.3(b) with the Program C codename POPPY, superseded the earlier WALNUT security system.³¹ The final intelligence product, as delivered by NSA to users, would be handled under the TALENT-KEYHOLE system, which had been initially instituted for photo results. The primary reason for this arrangement was to make it possible to deliver the data to cleared personnel of the Intelligence Community, while avoiding the necessity of providing them access to BYEMAN information about satellites and collection operations.

With the arrival of the BYEMAN system, mission numbers in the EO 135 series were assigned to POPPY launches. A switch from the Scout to the Thor/Agena booster, launched from Vandenberg AFB on the West Coast, permitted multiple POPPY satellite launches with much greater weight capability. Additionally, no over payloads were required since there

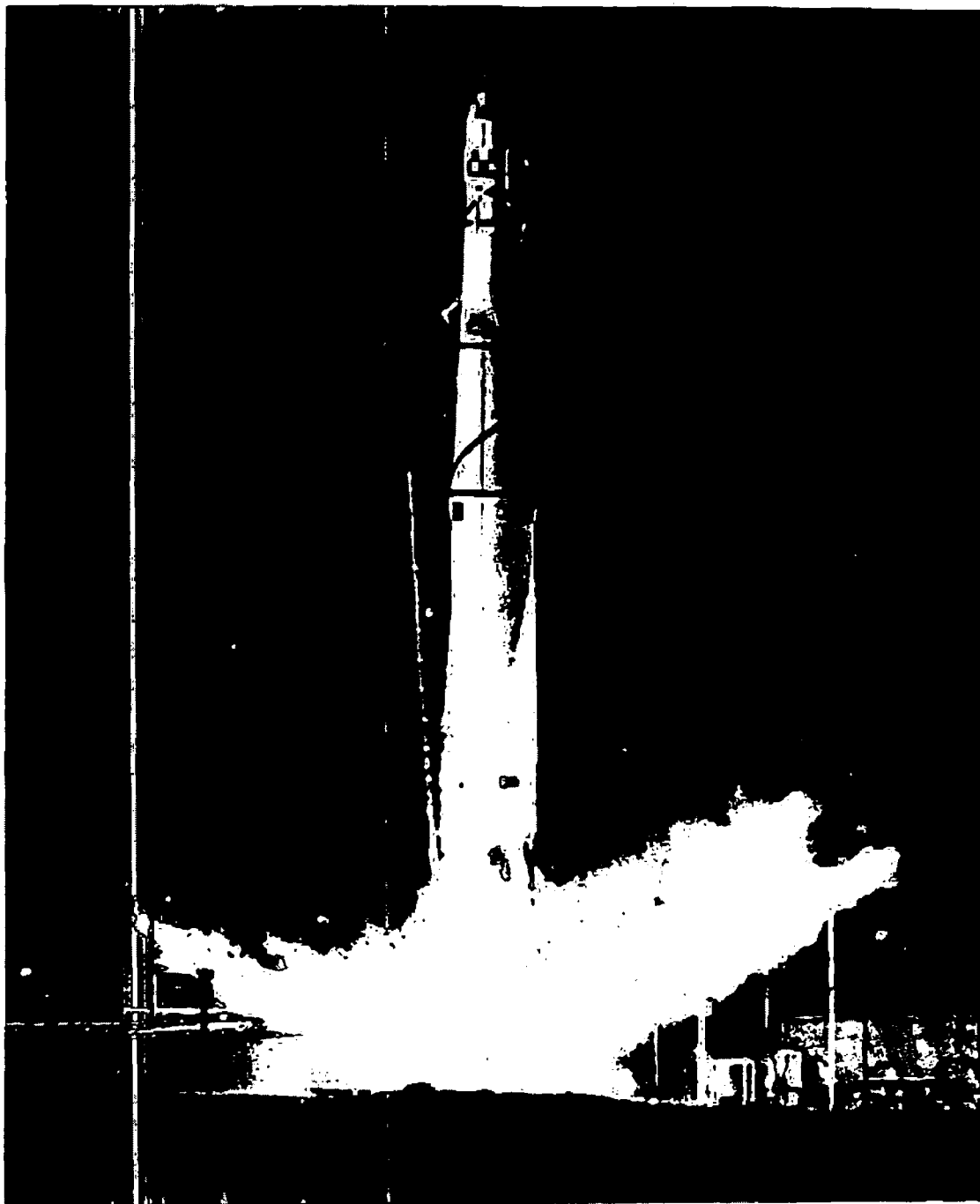
were frequent military Thor/Agena launches from Vandenberg that were not announced in the press except as classified launches about which no details could be revealed.

The initial Program C launch, EO 13526 3.3 on 13 December 1962, was the first POPPY launch using a Thor/Agena booster from Vandenberg AFB. The Agena vehicle failed to cut-off at the end of first burn, producing a very eccentric orbit of 124 by 1,500 miles at 70.3 degrees inclination. This made reception of data at the ground sites difficult, but it did produce a satellite lifetime of over EO 13526 3.3(b) The objective of the mission was to search parts of the radio frequency (RF) band between EO 13526 3.3(b)(1)>25Yrs for new radars and RF bands in use by the EO 135 Soviet Bloc.

This Thor/Agena launched another Van Allen INJUN payload and two other scientific satellites along with the two satellites of EO 13526 3.3(b)(1) The POPPY satellites were somewhat larger than DYN0 due to the addition of a four-inch-diameter "belly band" to accommodate additional capabilities, which made the spherical satellites slightly thicker in the middle. EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs

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First POPPY/Thor/Agena launch, Vandenberg Air Force Base, 13 December 1962

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526



EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 135



Following up on this suggestion.

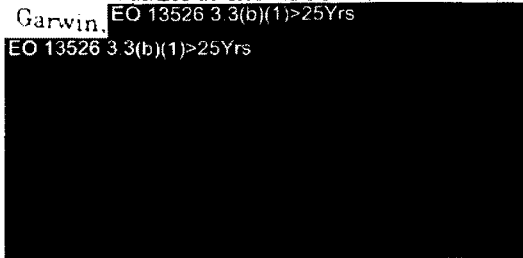
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13



gested when the President's Scientific Advisory Committee (PSAC) initiated a special study in 1963 to stimulate new ideas in emitter location finding. Richard Garwin of IBM, representing the PSAC, chaired a series of meetings at NSA with personnel from SAC and NSA who had been working on techniques to produce emitter locations from POPPY data. These discussions were very open. Many hours were spent at the computer, with lots of explanations, lots of "what ifs," and lots of worry about what had been overlooked.

Following the launch of POPPY 1, and as a result of the 1963 meetings with Garwin,

EO 13526 3.3(b)(1)>25Yrs
EO 13526 3.3(b)(1)>25Yrs



Doc 1, 10

EO 13526 3.3(b)(1)>2 and then recording them on separate tracks of a GR-2500 instrumentation magnetic-tape recorder. These recorders had been installed in late 1961 as upgrades to the mission ground stations. The analog tapes were later digitized by AUDICO at NSA using the stable reference tone recorded on the tapes at the time of collection to control the digitizer clock. The digitized data were processed on an IBM 7094 computer to deinterleave the signals and form EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 1352

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 1352

Early attempts involved considerable manual effort using electromechanical Frieden desk calculators to associate

EO 13526 3.3(b)(1)>25Yrs

be a major problem. In the early 1960s, orbit determination programs were very elementary. Vanguard I was placed in a highly eccentric orbit on 17 March 1958 and 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 a series of sophisticated modeling efforts of the oblate Earth's gravity field, which were important for predicting satellite positions versus time. This early work in orbital dynamics was essential to the development of accurate emitter locations.

Papers appeared in many publications in the open literature providing new gravitational constants, new closed-form solutions, new estimates of the size and

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shape of the Earth, and many ideas on how atmospheric drag would affect the orbits. Among the early important contributors was EO 13526 3.5(c) of NSA, who published an article, "Maximum Likelihood Estimation of an Orbit," in 1961.³⁴ Orbital elements were available from the Navy Space Surveillance Center (NAVSPASUR), established at Dahlgren, Virginia, on 9 April 1960 to operate NRL's space surveillance system. North American Air Defense Command (NORAD) also produced orbital elements. NSA attempted to use the NORAD data, but at that time the data were frequently incomplete, not timely, or, in some cases, inaccurate. At first, none of the calculated orbital elements were consistent.

To help solve the problem, EO 13526 and a group of mathematicians from NSA visited Hunt Small at Lockheed Missile and Space Company (LMSC) and met with John V. Breakwell at Stanford University. As a result of these discussions, NSA arranged for NAVSPASUR to provide magnetic tapes containing the satellite location and velocity vectors on a regular-time grid. NAVSPASUR was able to provide accurate orbital data, greatly aiding NSA. NSA also prepared the predictions for the POPPY orbits that the Naval Security Group (NSG) sent to the sites to guide the antenna steering.³⁵

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO
[REDACTED]EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3
[REDACTED]

EO 13526 3.3(b)(1) was very similar to EO 135 but consisted of three satellites and EO 13526 EO 13526 3.3(b) The mission covered in large part RF bands not covered by EO 135 continuing the mission of discovering new radars and frequency band usage. The launch occurred on 15 June 1963 from Vandenberg AFB. This time, the Agena cut-off properly after the first burn but failed to circularize the orbit by means of a second burn. The resulting orbit was 95 by 495 miles, at an inclination of 69.9 degrees. The low perigee severely limited the orbital lifetime and the satellites reentered the atmosphere after EO 13 EO 135 As a consequence, very few data were collected.³⁷

In the meantime, ground station upgrades continued, and in 1963, various site facilities were equipped to do field screening and analysis. The POPPY collection positions in the portable aluminum shelter huts had a playback capability but limited analysis equipment. However, by 1963, all of the original magnetic-tape recorders had been replaced by instrumentation-type machines with seven tracks using 1/2-inch magnetic tape.

EO 1.4. c
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Solid-state digital-time generators also were added. EO 13526 3.3(b)(1)>25Yrs
EO 13526 3.3(b)(1)>25Yrs

led to advancements in the technical analysis of the analog data. As successive satellites were equipped with more RF bands and data links, analysts noted the

EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)

The new collection tape recorders at the POPPY ground stations enabled the NSA playback recorder to use a frequency synthesizer to play the tapes at the same speed with which they were recorded by the field station during collection by using the 50-kHz reference signal. Other equipment could be used to record and repeatedly cycle through a short segment of data, to stop the recorder and display the pulses on the scope, or to print a chart of pulse amplitude versus time. This equipment aided in the

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.3(b)(1)>25Yrs.

EO 13526 3.3(b)(1)>25Yrs. In April 1963 NSG operators began searching for and reporting new or unusual signals detected from analog analysis.³⁸

A Memorandum of Understanding governing Navy processing and analysis of POPPY data was signed by ONI and NSA in July 1963. NSA provided planning support and furnished tapes to the Naval Scientific and Technical Intelligence

Center (STIC) for processing and technical analysis. NSA also provided support and guidance.³⁹

Some of the POPPY sites also had been equipped with an operator position dedicated to checking the quality of the data. These positions were installed in permanent buildings where proper security could be maintained for the SIGINT data. These quality-control positions were used by collection operators for post-pass playback of recordings to verify verbal annotations, the presence of data, and correspondence with collection logs. With the aid of training tapes sent by NSA, collection operators were trained to listen for and recognize signals with the desired characteristics. Collection operators noted in their logs occurrences of

EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs

After a collection pass, analog analysts at the ground stations played back the tapes at their analysis and quality-control positions and performed audio and visual scans of each of the recorded data links. Parameters of these signals of interest and unidentified signals were measured and tabulated. Additional collection time was provided by the installation of an interrogation capability a

EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs. for orbital passes not available from the EO 13526 3.3(b)(1)>25Yrs. EO 13526 3.3(b)(1)>25Yrs. site.

EO 13526 3.3(b)(1)>25Yrs

This online manual analysis produced the

EO 13526 3.3(b)(1)>25Yrs

EO 13526 1.4(c)< These alerts enabled NSA to set priorities for the processing and technical analysis of the POPPY data after they were couriered back to NSA.⁴⁰

EO 13526 3.3(b)(1)>25Yrs launched on 11 January 1964 from Vandenberg AFB, achieved for the first time a planned near-circular orbit, 490 by 506 miles at 69.9 degrees inclination. This was the first mission boosted by a thrust-augmented Thor (TAT), which permitted heavier and/or more payloads. This was the second three-satellite launch, with some overlapping RF coverage on satellites EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs

devised by R. T. Deal of NRL. EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 1

Although the EO 13526 continued to operate for a record EO 13526 3.3(b)(1)>25Yrs and lost battery power after EO 13526 3.3(b)(1)>25Yrs. All of the satellites used a solar array/battery combination power system; the solar

arrays were used to charge the batteries and the systems operated from battery

power EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 1352

Mission 7104, launched on 9 March 1965, achieved a 490- by 506-mile circular orbit, inclined 70.1 degrees. This was the first simultaneous launch of four POPPY satellites. The 24-inch-diameter satellites were launched EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.3(b)(1)>25Yrs

This activity was limited by the failure of the batteries in EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.3(b)(1)>25Yrs respectively. EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.3(b)(1)>25Yrs during their lifetimes of EO 13526 3.3(b)(1)>25Yrs respectively. EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs

EO 13526 Unfortunately, the satellite stabilized on its side, thereby making it impossible to conduct the micro thruster test. The RF coverage was extended without a gap to EO 13526 3.3(b)(1)>25Yrs. After a satellite commanding capability was installed at EO 13526 3.3(b)(1)>25Yrs in March 1966, the EO 13526 3.3(b)(1)>25Yrs facility was deactivated. For these missions, NSA in-house processing was upgraded to EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.3(b)(1)>25Yrs and to accommodate the large volumes of data being collected. Appendix A shows the increasing volume of data processed. The

EO 1.4.(c)
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EO 13526 3 3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.1 EO 13526 3 3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.1

The regular satellite and processing system upgrade process was given a great boost on 18 November 1966 when the USIB approved an urgent requirement for satellite SIGINT collection directed

EO 13526 3.3(b)(1)-25Yrs

program. As a result, the PSAC, which had a powerful review function on intelligence equipment and technology development, formed the Harry Davis Committee. The Davis Committee recommended, and DNRO Alexander H. Flax directed, modification of EO 13526 3.3(b)(c) to provide EO 13526 3.3 EO 13526 3.3(b)(1)>25Yrs EO 13526 1.4(c)<25Yrs, EO range, on which the Davis Committee wanted POPPY to concentrate its efforts.

MHz, within which the Davis Committee believed the ~~EO 13526 3.3(b)(1)>25Yrs~~ systems would be found.

Just six months after this direction, the launch of ~~EO 13526 3.3(b)(1)>25Yrs~~ on 31 May 1967 from Vandenberg demonstrated that the NRO space and NSA ground technology had come of age. The four satellites were launched into a near-perfect 500- by 508-mile orbit, inclined at exactly 70.0 degrees! During the almost ~~EO 13526 3.3(b)(1)>25Yrs~~ lifetime of this mission a major advancement in system performance was realized. The previously used spherical configuration of the satellite was replaced with a multiface design for the ~~EO 13526 3.3(b)(1)>25Yrs~~ increasing their diameter to 27 inches and average weight to 180 pounds. Two of the satellites used ~~EO 13526 3.3(b)(1)>25Yrs~~

~~EO 13526 3.3(b)(1)>25Yrs~~

~~EO 13526 3.3(b)(1)>25Yrs~~

Following this launch, all subsequent POPPY satellites used a ~~EO 13526 3.3(b)(1)>25Yrs~~ ~~EO 13526 3.3(b)(1)>25Yrs~~

~~EO 13526 3.3(b)(1)>25Yrs~~ Anhydrous ammonia crystals were heated in the satellite to produce control gas for thrusting whenever a correction was required. This thrusting system worked so well that it was used in all subsequent satellites. Other innova-

~~EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13~~

~~EO 13526 3.3(b)(1)>25Yrs EO 13526 1.4(c)<25Yrs, EO 1~~

On the ground, to meet the ~~EO 13526 3.3(b)(1)>25Yrs~~ requirement, an analog-to-digital conversion system (ADCS) was installed to convert the analog down-link data to computer-processable digital data at the ~~EO 13526 3.3(b)(1)>25Yrs~~ This change allowed on-site digital processing. Also, by this time a program to move all equipment from the original Earth satellite vehicle (ESV) huts into permanent facilities was well underway. This move included installing remote control of the antenna, adding elevation control, and doubling the number of Yagi antennas. Vertical polarization was added to the existing horizontally polarized Yagi antennas to further improve signal reception from the satellite regardless of the polarization of the signal from the satellite (which might vary from vertical to horizontal depending on position of the satellite relative to the ground station and/or the attitude of the satellite). In 1967 the engineering data readout and commanding facility operated by NRL was moved from Hybla Valley, Virginia, ~~EO 13526 3.3(b)(1)>25Yrs~~

Starting in 1967, ~~EO 13526 3.3(b)(1)>25Yrs~~ developed at NRL, replaced the World War II-type R-390A/URR receivers that were used in the original huts for reception of the satellite down-links. Each receiver was calibrated to minimize any ~~EO 13526 3.3(b)(1)>25Yrs~~ between receiving channels. The "half amplitude threshold" included in this receiver design also eliminated all time measurement error associated with amplitude variations in the data

Flight summary: Program C, Project POPPY satellites

MISSION NUMBER	PROJECT and PAYLOAD	MISSION (All payloads are ELINT)	OPERATIONAL LIFETIME								LIFETIME
			1960	1961	1962	1963	1964	1965	1966	1967	1968
N/A	GRAB/ DYNQ-1	GS/TI	EO 13526 3 3(b)(1)>25Yrs								EO 13526
N/A	GRAB/ DYNQ-2	GS/TI									Booster failure Booster failure Booster failure
N/A	GRAB/ DYNQ	GS/TI									
N/A	POPPY-1	GS/TI									
N/A	POPPY-2	GS/TI									
EO 13526	POPPY-3	GS/TI	EO 13526								EO 13526
	POPPY-3	GS/TI									
	POPPY-4	GS/TI									
	POPPY-4	GS/TI									
	POPPY-4	GS/TI									
	POPPY-5	GS/TI AND EOB									
	POPPY-5	GS/TI AND EOB									
	POPPY-5	GS/TI AND EOB									
	POPPY-6	GS/TI AND EOB									
	POPPY-6	GS/TI AND EOB									
POPPY-6	GS/TI AND EOB										
POPPY-6	GS/TI AND EOB										

GS = General Search
TI = Technical Intelligence

EOB = Electronic Order of Battle

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COMINT Control Channel
AT 91724

Chapter 3

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NOFORN/COMINT

POPPY means:

Top Secret
 Handle as STRATEGIC INTELLIGENCE
 (When removed from document, handle as such)

Flight summary: Program C, Project POPPY satellites (continued)

MISSION NUMBER	PROJECT and PAYLOAD	MISSION (All payloads are ELINT)	OPERATIONAL LIFETIME								LIFETIME	
			1967	1968	1969	1970	1971	1972	1973	1976	1977	Months
EO 13526	POPPY-	EO	EO 13526 3.3(b)(1)>25Yrs									
	POPPY-											
	POPPY-	ABM, EOB, GS/TT										
	POPPY-											
EO 13526 3.3(b)(1)>25Yrs												

GS = General Search
 TT = Technical Intelligence

EOB = Electronic Order of Battle
 ABM = Antibalistic Missile Radar

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stream and in both the recording and the playback systems.⁴⁹ The highly stable data were furnished to the ADCS, which
EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

EO 13526 1.4(c)<25Yrs, EO 13526 3.5 Field digitization significantly reduced time variations and the resulting digital tape was forwarded to NSA.⁵⁰

With the high priority of the ABM radar search requirement directed by the DNRO at the recommendation of the Harry Davis Committee, NRL procured a System Engineering Laboratories SEL-810 computer in three weeks, developed software to conduct ABM search, and deployed the computer-aided manual search (CAMS) system to the site at
EO 13526 3.3(b)(1)>25Yrs four months prior to the launch of EO 135 in May 1967.⁵¹ Haller, Raymond and Brown, later HRB-Singer Company of State College, Pennsylvania, was given the contract to develop the computer-aided manual data processing system for the SEL-810 computer.

V. Hellrich of NRL was the architect of the SEL-810 computer configuration. L. M. Hammarstrom of HRB-Singer specified the requirements for the initial field
EO 13526 1.4(c) software. R. Daniels of HRB-Singer developed the initial algorithms/software. Refinements and additions in the years following were made by Navy Lt Ronald L. Potts* (no relation to NSA's

* In recalling these events, Ronald Potts said, "When I think of the contributors to the Navy program over the years, I remember Reid Mayo most gratefully as the gentle man who inspired and challenged so many people in the field. He would come to the stations and tell us what the nation needed and what we could do to help, and it would be as though he were coming directly to us from the CNO or the



Lt Ronald L. Potts, USN

Rav Potts) and Petty Officer C. Jorger, at
EO 13526 3.3(b) M. Keebaugh, J. Riale, W. Bickam, and R. Daniels of HRB-Singer; and Ens L. A. Eichel, at
EO 13526 3.3(b)(1)52

Collected ELINT reconnaissance data were sorted
EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.3(b)(1)>25Yrs
Known Soviet ABM-related test-site geographic coordinates were used to calculate a sequence of
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 1

of interest, many individual radars were located. Although originally these intercepts required manual analysis to determine the actual radar characteristics and location, by 1969 the analysis routines had been automated by HRB-Singer personnel and could be selected on demand.

The CAMS system was installed in
EO 13526 3.3(b)(1)>25Yrs in April 1969 and
EO 13526 3.3(b)(1) in late 1970. Processing

DIRNSA or the NSC. Reid would listen and act on our needs for equipment or technical information or logistics support or even a water cooler. At any hour you might find him sitting the posts with the sailors, and we could talk about signals with him as though they were mutual acquaintances."

results were reported by teletype message to NSA at Fort Meade and to selected military organizations, with emphasis on those requiring time-critical signals. NSA, in turn, reported them electrically as preliminary ELINT technical reports (ELTs) to the Intelligence Community.

These improvements in the ground station receiving system made it possible for NSA's EO 13526 3.5(c) and EO 13526 3.5(c) to develop another technique to compute locations from EO 13526 3.3(b)(1)>2 EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)>25Yrs, EO 13

do on-site screening of collected data and report results to NSA. Only those tapes carrying signals of special interest were forwarded to NSA for technical analysis. Since several ground stations collected the same data, only tapes from the station with the best coverage were forwarded for EO 13526 3.3(b)(1) by machine processing.

NSA identified in advance which POPPY site had the best EO 13526 3.3(b)(1)>25Yrs processing. This site was then notified which tape to forward for EO 13526 processing. NSA also requested all POPPY tapes collected at the same time that other collectors intercepted signals of interest or when a high-interest event took place. Recordings not forwarded were retained for 90 days and then reused, unless requested by NSA for analysis. By this time the POPPY EO 13526 system at NSA had been validated. The system was basically an all-automatic computer process that routinely produced EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526

table at the end of Chapter 1 shows the increases in location accuracy achieved from satellite ELINT data over time as improvements were made.⁵³

The rapidly increasing volume of data to be processed from POPPY satellites began to tax analysis capabilities, and NSA adjusted processing priorities in 1967. This adjustment required Navy ground stations with analog analysis capability to

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EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 135

[REDACTED]

The SEL-810 conversion of data processing in [REDACTED] from analog to digital in 1967 had other far-reaching consequences totally apart from the ABM problem. Because the accuracy of the digital manipulation of the data permitted the

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO

[REDACTED]

A number of special tasks were levied on mission ground stations to exploit the new overhead ELINT capabilities. In August 1967 USIB approved an NRO request that NSG task mission ground stations to identify and report on a not-to-interfere basis the details of intercepts of [REDACTED] In April 1968, NSG personnel at the POPPY station in [REDACTED]

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 1

[REDACTED]

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526

[REDACTED]

analyzed, and located on a not-to-interfere basis sufficiently often to show feasibility and establish processing techniques.

However, major emphasis was placed on the [REDACTED]

EO 13526 3.3(b)

In July 1969 NSG obtained authorization and directed [REDACTED] station to use suitably tasked passes and ordinarily untasked fringe passes to locate and report elements of a [REDACTED]

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 135

[REDACTED]

Throughout this period, Adm Thomas Moorer, CNO, was being briefed periodically

on the POPPY capability to identify and track ships at sea and on the results of these preliminary tracking exercises.⁶⁹

EO 13526 3.3(b)(1)> providing coverage of a total of EO 13526 3.3(b)(1)>25Yrs was launched from Vandenberg AFB on 30 September 1969 into a 491- by 506-mile orbit, with an inclination of 70.0 degrees. It consisted of four multiface satellites weighing an average of 235 pounds each. Five other scientific satellites were also launched on the same booster. EO 13526 3.3(b)

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 135

Four transponded pulsewidths were used on each data link, thereby doubling the collection capability. By this time, the EO 13526 3.3(b)(1)>25Yrs

ground stations had been closed, concluding the participation of the AFSS in the POPPY Program. This left EO 1 improved ground stations in the network: EO 13526 3.3(b)

EO 13526 3.3(b)(1)>25Yrs

On 27 August 1969 the USIB SORS, responding to the CNO, made ocean surveillance an official function of POPPY in SORS 10/96, BYE-1565-69. "Mission Guidance EO 1352 In July 1970 NSG directed

EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)> was launched on 14 December 1971 into a nearly circular 530- by 540-mile orbit, inclined 70.0 degrees. It was to be the last POPPY launch and consisted of four multiface satellites weighing 270 to 280 pounds each, containing a total

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526

EO 1.4.(c)
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Key accomplishments, Project POPPY

- First SIGINT satellite, 1960; demonstrated intercept of foreign radars using the realtime transpond technique to relay signals directly to US stations.

- Discovered ^{EO 13526} radars very dense in ^{EO 13526 3.3(b)(1)>25Yrs} USSR.

- Many intercept firsts, including ^{EO 13526 1.4}

^{EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)}

^{EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO}

- ^{EO 13526 3.3(b)(1)>25Yrs} first satellites launched simultaneously, 1962.

- First ocean surveillance of shipborne radars, 1967.

^{EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526}

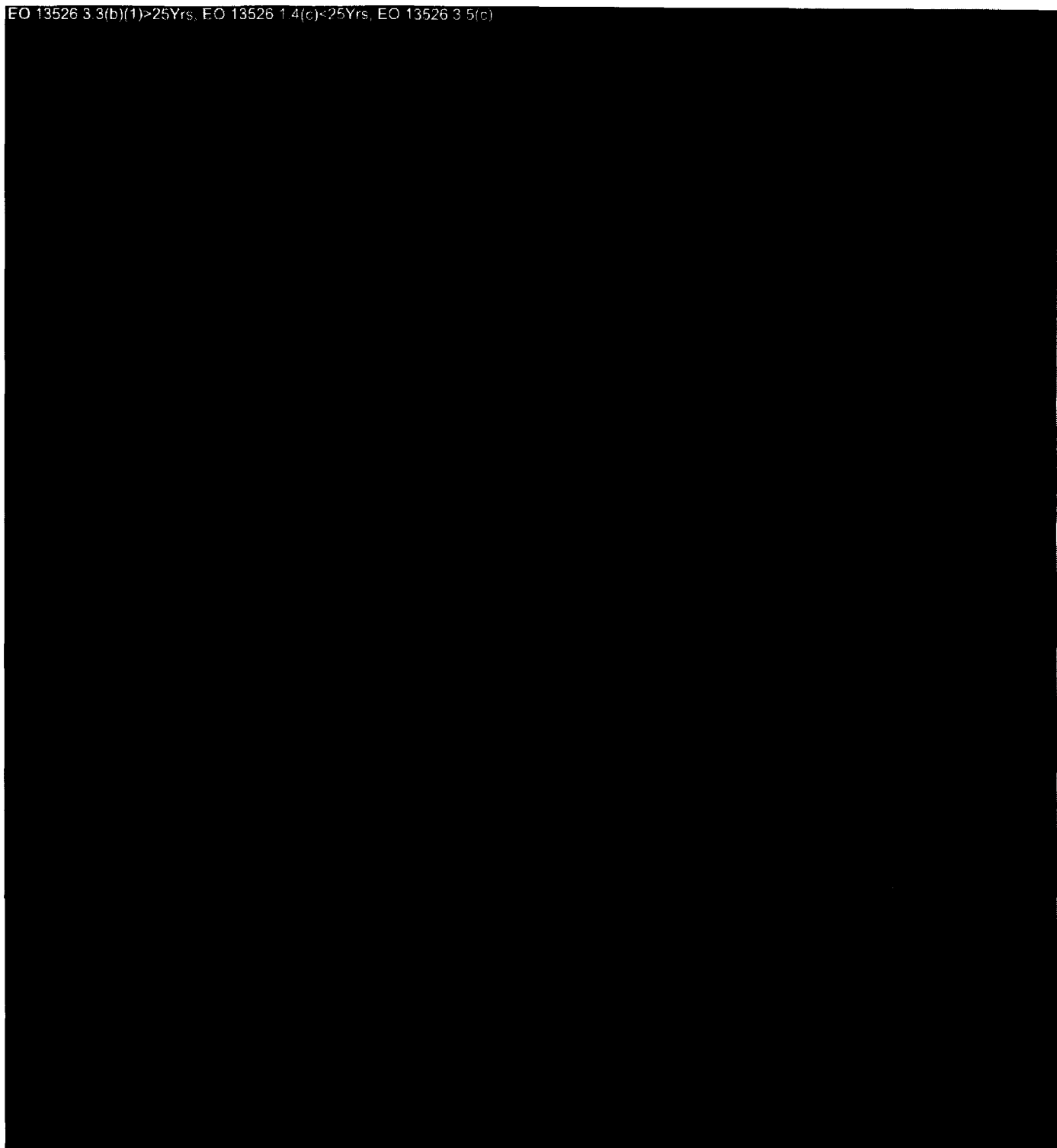
In July 1970 authority was granted by USIB SORS for ongoing ^{EO 13526 3.3(b)(1)>25Yrs} to engage in ocean surveillance in support of US fleet commanders. Specifics of this mission were stated by COMNAVINTCOM in August 1970. By this time USIB mission guidance added search for new or unusual emitters in

NSA added a CDC 6600 computer in 1968 to be used full time with the CDC 6400 computer to handle the increased volume of POPPY data being collected. NSA machine processing with the 6600 computer produced and reported over ^{EO 13526} radar locations, with accuracies of about ^{EO 13526 3} or less in the first 15 months of its operation. Many new/ unidentified signals reports were issued and technical measurements made.⁶³ During the first five months of operation, information was developed by NSA

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EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



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Handle via ~~BYEMAN-TALENT-KEYHOLE-~~
~~COMINT Control Channels jointly~~
~~BYE.010701~~



RAdm Robert K. Geiger

POPPY Project director functions were to be performed within the System Project Office (SPO) of PM-16.*

Picking up on earlier planning that had been started by the Director, Naval Security Group in July 1969, Geiger carried out some funded studies to determine which ELINT technology would be most effective in an

EO 13526 3.3(b)(1)>25Yrs
EO 13526 3.3(b)(1)>25Yrs

During a trip to Europe in late 1971, DNRO McLucas visited the POPPY site at
EO 13526 3.3(b)(1)>25Yrs That evening, in a hotel in EO 13526 3.3(b)(1)>25Yrs DNRO McLucas, Robert J. Hermann of NSA, Col David D.

* For a further description of the POPPY system management relationships see NRO/NSA/CIA/USN Management Agreement for the POPPY System, 5 November 1971 Appendix E.

Bradburn of the NRO Staff, and Capt

Geiger worked out the EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs

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EO 13526 3.3(b)(1)>25Yrs EO 13526 1.4(c)<25Yrs EO 13526 3.5(c) EO 13526 3.3(b)(1)>25Yrs EO 13526 1.4(c)<25Yrs, EO 13526 3

Meanwhile, on the POPPY front, in September 1972 a further improvement in intercept capability occurred when the new POPPY Automated Processing System (PAPS) was added to the

EO 13526 3.3(b)(1)>25Yr This NRL/HRB-Singer development used the SEL 86 computer to achieve the goal of a higher volume of

EO 13526 3.3(b)(1)>2 The new computer made possible processing in a continuous stream. PAPS was fed by either digital tape or for online processing by a priority data extractor (PDE). The system became operational two weeks after receipt at the site. About two months later, DNRO McLucas was shown the speed and ease of PAPS operations when two Soviet Naval combatant ships were located and reported

EO 13526 3.3(b)(1)>25Yrs

In June 1973, the Navy's PM-16 was redesignated PME-106 of the Naval Electronic Systems Command, with its manager continuing as Director, Program C. Coordination continued with the Naval Intelligence Command, and NRL continued to be responsible for technical develop-

EO 13526 3.3(b)(1)>25Yrs

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COMINT Control Channels jointly
BYE-914744

EO 13526 3.3(b)(1)>25Yrs

POPPY's strengths stemmed from its utilization of traditional concepts and methods and an insistence on proven hardware and techniques not only to guarantee success, but also to hold costs to a bare minimum. Between 1959 and EO 13526 the development cost amounted to only EO 13526 3.3(b). The costs of launch and of the Consolidated Cryptologic Program (CCP) are not included in this calculation. POPPY utilized existing personnel and facilities whenever it was reasonably possible, and although innovative in many ways, the designers added only those improvements that involved minimal risk to the program. It grew from a single satellite with limited ELINT capability to a sophisticated EO 13526 3.3(b) satellite configuration per launch, which comprised an overhead ELINT reconnaissance system capable of ocean surveillance, search and EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.3(b)(7)

better characteristics. This low-cost success story is unlikely ever to be duplicated.*

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EO 1.4.(c)

* This account of POPPY EO 13526 3.3 covers the highlights of the projects. Additional information can be found in the *History of the POPPY Satellite System*, BYE-56105-78, which has been extensively referenced here.

Chapter 3 References

1. *NRO, Program C, Organization Manual*, 18 May 1989, BYE 56 255-89 (hereafter referred to as *Navy Org Manual*), p. 73. Also: *History of the POPPY Satellite System*, BYE-56105-78 (hereafter referred to as *POPPY History*), p. 2.
2. *POPPY History*, pp. 2 and A3-3.
3. *POPPY History*, p. 8.
4. *POPPY History*, pp. 8 and 12.
5. *POPPY History*, p. 10.
6. *POPPY History*, pp. 4-5.
7. *Navy Org Manual*, p. 73.
8. *POPPY History*, pp. 4-5.
9. *POPPY History*, p. 17, paragraph 5.
10. *POPPY History*, p. 2.
11. *POPPY History*, pp. 2, 8, and A3-3.
12. *POPPY History*, p. A1-2.
13. *POPPY History*, pp. 2-3.
14. *POPPY History*, p. A3-5.
15. *NSA Technical Journal*, Vol. V, No. 2, pp. 67-78. (S)
16. EO 13526 3.5(c) paper (provided 10 September 1990).
17. *POPPY History*, p. 44.
18. *POPPY History*, p. 39.
19. *POPPY History*, p. 39.
20. *POPPY History*, p. 39.
21. *POPPY History*, p. 45.
22. *POPPY History*, p. 30.
23. *NSA in Space*, April 1975, BYE-19385-75, p. 17.
24. *POPPY History*, p. 31.
25. *POPPY History*, p. 17.
26. *POPPY History*, pp. 39-40.
27. *POPPY History*, p. 40.
28. *Navy Org Manual*, p. 75.
29. Memo from Col Henry C. Howard, USAF, "A cursory Review of the Evolution of the SOC," July 1968.

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30. Letter from DNI to DNRO, Subject: "System POPPY, reassignment of responsibilities for" (TS), 21 January 1963 (see Appendix E).

31. *Navy Org Manual*, p. 75.

32. *POPPY History*, pp. 40, A1-8, and A1-9.

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33. EO 13526 3.5(c) [redacted] paper (provided 10 September 1990).

34. *NSA Technical Journal*, Vol VI, Fall 1961, No. 4, pp. 39-50.

35. EO 13526 3.5(c) [redacted] paper (provided 10 September 1990).

36. *POPPY History*, pp. 45 and 46.

37. *POPPY History*, p. 46.

38. *Navy Org Manual*, p. 75.

39. *NSA in Space*, p. 73.

40. *POPPY History*, p. 6.

41. *POPPY History*, pp. 46, 47, A1-13, and A1-14.

42. *NSA in Space*, p. 18, and Raymond Potts' personal notes (hereafter Potts' notes).

43. *POPPY History*, pp. 33, A1-13, and A1-14.

44. Potts' notes.

45. *POPPY History*, pp. 31 and 33.

46. *NSA in Space*, p. 18.

47. *POPPY History*, p. 47.

48. *POPPY History*, pp. 15, 16, A1-15, and A1-16.

49. *POPPY History*, pp. 24 and 26.

50. *POPPY History*, p. 35.

51. *POPPY History*, p. 35.

52. *POPPY History*, p. A3-6.

53. EO 13526 3.5(c) [redacted] interview, 11 August 1992.

54. *POPPY History*, p. 48.

55. *POPPY History*, p. 48.

56. *POPPY History*, pp. 48-49.

57. *POPPY History*, pp. 48-49.

58. *Navy Org Manual*, p. 77.

59. RAdm Robert K. Geiger comments, SIGINT Satellite History peer review, March 1994.

60. *POPPY History*, pp. 50, 51, 52, A1-17, and A1-18.

61. *NSA in Space*, p. 20.

62. *POPPY History*, pp. 52 and 53.

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63. K4SP Status Board, 20 December 1970.
64. *POPPY History*, p. 51.
65. K4SP Status Board, 20 December 1970.
66. *POPPY History*, p. 51.
67. *POPPY History*, p. 52.
68. Geiger comments, SIGINT Satellite History peer review, March 1994.
69. Geiger comments, SIGINT Satellite History peer review, March 1994.
70. Robert J. Hermann comments, SIGINT Satellite History peer review, March 1994.
71. Hermann comments, SIGINT Satellite History peer review, March 1994.
72. Geiger comments, SIGINT Satellite History peer review, March 1994.
73. Geiger comments, SIGINT Satellite History peer review, March 1994.

4 The Air Force WS-117L-Derived Projects

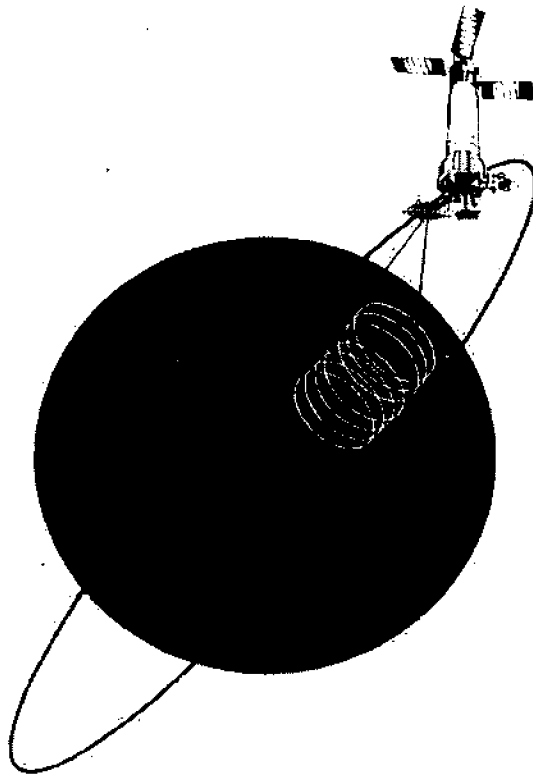
SAMOS E-1/F-1 (WS-117L and Project 102)

The requirements for the Advanced Reconnaissance System, Weapon System 117L (WS-117L), were incorporated in System Requirement No. 5, published by Headquarters, Air Research and Development Command (ARDC), on 29 November 1954, and were validated in General Operational Requirement 80-2, issued by Headquarters, US Air Force, on 15 March 1955. At that time ELINT was the responsibility of the US Air Force, as spelled out in DOD Directive S-3115.2 issued on 13 July 1955. Intelligence requirements for the ELINT satellites of WS-117L were developed under guidance from Air Force Assistant Chief of Staff for Intelligence (AFCIN), MGen James Walsh. On 29 October 1956 the Air Force awarded contract AF 04 (647)-94 to Lockheed Missiles and Space Division (LMSD) in Sunnyvale, California, for initial system development studies on WS-117L. In June 1957 LMSD awarded the first contract for US ELINT satellite payloads to the Airborne Instruments Laboratory (AIL) at Mineola, Long Island, New York. The work on contract was Subsystem F (S/S F), the ELINT payload of WS-117L.

Because the US did not have radar data from the interior of the Soviet Union at that time, the requirements for WS-117L

were stated in very general terms. Consequently, the S/S F ELINT payload designs were based on various national estimates of the Soviet radar environment. These estimates were contained in the RAND Corporation's Report 280, "Signal Density Study," published 1 September 1955; the Air Force Technical Intelligence Center (ATIC) report, "Handbook of Soviet and Satellites RADAR Equipment," 9 November 1955; and in estimates by the Planning Research Corporation, a subcontractor to Ramo-Wooldridge, Inc., under contract to the Air Force for development of the WS-117L Intelligence Data Processing Subsystem I (S/S I). These estimates relied on peripheral intercepts from ground sites, airplanes (including limited U-2 collection), and ships. Radar data collected by the early satellite ELINT payloads (Navy GRAB/DYNO in 1960 and Air Force ferret systems in 1961) showed that the actual density of radar data collected over the Soviet interior was many times greater than anticipated. Accommodating this large volume of data slowed the development of data processing systems, changed payload-tasking plans, and resulted in some payload modifications.

The first true source of national requirements for satellite reconnaissance systems was published by the US Intelligence Board (USIB) in USIB-D-33.6/8, "Intelligence Requirements for a Satellite



STRAWMAN operational concept

Program A: Projects 102, 6988K, & 770 (STRAWMAN satellite shown)

Orbital inclination:	67° - 75°
Orbital altitude:	275 miles
Orbital shape:	Circular
Ground coverage:	100-mile-diameter circle
Collection technique:	Read-in over denied area, record, and read-out to SCF remote tracking stations.
Collection antennas:	Circular horns for high frequency. Logarithmic conical spiral for VHF/UHF

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Reconnaissance System of which SAMOS is an Example," 5 July 1960. It stated, in part, "There are important problems toward which electronic reconnaissance could contribute critical information during the research and development phase . . . One of the most important of these is the search for emissions associated with an ABM system." Paragraph 1c. stated, "Additional types of directed coverage may be required. Provision should be made to procure such equipment by Quick Reaction Capabilities (QRC)." Also "... a close working relationship between the R&D organization and the intelligence community is required."¹



Col John O. Copley

Prior to the publication of USIB-D-33.6/8, Maj (later Col) John O. Copley, the Air Force WS-117L Project Officer for S/S F at the Air Force Ballistic Missile Division (AFBMD), Inglewood, California, had worked with LtCol John Poe of the AFCIN staff, Capt John Marks of the Headquarters SAC Intelligence staff, and Jim Foreman and Art Thom, who were senior analysts at ATIC, Wright-Patterson

AFB, Ohio, to determine collection requirements for the S/S F payloads. They decided that the urgent requirement of SAC for an electronic order of battle (EOB) was the most important factor guiding payload design. These data were essential to SAC in planning bomber penetration routes. Next in order of importance were the detailed technical characteristics of these radars, especially for the early warning and ground-to-air missile systems. The F-1 and F-2 ELINT payloads, with their compressed digital description of the radar intercepts, were designed for the EOB and general-search missions, while the F-3 payloads, with their wide-band (6 MHz) analog output, provided the fine grain technical characteristics of selected radars.

The 5 July 1960 USIB guidance appeared to validate the design of the S/S F payloads, if a QRC effort were included. The QRC requirement was met by a separate series of relatively simple, single-mission payloads that could be developed rapidly and mounted on the aft rack of the Lockheed Agena spacecraft.

The S/S F payloads were mounted on the front rack of the nose-down, vertically stabilized Agena, which was continuously Earth-oriented when in orbit. The three-axis stability of the vehicle was provided by control moment gyros supplementing the natural gravity-gradient force that tended to orient the vehicle vertically. Nickel-cadmium batteries supplied the power, limiting average spacecraft life to five or six days, depending on the weight of batteries that could be carried.

The S/S F-1 payload covered the frequency range of 2.5 to 3.2 and 9.0 to 10.0 GHz. These frequency bands were the popular World War II S-band and X-band in which most of the area search, air-to-air, and ground-to-air missile radars were still operating. One additional frequency band, from 100 to 400 MHz, was used by the higher power, ground-based early warning radars, but the F-1 vehicle was incapable of carrying an antenna of sufficient size to be effective in that radio-frequency range. This was remedied in the follow-on F-2 payloads by extending frequency coverage down to 59 MHz.

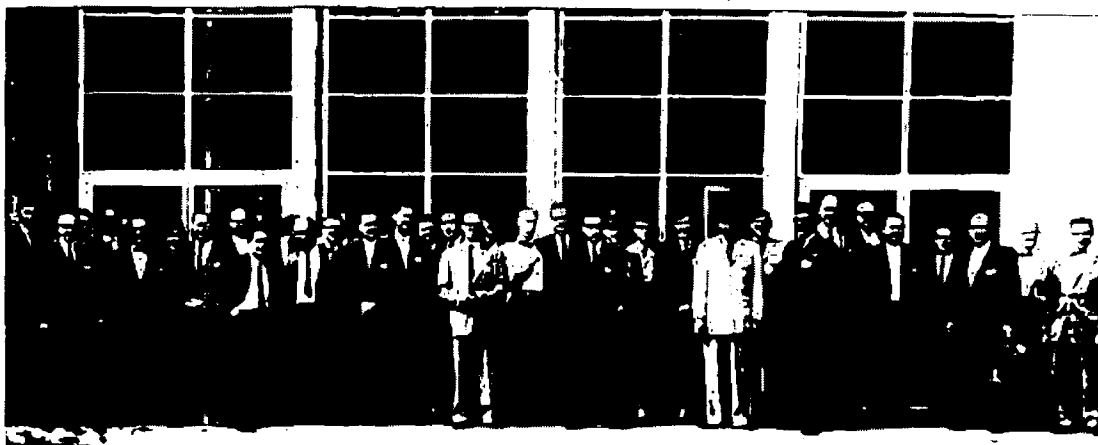
The F-1 superheterodyne receiver scanned the radio frequency bands, measuring two pulse repetition intervals (PRIs), pulsewidth (PW), radio frequency (RF), and time for each signal intercepted. This information formed a digital word for each intercept that was then transmitted at a 10-kilobit rate via a very high frequency (VHF) down-link to the tracking stations. The data could be transmitted in realtime or stored on a magnetic-tape recorder over the target area and played back when the satellite was in contact with a tracking station. Spacecraft and payload status data were transmitted on a second VHF telemetry link using pulse amplitude modulation of various tones to frequency-modulate the down-link (PAM/FM). Commands were sent to the vehicle via a 3,200-MHz transponder on the Agena vehicle, which was also used for tracking.

The payload intercept antennas were nadir-pointing directional arrays, with a coverage circle on the ground about 100 miles in diameter at the center frequency

of each band.* Additional nondirectional antennas performed an inhibit function, preventing signals originating outside the coverage circle of the directional antennas from reaching the payload via the sidelobes of the directional antennas. The system was known as a "sidelobe" interceptor because it intercepted the sidelobes of the ground radar antennas using its own main beam while, at the same time, it rejected signals (mostly main beams) from other ground radars that entered its sidelobes. The payload intercept antenna main beam looked only at the zenith lobes (sidelobes) of the ground radar, thereby eliminating the scan rate of the ground radar main beam as an influence on the probability of intercepting the radar. This system was the reverse of the Navy DYNO payloads, which depended on seeing the main beams of the ground radars. In both systems the sensitivity of the system was adjusted very carefully to assure reception of only the portion of the ground radar antenna power that was desired (sidelobes for S/S F and main beams for DYNO).

The S/S F and follow-on payloads were built by the AIL at Mineola and Deer Park, Long Island, New York, under the direction of Win Fromm. The F-1 payload used components of a vacuum-tube-type ELINT receiver, the AN/APR-9, which AIL had developed for the Air Force in 1948. This equipment was extensively modified to operate in the space environment and was unique in being the only vacuum-tube-type ELINT payload ever flown in space by the United States. F-1 used motor-driven mechanical CAMS for frequency scanning, which was also unique to satellite-borne ELINT systems.

* For a fixed antenna size, the diameter of the coverage circle is an inverse function of frequency.



Participants in the dedication ceremony of the Airborne Instruments Laboratories, Inc., facility at Melville, Long Island, New York, where Subsystem F and subsequent 698BK payloads were built, 13 October 1959

(Partial listing from left): Don Clark, Phil D. Doersam (third), George P. Minaiga (fourth), Pete Sielman (sixth), Maj Walt H. Spindler (eighth), John L. Hyrne (ninth), Eugene Fubini (11th), Maj Bill Bean (12th), Sid Hassin (13th), George W. Price (14th), George Heiniger (15th), Bob Hunter (20th), William M. Harris (24th), James J. Foreman (26th), Col Will Ray (27th), Capt Don Wipperman (28th), LtCol Robert Yundi (29th), LtCol John E. Poe (30th), Maj John O. Copley (31st), Maj Donald Furr (32nd), Winfield E. Fromm (33rd), Ken Knopi (34th), Jim Stevenson (35th), Jack Wieland (37th), and Gregg Stevenson (38th).

To translate the 10-kilobit data stream received at the ground tracking site at Vandenberg AFB, California, into the actual PRI, PW, and RF of the individual intercepts, an F-1 ground data handler was furnished by AIL. This equipment used logic circuits constructed of hardware components to interpret the data stream and produce an output that listed PRI, PW, RF, and time of each intercept for each readout of the payload. This information was used at the tracking station to determine the payload status, particularly on realtime readouts, that contained data from special LMSC-operated calibration vans and known local radars. A second F-1 ground data handler unit was located at

the Satellite Test Center (STC) at Sunnyvale, California, to provide input data for the CDC-1604 computer. The readout data, recorded on magnetic tape at the Vandenberg tracking station, were transported by courier to the STC. There the data were translated by the F-1 ground data handler in the same manner as at Vandenberg and were processed on the CDC-1604 computer. The computer contained acceptance criteria to validate the individual intercepts and, using the spacecraft ephemeris, translated the time of intercept into the location of each valid intercept. These data were then manually checked against the characteristics and location of known ground radars and the

calibration van transmitters to evaluate the accuracy of the output data. It was planned that readout data played back from the vehicle recorder, consisting of data intercepted over the Soviet Union or other areas outside the coverage circle of the ground tracking station, would be recorded at the tracking station and furnished to the processors at the Strategic Air Command (SAC) Headquarters at Omaha, Nebraska. There, functions similar to those used at the STC would be performed using the WS-117L Subsystem I Data Management System to develop finished intelligence data.

When the SAMOS Program Office (SAFSP) was formed at Los Angeles Air Force Station, California, on 30 August 1960, two development areas were defined. Program I included the readout projects of Subsystems E and F. The E-1, E-2, and E-3 photo payloads (in increasing order of ground resolution) became Project 101, while the F-1, F-2, and F-3 ELINT payloads became Project 102. Program II was reserved for the photo recovery projects. In Program I, the SAMOS 1 payload was unique, combining as it did the F-1 ferret and E-1 photo readout payloads. This arrangement was developed during the regime of the Advanced Research Projects Agency (ARPA) as a cost-saving measure. The F-1 was mounted in front of the E-1 lens; that lens looked Earthward through a hole cut in the S-band horn antenna of the F-1. This novel arrangement severely vignetted the view of the E-1 camera. The problem was solved by installation of a squib which, when fired on orbit 21, detached the F-1, thereby providing the E-1 a full field of view.

To determine the accuracy of the PRI, PW, and RF measurements made by the payload it was necessary to use the real-time mode to collect radar signals with known parameters and then check the payload measurements against the signals being transmitted. The S/S F Project Officer, Maj John Copley, remembered that in his previous assignment as the QRC Officer at Rome Air Development Center, New York, he was responsible for the modification of several AN/GPQ-T1 training sets, which were van-mounted radar receivers and simulated radar transmitters used by SAC for training electronic warfare officers. Since the radar transmitters could simulate known radars, they seemed an excellent choice for calibration vans, or "cal vans," to transmit radar signals to the satellite receivers. Copley located three vans in Air Force inventory and they were provided to LMSC to modify for this use. These vans were used for several years until requirements for radar simulation became too sophisticated for this relatively ancient equipment, originally built for the Korean War. In 1965 they were replaced with more modern equipment mounted in modified tour buses.

The SAMOS 1 used an Atlas booster to lift the Agena vehicle into a low Earth orbit. The first ignition of the Agena main engine placed it in an eccentric transfer orbit with an apogee of 275 miles. A second ignition at apogee circularized the orbit at 275 miles. Polar inclination of the orbit assured coverage of the entire Soviet land mass.

Despite all obstacles, on a clear, crisp day on 11 October 1960, Copley, George Price (the LMSC payload manager), Vince Henry (the AIL F-1 specialist), and the rest of their crew stood in the Vandenberg tracking station parking lot looking out over the launch base. The great day had arrived and SAMOS 1 was on the pad, ready to launch. They watched it rise out of a plume of white smoke in a picture-perfect launch until it was out of sight. Jubilation reigned momentarily until they reentered the tracking station control room and discovered that, during the launch, the umbilical connector had stuck to the cold-gas bottle connection, thereby releasing all the attitude-control gas. Because this gas was needed to control the vehicle during the burning of the orbital engine, the Agena did not attain orbit.

The launch of SAMOS 2 a few months later was somewhat different. It was a gray, rainy day on 31 January 1961 and the launch pad was not even visible from the tracking station. This did not deter the launch crew, and vehicle 2102 was launched into the desired orbit with both the E-1 and F-1 payloads working as expected. On orbit 8 a realtime readout at the Vandenberg tracking station produced the first orbital intercept data from the F-1 system. These data were processed on the F-1 ground data handling equipment, which transformed the 10-kilobit data stream into individual intercepts. This was done at Vandenberg and the STC in Sunnyvale. Output of the F-1 ground data handler at the STC was processed on the 1604 computer, producing 69 identifiable intercepts of signals from US West Coast radars and the cal vans. This verified

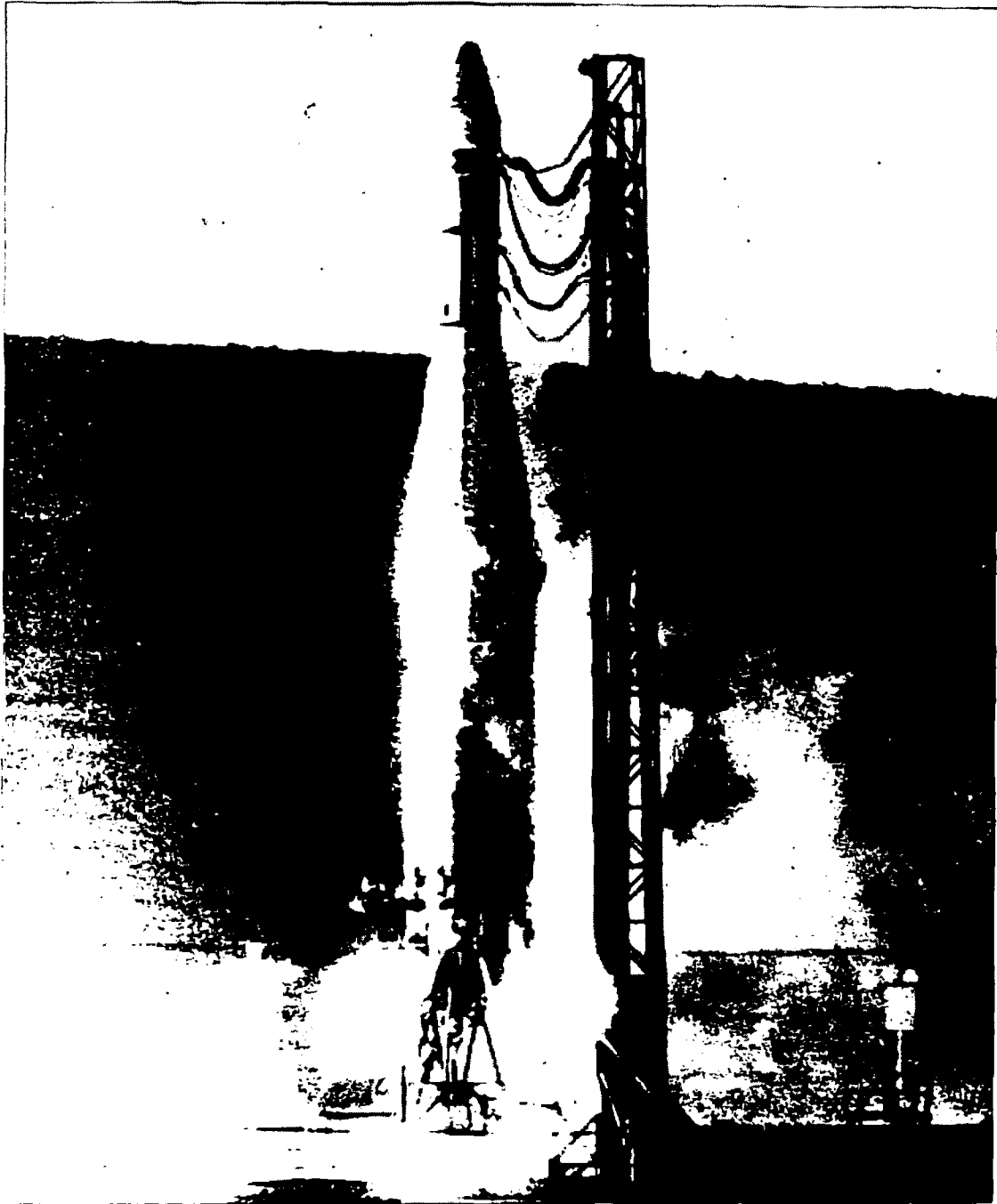
beyond doubt that the AIL concept had produced a working system. The 2-kilocycle inverter in the payload power supply failed shortly thereafter and no more intercepts, friendly or otherwise, were made.

In the meantime the E-1 photo payload was collecting pictures through the hole in the S-band horn and there was great elation at the tracking station as the E-1 ground processing system produced 100-foot-resolution pictures on many orbits, even though they were rather vignetted. There was great anticipation of bigger and better pictures when the squib was fired on orbit 21 to remove the F-1 payload, but the results suggest that a catastrophe had occurred. The spacecraft was never heard from again.

This proved to be the only successful SAMOS Atlas/Agena readout program launch, and it was only a partial success. The third E-1/F-1 was cancelled to save money for the E-2 launch the following spring. Unfortunately, in April 1961 the Atlas booster for that vehicle blew up on the pad; consequently, shortly thereafter, the photo readout program was cancelled in favor of the more promising photo recovery programs (the already successful CORONA, and GAMBIT, approved for development). The third E-1/F-1 payload was placed in storage until the F-1 was resurrected and used as the Group 0 payload in the upcoming Project 102 missions.

The F-1 payload worked long enough to produce 69 intercept words, but that was not the whole story. Just as importantly, under the leadership of Frank

~~Top Secret~~
~~NOFORN-ORCON~~



SAMOS 2/Atlas/Agena launch, Vandenberg Air Force Base, 31 January 1962

...ing, the LMSC crew at the STC processed the data on the CDC 1604 computer. Using known West Coast radars and the cal van signals for verification, they proved that a workable system had been developed. Not only could the data be collected, but the data could also be processed and a useful output produced. The approval of the follow-on SAMOS Project 102 ELINT missions on 9 March 1961 by the Under Secretary of the Air Force, Joseph V. Charyk, was very strongly influenced by these factors.²



BGen William G. King, Jr.

The F-2 and F-3 Thor-Boosted Projects: 102, 698BK, and 770

On 23 December 1960, even prior to the successful E-1/F-1 launch of January 1961, Under Secretary of the Air Force Charyk directed modification of the SAMOS ELINT Project 102, as follows: "The use of Atlas boosters in the flight test program for subsystem F-2 will be terminated. Subsystem F-2 and F-3 flight test will utilize Thor boosters in combination with the Agena vehicle, and will be conducted as an integral part of the SAMOS Program. The initial F-2 flight test should be scheduled at the earliest practical date. In planning for the F-3 development and flight test, consideration should be given to include provisions for secure transmission of analog readout data through encryption or other techniques."³

² During the SIGINT Satellite History peer review in March 1994, BGen William G. King, Jr., who played a prominent role in this history, said, "The curt nature of Dr. Charyk's direction to redirect Project 102 was typical of the explicit and direct instructions we received in the field. Suggest you highlight this fact. It probably was basic to the DNRO management approach."

The switch from Atlas intercontinental ballistic missile (ICBM) to Thor intermediate-range ballistic missile (IRBM) boosters was a logical step in light of the rapid developments in solid-state electronics and digital circuitry. Use of these techniques, plus new lightweight materials, resulted in an F-2 payload less than two-thirds the weight of the F-1. The F-2 covered more of the radio frequency spectrum using three frequency bands, as compared to the two on F-1. Nonetheless, Col (later BGen) William G. King, Jr., the Project 102 director, recommended four F-2 and four F-3 launches, using an Agena vehicle patterned after the Agena of the DISCOVERER/Thor program. Having first-hand knowledge of the failures that the DISCOVERER program had overcome, he felt that four launches of each payload would provide adequate assurance that at least one of each would be successful (DISCOVERER had finally been successful on the 13th launch). This philosophy, along with the success of F-1, was convincing enough to gain Charyk's approval of an eight-launch program, with the first launch in February 1962.

On 9 March 1961, Charyk allocated \$35 million in FY62 funds as an initial increment for Project 102, scheduled to launch four F-2s in 1962 and four F-3s in 1963.⁴

The new Project 102 required names for each payload more specific than F-2 and F-3. To accomplish this, Copley and his counterpart, LtCol Edwin J. Istvan of the Air Force Office of Missiles and Space (SAFMS) staff, devised a system that identified payloads by the type of output data they produced (a digital data stream or a wide-bandwidth analog signal) and by the radio frequency bands that they intercepted. The frequency band configurations were numbered 1, 2, or 3, and the term "digital" was adopted for payloads with digital output and "analog" for those with analog output. For example, Group 2D provided radio frequency coverage from 0.059 to 0.130, 2.5 to 3.2, and 8.2 to 12.4 GHz and produced a digital data stream as the output, whereas Group 2A provided a wide-bandwidth analog output covering the same frequency bands. Payloads with digital output were EOB and general search (GS) collectors. Their output was a 10-kilobit digital data stream. Payloads with wideband analog output collected technical intelligence (TI) to determine the fine-grain characteristics of radars of the highest priority. Their output bandwidth was 6 MHz and they utilized the analog magnetic instrumentation equipment (AMIE) wideband helical scan video recorder developed by RCA for on-orbit recording.

As a further cost-saving measure, the third SAMOS E-1/F-1 Agena vehicle, 2103, with the E-1 photo components removed,

was redesignated 2301 and reconfigured for launch on a Thor booster. The F-1 payload became Group 0, the first of the Project 102 Thor-boosted launches.

Although it was conducted as part of the SAMOS Program, Project 102 had much more in common with DISCOVERER, which was the cover name for the "black" CORONA photo recovery project. They both used the same Thor/Agena launch configuration and had many common subsystems, they were both under contract to LMSC, and administration of the "white" elements of DISCOVERER had been transferred to the SAMOS office on 9 September 1960.

It soon became clear that operating Project 102 as part of the SAMOS office required duplication of most functions of the DISCOVERER office except for payload operation. As a result, in April 1961 BGen Robert E. Greer moved Project 102 from SAFSP to the nearby DISCOVERER office, both of them located at the Air Force El Segundo complex. This essentially meant that Maj Copley and his secretary Katherine Holt moved in with Col Lee Battle and the DISCOVERER development team. The arrangement worked out very well with Copley handling the SIGINT payloads and Capt Bill Johnson handling the photo payloads. Most other subsystems were common to both programs, and from external observation it was impossible to tell the difference between a SIGINT and a photo launch. There was a difference in the security classification of the payloads. The photo payloads were developed and operated using the CIA's covert ("black") CORONA security

system, whereas SIGINT payloads were DOD SECRET, with strict "need-to-know" enforced.

That this combination of the two programs worked well was proven when, instead of the minimum two-out-of-eight successes King had predicted, by the end of 1965 the SIGINT program had grown to nine launches, all of which had been successful. Lee Battle believed that one manager per subsystem or element was more than adequate and steadfastly refused to fill extra billets that were made available to him. The success of the DISCOVERER and 102 projects certainly validated this position.

When the joint CIA/DOD agreement was signed on 6 September 1961, forming the National Reconnaissance Program, the administrative bond between the photo and SIGINT sections of the DISCOVERER Project Office was strengthened further.⁵ The most notable effect was that the CIA CORONA payload was now procured and operated under the new joint-agency covert DOD-CIA BYEMAN system, which included both the CIA's CORONA compartment and the Air Force "black" compartments (GAMBIT for the photo recovery system and ~~EO 13526 3.3(h)~~ for SIGINT projects). The Air Force ELINT payloads in Project 102 remained DOD SECRET, with a strict "need to know," and were assigned "mission numbers" in the TALENT-KEYHOLE intelligence product protection security system, starting with 7151 for the Group 0 launch of January 1962.

By December 1961 Project 102 was settling into its new environment. Due to funding limitations, every effort was made to simplify the configuration and the project was cut back to seven flights, four in 1962 and three in 1963. There would be no Group 2 analog payload and no flexible on-orbit programmer for the analog missions. Encryption for the wideband analog down-link was still required. A project ceiling of \$33.4 million for FY62 was imposed.⁶ To meet this ceiling, Copley worked closely with George Price, the LMSC payload director, to assure that the Project 102 payload designers were imbued with a "no-frills" attitude. Digital Group 0 was not a problem since it used the last F-1 payload and was compatible with the subsystems of the Agena vehicle.

The new digital payloads used many of the F-1 techniques including frequency-sweeping superheterodyne receivers, but with lightweight solid-state components that provided improved versatility and reliability. Electronic frequency scan and switching were a great improvement over the former electromechanical methods employed for these functions by the F-1 payloads. The digital output continued to be a 10-kilobit data stream similar to that of F-1. The frequency range from 59 to 12,500 MHz was covered in three configurations (Groups 1 through 3). To provide the wide-bandwidth TI needed to understand the operation of new Soviet ABM and ground-to-air radars, operation of the analog payloads was necessarily more complex. Recording of radar intercepts was accomplished by the AMIE recorder developed for this task by RCA in Camden, New Jersey. To obtain the 4-MHz

bandwidth of the early models, a helical scan machine was developed using four recording heads scanning sequentially in exactly the way present-day video cassette recorders (VCRs) operate. To obtain maximum utilization of the wideband recording capability of the AMIE recorder, it was necessary to stop the frequency scan of the receivers and dwell on the frequency of interest while making the recording. The receiver had to either recognize a signal of interest (at least, the presence of a signal) or be pretuned to suspected frequencies of interest. Because the AMIE recorded only when the receiver "recognized" a specific signal, the recording time per orbit was frequently very short and used a small fraction of the tape available. To avoid wearing out the tape by constantly using the first few minutes of tape recording time, it was necessary to allow the analog payloads to collect for many orbits before reading out the data. This often caused the analyst processing the data great difficulty in identifying the segment he was looking at, particularly when (sometimes inadvertently) another read-in occurred before all the previous data had been read-out. To ease this problem, in later payloads the digital data word describing the signal characteristics, in addition to time, was recorded on the AMIE recorder tape along with each intercept.

The Agena support systems were very similar for all DISCOVERER flights except that the photo-mission spacecraft were horizontally stabilized, while the SIGINT missions were vertically stabilized, with the front rack of the Agena vehicle nadir-oriented. The Agena spacecraft would naturally assume a vertical

position with respect to Earth while in orbit due to the gravity-gradient effect. This made the attitude control for the SIGINT spacecraft much less complex than for the photo systems, which had to make constant adjustments. The command and control systems were very similar except that the SIGINT vehicles had two encrypted 10-kilobit down-link transmitters on the digital missions and an encrypted 10-megabit down-link for the analog system. Actually, it was not technically feasible to encrypt the full 4-MHz bandwidth of the analog recorder at that time (it would have required at least a 40-megabit down-link), so the first analog mission returned 750-kHz bandwidth of analog data via the 10-megabit down-link. This system was flown on the first analog mission, 7156, on 27 February 1964. Afterward, the Director of NSA reviewed the situation and determined that, due to the complexity of wideband analog data, encryption would not be necessary for future analog down-link data.

Both the digital and analog payload commands were transmitted via the S-band (3.2 GHz) transponder used for tracking the Agena. The command instructions for each orbit were generated by the Mission Control Center (MCC) in the STC for the F-1 and Project 102, Group 0. Only off/on commands were available at this time and the normal commanding was to turn the payload on as it came within sight of the Soviet-Sino Bloc and turn it off as it exited the area. Command instructions became more complex for the Project 102 payloads, starting with the Group 2-D launch on 18 June 1962.

On 2 May 1962, the National Reconnaissance Office (NRO) was formally created and in July 1962 the Director of the NRO (DNRO), Joseph V. Charyk, defined his support staff, known as the Office of Space Systems, Office of the Secretary of the Air Force (SAFSS). An operations staff, SS-4, headed by Col Tom Herron, was responsible for working with the appropriate committees of the USIB to translate their requirements to specific payload operations and to advise these boards of present and planned capabilities of the NRO. By this time, the SAMOS Program Office at Los Angeles Air Force Station had been renamed the Office of Special Projects, Office of the Secretary of the Air Force (SAFSP), and was still headed by BGen Robert E. Greer, who reported directly to Charyk. Greer gave his operations staff at SAFSP the office symbol ~~EO 13526~~

DNRO Charyk proposed and received an approval from the President's Foreign Intelligence Advisory Board (PFIAB) in 1962 that, "... all satellite projects of the National Reconnaissance Program (NRP) should be handled in the same manner by a single operations unit of the NRO Staff." A Satellite Operations Center (SOC) was created as part of SS-4, an office in SAFSS, and was located in Room BD-944 in the Pentagon. Initially, the SOC was concerned primarily with tasking the CORONA and GAMBIT photo programs and exercised minimal control over the SIGINT satellites, which, like the photo satellites, were controlled from the Satellite Test Center (STC) in Sunnyvale. In the SIGINT arena, the initial function of SOC was to translate USIB requirements

into mission requirements for specific payloads. The National Security Agency (NSA) representative ~~EO 13526 3 5(c)~~ who had joined the NRO staff as part of the 1962 DNRO agreements, became increasingly involved in this process. In 1964, as the SIGINT satellite payloads, and consequently their commanding or "tasking" (planning and controlling their collection operations) became more complex, ~~EO 13526~~ of NSA was added to the SOC staff to oversee the SIGINT tasking requirements. These requirements were transmitted to ~~EO 13526~~ in Los Angeles where, in conjunction with the MCC personnel at the STC, they were translated into specific tasking for each mission. Lockheed technical personnel at the STC ensured that operation of the satellite vehicle support subsystems was optimized.

The lifetimes of the early vehicles were limited to between six and 20 days depending on the weight of the batteries that could be carried. In late 1962 the "standard" Agena D satellite development was initiated at AFBMD, basically to control cost. This vehicle made it possible for each project to choose "accessories" to customize the standard Agena bus. This improvement, plus the thrust augmented Thor (TAT) program, which added three solid rockets to the Thor booster, increased the available on-orbit weight and flexibility of the Agena. Lockheed incorporated solar arrays starting with vehicle 2702, launched on 19 July 1965. ELINT payload life gradually increased from 51 days for 2702 to over one year for the follow-on MULTIGROUP and STRAWMAN payloads.

The Group 0 digital mission, vehicle 2301, mission 7151, was launched on 21 February 1962 from Vandenberg AFB, California. The tube-type F-1 receiver operated successfully for six days in orbit until the spacecraft batteries were depleted and the mission was terminated. It became the first Project 102 mission to collect data from the Soviet Union and read-out data at the New Hampshire and Hawaii remote tracking stations (RTSs) as well as at the Vandenberg RTS. Data were processed in essentially the same way that the F-1 data had been handled. The output from the F-1 ground data handling equipment in the STC was processed on the CDC 1604 computer to validate each intercept and, based on the vehicle ephemeris, translate time of intercept into geoposition.

Development of the data handling subsystem, S/S I of WS-117L, was under way prior to the formation of SAFSP. It was designed to process the data from the wideband photo readout (RF down-linked) surveillance system on film and the data from the ELINT readout systems as they were recorded on magnetic tape at the tracking stations. When Acting Secretary of the Air Force Joseph V. Charyk directed the change of program emphasis from readout to recovery on 4 November 1960, he also cancelled Subsystem I.⁸ This left the S/S F ELINT data users with no system to process the S/S F data. The LMSC data processing of realtime readouts in the STC for engineering evaluation was the only capability available to produce validated and geopositioned intercepts from the Group 0 payload. By applying the LMSC processing system to all of the data (rather than just the realtime readouts), it

was possible to provide both the NSA and SAC with verified intercepts containing emitter parameters and locations.

During 1961, increasing emphasis was placed on protecting the security of Project 102 data and mission operations. John G. Schaub, the Lockheed Project 102 manager, recognized the difficulty of protecting both the hardware and the data in building 104, the heart of the Lockheed building complex at Sunnyvale, California, which was surrounded by a myriad of unclassified activities. To provide a facility where good security could be maintained, he convinced Lockheed management that an isolated location was required. This led to the construction of EO 13526 3

in an isolated area of Sunnyvale formerly occupied by tomato fields. For many years this area was known as the EO 13526 3.3(b)(1)>25Yrs housed the unclassified spacecraft development and test activities, and EO 135 provided a secure area to conduct the classified development program, check out the payload, and process the reconnaissance data.

The buildings were completed in January 1962, shortly before the launch of vehicle 2301, and included an F-1 ground data handler and CDC 1604 computer for processing the data. The original plans for EO 13526 3.3(b)(1)>25Yrs

called for a single stairway at one end of each building. Realizing the inconvenience this could cause when an individual on the stairless end wanted to go from floor to floor, Schaub insisted that there be stairways on both ends of the buildings. When he won this battle, the

second stairway in EO 13526 1.4(c) was
dubbed EO 13526 3.3(b)(1)>25Yrs

a name it presumably retains
to this day.

The data from mission 7151, Group 0,
was checked in EO 13526 3.3(b) by comparing
the computer output with manually
processed data from the calibration vans.
The STC capability was used primarily for
realtime data evaluation for mission con-
trol purposes. Preprocessing of mission
7151 data at both the STC and EO 13526 3
produced 4,800 intercept words of
high-quality corrected data, which were
sent to NSA on IBM 727 digital tape for
processing at their operations building at
Fort Meade, Maryland. Initial processing
was done on the IBM 7090 computer and
later on the IBM 7094. Each intercept

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)>25Yrs, EO 1

NSA processors to refine the radar charac-
teristics and determine a common area in
the individual circles of coverage, thereby
improving the location accuracy and
enhancing identification of the intercept.

The NSA operational ELINT organi-
zation, headed by EO 13526 3.3(b)(1)>25Yrs used
MILGO plotters to display the overlapping
intercept circles and produced EO 13526 3.3(b)

data, which were provided to the Defense
Intelligence Agency (DIA) for EOB listings
and to other customers for their direct use.

But early location accuracy produced by
the overlapping circles was generally poor,
with a circular error probable (CEP) as
great as EO 13526 3.3(b). By the conclusion of
mission 7152, in June 1962, the LMSC
team in EO 13526 3.3(b) had refined selected
data to a EO 13526 3.3(b)(1)>25Yrs, EO 13 and
concluded that this was about the limit of
the system as then constituted. The pre-
processed ELINT data were also sent to
the 544th RTG at SAC Headquarters,
Offutt AFB, Omaha, Nebraska, for further
processing on their Finder (AN/GSQ-1)
computer system. The output of this pro-
cessing was added to the Single Integrated
Operations Plan (SIOP), which SAC used
to control all their bombing missions.

Ed Stillman, one of the early LMSC
processing team members, recalled that
his first assignment at Lockheed was in
EO 13526 3.3(b) working with Jack Shepherd,
also of Lockheed, to handle the ground
segment of this mission and also mission
7152, flown in June 1962. To verify the
accuracy of the data, Stillman used loca-
tions of known radars in Alaska (such as
the MSQ-1) to correct the biases in the
ELINT reconnaissance data. The first
thing that Stillman discovered in the data
from vehicle 2301 (mission 7151) was that
the arithmetic signs of spacecraft pitch
and roll had been entered into the com-
puter reversed. Once this was corrected,
Stillman was able to correlate the data.
He discovered this error through manual
analysis and has since come to believe that
manually checking computer data (at least
the initial and unusual data) is really
mandatory.⁹

⁹ Circular error probable (CEP) is a term for accuracy. It
means that 50 percent of all the locations reported will be
within this distance of the correct location.

Vehicle 2312, mission 7152, was launched on 18 June 1962 carrying the first Project 102 digital payload, Group 2-D. This first all-solid-state system had many advantages over the vacuum tubes and mechanical scanners of the Group 0 (F-1) payload. In addition to extended frequency coverage, this system was much lighter, more reliable, and used considerably less power. Expectations for a long, useful life, however, were dashed on the second evening of operation (at about four a.m.). In those days program office personnel felt obligated to be in the Mission Control Center (MCC) of the Satellite Test Center (STC) to supervise the conduct of all orbital operations until everything was checked out and became routine. When the satellite was "acquired" on orbit 26, it appeared that the tape recorder would not read-out during the pass. What actually happened was that a "read-in" command had been sent by mistake. So, when the program office decision to send another read-out command was executed, the tape recorder tried to operate in forward and reverse simultaneously. This ended the mission and caused an immediate redesign of the recorder command system. It also terminated the continuous presence of program office personnel in the MCC (without, at least, some occasional sleep).

The Douglas Corporation, which manufactured the Thor booster, invented a method of increasing the booster's thrust by strapping three XLR-81 solid rockets to its base. Lee Battle of the DISCOVERER team decided that vehicle 2313 would be a good one to use for testing the new booster, which was called the thrust-augmented Thor (TAT). Unfortunately, George Price

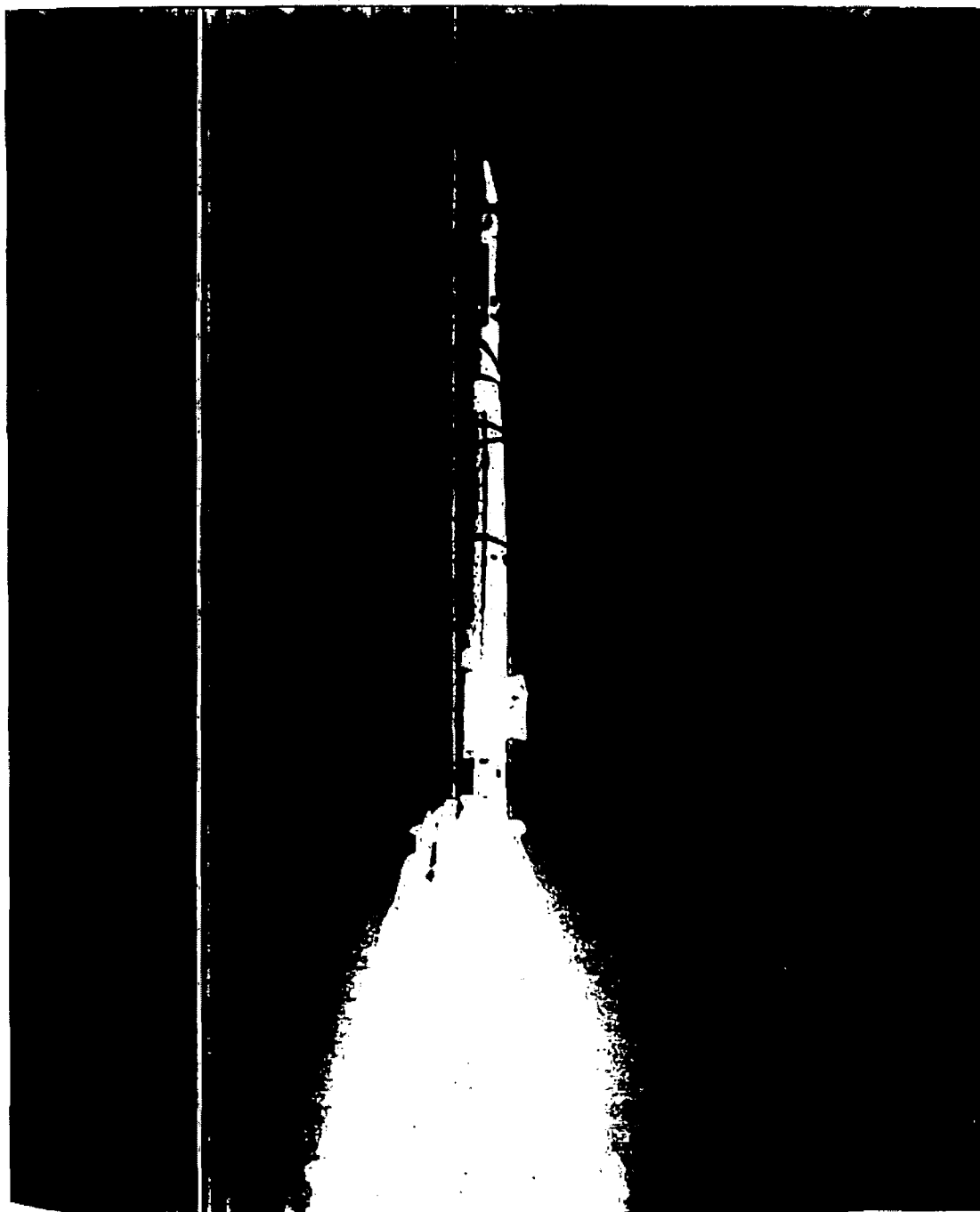
and his Lockheed payload engineers could not deliver the Group 1D payload by the November 1962 launch availability of the new Thor, so Battle substituted a photo bird. When it was launched on 16 November 1962, one of the solids failed to fire, promptly dumping the payload into the Pacific Ocean. The next flight, vehicle 2313, mission 7153, with a Group 1 digital payload, launched on 16 January 1963 using a Thor, was successful. However, the mission lasted only two days due to a battery failure. It collected EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO

and updated radar sites in the Soviet Union. Some months before, shortly after he was designated DNRO, Joseph Charyk changed the project identifier from 102 to 698BK. This made vehicle 2313 the first launch under the new program number and changed the security classification to DOD SECRET, SPECIAL HANDLING.

Vehicle 2314, mission 7154, a Group 1 digital payload, was launched on 29 June 1963 using a TAT booster, as did all subsequent 698BK launches. It established a program record of 10 days of orbital operations and produced approximately 140,000 good intercept words. The first wideband analog mission, 7156, was launched on vehicle 2316, 27 February 1964, with a mission life of 12 days. The value of the data was degraded by erratic operation of the wideband AMIE helical-scan tape recorder, mostly caused by tape "gunking" of the recording heads, resulting in frequent loss of data from one or two of the four recording heads. The down-link data

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

~~TOP SECRET~~
~~NOFORN/NOCON~~



6988K/TAT/Agena launch, Vandenberg Air Force Base, 29 June 1963

~~Top Secret~~
Handle via BYEMAN-PALENT-KEYHOLE-
COMINT Control Channels jointly
BYE-9197/94

~~Top Secret~~
~~NOFORN-ORCON~~

limited the analog data bandwidth to about 750 MHz and further degraded the data. A previous payload named HAYLOFT, mission 7210, had been orbited as an auxiliary payload on the POPPY Program launch of 11 January 1964 as a test bed for the AMIE recorder and KW-26 encryptor.

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13

Project 698BK, vehicle 2316, also carried an auxiliary payload that was to become an integral part of future Project 770 missions. The story of this payload began in Garland, Texas, a little over two years earlier, at the Electronic Systems Division of Ling-Temco-Vought (LTV). By the summer of 1962, Maj Copley had instituted regular monthly meetings to review the status of all the Program A SIGINT projects. Frequently these meetings would be held at the facility of a payload contractor. Organizations and representatives typically attending, in addition to Copley and/or his newly assigned assistant, Capt John O'Connell, would be EO 13526 3.3 from the Office of ELINT (OEL) at CIA (who was assigned to assist Copley in interpreting requirements and evaluating payload configurations), EO 13526 3.5(c) from NSA, Eldon Sasser from SAC, Don Wipperman from the US Air Force Security Service

EO 13526 3.5(c). EO 13526 3.3(b)(1)>25Y

(AFSS), and on occasion, representatives from other government organizations, plus LMSC and the payload subcontractors. George Price, Bill Harris, and Vince Henry of LMSC would present the project status, which would be followed by a discussion of problems or changes necessary. It was not unusual for new payload ideas to be presented at these meetings, followed by discussion of their merits.

Introduction of the new auxiliary payload came about in exactly this way. Gene Kieffer, President of LTV Electronic Systems Division (later E-Systems) in Dallas, Texas, had approached both Price and Copley about an interferometer-type payload that promised to obtain EO 13526 location accuracy from a 275-mile-high orbit. At a meeting in October 1962 at the LTV E-Systems facility, Kieffer presented the results of an EO 13526 1.4(c)<25Yrs aircraft test that supported this accuracy prediction when translated to a EO 13526 1.4(c)<25Yrs space payload targeted against the new EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

EO 1.4.(c)

PL 86-36/50 USC 3605

PL 86-36/50 USC 3605

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~~NOFORN ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

version of the S-band system that shot down F. Gary Powers' U-2). The payload idea gained wide acceptance and was named BIRD DOG for its pointing accuracy. Despite some concern for sensi-

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13

BIRD DOG was included as an auxiliary payload on 2316 and the following three vehicles, 2315 and 2317 of the 698BK Project and 2702 of the 770 Project.

The interferometer used phase measurements to describe the angle-of-arrival of a signal based on intercept of a single pulse. A digital word was formed in the payload, identifying the location cell by the phase measurements of the intercept. New digital words were formed for each of the multiple hits on the same radar while the emitter was in the spacecraft field-of-view. Digital words that described the same signal parameters and whose cells were in an approximate straight line parallel with the flight path of the spacecraft were combined to produce more accurate locations than was possible with a single direction-finding hit. The digital payload output was preprocessed at LMSC to correct for vehicle attitude and receiver and antenna calibration. These data were sent to NSA, where intercepts were combined and emitters identified. SAC also received and processed the same data for direct entry into the SIOP. BIRD DOG produced the first high volume locations with accuracies better than EO 13526 1.4(c)<25 Accuracies were often as good as EO 13526 1.4(c)<25Yrs.

Vehicle 2315, mission 7155, a Group 2 digital payload, was launched on 3 July 1964. It operated for 17 days and pro-

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

The last Project 698BK digital payload, 2317, mission 7157, carrying a Group 3 digital payload, was launched on 3 November 1964 and operated for four days. In addition to the digital output, to supplement the technical intelligence (TI) output of the wideband analog missions, the detected video output from the receivers was recorded in analog format on a 100-kHz bandwidth Leach magnetic recorder. The analog data proved to have limited value since the radar pulses had to be "stretched" to fit the 100-kHz bandwidth of the recorder, thus preventing effective analysis of the "fine grain" characteristics of the radar pulses needed for the TI mission. The location accuracy of the 698BK digital data provided to SAC and NSA had improved to approximately

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

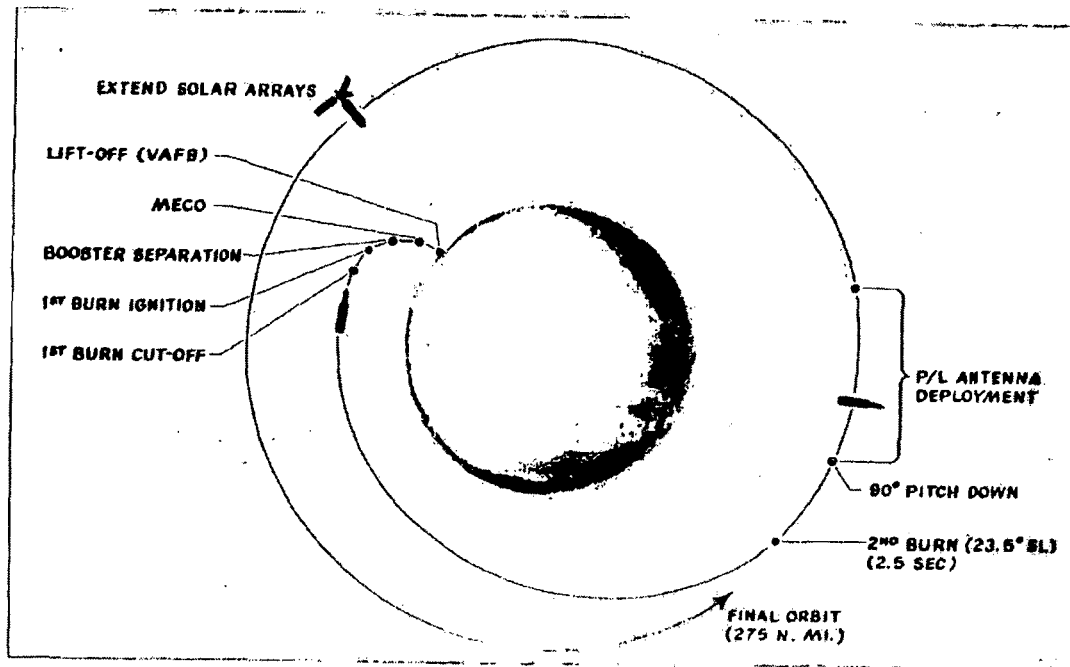
Also launched on vehicle 2317 was the auxiliary payload BIRD DOG 3. This version used an inflatable antenna system

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

the antenna proved to be incapable of withstanding orbital conditions and collapsed, completely ending thoughts of low-frequency BIRD DOGs. A powerful ground camera snapped a picture of this subsidiary payload in orbit and it was an ugly, wrinkled sight!

~~Top Secret~~
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COMINT Control Channels jointly
REF 919792

Top Secret
 Handle as STRIKE/INTEL/REF/OPS
 COMINT Control Channel Only
 REF/OPS/INTEL



Typical injection trajectory, Project 698BK and 770

Top Secret
 Handle as STRIKE/INTEL/REF/OPS
 COMINT Control Channel Only
 REF/OPS/INTEL

After the earlier June 1962 launch of the Group 2 digital payload, mission 7152, all of the Project 102/698BK digital data were preprocessed by Lockheed in EO 13526 3 using their CDC 1604 computer. In preparation for the processing of 7152 digital data, it was necessary to update the previously used F-1 processing capability to match the new payload format. The F-1 ground data handler was not useable without major changes in hardware logic, and it was recognized that, with the advances in data processing technology, writing computer software was much more effective than constantly rebuilding hardware logic circuits to match new formats. A program was written for the CDC 1604 computer to translate the 10-kilobit F-2 down-link data into radio frequency, pulse-width, pulse repetition rate, and time data for each intercept. A second program validated this data and translated time into geolocation using the vehicle ephemeris.

Since the project number was still 102 at that time, given the contemporary popularity of a St. Louis beer known as Brew 102, it wasn't strange that these computer software programs became known as BREW 1 and BREW 2. In the summer of 1962 when the CDC 1604 computers were upgraded to much more capable CDC 3200s and the project name was changed to 698BK, it seemed only logical to change these program names to the more conventional ferret system terms, ROOK and EO 13526 3

The validated ELINT output of these software programs was sent to both NSA and SAC. Once NSA had assumed the responsibility for processing ELINT data

in the fall of 1961, NSA and SAC had become parallel processors. A Memorandum of Understanding between NSA and SAC was signed on 11 September 1962 that clarified these ELINT processing arrangements. SAC would process certain space vehicle ELINT signals data in response to the operational intelligence need and in satisfaction of tasking instructions provided by NSA. NSA would provide planning and technical support and guidance.¹¹



Maj Eldon Sasser

A practical demonstration of this cooperation occurred late in 1962, when Raymond B. Potts of NSA Research and Development (R&D) met with Maj Eldon Sasser and Capt Donald Wagner, SAC 544th Reconnaissance Technical Group (RTG), at NSA, Fort Meade, Maryland, to discuss a SAC requirement for a special-purpose signal deinterleaver and photographic output to process U-2 and satellite data collected in dense signal environments. The deinterleaver consisted of special-purpose equipment that accepted analog signals on magnetic tape and used digital



Mitford M. Mathews

counters and hardware logic to separate overlapping signals (deinterleaving them) of the same pulse repetition interval (PRI) before filming the analog data for analysis. Mitford Mathews, Assistant Director for NSA R&D, approved the development of the special-purpose deinterleaver and proposed to develop an analog-to-digital converter and the necessary computer software to provide an automated analysis system for SAC. Mathews personally developed the software and Potts directed the development of the analog-to-digital converter in-house at NSA, Fort Meade. Potts also obtained a five-channel photographic strip film unit to photograph the output from the special-purpose deinterleaver from Space Technology Laboratories (STL) in El Segundo, California. The work at STL was under the direction of Douglas Royal. This equipment was installed at SAC headquarters in Omaha, Nebraska, in early 1965.*12

* The special-purpose deinterleaver was a hardware logic device that would open logic gates or windows so that all the analog pulses from a particular radar would be available for filming on one channel or track on the film. This system would separate up to five signals from five different radars with the same PRI. The filming device would present five parallel tracks of data—one from each deinterleaver output.

Since the initiation of the 698BK Project in June 1962, the project had been operating under the security of SECRET, SPECIAL HANDLING, even though the balance of the NRO projects by now were all operating under the BYEMAN security system, including the POPPY project. In order to achieve uniformity, 698BK was brought under the BYEMAN system in November 1963 and the program number was changed to 770. Since the contracting was switched from Air Force SECRET, SPECIAL HANDLING to SECRET/BYEMAN, it was necessary to change the vehicle numbering system to disguise the connection between 698BK and 770. The first 770 Agena vehicle became 2701, which was a POPPY Project launch in March 1965.

As a consequence of these changes, Copley had been moved from the DISCOVERER Program Office back to the nearby Air Force Special Projects Office (SAFSP) in El Segundo in November 1962. Within SAFSP, all the SIGINT projects were assigned to the SIGINT Project Office, EO 135 with Col Robert Yundt as chief. Copley became Chief of the Payload Section, EO 1352. In July 1964 Copley was transferred from Los Angeles to Andrews AFB, Maryland, and Capt John O'Connell, who had joined Copley during the DISCOVERER days, took charge of EO 1352. To provide O'Connell with adequate support, in the summer of 1964 Yundt requested technical assistance from The Aerospace Corporation, similar to the support that firm was providing the photo programs. An Aerospace group under Sandy Evans was formed for this purpose. He assigned



Col Robert W. Yundt

Daymond Speece to support software developments. Maj John G. Kulpa was assigned as Chief of [EO 13526 3.3(b)(1)] shortly thereafter.

To further improve relationships between the NRO and the NSA in their collection and processing activities, the DNSA proposed on 28 January 1964 to

[EO 13526 3.5(c)]

ward, LtCol George Barthel, USAF, was assigned to the Sunnyvale area as the SAC representative to the STC and [EO 13526 3.3(b)(1)]

Also at this time, [EO 13526 3.5(c)] US Army, who had been recently assigned to NSA from the CIA intercept site at [EO 13526 3.3(b)(1)], was assigned to the satellite data processing area. In October 1965,

following a series of monthly trips to Sunnyvale, California, [EO 13526 3.5(c)] was assigned to represent NSA at the STC and [EO 13526 3.3(b)(1)] Yundt was unsure of [EO 13526 3.5] NSA motives and required that he call [EO 13526 3.3(b)(1)] every time he visited [EO 13526 3.3(b)(1)] and to log in and out when he did so. Eventually, [EO 13526 3.5] convinced Yundt that [EO 13526 3.5] efforts were desirable and this unnecessary prohibition was lifted.

The first Project 770 mission was vehicle 2702, mission 7158, launched on 16 July 1965, the legacy of vehicle 2316, mission 7156, which had been the first wideband analog payload (it was launched on 27 February 1964). It was a Group 3 configuration covering 640 MHz to 8.28 GHz. It operated for 51 days and marked the first effective use of solar arrays on a SIGINT vehicle (vehicles starting with 2316 had solar arrays, but battery problems prevented effective use or very long life). NSA had been planning to process these data since late in 1962, when NSA's Ray Potts responded to a requirement from NSA operations and conducted a study of the analog-to-digital conversion needs to process the analog data that would be collected by the 698BK analog system. A special high-speed analog-to-digital converter, BEERMAN, was proposed and subsequently developed in-house in 1963 by NSA R&D.

The BEERMAN equipment had been operated in the R&D spaces at NSA to support the mission 7156 and 7210 launches in 1964, and it used the R&D CDC 1604 computer as the buffer tape controller to provide temporary digital-data storage and control for the digital-tape recorders.

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 135

EO 13526 1.4(c)<25Yrs, EO 13526 3.3(b)(1)>25Yrs, EO 13

Everything was in place to support mission 7158, the first mission whose output data would record predetection in 6-MHz bandwidth analog form and transmit to the ground without encryption. Computer programs had been written by NSA to process this data and to produce locations and identifications. The computer printouts were also used to scan the data for signals analysis. Considerable manual analysis of the analog data and the computer output was required to produce useable results from this first wideband analog mission. Experience gained in processing and analyzing the data from this mission in 1965 provided valuable design information for follow-on systems.¹⁵

Vehicle 2703 also carried an auxiliary payload proposed by LTV E-Systems as a follow-on to the BIRD DOG series. This version, known as SETTER, was designed

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c), EO 13526 3.3(b)

the best achieved to that date. A byproduct of this best-ever accuracy was the discovery by Ed Stillman of LMSC that the vehicle was yawing in response to the interaction of the vehicle's magnetic field with the magnetic field of the Earth. Duane Scott of the guidance department was able to calculate these forces and compensate for them by placing magnets appropriately on the vehicle structure to counteract the natural forces. This procedure was used to damp unwanted oscillations on the following MULTIGROUP and STRAWMAN missions with great success.

By the end of 1965 it was becoming increasingly obvious that EO 13526 3.3(b) was bursting at the seams. Moreover, EO 13526 3.3(b) was not designed to provide the electronic security required, particularly for personnel involved in data analysis at the product level and for the COMINT payloads, where testing and processing of sensitive data were very difficult. The need for a more secure facility, adequate to support expanded testing and processing requirements, became obvious to contractor and government personnel alike. Bill Harris and Bill Troetschel, LMSC, responsible for the AFTRACK packages; George Price, LMSC, in the 698BK area; Jerry Christensen, LMSC, in processing EO 13526 3.3(b); US Army, representing NSA, and LtCol George Barthel, US Air Force, representing SAC, all lobbied John Schaub, LMSC Program Manager, to press for a new building adequate for all their activities. Schaub listened and with the backing of Fritz Oder, LMSC Vice President for Programs, and Jim Plummer, also an LMSC Vice President, convinced Dan Haughton, LMSC Chairman of the Board,

to invest in an appropriate facility. Thus, construction of EO 13526 3.3(b) was initiated in the LMSC complex at Sunnyvale, California, and was completed just in time to process the output of the first of the new MULTIGROUP payloads, launched 28 December 1966.

EO 1.4.(c)
PL 86-36/50 USC 3605

MULTIGROUP Launches

By the summer of 1962 it was becoming clear to many on the 698BK development team that improvements could be made in the design of the 698BK payloads, which had a set of fixed frequency combinations labeled Group 1, 2, or 3 and covering EO 13526 1.4(c)-25Yrs that had to be selected long before launch. No other frequency coverage was possible without major payload modification. This was primarily because the antenna configurations were very difficult to change without major redesign and testing. Additionally, the command and control support systems were limited in flexibility by the small number of commands available.

To develop a payload more responsive to changing requirements, LMSC and AIL initiated proposal activity to develop a new payload configuration to be called MULTIGROUP. It would have eight frequency bands, each with a matched antenna. Any four bands could be flown on any given mission with minimal turnaround time. It also would be capable EO 13526 1.4(c)-25Yrs, EO 13526 3.5(c)

system and an on-orbit programmer would also improve system flexibility.

In June 1963, LtCol John Copley, along with George Price, Chief of the LMSC Payload Office, briefed the members of the Washington NRO staff (SAFSS) on details of the new payload project. In November 1963, approval to initiate development of the MULTIGROUP project was received from Brockway McMillan, who had replaced Joseph V. Charyk as the DNRO in April 1963. In April 1964 McMillan approved launch of the first MULTIGROUP for April 1966, plus three additional launches in FY67. This was later reduced to three total launches when the successor STRAWMAN project was approved in September 1966.

The configuration of the first Project 770 MULTIGROUP vehicle 2731, mission 7161, was similar to the previous Project 770 Agena launch vehicle 2703 with the exception of the new payload and improved UHF command system. It was the last Project 770 mission to use the TAT booster of the former 698BK project. The launch date slipped to 28 December 1966, mostly because of changes caused by concerns over the technical characteristics of the payload. The numbers and density of Soviet radars were increasing rapidly, and signal overlapping and interference were becoming difficult to deal with. Additionally, the presence of high-power continuous-wave (CW) signals (such as television and high-power point-to-point communications) had made processing of 698BK payload data even more complex. These signals tended to overpower the antenna's

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

signal-processing programs. To address these technical problems, the bandwidth of

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

making it possible for the data processors to, at a minimum, detect the presence of interference.



MGen John L. Martin, Jr.

EO 1.4.(c)
PL 86-36/50 USC 3605

BGen (later MGen) John L. Martin, Jr., named Director of Special Projects at El Segundo, California, on 1 July 1965, became concerned about the efficacy of performing a system test of the integrated payload and vehicle system in EO 13526 3.3(b)(1) at Sunnyvale and then disassembling it for shipment to Vandenberg AFB for launch. This required reassembly of the system at the Vandenberg vehicle assembly building and retest prior to launch. Not only did this process cause excessive wear and tear on the system, but it also made very attractive the option of shipping the payload and Agena from Sunnyvale with problems ("open items") that presumably would be solved or fixed at Vandenberg. After considerable study, a new, more rapid factory-to-pad system of processing the payload and vehicle as a unit was initiated for

Agena vehicle 2731. Named FASTBALL, it set as a goal 17 days from receipt of the payload at Vandenberg AFB to launch,

LtCol Jack Sides, who had replaced Yundt as the ^{EO 13526 3.5(c)} Project Director, felt confident enough to direct the launch on 29 December 1966, just 25 working days after 2731 had arrived at the base. Despite the misgivings of many of the contractors and launch crew, and much to the delight of Sides, the launch was perfect and the spacecraft operated with no problems on orbit. Sides, who was retiring from the Air Force at the end of December, considered this an excellent Christmas present! His successor, Col David D. Bradburn, presided over the remaining two MULTIGROUP launches with equal success.

Project 770 MULTIGROUP Agena Vehicles 2732 and 2733 were boosted into orbit by an improved Thor booster using CASTOR solid rocket motors replacing the former XLR-81s. The extra thrust made it possible for vehicle 2732 to carry an additional payload called DONKEY, which used a 6-foot parabolic "wrapped rib" dish antenna that deployed on orbit, in addition to the originally scheduled SETTER 1A and MULTIGROUP 2 payloads. MULTIGROUP set new records for length of on-orbit operation. Vehicle 2731 lasted over five months, the DONKEY payload on 2732 went a few days longer, and 2733 produced data for almost 15 months! A great deal of this success is attributable to improved solar arrays and batteries developed for the Agena D vehicle.

The more sophisticated commanding and programming capability of these payloads, which permitted many different adjustments of the payloads during each orbital collection pass, stimulated an effort to use the collection system in the most effective way. In July 1964 ^{EO 13526 3.5(c)} of NSA joined the staff at the Satellite Operations Center (SOC) at SAFSS and became a part of the effort to translate USIB guidance into vehicle operations responsive to this direction. NSA tasking messages were sent to the STC from the SOC, providing both long-term and immediate operating direction. These "ITEMY" messages, as they were called, combined NSA and NRO interpretation of USIB guidance. Alerts to upcoming Soviet activities were provided by NSA through their Defense Special Missile and Astronautics Center (DEFSMAC) so that payload tasking could be responsive.

In the late summer of 1966, the Director, NSA, LGen Marshall S. Carter, US Army, and Ray Potts visited the SAFSP contractor facility at LMSC while ^{EO 13526 3.3(b)} was under construction. The possibility of expanding NSA's participation with the Air Force and its contractor, was discussed with the local SAFSP representative and with ^{EO 13526 3.5(c)} the NSA representative at LMSC. On 28 October 1966 NSA forwarded to the Director SAFSP a concept paper regarding the establishment of an NSA Support Detachment (NSD) at Sunnyvale, California.¹⁶

Completed in December 1966, ^{EO 13526} was put to immediate use. Vince Henry of LMSC, now manager of the ^{EO 13526} payload program, had established a need

for a secure test and checkout area. This need dovetailed well with the government need for a secure data-analysis facility. The DNSA forwarded a letter to the Director, SAFSP, on 14 February 1967 describing the scope and nature of a West Coast NSD at [EO 13526 3.3(b)] and advising that SAC had agreed to participate in the detachment to support NSA processing and to serve as the SAC liaison officer.¹⁷ The NSA Assistant Director for Production, Oliver Kirby, subsequently forwarded a memorandum to DNRO Alexander H. Flax on 29 February 1967, informing him of the plans and rationale for the detachment.¹⁸ On 15 March 1967 the Director SAFSP concurred with the objectives and functions outlined for the NSD and agreed to arrange for contractor support by LMSC.¹⁹

The NSD was established in July 1967 at LMSC [EO 13526 3.3(b)] (with [EO 13526 3.5(c)] [redacted] had resigned from the Army in March 1967 and converted to civilian status with NSA, reporting to Potts (K4/SP). Assigned to [EO 13526 3.5(c)] were four analysts: [EO 13526 3.5(c)] [redacted]

[redacted] was also assigned as an NSA intelligence information research technician. Also working for [EO 13526 3.5(c)] were Maj Bob Jackson, US Air Force, and Maj Billy Thornton, US Air Force, of Operating Location 65 (OL65), SAC. Two analyst positions (operating stations) were quickly set up using Mincom 1-MHz recorders that [EO 13526 3.5(c)] [redacted] obtained," although the recorders were originally intended for George Cotter, already a senior official at NSA! Later they were replaced by properly ordered recorders, and Cotter got his Mincoms back. This

EO 13526 3.5(c)

capability was augmented by signals analysis support from LMSC that was later expanded by the establishment of an LMSC Special Signals Analysis Team (SSAT), headed by John Riley, which did in-depth analysis of new and unusual intercepts. The initial mission for the NSD was to prescan data and do preliminary analysis on signals of interest. In addition, the detachment was to support all West Coast NSA operations and interfaces with the SAFSP and their contractors located on the West Coast. To do this, the detachment had direct communications with K4/SP at NSA using a dedicated secure teletype link known as the "SUNCOM."

The NSA Support Detachment (NSD) activities pretty well filled up one side of [EO 13526 3.3(b)(1)>25Yrs] [redacted] was built essentially in the form of two mirror images, with space between the two halves of the building to park and check out the calibration vans. On the processing side, the new building made it possible for NSA to delegate certain ELINT data processing

and analysis activities to LMSC personnel, under NSD direction. In December 1966 LtCol Jack Sides, EO 135 and Potts agreed to place an NSA engineer as an integrated member of the SAFSP staff in El Segundo to manage the SAFSP processing operation at LMSC in Sunnyvale (both NRO and NSA responsibilities). EO 13526 3.5(c)

was assigned from NSA, K4/SP, and arrived at EO 135 in February 1967. He was welcomed by Col David D. Bradburn, who by then had succeeded Sides as head of EO 135

This action coincided with the implementation of the Mission and Data Services (MADS) contract with LMSC to support processing activities in EO 13526 3.3 EO 135 and also to support analysis activities of the NSD. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)

An action occurred on 29 September 1967 that illustrates the spirit of cooperation engendered by the close working relationship of Bradburn, EO 13526 3 and Potts. NSA K4/SP was notified by message from EO 135 that the Air Force budget would not permit their support of NSA processing operations at LMSC. Three and a half hours later Potts sent a message to EO 135 coordinated through all appropriate senior officials and NSA Deputy Director Tordella, transferring \$370,000 to fund a compatible computer facility in EO 13526 3 to process data for NSA.²⁰ This led to the negotiation of a formal agreement between Bradburn EO 13526 3.5 and Potts entitled "SAFSP SUPPORT FOR NSA PROCESSING OPERATIONS." It provided for a compatible Data Processing Facility implemented as a joint NRO/NSA

EO 13526 3.5(c)

activity at EO 13526 3.3(b) which was essentially parallel to the satellite data processing capability within NSA.

This combined payload development and processing facility in EO 13526 3.3(b) provided the flexibility necessary to make maximum and effective use of personnel and equipment on a mission-by-mission basis. Additional benefits included improved timeliness in processing, improved feedback for tasking operations, optimized interaction of processing considerations in the design of SIGINT payloads, and significant economies by having an integrated approach to collection and processing operations. This effort was provided by the SAFSP MADS contract with LMSC. The individual task orders under the contract were defined either as NRO or NSA data-processing functions.

NRO processing included payload support and preprocessing. NSA, through the EO 135 MADS contract, provided technical direction and selected processing and analysis by LMSC. This was the first use

- COMMAND GENERATION
- DATA ANALYSIS
OPERATING DECISIONS
- T/M DATA
- ORBITAL VECTORS
- COMMANDING INFORMATION

TM & P/L
DATA

COMMANDS

 TO NHS

MADS

STC

MICROWAVE

VTs

TO
GUAM

HTS

TRACKING STATIONS

- SGLS RANGE AND ANGLE TRACKING
- SGLS PCM DATA LINK
- SGLS DIGITAL COMMAND LINK
- WIDEBAND AND NARROW BAND ANALOG RECORDING
- COMPRESSED P/L DATA

Data collection network, Air Force Satellite Control Facility (AFSCF)

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Handle via DRYAD, STALENT-AE (HDCI-F)
COMINT Control Channels Only
REF 918794

~~TOP SECRET~~
~~NOFORN, COMCON~~

of contractor processing by NSA. Contractor signals analysis support had previously been established and used by NSD in early 1967.²¹ NSA arranged for special funding and transferred funds to [redacted] for the NSA share of the costs. Within [redacted] [redacted] EO 13526 3.5 was responsible for technical surveillance of the MADS contract. Potts was responsible for the NSA participation in the program.

Within [redacted] EO 13526 3.5(c) the SAFSP Assistant Deputy for Field Operations, Lt Col Rich Gray, was responsible to [redacted] EO 13526 3.5 for all data-processing operations performed on-site. The detachment chief, [redacted] EO 13526 3.5 and other NSA representatives as appropriate, provided the technical guidance for the NSA data processing and were technically responsible for contractor performance and acceptability of the final product. A Data Handling and Operations Plan (DAHOPS) identified responsibilities, milestones, effort, and equipment required. Software that had been developed by NSA was provided to the MADS contract. NSA sent knowledgeable personnel to assist the contractor in getting the system operational and in training personnel for the particular job.²² The establishment of the joint processing facility in LMSC [redacted] EO 13526 3.5 with the Air Force, NSA, and the contractor working closely together soon removed most, if not all, the suspicions and distrust that had previously existed.

On the digital processing side, NSA provided a CDC-6400 computer, initially to handle MULTIGROUP digital data (Ray Potts intervened with CDC President Bill Norris to secure the computer on time). The CDC-6400 computer was installed in

[redacted] EO 13526 3.3(b) in the fall of 1967. NSA sent the software developed to process MULTIGROUP/SETTER [redacted] EO 13526 3.5(c) Computer Processing Group (C Group) spent many long hours at [redacted] EO 13526 3.3(b) helping Jerry Christiansen and his LMSC crew to get this software installed and modified for the 17 January 1968 launch of MULTIGROUP 3. The MULTIGROUP/SETTER data were the first to be completely contractor-processed at LMSC under the [redacted] EO 13526 3.5 MADS contract under NSA technical direction. The results were sent directly via secure communications links to NSA's Operational ELINT Organization, then headed by [redacted] EO 13526 3.5(c) who had replaced [redacted] EO 13526 3.5(c) for reporting to the Intelligence Community and to SAC for integration into the SIOP. DIA received the radar identification and location data from NSA for inclusion in the DIA EOB database.

To handle the wideband analog, RCA model TR-22 CVR predetection recorders were used at the ground sites and processing centers. The TR-22 recorders were commercial television recorders modified for continuous video recording (CVR), with improved technical characteristics to meet the requirements for predetection instrumentation recording. NSA specified the recorders to be used and a combined purchase was made for all recorders by [redacted] EO 13526 3.5. Special processing and analysis equipment was developed jointly by NSA and [redacted] EO 13526 3.5. NSA, through [redacted] EO 13526 3.5 acquired a special RCA one-tenth-speed TR-22 CVR recorder to be used for detailed signal analysis.

The predetection analog data, along with other payload digital data from MULTIGROUP, were filmed at EO 13526 3.3

using a continuous strip of photographic film. NSD and LMSC (under detachment direction) selectively analyzed the film using the Analog Processing Equipment (APE) developed by Ben Gardner of Gardner Associates, San Diego, California. The original analog tapes were sent to NSA for technical analysis. At NSA the analog tapes were processed through the BEERMAN analog-to-digital converter, which was modified to accept the payload time and receiver data, which were merged to provide a digital tape output for computer processing. The computer printouts were used to produce radar locations and to scan the data for signal analysis. Considerable manual analysis of the analog data and the computer printouts was required to produce useable results.

The technical analysis efforts at NSA and at EO 13526 3.3(b) were very closely coordinated. The large volume of data required the combined efforts of all the technical analysis people available. Both analysis groups screened the data for signals of interest. NSA used tip-off from other sources or data and the results of intercepts from POPPY and the EO 13526 3.3(c) to identify dates and times of particular interest to be examined. Duplicate analysis was generally avoided except in those cases where the combined expertise of all the analysts and the payload designers was required to resolve analysis problems presented by unusual signals.

An excellent example of these combined efforts occurred in the analysis of a EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



Improvements to the digital EOB payloads resulted in significantly more accurate radar locations. Back in 1960-61, the original SAMOS collected three successive pulses from the cone of coverage. Processing of the data from each three-pulse group using overlapping circles produced locations with accuracies of about

Flight summary: Program A, Agena-based low-orbit SIGINT satellites

MISSION NUMBER	PROJECT and PAYLOAD	MISSION (All payloads are ELINT)	OPERATIONAL LIFETIME					LIFETIME Days
			1960	1961	1962	1963	1964	
N/A	SAMOS 1 (F-1 PAYLOAD)	GS	10/11					Booster failure
N/A	SAMOS 2 (F-1 PAYLOAD)	GS	1/31	2/1				1
7151	102 Group 0-D	EOB		2/21	2/27			6
7152	102 Group 2-D	EOB			6/18			1
7153	698BK Group 1-D	EOB			1/16	1/18		2
7154	698BK Group 1-D	EOB				6/29 7/9		10
7156	698BK Group 1-A	DC/TI				2/27	3/11	12
7212	BIRD DOG 2	EO 13526 1.4				2/27	3/13	15
7155	698BK Group 2-D	EOB					7/2 7/7	5
7211	BIRD DOG 1	EO 13526 1.4					7/3 7/8	5
7157	698BK Group 3-D	EOB					11/3 11/7	4
7213	BIRD DOG 3	VHF EOB					11/3	Antenna failure
7158	770 Group 1	DC/TI					7/16 9/5	51
7226	BIRD DOG 4	EO 13526 1.4					7/16	Power supply failure

GS = General Search
TI = Technical Intelligence

EOB = Electronic Order of Battle
ABM = Antibalistic Missile

DC = Directed Coverage
VHF = Very High Frequency

Flight summary: Program A, Agena-based low-orbit SIGINT satellites (continued)

MISSION NUMBER	PROJECT and PAYLOAD	MISSION (All payloads are ELINT)	OPERATIONAL LIFETIME					LIFETIME Days/ mos
			1966	1967	1968	1969	1970	
7180	770 Group 3-D	EOB	2/9 9/6					7 mos
7228	SETTER 1	S-BAND EOB	2/9 3/22					40 days
7181	770 MULTI-GROUP 1	GS/DC/TI EOB	12/28	6/17				5 mos
7229	SETTER 2A	S-BAND EOB	12/28	6/19				5 mos
7182	770 MULTI-GROUP 2	GS/DC/TI EOB		7/24 12/28				5 mos
7230	SETTER 1B	S-BAND EOB		7/24 12/28				5 mos
7183	770 MULTI-GROUP 3	GS/DC/TI EOB			1/17	4/3		14 mos
7232	SETTER 1B	S-BAND EOB			1/17	4/3		14 mos
7184	STRAWMAN 1; THRESHER 2	GS/DC/TI EOB			10/5	9/27		12 mos
7233	REAPER 1	GS/DC/TI EOB			10/5	9/27		12 mos
7238	CONVOY 1	ABM DC/TI			10/5	9/27		12 mos
7185	STRAWMAN 2; THRESHER 2	GS/DC/TI EOB				7/31	9/27	13 mos
7234	REAPER 2	GS/DC/TI EOB				7/31	9/27	13 mos
7239	CONVOY 2	ABM DC/TI				7/31	8/30	31 days

GS = General Search EOB = Electronic Order of Battle DC = Directed Coverage
 TI = Technical Intelligence ABM = Antibalistic Missile

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Flight summary: Program A, Agena-based low-orbit SIGINT satellites (continued)

MISSION NUMBER	PROJECT and PAYLOAD	MISSION (All payloads are ELINT)	OPERATIONAL LIFETIME				LIFETIME
			1970	1971	1972	1973	Months
7166	STRAWMAN 3; THRESHER 3	GS/DC/TI EOB	8/26		2/1		17
7235	REAPER 3	GS/DC/TI EOB	8/26		2/1		17
7167	STRAWMAN 4; THRESHER 6	GS/DC/TI EOB		7/16		3/23	17
7236	REAPER 4	GS/DC/TI EOB		7/16		3/23	18
7240	HARVESTER	GS		7/16	12/16		5
7168	STRAWMAN 5; THRESHER 5	PROGRAM CANCELLED - NO FLIGHTS					
7237	REAPER 5						

GS = General Search

TI = Technical Intelligence

EOB = Electronic Order of Battle

ABM = Antiballistic Missile Radar

DC = Directed Coverage

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EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c), EO 13526 3.3(b)(1)

radars in Vietnam became a high priority.
EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c), EO 13526 3.3(b)(1)

The technical capability provided by MULTIGROUP wide band predetection collection and the combined analysis by NSA headquarters, the NSD detachment, and LMSC of the collected data resolved

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c), EO 13526 3.3(b)

An important development occurred in the spring of 1968 when data on SA-2 surface-to-air missiles and other defensive

STRAWMAN Launches

Even before the first MULTIGROUP launch in December 1966, the payload and its support systems had been outdated by the rapidly changing electronics technology and collection requirements of the 1960s. The expectation that interchangeable receiver and antenna modules would give MULTIGROUP more flexibility did

not hold up when the realities of preparing the spacecraft for launch were confronted. A testing program at both the subsystem and system level was absolutely required to qualify any payload for launch. Once the system had been subjected to vacuum, thermal, mechanical, and electrical qualification testing, there was no way a receiver and antenna module could be changed (for different frequency coverage) without repeating the entire test process. Although MULTIGROUP did have different configurations on each mission, the configuration had to be determined six to eight months in advance. In the case of Agena vehicle 2733, the last MULTIGROUP, there was time to change the configuration to make the payload collection more responsive to the ABM/AES threat. It would have been desirable to change 2732 also, but the necessary six- to eight-month slip in schedule was unacceptable.

In the summer of 1964, ^{EO 13526 3} [redacted] from NSA joined ^{EO 13526} [redacted] as an integrated member of the payload staff, and at approximately the same time Bob Yundt requested technical support from The Aerospace Corporation. By the summer of 1965, ^{EO 13526} [redacted] along with Sandy Evans of Aerospace, through both an in-house effort and contractor studies, began defining an improved payload that would combine the capabilities of the MULTIGROUP payload, built by Airborne Instruments Laboratory at Deer Park, New York, and the SETTER payload, built by E-Systems at Dallas, Texas. Although these payloads flew together on all the MULTIGROUP missions, they operated independently, thereby requiring considerable duplication of support-system functions. The SETTER

payload provided excellent emitter location accuracy (± 5 miles), but it could not operate at frequencies lower than 2 GHz due to excessive size of the multiple antennas required for an interferometer-type payload. MULTIGROUP used single spiral antennas that divided the target area into sectors and used single-pulse phase comparisons to achieve geolocation. Though not as accurate as SETTER, it was capable of determining location within ± 20 miles at frequencies as low as 59 MHz. Using improved versions of these payloads sharing a new solid-state core memory for the digital data and an improved tape recorder called a data storage unit, for the wideband analog data, the proposed STRAWMAN payload offered increased flexibility combined with improved payload performance. Moreover, room would be available for one additional payload that could share the recorders and other new support systems.

Improvements in the support systems now included adoption of the new S-band Space-Ground Link System (SGLS) developed for the Satellite Control Facilities. This provided a pulse code modulation down-link operating at 128 kilobits per second (kbps) and an inflight-loadable programmer capable of 1,021 commands. There was also a backup command link with 32 discrete commands. For the first time it would be possible to encrypt these links using NSA-provided KGR-29 and KGT-28 equipment. The 6-MHz wideband down-link remained unencrypted.

An improved booster, the THORAD, allowed an increased on-orbit weight of the Agena spacecraft and ELINT payloads

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EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)

The first two STRAWMAN missions carried an auxiliary payload designed to determine detailed characteristics of ABM radars. The first was called CONVOY and

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

for a little over a year, twice the planned lifetime of six months. Agena 2735, launched on 31 July 1969, operated for over 13 months, resulting in a projection of at least a nine-month lifetime for the following launches. Agena 2736 continued the record by lasting for almost 18 months after a launch on 26 August 1970. The final vehicle, Agena 2737, was launched on 16 July 1971 and lasted over 20 months. On this mission the antenna connector to the lower band antenna of HARVESTER failed, thereby eliminating any chance to intercept the SA-5 signals at 5 GHz. This was the only major failure of any of the four vehicles, making STRAWMAN by far the most successful ELINT system to date.

By 1970 NSA had expanded the processing facility at Fort Meade for satellite-collected SIGINT to three CDC 6600 computers, in order to handle the greatly increased volume of data from the POPPY and **EO 13526** missions. Concentration on these programs at Fort Meade was possible because of the resources available at **EO 13526 3.5(c), EO 13526 3.3(b)(1)>25Yrs** **ALL**

EO 13526 3.5(c), EO 13526 3.3(b)(1)>25Yrs All
STRAWMAN, THRESHER, and REAPER
digital data were processed for NSA by
LMSC under the EO 13526 MADS contract in
EO 13526 3.3(b)(1) using the same arrangements
that were established for MULTIGROUP
and SETTER. The necessary software
modifications to take advantage of collec-
tion system improvements to provide more
accurate locations were developed under
the MADS contract for NSA as a joint NSA
and LMSC technical development effort.

In 1970 a CDC 6600 computer replaced the CDC 6400 computer at LMSC to provide the needed three-times increase in

processing capacity and speed to handle the increased volume of data being collected by the new satellite systems. At the same time, a new MADS contract was negotiated by [REDACTED] EO 13526 3.5(c) the NSA integrated member of the [REDACTED] EO 135 staff. This contract provided the needed flexibility to cover premature failure or the extended life of a payload being processed. It also provided for the addition of a new payload to be processed. The funding for the computer and the MADS contract was split between [REDACTED] EO 135 and NSA based on cost-sharing agreements worked out for each mission.

The THRESHER digital EOB collection and processing system produced radar locations with a 15-mile accuracy. The processing of data from THRESHER 2, launched 31 July 1969, produced 9,444 radar locations, including 183 radar locations reported electrically to US forces in Vietnam within hours of intercept. THRESHER 3, launched 26 August 1970, produced 11,519 radar locations with 15-mile accuracy in the first four months of operation. During this same four-month period, REAPER 3, a part of the same STRAWMAN mission, produced 33,915 locations with a 5-mile accuracy.²⁵

All ELINT payloads that were a part of the STRAWMAN collection system—THRESHER, REAPER, CONVOY, and HARVESTER—were connected to the predetection analog recorder in the prime payload. The predetection analog data analysis was split between NSA and the LMSC Special Signal Analysis Team (SSAT), which was working for the NSA detachment (NSD) to make efficient use of

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EO 1.4.(c)
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the limited number of technical analysts. The signal analysis efforts were complementary except for combined efforts on special signals of interest. The all-source and multiple-satellite-source technical analysis was generally done by analysts at NSA.

By 1968 the Grab Bag data system was developed by Joyce Warnkassel of LMSC to store all "left over" satellite data. This included all intercepts that were geolocated but did not meet NSA reporting criteria as valid emitters. This provided a very valuable database for comparison with other data and intercepts to find new high-interest signals for technical analysis. For example, Grab Bag made it possible to identify and correlate data from a frequency agile radar that transmitted signals at different radio frequencies but never stayed on one frequency long enough for the payload to make a pulse repetition interval (PRI) measurement.

Technical intelligence produced by STRAWMAN included ABM radar details

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 1

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5

GHz). These are but a few highlights of the technical contributions of STRAWMAN. The data processing experience gained from the STRAWMAN predetection data analysis provided the basis upon which the EO 13526 3.3(b) data analysis system was developed.

The extensive QRC reporting from THRESHER/REAPER to military forces in Vietnam and Europe continued the project PENDULUM effort initiated with MULTIGROUP/SETTER. All QRC reporting was in less than 24 hours from time of intercept, with the average time from collection to reporting being about 5 1/2 hours. During 1969 there were 41 project PENDULUM reports and 183 in 1970.

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In the spring of 1970, DNRO John L. McLucas reassessed the SIGINT satellite programs in view of budgetary constraints.

Considering the design capabilities of

EO 13526 3.3(b)(1)>25Yrs

[REDACTED] plus the capabilities of other low-orbiting ELINT satellites (POPPY and [REDACTED] EO 13), the STRAWMAN capability seemed redundant. He therefore directed the cancellation of vehicle 2738 and all further development work. Under this plan, the STRAWMAN system continued operations through July 1972.

STRAWMAN represented the culmination of a development effort that started before the first spacecraft was launched and incorporated many pioneering concepts. STRAWMAN's legacy could be seen not only in the development of spaceborne equipment but, even more importantly, in the development of ELINT predetection technical analysis techniques and equipment used by practically every follow-on system.

Chapter 4 References

1. USIB-D-33.6/8, "Intelligence Requirements for a Satellite Reconnaissance System of which SAMOS is an Example" 5 July 1960.
2. MSG ~~SECRET~~/SAFMS SEN-61-29, Part I, Program I, Project 102, 9 March 1961.
3. MSG ~~SECRET~~/SAFMS PHOTO 60-68, 23 December 1960.
4. MSG ~~SECRET~~/SAFMS SEN-61-29, Part 1, Program I, Project 102, 9 March 1961.
5. Letter from Roswell L. Gilpatric, Deputy Secretary of Defense, to Allen W. Dulles, Director of Central Intelligence, "Management of the National Reconnaissance Program," 6 September 1961.
6. SMSG to LMSC, Sunnyvale, CA, fm HQ SSD, SSZDK-12-12-15, "Program 102 Reorientation," signed ~~EO 13526 3 3(D)(1)-(2)(5)(1)~~ Contracting Officer, 27 December 1961.
7. Memo from Col Henry C. Howard, USAF, "A cursory Review of the Evolution of the SOC," July 1968.
8. TWX (S) SAFMS-INS-60-31, quoting memo from Joseph V. Charyk to Chief of Staff, USAF, "Memoranda Relating to the Disposition of Sub System I," 4 November 1960.
9. Ed Stillman interview, 28 February 1991.
10. LMSC Data from 770 History, BIF003/2-021054-69, 22 July 1969.
11. NSA in Space, April 1975, (BYE-19385-75) p. 71.
12. Raymond Potts' personal notes (hereafter Potts' notes).
13. NSA-BYE-17835-4.
14. Potts' notes.
15. Potts' notes.
16. ~~EO 13526 3 3(D)(1)-(2)(5)(1)~~ 1535-6 (TS//B//PK).
17. NSA-BYE-60000-67, and NSA in Space, p. 33.
18. NSA-BYE-60051-67, and NSA in Space, p. 34.
19. NSA in Space, p.34.
20. Potts' notes.
21. SAFSP SUPPORT FOR NSA PROCESSING OPERATIONS (BYE-70872-67)(S//B); Appendix 4.
22. Stillman interview, 28 February 1991.
23. Stillman interview, 28 February 1991.
24. K4SP Status Board, 20 December 1970.
25. ~~EO 13526 3 5(c)~~
26. [REDACTED]
27. [REDACTED]
28. [REDACTED]

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The Air Force AFTRACK and

EO 13526 3.3(b)(1)-25Yrs

The Origins of Quick Reaction SIGINT in Space

In the summer of 1957, Col Frederic C. E. "Fritz" Oder, Director of the WS-117L Project Office at the Air Force Ballistic Missile Division (AFBMD), Inglewood, California, struggled with a very difficult budgetary crisis. Funds for missile and space activity had fallen victim to an austere DOD budget, providing only \$10 million



Col Frederic C. E. Oder

for FY57, with promise of little more in FY58. Oder and BGen Osmond J. Ritland, the Deputy Commander of AFBMD, decided a new approach was required to obtain effective support for the project. Their previous associations with the CIA on the U-2 project led them to the belief that a covert approach would be more

palatable and effective, particularly in view of President Eisenhower's desire to secure "Open Skies." The plan would involve the concept of covert overflight from orbit, participation of the CIA, and a definite project acceleration. Oder's secretary Betty Hawkins called it the "second story" because she was required to keep the details in a file separate from the WS-117L documentation.

The centerpiece of the plan was a covert photo payload with a recoverable film capsule, to be launched on Thor boosters, earlier than the already planned Atlas launches. On 7 February 1958 President Eisenhower, in a meeting with James Gillian, approved the plan. Eisenhower's decision was prompted in part by the launch of Sputnik I in October 1957. Richard Bissell, Assistant Director of the CIA and the U-2 Project Director, had agreed to head the CIA effort that would be responsible for the covert security system and procurement of the photo payload. Also in February 1958, President Eisenhower established the Advanced Research Projects Agency (ARPA) to consolidate all military space systems development. Since ARPA would be responsible for the "white" development of the reconnaissance spacecraft, booster, and all support systems, Oder arranged for his assistant on WS-117L, Capt Bob Truax, US Navy, to be assigned to ARPA to assure

adequate coordination between the white support systems and the "black" CORONA payload. ARPA named the cover for the capsule recovery project DISCOVERER and assigned to it biomedical and other scientific activities to disguise its real mission.

In November 1959 the DISCOVERER project was reassigned from ARPA to the Air Force as an "operational" project. When BGen Robert E. Greer became Director of the SAMOS Project in August 1960, he used the authority of his "second hat" as Deputy Commander of AFBMD to incorporate Col Lee Battle and the DISCOVERER Project Office into his organization. To the unwitting ("white") Air Force and to the world at large it appeared that DISCOVERER was an AFBMD scientific project.



Harold Willis

These events set the stage for the invention of the Agena AFTRACK Project. Harold Willis, who worked for George Miller in the Office of ELINT (OEL) at CIA Headquarters in Langley, Virginia, was

briefed on the CORONA project in 1959 because of concern in the Intelligence Community about the electronic security of the DISCOVERER Agena spacecraft's commanding and tracking subsystems. It was thought that the Soviets might be constructing antiballistic missile (ABM) or anti-Earth-satellite (AES) radars that could be used to track or even interfere with the US tracking of DISCOVERER satellites.

Willis was aware of the role of the Lockheed Missile and Space Company (LMSC), not only as the system engineer for development of the DISCOVERER Project, but also for the Air Force SAMOS Project, which included an ELINT capability called Subsystem F (S/S F). If a Soviet radio frequency (RF) transmission or interference threat existed, there was a good chance that in several years S/S F would be capable of detecting it. But Willis felt the Soviet RF threat could develop much sooner and that waiting several years to detect it was a very risky proposition. In discussions with Bill Harris of the LMSC S/S F payload staff and Maj John Copley, the Air Force S/S F SAMOS payload manager, Willis concluded that a small, self-contained electronic payload permanently attached to the aft rack of the DISCOVERER Agena vehicle would be capable of detecting any Soviet tracking or interference with the S-band beacon used on the Agena vehicle. This critical beacon was used for tracking and commanding the vehicle through US Verloort ground radars. Copley obtained approval and the minimal funding necessary for the payload development, test, and incorporation on the aft rack of the Agena. Willis briefed Bissell

and obtained CIA approval of the scheme in November 1959. The small AFTRACK project was underway.

Although S/S F procurement was done in the white world at the DOD SECRET level, there was general agreement that, in keeping with the covert nature of the CORONA payload, activities associated with the AFTRACK project should be handled on a strict need-to-know basis. In the same way they had provided the Hiller Aircraft Building as a cover for the CORONA development, LMSC arranged office space on Hanover Street in Palo Alto, California, for Bill Harris to conduct payload development and integration activities. Only those people directly associated with the project were made aware of its existence.

From this modest beginning, the concept of a quick reaction capability (QRC) payload that was small, simple, and required minimal development time caught on rapidly. QRC developmental activities for intercept of ELINT had a history in the Air Force dating back to the Korean War, when radar technology was advancing at a rapid rate and collection systems that required years of normal development time were hard pressed to keep up. The plan was to build systems that could be developed in less than nine months, did not necessarily conform to all military standards (even commercial parts were allowed), but could operate reliably for a long enough period to answer urgent questions and provide inputs to the Intelligence Community and to the design of collection systems then under development. The program had started at Wright-

Patterson AFB, Ohio, at the Wright Air Development Center (WADC) in the early 1950s for airborne equipment (primarily in the area of electronic warfare). The ground QRC program was initiated at Rome Air Development Center in 1955, and Copley was chosen as the first ground QRC officer. This background provided the necessary basis for the concept of simple, rapidly developed, and effective AFTRACK payloads fixed to the DISCOVERER Agena vehicle.

The aft rack of the Agena vehicle was well suited to this application. There was considerable vacant space available; the real problems were power and weight. Small, simple, lightweight payloads requiring minimal power were ideally suited to this application. A few extra telemetry points were always available for narrow-band data to be down-linked and a simple on/off command did not overtax the command system. The Agena vehicle developers had only one mandatory requirement: there must be a fuse in the power line of the SIGINT payload so that there was no way the primary payload power system could be jeopardized. Since the DISCOVERER Agena vehicle flew with its major axis perpendicular to nadir (so that the CORONA camera, mounted at right angles to the long axis of the Agena, would always point toward the Earth), it was no problem to install Earth-pointing antennas on the aft rack.

Initially the DISCOVERER vehicle had a lifetime limited to five or six days, owing to complete reliance on battery power. This limited the collection time for the AFTRACK payloads but it was long

enough to collect useful data. When the CORONA Program developed a capability to return two recovery capsules, a system

EO 13526 3.3(b)(1)>25Yrs

[REDACTED] For this it was necessary to add an independent programmer and data link. This was done and many later AFTRACK payloads did operate during the [REDACTED] Very early in the AFTRACK program, recorders had been added (where the telemetry recorder was not adequate) so the payload could collect data over the Soviet Union and return it to the remote tracking stations (RTSs) of the US Satellite Control Facility (SCF) in Sunnyvale.

Security was a serious concern, as mentioned earlier, not only because of the CORONA payload on the same vehicle, but also to avoid providing the Soviets with ammunition to attack President Eisenhower's "Open Skies" efforts in space. Initially the project was handled at the DOD SECRET level and strict need-to-know was enforced. The initial DOD/CIA partnership agreement to participate in a National Reconnaissance Program (NRP) in September 1961 required stricter security. The SAMOS Program Office in El Segundo became the Office of Special Projects (SAFSP). LtCol Ed Istvan, who had been assigned responsibility for Space SIGINT Systems on the SAFSS staff in Washington, was tasked with developing a

more secure system-access control. After struggling mightily with Air Force Security Regulation 205-1 (the SIGINT program was still under DOD security control), he came up with the codeword [REDACTED] to protect AFTRACK payloads. This required all personnel requiring access to sign a [REDACTED] security agreement, and a list of cleared personnel was maintained. Documents were stamped "SPECIAL HANDLING," in the same manner as the Air Force black GAMBIT photo project. The National Reconnaissance Office (NRO) was formed on 2 May 1962. In December 1962 the BYEMAN system was applied to all SIGINT Programs except 698BK, which remained "SPECIAL HANDLING" until November 1962. A new codeword [REDACTED] replaced the Air Force [REDACTED] and Navy POPPY designators. From that time on all space reconnaissance programs have been conducted by the NRO under security control of the BYEMAN system.

In December 1962 Copley was transferred from the DISCOVERER Program Office to the newly formed SIGINT Project Office of SAFSP as Chief, [REDACTED] Division, responsible for payload development. In November 1963, a new program number, 770, was assigned to disassociate the new BYEMAN effort from the previous DOD 698BK program. Boosters, Agenas, and associated support equipment continued to be procured in the white world, but since that time all payloads have been procured through black BYEMAN contracts.

Five days prior to the launch of the first AFTRACK payload on DISCOVERER 13, 10 August 1960, the US Intelligence

Board (USIB) issued the first national-level SIGINT requirements document, USIB-D-33.6/8, "Intelligence Requirements for a Satellite Reconnaissance System of Which SAMOS is an Example," 5 July 1960. Paragraph 1c. stated: "... additional types of directed coverage may be required. Provision should be made to procure such equipment by Quick Reaction Capabilities (QRC)." Also "... a close working relationship between the R&D organization and the Intelligence Community is required." The AFTRACK project personnel felt that the program followed this direction very closely!

EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs

This development eventually led to the phasing out of the fixed aft rack payloads on the Agena vehicle except for the "vulnerability payloads," which were continued on the aft rack of all photo missions to detect hostile radar tracking of the vehicle. The last of the SIGINT AFTRACK payloads, mission 7225, SQUARE TWENTY, was launched 28 October 1965 on vehicle 1620. Although the 72XX series of mission numbers was continued after this time for secondary payloads, none were mounted on the aft rack during the time frame covered by this history.

Work started on the first ARPA EO 13526 3.3(b)(1)>25Yrs called EO 13526 3.3(b)(1)>25Yrs in the spring of 1962. EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs Col Lee Battle and his staff at the DISCOVERER Project Office brought it to the attention of Maj John Copley, who sponsored the fixed AFTRACK payloads.

EO 13526 3.3(b)(1)>25Yrs

The AFTRACK Program

In early 1960, concern was growing in the US Intelligence Community that the Soviet Union was building not only missile systems but also systems to counter US missiles and satellites. U-2 photography had shown that large ground radar sites were under construction at the Soviet Sary

EO 13526 3.3(b)(1)>25Yrs

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The SICINT Satellite Story

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Shagan R&D test site in the vicinity of the missile launch pads. The Soviets also had several ships and trawlers equipped with large radomes whose purpose was not known. In February 1960, Harold Willis of the CIA Office of ELINT (OEL), having recently been briefed on the CORONA photo satellite program, contacted Maj Copley and told him of these concerns. He expressed the national-level fears that the Soviets might in some way interfere with the operation of the CORONA command and tracking subsystems.

Copley was responsible for the contract with LMSD to develop the ELINT subsystem, S/S F of the SAMOS System, for the Air Force with the Airborne Instruments Laboratory (AIL) at Mineola, Long Island, New York, as the subcontractor. Willis had discussed with Bill Harris of the LMSD S/S F office the possibility that support might be available on the aft rack of the CORONA Agena spacecraft for a small electronic "black box" that could detect any electronic interference to the mission. Willis had also discussed the problem with Gene Fubini of AIL, who became an enthusiastic supporter of the AFTRACK concept and suggested a small payload called SOCTOP, which received signals in the 2.5- to 3.2-MHz frequency band in which the Agena S-band beacon operated. It required only an on/off command and a few telemetry points to encode its output. Copley was able to obtain the minimal funding required, and Willis arranged for authority to mount SOCTOP on the aft rack of the DISCOVERER 13 Agena vehicle. The presence of SOCTOP created very little notice when DISCOVERER 13 was launched on 10 August 1960.

Most of the attention was focused on the recovery capsule that attained fame as the first object to be recovered intact from an orbiting spacecraft (something the Soviet Union had not yet achieved).

The immediate analysis of the SOCTOP data was almost as remarkable as the capsule recovery. It showed what appeared to be Soviet tracking of the CORONA spacecraft on almost every readout by a US-operated tracking station (there was no recorder, so data could be received only when the spacecraft was in view of the tracking stations). That Soviet tracking was so extensive worldwide was a surprising and alarming discovery; Willis quickly passed the "tracking" story on to the Intelligence Community. However, further analysis of the data revealed that SOCTOP actually was receiving signals from US Verloort radars at the remote tracking stations (RTSs) as they tracked the spacecraft. Despite the embarrassment to Willis and others caused when the error was discovered, the small AFTRACK payload for QRC response to urgent ELINT questions did catch on!

SOCTOP was the first of a long series of "vulnerability" payloads, so called because of their part in an NRO program to determine susceptibility of reconnaissance satellites to hostile Soviet (or other) activities. Eventually this type of payload flew on almost every Program A low-altitude reconnaissance satellite launched. The objective was to determine if Soviet or other hostile radars were actually tracking or trying to interfere with the electronics on the vehicle and the degree of success they achieved. A byproduct of this

activity was verification of the tracking radar characteristics or discovery of new variations in their patterns not seen previously. The payload configuration changed as new and improved tracking radars appeared and as collection payload technology improved.

In early 1963, following a series of SOCTOP launches, a competition was held by the Special Projects Office to design a more sophisticated payload capable of receiving and returning characteristics of signals in the [redacted] frequency range. A recorder was to be included, [redacted]

Pitsenbarger and his team at Electronics Defense Laboratory (EDL)-Sylvania in Mountain View, California, won the competition and produced the new version, known as STOPPER. This initiated an era, continuing through 1975, in which EDL produced all of the electronic vulnerability payloads that were installed on most photo and SIGINT satellites.

[redacted] to this frequency range. By this time the NRO had been formed and the SAFSP in El Segundo, California, had been given responsibility for the development of a survivability program for all NRO vehicles. Accordingly, sponsorship of these "BIT

boxes" was transferred from the SAFSP ELINT office to the SAFSP vulnerability office.

Maj Murray J. Sherline developed the concept of tailoring the frequency coverage of the BIT boxes to the known radar threats, rather than duplicating the mission of the ELINT satellites of looking for new threats. The data from the STOPPER missions was processed at the EDL-Sylvania plant at Mountain View, California. [redacted]

Many versions of the BIT boxes were developed as new radar data were received and as payload construction techniques improved. BIT I through IX versions were built as more data on [redacted]

collected. In 1968 the BIT boxes were consolidated under the title [redacted] with configurations tailored to the individual launches.

[redacted]

EO 13526 3.3(b)(1)-25Yrs

The BIT box output was distributed to NSA and other interested agencies and was also used to program the operation of, and sometimes to aid in the design of, other SIGINT satellite payloads. NSA had no responsibility for processing the vulnerability payloads but did benefit from the results. EO 13526 3.3(b)(1)-25Yrs

Following the first AFTRACK payload (SOCTOP 1), flown in August 1960, Gene Fubini and his AIL team came up with a simplified version of the forward rack SAMOS Project 102 payload (F-2) that would simply scan the 0.4- to 1.5-GHz band to detect radar activity in the Soviet Union, including suspected ABM/AES radars. Its mission was almost the reverse of SOCTOP (detection of ground radars rather than radar tracking of the satellite) so, naturally, it was named TOPSOC. It used the F-2 high-gain super-heterodyne receivers and, essentially, omnidirectional

antennas. Since TOPSOC lacked the directional antenna of the F-2 payload, but still retained the sensitivity, it scooped up a large number of interleaved signals, horizon to horizon, including sidelobes and main beams! Although an RF band had been chosen that was thought to be relatively quiet (400 to 1,600 MHz), the first TOPSOC, launched on 12 September 1961, encountered a signal environment in the Soviet Union that proved far too populated and active to be successfully processed by any automatic or manual techniques available at that time. The first lesson in matching the collection system to the processing system had been learned! It was also clear that, in the 1960s, there were many more radars in the Soviet Union than previously thought. Another thing learned was that unless the intercept is unique and of very high priority, an intercept without a location has very little value (at the same time, Navy POPPY satellites were proving this same axiom).

The TOPSOC launches occurred in the summer and fall of 1961, but sometime before this another approach to the QRC AFTRACK payloads had developed. In those days, the Air Force sponsored an annual review at the Stanford Electronics Laboratories (SEL) in Palo Alto, California, of SEL's activities in support of ELINT, or more precisely, the electronic warfare community. These were called the Technical Advisory Committee (TAC) meetings. Almost all contractors and government agencies involved in the development or use of electronic warfare systems attended regularly, making it one of the premier

ELINT events of the year. Until this time, of course, ground, sea, and airborne platforms were the extent of the discussions.

Bill Harris, the LMSC AFTRACK payload manager; Phil Doersam, LMSC S/S F manager; and Maj Copley attended the TAC meeting in August 1960 in search of concepts for AFTRACK payloads. At the meeting, Jim DeBroekert of SEL demonstrated a newly developed miniaturized receiver. With the receiver connected to a power meter, he had been flying it in his Cessna airplane around the San Francisco Bay area to demonstrate radar-location techniques. Harris asked DeBroekert if his receiver could be adapted to an AFTRACK application. The result was

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

included a tape recorder, making it the first AFTRACK payload with this capability. Bill Rambo, in charge of SEL at the time, was intrigued with the simplicity of the concept and even made a short 8-mm movie to illustrate it. This was the beginning of a long association between SEL, LMSD, and SAFSP that ended only when pacifists protested SEL's involvement with the military during the Vietnam war.

Don Grace, who became the SEL manager for AFTRACK payloads, set up a small lab in the basement of their building on the Stanford campus where Don Eslinger built (essentially single-handed) all the SEL payloads (10 total). Other very capable members of their staff were John

Hunter, Tony Taussig, Tom Miles, and Chuck Schoens. DeBroekert, Miles, and Hunter went on to form ARGO Systems when the university gave in to protesters in the spring of 1967 and closed SEL. Eslinger went to Georgia Tech, Schoens to Stanford Research Laboratories (SRI), and

EO 13526 3.5(c)

by way of Applied Technology, Inc (ATI).

The SEL policy was to design and build the first of a new series and then turn production over to industry. Following TAKI, WILD BILL was invented in the spring of 1961. (Neither Grace nor DeBroekert would admit which Bill—Harris or Rambo—it was named after.)

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

would utilize. The first WILD BILL was launched on 7 July 1961 and operated for two days with no important intercepts. The second, designated WILD BILL 1, was launched on 27 February 1962 and operated for only two orbits with no significant results. Later versions of WILD BILL were built by ATI, which had been formed in the Palo Alto area by John Grigsby,

EO 1.4.(c)
PL 86-36/50 USC 3605

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EO 1.4.(c)
PL 86-36/50 USC 3605

another former SEL engineer. LMSC had contracted with Grigsby to build the follow-on versions of SEL payloads.

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

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PL 86-36/50 USC 3605

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

[REDACTED]

to provide an output compatible with the ELINT processing system called FINDER, which had been designed to process data from the U-2 and other airborne collection systems. PLYMOUTH ROCK 1 was launched on 24 November 1962 and achieved at least two firsts: it was the first AFTRACK payload to receive a mission number, 7201, in accordance with the new BYEMAN procedures, and it was also the first space payload to use a sweeping yttrium-iron-garnet (YIG) filter for frequency discrimination. Two more PLYMOUTH ROCKs were built by ATI, the last of which had the further distinction of being the only AFTRACK payload [REDACTED] EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.5(c)

The outputs from the AFTRACK payloads included commutated data from selected points on the primary mission telemetry commutator and also, at times, recorder output from the AFTRACK payload. Each payload was unique and produced different processing and analysis challenges. LMSC processed the data to evaluate payload performance and assisted NSA and SAC in their processing and analysis effort.

Data from TAKI, WILD BILL, TOPSOC, PLYMOUTH ROCK, and LONG JOHN were processed at NSA on an electronic machine complex known as [REDACTED] EO 13526 3.3(b)(1)>25Yrs

[REDACTED] The differences in data format for each mission required extensive programming effort to write and extensive machine-time to check out the computer programs for each individual package. Frequently more time was spent in developing the processing than was required to process the data. For example, once the basic computer programs for a TAKI mission were written and checked out, it took a relatively small amount of time to process all the formatted data from that TAKI mission and any subsequent identical TAKI mission. Unfortunately, most missions were not identical because the AFTRACK payloads had to compete for points on the primary mission telemetry commutator, so data formats changed frequently. Analysis of the data still required extensive manual effort after or in parallel with the machine processing.

SAC processing and analysis of data from the AFTRACK payloads were frequently done by LMSC in [REDACTED] EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.5(c) Sunnyvale, for SAC with SAC participation. LMSC provided space and equipment. [REDACTED] EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

elements of the US Intelligence Community to function as a part of the Soviet ABM system.

EO 13526 1.4(c)-25Yrs, EO 13526 3.5(c)

the Soviet Union. These data were used extensively in later payload designs. In the summer of 1961, Sanders Associates at Nashua, New Hampshire, teamed with

EO 13526 1.4(c)-25Yrs, EO 13526 3.5(c)

While the AFTRACK ELINT story was unfolding, other parallel efforts were underway in the COMINT area. Interest in COMINT had surfaced in several

EO 13526 3.5(c)

In another area of the COMINT scene, Wayne Burnett of HRB-Singer at State College, Pennsylvania, came up with a concept to intercept, encode, and record.

EO 13526 1.4(c)-25Yrs, EO 13526 3.5(c)

of WS-117L might be adapted to COMINT collection, but he felt that feasibility needed to be demonstrated.

It was Capt Don Wipperman and his associates at Air Force Security Service (AFSS), San Antonio, Texas, who came up with the first COMINT satellite concept. Together with the AIL team, they presented an idea for an AFTRACK payload capable of intercepting communications signal that was then thought to be from the prevalent air/ground (A/G) communications system in the Soviet Union. This resulted in the TEXAS PINT (AFSS was in Texas). Its only drawback was that when launched on 30 August 1961, it showed that had been superseded by more advanced communications systems. It did provide a good look at the VHF environment over

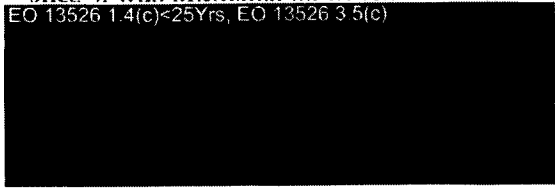
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EO 13526 3.5(c)

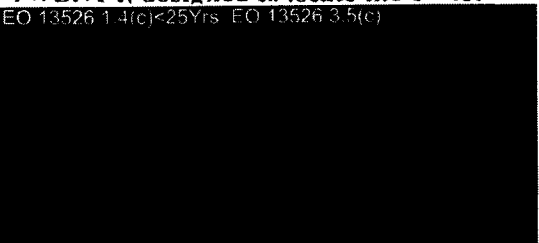
EO 13526 1.4(c)

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PL 86-36/50 USC 3605

payload launched on 4 December 1962 had pretty much the same results. A final version, OPPORKNOCKITY ("it tunes but once"), was launched on 21 August 1964
EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

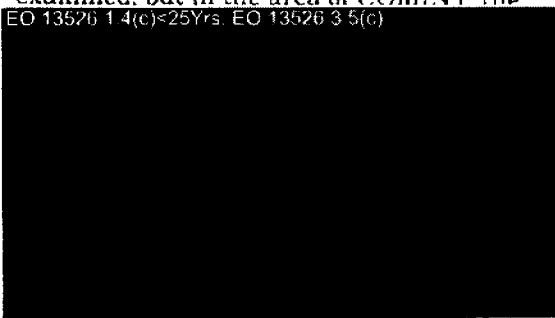


Two more payloads, SQUARE TWENTY and DONKEY, launched in 1965 and 1967, completed the story of AFTRACK COMINT collection. With the experience to date, the concept of copying content from low orbiters was losing its attraction, and accurate location was becoming a more important consideration. SQUARE TWENTY, designed to locate the Soviet
EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



One other AFTRACK payload that was actually integrated into the front rack along with MULTIGROUP 2 and SETTER 1B was DONKEY, launched on 24 July 1967. This payload was part of a program initiated by Col John Copley, who was then assigned to the Manned Orbiting Laboratory (MOL) staff at US Air Force Headquarters. The payload activities were handled under the BYEMAN program, but through a unique management arrangement, the overall effort was managed by the Air Force. Back in February 1965, Copley had been assigned to determine if there were

any SIGINT applications that might be enhanced by the manned aspect of the MOL. Several ELINT applications were examined, but in the area of COMINT, the
EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



could also be collected from the sidelobes, however, intercept times could be lengthened appreciably and might permit intercept of adjacent emitters on the same link, thereby providing the necessary continuity. This is what DONKEY attempted to demonstrate.

A program developed by the team of E-Systems in Garland, Texas, and EDL-Sylvania, using Soviet ~~EO 13526 3.3(b)(1)>25Yrs~~ transmitter specifications ~~EO 13526 3.3(b)(1)>25Yrs~~ involved airborne testing against a simulated ~~EO 13526~~ terminal installed at the E-Systems facility. An Air Force helicopter was used to fly a payload in an intercept pattern through the main beam and sidelobes of the microwave antenna. Phil Fyre and a team of analysts at EDL analyzed the data and made recommendations for mission profiles. The results were sufficiently encouraging to convince the team that a satellite test should be performed to verify the flight-test data. ~~EO 13526 3.3(b)(1)>25Yrs, EO 1~~
~~EO 13526 3.3(b)(1)>25Yrs, EO 1~~ but the need for a three-axis-stable platform indicated the Agena vehicle was the appropriate carrier. Vince Henry, the AFTRACK and ~~EO 13526~~

Flight summary: Program A, Project AFTRACK SIGINT payloads

EO 1.4.(c)
PL 86-36/50 USC 3605

MISSION NUMBER	PROJECT and PAYLOAD	MISSION	OPERATIONAL LIFETIME									LIFETIME
			3rd Quarter 1960	4th Quarter 1960	1st Quarter 1961	2nd Quarter 1961	3rd Quarter 1961	4th Quarter 1961	1st Quarter 1962	2nd Quarter 1962	3rd Quarter 1962	Days
N/A	SOCTOP 1**	EO 13526, 13526A	8/10-11 									1
N/A	TAKI 1					06/16-17 						2
N/A	WILD BILL						7/7-8 					2
N/A	TEXAS PINT						8/30-9/1 					2
N/A	TOPSOC 1						9/12-9/19 					5
N/A	TOPSOC 2						9/17-9/21 					4
N/A	TOPSOC 3							10/13-10/15 				2
N/A	TOPSOC 4							11/5-11/7 				2
N/A	GRAPE- JUICE 1							12/12-12/13 				1
N/A	WILD BILL 2								2/27 			2 orbits; 0.15
N/A	GRAPE- JUICE 2									4/18-4/22 		5
N/A	TAKI 2										6/28-7/5 	7
N/A	NEW JERSEY 1										7/27-8/2 	5
N/A	GRAPE JUICE 3										9/17-9/22 	5

OS = General Search

ABM = Antibalistic Missile

COPY = Lock-on Copy Content

* Mission number not assigned to AFTRACK payloads until November, 1961
** Follow-on vulnerability payloads listed on separate table

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COMINT/COMINT-SECURITY
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Flight summary: Program A, Project AFTRACK SIGINT payloads (continued)

MISSION NUMBER	PROJECT and PAYLOAD	MISSION	OPERATIONAL LIFETIME								LIFETIME
			4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	Days	
			1962	1963	1963	1963	1963	1964	1964		
7201	PLYMOUTH ROCK 1	EO 13526 3 3(b)	11/24-12/01							5	
7202	WILD BILL 2		12/12-12/15							3	
7203	VINO 1		12/4-12/7							3	
7204	TAKI 3		12/4-12/7							6	
7205	NEW JERSEY 2		1/7-1/14							8	
7206	VINO 2		2/28	(Failed to orbit)						0	
7207	WILD BILL 3			6/12 6/26						13	
7216	WILD BILL 4			6/15 7/20						35	
7208	PLYMOUTH ROCK 2			6/29 7/11						12	
7219	LONG JOHN 2					11/27 12/12				15	
7218	LONG JOHN 1					12/21 1/10				20	
7210	HAYLOFT					1/11 1/30				19	
7222	LONG JOHN 3					2/15 3/9				23	
7224	LONG JOHN 4							6/13 6/26		13	

DC = Directed Coverage
GS = General Search
TI = Technical Intelligence
ABM = Antiballistic Missile
COPY = Lock on Copy Content

Flight summary: Program A, Project AFTRACK SIGINT payloads (continued)

MISSION NUMBER	PROJECT and PAYLOAD	MISSION	OPERATIONAL LIFETIME									LIFETIME Days
			3rd Quarter 1964	4th Quarter 1964	1st Quarter 1965	2nd Quarter 1965	3rd Quarter 1965	4th Quarter 1965	1st Quarter 1966	2nd Quarter 1966	3rd Quarter 1966	
			1964	1964	1965	1965	1965	1965	1966	1966	1966	
7215	OPPOR-KNOCKITY	EO 13526 3 30	8/21	10/23								53
7223	NEW HAMPSHIRE		Cancelled due to technical problems									0
7225	SQUARE TWENTY						10/28	11/8				20
7231	DONKEY									7/24	1/28	190

Note: 7100 Series BIRD DOG, BETTER, CONVOY, and HARVESTER were classified as secondary payloads on 8908K, 770, and STRAWMAN Projects, and were listed with them.

COPY = Lock-on Copy Content
LOC = Locate - 15 miles

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PL 86-36/50 USC 3605

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COMINT/COMINT/COMINT/COMINT
8/6/97/1992

Top Secret
NOFORN/NOCON

manager at LMSC, determined that a location on the forward rack was the only practical place to mount the 6-foot expandable parabolic antenna required for the mission. Agena vehicle 2732, scheduled to launch the MULTIGROUP 2 and SETTER 1B payloads in July 1967, would have new, more powerful CASTOR II solid rockets, providing greater thrust than the previously used thrust-augmented Thor (TAT) booster. This made it a logical choice for the addition of DONKEY. Installation of all three payloads (including three out-board expandable antennas) required very innovative engineering. This may have been the point at which the payload was named DONKEY (for lack of a better explanation). In any case DONKEY boasted an independent down-link and when launched on 24 July 1967 operated 30 days longer (for a total of 182 days) than the other payloads following the failure of their data link transmitter.

DONKEY was unable to perform the sidelobe intelligibility mission on orbit due to the failure of the pointing mechanism on the 6-foot dish antenna. This did not

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

primary COMINT data were valuable in mission planning for the

in fact, the initial airborne intelligibility program convinced Gene Pitsenbarger of EDL and Vince Henry (and his boss, George Minalga) of LMSC

emitter as the low-orbiting MOL flew swiftly over the Soviet Union (this may be another explanation for the name of the DONKEY COMINT AFTRACK payload).

EO 13526 3.3(b)(1)>25Yrs

The locations produced by SQUARE TWENTY, DONKEY, and the

EO 13526 3.3(b)(1)>25Yrs

All of the data from the COMINT payloads were analyzed at the contractor facilities and at NSA, mostly by rather laborious manual processing. The information gained from the early TEXAS PINT, NEW JERSEY, GRAPE JUICE, and VINO payloads was minimal except for the development of a healthy respect for the interference environment over eastern Russia

EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c), EO 13526 3.3(b)(1)>25Yrs

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PL 86-36/50 USC 3605

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EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)

The AFTRACK payloads had run
their course by the time of the SQUARE
TWENTY launch in 1965. The much more

EO 13526 3.3(b)(1)>25Yrs

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COMINT Control Channels jointly
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by LMSC, took over the original QRC-type missions of the AFTRACKs, and went on to greater capability, utility, and inevitably, the accompanying and ever-increasing cost.

EO 13526 3.3(b)(1)>25Yrs EO 13526 1.4(c)<25Yrs




EO 13526 3.3(b)(1)>25Yrs EO 13526 1.4(c)<25Yrs



Key accomplishments, Agena AFTRACK payloads

EO 13526 1.4(c)<25Yrs, EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.5(c)



EO 13526 3.3(b)(1)>25Yrs



Top Secret
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COMINT/Control Channels/Security
#R-011720

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PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)

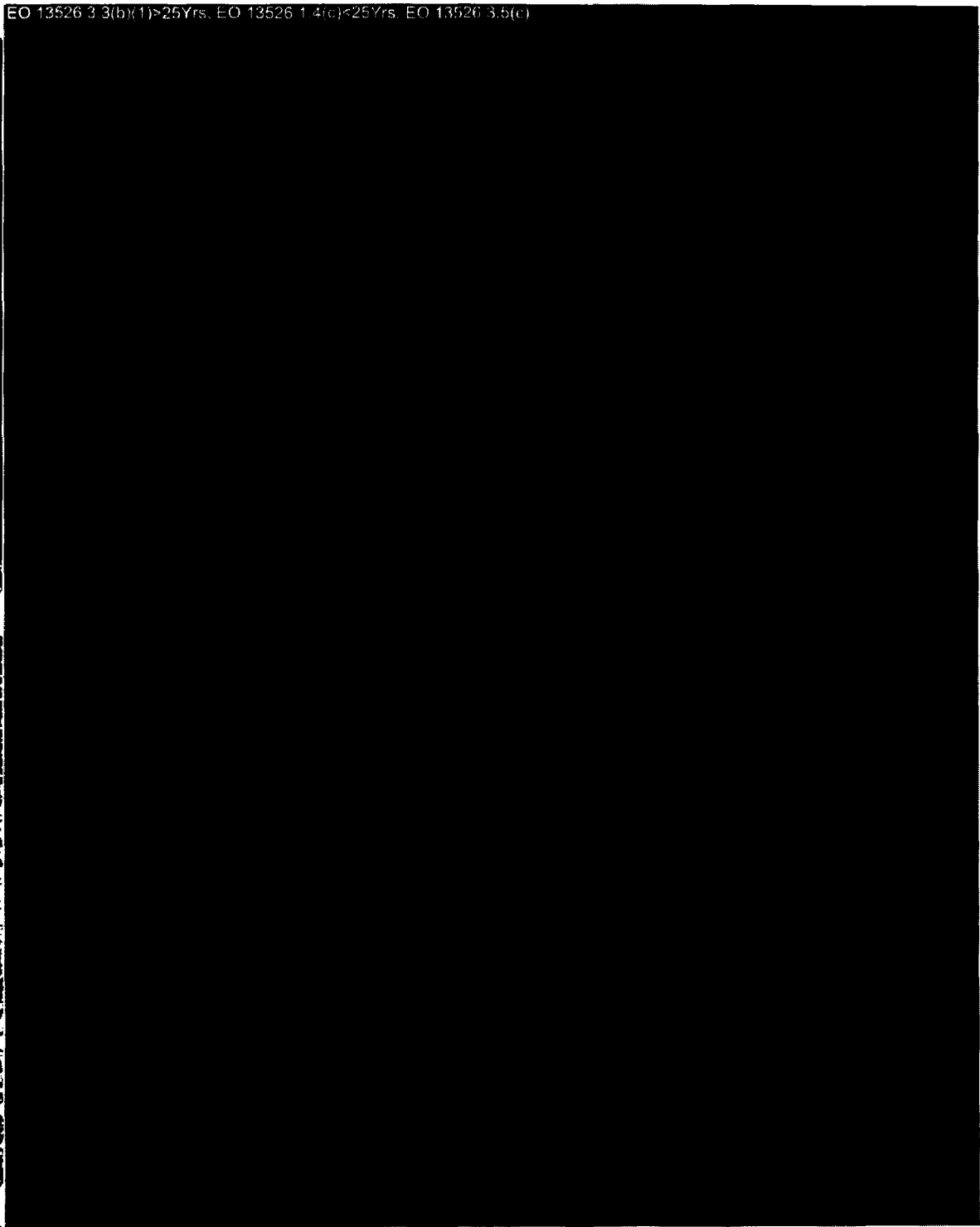


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~~COMINT Control Channels jointly~~
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EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)

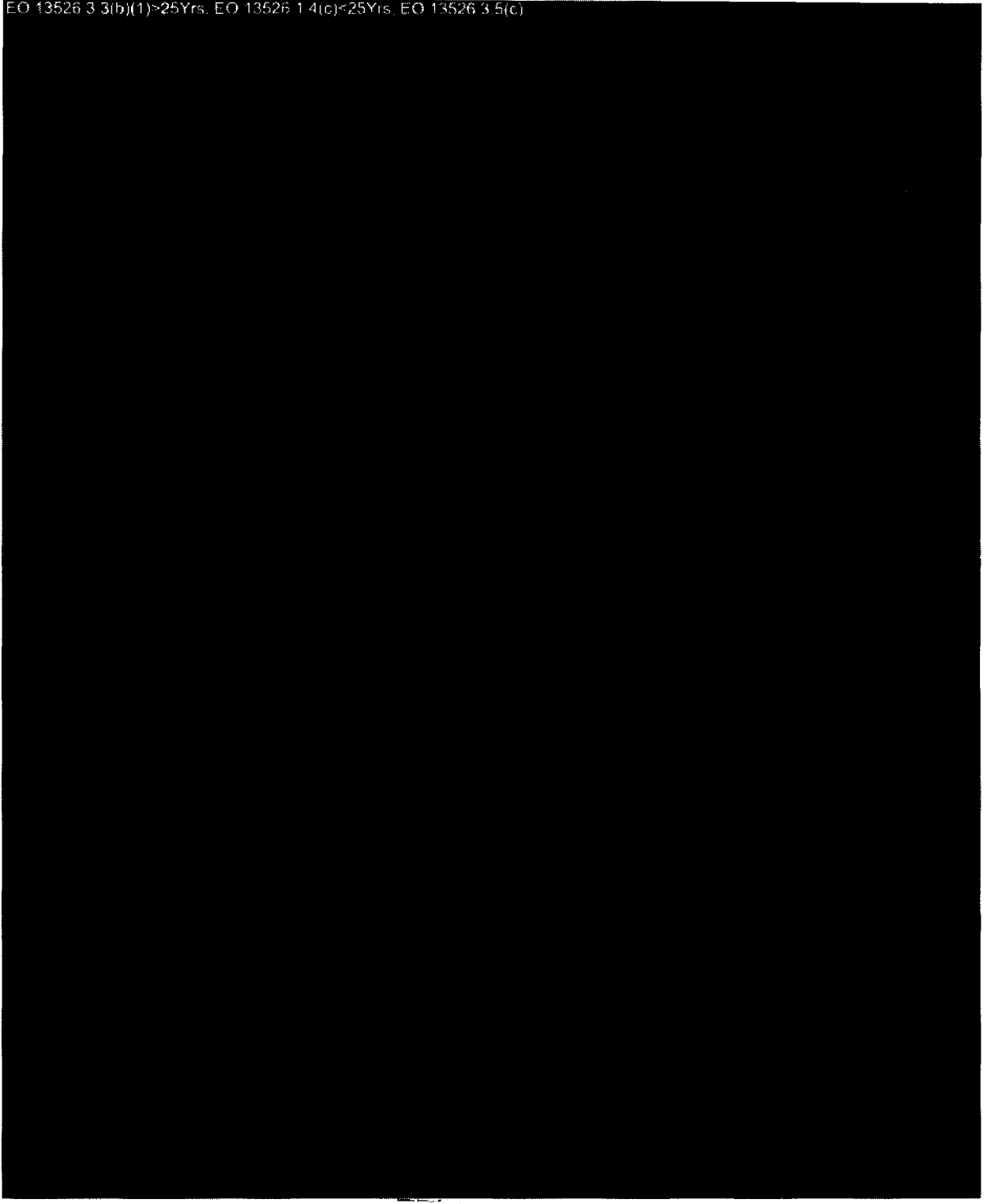


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COMINT Control Channels only.
BYE 9197/94

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PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)-25Yrs, EO 13526 1.4(c)-25Yrs, EO 13526 3.5(c)



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~~COMINT Control Channels jointly~~
~~BYE-9197/94~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3 3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs EO 13526 3 5(c)



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels Jointly
BYE-9197/94

~~Top Secret~~
~~NOFORN-FRUCI~~

EO 13526 3.3(b)(1)>25Yrs



~~Top Secret~~
~~Handle via BYEMAN-TALENT-KEYHOLE-~~
~~COMINT Control Channels jointly~~
~~BYE-919793~~

~~Top Secret~~
~~NOFORN ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAD-TALENT-KEYHOLE-
COMINT Control Channels jointly
BYE-9197/94

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

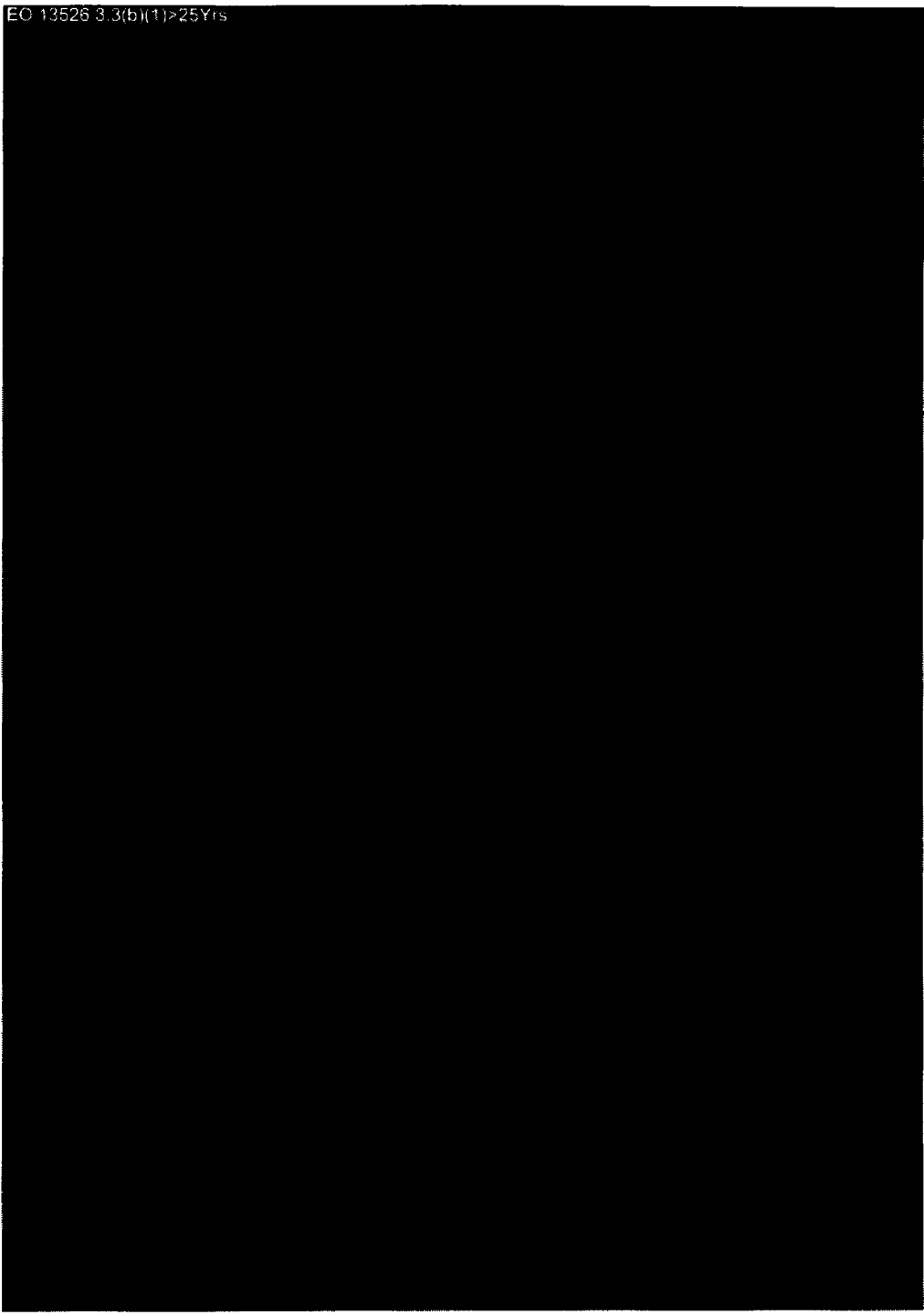
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~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels Jointly
BYE-917794

~~Top Secret~~
~~NOFORN ORCON~~

EO 13526 3.3(b)(1)>25Yrs




~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels (only)
REF: 9197.03

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)-25Yrs. EO 13526 1.4(c)-25Yrs. EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN TALENT-KEYHOLE-
COMINT Control Channels Jointly
~~BYE-9197/41~~

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

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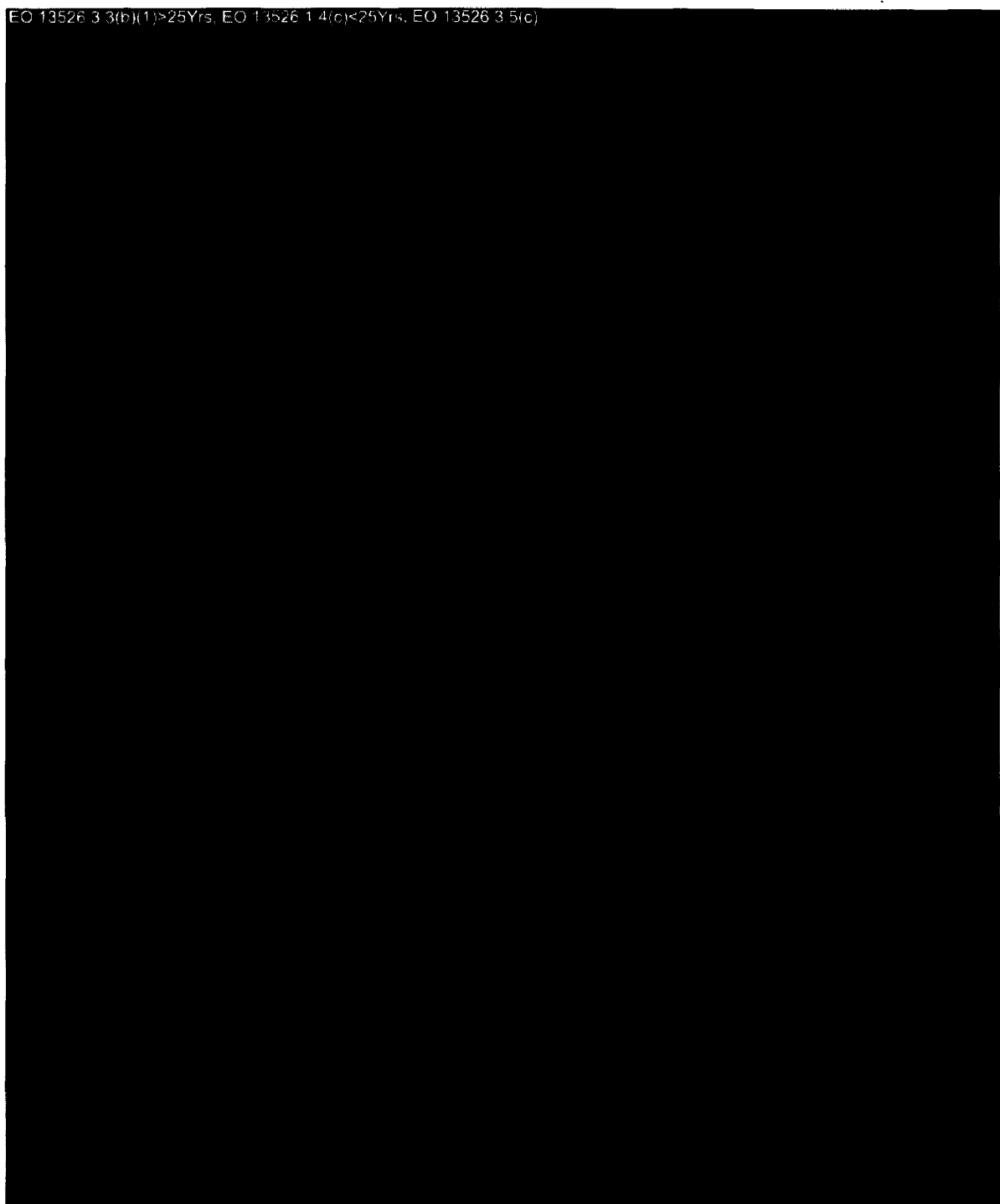


~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels family
BYE.019744J

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels for only
BYE-010701

~~TOP SECRET~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3 3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs EO 13526 3 5(c)



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
~~BYE-9197/94~~

~~Top Secret~~
~~NOFORN ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605


EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels Jointly
BYE-4197/94

~~Top Secret~~
Handle as BRISMA, JALINT, ETHOC,
COMINT, COMINT Channel, COMINT
BYE 015794

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)>25Yrs. EO 13526 3.5(c)



~~Top Secret~~
NOFORN, COMINT

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~TOP SECRET~~
HANDLED BY AUTHORIZED PERSONNEL
ONLY
NO DISSEM

CHAPTER 5
155

~~TOP SECRET~~
NO DISSEM


EO 1.4.(c)
PL 86-36/50 USC 3605

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The SIGINT Satellite Story

~~Top Secret~~
Handle with Extreme Caution
COMINT/COMSEC/CRYPTANALYTICS
DIS 9147-91

EO 13526 3.3(b)(1)>25Yrs EO 13526 1.4(c)<25Yrs EO 13526 3.5(c)



~~Top Secret~~
NOFORN/NOCON

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN TALENT KEYHOLE-
COMINT Control Channels jointly
BYE-9197/94

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

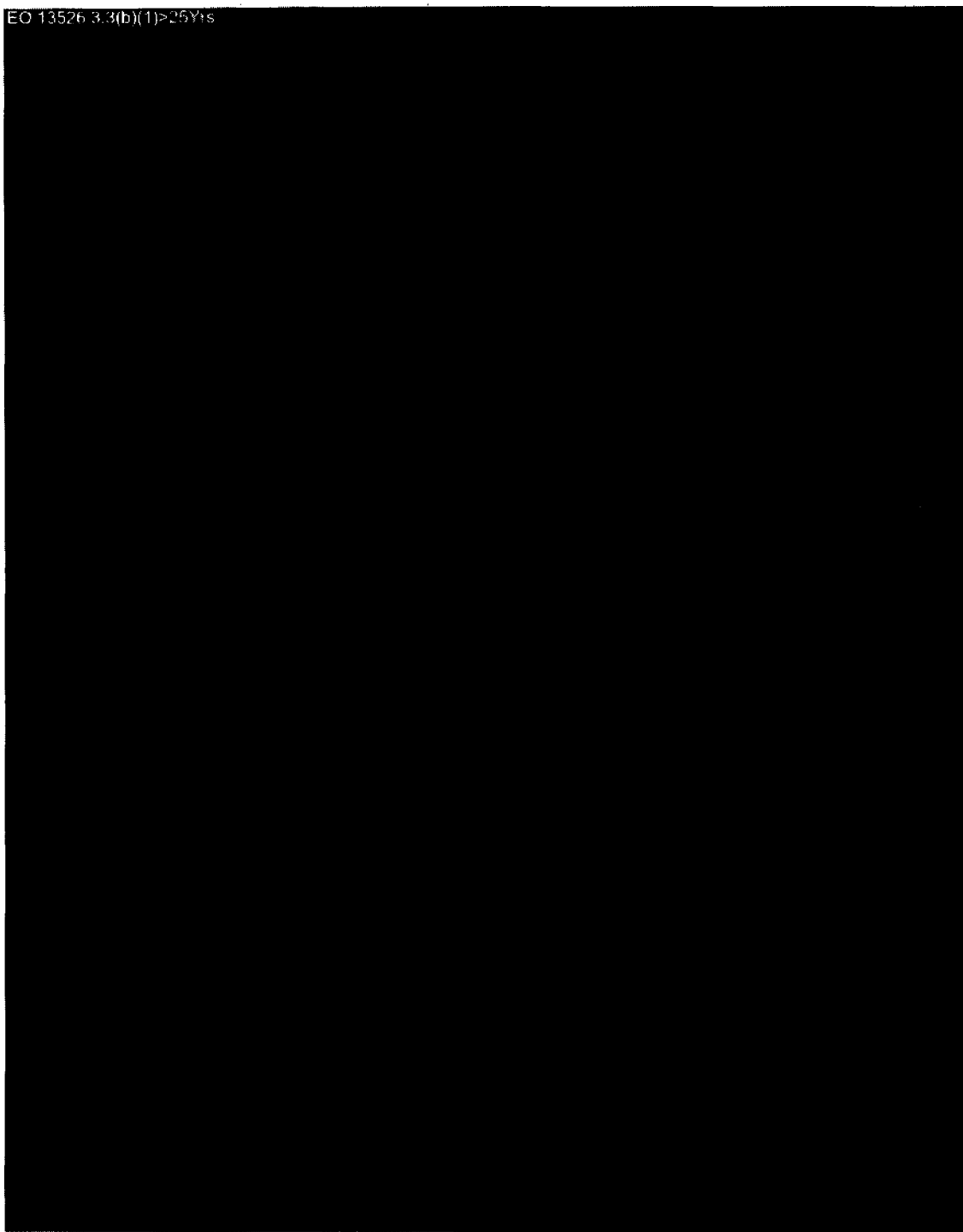
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~~Top Secret~~
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~~COMINT Control Channels Identify~~
~~BYX-9197-92~~

~~Top Secret~~
~~NOFORN-CRCON~~

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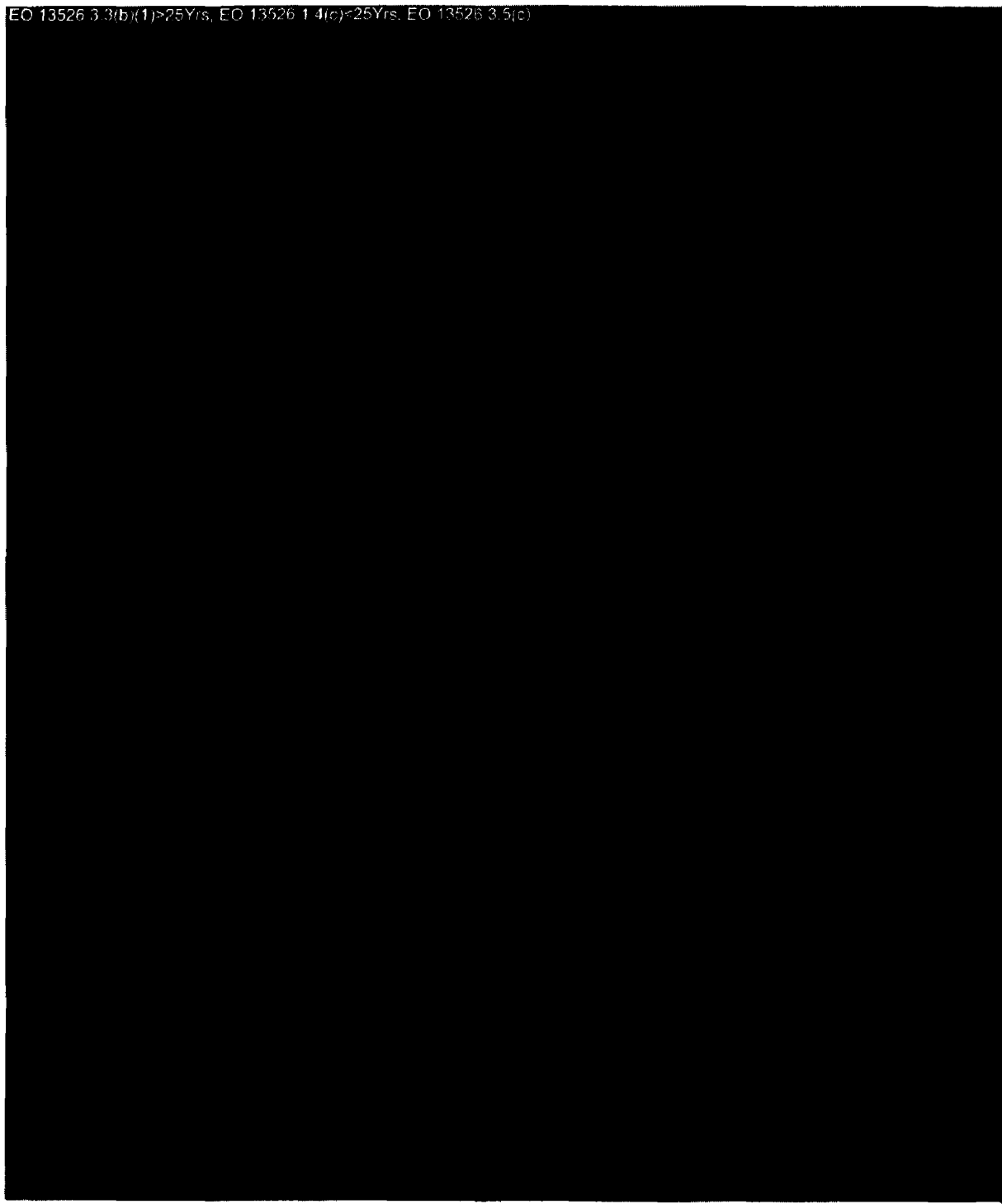


~~Top Secret~~
Handle via BYEMAN TALENT KEYHOLE-
COMINT Control Channels Identity
RVT.010-93

~~Top Secret~~
~~NOFORN/NOFORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
RYF-030-01

~~Top Secret~~
~~NOFORN, ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

36/50 USC 3605

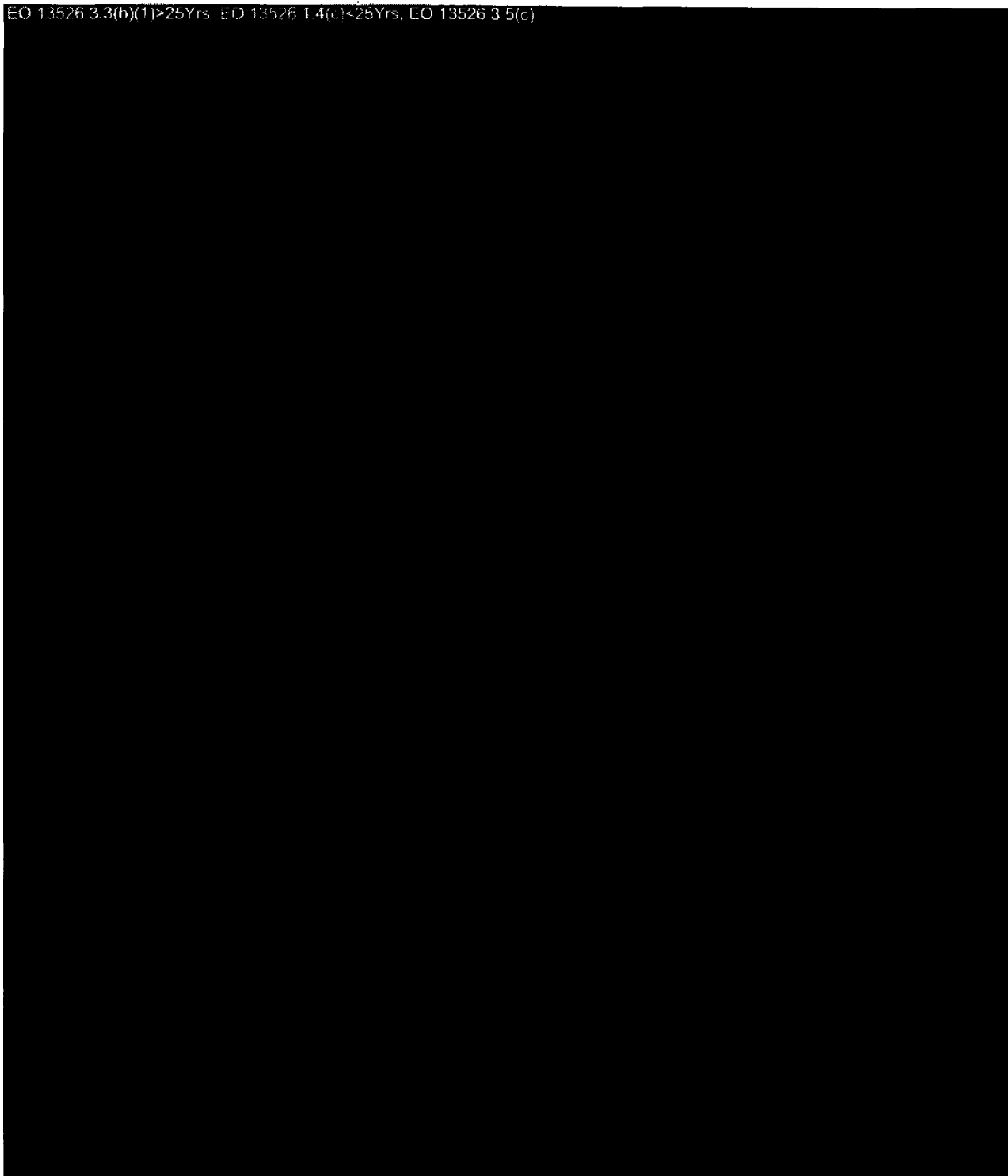
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Handle via BYEMAN, TRENT, KEYHOLE-
COMINT Control Channels jointly
~~BYE-9197Aa~~

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
~~Handle via BYEMAN-TALENT-KEYHOLE-~~
~~COMINT Control Channels Jointly~~
~~RYE-019-03~~

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs EO 13526 1.4(c)<25Yrs EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
BYE-9197/94

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Chapter 5 References

1. NSA-BYE-20850-65 and EO 13526 3.5(c)
2. *NSA in Space*, April 1975, BYE-19385-75, pp. 13-14.
3. EO 13526 3.3(b)(1)>25Yrs, *Final Report*, 1 May 1968, BYE-19347-68.
EO 13526 3.5(c), EO 13526 3.3(b)(1)>25Yrs
5. *NSA in Space*, pp. 14-15.
6. EO 13526 3.5(c)
7. [REDACTED]
8. *NSA in Space*.
9. Reports AM41, 17 June 1970, and AM78, 30 October 1970, TK/WC-W205/47-71
EO 13526 3.5(c)
10. *NSA in Space*, p. 29.
11. EO 13526 3.5(c) EO 13526 3.3(b)(1)>25Yrs
12. [REDACTED]
13. [REDACTED]
14. [REDACTED]
15. [REDACTED]
16. [REDACTED]
17. [REDACTED]
18. [REDACTED]
19. [REDACTED]
20. [REDACTED]
21. [REDACTED]
22. [REDACTED]
23. [REDACTED]
24. [REDACTED]
25. Report 004, 16 January 1970.
26. TCS 58527-71, 13 October 1971; Report AM63, 28 September 1970; Report AM81, 24 November 1970; Report AM07, 23 February 1971; Report AM16, 15 April 1971; Report AM29, 5 August 1970; Report AM09, 28 January 1972.
27. Report 29, 1 and 12 May 1970; Report 32, 15 May 1970; Report 25, 29 June 1971; Report 27, 2 August 1971; Report 51, 4 November and 8 December 1971; Report 43, 7 October 1971; Report 28, 5 May 1972 EO 13526 3.5(c)
28. EO 13526 3.5(c)
29. [REDACTED]

~~Top Secret~~
~~NOFORN-ORCON~~

30. [REDACTED] EO 13526 3.5(c)
31. [REDACTED]
32. Raymond Potts' personal notes (hereafter Potts' notes).
33. TK/WC-W205/47-71 (TS//B//PK).
34. Potts' notes.
35. TK/WC-W205/47-71.
36. TK/WC-W205/47-71.
37. [REDACTED] EO 13526 3.5(c)
38. [REDACTED]
39. Report # R19, 21 March 1969.
40. Photo of the K4SP Status Board, 20 December 1970.
41. [REDACTED] EO 13526 3.5(c)
42. TK/WC-W205/43-71.
43. K4SP Status Board photo.
44. [REDACTED] EO 13526 3.5(c)
45. [REDACTED] EO 13526 3.5(c) interview, 11 August 1992.
46. [REDACTED] EO 13526 3.5(c)
47. K4SP Status Board photo.
48. Report 72, 20 October 1970.
49. [REDACTED] EO 13526 3.5(c) TK/WC-E205/008-72.
50. Report 45, 8 October 1971.
51. Report 61, 29 December 1971.
52. [REDACTED] EO 13526 3.5(c) TK/WC-E205/008-72.
53. QR, 31 March 1971.
54. Interviews with [REDACTED] EO 13526 3.5(c) 26 June 1992.
55. [REDACTED] EO 13526 3.5(c)
56. [REDACTED]
57. NSA in Space, p. 30.
58. QR, 31 March 1974.
59. [REDACTED] EO 13526 3.5(c) interview, 25 July 1990.
60. [REDACTED] interview, 27 February 1991.
61. NSA in Space.
62. Interviews with [REDACTED] EO 13526 3.5(c) 27 February 1991 [REDACTED] EO 13526 3.5(c) 24 June 1992;
 and [REDACTED] EO 13526 3.5(c) 24 June 1992.
63. [REDACTED] EO 13526 3.5(c) interview, 24 June 1992.

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 Handle via BYEMAN-TALENT-KEYHOLE-
 COMINT Control Channels only
 BYE-9197/94

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~~NOFORN ORCON~~

EO 13526 3.3(b)(1)>25Yrs

PL 86-36/50 USC 3605
EO 1.4.(c)

Mission Requirements

During the late 1950s, the Intelligence Community's weapons system analysts began to realize that overhead photography alone could not do a complete job of assessing the Soviet missile threat. Though crucial for strategic indications and warning (I&W), photography was essentially static; it showed the number and kind of launching pads but revealed little about the missiles themselves in terms of actual in-flight performance. The information of greatest value to US missile intelligence analysts was that used by the Soviet missile designers themselves. Like their US counterparts, Soviet missile designers put instruments on board their vehicles to monitor various internal functions during the missile development and test phase. These data were transmitted to Earth in coded-signal format, called telemetry, for engineering evaluation and assessment. Because of the design and function of telemetry, US intelligence agencies made special efforts to collect this information, along with beaconry and other electronic emissions from rocket test vehicles, all of which came to be called foreign instrumentation signals, or FIS. The collection and analysis of such signals for intelligence purposes is called TELINT.

EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
BYE-9197/94

EO 1.4.(c)
PL 86-36/50 USC 3605
Chapter 6 167

EO 13526 3.3(b)(1)>25Yrs

~~Top Secret~~
~~NOFORN-ORCON~~

169

The SICINT Satellite Story

~~TOP SECRET~~
 MEMORANDUM FOR THE DIRECTOR
 FROM THE CHIEF OF BUREAU OF INVESTIGATION
 SUBJECT: [REDACTED]

turned beneath it, the equatorial geosynchronous satellite appears to an observer on the ground to remain motionless in the sky. This is a perfect orbit for a satellite designed for relaying information from one place on the Earth to another—ideal for a communications satellite or a COMINT satellite. SynCom II marked the birth of the era of communications satellites and it also set in motion the idea for a project that was to play center stage at the CIA and the National Reconnaissance Office (NRO) EO 13526 3.3(b)(1)>25Yrs



Albert D. Wheelon

Albert D. "Bud" Wheelon was one of the original bright young engineers hired by Simon Ramo at the Ramo-Wooldridge Corporation, the technical manager of the US Air Force ballistic missile program, in November 1953. By the late 1950s Wheelon was involved in Ramo-Wooldridge's analysis work on the capabilities of Soviet missiles. He became acquainted with Presidential Science Advisors Jerome Wiesner, James Killian, and Edwin A. "Din" Land. In June 1962, at the invitation of Herbert "Pete" Scoville, Jr., he joined the CIA.

The Project Story

On 27 July 1963, the Hughes Aircraft Company's SynCom II became the world's first successful equatorial geosynchronous satellite. Located 22,000 miles above the Earth's equator and orbiting around the Earth once each day at the same peripheral velocity that the Earth's equator

~~Top Secret~~
~~NOFORN ORCON~~

Then, at the request of Ray Cline, Deputy Director for Intelligence (DDI), and over Scoville's objections, Wheelon was assigned as Assistant Director for Scientific Intelligence and head of the Office of Scientific Intelligence (OSI), reporting to Cline, and Chairman of the Guided Missiles and Astronautics Intelligence Committee (GMAIC) of the US Intelligence Board (USIB). These were the dark days of the Cuban Missile Crisis. CIA's reputation for innovative excellence, built on the reconnaissance successes with the U-2 aircraft and CORONA photo satellites, was now being overtaken by the failures of the Bay of Pigs. At the highest levels of government, CIA's reputation and influence were declining. In August 1963 Wheelon was appointed Deputy Director for Science and Technology (DDS&T) of the CIA by Director of Central Intelligence (DCI) John McCone. Wheelon was given McCone's mandate to put the CIA back into the reconnaissance business in a strong way.

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs EO 13526

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526

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Handle via BYEMAD/TALENT-KEYHOLE-
COMINT Control Channels Only
BYE:9197/94

~~Top Secret~~
~~NOFORN-ORCON~~



Brockway McMillan

EO 13526 3.3(b)(1)>25Yrs



Lloyd Lauderdale

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.



John McMahon

EO 13526 3.3(b)(1)>25Yrs

PL 86-36/50 USC 3605
EO 1.4.(c)

~~Top Secret~~
Handle via BYE/BLACK-TALENT-KEYHOLE-
~~COMINT~~ Control Channels family
BYE-9197/04

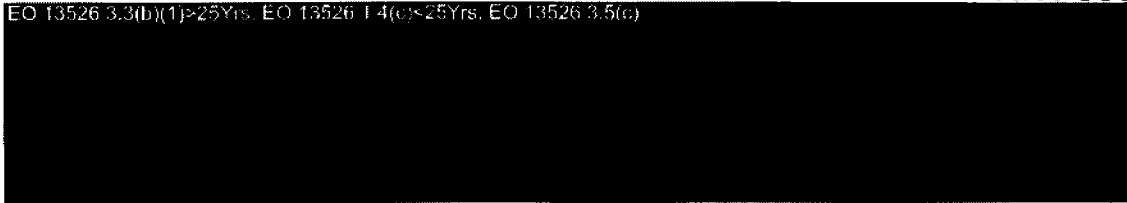
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~~Top Secret~~
~~NOFORN-ORCON~~

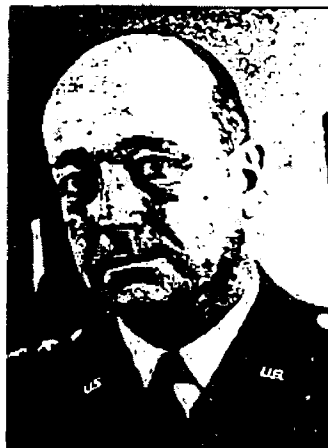
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EO 1.4.(c)

PL 86-36/50 USC 3605

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Alexander H. Flax



Lt Gen Marshall S. Carter

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)>25Yrs, EO 13526 3.5(c)



~~Top Secret~~
~~Handle via BYEMAN/TALENT-KEYHOLE-~~
~~COMINT Control Channels mainly~~
~~NYF 010002~~

PL 86-36/50 USC 3605
EO 1.4.(c)

~~NOFORN ORCON~~

PL 86-36/50 USC 3605
EO 1.4.(c)

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
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~~Top Secret~~
~~NOFORN-ORCON~~

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PL 86-36/50 USC 3605
EO 1.4.(c)

~~Top Secret~~
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~~BYF-919704~~



Charles C. Tevis

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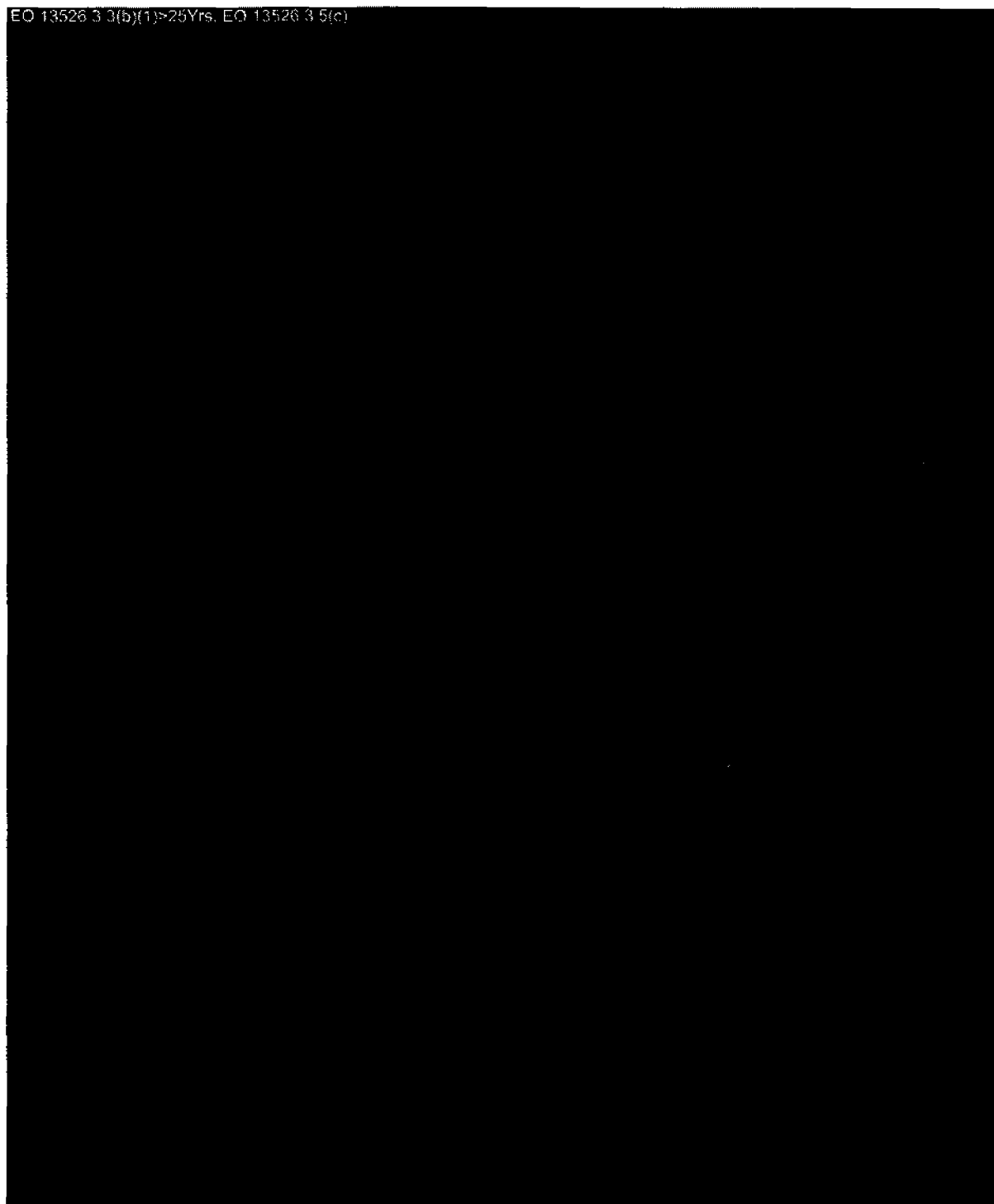
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COMINT Control Channels jointly
BYE-9197/94

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.5(c)



~~Top Secret~~
~~Handle via BYEMAN-TALENT-KEYHOLE-~~
~~COMINT Control Channels jointly~~
~~BYE-9197/94~~

EO 13526 3.3(b)(1)>25Yrs



~~Top Secret~~
~~Handle via BYEMAS TALENT-KEYHOLE-~~
~~COMINT Control Channels Jointly~~
~~BYE-9192/94~~

~~Top Secret~~
~~NOFORN-ORCON~~

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Julian Caballero

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.5(c)



~~Top Secret~~
~~NOFORN-ORCON~~

PL 86-36/50 USC 3605
EO 1.4.(c)



John L. McLucas

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3

PL 86-36/50 USC 3605
EO 1.4.(c)

~~Top Secret~~
Handle via BYEMAN-TALENT-KEYMOLE-
COMINT Control Channels Jointly
BYE-9197/94

~~Top Secret~~
~~NOFORN-ORCON~~



Robert F. Naka

EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs

~~Top Secret~~
~~Handle via BYEMAN-TALENT-KEYHOLE-~~
~~COMINT Control Channels jointly~~
~~BYE-910794~~

~~Top Secret~~
~~NOFORN-ORCON~~

EO 13526 3.3(b)(1)>25Yrs



~~Top Secret~~
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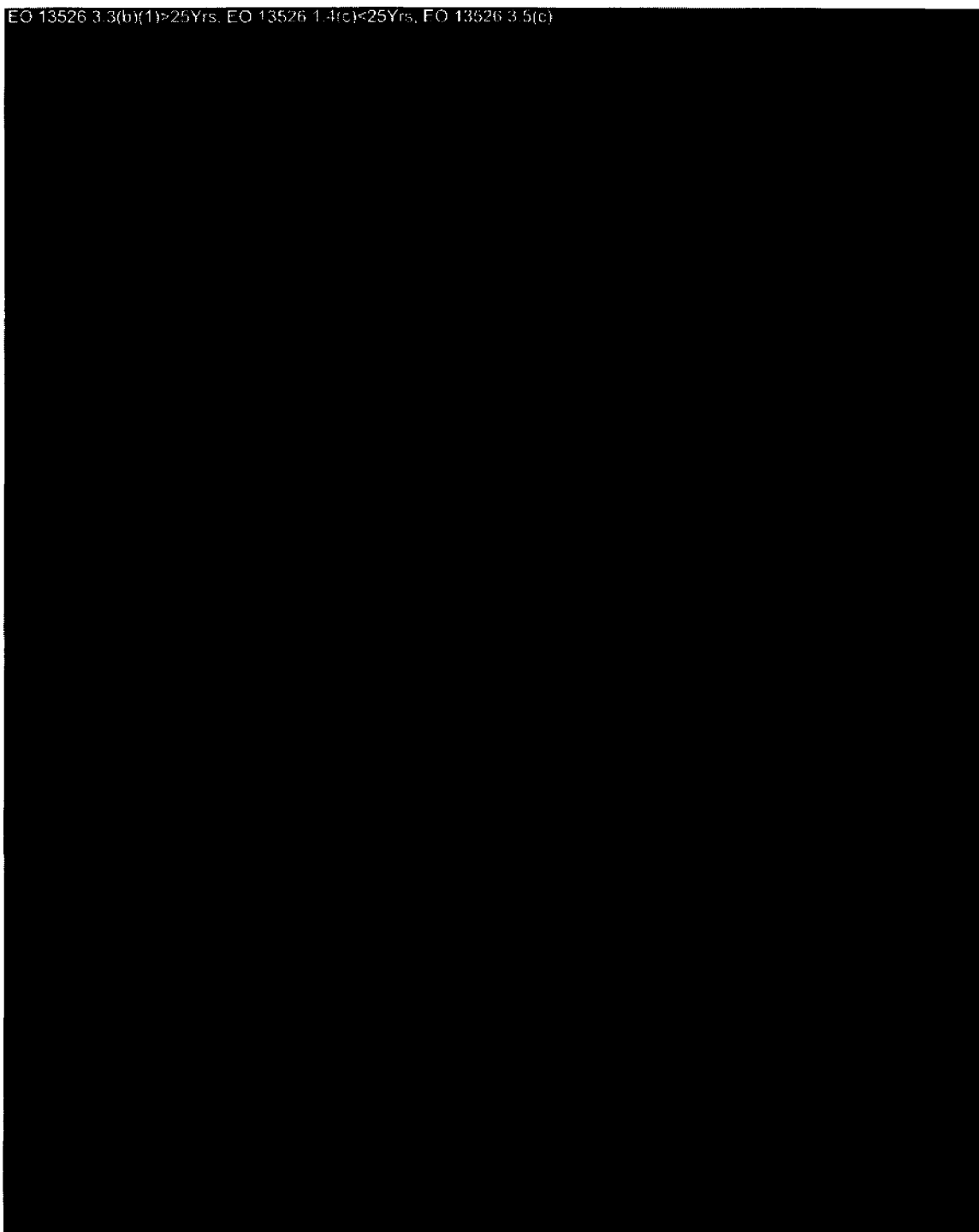
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~~COMINT Control Channels Jointly~~
~~BYE-9147/94~~

~~Top Secret~~
~~NOFORN-CIRCUM~~

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EO 1.4.(c)
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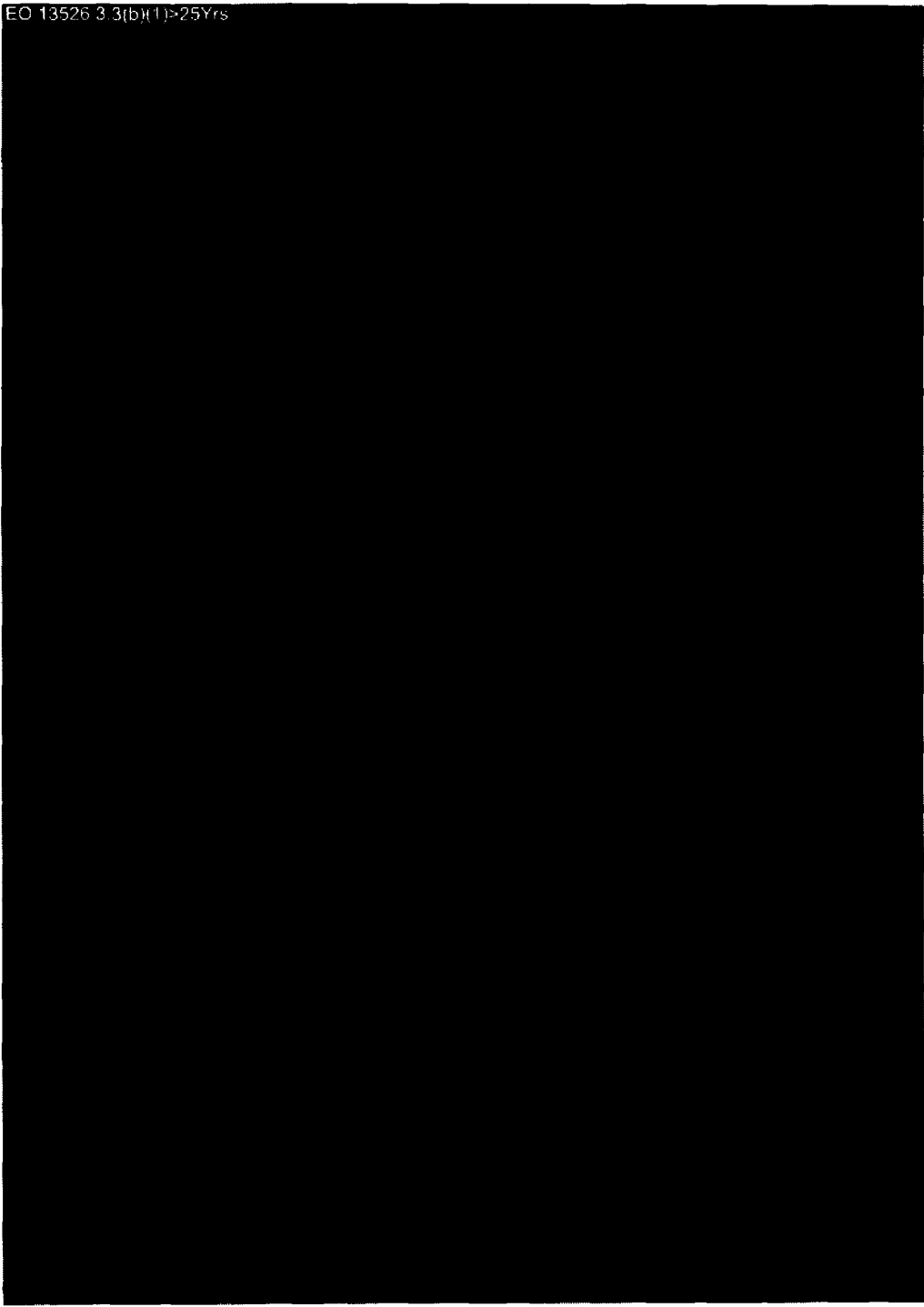
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~~Top Secret~~
~~NOFORN/ORCON~~

EO 13526 3.3(b)(1)>25Yrs



~~Top Secret~~
~~Handle via BYEMAN TALENT KEYHOLE-~~
~~COMINT Control Channels Jointly~~
~~BYE-919794~~

~~NOFORN ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMANTALENT-KEYHOLE-
COMINT Control Channels jointly
~~BYE-9197/94~~

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

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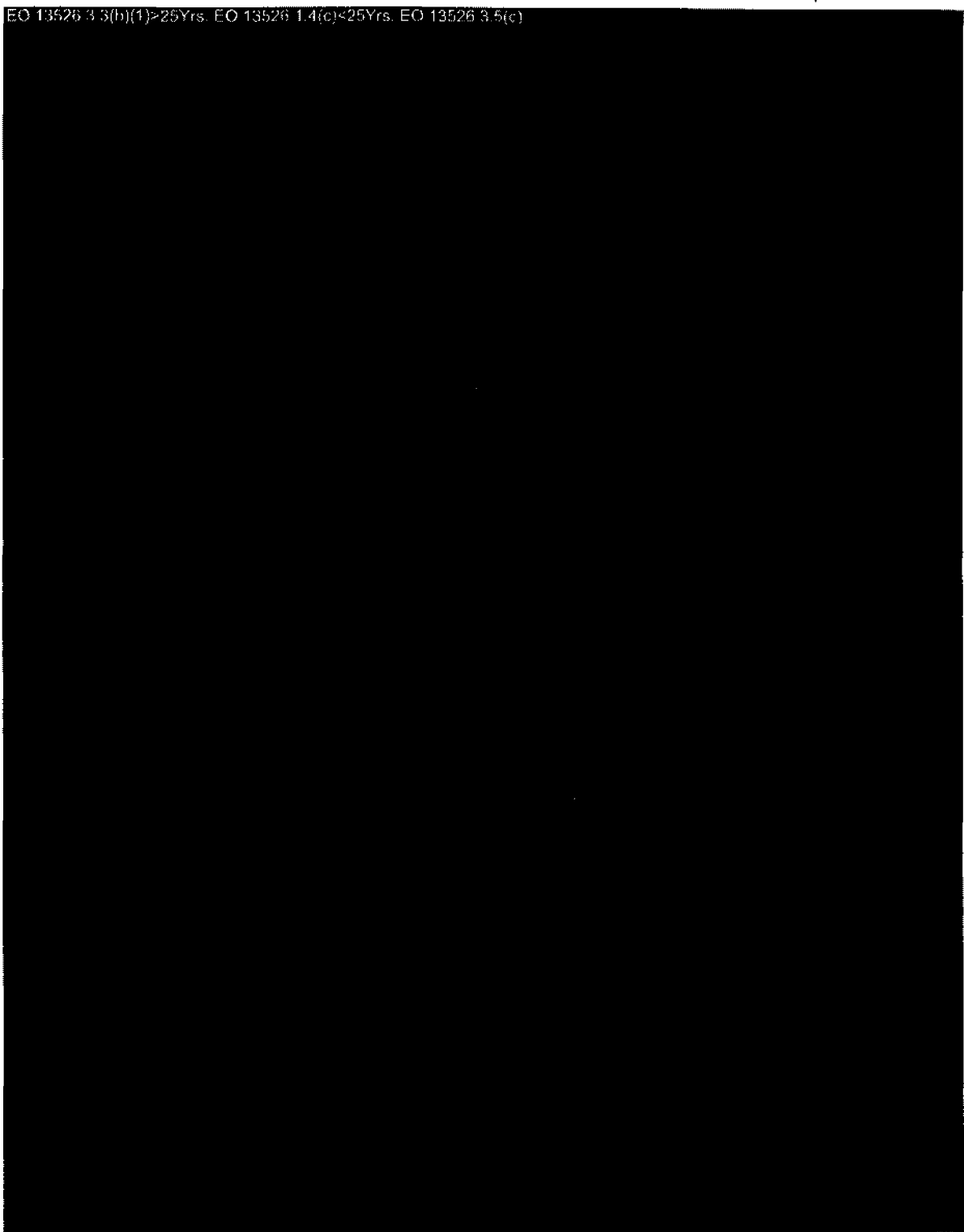


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~~BYE. 0197/94~~

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~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

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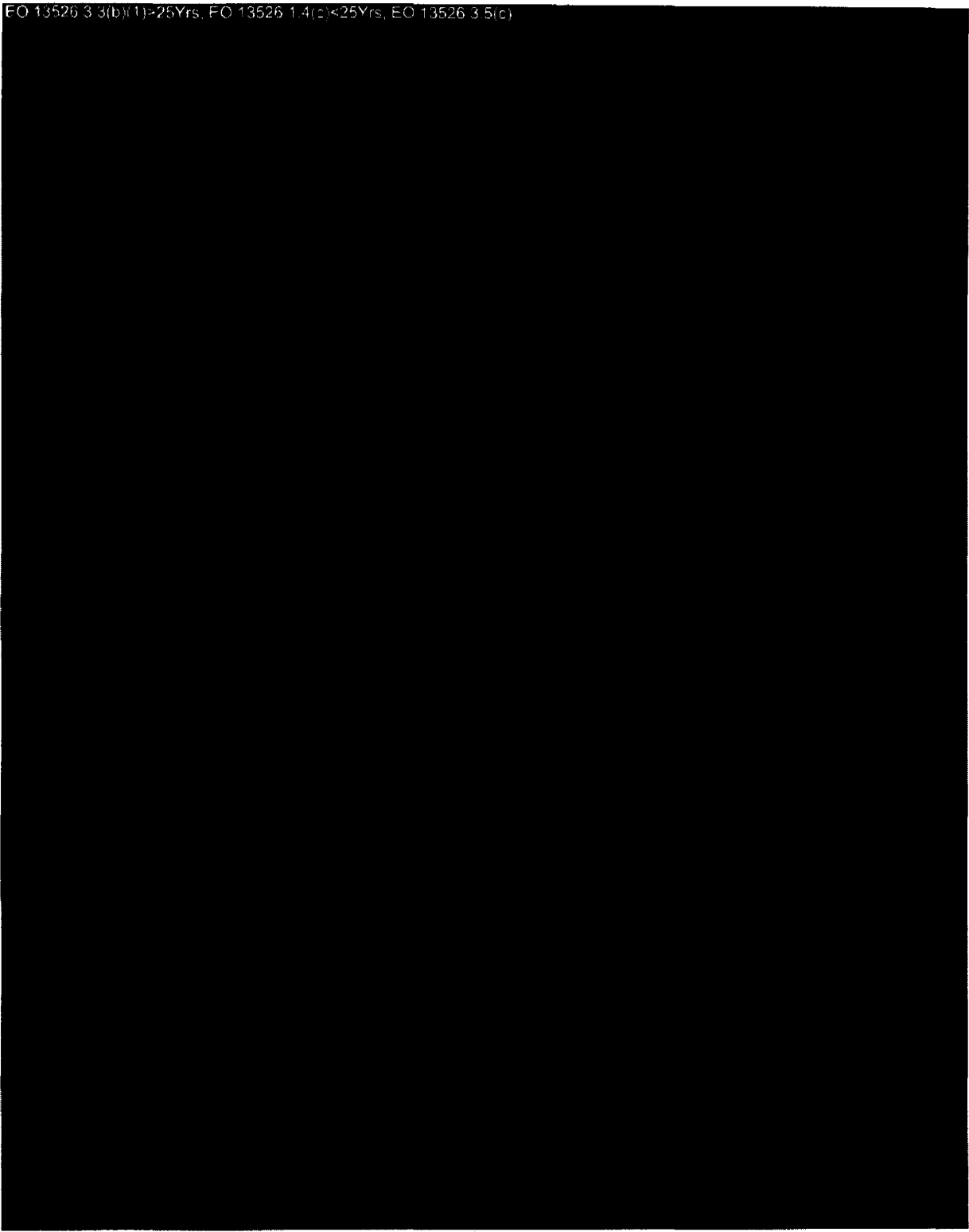


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BYE-9197/94

~~Top Secret~~
~~NOFORN ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)-25Yrs, EO 13526 1.4(c)-25Yrs, EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN TALENT KEYHOLE
~~COMINT Control Channels family~~
BYE 919794

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)



~~Top Secret~~
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COMINT Control Channels jointly
BYE-919744

~~Top Secret~~
~~NOFORN-ORCON~~

b2

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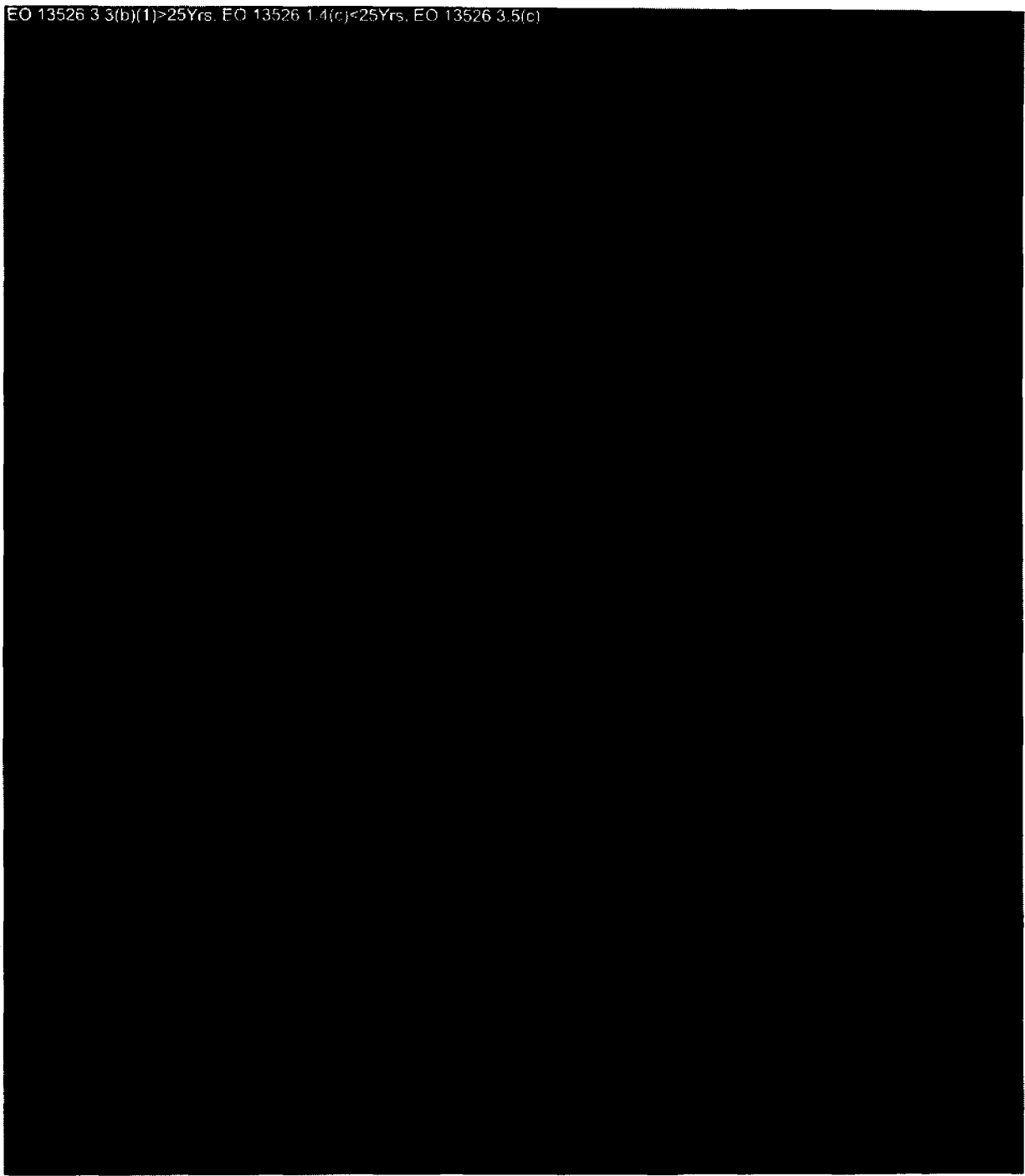
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~~Top Secret~~
~~NOFORN/ARCON~~

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)




EO 1.4.(c)
PL 86-36/50 USC 3605

~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
BYE-919794

~~NOFORN ORCON~~

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)



EO 1.4.(c)
PL 86-36/50 USC 3605

~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointiv
BYE-9197/94

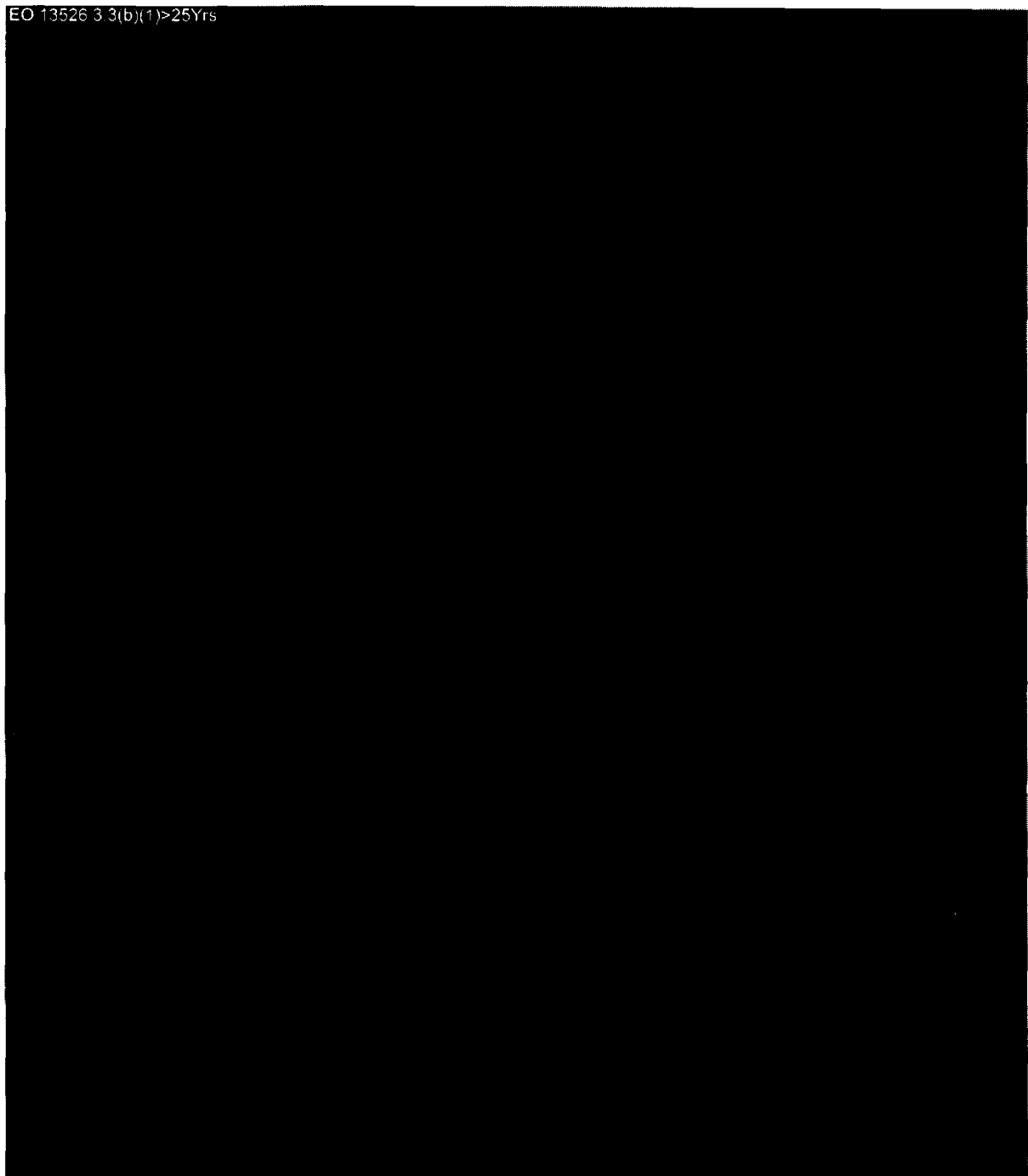
Chapter 6

193

~~Top Secret~~
~~NOFORN/ORCON~~

Chapter 6 References

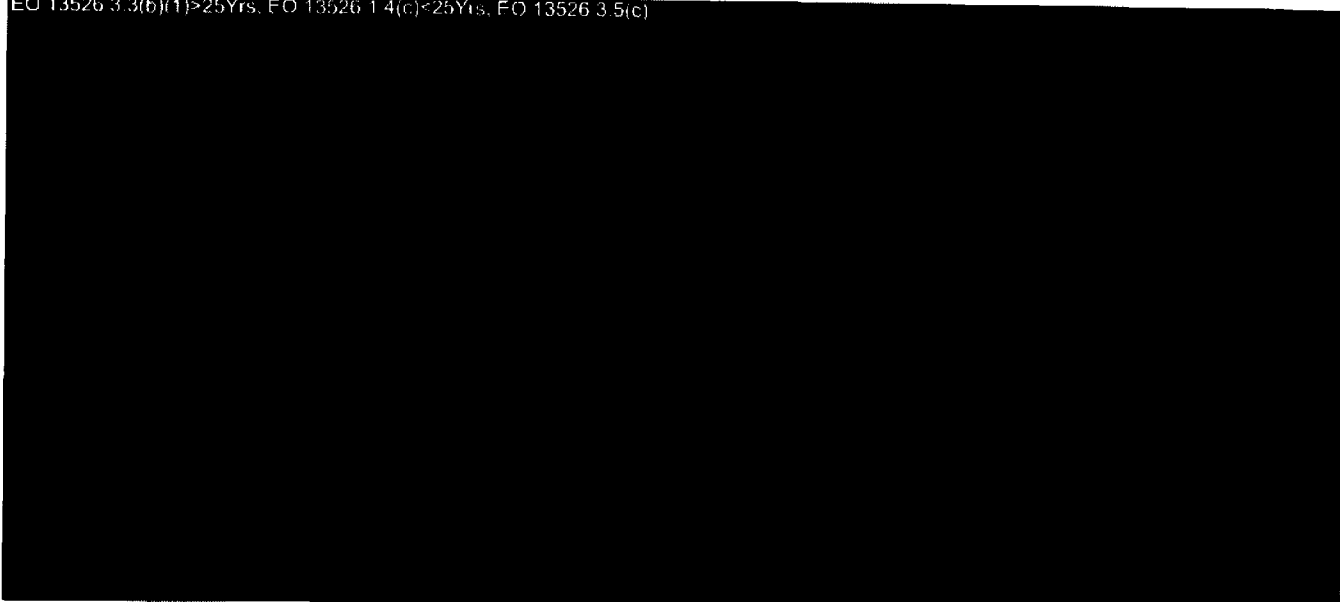
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~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels family
~~RVE-4107-04~~

~~Top Secret~~
~~NOFORN-ORCON~~

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



PL 86-36/50 USC 3605
EO 1.4.(c)

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~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
BYE-9197/94

~~Top Secret~~
~~NOFORN/ORCON~~

EO 13526 3.3(b)(1)>25Y

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels fourth
BYE-9197/03

EO 13526 3.3(b)(1)>25Yrs

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The SIGINT Satellite Story

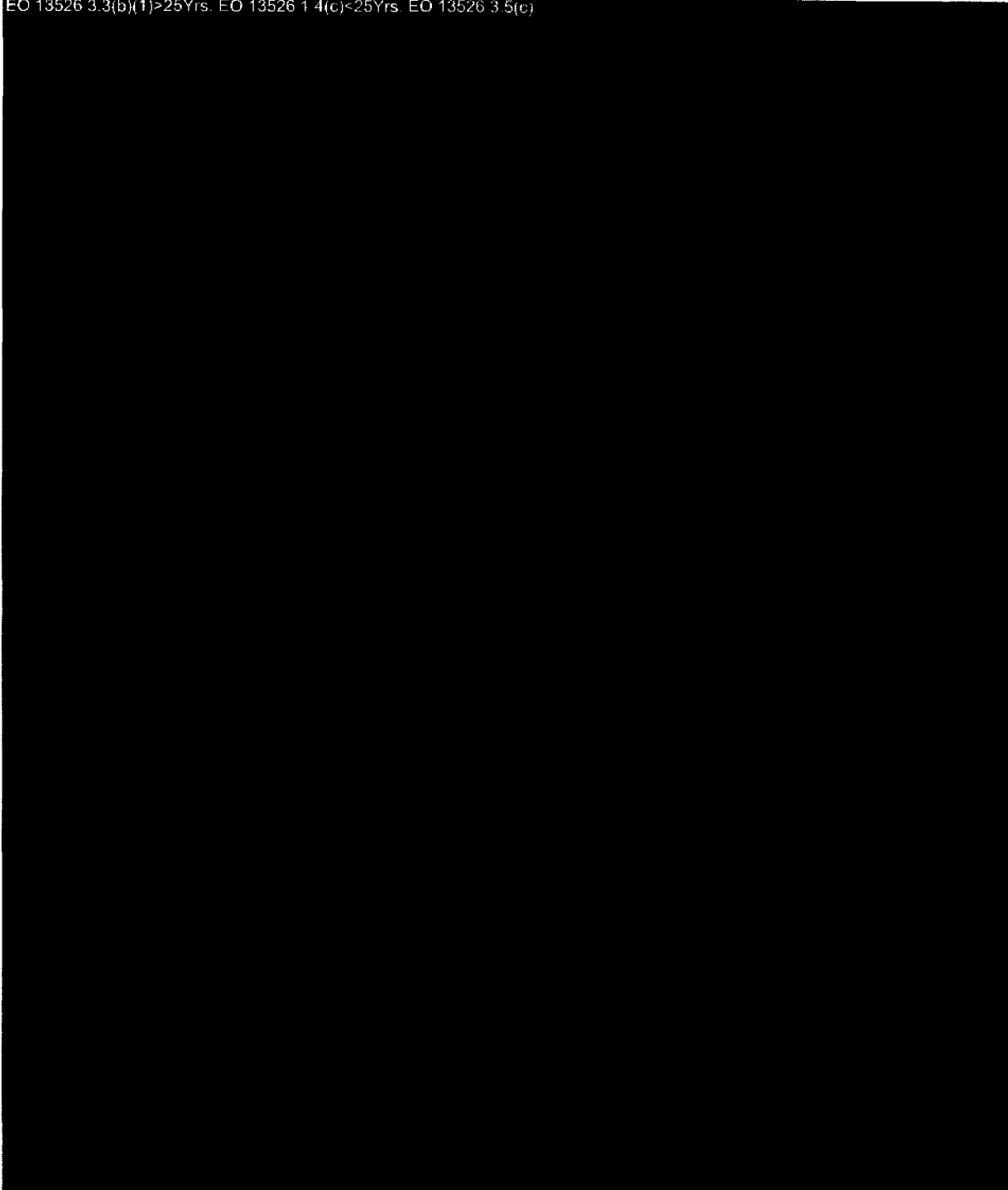
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COUNT COPIES/CHRONICALLY

~~Top Secret~~
NOFORN/NOCON

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)



50 USC 3605

PL 86-36/50 USC 3605
EO 1.4.(c)

~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
~~COMINT~~ Control Channels jointly
BYE-9197/94

Chapter 7 199

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



PL 86-36/50 USC 3605

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)>25Yrs. EO 13526



Col David D. Bradburn

EO 13526 3.3(b)(1)>25Yrs

~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels kindly
BYE-1142/4

~~Top Secret~~
~~NOFORN-ORCON~~

EO 13526 3.3(b)(1)>25Yrs. EO 13526 3.5(c)

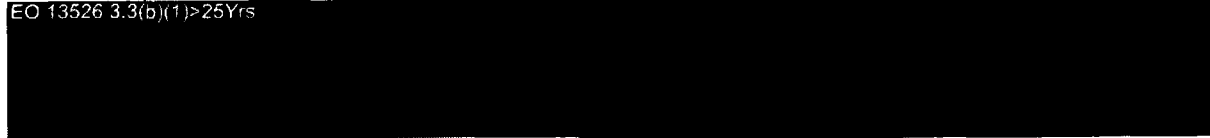


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Robert J. Hermann

EO 13526 3.3(b)(1)>25Yrs

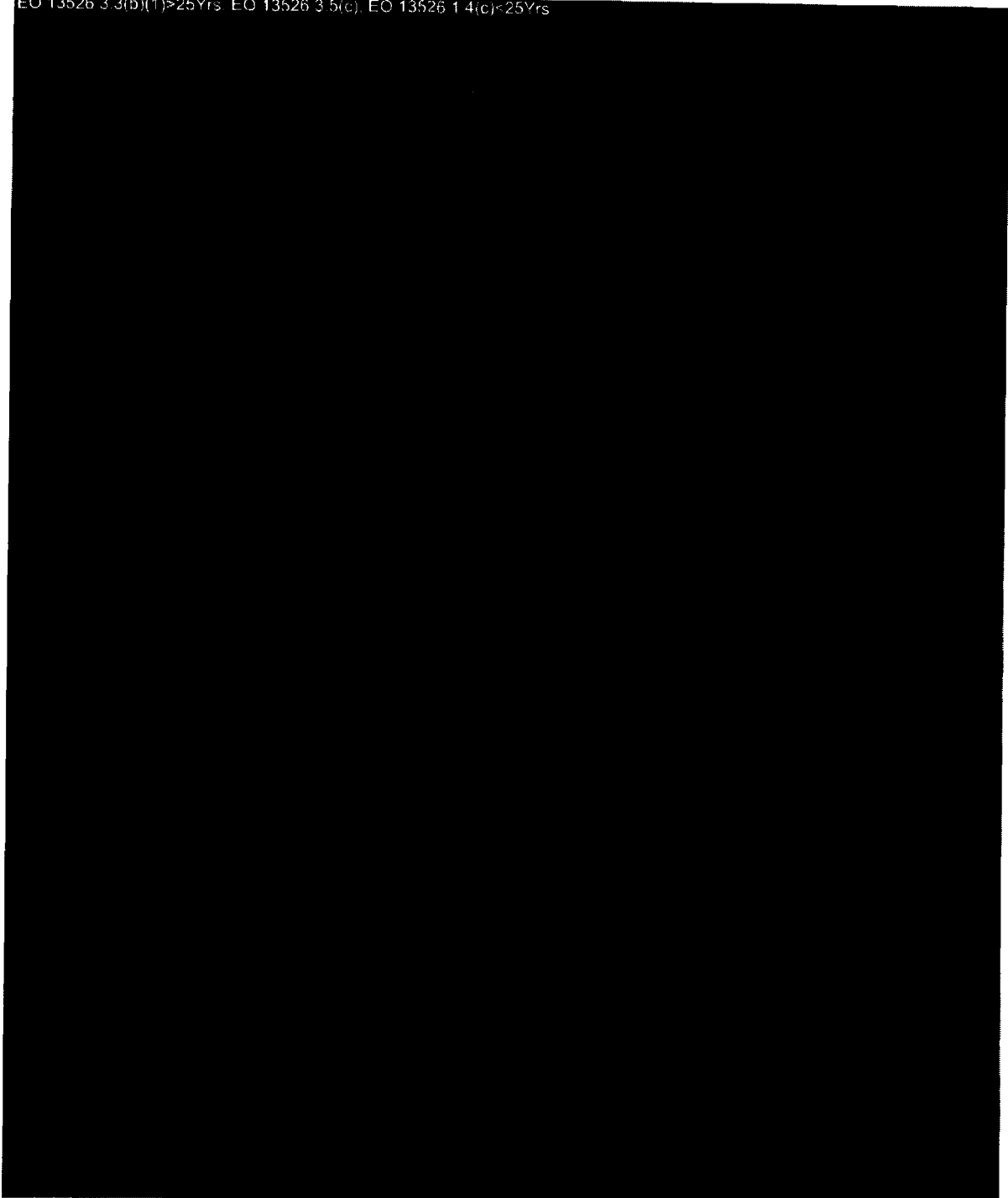


PL 86-36/50 USC 3605

~~Top Secret~~
~~NOFORN-ORCON~~

PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs EO 13526 3.5(c) EO 13526 1.4(c)<25Yrs



EO 1.4.(c)
PL 86-36/50 USC 3605

~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
BYE-9197/94

Chapter 7

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~~Top Secret~~
~~NOFORN/NOCON~~

PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



EO 1.4.(c)
PL 86-36/50 USC 3605

~~Top Secret~~
Handle via BYEMINT-TALENT-KEYHOLE-
~~COMINT Control Channels for only~~
~~BYE-9197-94~~

~~Top Secret~~
~~NOFORN-ORCON~~

EO 13526 3.3(b)(1)>25Yrs



~~Top Secret~~
~~Handle via BYEMAN-TALENT-KEYHOLE-~~
~~COMINT Control Channels jointly~~
~~BYE-4197-94~~

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs EO 13526 1.4(c)<25Yrs EO 13526 3.5(c)



PL 86-36/50 USC 3605

~~Top Secret~~
Handle via BYEMANTALENT-KEYHOLE-
~~COMINT Control Channels Exclv~~
BYE.010703

~~Top Secret~~
~~NOFORN-ORCON~~

PL 86-36/50 USC 3605
EO 1.4.(c)

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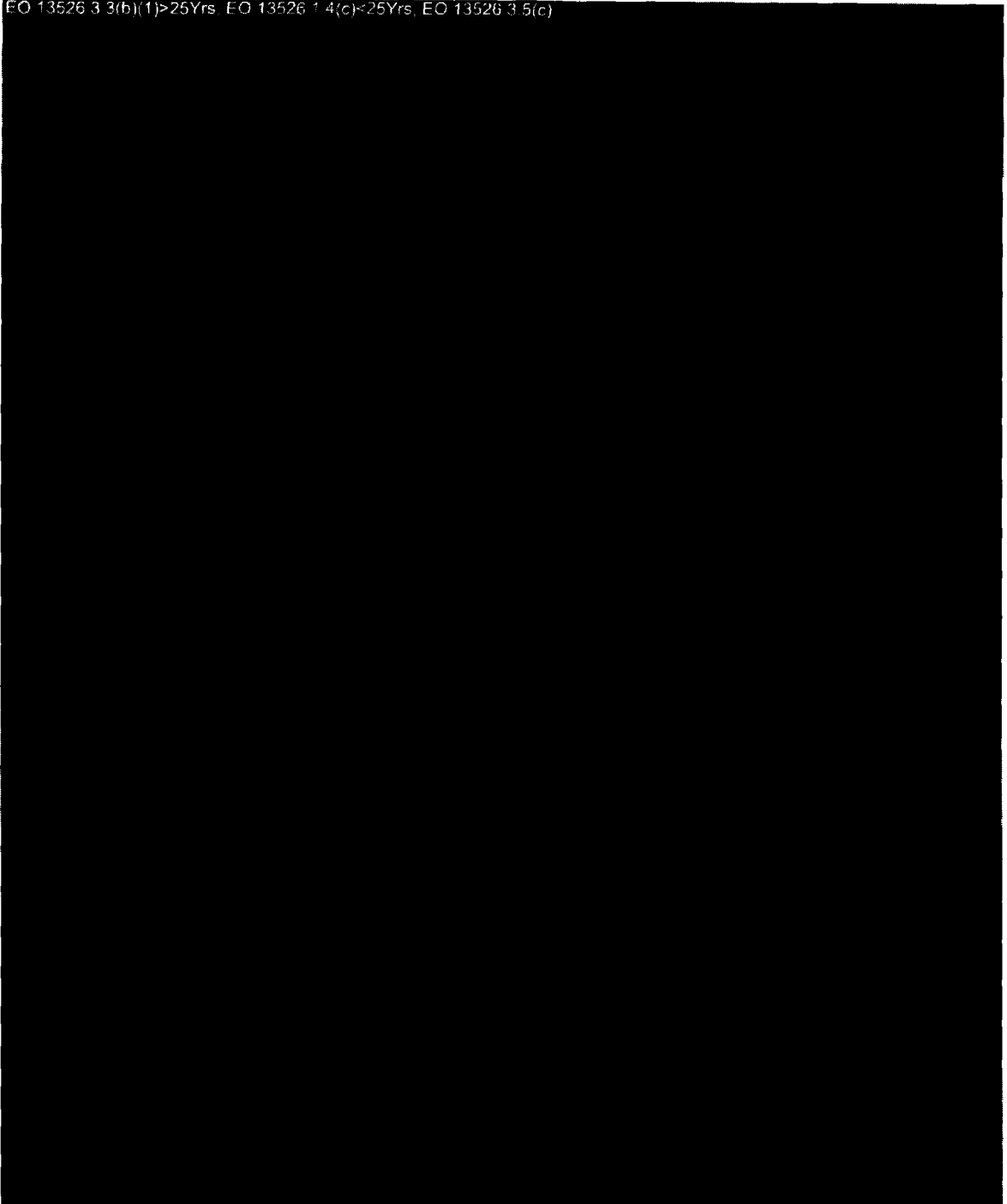
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COMINT Control Channels kunitiv
BYE-9192/94

~~Top Secret~~
~~NOFORN ORCON~~

PL 86-36/50 USC 3605

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3 3(b)(1)>25Yrs EO 13526 1 4(c)<25Yrs EO 13526 3 5(c)



~~Top Secret~~
~~Handle via BYEMAN-TALENT-KEYHOLE-~~
~~COMINT Control Channels jointly~~
~~BYE-9197-94~~

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)

PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



VAdm Noel Gayler

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels kintlv
037-010-03

~~Top Secret~~
~~NOFORN-ORCON~~

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526

USC 3605



EO planning meeting, El Segundo, California, April 1970

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526

PL 86-36/50 USC 3605
EO 1.4. (c)

~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
RYP-011700

~~Top Secret~~
~~NOFORN-ORCON~~



Col John W. Browning

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 135

EO 1.4.(c)
PL 86-36/50 USC 3605

PL 86-36/50 USC 3605

~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
BYE-9197/94

Chapter 7

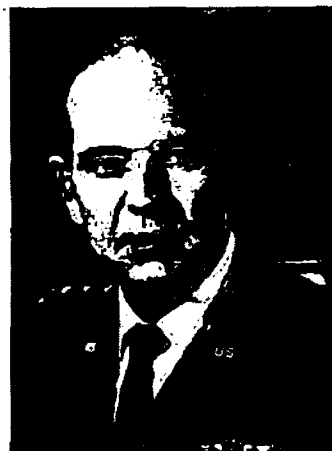
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PL 86-36/50 USC 3605

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EO 13526 3.3(b)(1)>25Yrs EO 13526 1.4(c)<25Yrs EO 13526 1.4(d)<25Yrs



LGen Lew Allen, Jr.

EO 13526 3.3(b)(1)>25Yrs

EO 1.4.(c)
EO 1.4.(d)
PL 86-36/50 USC 3605

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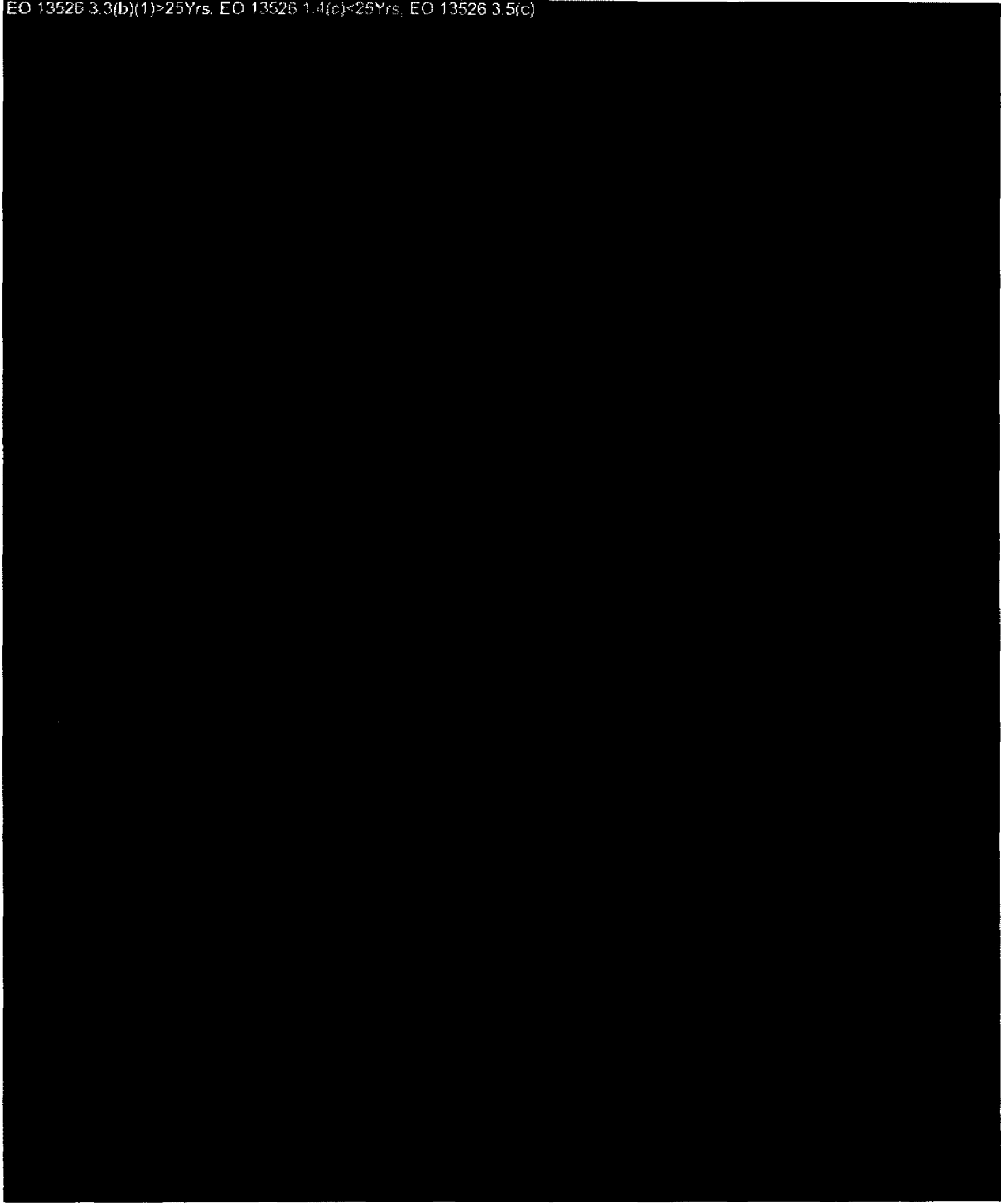


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PL 86-36/50 USC 3605

EO 1.4.(c)
PL 86-36/50 USC 3605

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~~Top Secret~~
Handle via BYE/PAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
BYF.0197-94

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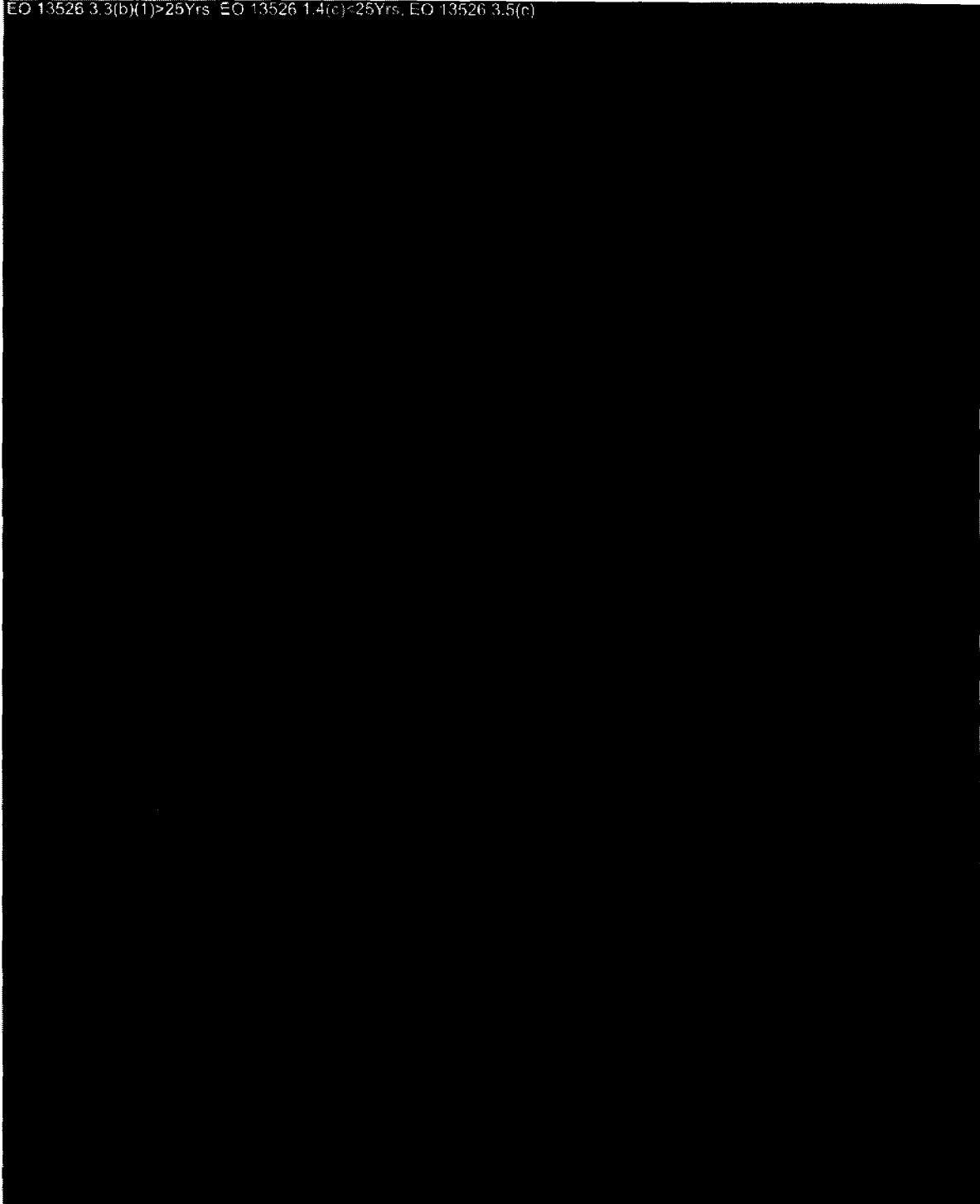
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Handle via BREVAN/ALINT KEYNOTE
COMINT Countdown Group's handle
by 01/03/04

~~Top Secret~~
NOFORN/NOCTV

~~Top Secret~~
~~NOFORN/DRCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

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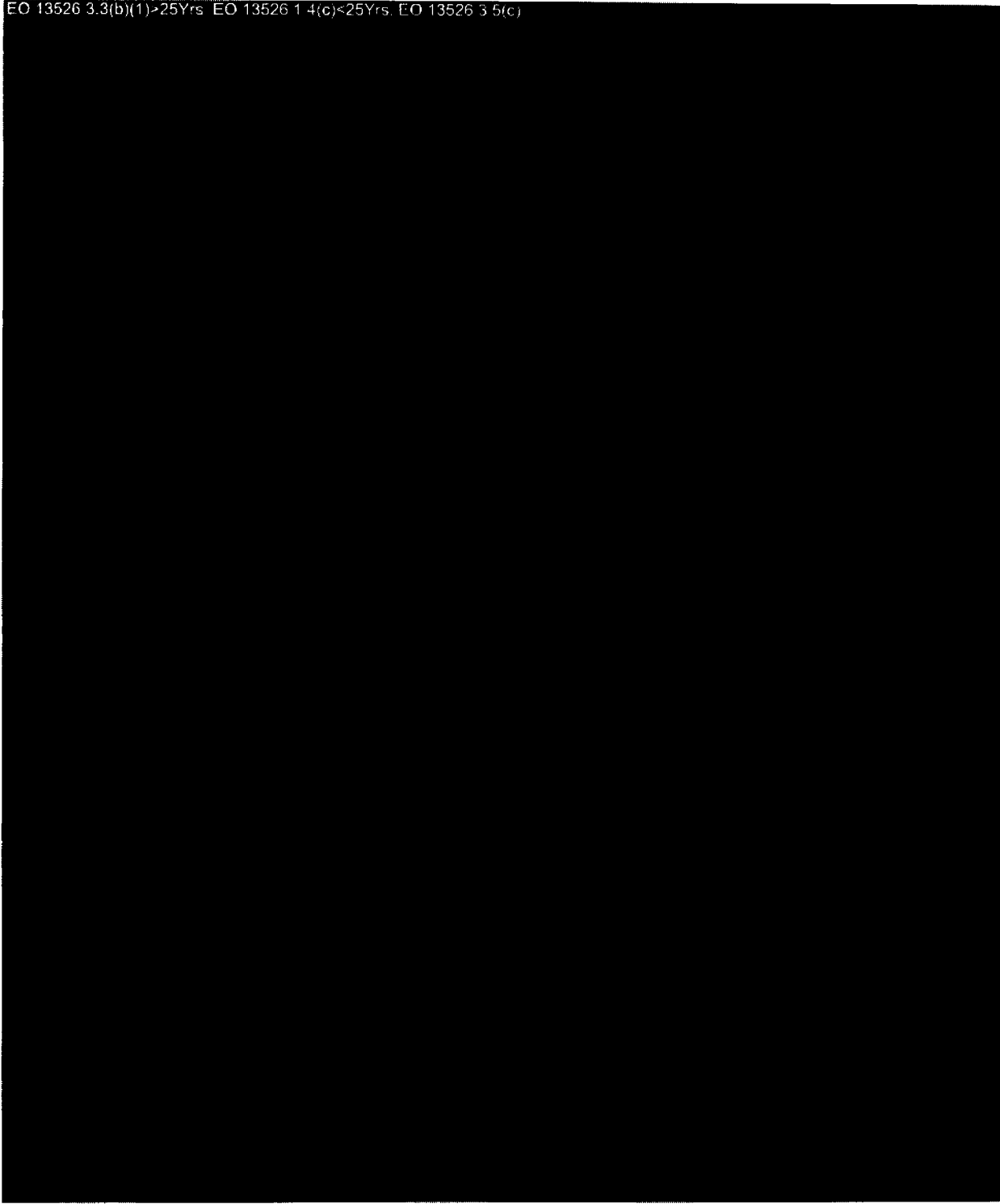
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~~Top Secret~~
~~Handle via RYEMANTALENT-KEYHOLE-~~
~~COMINT Control Channels (unfiled)~~
~~Rev 01/01/01~~

~~Top Secret~~
~~NOFORN/NOACORN~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs EO 13526 1.4(c)<25Yrs EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
BYE-9197/94

~~Top Secret~~
~~NOFORN ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
BYE-9197/94

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526

*Outstanding high-school graduates with a demonstrated aptitude for foreign language were hired and trained because the military services could not recruit enough.

EO 13526 3.5(c)

*Congressional committees have oversight of NSA and NRP operations, and approve NSA and NRP budgets and activities. The six committees are the House Armed Services Committee (HASC), the Senate Armed Services Committee (SASC), the House Appropriations Committee (HAC), the Senate Appropriations Committee (SAC), the House Permanent Select Committee on Intelligence (HPSCI), and the Senate Select Committee on Intelligence (SSCI).

school graduates who qualified for the program were hired as GS-3s, promoted to GS-4s upon successful completion of the first six months of the program, and promoted to GS-5s upon completion of the intensive one-year program. Many went on to get a college degree in language from a local college or university while continuing to work for NSA.

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)-25Yrs, EO 13526 1.4(c)-25Yrs, EO 13526



~~Top Secret~~
Handle via BYEMAN/TALENT-KEYHOLE-
COMINT Control Channels jointly
~~BYE-9197/94~~

~~Top Secret~~
~~NOFORN/CON~~



Chapter 7 References

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USC 3605

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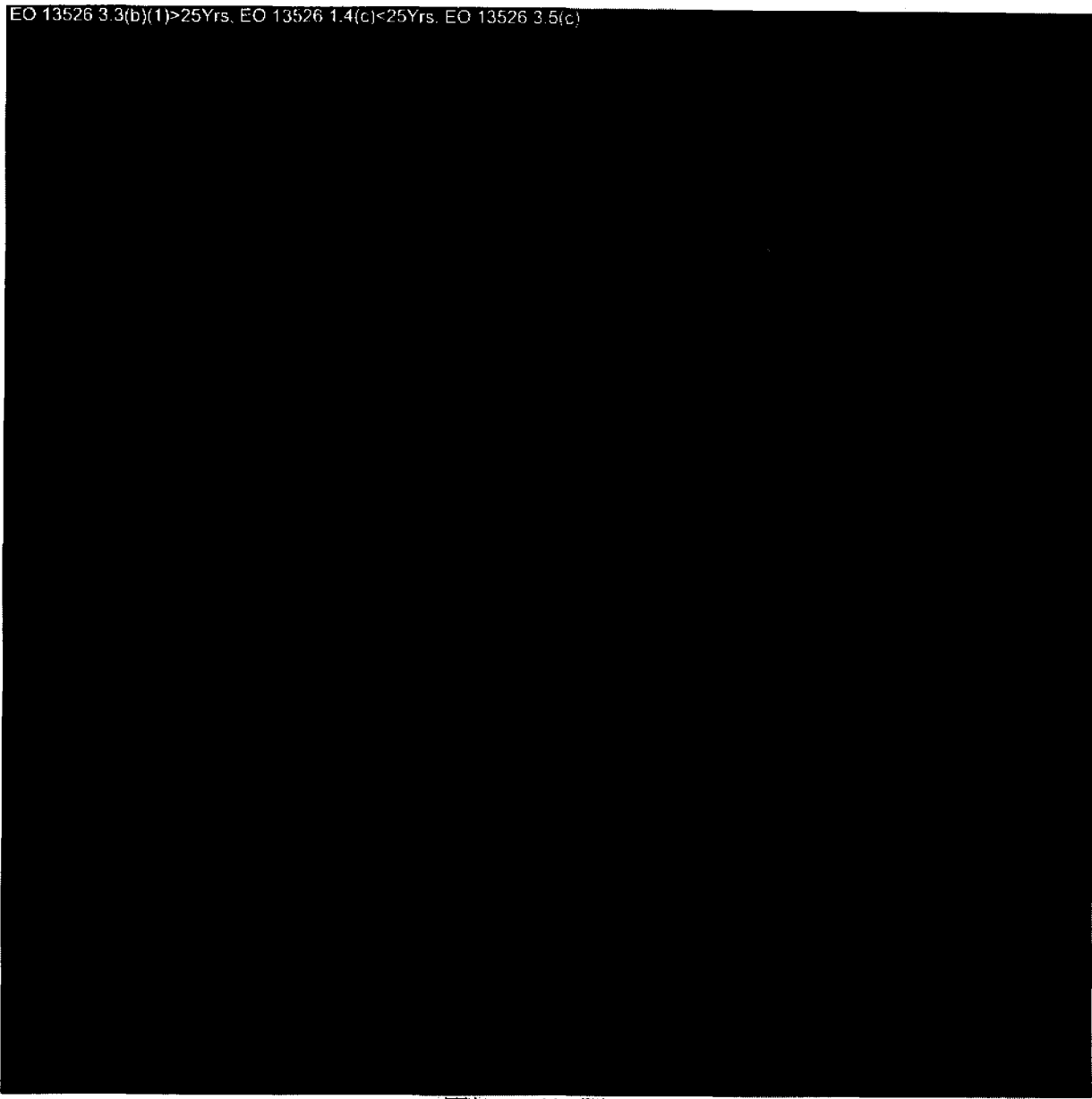
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COMINT Control Channels only
~~NOFORN/CON~~

~~Top Secret~~
~~NOFORN-ORCON~~

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EO 1.4.(c),
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



PL 86-36/50 USC 3605

~~Top Secret~~
~~Handle via BYEMAN-TALENT-KEYHOLE-~~
~~COMINT Control Channels jointly~~
~~BYE-4147-04~~

Chapter 8 223

~~TOP SECRET
NOFORN (S) NOCON~~

EO 13526 3.3(b)(1)>25Yrs

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The SIGINT Satellite Story

~~TOP SECRET~~
Handle via BERNARD LALIN-FREYHOUE -
COMINT Control Channels Only
BYE. 910704

~~Top Secret~~
~~NOFORN/COMINT~~

EO 1.4.(c)
PL 86-36/50 USC 3605

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PL 86-36/50 USC 3605

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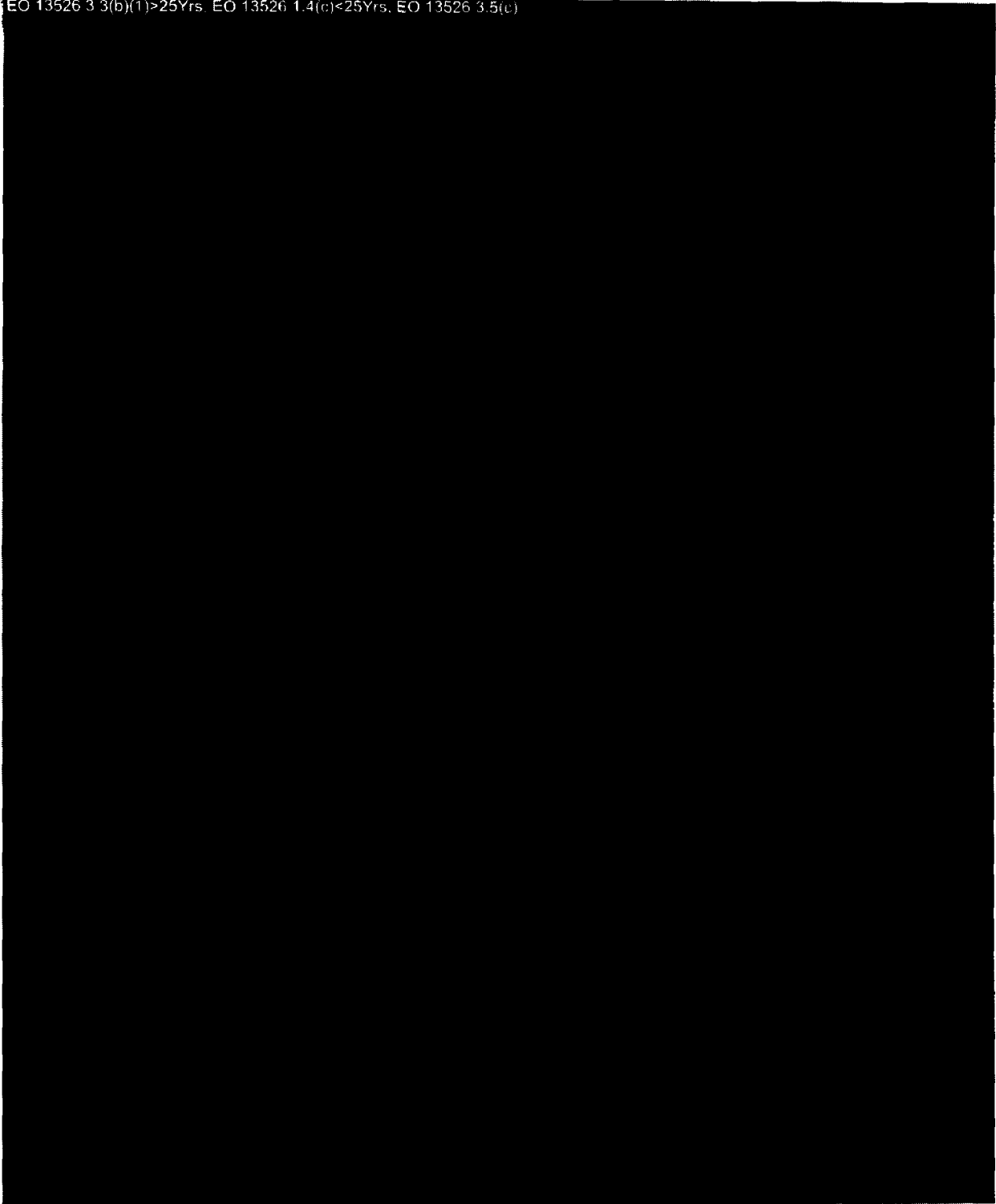
Chapter 8

225

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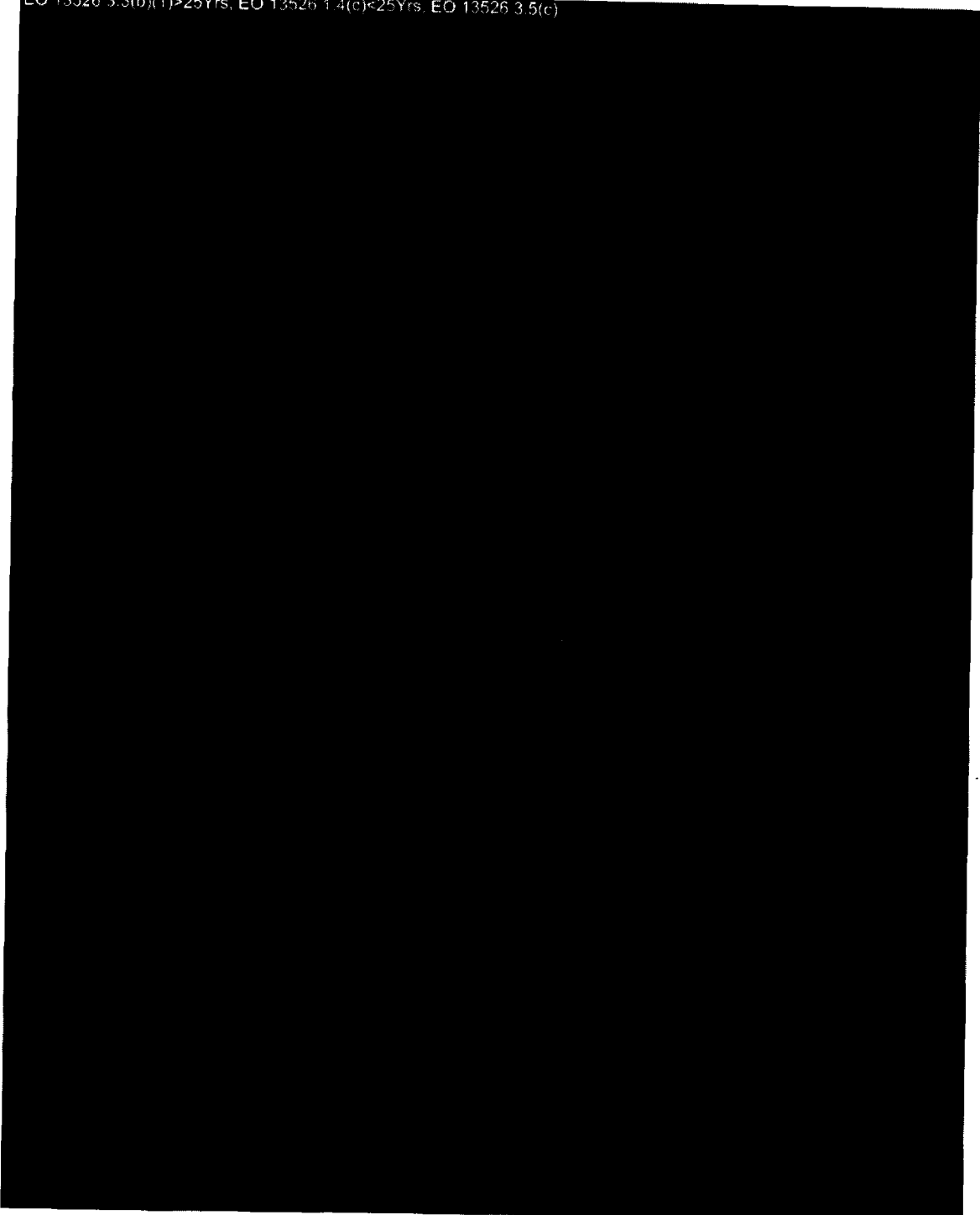


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~~COMINT Central Channels South~~

~~Top Secret~~
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PL 86-36/50 USC 3605

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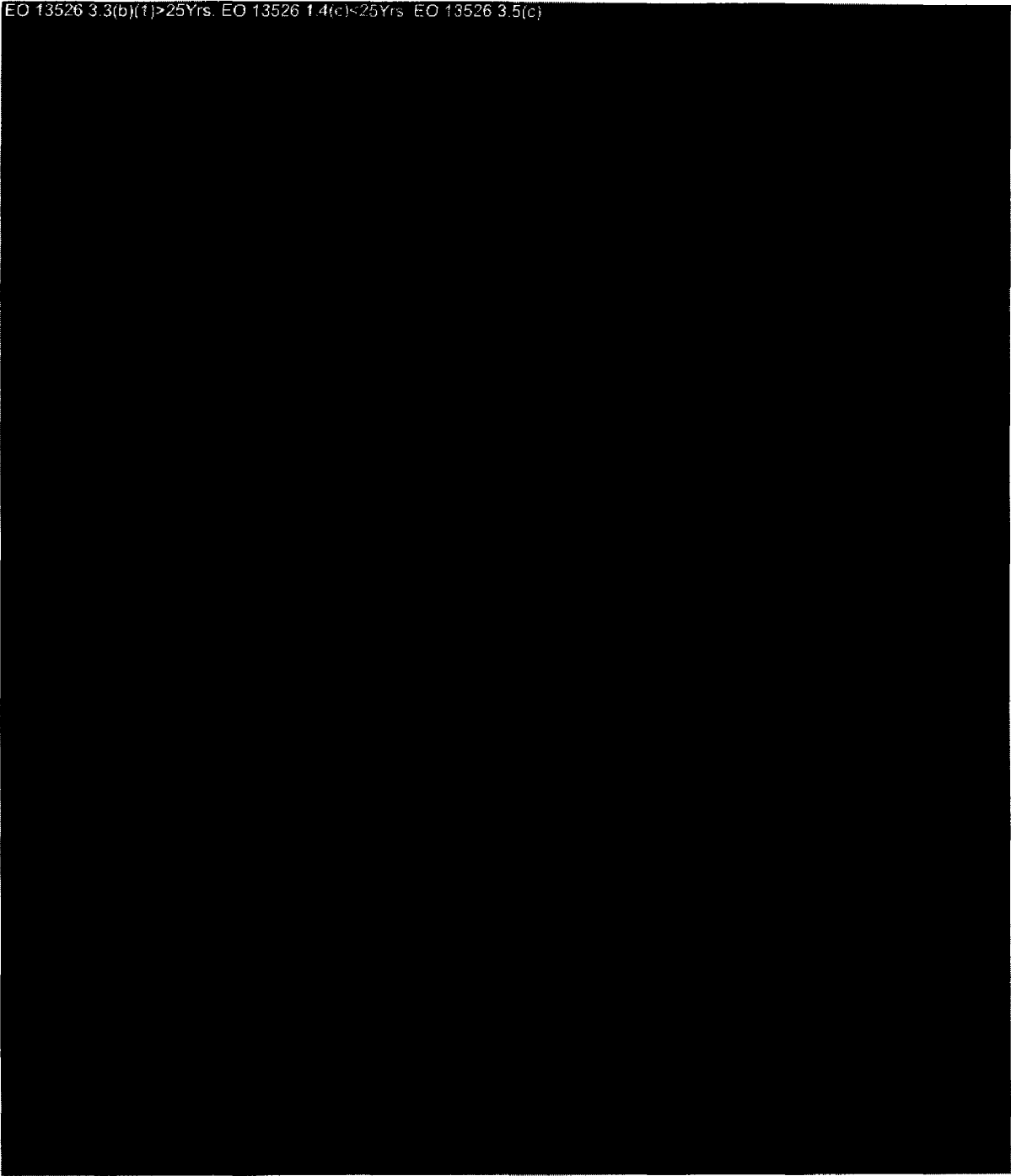
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EO 1.4.(c)

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~~COMINT Control Channels jointly~~
~~BYE-919794~~

~~Top Secret~~
~~NOFORN ORCON~~

EO 1.4.(c)
EL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
BYE-9197/94

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEM/K-TALENT-KEYHOLE-
COMINT Control Channels jointly
BYE-9197/94

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

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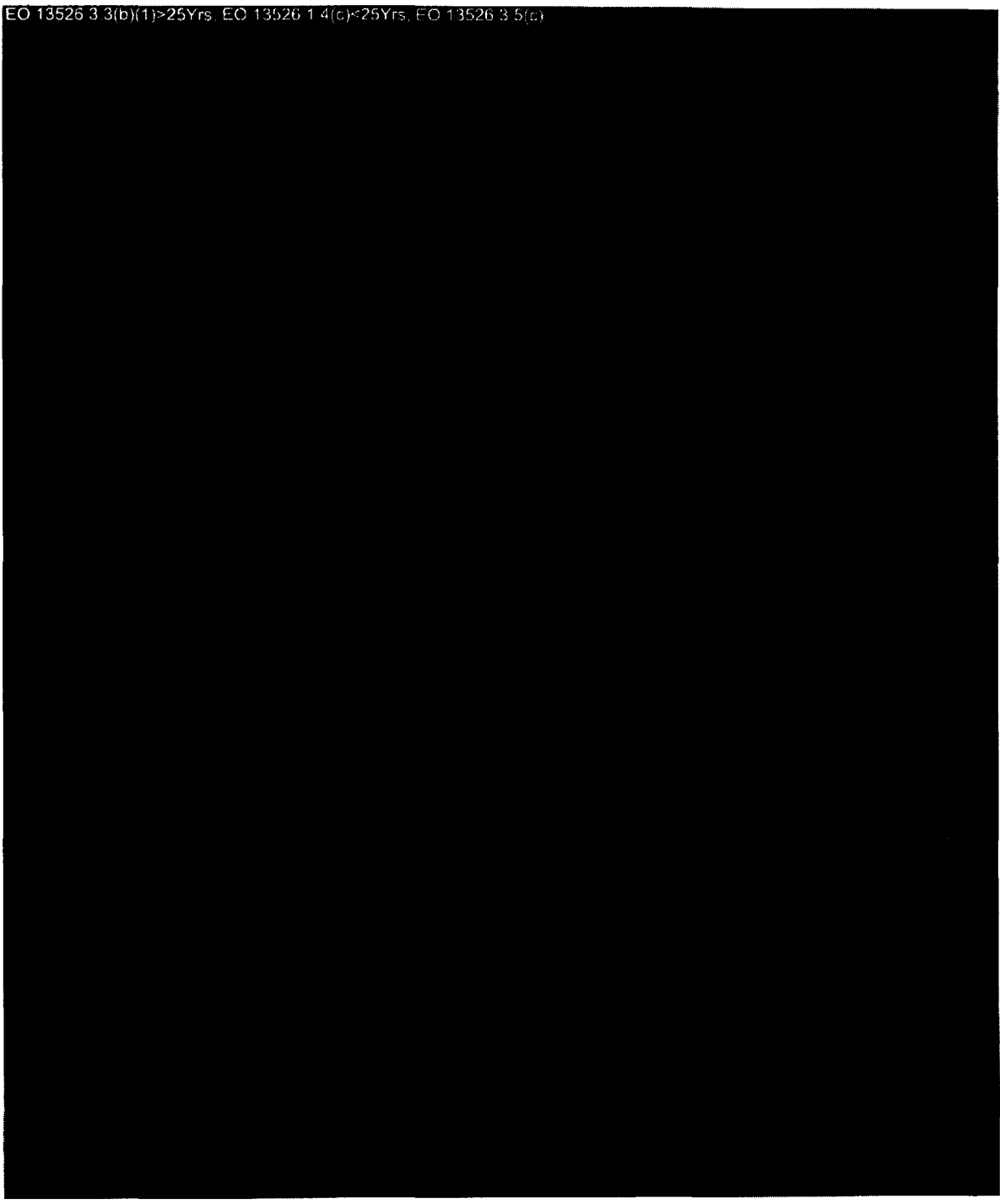


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~~Top Secret~~
~~NOFORN-ORCON~~

PL 86-36/50 USC 3605

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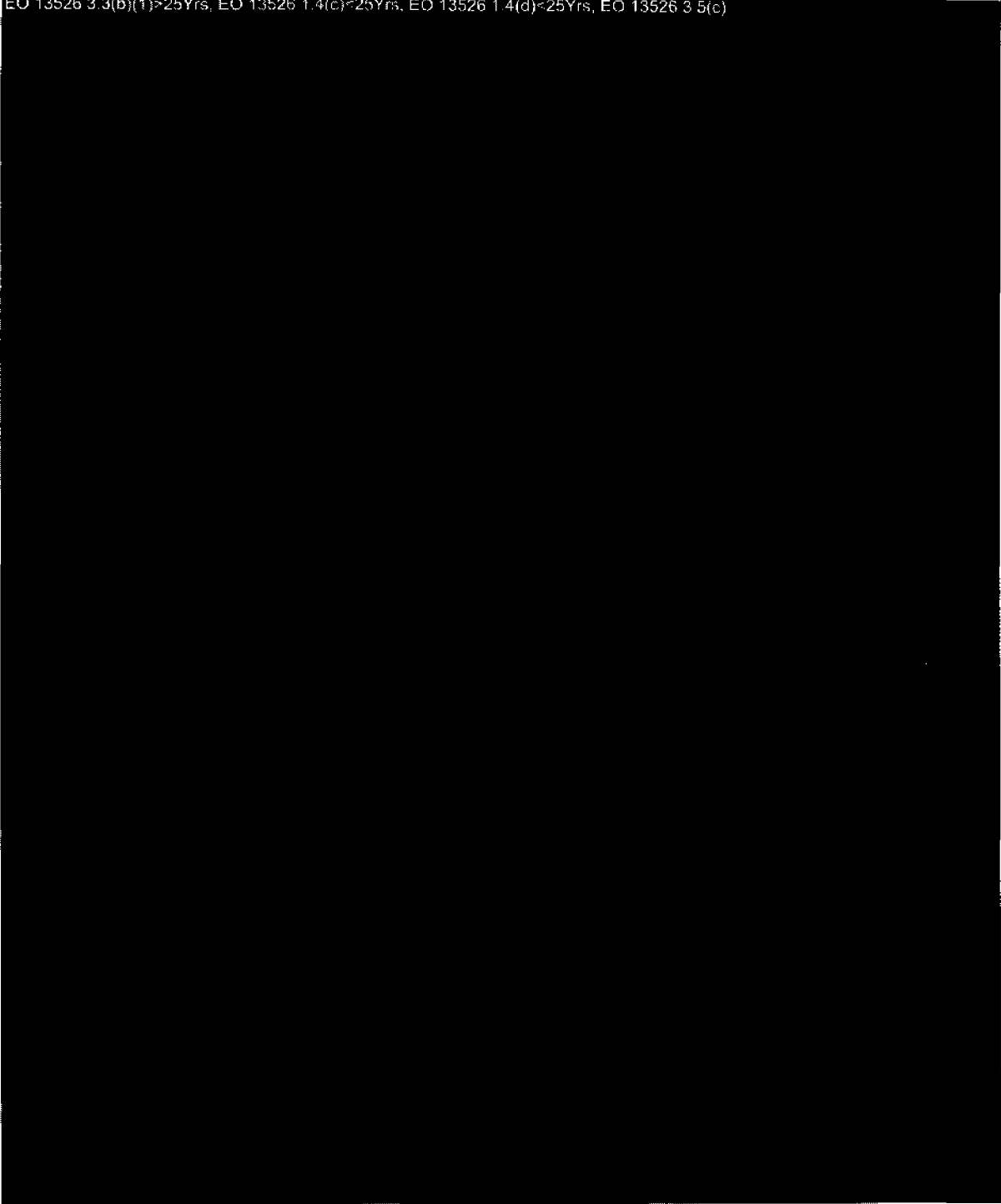


~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
~~COMINT Control Channels~~ kmily
81E-9147/44

~~Top Secret~~
~~NOFORN ORCON~~

EO 1.4.(c)
EO 1.4.(d)
PL 86-36/50 USC 3605

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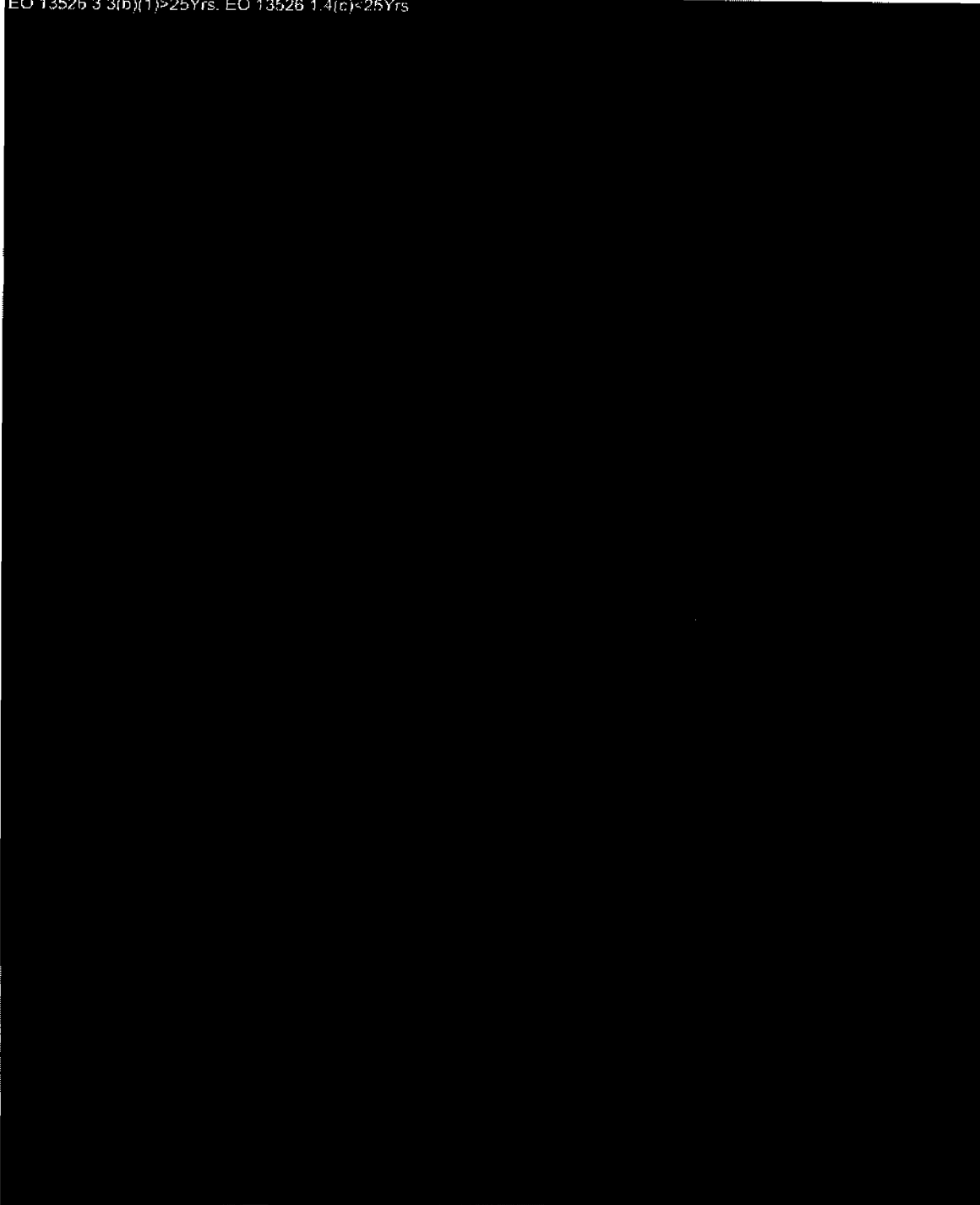
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~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
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~~BYE-0107M4~~

~~Top Secret~~
~~NOFORN-ORCON~~

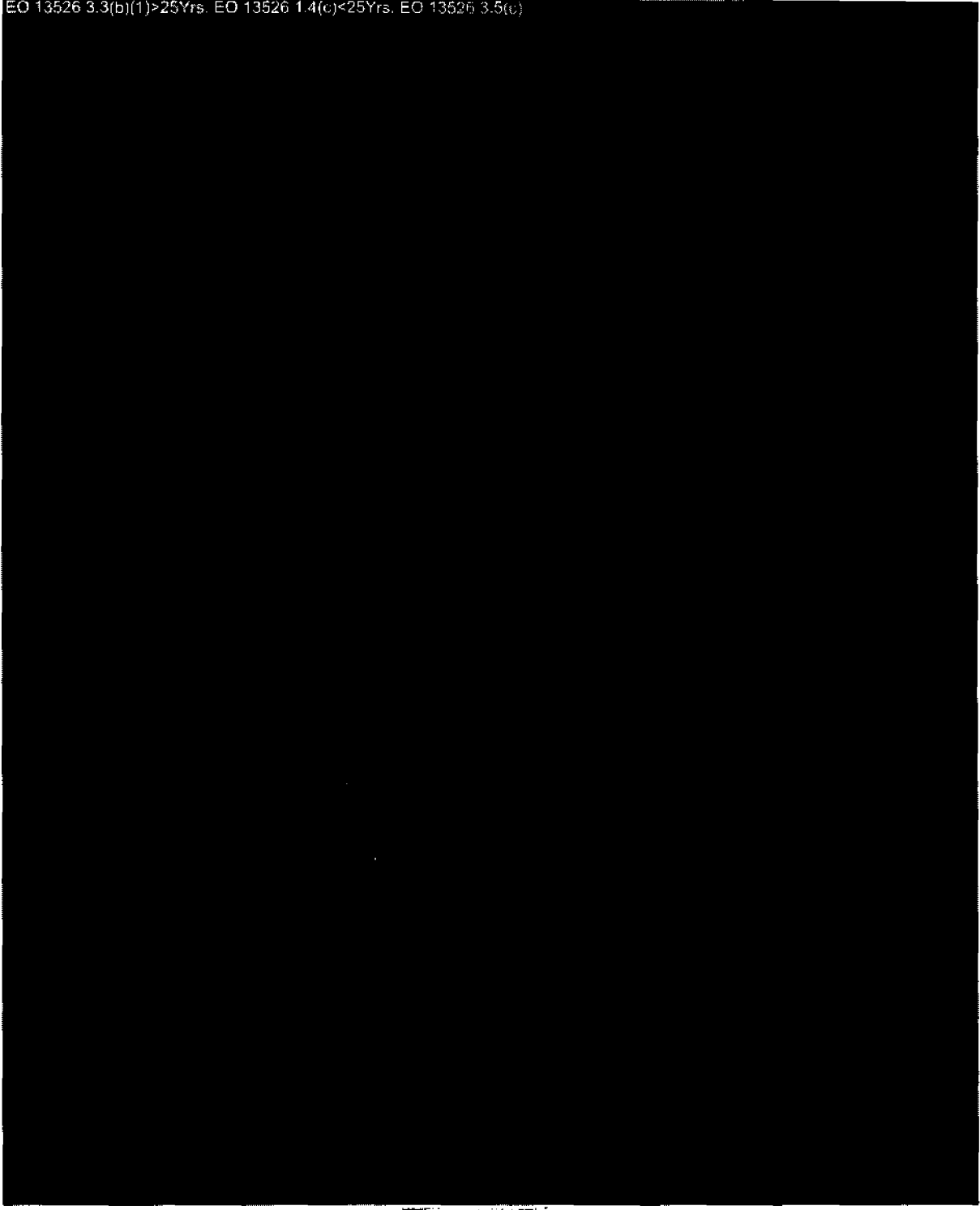
EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
~~COMINT~~ Control Channels Jointly
BYE-9197/94

~~Top Secret~~
~~NOFORN-ORCON~~

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)



EO 1.4.(c)
PL 86-36/50 USC 3605

~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels Jointly
BYE.919701

~~Top Secret~~
~~NOFORN-ORCON~~

PL 86-36/50 USC 3605

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PL 86-36/50 USC 3605

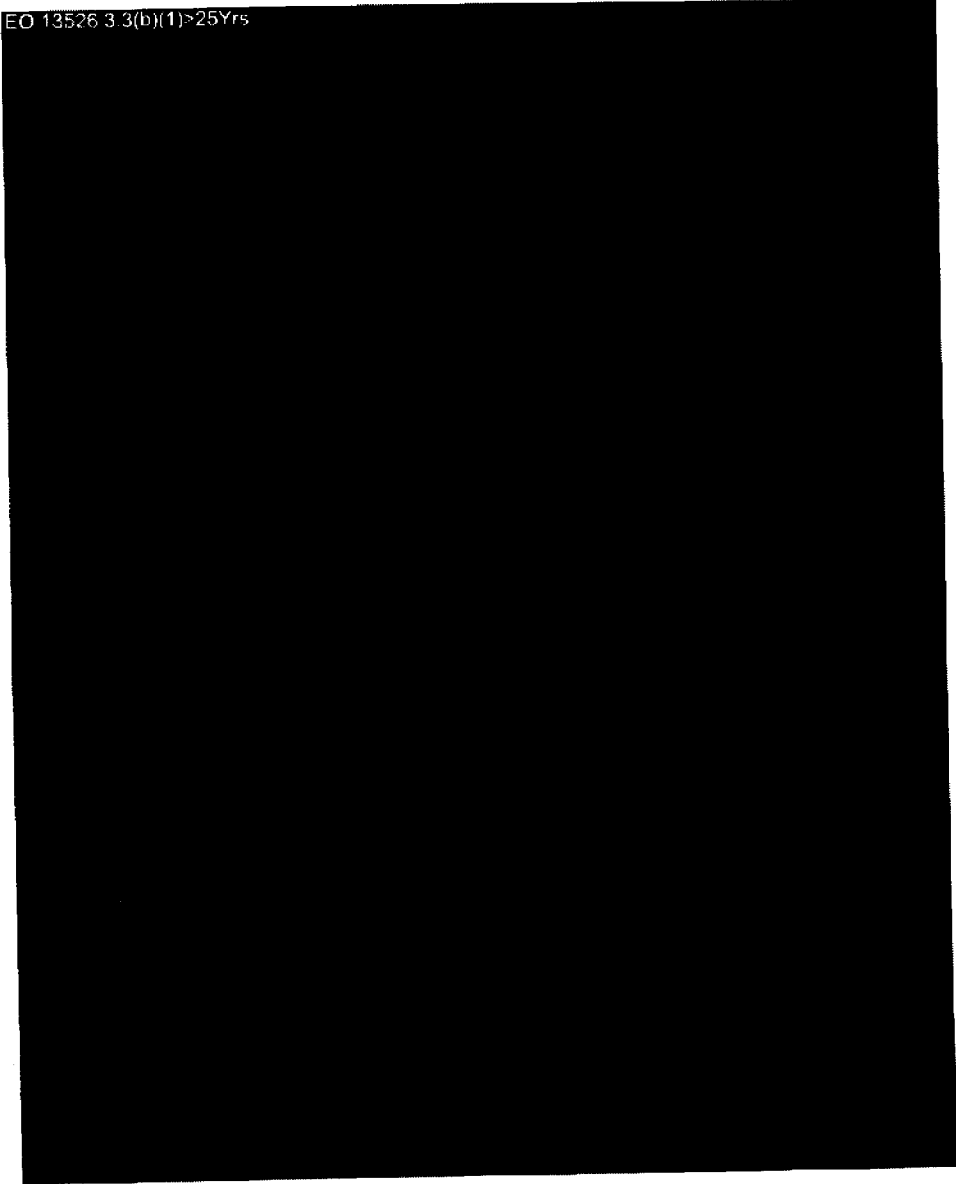
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~~Top Secret~~
Handle via BYEALING-TALENT-KEYHOLE-
~~COMINT Control Channels Initially~~
~~RYF-0111-04~~

~~Top Secret~~
~~NOFORN-ORCON~~

EO 13526 3.3(b)(1)-25Yrs



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
RYF-010702

~~Top Secret~~
~~NOFORN ORCON~~



Col David D. Bradburn (left) congratulates Col Henry B. Stelling, Jr., as Stelling takes charge of [redacted] in May 1971



Col Jack Simonton

EO 13526 3.3(b)(1)>25Yrs

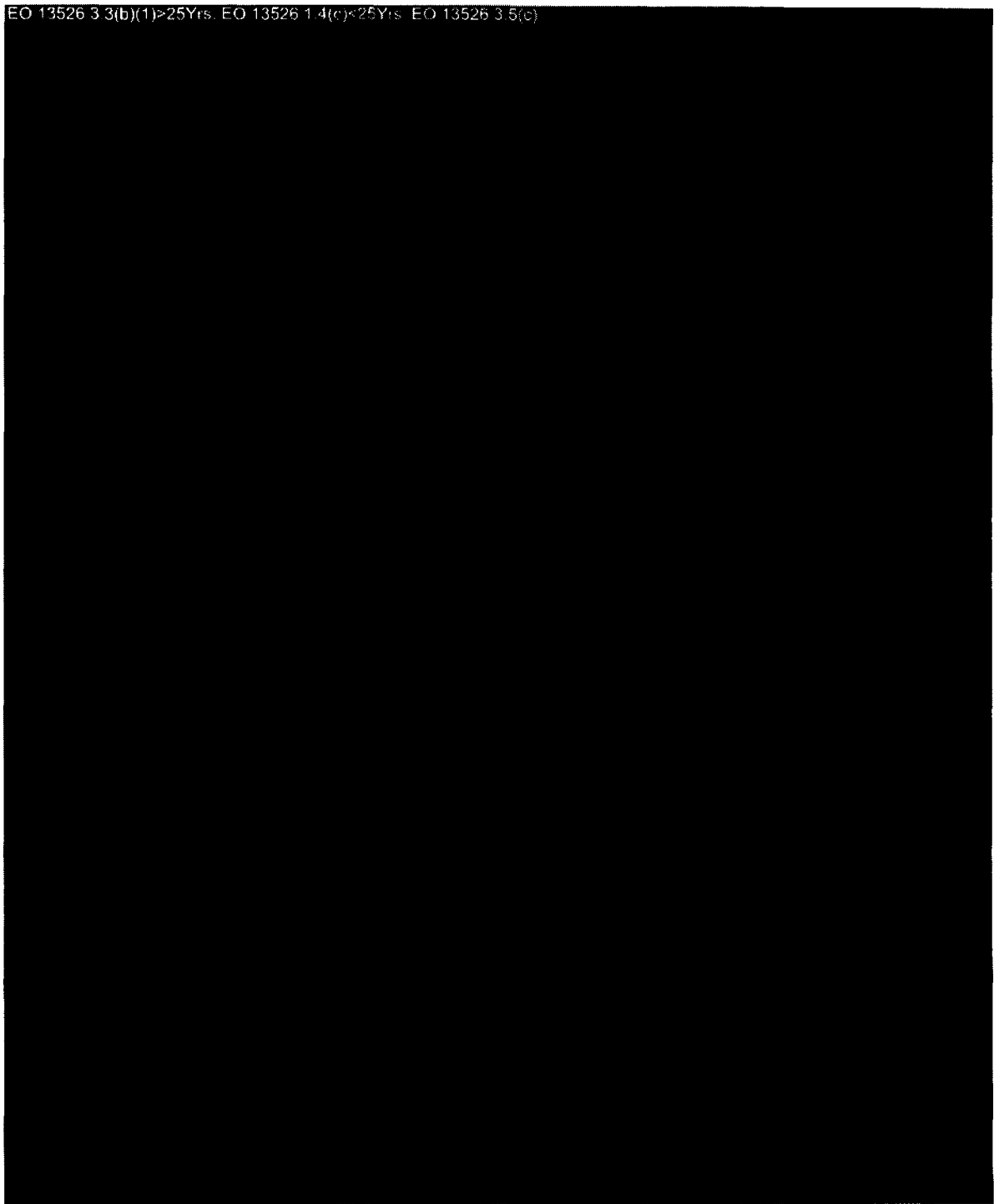
EO 13526 3.3(b)(1)>25Yrs

~~Top Secret~~
Handle via BYEMAD TALENT KEYHOLE-
COMINT Control Channels jointly
BYE-9197/93

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)



PL 86-36/50 USC 3605

~~Top Secret~~
Handle via BYEMIAN TALENT-KEYHOLE-
COMINT Control Channel Jointly
~~BYE-0102-93~~

~~Top Secret~~
~~NOFORN-ORCON~~

EO 13526 3.3(b)(1)>25Yrs



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channel jointly
~~BYE-919.794~~

~~Top Secret~~
~~NOFORN/NOCON~~


EO 13526 3.3(b)(1)>25Yrs EO 13526 1.4(c)<25Yrs EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN/TALENT/KEYHOLE-
COMINT Control Channels Identity
BYE 919704

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PL 86-36/50 USC 3605

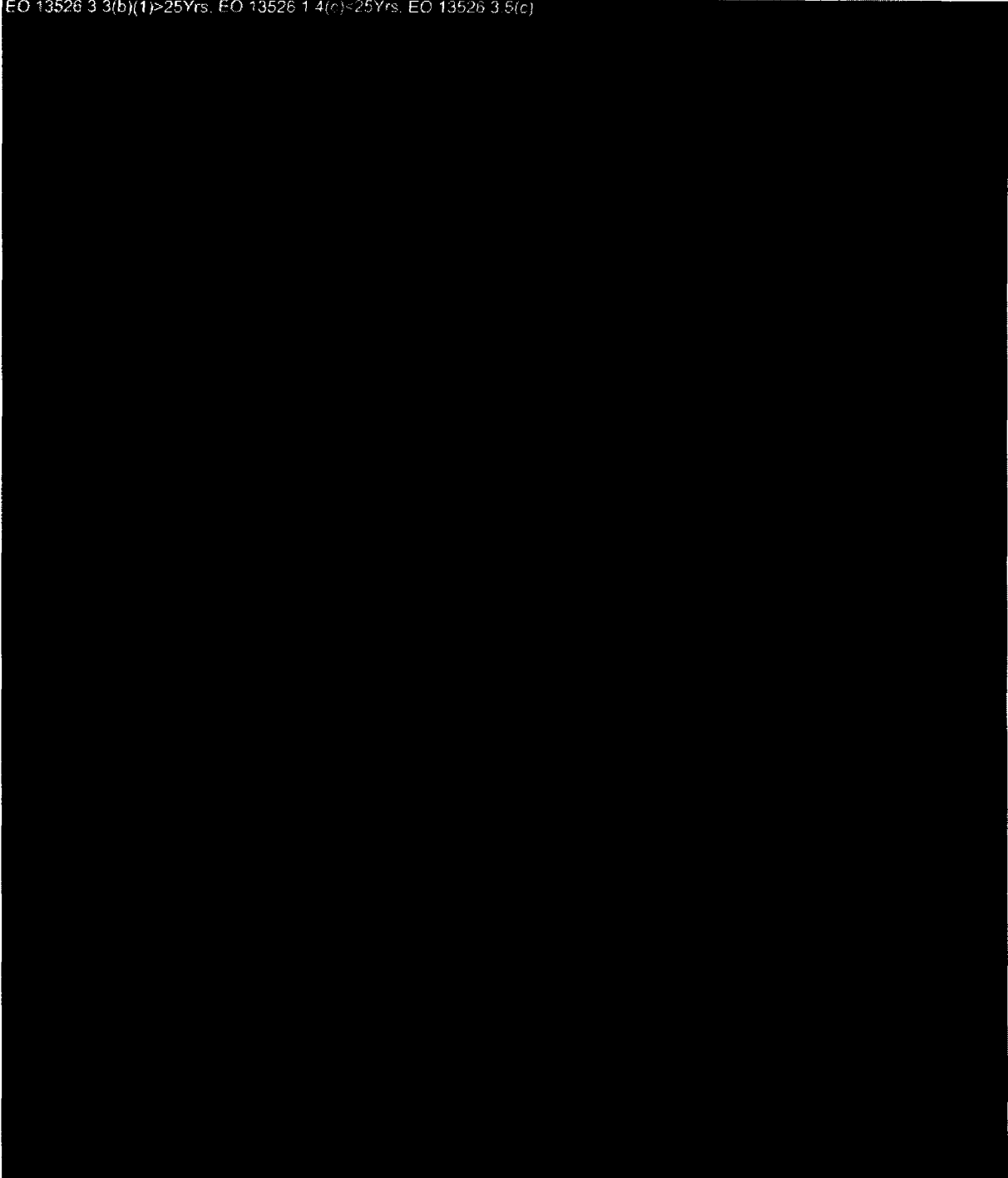
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~~Top Secret~~
Excluded from automatic
downgrading and
declassification

~~Top Secret~~
~~NOFORN/NO RC(3)N~~

EO 13526 3 3(b)(1)>25Yrs. EO 13526 1 4(c)<25Yrs. EO 13526 3 5(c)



PL 96-36/50 USC 3605

~~Top Secret~~
Handle via BYEM/NO-PALENT-KEYHOLE-
COMINT Control Channels jointly
RYE 9197/83

~~Top Secret~~
~~NOFORN-ORCON~~

EO 1.4.(c)
PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
COMINT Control Channels jointly
BYE-919794

~~Top Secret~~
~~NOFORN-ORCON~~

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
~~Handle via BYE-PAN-TALENT-KEYHOLE-~~
~~COMINT Control Channels family~~
~~BYE-9197/04~~

EO 1.4.(c)
PL 86-36/50 USC 3605

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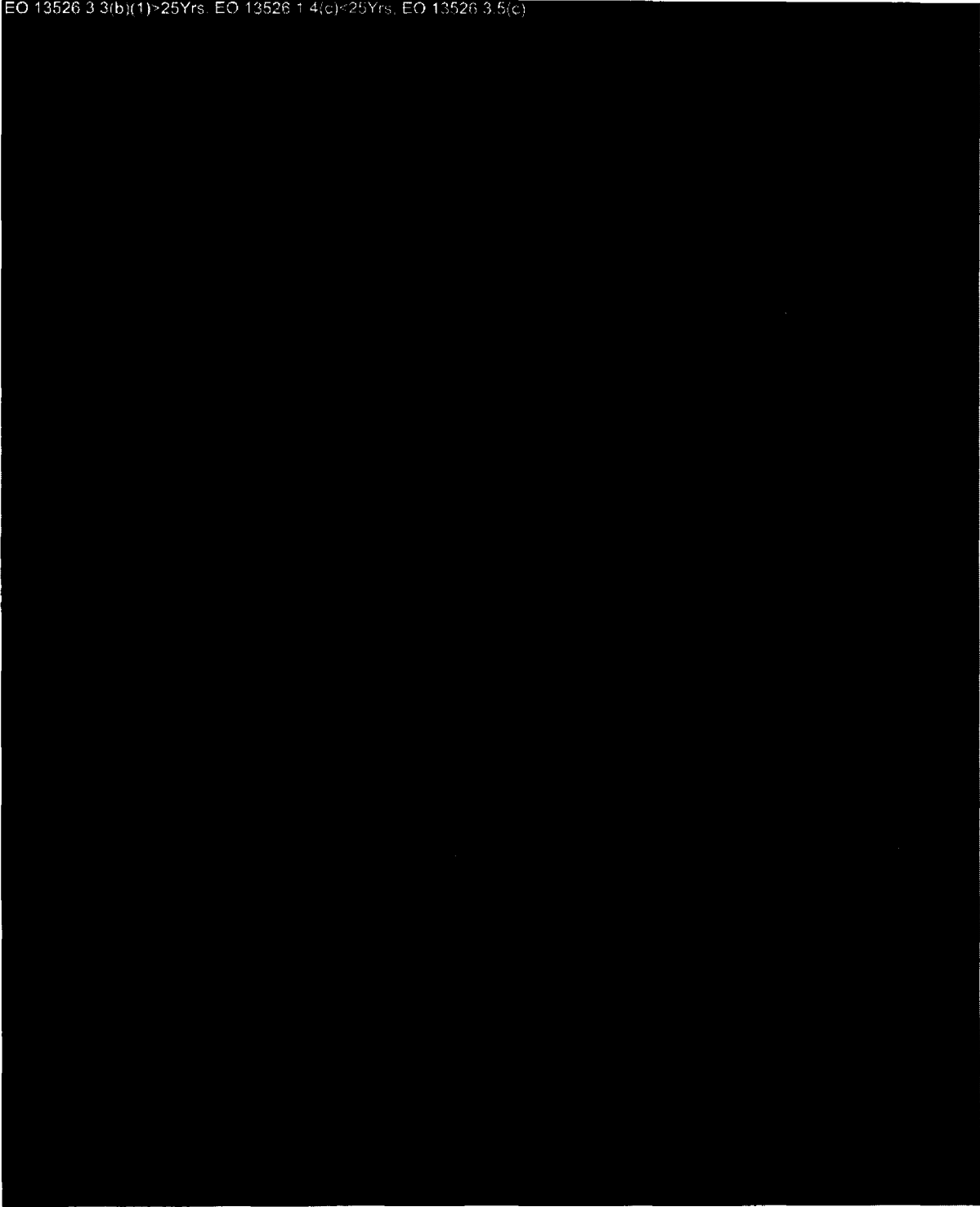
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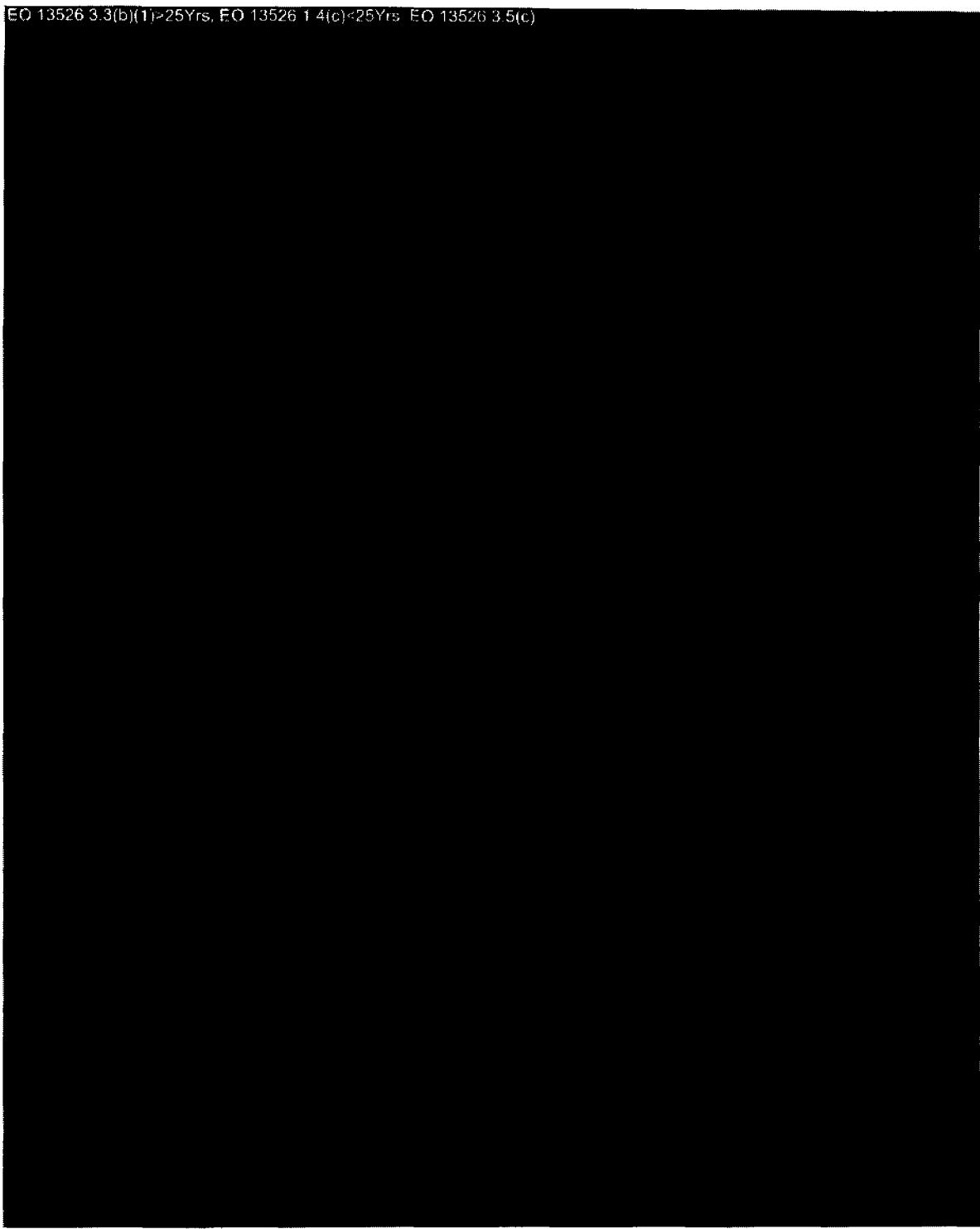


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PL 86-36/50 USC 3605

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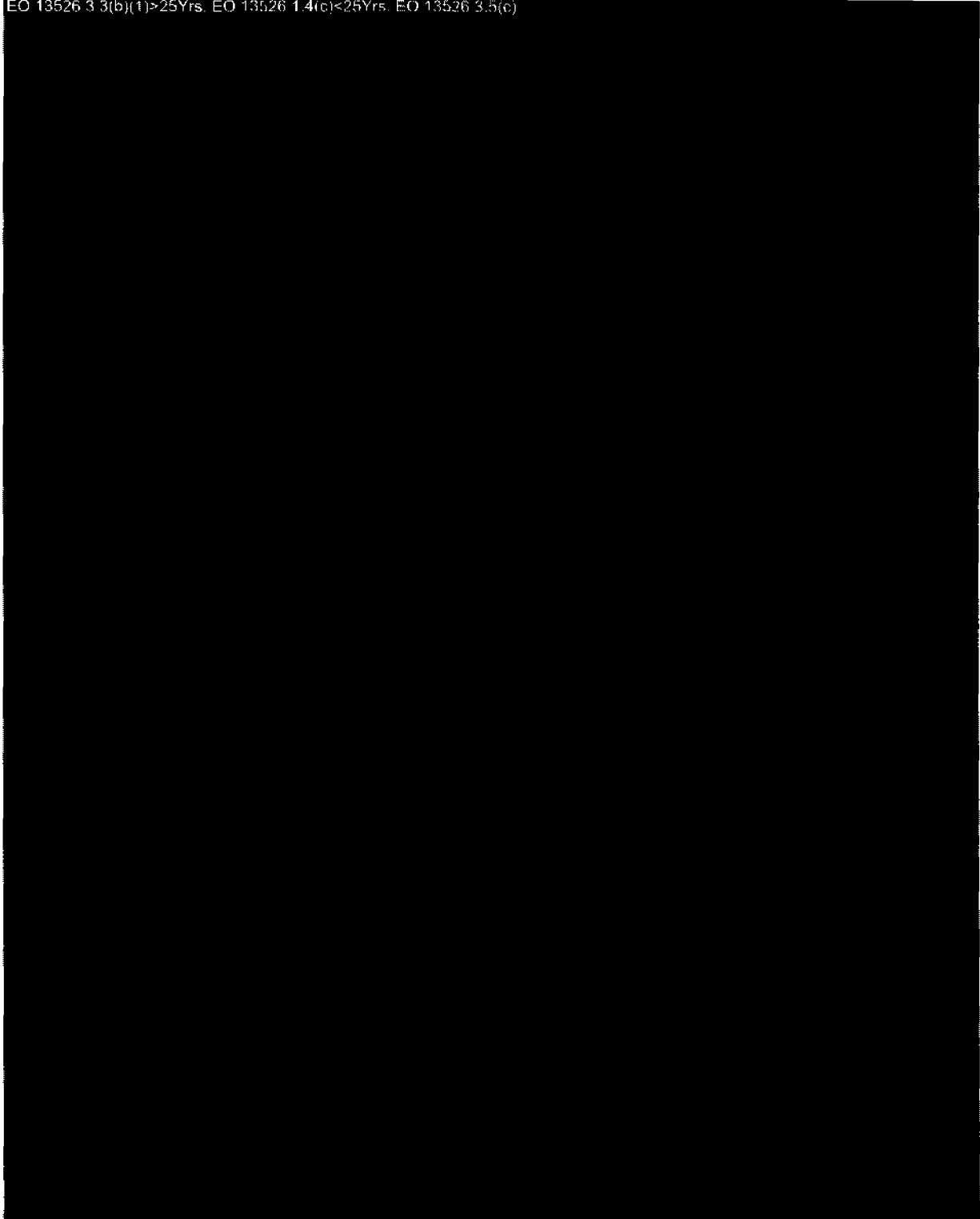


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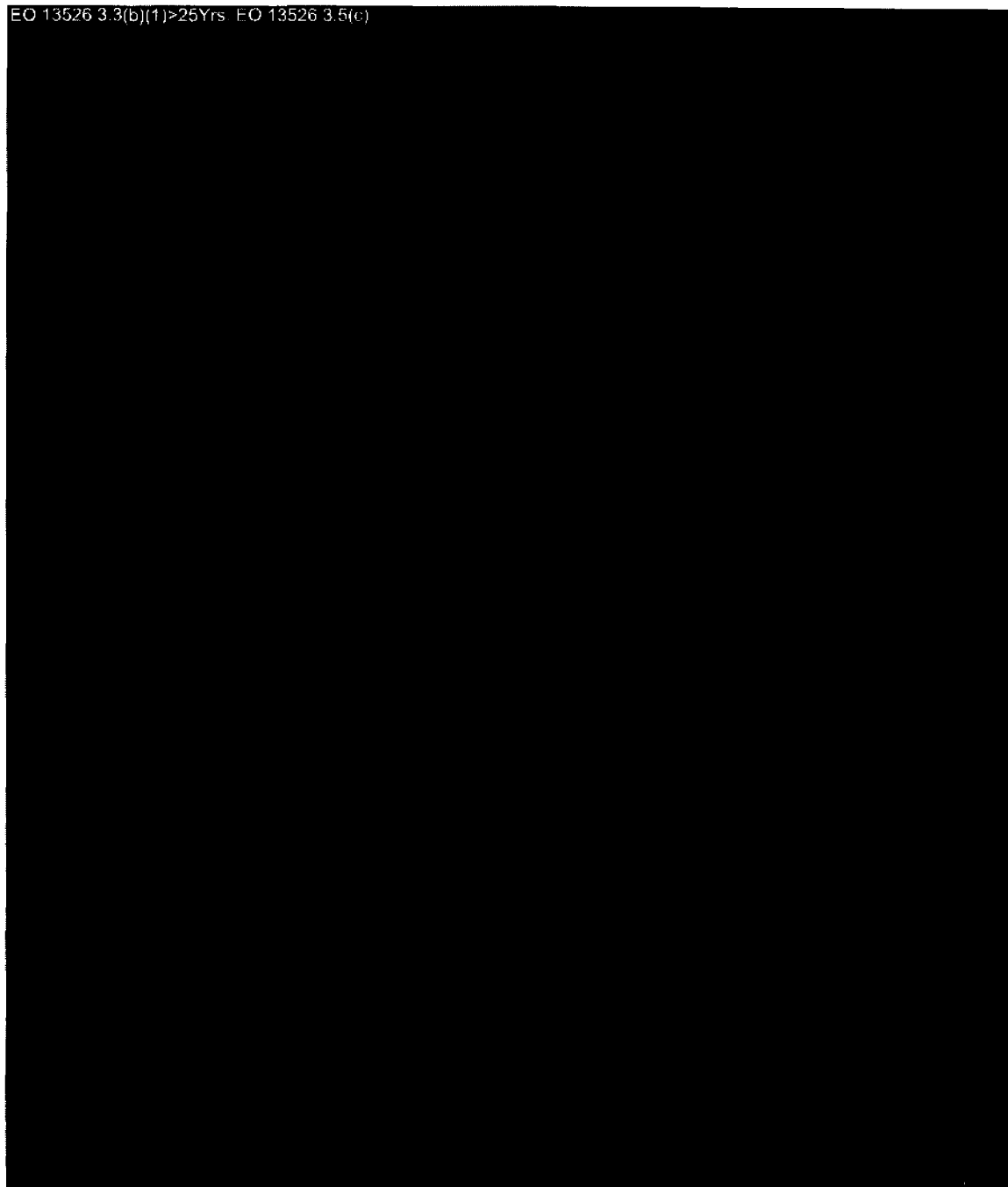
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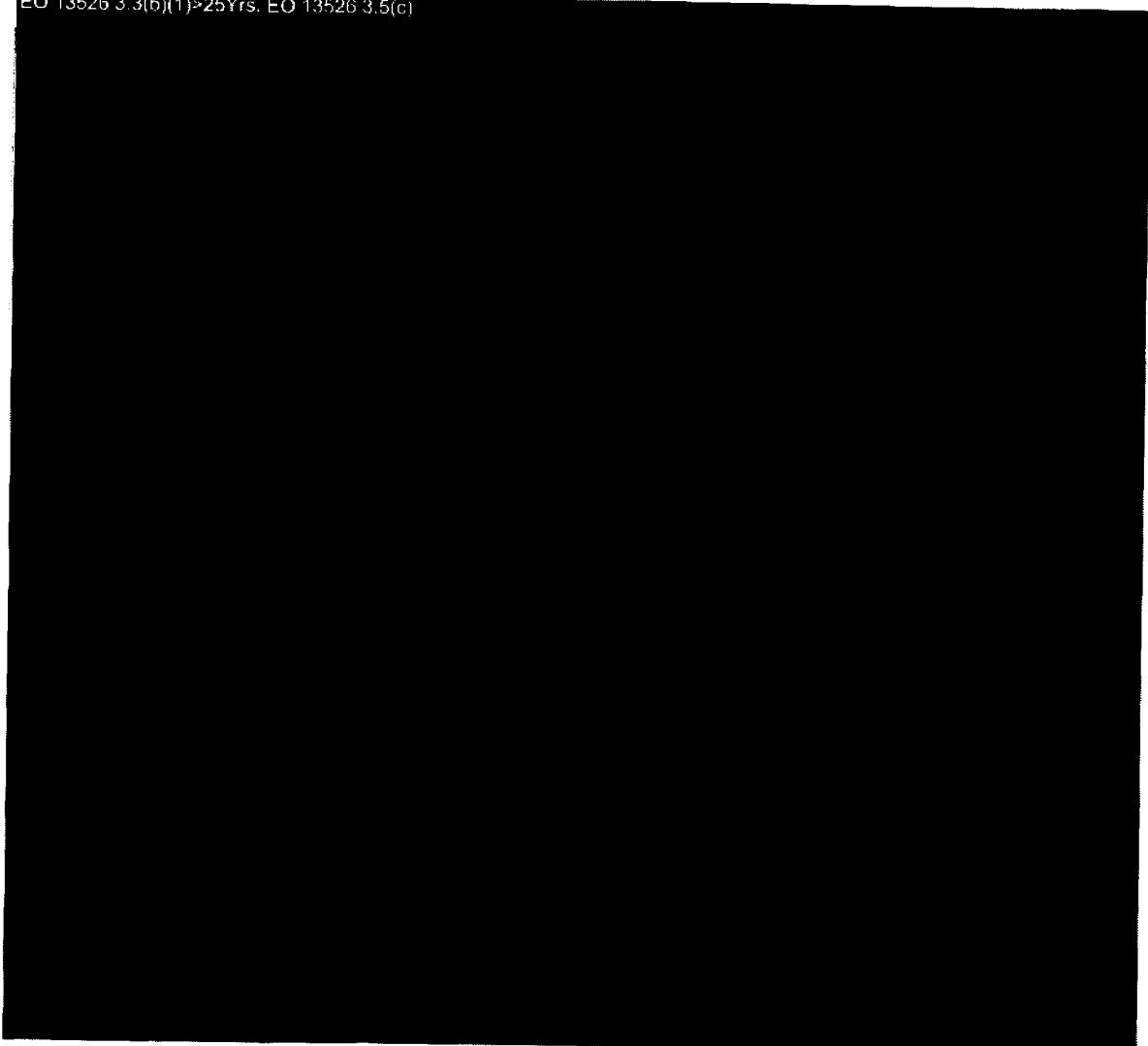
Chapter 8 References

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9 Conclusions and Accomplishments

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The SIGINT Satellite System Mix as of 1975 and Why It Was Effective

By 1975 the National Reconnaissance Office (NRO) SIGINT satellite world consisted of an effective set of complementary space vehicles. The low-orbiting POPPYs were busy searching for new signals and using their elegant relay techniques to provide the Navy, especially, with up-to-date locations of radar-equipped ships anywhere on the surface of the Earth. Going through a constant evolution from launch to launch, POPPY proved to be the best system for intercepting ship-based radars, which were sometimes only on for a few fleeting moments as the commanders used special tactics to avoid detection. This same main-beam intercept capability was immensely powerful in determining the power and scan properties of any ground-based radar that happened to illuminate the POPPY satellites. As a main-beam collector POPPY was the best and, EO 13526 3.3(b)(1)>25Yrs was assured of an important continuing role.

EO 13526 3.3(b)(1)>25Yrs

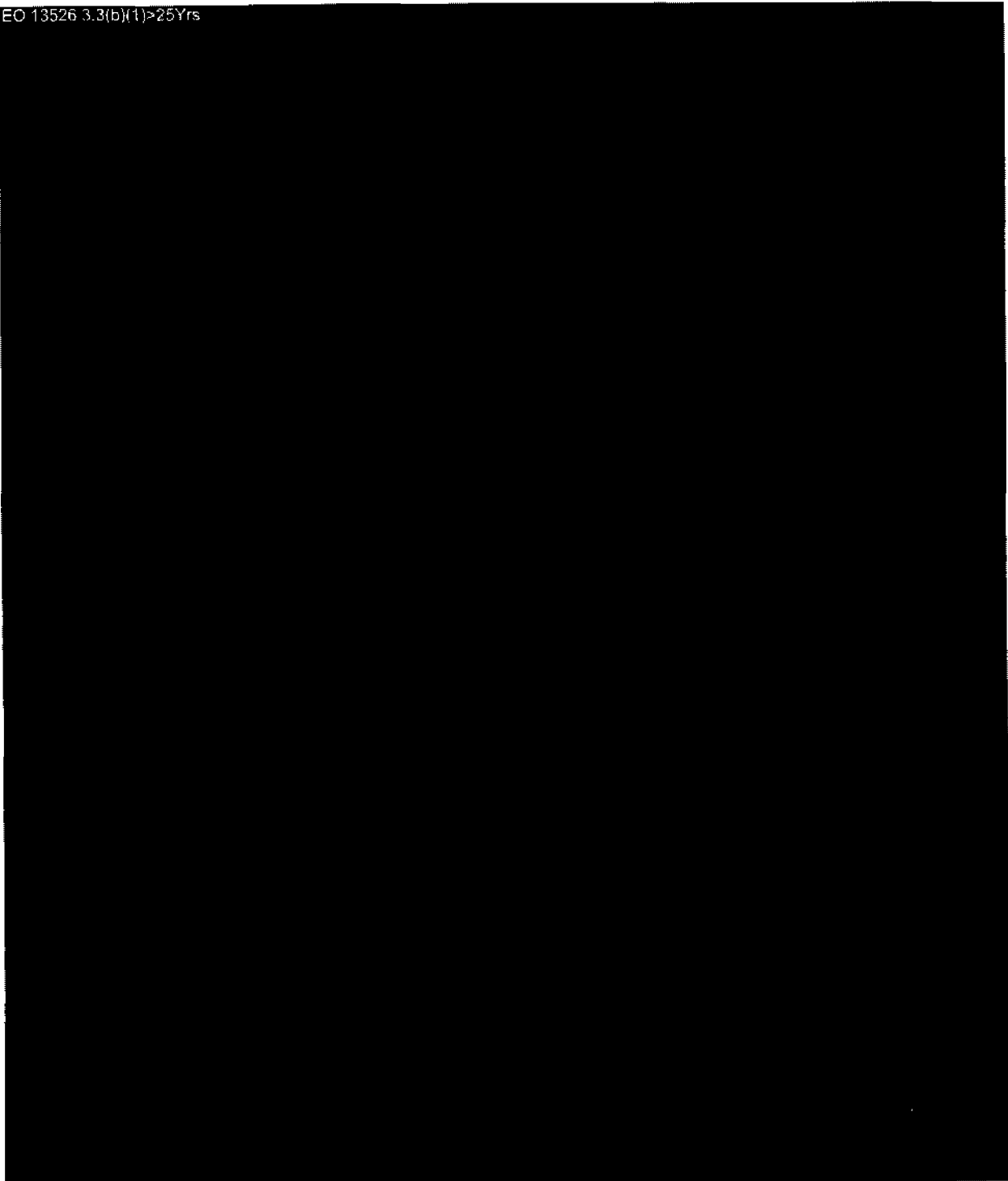
EO 13526 3.3(b)(1)>25Yrs

Along the way, the original WS 117L low-orbiters helped pave the way, but had been retired by the early 1970s. They were replaced by a new ensemble that could bring back signals faster, locate them more accurately, and make reports almost as the events were happening.

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EO 13526 3.3(b)(1)>25Yrs



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EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 1352

The NRO Program Offices as Managers of Satellite Projects

The NRO SIGINT Program Offices shared a short chain of command, high motivation, a sense of team spirit, and a sense of urgency. They also worked in total secrecy. It was a management environment that the participants say was unusually rewarding and unlikely ever to be repeated.

In SIGINT satellite development, the Office of the Secretary of Defense staffs and the Army and Air Force staffs (but not the Navy, initially) were removed from the management chain by the establishment of the SAMOS Project Office (later the Director of Special Projects, SAFSP), reporting to the Secretary of the Air Force, in late 1960. This Presidential decision effectively froze out all other participants and provided for a short chain of command and quick decisions, first for the Air Force's SAMOS Project. This organizational precursor became the NRO, established formally in 1962. From 1962 on, all SIGINT satellites, including Air Force, Navy, and CIA satellites, would be developed and operated by the NRO.

The creation of the NRO, and in particular, the office of the Director of the NRO (DNRO), harnessed the creative technical energies of the nation. The DNRO was empowered to work on the whole problem of providing satellite reconnaissance for the country. That job, being covert, did not in itself, require the DNRO to do anything except work on the problems of developing and operating the nation's reconnaissance satellite fleet. The tying of

By 1975, the NRO had a strong capability in basic SIGINT satellite systems. The mix of orbits and capabilities proved an important quality.

EO 13526 3.3(b)(1)>25Yrs
EO 13526 3.3(b)(1)>25Yrs

They covered the frequencies of interest and each of them carried out missions that were easy and natural to do from each orbit. This ensemble, developed thoughtfully over time in response to various perceived problems was actually a good set of architectural pieces, efficient and technically clever, that met real intelligence needs.*1 Budget pressures prompted efforts at consolidation, using fewer basic satellite systems. But no such effort at consolidation was to be successful because, despite some mutually reinforcing overlaps in capability, each of the systems possessed a unique basic function that the others could not perform at all—a testimony to the ingenuity and insight that put them there.

* DNRO Alexander H. Flax said, "There was a plan, although like all long-range planning it evolved over time (particularly in COMINT collection), but in many respects the architecture was envisioned in crude outline from the beginning."

research and development (R&D) with operations, all under the DNRO, became the key to the whole plan. The genius was in defining the job in this way. It provided a single forum to focus on how systems would work together. Consideration of engineering principles, along with cost and the desires of the individual participants, was possible. This approach allowed system-level and architectural decisions to be made cleanly. It saved valuable time in putting new designs into orbit and it ensured that the reconnaissance satellites of the United States would be technically superior.

DNRO Alexander H. Flax said, "In my mind, tying R&D to operations under the DNRO was essential. The NRO never had a pure R&D launch; all had some operational objective. Feedback from operations to R&D was almost instantaneous. Given the rapid pace of the technologies involved, these characteristics were invaluable."² Eugene Fubini reinforced this view: "The NRO was designed to relieve stresses; the fact that it has survived so long is a testimony to the wisdom of those who set it up."³

This management approach made possible the creative work by the Directors of Programs A, B, and C, who similarly had both operational and R&D work blended under their operating charters. Within the NRO, then, the work came to support the primary missions of the organizational elements that were to carry it out.

The covert Air Force (SAFSP) elements, Program A, based in Los Angeles, California, developed the WS-117L-derived

low-altitude systems (SAMOS F-1, 698BK, MULTIGROUP, and STRAWMAN) EO 13526

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These projects all originated in Air Force needs and interests. They were mostly carried out within the SAFSP offices in Los Angeles, with support easily arranged from the non-covert, or "white," Air Force organizations for launch services, tracking, and communications. The DNRO was also the Under Secretary of the Air Force* and this was the key to a simple and effective management arrangement for Director, Program A. He was working on projects of interest to the Air Force and he reported to the top of the Air Force's statutory chain of command. Since the DNRO occupied an overt position—usually Under Secretary of the Air Force—he had the obvious authority to provide the necessary direction to elements outside the NRO. This arrangement worked well but at a price. The Air Force people in Program A came to view themselves, and to be viewed by the rest of the Air Force, as "outside the system."[†] The DNRO was also in a difficult position, having to exclude from the management chain senior Air Force officers and others throughout

* DNROs Joseph V. Charyk (1962-63), Brockway McMillan (1963-65), and John L. McLucas, Jr. (1969-73), served as Under Secretary of the Air Force; McLucas later served as Secretary of the Air Force (1973-75). DNRO Flax (1965-69) was Assistant Secretary of the Air Force for Research and Development, and arranged for special authorities to carry out his job. Other DNROs have served as either Secretary, Under Secretary, or Assistant Secretary of the Air Force.

† All Directors of Program A, except one, retired in the rank held (brigadier general or major general) as Director of Special Projects (SAFSP). Lew Allen, Jr., was the exception: after serving as Director of Special Projects (major general, 1971-72), he served as Director, NSA (lieutenant general, 1973-77), and Chief of Staff, United States Air Force (general, 1978-82).

the Department of Defense who would normally be able to offer good counsel but who were excluded and knew it.* 4

At the CIA, the Director of Program B had a different set of problems and motivations. EO 13526 3.3(b)(1)-25Yrs

It was a major organizational and conceptual victory within the NRO. But the CIA Director of Program B, with EO 13526 3.3(b)(1)-25Yrs also lived in a complicated world, alienated from the larger CIA because of his affiliation with the NRO. He, too, had his own problems of reporting to a line boss, the Deputy Director for Science and Technology in the CIA, and by dotted line to the DNRO, an official of the Defense Department. His management chain was not as clean as for Director, Program A, but he had an advantage: Director, Program B, was in the CIA and therefore was closer to the requirements side of the Intelligence Community than were the other program managers.

EO 13526 3.3(b)(1)-25Yrs

*The DNRO collaterally reported to the senior Air Force management, but for most NRO matters, reporting was to the Secretary or Deputy Secretary of Defense.

The Navy's POPPY, originally designed to collect against land-based emitters, came under NRO control in 1962, and the role of ocean surveillance, late in 1970, fit in well with the interests of Navy sponsors outside the Program C offices. Still, the Director of Program C also had the problem of dual allegiance: he reported to the Chief of Naval Operations, either through the Director of Naval Intelligence or, later, through the Chief of Naval Materiel.⁶ His reporting line to the DNRO was a dotted line to an office that was really in the Air Force. So the Director of Program C had a slightly more complicated life than Director of Program A. But the POPPY project proved of interest and value to the Navy and generally was well supported by both NRO Navy leaders.⁷

These charters, arrived at through historical experience and by executive decisions of the DNRO, turned out to be very practical and productive. The POPPY EO 13526 3.3(b)(1)-25Yrs

effective set of SIGINT satellites in an engineering and analytic sense and also matched the interests of their sponsoring development and acquisition agencies. Altogether, the NRO management team consisted of highly mission-oriented project offices, with extremely short lines of control to the decision makers.

NSA, while not a builder of satellites, played a central role in the decision process for new SIGINT systems. Gen Lew Allen described it this way: "If the DNRO wants to make a major decision in the SIGINT world, he should have NSA on his

side and the CIA not opposed." From 1960 to 1975, that set of conditions was always present. The DNRO had NSA working with him, supporting the recommended plan. EO 13526 3.3(b)(1)>25Yrs
EO 13526 3.3(b)(1)>25Yrs the CIA got into the planning discussions too and did not question DNRO decisions after they were made.⁸ So long as the DNRO did his homework, he could make his decisions stick.

With the NRO jobs assigned and the organizational relationship established, the actual design and building of satellites in Program A and Program B were carried out by industrial contractors. The Navy's Program C POPPY satellites were built by the Naval Research Laboratory (NRL); EO 13526 3.3(b)(1)>25Yrs were first built by NRL and subsequently manufactured by industrial contractor teams. In Program A, the SAFSP SIGINT project offices in EO 13526 3.3(b)(1)>25Yrs used a few people in the office for each project. In a matrix form of organization, each project team was supported by an SAFSP procurement team EO 13526 3.3(b)(1)>25Yrs, a budget team EO 13526 3.3(b)(1)>25Yrs, and an operations team EO 13526 3.3(b)(1)>25Yrs that worked with the tracking and communications network of the Air Force Satellite Control Facility (AFSCF) sites. Launch vehicles—the Atlas, Thor, and Titan derivatives—were procured by sending money to the "white" Air Force project offices in Los Angeles. This arrangement allowed EO 13526 3.3(b)(1)>25Yrs project managers to concentrate on the SIGINT mission part of the job, which, because it revealed that reconnaissance was being carried out, was bought with covert or "black" contracts.

The black contracts were administered so as to comply with all procurement rules contained in Federal Statutes—the law—but with waivers from any of the implementing or reporting instructions of the US Department of Defense or the US Air Force that would have required disclosure of the existence of the contracts to persons who were not working on them. The Director of SAFSP, as head of a contracting agency, held his own warrant as a contracting officer and signed in that capacity on large procurements. These arrangements gave him effective control over every aspect of the reconnaissance side of his job and a way of getting support for all the other space-related needs through the "white" Air Force, which operated the tracking network and the launch bases at Cape Canaveral and Vandenberg Air Force Base.

The Air Force EO 13526 3.3(b)(1)>25Yrs project manager viewed himself as the head of a task force, with his main job being the leading of a team made up mostly of industrial contractors. To motivate that team he used performance incentive contracting, developed for the photo satellites by BGen John L. Martin, Jr., (the "Martin Incentive") and then first applied to SIGINT satellites by BGen David D. Bradburn with Martin's close supervision. Under this approach, good performance by the contractor was linked to successful mission performance. If the project succeeded, the fee would be high. If the project failed, the fee would be low. This direct coupling of the project goals turned the contract into an important instrument of delegation. The contractor team became an extension of the EO 13526 3.3(b)(1)>25Yrs project office.

Under the Martin Incentive, objective measures of performance, such as total days of successful operation and the percentage of usable information, were worked out in advance. With this system, if the satellite needed more testing on the ground to ensure it would work right in orbit, the contractor would do the testing on his own initiative. When all were confident, the launch would proceed.

The Air Force, through ~~FOUO~~ became responsible for operating each Program A satellite as it went into orbit. From that time on, the incentive provisions were especially useful, because contractor team members, experts on the mission, were on duty at the mission ground stations, pursuing the same goals in the contract originally laid out by the government project manager. If the Air Force manager decided to operate the satellite in a way that would place the vehicle at risk, the contractors affected by the planned action could choose either to accept the risk and leave their incentive fees riding or to select the "no-fault" option, with fees lower than for a full success (but not zero) for the remainder of the flight.

This Performance Incentive contracting method made for simple, short contracts. Air Force managers spent much of their time negotiating and administering these incentive provisions. Senior managers of the contractors also spent their time on the incentive provisions, before and during the life of the contract. This was time well spent because it constituted the heart of the delegation process. When all had agreed on the incentives, there was then no need for detailed government contract

specifications, and contract changes could be made without fear by the government that some important performance goal might be lost. Government offices to administer the black projects were much smaller than equivalent offices administering similar white programs because the more detailed specification process (called "configuration management" on the white side) was not applied on the black side.

To reiterate: The Program A SIGINT projects used a team approach, incentives, motivation, and simple contracts to delegate the work to the contractor teams. In this way they made the contractors part of a task force, with the same priorities as the government managers.

A set of special circumstances not usually found in the Air Force, in the opinion of MGen John Martin, Jr., helped make this management structure successful:

1. The effect of the increased responsibility which such limited and compartmented management places on each of the participants. SAFSP captains typically had more responsibility than many colonels.
2. The extent of continuity realized within the system. There were changes of station and specific jobs, while maintaining essential continuity for both individual development as well as the organization's effectiveness.
3. The extremely beneficial effect of many key people being in place long enough for the 'chickens to come home to roost'—to see the direct

results produced by the decisions which they made or in which they participated.

4. The unique benefit of working in a closed-loop enterprise, where the end results are evident to all—where, although it's nice to be told that one's work is good, it's not necessary in order to know, for the entire results tell all there is to be told: technically, operationally, financially; the ultimate in work incentive and job satisfaction.⁹

Secrecy was probably a help, on balance, especially during the formative days of the NRO, between 1958 and 1962, when steps were taken to exclude the military services and the Office of the Secretary of Defense staff from the management chain. The freedom not to be involved in routine R&D administration, more a question of short decision-making channels than of secrecy as such, motivated those on the inside. The disadvantage was the ill will engendered among those on the outside, who were not taken into confidence, and whose cooperation was sometimes difficult to arrange. This was a continuing problem, particularly in the Air Force, because the SAFSP organization did not report through the Air Force Systems Command or the Air Force Staff in the Pentagon; to those on the outside, it often appeared that the SAFSP people and their CIA friends were using secrecy to keep others away for personal convenience rather than for any legitimate purpose. This difficulty—there were outsiders who knew generally what was going on and wanted more access and less secrecy—was a manageable problem

at the time but, with the passing of the Cold War, will lead to new looks at security policy.

In this history, the real argument for short management channels was the urgency of the SIGINT satellite mission. The real argument for secrecy was the fear of Soviet diplomatic intervention or attempts to interfere with the satellites; there was also the concern for compromise of intelligence sources and methods—the possible drying up of a SIGINT source when the Soviets became aware of our ability to use the radio frequency (RF) signal. Secrecy made the job easier in most cases and helped to ensure the privacy of the short management channels. Both factors were probably important to the results that were achieved.

The NRO project teams, charged with building and operating SIGINT satellites, brought these new spacecraft into existence in a short time and brought them to bear on the intelligence problems of the nation quickly and effectively. POPPY typically achieved new models within one or two years. EO 13526 3 3(b)(1)>25Yrs

EO 13526 3 3(b)(1)>25Yrs

These short times from concept to operation were remarkable and a testimony to the dedication and skill of their government and contractor teams. These records were achieved in unique circumstances—a one-time blending of threats to our national survival and technological

opportunity—and were made possible by an astute decision about how to organize for the job.*10

NRO and NSA Working Together

In 1958, National Security Council (NSC) Directive No. 6 (NSCID No. 6) placed NSA in charge of coordinating all US ELINT activity. This decision put NSA in a business it had not been in before; up to that time NSA people were really COMINT specialists, not ELINTers. This new assignment for NSA was resisted by many of the rank and file in the CIA and in the military services, who were the traditional ELINT collectors, users, and operators. By the 1960s, NSCID No. 6 also led to a conflict between NSA and the NRO over roles and missions: with the NRO in charge of satellite reconnaissance and NSA in charge of ELINT, who would be in charge of ELINT satellites? This question came up again, and with more importance, when COMINT satellites became a reality. The answer was usually worked out by NRO/NSA teaming arrangements and agreements on a project-by-project basis, along the lines suggested by Gene Fubini in 1961: typically, the NRO would build and operate the satellites, and NSA would be the resident SIGINT expert and process the satellite data for analysis by the Intelligence Community customers.

At the end of the 1950s, NSA was recognized as the processor of satellite-collected SIGINT and that, too, was not

* There were no dedicated R&D flights and no formal test and evaluation flight programs. This alone distinguished NRO programs from almost all other R&D programs.

seriously questioned thereafter, although
EO 13526 3.3(b)(1)>25Yrs

tasking—that is, giving detailed commands to the satellites to direct their collection operations—on the other hand, was more painfully sorted out. Eventually, tasking was defined in phases; authority ultimately resided in the US Intelligence Board (USIB), which delegated the detailed work of target selection and priorities to its committees. The committees discussed and wrote the official requirements and set priorities which, in some cases, became extremely detailed, even awkward, and, at least in the early 1960s, inefficient. The NRO acquiesced to what many felt was an intrusion and, in 1962, set up the Satellite Operations Center (SOC) in the Pentagon. NSA, in turn, saw the SOC as usurping a traditional NSA role in managing the tasking of SIGINT collectors. Later in 1962, NSA personnel were integrated into the NRO, both on the collection side (satellite planning and budgeting) in the Office of the Secretary of the Air Force, Space Systems (SAFSS), and on the operational side, in the SOC. Then, in an evolutionary step, in 1968 the SIGINT part of the SOC provided a representative to NSA offices at Fort Meade, Maryland. An amicable arrangement evolved: USIB was in titular control,† NRO was in control of the satellite vehicles, and NSA orchestrated target collection and, of course, did or arranged for all the SIGINT processing.

† Actually, when one reviews the voluminous detail in the more recent USIB files on SIGINT satellites, particularly their "Guidance on the NRP" published annually and then for five and then 10 years in advance, one could conclude that USIB, if not in control, certainly spent a lot of time and resources attempting control of SIGINT satellites.

The mission ground stations (MGSs) were important to the collaboration between the NRO and NSA. The GRAB/POPPY mission ground stations were primarily at the Navy ~~EO 13526 3.3(b)(1)>25Yrs~~ stations ~~EO 13526 3.3(b)(1)>25Yrs~~

~~EO 13526 3.3(b)(1)>25Yrs~~

~~EO 13526 3.3(b)(1)>25Yrs~~ used the Air Force Satellite Control Facility (AFSCF) sites built by the Air Force for the imaging and SIGINT satellites. In 1966 ~~EO 13526 3.3(b)(1)>25Yrs~~

~~EO 13526 3.3(b)(1)>25Yrs~~ ~~EO 13526 1.4(c)<25Yrs~~ ~~EO 13526 3.3(b)(1)>25Yrs~~

became the first collaboratively manned operational site at which NSA people carried out processing of SIGINT data with the support of the NRO ~~EO 13526 3.3(b)(1)>25Yrs~~ satellite

~~EO 13526 3.3(b)(1)>25Yrs~~

~~EO 13526 3.3(b)(1)>25Yrs~~ ~~EO 13526 1.4(c)<25Yrs~~ ~~EO 13526 3.3(b)(1)>25Yrs~~

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With the advent of the high-altitude, and also realtime, SIGINT satellites, NSA did in fact make a determined and successful effort to get back into the business of SIGINT operational control. On 10 February 1968 the Director of NSA, LGen Marshall S. "Pat" Carter, approved the establishment of the SIGINT Satellite Support Center (SSSC) at NSA Headquarters, Fort Meade, Maryland.¹⁴ This was a specialized tasking center to focus and centralize all tasking for EO 13526 3.3 conceived by Charlie Tevis and headed by EO 13526 3.5(c) who had developed much of the software himself. The SSSC was originally manned by approximately eight people to handle COMINT, ELINT, and TELINT. In January 1972 two representatives from the NRO/SOC were integrated into the SSSC to operate certain phases of NRO tasking at NSA. By the summer of 1972

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there were at least four NRO/SOC representatives, mostly Air Force personnel, working jointly with NSA personnel in the SSSC.*15

The timing and personnel were just right for the SSSC to go into operation. The spirit of cooperation between NSA and the NRO was high under Carter and his Directors of Operations, Oliver Kirby and later MGen John E. Morrison, Jr., US Air Force. As ^{EO 13526 3.5(c)} NSA assistant to the Director of SSSC, remarked, NSA could not unilaterally have developed and begun operating its SSSC as part of the NRO satellite control and tasking system either before or after the late 1960s: earlier, the NSA wasn't capable; later, the NRO was better organized and probably wouldn't have relinquished control of SIGINT satellite operations.¹⁶ Later, much of the task planning for ^{EO 13526 3.3(b)(1)>25Yrs}

^{EO 13526 3.3(b)(1)>25Yrs}

The SSSC was ahead of its time, but it was not politically acceptable in the Intelligence Community. The US Intelligence Board (USIB) hierarchy—its SIGINT Requirements Subcommittee, especially—did not like the SSSC, even though it was intended to provide a mechanism for consolidating NSA recommendations on the SIGINT satellite collection requirements. As a part of an internal NSA reorganization, the SSSC was formally disestablished on 18 September 1974. The 24-hour watch operations in SSSC were assimilated into

^{EO 13526 3.3(b)(1)>25Yrs}

* The Operations Center for Mission Control (OCMC) was established at NSA by a memo signed by John McMahon, Deputy Director of Central Intelligence, in 1984.

The good times were when the lime-light was shared—when each participant respected the other.

- This sharing started in the early years, from 1958, between the Air Force and NSA, as John Copley and EO 13526 3.5(c) remember so well.
- Charlie Tevis and Raymond Potts remember that the good times overwhelmingly outnumbered the bad, and both cite the enthusiastic support of Deputy Director of NSA Louis Tordella as crucial throughout all those years, until Tordella's retirement in 1974. He set up direct access/short-chain management.
- NSA Director LGen Pat Carter, 1965 to 1969, of course, encouraged team play.
- DNROs Joseph V. Charyk (1962 to 1963), Brockway McMillan (1963 to 1965), Alexander H. Flax (1965 to 1969), and John L. McLucas (1969 to 1973) also added to the cooperative spirit.
- SAFSP key team leaders in the 1960s and 1970s were BGen Bill King, Col Bob Yundt, LtCol Jack Sides, and MGen Dave Bradburn. Bradburn was among the first in SAFSP senior management to establish a close collaborative working relationship between SAFSP and NSA.

- LMSC leaders such as Bill Troetschel, Bill Harris, George Price, and EO 13526 3.3(b) were team players who often acted as extensions to the SAFSP project offices.
- Bob Hermann, as NSA Chief, (high altitude) Satellite Programs in the 1970s, then as Director of all NSA R&D, from mid-1973 to 1975, advised NSA not to try to take over. He was instrumental in resolving NSA/Air Force and NSA/CIA problems.
- NSA Directors VAdm Laurence H. Frost (1960 to 1962), and VAdm Noel Gayler (1969 to 1972) tried to get control, while the Air Force and Army Directors of NSA, LGen Gordon Blake, US Air Force (1962 to 1965), Pat Carter, US Army (1965 to 1969), Samuel C. Phillips, US Air Force (1972), and Lew Allen, US Air Force (1973 to 1977), felt comfortable without getting complete control.

So there was an ebb and flow of NSA/NRO/CIA cooperation. George Cotter says he will always consider SIGINT satellites as the only SIGINT program where NSA was not master. EO 13526 and Potts believe that some Air Force and Navy airborne military SIGINT EO 13526 3.3(b)(1)-25Yrs also belong in the same (NSA not driving) category.

The CIA, from the early days of Bud Wheelon's arrival from the academic community and industry, was a technical tiger. As Wheelon said, "Killian and Land got to President Kennedy after the Bay of Pigs

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when Allen Dulles was fired in November 1961; so CIA was not gutted; instead, its technical capability was preserved and expanded."* The Air Force and NSA then had real competition. So, tensions were bound to develop; they were resolved only when personalities allowed for cooperation or when the excitement of the job overwhelmed the spirit of competition. In the interviews conducted for this history, an opinion frequently proffered was that in the late 1970s and later years, interagency relations became more formal and difficult.

This point of view (actually in EO 13526 words) could be summarized this way: "There are too many middlemen and we won't ever get back to the simple days; the systems are so large we can't do some very important jobs the way we used to do with small systems—we have lost that skill; and organizations have become so large, it is easier not to do at all what, in the old days, was accomplished with a short discussion."

Concluding Thoughts

The story of the SIGINT satellites is first the story of decisions by national leaders: The creation of a Department of Defense, a Director of Central Intelligence, and a National Security Agency by President Truman; the arrangement to have the Director of Central Intelligence take full charge of setting priorities for military and civil intelligence operations by President Eisenhower; Eisenhower's creation of the US Intelligence Board (USIB), the

* Wheelon was the first CIA Deputy Director for Science and Technology (DDS&T); preceding Wheelon were Herb (Pete) Scoville and Don Chamberlain, who were the first and second CIA Deputy Directors for Research.

President's Scientific Advisory Committee, and the President's Foreign Intelligence Advisory Board; and Eisenhower's initiation of what became the National Reconnaissance Office (NRO), which brought creative minds to assist the President in his stewardship over these crucial national security activities of the country. These decisions can now be seen as legacies of the very first importance—actions that shaped the manner in which the Cold War would unfold.

The objectives of President Eisenhower's "Open Skies" proposal were actually achieved at greater altitudes above national airspace by the US space reconnaissance systems. Even though the Soviets never agreed to permit US reconnaissance aircraft to overfly their airspace, they did permit US reconnaissance satellites to overfly the Soviet Union and benefited by the same access for their satellites over the United States. This tacit cooperation was made possible by Eisenhower's three-track approach to organizing and carrying out the US space effort. Assigning the manned and scientific space work to NASA, the standard military projects to the military services, and all space reconnaissance under a separate and covert organization was a brilliant organizational plan. By hiding the US reconnaissance effort under the NRO, the United States kept the diplomatic pressure off. Neither the Soviet Union nor the United States had to admit publicly that it was overflying the territory of the other or that the sovereignty of its own territory might be "violated." The tacit agreement served well. These initiatives and activities would have been hard to negotiate and even harder for leaders to

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agree to in public. So the plan was good, it worked, and it suited the special circumstances of the Cold War perfectly.

The SIGINT satellites that were built were good, too. They made a complementary set and provided our leaders with the information they needed to make crucial defense decisions. Especially on the Soviet ABM—the big question as to whether the Soviets could actually defend themselves against incoming US missiles (they couldn't!)—the answers were vital and they were provided in time to preserve the confidence of US leaders in the deterrent power of their forces.

These results meant that the leaders of the United States could wait and not be led by uncertainty into the disaster of a nuclear exchange. For the United States, this made possible the successful outcome of the Cold War.

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Chapter 9 References

1. Alexander H. Flax comments, SIGINT Satellite History peer review, March 1994.
2. Flax comments, SIGINT Satellite History peer review, March 1991.
3. Eugene Fubini interview, 20 May 1991.
4. Flax comments, SIGINT Satellite History peer review, March 1994.
5. Flax comments, SIGINT Satellite History peer review, March 1994.
6. RAdm Robert K. Geiger comments, SIGINT Satellite History peer review, March 1994.
7. Flax comments, SIGINT Satellite History peer review, March 1994.
8. Flax comments, SIGINT Satellite History peer review, March 1994.
9. MGen John L. Martin, Jr., comments, SIGINT Satellite History peer review, March 1994.
10. Flax comments, SIGINT Satellite History peer review, March 1994.
11. Julian Caballero interview, 29 October 1990.
12. James V. Boone interview, 19 September 1971.
13. George Cotter interview, 23 May 1991.
14. NSA-BYE-19016-68, 9 February 1968.
15. *NSA in Space*, April 1975, BYE-19385-75, pp. 84-85.
16. EO 13526 3.5(c) interview, 1 October 1991.

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A

Appendix

Role of Digital Computing in SIGINT Satellite Collection Systems

The role of digital computers in the development of SIGINT satellite collection systems can be appreciated through a review of digital computer development and the application of this development to processing of SIGINT data collected by the various overhead satellite systems.

The timeline in this appendix presents a brief outline of computer development from 1935 to 1975.

Chart 1 depicts the improvement in processing capacity at the National Security Agency (NSA) from 1960 through 1971 as more powerful computers were developed and applied to the processing of SIGINT data from the first mostly experimental programs of the early 1960s to the more sophisticated programs of the 1970s.

Chart 2 demonstrates a similar trend in the processing capability developed by EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13

Chart 3 is a measure of the increasing data produced by the POPPY Program as its collection progressed from a single

satellite with a single frequency band to multiple satellites with as many as EO 13526 3.3(b)(1)>25Yrs

Chart 4 shows the total number of radar locations produced per year as the number of collection systems increased and became more sophisticated. Advanced techniques EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.3(b)(1)>25Yrs made these increases possible.

Chart 5 is a comparison of emitter location accuracy for the various SIGINT systems as they were developed. EO 13526 3.3(b)(1)>25Yrs is a far cry from the 400- to 8,000-mile locations of the first POPPIES or even the 300-mile accuracy of the first Project 698BK satellites.

Chart 6 reminds us that in addition to the digital processing applied to identification and location of SIGINT emitters, there was a parallel development in using digital techniques to glean the technical information from the narrow and wide bandwidth analog tapes produced in the same timeframe.

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Digital Computer Evolution

Date	Event
1935	IBM 601 Multiplying Card Punch was developed. ¹ These punched-card machines were the backbone of the machine support for processing by NSA's predecessor organizations, the Navy's Communications Supplementary Activities, Washington (CSAW), and the Army Security Agency (ASA).
1944	Mark 1 relay computer was developed at Harvard under direction of Howard Aiken. ²
1946	ENIAC, the first large, general-purpose electronic computer, which had 18,000 vacuum tubes, stored only 20 numbers, and was programmed by plugging large cables between registers, was developed by J. Presper Eckert and John Mauchly at the Moore School of Electrical Engineering, University of Pennsylvania. ³
1950	Engineering Research Associates, Inc. (ERA), delivered the first ATLAS computer (started in 1948) to CSAW in December 1950. The ATLAS digital computer was a large, vacuum-tube machine that used magnetic-drum storage with a capacity of 16,384 words of 24 bits (binary digits) each and had an access time of 17 milliseconds. ⁴ ATLAS I was the first parallel electronic computer in the US with drum memory.
1952	ABNER I, developed by ASA engineers, became operational in 1952. ABNER I used mercury delay lines developed by Technitrol for ASA for memory, digital tape drives developed by Raytheon, and a unique instruction set developed by ASA programmers and engineers, the first of which emphasized upon nonarithmetic operations. ABNER was a serial computer similar in logic to SEAC and EDVAC. It was the most sophisticated computer of its time and was the first computer to perform computations simultaneously with input-output operations. ABNER had the most complete complement of input-output capabilities of its time, including punched cards, punched paper tape, magnetic tape, parallel printer, typewriter, and console. ABNER II, built for NSA by Technitrol Corporation, became operational in June 1955. ⁵
1953	The first ATLAS II computer was delivered to NSA (established on 4 November 1952) in October 1953 by UNIVAC (ERA had been acquired by Remington Rand, Inc., in 1952, and UNIVAC was formed). The first ATLAS II computer used electrostatic tubes for high-speed memory.

- 1954 The second ATLAS II computer delivered to NSA in November 1954 is believed to be the first magnetic-core-memory computer delivered. ATLAS II was 1,000 times faster than ATLAS I, with the new magnetic-core memory.⁷
- 1956 IBM 703 and UNIVAC 1103 are the first commercial digital computers to use magnetic-core storage.⁸ The UNIVAC Scientific 1103 was the commercial version of the ATLAS II.⁹
- 1957 The first of five BOGART computers, built by Sperry Rand (Remington Rand and Sperry Corporation combined in 1955 to form Sperry Rand.), St. Paul, Minnesota, to specifications provided by NSA to provide data conversion, formatting, and other special functions, was delivered to NSA, Fort Meade, in July 1957. Work started on BOGART in July 1954. The BOGART computer used diode and magnetic-core logic with a 24-bit word size and had the capability to select any of three 8-bit portions of the word. The cycle time of the magnetic core memory was 20 microseconds. IBM 727 magnetic tape drives, which were becoming the industry standard, were also used. BOGART was probably the first US computer that was built using "design automation" techniques. Many features of BOGART were carried over into the family of Navy Tactical Data System computers.¹⁰ The BOGART computer was the first computer used by NSA in 1961 to process ELINT data collected by the Navy program (see Chapter 3).
- 1958 SOLO, the first operational digital computer using transistors, was delivered to NSA in March 1958. NSA recognized in January 1955 the potential for transistors to replace vacuum tubes and formed a small group of engineers (including EO 13526 3.5(c) and Raymond Potts) to lead efforts using transistors and to form the nucleus of what became the transistor generation. In June 1955 Philco Corporation was awarded a contract to build a transistor machine using surface-barrier transistors (a technology that was superseded by junction transistors) to duplicate the design of the ATLAS II computer. The SOLO transistor version of the ATLAS II computer operated with a clock speed of 1 megacycle and was contained in a desk, compared to the 400 square feet of space required for ATLAS II. Philco marketed a commercial version of SOLO as the TRANSAC 1000. A larger, improved computer, the TRANSAC S-2000, based on the Navy CXPQ computer and later called Philco S-2000, was marketed with more success.¹¹
- 1960 The first Control Data Corporation (CDC) 1604A computer was delivered. CDC was formed by William Norris and a small group of engineers from Remington Rand in 1957. These engineers included Seymore Cray as the chief computer designer. Cray later formed Cray Research where he designed, built, and delivered the very large scientific CRAY computers.

1962 HARVEST, the most sophisticated model of the STRETCH series of computers built by IBM, was delivered to NSA in February 1962.¹² Construction of the IBM STRETCH series of computers started in 1955 with the design for the more capable HARVEST version to meet NSA requirements submitted in May 1957. The proposed HARVEST system was estimated to be 100 to 200 times faster than current equipment. The HARVEST system for NSA was basically the same as other STRETCH systems, with the following major additions: two additional banks of high-speed memory, with a 0.9-microsecond access time; a high-speed streaming unit to perform special statistical calculations; and the TRACTOR automatic, high-speed, high-capacity data storage system. TRACTOR consisted of three automatic tape-cartridge handling units, each capable of automatically seeking and extracting data under program control. The 160 tape cartridges, each using 1.75-inch-wide tape with 3,000 bits per inch, could store 88-billion characters, with an instantaneous information-transfer rate of 1,280,000 characters per second. The TRACTOR tape system was the first completely automated tape library. The system also pioneered the use of error-correcting codes and de-skewing buffers.

The logic technology used in IBM's 7000-series and subsequent models followed the STRETCH and HARVEST foundation. The 2-microsecond magnetic-core memory technology was used in IBM's 7090 and other computers.¹³

Chart 2

Processing capacity increases applied to satellite SIGINT data
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4

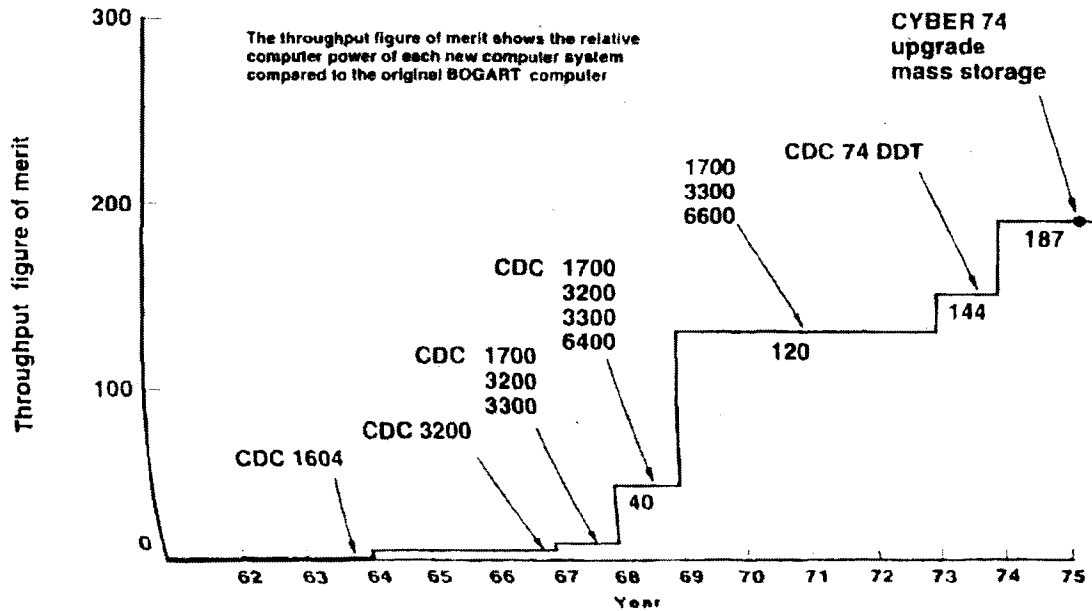
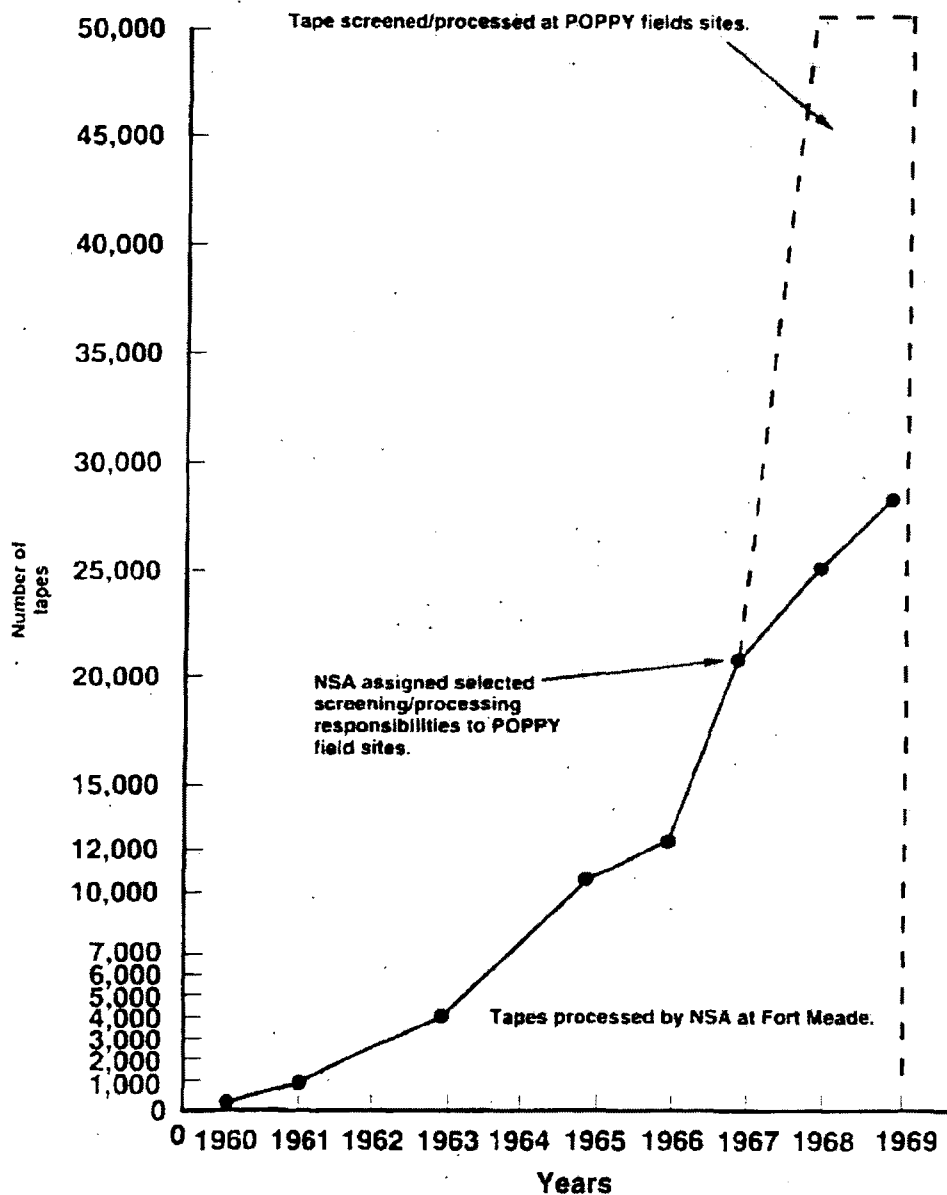


Chart 3

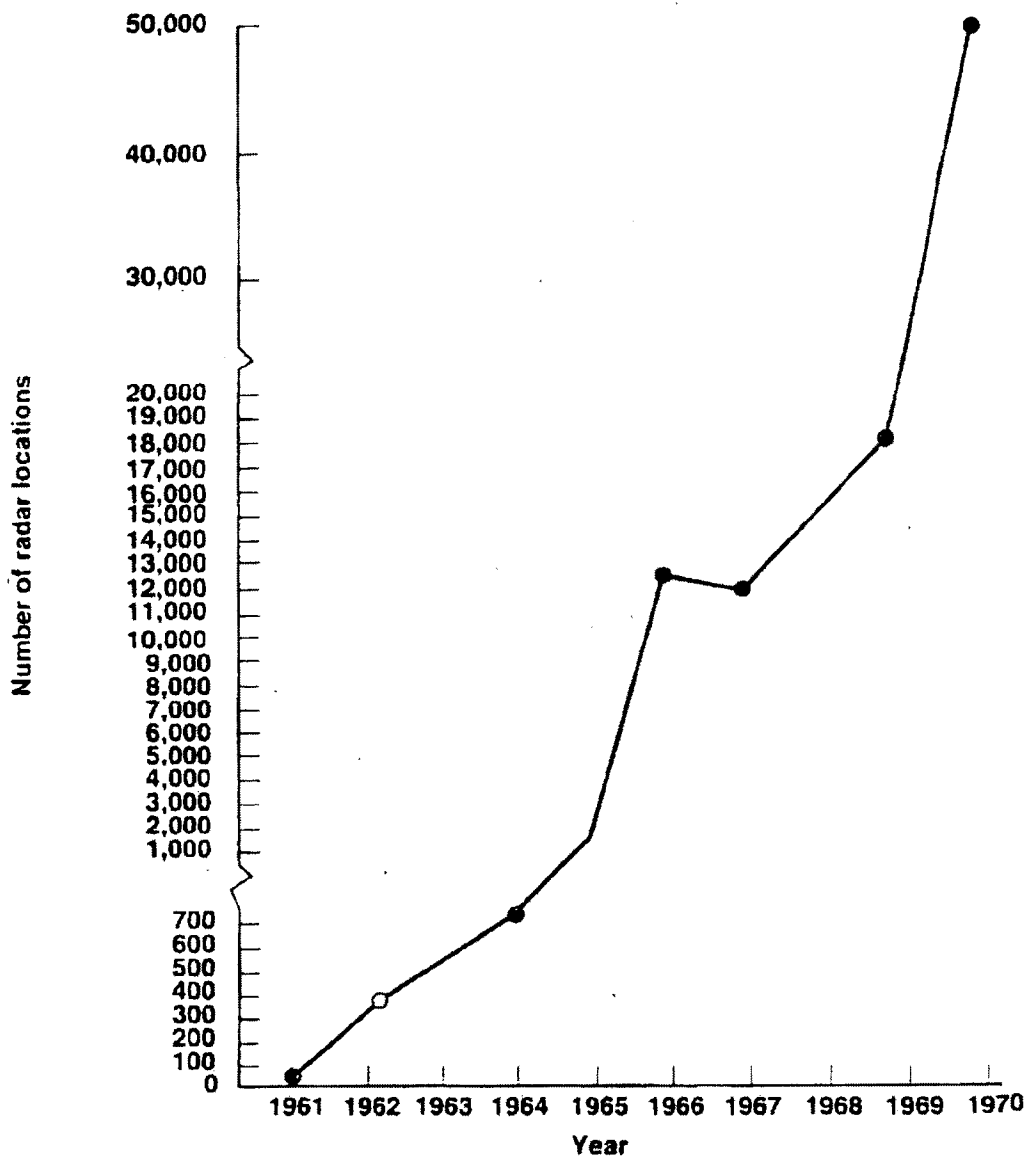
POPPY tapes processing.



No accurate tape volume data available after 1969

Chart 4

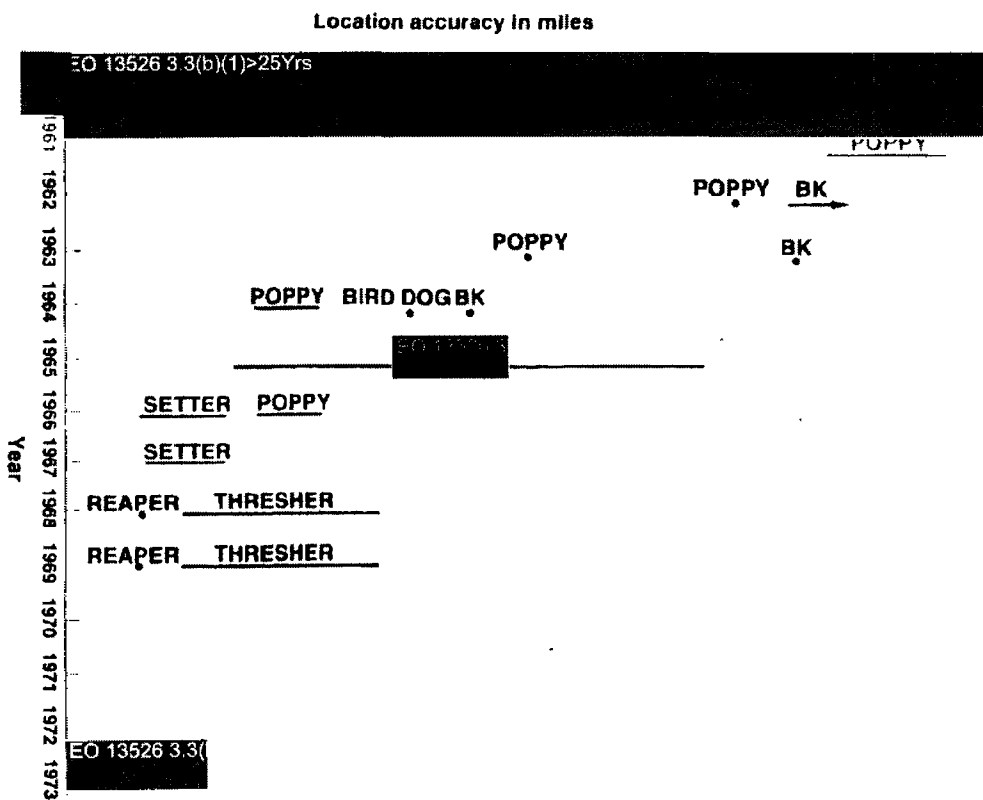
Number of radar locations produced per year.



No accurate tape volume data available after 1970

Chart 5

Location accuracy improvements by ELINT satellite.

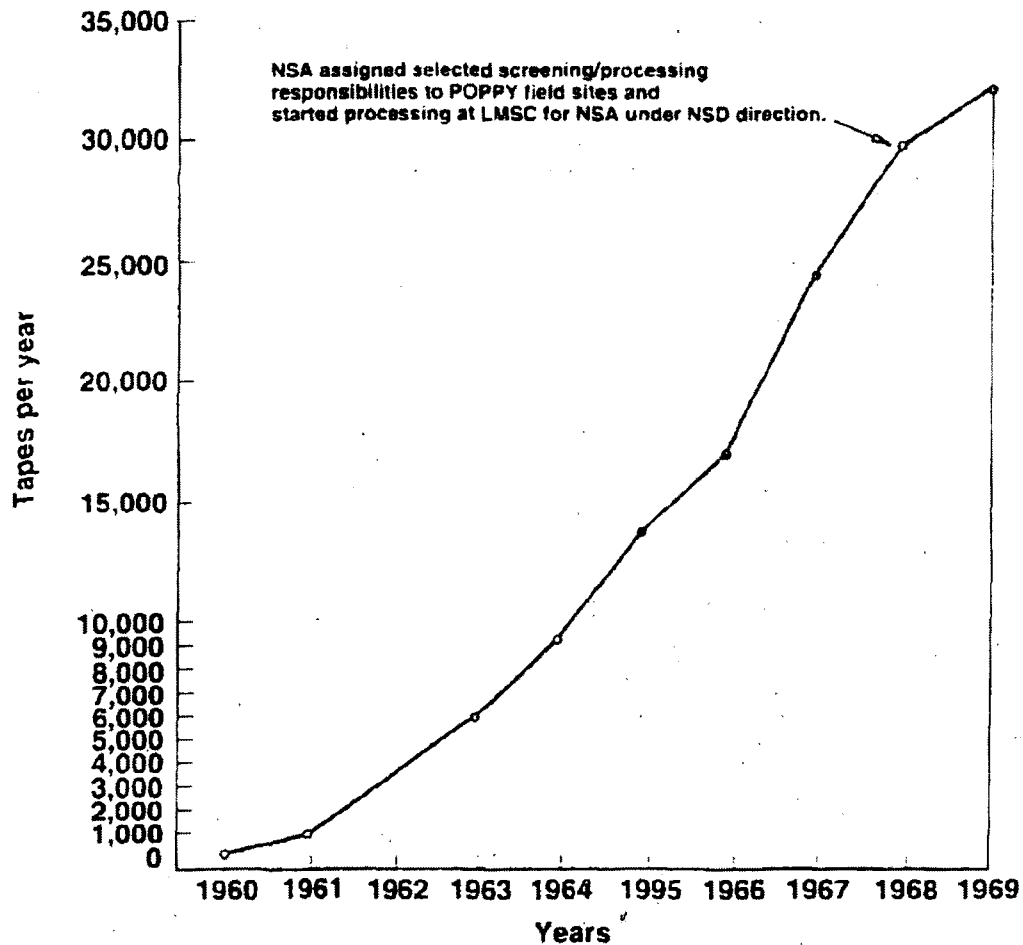


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Chart 6

Volume of ELINT analog tapes processed by NSA at Fort Meade, Maryland.
EO 13526 1.4(c)-25Yrs, EO 13526 3.5(c)



In addition to the ELINT analog tapes there were large quantities of digital data processed. There are NO complete records of the digital volume. The analog tapes include 10 kHz, detected data up to 10 MHz, and pre-detected data.

No accurate tape volume data available after 1969

Appendix A References

1. *Encyclopedia of Computer Science*, 3rd Edition. Van Norstrand Reinhold. NY, 1993. p. 1488.
2. *Encyclopedia of Computer Science*, p. 1488.
3. Snyder, Samuel S. *Influence of U.S. Cryptologic Organizations On The Digital Computer Industry*. National Security Agency, Fort George G. Meade, MD, May 1977, p. 3.
4. Snyder, pp. 5, 7, and 8.
5. Snyder, p. 10.
6. Snyder, p. 8.
7. Snyder, p. 8.
8. *Encyclopedia of Computer Science*, p. 1488.
9. Snyder, p. 8.
10. Snyder, pp. 17-18.
11. Snyder, pp. 18-19.
12. Snyder, p. 29.
13. Snyder, pp. 19-22.

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B

Appendix

SIGINT Satellite Contributions to Understanding Soviet Antiballistic Missile/ Anti-Earth Satellite (ABM/AES) Radar System Capabilities

Date	Mission	ABM/AES Information Developed
Apr 60	U-2 photography	Two HEN ROOST radars, one HEN HOUSE radar, a HEN NEST radar, and two HEN EGG radars, all thought to be tracking radars, were photographed at the research and development complex under construction at Sary Shagan. ¹
1961	Satellite photo	BIG SCREEN construction detected. ²
7 Aug 61	GRAB/DYNO 2	"On the 7th of August 1961, the first signals believed to emanate from the BIG SCREEN complex were detected." EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)
28 Oct 62	EO 13526 3.3(b)(1)>25Yrs	
26 Jun 63	WILDBILL 3, Mission 7207; and POPPY 4. EO 13526 3.3(b)(1)>25Yrs	
27 Nov 63	LONG JOHN 2, Mission 7219	
11 Jan 64	POPPY 5. EO 13526 3.3(b)(1)>25Yrs	Using a series of intercepts in the EO 13526 1.4(c)<25Yrs band made during POPPY 5 operations, National Security Agency (NSA) analysts detected the following signals: EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)
27 Jan 64	MOON BOUNCE EO 13526 program	Satellites provided the only signal collection of Soviet ABM radars until the MOON BOUNCE intercept arranged by NSA and the Naval Research Laboratory (NRL).
25 Dec 64	POPPY 5. EO 13526 3.3(b)(1)>25Yrs	EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

(Table continues)

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**SIGINT Satellite Contributions to Understanding Soviet Antiballistic Missile/
Anti-Earth Satellite (ABM/AES) Radar System Capabilities**


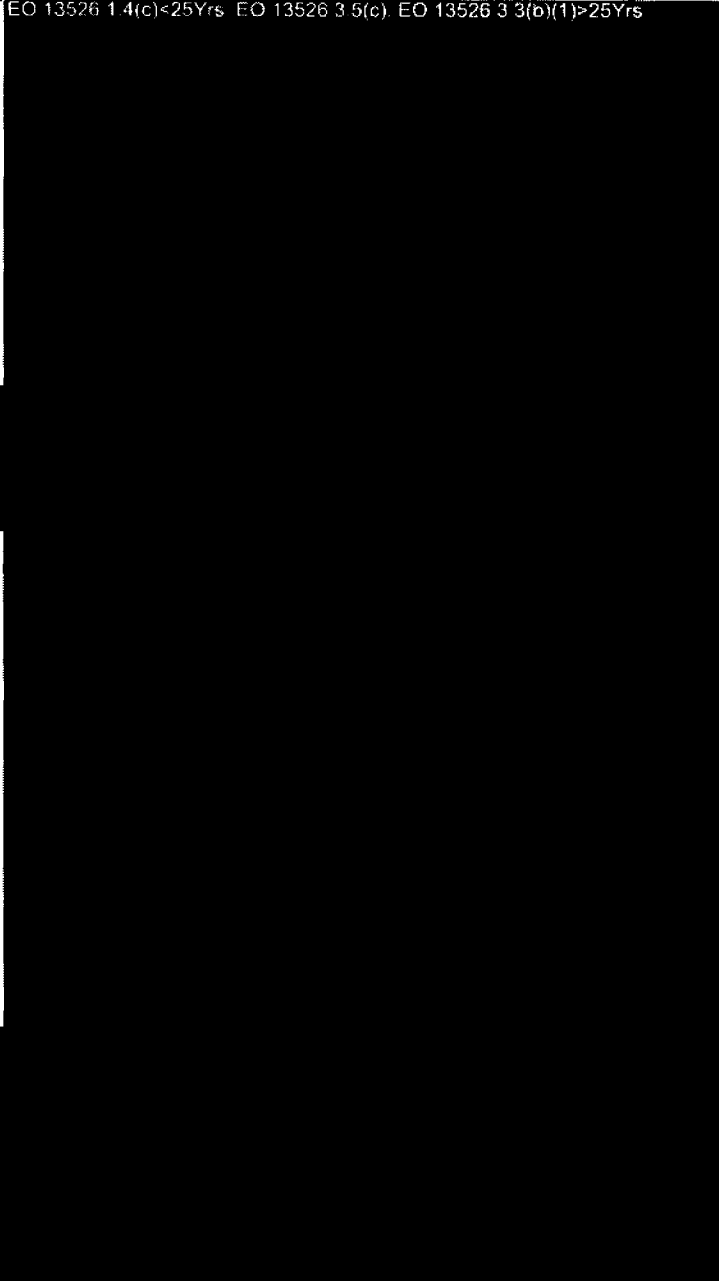
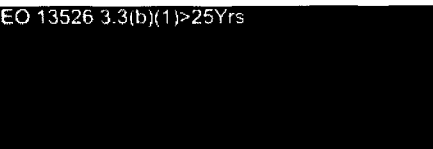
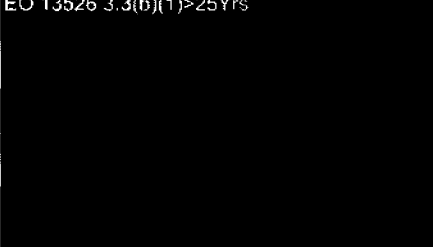
Date	Mission	ABM/AES Information Developed
2 Feb 65	POPPY 5, 	EO 13526 1.4.(c)<25Yrs EO 13526 3.3(b)(1)>25Yrs 
9 Mar 65	POPPY 6, EO 13526 3.3(b)(1)	
EO 13526 3.3(b)(1)>25Yrs 		
25 Jun 65, 1 Sep 66, and 21 Dec 66	POPPY 6, EO 13526 3.3(b)(1)	
28 Dec 66	MULTIGROUP 1, Mission 7161	
EO 13526 3.3(b)(1)>25Yrs 		

Table continues

EO 1.4.(c)
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Date	Mission	ABM/AES Information Developed
31 May 67	POPPY 7, EO 13526 3.3(b)(1)>25Yrs	EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)
24 Jul 67	MULTIGROUP 2, Mission 7162	
28 Sep 67	MULTIGROUP 2, Mission 7162	
	EO 13526 3.3(b)(1)>25Yrs	
19 Dec 67	POPPY 7, EO 13526 3.3(b)(1)>25Yrs	
9 Apr 68	EO 13526 3.3(b)(1)>25Yrs MULTIGROUP 3, Mission 7163	
5 Oct 68	THRESHER 1, Mission 7164	

(Table continues)

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Date	Mission	ABM/AES Information Developed
5 Oct 68	CONVOY, Mission 7238	EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

31 Jul 69 THRESHER 2,
Mission 7165

31 Jul 69. CONVOY 2.
Mission 7239

26 Aug 70 REAPER 3.
Mission 7235

Figure continues

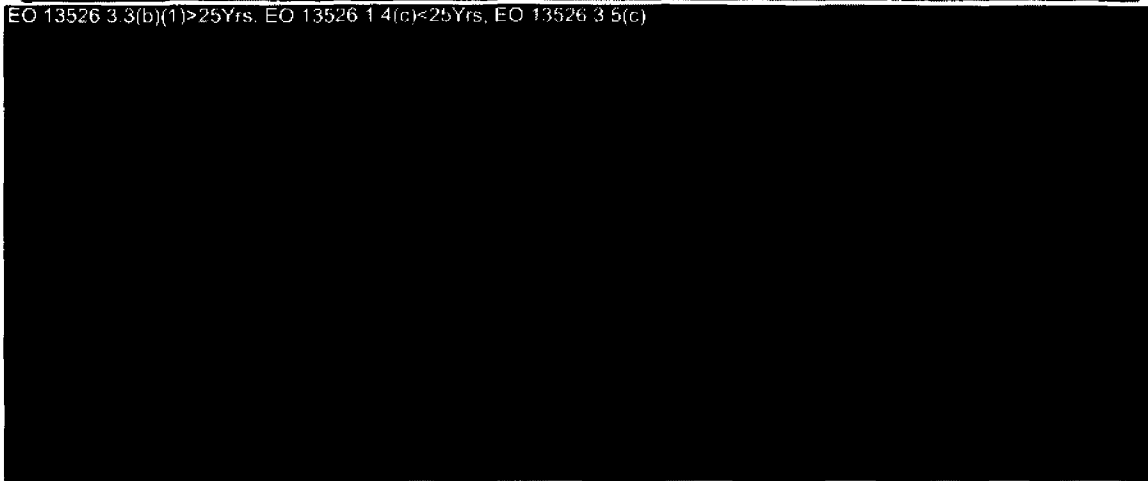
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**SIGINT Satellite Contributions to Understanding Soviet Antiballistic Missile/
Anti-Earth Satellite (ABM/AES) Radar System Capabilities**

Date	Mission	ABM/AES Information Developed
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EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)



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Appendix B References

1. Thompson, Fred C., Emory Richardson, Thomas F. Kenly, and Leo W. Lemley. *Synthesis of the [redacted] Radar System*, HRB Singer Inc. Report, [redacted] EO 13526 3.5(c) 5 June 1964, p. 9. (S)
2. *A Study of the [redacted] Radar Signal*, by the Special Signal Analysis Team of Lockheed Missile and Space Company, under the direction of the National Security Agency. [redacted] EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)
3. [redacted] EO 13526 *Signal Characteristics, Summary of Antimissile/Antisatellite System Type Signals*, 27 January 1966, TCS-650001-66, p. 9, para 7.
4. *History of the POPPY Satellite System*, BYE-56105-78, p. 45 (hereafter cited as *POPPY History*).
5. *Summary of Antimissile/Antisatellite System Type Signals*, 27 January 1966, TCS-650001-66, pp. 10-11.
6. *Summary of Antimissile/Antisatellite System Type Signals*, p. 13.
7. *NSA in Space*, April 1975, BYE-19385-75, p. 13.
8. *POPPY History*, p. 46.
9. *A Study of the [redacted] Radar Signal*, p. 3. [redacted] EO 13526 1.4(c)<25Yrs.
10. *Summary of Antimissile/Antisatellite System Type Signals*, p. 21, and *Radar Signal Similar to [redacted] Intercepted by Satellite* [redacted] EO 13526 1.4(c)<25Yrs. EO 13526 3.3(b)(1)>25Yrs. EO 13526 3.5(c)
11. *POPPY History*, p. 47.
12. *History of [redacted] Intercepts by Mission 7312* [redacted] EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c) TCS-650070-66, 9 May 66.
13. *A Study of the [redacted] Radar Signal*, pp. 3-4. [redacted] EO 13526 1.4(c)<25Yrs.
14. [redacted] EO 13526 3.5(c)
15. [redacted]
16. [redacted]
- [redacted] EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)
18. *Summary of SLEWTO, Mission 7318, Intercept Analysis*, [redacted] EO 13526 3.5(c) TCS-40117-68, 20 March 68.
19. *POPPY History*, pp. 47-48.
20. [redacted] EO 13526 3.5(c)
21. [redacted]
22. *A Study of the [redacted] Radar Signal*, p. 4. [redacted] EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)
23. [redacted]
24. *POPPY History*, p. 48.

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25. [REDACTED] EO 13526 3.5(c)
26. *A Study of the* [REDACTED] EO 13526 1.4(c) < *Radar Signal*, p. 5.
27. [REDACTED] EO 13526 3.5(c)
28. [REDACTED]
29. [REDACTED]
30. [REDACTED]
31. TK/WC-W205/47-71 and TK/WC-W205/08-72.
32. Report AM019, 17 April 1970 and 22 July 1970.
33. Report AM 103, 8 December 1989.
34. Report AM007, 20 February 1970.
35. Report AM73, 21 October 1970.
36. Report 004, 16 January 1970.
37. *Performance Characteristics Based on Wave Form Analysis of* [REDACTED] EO 13526 *Signals*, by the Special Signal Analysis Team of Lockheed Missiles and Space Company, under the direction of the National Security Agency, 13 October 1971, TCS 58527-71.
38. Reports: 06, 18 February 1971; AM10, 12 March 1971; 15, 6 April 1971; and AM24, 15 June 1971.
39. [REDACTED] EO 13526 3.5(c)
40. [REDACTED]
41. [REDACTED]
42. *NSA in Space*, April 1975, BYE-19385-75, Appendix H, p. 1.

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C Appendix

Soviet and Chinese Radar and Communications Signals

Radars

US/NATO Name	Function
EO 13526 (HEN HOUSE I)	Soviet ABM, target acquisition and tracking
(HEN HOUSE II)	Soviet ABM, target acquisition and tracking
BACK NET	Soviet acquisition radar for the SA-5 GAMMON surface-to-air-missile (SAM) system
BALL GUN	Soviet shipborne surface search
BAR LOCK	Soviet early warning
BEER CAN	Soviet early warning, ground-controlled intercept
BIG BAR	Soviet early warning
BIG MESH	Soviet early warning
BIG NET	Soviet shipborne early warning
BIG SCREEN	Soviet ABM target warning
BUEB (HEN HOUSE)	Soviet ABM, target acquisition and tracking
BUGH	Soviet ABM
EO 13526 (HEN HOUSE)	Soviet ABM, target acquisition and tracking
(HEN HOUSE)	Soviet ABM, target acquisition and tracking
CAT HOUSE	Soviet target tracking for the GALOSH antiballistic missile (ABM) system
CROSS OUT	Soviet early warning
DOG HOUSE	Soviet target acquisition for the GALOSH ABM system
DRUM TILT	Soviet antiaircraft fire control
EGG HEAD	Soviet, believed slewable phased array
FAN SONG, C-band	Soviet target tracking and missile guidance for SA-2 GUIDELINE SAMs also used in the People's Republic of China (PRC)
FAN SONG, S-band	Soviet target tracking and missile guidance for SA-2 SAMs
FIRE CAN	Soviet antiaircraft fire control
FLAT FACE	Soviet early warning for antiaircraft fire control
FLAT TWIN	Soviet target tracking with coherent radio frequency, believed to emit from a slewable phased array
FULL TIME	Soviet early warning
GIN SLING	PRC target-tracking radar associated with the CSA-1 SAM system

(Table continues)

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Radars

US/NATO Name	Function
GUN DISH	Soviet shipborne antiaircraft
HEAD LIGHTS	Soviet shipborne target tracking and missile guidance for the SA-N-3 missile
HEAD NET	Soviet shipborne air search and early warning for the SA-N-1
HEN EGG	Soviet ABM
HEN HOUSE I	Soviet ABM target-tracking: B357Z, formerly BUEB and BV01
HEN HOUSE II	Soviet ABM target-tracking: B375Z, formerly BVFW and TS136
HIGH SIEVE	Soviet shipborne surface search
LONG TRACK	Soviet target acquisition radar associated with SA-4 GANEF, SA-6 GAINFUL, and SA-8 GECKO SAM systems
LOW BLOW	Soviet target-tracking radar associated with the SA-3 GOA SAM
MOON MAT	Early warning copy US SCR-270
MUFF COB	Soviet shipborne antiaircraft fire control
NYSA-C	Polish early warning
PART TIME	Soviet early warning
PAT HAND	Soviet target-tracking for the GANEF SA-4 SAM system
POP GROUP	Soviet shipborne SA-N-4 missile guidance, target tracking
ROCK CAKE	Soviet height finder
SHEET BEND	Soviet coastal surveillance radar associated with the SS-2B surface-to-surface missile system
SHIP WHEEL	Soviet missile beacon-tracking/instrumentation
SHOCK SING	PRC early warning associated with the SA-3
SLIM NET	Soviet shipborne surface search/target acquisition
SNOOP SLAB	Soviet submarine-borne navigation
SNOOP TRAY	Soviet submarine-borne navigational radar
SQUARE PAIR	T8856 Soviet target-tracking radar for the SA-5 missile system
STRAIGHT FLUSH	Soviet target-tracking radar associated with the SA-6 missile system
STRIKE OUT	Soviet early warning
STONE CAKE	Soviet height finder
TALL KING	Soviet early warning
THIN SKIN	Soviet height finder associated with the SA-4, SA-6, and SA-8
TOKEN	Soviet early warning
TOP ROOST	Soviet ABM target-tracking, can track multiple targets
TOP SAIL	Soviet shipborne for SA-N-3
TOP TROUGH	Soviet shipborne early warning
TRY ADD	Soviet target-tracking, missile tracking, and guidance for the GALOSH ABM system
YO YO	Soviet target tracking for GUILD SA-1 SAM

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Communications Signals

US/Soviet Name	Soviet Designator	Function	Frequency*
EO 13526 1.4(c)-25Yrs, EO 13526 3.5(c)			

Radio Frequency Ranges

pe	Range	Wavelength
HF (high frequency)	3-30 MHz	100-10 meters
VHF (very high frequency)	30-300 MHz	10-1 meter
UHF (ultrahigh frequency)	300-3,000 MHz	1 m to 10 cm
S-band	2,000-4,000 MHz	10 cm
C-band	4,000-6,000 MHz	5 cm
X-band	8,000-10,000 MHz	3 cm
SHF (superhigh frequency)	3-30 GHz	10-1 cm

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SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
					EO 13526 1.4(
1960							
6/22/60	xxxx	GRAH/DYNCO-1	Transit IIA Thor/Able-Star	NRI		90 days	First SIGINT (ELINT) satellite
8/10/60	xxxx	SOCTOP 1*	Thor Agena DISCOVERER 13	AIR		1 day	First alt-rack payload vulnerability mission
10/11/60	xxxx	SAMOS 1	Atlas-Agena E-1/F-1	AIR		—	Failed to orbit
11/30/60	xxxx	GRAH/DYNCO	Transit IIA Thor/Able-Star	NRI		—	Failed to orbit
1961							
01/31/61	xxxx	SAMOS 2 E-1/F-1	Atlas-Agena	AIR		21 orbits	First on-orbit digital processing (ELINT)

*The SOCTOP payloads were the first in a series of vulnerability payloads to be flown on most photo reconnaissance missions. The SOCTOP payloads were intended to determine if the Soviets were tracking or trying to interfere with the commanding of the satellites, either at beacon frequencies in S-band (2.5-3.2 GHz) or suspected ABM radar frequencies between 100 MHz and 1.0 GHz. These were followed by BIT I (0.150-0.164 GHz) and BIT II (0.15-0.30 GHz) payloads flown from 1964 to 1966 to determine if the satellites were being tracked by HEN HOUSE radars. Another series EO 13526 3.3(b)(1) > 25 was to determine if the satellites were being detected/tracked by the HEN HOUSE, HEN EGGS/TRY ADD, or DOG HOUSE radars. EO 13 was divided into BIT IV, BIT V, and BIT IX packages. EO 13526 2.3 packages were developed to determine if the Soviets were using EO 13526 3.3(b)(1) > 25Yrs interfere with photo satellite operations. SOCTOP packages were flown on 10 additional CORONA missions (from mission 9010, launched on 09/13/60, to mission 9028, launched on 11/15/61) and two SAMOS missions (mission 2203, launched on 12/22/61, and mission 2204, launched on 03/07/62). BIT packages were flown on 49 CORONA missions (from mission 7051, launched on 07/21/61, through mission 1117, launched on 05/25/72), on 33 GAMBIT missions (from mission 4029, launched on 06/03/66, through mission 4144, launched on 04/18/75), and on 13 HEXAGON missions (from mission 1201, launched on 06/15/71, through mission 1214, launched on 06/27/77). EO 13526 2.3(b)(1) > 25 (For further details on these missions, see SIGINT Satellite Mission Log, National Reconnaissance Office, Washington, DC, 15 February 1978.)

(Table continues)

Appendix

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Appendix D

SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
1961 (cont)					EO 13526 3.3(f)		
06/16/61	XXXX	TAKI 1	Thor Agena B DISCOVERER 25	SEL		2 days	First ELINT mission to record/playback data
06/29/61	XXXX	GRAV/ DYNO-2	Transit IIIB Thor Able-Star	NRL		6 months	Failed to separate. Limited L-band ELINT.
07/07/61	XXXX	WILD BILL 1	Thor Agena B DISCOVERER 26	SEL		2 days	HEN HOUSE search. Wrong frequency band
07/17/61	XXXX	TOPSOC 2	Thor Agena B DISCOVERER 31	AIR		11 days	See TOPSOC 1
08/10/61	XXXX	TEXAS PINE	Thor Agena B DISCOVERER 29	AIR		2 days	First COMINT payload. Sampled VLF environment EO 13526 3.3(f)
09/12/61	XXXX	TOPSOC 1	Thor Agena B DISCOVERER 30	AIR		5 days	AIM search; high-gain receiver clogged data processing.
10/13/61	XXXX	TOPSOC 3	Thor Agena B DISCOVERER 32	AIR		2 days	See TOPSOC 1
11/05/61	XXXX	TOPSOC 4	Thor Agena B DISCOVERER 35	AIR		2 days	See TOPSOC 1
12/12/61	XXXX	GRAPHICUL 1	Thor Agena B DISCOVERER 36	HRL-Singer		1 day	COMINT covered a channel at EO 13526 3.3(f)
1962							
01/13/62	XXXX	TAKI	Thor Agena B DISCOVERER 37	SEL			Failed to orbit

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SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
1962 (cont)					EO 13526 3.3(b)(1)>25Y		
01/24/62	xxxx	POPPY 1	Thor/Able-Star	NRL	Failed to orbit. DYNCO plus four payloads.		
02/21/62	7151	Project 102 Group 0	Thor Agena B 2301	ATI	ELINT: 23 readouts; 9,600 readout words. First digital-computer-processed locations of Soviet radars.		
02/27/62	xxxx	WILD BILL 1	Thor Agena B DISCOVERER 48	SEL	Link two failed. ABM ELINT mission.		
04/17/62	xxxx	GRAPEJUICE 2	Thor Agena B DISCOVERER 49	HRB-Singer	EO 13526 1.4(c)<25Yrs.		
04/29/62	xxxx	TAKE 2	Thor Agena B DISCOVERER 40	ATI	Sampled TALL KING radar environment		
06/18/62	7152	Project 102 Group 2-D	Thor Agena B Vehicle 2312	ATI	Tape recorder failure on orbit 26. Digital ELINT, TOB.		
06/24/62	xxxx	POPPY 2	Scout	NRL	Failed to orbit		
07/27/62	xxxx	NEW JERSEY 1	Thor Agena B CORONA 9040	Sanders	COMINT - located		
09/17/62	xxxx	GRAPEJUICE 3	Thor Agena B CORONA 9011	HRB-Singer	EO 13526 1.4(c)<25Y COMINT - manual copy. Heavy interference.		

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Appendix D

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COMINT/NOFORN/NOFORN/NOFORN
BYE/NOFORN

SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
1962 (cont)					EO 13526 1.4(
11/24/62	7201	PLYMOUTH ROCK 1	Thor Agena B CORONA 9048	SEI		7 days	First YIG filter in space. ELINT GS. Processed by SAC.
12/14/62	7201	VINCE 1	Thor Agena B CORONA 9049	HRB-Singer		3 days	Improved GRAPEHICE. Minimal copy due to interference.
12/12/62	7101	POPPY 1A/B (2 satellites)	Thor Agena B Vehicle 2451	NRL	EO 13526 3.3(b)(1)>25Yrs		ELINT GS. Located (W/C) radars. Bad orbit (124 by 1,500 miles).
12/12/62	7202	WILD BILL 2	Thor Agena B POPPY EO 1	ATI	EO 13526 1.4(15 days	ELINT/EC/PSL search. Wrong frequency band.
12/14/62	7204	TAKI 1	Thor Agena B CORONA 9050	ATI		6 days	ELINT - TALL KING radar search (no locations).
1963							
01/17/63	7205	NEW JERSEY 2	Thor Agena B CORONA 9051	Sanders		6 days	COMINT - doppler locations by contractor processing.
01/16/63	7153	Project HARBOR Group 1-D	Thor Agena D Vehicle 2413	ATI		1 days	ELINT FOR EO 13526 radar locations in Soviet Union.
02/28/63	7206	VINCE 2	Thor Agena D CORONA 9052	HRB-Singer			Failed to orbit.

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SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
1963 (cont)							
06/12/63	7207	WILD BILL 4	Thor Agena D CORONA 9054	ATI	EO 13526 1.	13 days	First HEN HOUSE radar intercept. First ELINT mission. EO 13526
06/15/63	EO 1	POPPY 4 (3 satellites)	Thor Agena D Vehicle 2353	NRI	EO 13526		Bad orbit (96 by 495 miles). ELINT GS. Confirmed HEN HOUSE intercept.
06/15/63	7216	WILD BILL 4	Thor Agena D POPPY 7102	ATI		37 days	ELINT, ABM radar search. More HEN HOUSE intercepts.
06/29/63	7154	Project G900K Group 1 digital	TAT Agena D Vehicle 2114	ATI		10 days	First TAT-boosted SIGINT mission. ELINT: GS and EOB.
06/29/63	7208	PLYMOUTH ROCK 2	TAT Agena D G900K 2154	ATI		12 days	ELINT GS. Processed by SAC for EOB input.
EO 13526 3.3(b)(1)>25Yrs							
11/27/63	7219	LONG JOHN 2	TAT Agena D CORONA 9061	ATI		15 days	ELINT II. Defined center frequency of HEN HOUSE.
EO 13526 3.3(b)(1)>25Yrs							

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SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
1963 (cont)					EO 13526 1.4		
12/21/63	7210	LONG JOHN 1	TAT Agena D CORONA 9062	ATI		20 days	EUMT T1. Same as LONG JOHN 2.
1964					EO 13526		
01/11/64	EO 1	POPPY 5 (3 satellites)	TAT Agena D Vehicle 2154	NRL			First 500-mile circular orbit. EUMT GS/EOB.
01/11/64	7210	HAYLOFT	TAT Agena D POPPY 7103	HRH-Singay		14 days	Test flight of AMIE wideband recorder with 10-megabit encrypted down link.
02/15/64	7222	LONG JOHN 3	TAT Agena D CORONA 1004	ATI		21 days	No data collection. Tape recorder failed.
02/27/64	7156	Project GORRUK Group 1-A	TAT Agena D Vehicle 2116	ATI		12 days	First wideband analog tape recorder. EUMT T1.
02/27/64	7212	BIRD DOG 2	TAT Agena D GORRUK 7156	LIV		14 days	First EUMT intercom- munications satellite payload. C- band EO 13526 radar collection.
06/13/64	7224	LONG JOHN 4	TAT Agena D ARCON 9063a	ATI		14 days	EUMT EO 13526 1.4 center frequency. Recorder stalled on fourth day.

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SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
1964 (cont) 07/02/64	7155	Project G98BK Group 2-D	TAT Agena D Vehicle 2115	AIL	EO 13526 1.4(c)	12 days	ELINT FOB, 114,521 intercept words, 357 confirmed sites, 48 new sites. Beacon problem limited read-in orbits.
07/02/64	7211	BIRD DOG 1	TAT Agena D G98BK 7155	ITT		6 days	EO 13526 1.4(c)<25Yrs, [REDACTED]
EO 13526 1.4(c)<25Yrs. EO 13526 3.3(b)(1)>25Yrs. EO 13526 3.5(c)							
07/21/64	7215	CHUCK-KNOCKITY	TAT Agena D ARCON 9066a	HKB-Singer		51 days	EO 13526 1.4(c)<25Yrs, E [REDACTED]
EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)							

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SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
1964 (cont)					EO 13526 3.3(c)		
11/03/64	7157	Project 698BK Group 3-digital	TAT Agena D Vehicle 2317	AIR		4 days	ELINT: digital EOB plus 100 kHz analog data
11/03/64	7211	BIRD DOG 3	TAT Agena D 698BK 7157	LTV			Antenna failed to inflate
1965					EO 13526 3.3(b)(1)>25Yr		
03/09/65	EO 13	POPPY EO 135	TAT Agena D Vehicle 2703	NRL			ELINT US. First SIGINT launch under BYFMAN system (Project 770).
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)							
07/16/65	7158	Project 770 Group 1-A	TAT Agena D Vehicle 2702	AIR	EO 13526 3.3	51 days	ELINT II: 4 MHz wideband recorder
07/16/65	7226	BIRD DOG 4	TAT Agena D 770 7158	LTV		2 orbits	Power supply failed
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)							

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SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
1965 (cont)							
10/21/65	7225	SQUARE TWENTY	TAT Agena D CORONA 1026	LTV	EO 13526 3.3	11 days	COMINT - first locations EO 13526 3.3(b)(1) MRS - 11.30 PPM voice converter from EDL
1966							
02/19/66	7160	Project 770 Group 3-D	TAT Agena D Vehicle 2703	AIL		7 months	ELINT EOB. Digital with 100-kHz analog data.
02/19/66	7228	SETTER 1A	TAT Agena D 770 21601	LTV		40 days	ELINT EOB. S-band.
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)							

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SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
1966 (cont)							
EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)<25Yrs. EO 13526 3.5(c)							
12/28/66	7161	MULTI-GROUP 1	TAT Agena D Vehicle 2731	AIR	EO 13526 1.4	5 months	ELINT EOB 11. First analog predetection wide band receiver. First EO 13526 1.4(c)<25Yr
12/28/66	7229	SETTER 1A	TAT Agena D 270 7161	CIV		40 days	ELINT EOB 5-band
1967							
05/11/67	EO 13	POPPY EO 13	Thor Agena D Vehicle 2704	NRI	EO 13526 3.3(b)(1)>25Yrs		ELINT CS. Allat cables. Shipborne cables

Table continues

Top Secret
Handle as RUCAL/TA/INT/AT/NOAL/EO 1.4(c)<25Yr

Top Secret
NOAL/NOAL/NOAL

SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
1967 (cont)					EO 13526 1.4		
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)							
07/24/67	7162	MULTI-GROUP 2	TAT Agena D Vehicle 2732	ALL		5 months	ELINT EOB and TL, ABM radar search and definition.
07/24/67	7210	SEITER 1A	TAT Agena D 770 7162	LTV		5 months	ELINT EOB and TL, S-band.
07/24/67	7211	DONKEY	TAT Agena D 770 7162	IDL		5 months	EO 13526 3.3(b)(3)>25Yrs
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)							
1968							
01/17/68	7163	MULTI-GROUP 3	TAT Agena D Vehicle 2733	ALL		14 months	ELINT EOB and TL, ABM radar search and definition.
01/17/68	7212	SEITER 1B 770 7163	TAT Agena D	LTV		14 months	ELINT EOB, S-band.
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)							

(Table continues)

Top Secret
 Handle as Official Information
 Control Group 1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/31/32/33/34/35/36/37/38/39/40/41/42/43/44/45/46/47/48/49/50/51/52/53/54/55/56/57/58/59/60/61/62/63/64/65/66/67/68/69/70/71/72/73/74/75/76/77/78/79/80/81/82/83/84/85/86/87/88/89/90/91/92/93/94/95/96/97/98/99/100/101/102/103/104/105/106/107/108/109/110/111/112/113/114/115/116/117/118/119/120/121/122/123/124/125/126/127/128/129/130/131/132/133/134/135/136/137/138/139/140/141/142/143/144/145/146/147/148/149/150/151/152/153/154/155/156/157/158/159/160/161/162/163/164/165/166/167/168/169/170/171/172/173/174/175/176/177/178/179/180/181/182/183/184/185/186/187/188/189/190/191/192/193/194/195/196/197/198/199/200/201/202/203/204/205/206/207/208/209/210/211/212/213/214/215/216/217/218/219/220/221/222/223/224/225/226/227/228/229/230/231/232/233/234/235/236/237/238/239/240/241/242/243/244/245/246/247/248/249/250/251/252/253/254/255/256/257/258/259/260/261/262/263/264/265/266/267/268/269/270/271/272/273/274/275/276/277/278/279/280/281/282/283/284/285/286/287/288/289/290/291/292/293/294/295/296/297/298/299/300/301/302/303/304/305/306/307/308/309/310/311/312/313/314/315/316/317/318/319/320/321/322/323/324/325/326/327/328/329/330/331/332/333/334/335/336/337/338/339/340/341/342/343/344/345/346/347/348/349/350/351/352/353/354/355/356/357/358/359/360/361/362/363/364/365/366/367/368/369/370/371/372/373/374/375/376/377/378/379/380/381/382/383/384/385/386/387/388/389/390/391/392/393/394/395/396/397/398/399/400/401/402/403/404/405/406/407/408/409/410/411/412/413/414/415/416/417/418/419/420/421/422/423/424/425/426/427/428/429/430/431/432/433/434/435/436/437/438/439/440/441/442/443/444/445/446/447/448/449/450/451/452/453/454/455/456/457/458/459/460/461/462/463/464/465/466/467/468/469/470/471/472/473/474/475/476/477/478/479/480/481/482/483/484/485/486/487/488/489/490/491/492/493/494/495/496/497/498/499/500/501/502/503/504/505/506/507/508/509/510/511/512/513/514/515/516/517/518/519/520/521/522/523/524/525/526/527/528/529/530/531/532/533/534/535/536/537/538/539/540/541/542/543/544/545/546/547/548/549/550/551/552/553/554/555/556/557/558/559/560/561/562/563/564/565/566/567/568/569/570/571/572/573/574/575/576/577/578/579/580/581/582/583/584/585/586/587/588/589/590/591/592/593/594/595/596/597/598/599/600/601/602/603/604/605/606/607/608/609/610/611/612/613/614/615/616/617/618/619/620/621/622/623/624/625/626/627/628/629/630/631/632/633/634/635/636/637/638/639/640/641/642/643/644/645/646/647/648/649/650/651/652/653/654/655/656/657/658/659/660/661/662/663/664/665/666/667/668/669/670/671/672/673/674/675/676/677/678/679/680/681/682/683/684/685/686/687/688/689/690/691/692/693/694/695/696/697/698/699/700/701/702/703/704/705/706/707/708/709/710/711/712/713/714/715/716/717/718/719/720/721/722/723/724/725/726/727/728/729/730/731/732/733/734/735/736/737/738/739/740/741/742/743/744/745/746/747/748/749/750/751/752/753/754/755/756/757/758/759/760/761/762/763/764/765/766/767/768/769/770/771/772/773/774/775/776/777/778/779/780/781/782/783/784/785/786/787/788/789/790/791/792/793/794/795/796/797/798/799/800/801/802/803/804/805/806/807/808/809/810/811/812/813/814/815/816/817/818/819/820/821/822/823/824/825/826/827/828/829/830/831/832/833/834/835/836/837/838/839/840/841/842/843/844/845/846/847/848/849/850/851/852/853/854/855/856/857/858/859/860/861/862/863/864/865/866/867/868/869/870/871/872/873/874/875/876/877/878/879/880/881/882/883/884/885/886/887/888/889/890/891/892/893/894/895/896/897/898/899/900/901/902/903/904/905/906/907/908/909/910/911/912/913/914/915/916/917/918/919/920/921/922/923/924/925/926/927/928/929/930/931/932/933/934/935/936/937/938/939/940/941/942/943/944/945/946/947/948/949/950/951/952/953/954/955/956/957/958/959/960/961/962/963/964/965/966/967/968/969/970/971/972/973/974/975/976/977/978/979/980/981/982/983/984/985/986/987/988/989/990/991/992/993/994/995/996/997/998/999/1000/1001/1002/1003/1004/1005/1006/1007/1008/1009/1010/1011/1012/1013/1014/1015/1016/1017/1018/1019/1020/1021/1022/1023/1024/1025/1026/1027/1028/1029/1030/1031/1032/1033/1034/1035/1036/1037/1038/1039/1040/1041/1042/1043/1044/1045/1046/1047/1048/1049/1050/1051/1052/1053/1054/1055/1056/1057/1058/1059/1060/1061/1062/1063/1064/1065/1066/1067/1068/1069/1070/1071/1072/1073/1074/1075/1076/1077/1078/1079/1080/1081/1082/1083/1084/1085/1086/1087/1088/1089/1090/1091/1092/1093/1094/1095/1096/1097/1098/1099/1100/1101/1102/1103/1104/1105/1106/1107/1108/1109/1110/1111/1112/1113/1114/1115/1116/1117/1118/1119/1120/1121/1122/1123/1124/1125/1126/1127/1128/1129/1130/1131/1132/1133/1134/1135/1136/1137/1138/1139/1140/1141/1142/1143/1144/1145/1146/1147/1148/1149/1150/1151/1152/1153/1154/1155/1156/1157/1158/1159/1160/1161/1162/1163/1164/1165/1166/1167/1168/1169/1170/1171/1172/1173/1174/1175/1176/1177/1178/1179/1180/1181/1182/1183/1184/1185/1186/1187/1188/1189/1190/1191/1192/1193/1194/1195/1196/1197/1198/1199/1200/1201/1202/1203/1204/1205/1206/1207/1208/1209/1210/1211/1212/1213/1214/1215/1216/1217/1218/1219/1220/1221/12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SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
1969 (cont)							
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)							
09/10/69	EO 13	POPPY I EO 135	THORAD Agena D Vehicle 2706	NRL		A 28 mos B 5 mos C 28 mos D 5 mos	ELINT EOB, Ocean surveillance.
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)							
1970							
EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)							
08/26/70	7166	STRAVAMAN/ THRESHOLD	THORAD Agena D Vehicle 2736	AIL		12 months	ELINT EOB and U Digital and analog

(Table continues)

SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
1970 (cont)					EO 13526 3.		
08/26/70	7215	STRAWMAN/ REAPER 3	THORAD Agena D Vehicle 2746	LTV		17 months	ELINT EOB and TL. Digital and analog.
EO 13526 3.3(b)(1)>25Yrs. EO 13526 1 4(c)<25Yrs. EO 13526 3 5(c)							
1971							
EO 13526 3.3(b)(1)>25Yrs. EO 13526 1 4(c)<25Yrs. EO 13526 3 5(c)							
07/16/71	7217	STRAWMAN/ THRESHER 4	THORAD Agena D Vehicle 2747	All		20 months	ELINT EOB and TL. Analog and digital.
07/16/71	7236	STRAWMAN/ REAPER 4	THORAD Agena D Vehicle 2747	LTV		20 months	ELINT EOB and TL. Analog and digital.
07/16/71	7240	HARVESTER	THORAD Agena D Vehicle 2737	ESL		5 months	ELINT CS. Pulsed and continuous wave radars. Low band antenna failed, preventing intercept of SA-5 radar.
EO 13526 3.3(b)(1)>25Yrs. EO 13526 1 4(c)<25Yrs. EO 13526 3 5(c)							

(Table continues)

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The SIGINT Satellite Story

SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
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1971 (cont)

EO 13526 3.3(b)(1)>25Yrs

12/14/71

EO 135

TOP SECRET
EO 135

THORAD Agena D
Vehicle 2707

NRL

EO 13526 3

70 months
(A/B/C/D)

ELINT CS, EOB, and
TL Ocean surveillance.

1972

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

(Table continues)

TOP SECRET
Handle and REVIEW TALENT REMOVE-
COMINT Critical Element Identity
8/21/14

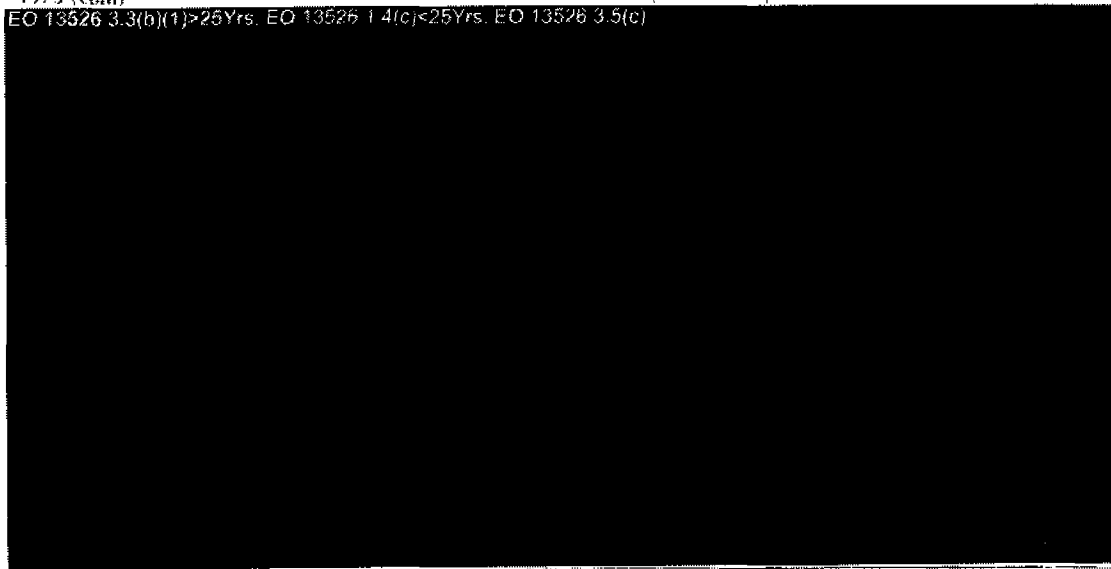
TOP SECRET
HANDLE/REMOVE

SIGINT Satellite Mission Summary

Date	Mission	Payload	Launch Vehicle	Contractor	Frequency Range (GHz)	Life	Features, Mission, Accomplishments
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1973 (cont)

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Appendix

Full-Text References

Explanatory note to full-text documents: National Security Council Intelligence Directive 6 (NSCID 6), dated 15 September 1958, delegated to NSA the authority to organize and control all US electronic intelligence (ELINT) intercept and processing. The 1958 version of this NSCID added ELINT to NSA's responsibilities, and since this directive was written before SIGINT began to use space vehicles, references to "satellites" are neither specifically included nor excluded. As a result of a Presidential reorganization in 1971, NSCID 6 was rewritten; the 1972 revision of the directive delineates NSA's responsibilities on control of the intercept payload and processing of data collected by SIGINT satellites. This appendix contains both an extract from the original NSCID 6 on the mission, administration, and specific responsibilities of NSA and its director and a copy of the 17 February 1972 directive. (Ref: Page 60, *NSA in Space*.)

The following documents are reproduced here in full text:

Extract from National Security Council Intelligence Directive 6, dated 15 September 1958, paragraphs 6 and 7. (Ref: Appendix N, *NSA in Space*.)

Full text of National Security Council Directive 6, dated 17 February 1972. (Ref: Appendix N, *NSA in Space*.)

Memorandum signed by Secretary of Defense Robert S. McNamara, dated 6 September 1961, attaching letter from Deputy Secretary of Defense Roswell L. Gilpatric to Director of Central Intelligence Allen W. Dulles, dated 6 September 1961, subject: Management of the National Reconnaissance Program. (Ref: Appendix P, *NSA in Space*.)

Memorandum from the Secretary of Defense, subject: Space Vehicle Electronics Intelligence Program, dated 20 October 1961. (Ref: Appendix Q, *NSA in Space*.)

Tordella-Scoville-Charyk agreement, dated 25 May 1962. (Ref: Appendix R, *NSA in Space*.)

Agreement for Reorganization of the National Reconnaissance Program, dated 11 August 1965, signed by Deputy Secretary of Defense Cyrus Vance and Director of Central Intelligence W. F. Raborn. (Ref: Appendix S, *NSA in Space*.)

Memorandum from Chief of Naval Operations, subject: System POPPY, reassignment of responsibilities for, dated 21 January 1963. (Ref: Appendix T, *NSA in Space*.)

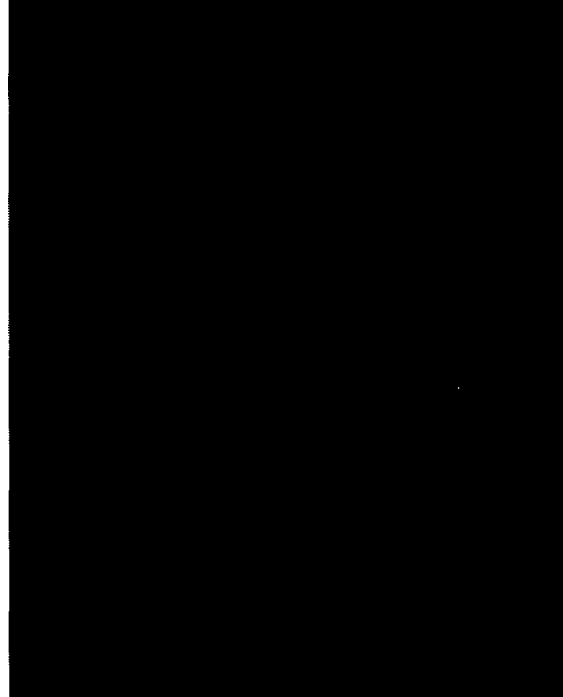
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NRO/NSA/CIA/USN Management
Agreement for the POPPY System, dated 5
November 1971. (Ref: Appendix U, *NSA
in Space.*)

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EXTRACT FROM NSCID 6, DATED 15 SEPTEMBER 1958

"6. The National Security Agency

a. The COMINT and ELINT missions of the National Security Agency (NSA) shall be to provide an effective, unified organization and control of the (1) COMINT and (2) ELINT intercept and processing activities of the United States, to provide for integrated operational policies and procedures pertaining thereto and to produce COMINT information and ELINT information in accordance with objectives, requirements and priorities established by the U.S. Intelligence Board.

b. NSA shall be administered by a Director, designated by the Secretary of Defense after consultation with the Joint Chiefs of Staff, whose appointment shall be for a term of four years. The Director shall be a career commissioned officer of the armed services on active or reactivated status, and shall enjoy at least 3-star rank during the period of his incumbency. The Director shall have a civilian Deputy.

7. The Director, National Security Agency.

a. The Director of NSA shall be responsible for accomplishing the mission of NSA. For this purpose all COMINT and ELINT intercept and processing activities of the United States are placed under his operational and technical control. When action by the Chiefs of the operating agencies of the Services or civilian departments or agencies is required, the Director shall normally issue instructions pertaining to COMINT and ELINT operations through them. However, because of the unique technical character of COMINT and ELINT operations, the Director is authorized to issue direct to any operating elements under his operational control task assignments and pertinent instructions which are within the capacity of such elements to accomplish. He shall also have direct access to, and direct communications with, any elements of the Service or civilian COMINT or ELINT agencies on any other matters of operational and technical control as may be necessary, and he is authorized to obtain such information and intelligence...

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NATIONAL SECURITY COUNCIL
Washington, D.C. 20505

February 17, 1972

MEMORANDUM FOR

The Secretary of State
The Secretary of the Treasury
The Secretary of Defense
The Attorney General
The Director of Central Intelligence
The Director, Office of Science and Technology
The Chairman, President's Foreign Intelligence Advisory Board
The Chairman, U.S. Atomic Energy Commission

SUBJECT: Issuance of Revised NSCID's

In accordance with the President's memorandum of November 5, 1971, directing a reorganization of the intelligence community, the staffs of the NSC, DCI, and OMB, in consultation and coordination with the President's Foreign Intelligence Advisory Board, have prepared revisions of National Security Council Intelligence Directives 1-8. These revisions have been approved, and the revised NSCID-6 is attached. This supersedes all previous versions of this NSCID.

The revised NSCID's 1-5 and 7-8 have been distributed separately.

/S/

Henry A. Kissinger

Attachment

cc: The Director, Office of Management
and Budget

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NATIONAL SECURITY COUNCIL INTELLIGENCE
DIRECTIVE NO. 6¹

SIGNALS INTELLIGENCE
(Effective 17 February 1972)

Signals Intelligence (SIGINT), which comprises Communications Intelligence (COMINT) and Electronics Intelligence (ELINT) and the activities pertaining thereto are national responsibilities and must be so organized and managed as to exploit to the maximum the available resources of the Government, to satisfy the intelligence needs of the National Security Council and the departments and agencies of the Government, and to provide for efficiency and economy in the use of technical resources. Therefore, pursuant to the National Security Act of 1947, as amended, the National Security Council authorizes and directs that SIGINT activities shall be conducted as prescribed herein.

1. Definitions

For the purpose of this directive, the terms "Communications Intelligence" or "COMINT" shall be construed to mean technical and intelligence information derived from foreign communications by other than the intended recipients.

COMINT activities shall be construed to mean those activities that produce COMINT by the collection and processing of foreign communications passed by radio, wire or other electromagnetic means, with specific exceptions stated below, and by the processing of foreign encrypted communications, however transmitted. Collection comprises search, intercept and direction finding. Processing comprises range estimation, transmitter/operator identification, signal analysis, traffic analysis, cryptanalysis, decryption, study of plain text, the fusion of these processes, and the reporting of results.

COMINT and COMINT activities as defined herein shall not include (a) any intercept and processing of unencrypted written communications, press and propaganda broadcasts, or (b) censorship.

¹ This Directive supersedes NSCID No. 6 dated 15 September 1958, revised 18 January 1961.

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ELINT activities are defined as the collection (observation and recording), and the processing for subsequent intelligence purposes, of information derived from foreign, non-communications, electromagnetic radiations emanating from other than atomic detonation or radioactive sources. ELINT is the technical and intelligence information product of ELINT activities.

2. The Director of Central Intelligence

Consistent with his responsibilities as set forth in NSCID Nos. 1, 2 and 3, the Director of Central Intelligence shall:

a. Establish with the advice of the United States Intelligence Board and issue appropriate intelligence objectives, requirements and priorities to guide the conduct of all United States SIGINT activities.

b. Review the needs and performance of United States SIGINT activities as a basis for preparing a consolidated intelligence program budget.

c. Establish policies and procedures for the conduct of SIGINT arrangements with foreign governments with the advice of the United States Intelligence Board.

d. Develop and establish policies and procedures for the protection of SIGINT including the degree and type of security protection to be given SIGINT activities through the protection of information about them or derived from them.

3. The Secretary of Defense

a. The Secretary of Defense is designated as Executive Agent of the Government for the conduct of SIGINT activities in accordance with the provisions of this directive and for the direction, supervision, funding, maintenance and operation of the National Security Agency. The Director of the National Security Agency shall report to the Secretary of Defense and shall be the principal SIGINT advisor to the Secretary of Defense, the Director of Central Intelligence, and the Joint Chiefs of Staff. The Secretary of Defense may delegate in whole or part authority over the Director of the National Security Agency within the Office of the Secretary of Defense.

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b. The Secretary of Defense may determine, after consultation with the Secretary of State and the Director of Central Intelligence, that a SIGINT matter forwarded by the Director of Central Intelligence to the National Security Council for decision presents a problem of an emergency nature and requires immediate action. His action will be implemented and will govern, pending a decision by the National Security Council.

4. The National Security Agency

a. There is established under the Secretary of Defense and subject to his authority and control a National Security Agency with a Director who shall be head thereof and a Deputy Director who shall act for, and exercise the powers of, the Director during his absence or disability. The Director and Deputy Director shall be designated by the Secretary of Defense subject to the approval of the President. The duration of their appointments shall be at the pleasure of the President. The Director shall be a commissioned officer of the armed services, on active or reactivated status and shall enjoy not less than three star rank during the period of his incumbency. The Director shall have a Deputy who shall be a career civilian with SIGINT experience.

b. It shall be the duty of the Director of the National Security Agency to provide for the SIGINT mission of the United States, to establish an effective unified organization and control of all SIGINT collection and processing activities of the United States, and to produce SIGINT in accordance with objectives, requirements and priorities established by the Director of Central Intelligence with the advice of the United States Intelligence Board. No other organization shall engage in SIGINT activities except as provided for in this directive.

c. Except as provided in paragraphs 5 and 6 of this directive, the Director of the National Security Agency shall exercise full control over all SIGINT collection and processing activities, except the operation of mobile SIGINT platforms which will normally be exercised through appropriate elements of the military command structure. The Director of the National Security Agency is authorized to issue direct to any

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operating elements engaged in SIGINT operations such instructions issued by the Director under the authority provided in this paragraph shall be mandatory, subject only to appeal to the Secretary of Defense.

d. In consonance with the aims of maximum overall efficiency, economy and effectiveness, and to the extent he deems necessary and desirable, the Director shall centralize and consolidate the performance of SIGINT functions for which he is responsible. To this end, there is established a Central Security Service under the Director of the National Security Agency, which shall be organized in accordance with a plan approved by the Secretary of Defense. It shall be principally collection oriented and shall include SIGINT functions previously performed by various Military Department and other United States governmental elements engaged in SIGINT activities. The Director of the National Security Agency shall determine the appropriate division of responsibilities among the elements under his direction.

e. The Armed Forces and other departments and agencies often require timely and effective SIGINT. The Director of the National Security Agency shall provide information requested, taking all necessary measures to facilitate its maximum utility. As determined by the Director of the National Security Agency or as directed by the Secretary of Defense, the Director of the National Security Agency shall provide such SIGINT either through the direction of activities under his control or through the delegation to an appropriate agent of specified SIGINT facilities and resources from among the elements under his direction for such periods and for such tasks as appropriate.

f. Specific responsibilities of the Director of the National Security Agency include the following:

- (1) Formulating necessary operational plans, policies and procedures to provide for integrated operations.
- (2) Managing SIGINT resources, personnel and programs.
- (3) Conducting research and development to meet the needs of the United States for SIGINT.

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(4) Determining and submitting to the authorities responsible for logistic support for activities under his control requirements together with specific recommendations as to what each of the responsible departments and agencies of the Government should supply.

(5) Prescribing within his field of authorized operations requisite security regulations covering operating practices, including the transmission, handling and distribution of SIGINT material within and among the elements under his control; and exercising the necessary monitoring and supervisory control to ensure compliance with the regulations.

(6) Providing the Director of Central Intelligence with such information as he may require on the past, current and proposed plans, programs and costs of the SIGINT activities under the control of the Director of the National Security Agency.

g. The intelligence components of individual departments and agencies may continue to conduct direct liaison with the National Security Agency in the interpretation and amplification of requirements and priorities within the framework of objectives, requirements and priorities established by the Director of Central Intelligence.

h. It is the intent of this directive that the National Security Agency not engage in the production and dissemination of finished intelligence, but be limited to the production and dissemination of COMINT and ELINT.

5. Relationship to other SIGINT Activities

a. The Director of Central Intelligence with the advice of the United States Intelligence Board shall determine the requirements and priorities for collection by SIGINT satellites that shall be developed, launched and maintained in operation by the National Reconnaissance Office. The Director of the National Security Agency, with respect to his technical and operational control of the intercept payload, and the Director of the National Reconnaissance Office, with respect to his control of spacecraft operations, shall provide for the tasking of these satellites based on guidance provided

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by the Director of Central Intelligence. The National Security Agency shall process the collected data.

b. Nothing in this directive shall be construed to encroach upon or interfere with the unique requirements for clandestine operations covered under NSCID No. 5. Those SIGINT collection and processing activities (other than cryptanalysis) that are specifically designated by the Director of Central Intelligence to be essential and integral to the operation of clandestine espionage and counterintelligence activities abroad, including arrangements with foreign clandestine services, shall be conducted under the provisions of that directive. To the extent practicable, however, information pertaining to the activities and derived therefrom shall be handled so as to give suitable protection to related SIGINT activities. Material collected under these circumstances that would have been considered COMINT or ELINT will be passed to the National Security Agency to the extent desired by the Director of the National Security Agency as soon as special requirements of the collector have been satisfied.

c. The Director of the National Security Agency shall conduct such COMINT and ELINT activities as are required to support electronic warfare activities. The conduct of such search, intercept, direction-finding, range-estimation, and signal analysis of non-communications electromagnetics radiation as must be undertaken to permit immediate operational use of the information in support of electronic measures and countermeasures and rescue operations, if delegated by the Director of the National Security Agency, shall be the responsibility of the Military Departments or Commands, as appropriate. The responsibility for such activities with respect to electromagnetic radiations of COMINT interest shall normally not be delegated and shall remain the responsibility of the Director of the National Security Agency.

6. The Federal Bureau of Investigation

Nothing in this directive shall be construed to encroach upon or interfere with the unique responsibilities of the Federal Bureau of Investigation in the field of internal security, including such intercept and processing activities as may be undertaken by the Federal Bureau of Investigation in connection with its functions.

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THE SECRETARY OF DEFENSE

Washington

6 September 1961

MEMORANDUM FOR THE SECRETARY OF THE ARMY
THE SECRETARY OF THE NAVY
THE SECRETARY OF THE AIR FORCE
THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
THE CHAIRMAN OF THE JOINT CHIEFS OF STAFF
THE GENERAL COUNSEL

SUBJECT: (TS) Assistant for Reconnaissance

Reference the attached Agreement between the Secretary of Defense and the Director of the Central Intelligence Agency entitled Management of the National Reconnaissance Program.

The Under Secretary of the Air Force is hereby designated my Assistant for Reconnaissance, and is delegated full authority for management of this program. In this regard, he will act as my direct representative both within and outside the Department of Defense. He will be given any support that he requires from normal staff elements, although these staff elements will not participate in program matters except as he specifically requests. He will, however, keep pertinent key officials informed on a regular basis on the status of these programs.

Because of the extreme sensitivity of the projects involved in the National Reconnaissance Program, particular care must be taken to protect the Security of the arrangements described herein. The existence of the referenced Agreement, its contents and the organizational implementation employed for its execution are all classified TOP SECRET. This information will not be disclosed to anyone to whom such disclosure is not mandatory in order to carry out actions required by the terms of the referenced Agreement or by my Assistant for Reconnaissance in carrying out his responsibilities in the National Reconnaissance Program.

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All Department of Defense satellite or overflight photographic reconnaissance, mapping, geodesy, and electronic signal collection programs will be handled in accordance with the referenced Agreement, and existing project assignments will be brought into conformity and present directives will be revised at the earliest date that such action can be taken with plausible overt appearance.

A new public relations policy for satellite launches will be announced as a separate action to minimize political vulnerability of these programs.

Robert S. McNamara

1 Att.
Agreement

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THE SECRETARY OF DEFENSE
Washington

6 September 61

The Honorable Allen W. Dulles
Director of Central Intelligence
Washington, D.C.

Re: Management of the National Reconnaissance Program

Dear Mr. Dulles:

This letter confirms our agreement with respect to the setting up of a National Reconnaissance Program (NRP), and the arrangements for dealing both with the management and operation of this program and the handling of the intelligence product of the program on a covert basis.

1. The NRP will consist of all satellite and overflight reconnaissance projects whether overt or covert. It will include all photographic projects for intelligence, geodesy and mapping purposes, and electronic signal collection projects for electronic signal intelligence and communications intelligence resulting therefrom.

2. There will be established on a covert basis a National Reconnaissance Office to manage this program. This office will be under the direction of the Under Secretary of the Air Force and the Deputy Director (Plans) of the Central Intelligence Agency acting jointly. It will include a small special staff whose personnel will be drawn from the Department of Defense and the Central Intelligence Agency. This office will have direct control over all elements of the total program.

3. Decisions of the National Reconnaissance Office will be implemented and its management of the National Reconnaissance Program made effective: within the Department of Defense, by the exercise of the authority delegated to the Under Secretary of the Air Force; within the Central Intelligence Agency, by the Deputy Director (Plans) in the performance of his presently assigned duties. The Under Secretary of the Air Force will be designated Special Assistant For Reconnaissance to the Secretary of Defense and delegated full authority by me in this area.

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4. Within the Department of Defense, the Department of the Air Force will be the operational agency for management and conduct of the NRP, and will conduct this program through use of streamlined special management procedures involving direct control from the office of the Secretary of the Air Force to Reconnaissance System Project Directors in the field, without intervening reviews or approvals. The management and conduct of individual projects or elements thereof requiring special covert arrangements may be assigned to the Central Intelligence Agency as the operational agency.

5. A Technical Advisory Group for the National Reconnaissance Office will be established.

6. A uniform security control system will be established for the total program by the National Reconnaissance Office. Products from the various programs will be available to all users as designated by the United States Intelligence Board.

7. The National Reconnaissance Office will be directly responsive to, and only to, the photographic and electronic signal collection requirements and priorities as established by the United States Intelligence Board.

8. The National Reconnaissance Office will develop suitable cover plans and public information plans, in conjunction with the Assistant Secretary of Defense, Public Affairs, to reduce potential political vulnerability of these programs. In regard to satellite systems, it will be necessary to apply the revised public information policy to other non-sensitive satellite projects in order to insure maximum protection.

9. The Directors of the National Reconnaissance Office will establish detailed working procedures to insure that the particular talents, experience and capabilities within the Department of Defense and the Central Intelligence Agency are fully and most effectively utilized in this program.

10. Management control of the field operations of various elements of the program will be exercised directly, in the case of the Department of Defense, from the Under Secretary of the Air Force to the designated project officers for each program and, in the case of the Central Intelligence Agency, from the Deputy Director (Plans) to appropriate elements of the Central Intelligence Agency. Major program elements and operations of the National Reconnaissance Office will be

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reviewed on a regular basis and as special circumstances require by the Special Group under NSC 5412.

If the foregoing is in accord with your understanding of our agreement, I would appreciate it if you would kindly sign and return the enclosed copy of this letter.

/s/

Roswell L. Gilpatric
Deputy Secretary of Defense

1 Atch:
Chart "Single Mgmt for
National Reconnaissance
Programs (TS)

CONCUR:

C. P. Cabell, General, USAF
Acting Director
Central Intelligence Agency

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THE SECRETARY OF DEFENSE
WASHINGTON

October 20, 1961

MEMORANDUM FOR SECRETARY OF THE ARMY
SECRETARY OF THE NAVY
SECRETARY OF THE AIR FORCE
DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
CHAIRMAN, JOINT CHIEFS OF STAFF
GENERAL COUNSEL
DIRECTOR, NATIONAL SECURITY AGENCY
SPECIAL ASSISTANT FOR RECONNAISSANCE TO THE SECRETARY
OF DEFENSE

SUBJECT: Space Vehicle Electronics Intelligence Program

The attached document entitled "Space Vehicle Electronic Signal Collection Responsibilities and Resources" is approved and will be implemented within the Department of Defense by all departments, agencies, and special activities.

This documentation is provided as an additional basis for understanding the relationships, responsibilities and working arrangements applicable to space vehicle electronic signal collection and data processing that is in consonance with the responsibilities set forth in my memorandum of 6 September 1961, subject: "Assistant for Reconnaissance". As used within this document, the term "Department of the Air Force (SAFMS)" specifically refers to that activity for which the Under Secretary of the Air Force has been designated as my Assistant for Reconnaissance.

1 Attachment

As stated, w/tabs A and B

cc: OSD/DDR&E, Dr. Eugene G. Fubini
OSD/OSO, Mr. Clyde W. Elliott
ACSI, D/A, Maj Abram V. Rinearson, III, USA
ONI, D/N, Capt D. M. Showers, USN
SAFMS, D/AF, Lt Col Edwin J. Istvan, USAF
USA, Mr. Herbert L. Conley
CIA, Mr. Harold Willis

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SPACE VEHICLE ELECTRONIC SIGNAL COLLECTION
RESPONSIBILITIES AND RESOURCES

- References:
- (a) National Security Council Intelligence Directive No. 6
 - (b) National Security Council Memo, dated 1 Sep 60, Subject: Reconnaissance Satellite Program
 - (c) DOD Directive 5160.32, Development of Space Systems
 - (d) DOD Directive 5160.34, Reconnaissance and Geodetic Programs
 - (e) Secretary of Defense Memo, dated 6 Sep 61, with Inclosures

1. The utilization of space vehicles as a means for collection of electronic signal information is a special augmentation to other signal intelligence resources of the U.S. Government. In order that the present and future intelligence collection capabilities of earth satellites and other space vehicles can be vigorously explored and developed to add to the total U.S. intelligence posture, the procedures used for management, direction, and technical supervision of this intelligence collection medium will:

a. Assure that appropriate planning takes place for both collection and processing systems in a well-coordinated fashion.

b. Provide a means whereby immediate advantage is taken of breakthroughs in either the collection or processing state-of-the-art.

2. Present approved collection and processing programs, through CY 1962 are essentially complementary and will not be modified, except as supplementary programs are developed in accordance with the responsibilities and procedures contained herein.

3. Security considerations affecting this medium will provide that the sensitivity of the projects can be protected, and that full dissemination is made of extracted intelligence information to elements having a genuine need.

4. To provide for accomplishment of management, direction, and technical supervision in accordance with the above, the following responsibilities and arrangements are defined.

a. The Department of the Air Force (SAFMS) will be solely responsible for the research, development, planning, and operations for electronic signal collection by space vehicles, taking into consideration

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the effective utilization of all resources available to the U.S. Government. This responsibility will be implemented in accordance with Tab A hereto.

b. The Department of the Air Force (SAFMS) will develop the over-all collection effort to satisfy electronic signal collection requirements established by the U.S. Intelligence Board. The National Security Agency will review USIB electronic signal (COMINT and ELINT) requirements and will recommend to the Department of the Air Force (SAFMS) those which, in NSA's opinion, can best be fulfilled by means of overhead reconnaissance. The over-all collection program prepared by the Department of the Air Force (SAFMS) will be subject to approval by the USIB.

c. The National Security Agency will be solely responsible for the research, development, planning, and operations for processing of electronic signal data (COMINT and ELINT) collected from space vehicle sources, taking into consideration the effective utilization of all processing resources available to the U.S. Government. The processing will include technical feedback to the Department of the Air Force (SAFMS) as well as extraction of intelligence data, but technical feedback from other sources may be provided. This responsibility will be implemented in accordance with Tab B hereto.

d. The Department of the Air Force (SAFMS) will determine the data format for the electronic signal collection products in close consultation with the National Security Agency so as to optimize the match between collection and processing.

5. All applicable resources of the Department of Defense will be used in fulfillment of the above responsibilities. The resources of all other components of the U.S. Government engaged in electronic signal intelligence activity will be utilized as feasible.

2 Incls:

1. Tab A - Implementation of Collection Responsibilities
2. Tab B - Implementation of Processing Responsibilities

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TAB A

IMPLEMENTATION OF COLLECTION RESPONSIBILITIES

1. The Department of the Air Force (SAFMS) collection responsibilities include all aspects of the research, development, planning and operation of electronic signal collection by earth satellites or other space craft. These responsibilities encompass all aspects of the collection systems and include necessary ground support functions and equipment incident to the proper operation of the space craft and/or payload and as may be required to recover, transmit, convert, reformat and technically correct or reconstruct the collected data in order to yield a usable collection product for exploitation by the processor.
2. The Department of the Air Force (SAFMS) will utilize all resources within the U.S. Government in the accomplishment of its collection responsibilities.
3. The Department of the Air Force (SAFMS) will establish, organize and manage the electronic signal collection effort in accordance with USIB approved requirements and priorities, and will exercise technical direction, program planning, funding, security, and operational control of the collection programs.
4. The Department of the Air Force (SAFMS) will accomplish payload configuration control and mission planning. In accomplishing these functions, the Department of the Air Force (SAFMS) may utilize the services of a technical advisory group.
5. The collection products of this effort will be placed under a single unified security control system.
6. All original (record) copies of the collection product will be maintained in a repository designated by the Department of the Air Force (SAFMS).
7. The collection product of this effort will be made available by the Department of the Air Force (SAFMS) to the NSA for fulfillment of processing responsibilities, and to such other activities designated by NSA or specifically authorized by USIB.
8. No basic changes to existing collection programs scheduled through calendar year 1962 will be made. Augmentations to the collection effort will be in accordance with the procedures and responsibilities outlined herein.

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9. The Department of the Air Force (SAFMS) will consult with the National Security Agency, in a timely manner, concerning the anticipated product and format from each electronic collection effort to facilitate planning for the exploitation processing in accordance with the responsibilities assigned to the National Security Agency, and will provide technical assistance to facilitate accomplishment of the exploitation processing.

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TAB B

IMPLEMENTATION OF PROCESSING RESPONSIBILITIES

1. The National Security Agency processing responsibilities include all aspects of the research, development, planning, and operation of the processing effort for electronic signal collection products provided by the Department of the Air Force (SAFMS). These responsibilities encompass all aspects of the processing of collection product, including the distribution of end product information reports as authorized by USIB.

2. The National Security Agency will establish, organize, and supervise the electronic signal processing effort in accordance with the requirements and priorities established by the USIB and will exercise technical direction, program planning, security control, and supervision of the processing program.

3. The National Security Agency will take cognizance of all resources within the U.S. Government in accomplishment of its processing responsibilities. To achieve maximum effectiveness, the National Security Agency will be responsible for specifying those U.S. resources to be applied to the processing of space vehicle collection products. In accomplishing its responsibility, the Director, National Security Agency may utilize the services of a technical advisory group.

4. No basic changes to presently existing approved processing programs scheduled through calendar year 1962 will be made. Additions or augmentations to the processing effort will be in accordance with the procedures and responsibilities outlined herein.

5. The National Security Agency will place the end product information reports of the processing effort under a security control system to safeguard the source of the material. Such a system will be subject to USIB approval.

6. The National Security Agency will provide specified technical or other feedback as required by the Department of the Air Force (SAFMS).

7. In the exercise of the responsibility for processing the collection product, the National Security Agency shall assign tasks to appropriate organizations of the United States Government. An organization within the Department of Defense may not refuse to apply available resources for the accomplishment of a particular task on the basis that it will require the diversion of such resources from the accomplishment of other missions, unless such refusal is approved by the Secretary of the Military Department or the Commander of the Unified or Specified Command concerned. Assignment of tasks to organizations outside the Department of Defense will be subject to the approval of the head of the particular organization concerned.

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8. In those cases where NSA delegates processing responsibility, the NSA will:

a. Provide appropriate planning support, and will furnish required operational and technical instructions.

b. Assure that specified feedback as required by the Department of the Air Force (SAFMS) is provided.

c. Arrange for each processing element to provide results to NSA, in one of two forms, either (1) as data to be integrated with other information into NSA distributed reports, or (2) as a finished report to be provided to all authorized customers. In either case, distribution will be made as authorized by USIB. The reports of type (2) above will be distributed in an NSA reporting series but will contain a designator showing the organization of origin.

d. As authorized by USIB, provide appropriate processing units with instructions for "sanitization" in order that information produced can be provided under appropriate classification to all intelligence users, including the unified and specified commands and their operating elements.

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MEMORANDUM OF AGREEMENT CONCERNING
NSA PARTICIPATION IN THE
~~(S)~~ NATIONAL RECONNAISSANCE OFFICE

1. In the course of discussions between Dr. Charyk, Dr. Scoville, Admiral Frost and Dr. Tordella on 25 May 1962, it was made known that the ~~(S)~~ National Reconnaissance Office in its SIGINT program will respond only to requirements levied by the United States Intelligence Board. Further, that the NRO will request the USIB to determine which subordinate committee on the Board (COMOR or SIGINT Committee) will be responsible for applicable SIGINT requirements.

2. During these discussions, it was agreed that:

a. NSA will provide advice and consultation to the NRO on how best to meet requirements which are levied by the Board.

b. NSA will nominate one of its personnel to become a full-time member of the NRO.

c. After discussion with the NSA the NRO may assign primary responsibility for development of certain aspects of the SIGINT collection program to NSA.

d. NSA will be responsible for advising the NRO on desired format of the SIGINT material to be collected. NSA will also be responsible for accomplishing or supervising analysis and reporting of collected SIGINT materials.

e. Security safeguards required for the handling of NRO collected SIGINT materials can be provided as described in memorandum from Director, NRO, to Chairman USIB; dated 31 May 1962; Subject: Security Handling of SIGINT Collected by Reconnaissance Satellites.

/S/

LOUIS W. TORDELLA
Acting Director

Concur. /s/ Herbert Scoville, Jr.

Concur. /s/ Joseph V. Charyk

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AGREEMENT FOR REORGANIZATION OF THE
NATIONAL RECONNAISSANCE PROGRAM

A. The National Reconnaissance Program

1. The NRP is a single program, national in character, to meet the intelligence needs of the Government under a strong national leadership, for the development, management, control and operation of all projects, both current and long range for the collection of intelligence and of mapping and geodetic information obtained through overflights (excluding peripheral reconnaissance operations). The potentialities of U.S. technology and all operational resources and facilities must be aggressively and imaginatively exploited to develop and operate systems for the collection of intelligence which are fully responsive to the Government's intelligence needs and objectives.

2. The National Reconnaissance Program shall be responsive directly and solely to the intelligence collection requirements and priorities established by the United States Intelligence Board. Targeting requirements and priorities and desired frequency of coverage of both satellite and manned aircraft missions over denied areas shall continue to be the responsibility of USIB, subject to the operational approval of the 303 Committee.

B. The Secretary of Defense will:

1. Establish the NRO as a separate agency of the DoD and will have the ultimate responsibility for the management and operation of the NRO and the NRP;

2. Choose a Director of the NRO who will report to him and be responsive to his instructions;

3. Concur in the choice of the Deputy Director of the NRO who will report to the DNRO and be responsive to his instructions;

4. Review and have the final power to approve the NRP budget;

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5. Sit with members of the Executive Committee, when necessary, to reach decisions on issues on which committee agreement could not be reached.

C. The Director of Central Intelligence will:

1. Establish the collection priorities and requirements for the targeting of NRP operations and the establishment of their frequency of coverage;

2. Review the results obtained by the NRP and recommend, if appropriate, steps for improving such results;

3. Sit as a member of the Executive Committee;

4. Review and approve the NRP budget each year;

5. Provide security policy guidance to maintain a uniform system in the whole NRP area.

D. National Reconnaissance Program Executive Committee

1. An NRP Executive Committee, consisting of the Deputy Secretary of Defense, the Director of Central Intelligence, and the Special Assistant to the President for Science and Technology, is hereby established to guide and participate in the formulation of the NRP through the DNRO. (The DNRO will sit with the Executive Committee but will not be a voting member.) If the Executive Committee can not agree on an issue the Secretary of Defense will be requested to sit with the Committee in discussing this issue and will arrive at a decision. The NRP Executive Committee will:

a. Recommend to the Secretary of Defense an appropriate level of effort for the NRP in response to reconnaissance requirements provided by USIB and in the light of technical capabilities and fiscal limitations.

b. Approve or modify the consolidated National Reconnaissance Program and its budget.

c. Approve the allocation of responsibility and the corresponding funds for research and exploratory development for new systems. Funds shall be adequate to ensure that a vigorous research and exploratory development effort is achieved and maintained by the Department of Defense and CIA to design and construct new sensors to meet intelligence requirements aimed at the acquisition of intelligence data. This effort shall be carried out by both CIA and DoD.

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d. Approve the allocation of development responsibilities and the corresponding funds for specific reconnaissance programs with a view to ensuring that the development, testing and production of new system is accomplished with maximum efficiency by the component of the Government best equipped with facilities, experience and technical competence to undertake the assignment. It will also establish guidelines for collaboration between departments and for mutual support where appropriate. Assignment of responsibility for engineering development of sensor subsystems will be made to either the CIA or DoD components in accordance with the above criteria. The engineering development of all other subsystems, including spacecraft, reentry vehicles, boosters and booster interface subsystems shall in general be assigned to an Air Force component, recognizing, however, that sensors, spacecraft and reentry vehicles are integral components of a system, the development of which must proceed on a fully coordinated basis, with a view to ensuring optimum system development in support of intelligence requirements for overhead reconnaissance. To optimize the primary objective of systems development, design requirement of the sensors will be given priority in their integration within the spacecraft and reentry vehicles.

e. Assign operational responsibility for various types of manned overflight missions to CIA or DoD subject to the concurrence of the 303 Committee.

f. Periodically review the essential features of the major program elements of the NRP.

2. The Executive Committee shall meet on the call of either the Deputy Secretary of Defense or the Director of Central Intelligence. All meetings will be attended by the DNRO and such staff advisors as the Deputy Secretary of Defense or the Director of Central Intelligence consider desirable.

E. National Reconnaissance Office

1. To implement the NRP, the Secretary of Defense will establish the NRO as a separate operating agency of the DoD. It shall include the SOC which shall be jointly manned.

2. The Director of the NRO shall be appointed by the Secretary of Defense. The Director NRO will:

a. Subject to direction and control of the Secretary of Defense and the guidance of the Executive Committee as set forth in Section D above, have the responsibility for managing the NRO and executing the NRP.

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b. Subject to review by the Executive Committee, and the provisions of Section D above, have authority to initiate, approve, modify, redirect or terminate all research and development programs in the NRP. Ensure, through appropriate recommendations to the Executive Committee for the assignment of research and development responsibilities and the allocation of funds, that the full potentialities of agencies of the Government concerned with reconnaissance are realized for the invention, improvement and development of reconnaissance systems to meet USIB requirements.

c. Have authority to require that he be kept fully and completely informed by all Agencies and Departments of the Government of all programs and activities undertaken as part of the NRP.

d. Maintain and provide to the members of the Executive Committee records of the status of all projects, programs and activities of the NRP in the research, development, production and/or operational phases.

e. Prepare a comprehensive budget for all aspects of the National Reconnaissance Program.

f. Establish a fiscal control and accounting procedure to ensure that all funds expended in support of the National Reconnaissance Program are fully accounted for and appropriately utilized by the agencies concerned. In particular, the budget shall show separately those funds to be applied to research and exploratory design development, systems development, procurement, and operational activities. Funds expended or obligated under the authority of the Director of Central Intelligence under Public Law 110 shall be administered and accounted for by CIA and will be reported to DNRO in accordance with agreed upon procedures.

g. Sit with the USIB for the matters affecting the NRP.

3. The Deputy Director NRO shall be appointed by the DCI with the concurrence of the Deputy Secretary of Defense and shall serve full time in a line position directly under the Director NRO. The Deputy Director shall act for and exercise the powers of the Director, NRO during his absence or disability.

4. The NRO shall be jointly staffed in such a fashion as to reflect the best talent appropriately available from the CIA, the three military departments and other Government agencies. The NRO staff will report to the DNRO and DDNRO and will maintain no allegiance to the originating agency or Department.

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F. Initial Allocation of Program Responsibilities

1. Responsibility for existing programs of the NRP shall be allocated as indicated in Annex A attached hereto.

(signed) Cyrus Vance
Deputy Secretary of Defense

(signed) W. F. Raborn
Director of Central Intelligence

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ANNEX A

The following assignments for the development of new optical sensor subsystems are made to take full advantage of technical capability and experience of the agencies involved.

1. The CIA will develop the improvements in the CORONA general search optical sensor subsystems.
2. Following the selection of a concept, and a contractor, for full-scale development, in the area of advanced general search, the CIA will develop the optical sensor subsystem for that system.
3. The Air Force (SAFSP) will develop the G-3 optical sensor subsystem for the advanced high-resolution pointing system.
4. SAFSP will develop the optical sensor subsystems (manned and unmanned) for the MOL program.

The Director, NRO will, in managing the corresponding overall systems developments, ensure that:

1. The management of an contracting for the sensors is arranged so that the design and engineering capabilities in the various contractors are most efficiently utilized.
2. The sensor packages and other subsystems are integrated in an overall system engineering design for each system, with DNRO having responsibility for systems integration of each overall system.

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DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON 25, D.C.

From: Director of Naval Intelligence
To : Director, National Reconnaissance Office(s)

Subj: System POPPY, reassignment of responsibilities for (TS)

Ref: (a) Missions operations Directive EO 135 (BYE-4337-62) of 6 Nov 62
(b) Your memo subj: "Organization and Functions of NRO (S)" of 23 July 62
(c) DNI ltr subj: "Project POPPY; assignment of responsibilities for (TS)" of 10 September 62

1. The responsibilities delineated by reference (a) necessitate a realignment of the organizational information requested by reference (b) and supplied by reference (c). Accordingly, reference (c) is hereby cancelled and superseded.

2. System POPPY of Project EO 13526 is currently the only NRP assignment within Program C.

3. One formal agreement has been made between the Director of Naval Intelligence and the Director, National Security Agency regarding interrogation of POPPY satellites. This agreement authorizes the NSA to direct POPPY satellite interrogation and collection when "quick-reaction", resulting from short tip-off of Soviet space or missile activity, is required. Although this is the only formal agreement entered into an additional informal understanding has been made with the National Security Agency. This understanding permits the allocation of U.S. Army, U.S. Air Force and U.S. Navy cryptologic personnel to man and operate Navy furnished electronic equipment at regularly established collection stations along the periphery of the EO 135 Soviet Bloc. EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs

in accordance with these understandings the respective services/agency man the equipment with their regularly assigned personnel when the POPPY satellites are transmitting and when the stations are tape recorded and couriered to the NSA for analysis. Operations resulting from these informal understandings have proven entirely satisfactory.

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4. The specific responsibilities of the organization/individuals associated with the project are as follows:

a. The Program Director's Staff (Technical Operations Group):

(1) This group of specialists provides the Program Director, through the Project Director, the necessary technical information and guidance. This includes advising the Director of Intelligence requirements, satellite instrumentation, missile rocketry, orbital requirements, field station operations, aid signal processing. In addition, this group insures that overt research and development programs, approved by the Director, Program C, are conducted in a proper manner to support System POPPY.

(2) Designated members of the Program Director's Staff (TOG) shall meet with the Deputy Director for Operations, NRO, as required, to prepare routine tasking schedules for the operational control of the POPPY satellite after it has achieved orbit. Activation of the satellite and appropriate collection facilities will be accomplished by this staff as directed by the Satellite Operations Center (SOC), NRO. The non-routine interrogation required in the event of indications requiring quick reaction will be accomplished as set forth in paragraph 3 above.

(3) The Staff will report, as occurring, any significant changes in the technical capability of the satellites to the Director, Program C.

b. The Director of Naval Intelligence is responsible for:

(1) Providing the Project Director

(a) The Project Director's responsibilities are to supervise and administer all aspects of the project subject to the approval of the Program Director.

(2) Providing the Product Control Representative

(a) The Product Control Representative is normally attached to the Scientific and Technical Intelligence Center of ONI and is responsible for informing the Project Director of intelligence requirements. Additionally, he is responsible for disseminating quality control technical data to the field stations, for monitoring the signal analysis program, and for supervision of in-house signal analysis support where required.

c. The Director, Naval Research Laboratory is responsible for:

(1) Providing the Project Technical Representative.

(a) The Project Technical Representative is responsible for establishing such liaison with the Naval Research Laboratory as will provide the following:

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1. Overall Instrumentation concepts, including the satellite.
2. Provision of all equipments required for collection and interrogation, including but not limited to, the shipment and supply of technical expendables and spare parts to the field stations.
3. Coordination of vehicle and mission payload integration, and the preparation including the monitoring of the launch thereof.
4. The training of all personnel involved in collection and interrogation.
5. Operational control of the satellite prior to its launch.

d. The Director, Naval Security Group is responsible for:

(1) Providing the Project Operational Representative whose responsibilities are:

(a) The direction and coordination of field station operations. These responsibilities include insuing project planning and operational-directives to the field stations and keeping each of these stations advised of the tasking requirements necessary to perform the project mission.

(2) Acting as the focal point for all electrical communications associated with the project. This includes all operational, technical and logistical traffic.

(3) Providing operating personnel at the Navy collection sites.

e. The Director, National Security Agency is responsible for:

(1) Providing a representative who shall act as an advisor to the Project Director's staff.

(2) Processing all collected data and developing an ELINT product therefrom.

(3) Disseminating, through specified security channels, any intelligence information derived from the data as initially agreed upon by the Project Director and Director, National Security Agency.

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(4) Interpreting National Intelligence Requirements into technical ELINT requirements and making recommendations to the staff for operational tasking of the satellite.

(5) Providing magnetic tapes to field collection sites on a continuing basis.

f. The Chief, Bureau of Naval Weapons is responsible for:

(1) Providing the Project Fiscal Representative whose responsibilities are:

(a) Budget preparation and submission. He is responsible for the disbursement of project funds to the U.S. Naval Research Laboratory and, further, for the submission of expenditure statements to the Program Director.

g. The Air Force Security Service is responsible for:

(1) Providing sites and the support facilities at these sites for a collection hut. This includes physical security and utilities.

(2) Providing operating personnel at the Air Force collection sites.

(3) Providing one qualified individual who may act with authority and may coordinate Air Force operations in coordination with the Project Director.

h. The Army Security Service is responsible for:

(1) Providing sites and the support facilities at these sites for a collection hut. This includes physical security and utilities.

(2) Providing operating personnel at the Army collection sites.

(3) Providing one qualified individual who may act with authority and may coordinate Army operations in coordination with the Project Director.

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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. EO 13526 3.3(b)(1)>25Yrs

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EO 13526 3.3(b)(1)>25Yrs

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

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POPPY system, executing the tasking directions of the NRO and processing priorities of NSA.

/S/
John L. McLucas
Director
National Reconnaissance Office

5 November 1971

/S/
Noel Gayler
Vice Admiral, USN
Director
National Security Agency
27 October 1971

/S/
Carl E. Duckett
Deputy Director for
Science and Technology
16 July 1971

/S/
Robert A. Frosch
Assistant Secretary of the Navy
(Research and Development)
25 June 1971

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SPECIFIC RESPONSIBILITIES IN SUPPORT OF THE POPPY SYSTEM

1. The Director, Program C, is responsible to the Director of the National Reconnaissance Office (DNRO) for overall management of the POPPY Project. Included in his responsibilities are the following:

- a. Establishes the policy for the management of the POPPY Project.
- b. Coordinates all aspects of the project to ensure optimum effective employment of the system.
- c. Develops requirements for POPPY mission concepts, personnel, ground support equipment, facilities, etc., and submits proposals to the DNRO for approval.
- d. Prepares a coordinated plan for the design, development, construction, and implementation of approved concepts.
- e. Coordinates, prepares, and submits the POPPY budget.
- f. Allocates NRO funds as required for the design, development, and support of the project in accordance with DNRO Program and fund approvals.
- g. Monitors the technical development, test, production, quality assurance, maintenance, training, and other logistic support matters to meet system objectives.
- h. Provides guidance to COMNAVSECGRU for his responsibilities in the execution of POPPY operations.
- i. Keeps the DNRO advised of the status, trends, accomplishments, problems, and any other important aspects of the project.
- j. Furnishes requirements information and basic planning data to elements of the POPPY Project.
- k. Performs continuous evaluation of progress against plans, cost against funds available, and capability against design objectives. Initiates corrective actions whenever necessary.
- l. Ensures efficient utilization of manpower, materials, and funds pertaining to the project.
- m. Provides guidance and review of security controls within the POPPY Project.

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2. 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 POPPY system. His responsibilities include the following:

- a. Prepares mission concepts for submission to the Director, Program C.
- b. Initiates system engineering design to support approved concepts in the space and ground systems.
- c. Designs, develops, and fabricates satellite vehicles and provides on-board equipment required to implement approved concepts.
- d. Provides ground support equipment and repair parts required in the collection and interrogation functions of POPPY ground sites, ensuring appropriate interface between collection and processing functions.
- e. Assures complete engineering coordination between spacecraft and launch vehicle.
- f. Provides pre-launch technical coordination and monitoring of the POPPY launch.
- g. Monitors satellite telemetry to assess on-orbit spacecraft systems and reports as required.
- h. Prepares funding data as required by the Director, Program C.

3. 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. His responsibilities include the following:

- a. Exercises management authority over POPPY field stations.
- b. Develops, plans, programs, and coordinates as required for current and future requirements for equipment, materials, supplies, facilities, maintenance, and administrative support services (other than that directly involved in collection and processing functions), housing, barracks, and messing needed for the POPPY operational mission.
- c. Plans and programs for manpower requirements at POPPY field stations.

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d. Develops procedures for executing the tasking directives of the NRO Satellite Operations Center and initiates guidance to field stations in response to NSA policy on processing priorities and other matters concerning field processing functions.

e. Monitors the operations of POPPY field activities to ensure the maintenance of high standards of performance.

f. Coordinates with NRL and NSA regarding all collection and processing equipment for POPPY field stations and monitors all installation plans and schedules for its impact on station facilities and service requirements.

g. Provides for routine repair and upkeep of POPPY operations equipment and interfaces with NRL regarding non-routine maintenance and repair.

h. Plans and programs for communications facilities to support POPPY operations.

i. Provides for the physical security facilities and services required to maintain authorized SI, TK, and BYEMAN control centers at the POPPY field stations.

j. Develops and administers, in coordination with Chief of Naval Personnel, the requisite training programs for officer and enlisted personnel assigned to POPPY field stations. Administers the personnel security program for these personnel.

4. The Director, National Security Agency, has overall responsibility for the processing, analysis, and reporting of POPPY collected data. Included in his responsibilities are the following:

a. Provides SIGINT technical guidance and feedback to the POPPY Processing System to ensure its effectiveness in conjunction with other satellite and non-satellite SIGINT operations.

b. Plans the technical and fiscal management of the processing and analysis functions of the POPPY system to include the manpower resources of the POPPY field sites. As such, he determines processing equipment requirements at the sites and coordinates with NRO, NRL, and NSG in the procurement, installation, and operational use of the equipment.

c. Budgets for the procurement and repair parts for POPPY processing and analysis equipment.

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d. Interfaces with the NRO; Director, Program C; NRL; and NSG in the development of future POPPY concepts as they relate to processing and analysis functions.

e. Processes, analyzes, and publishes data collected from the POPPY system.

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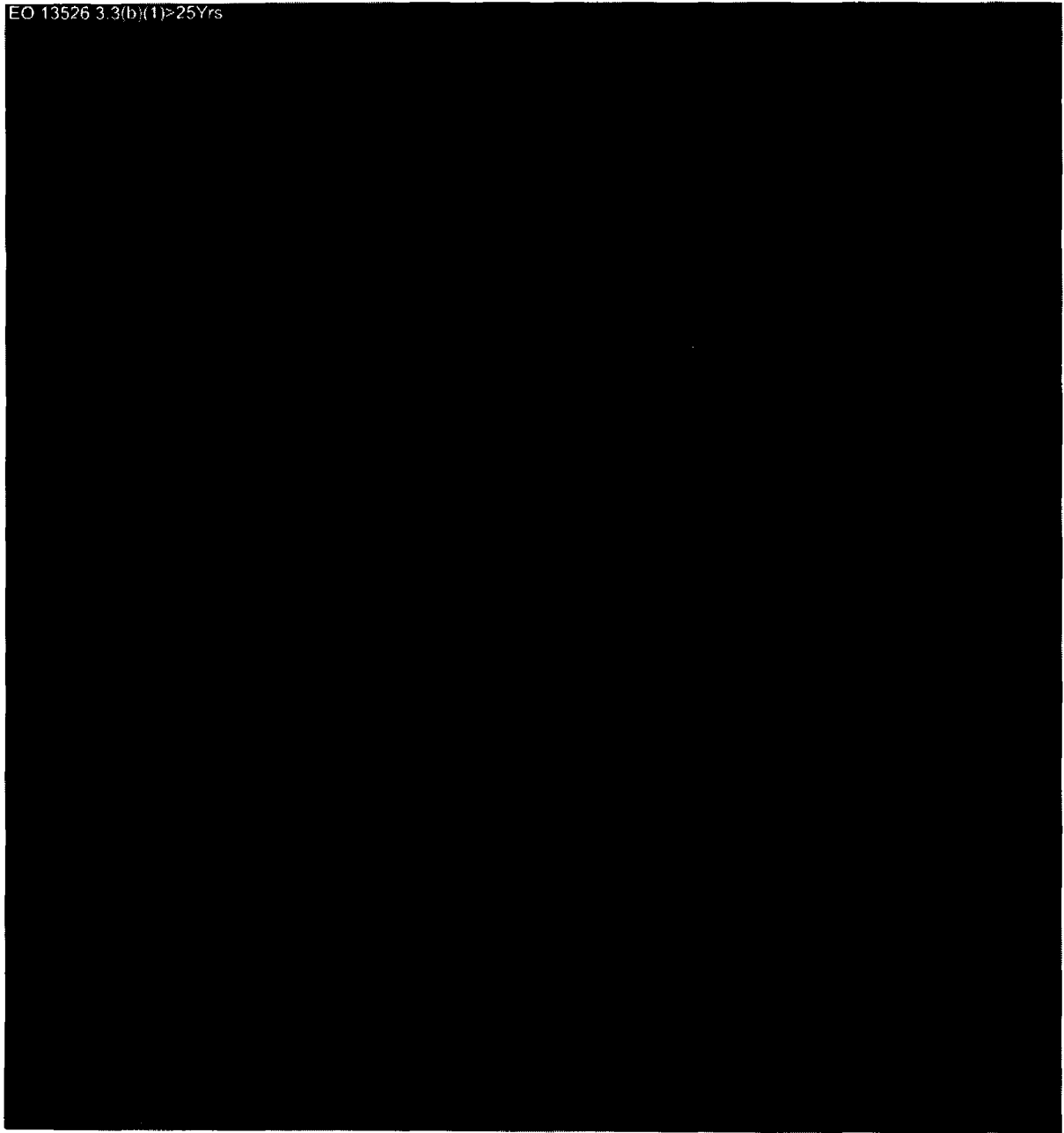
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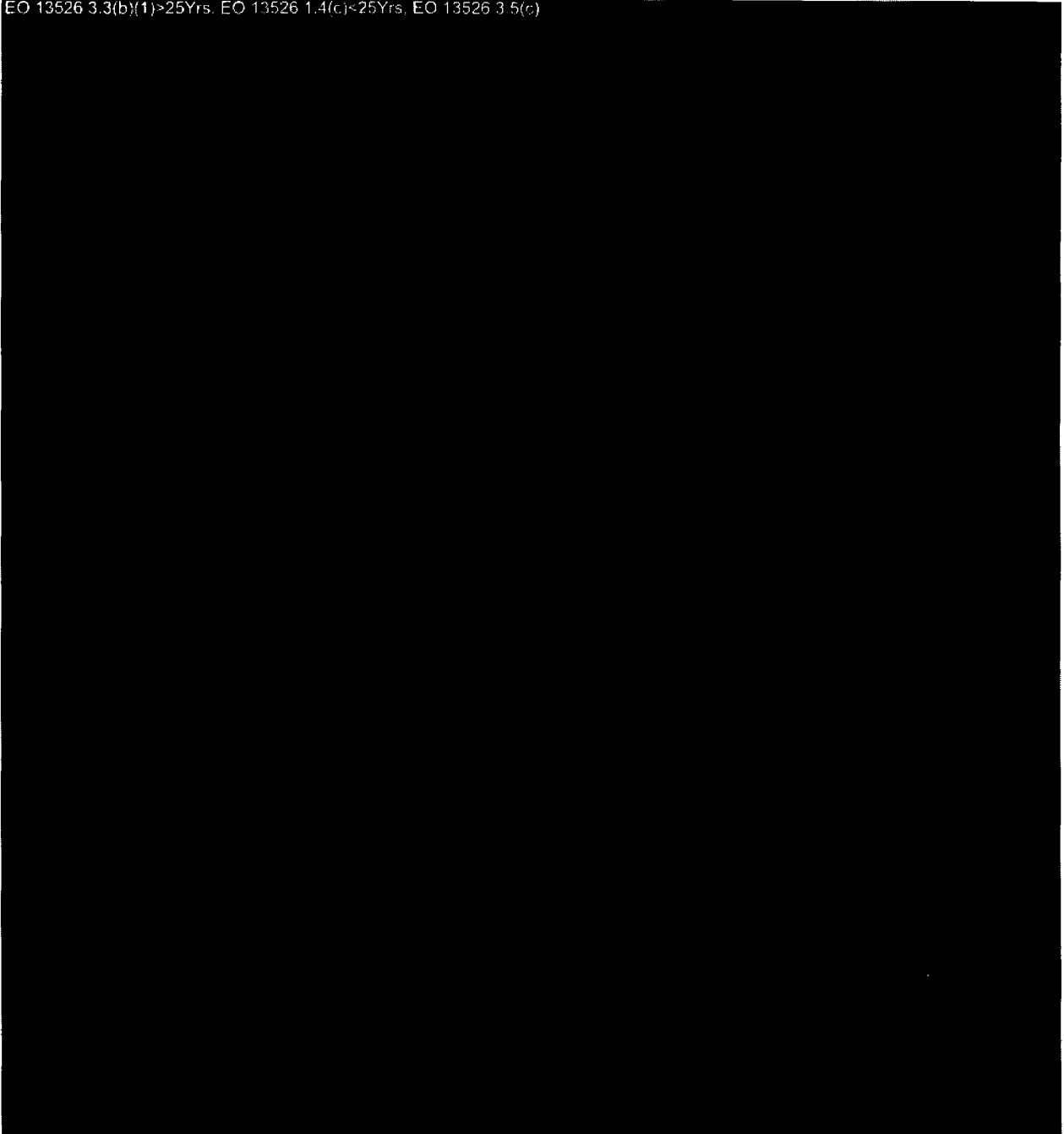
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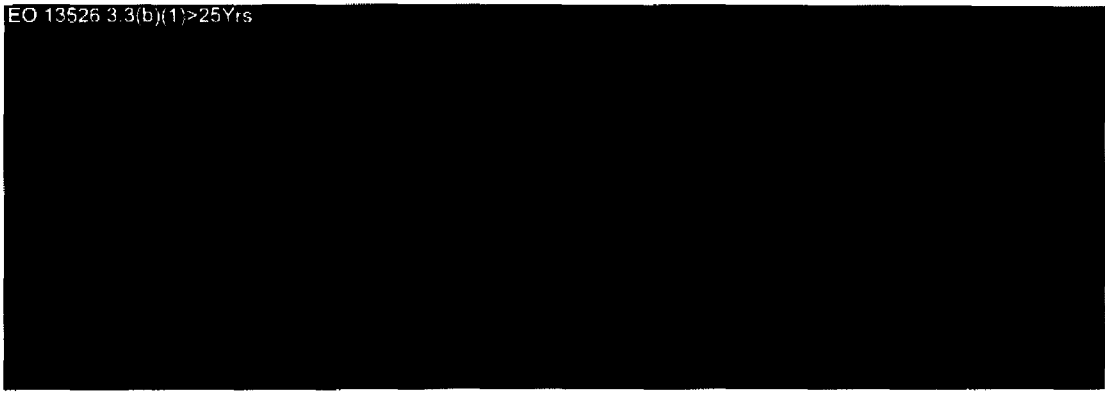
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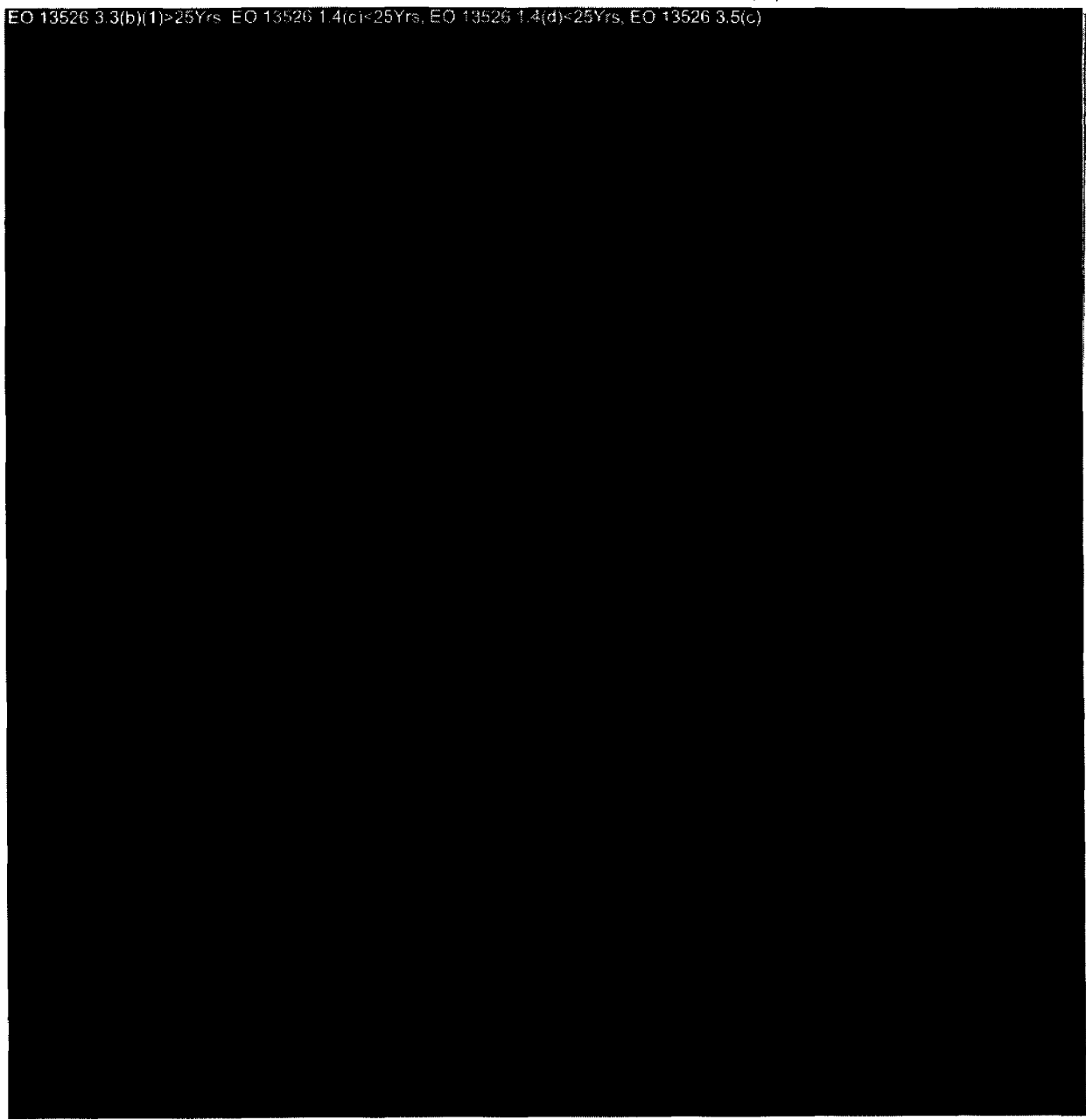
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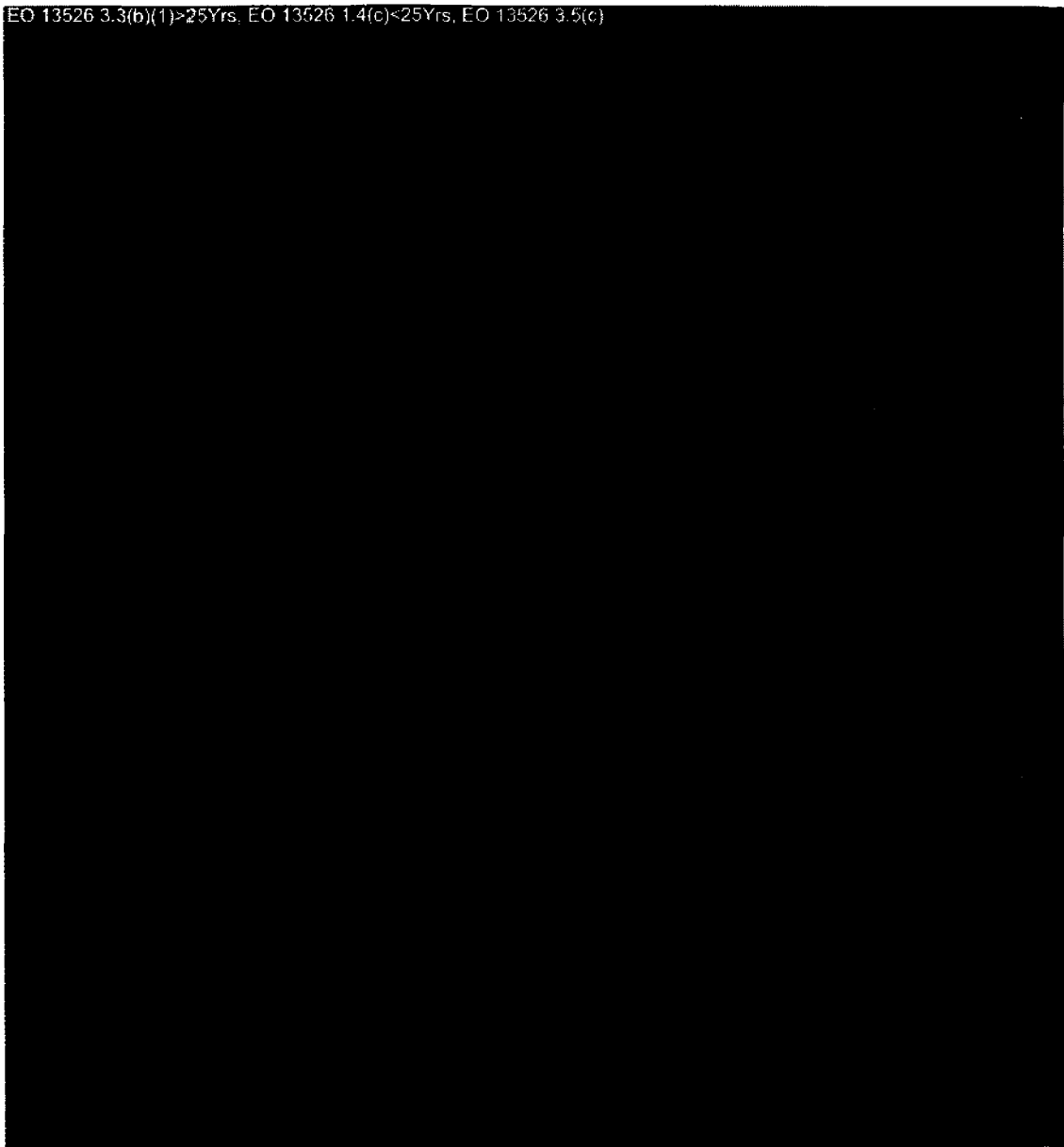
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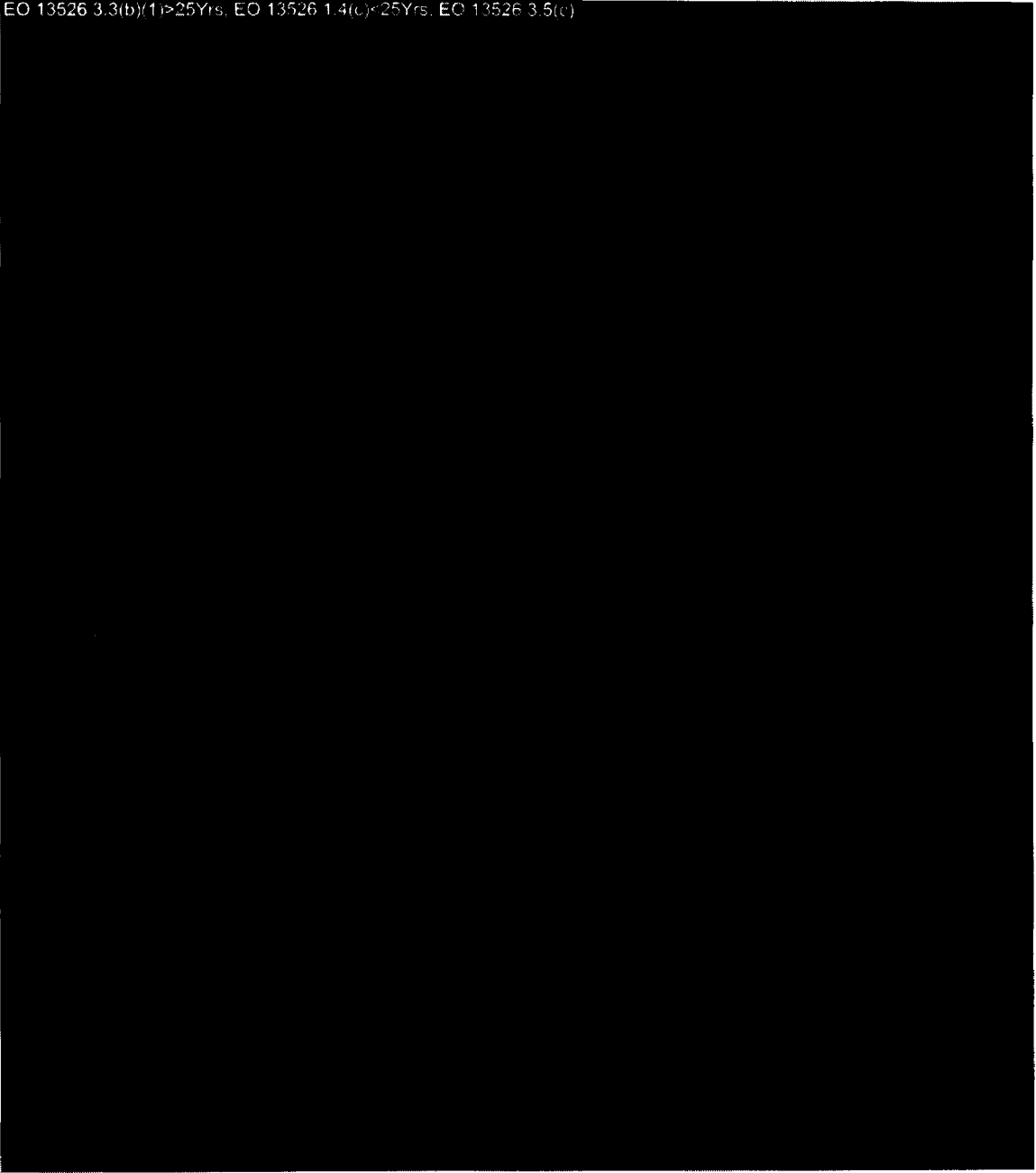
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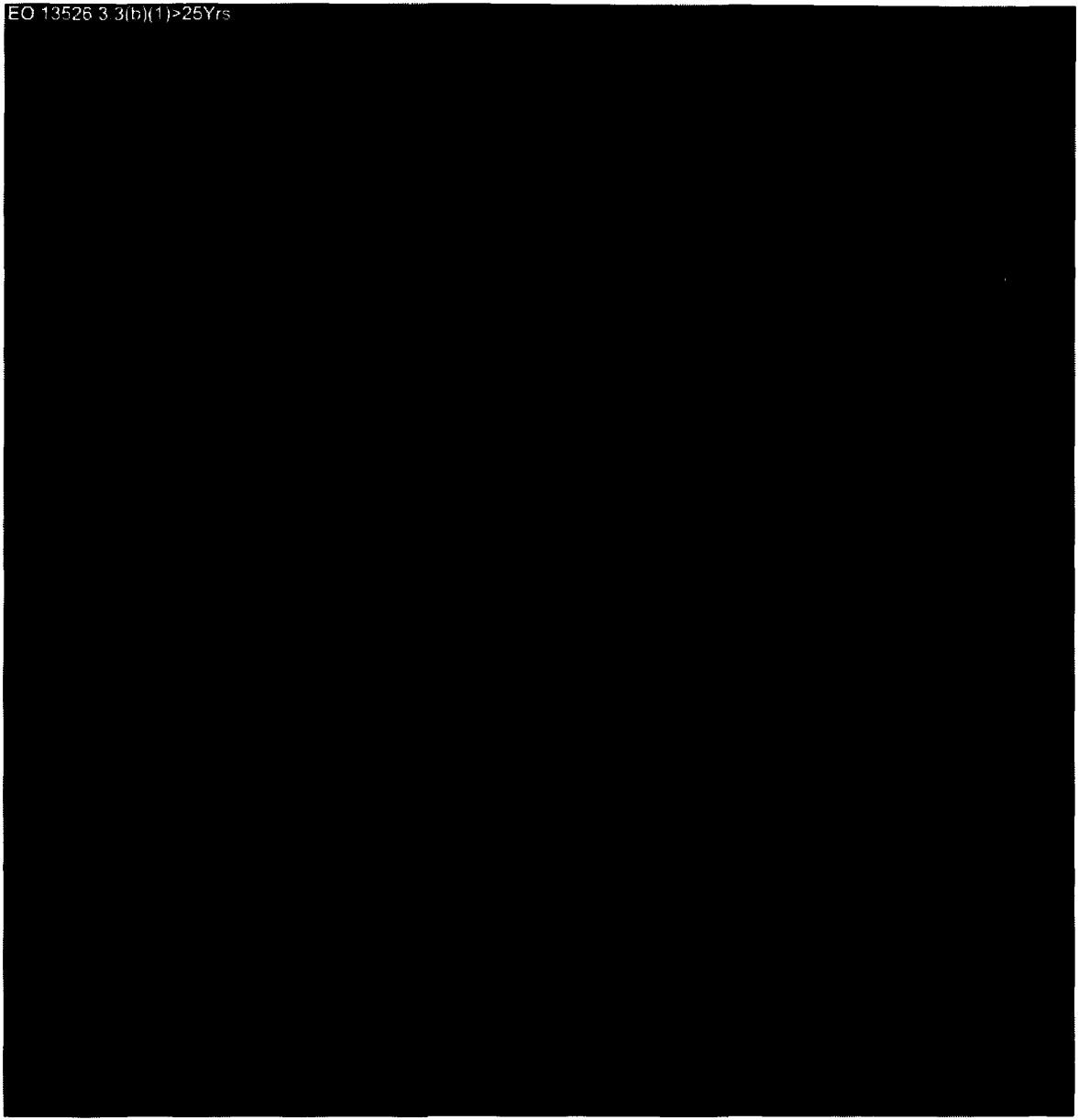
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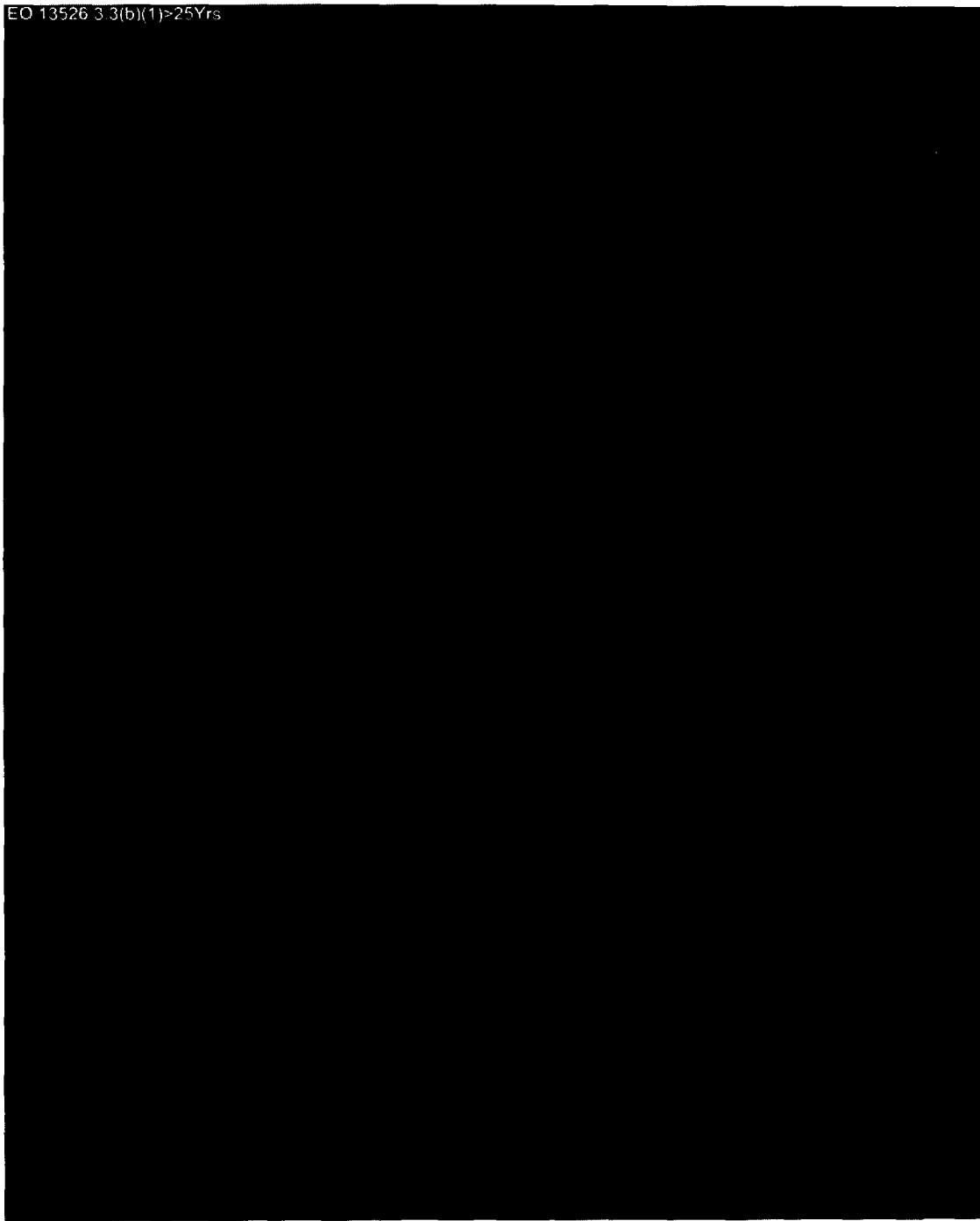
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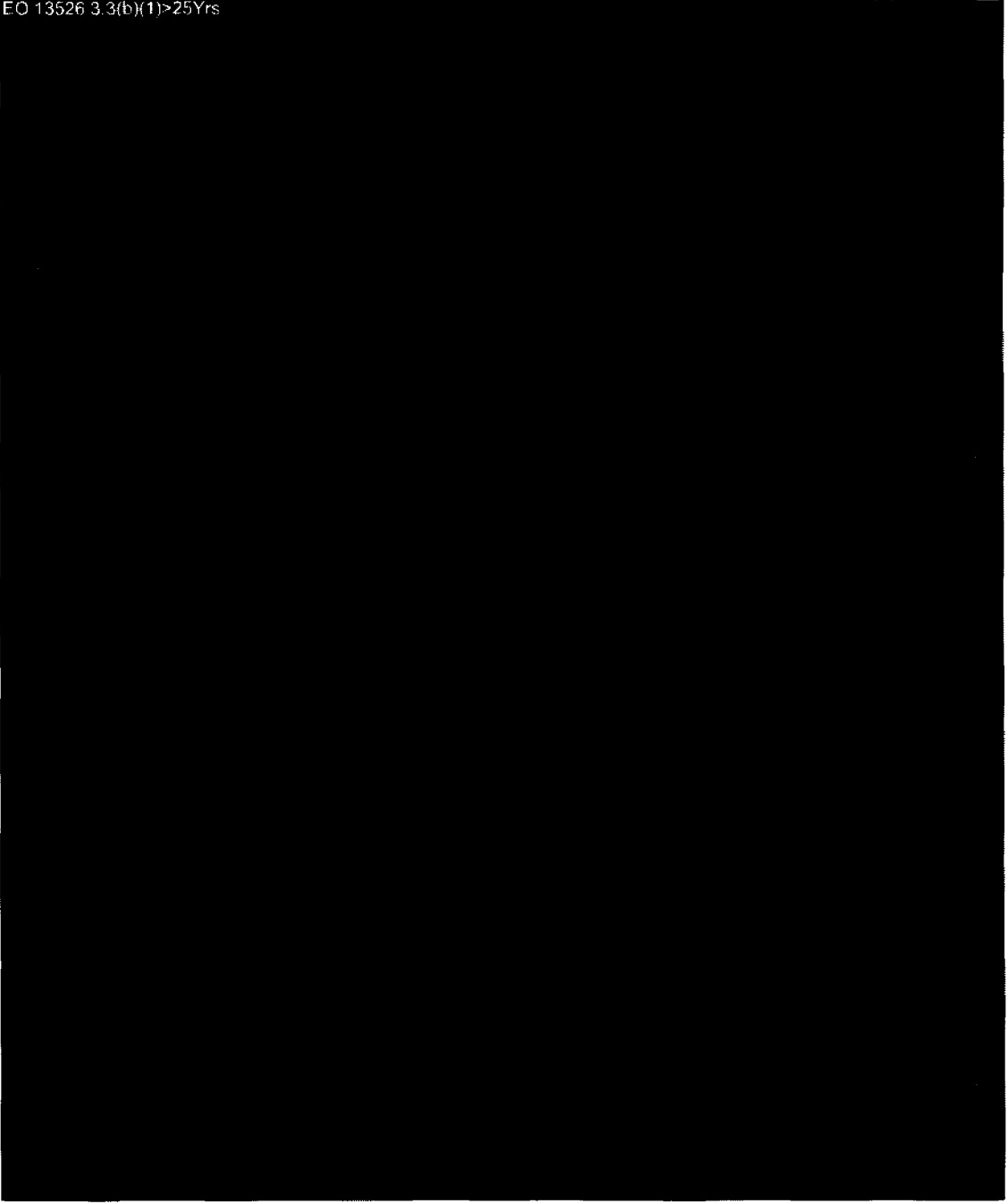
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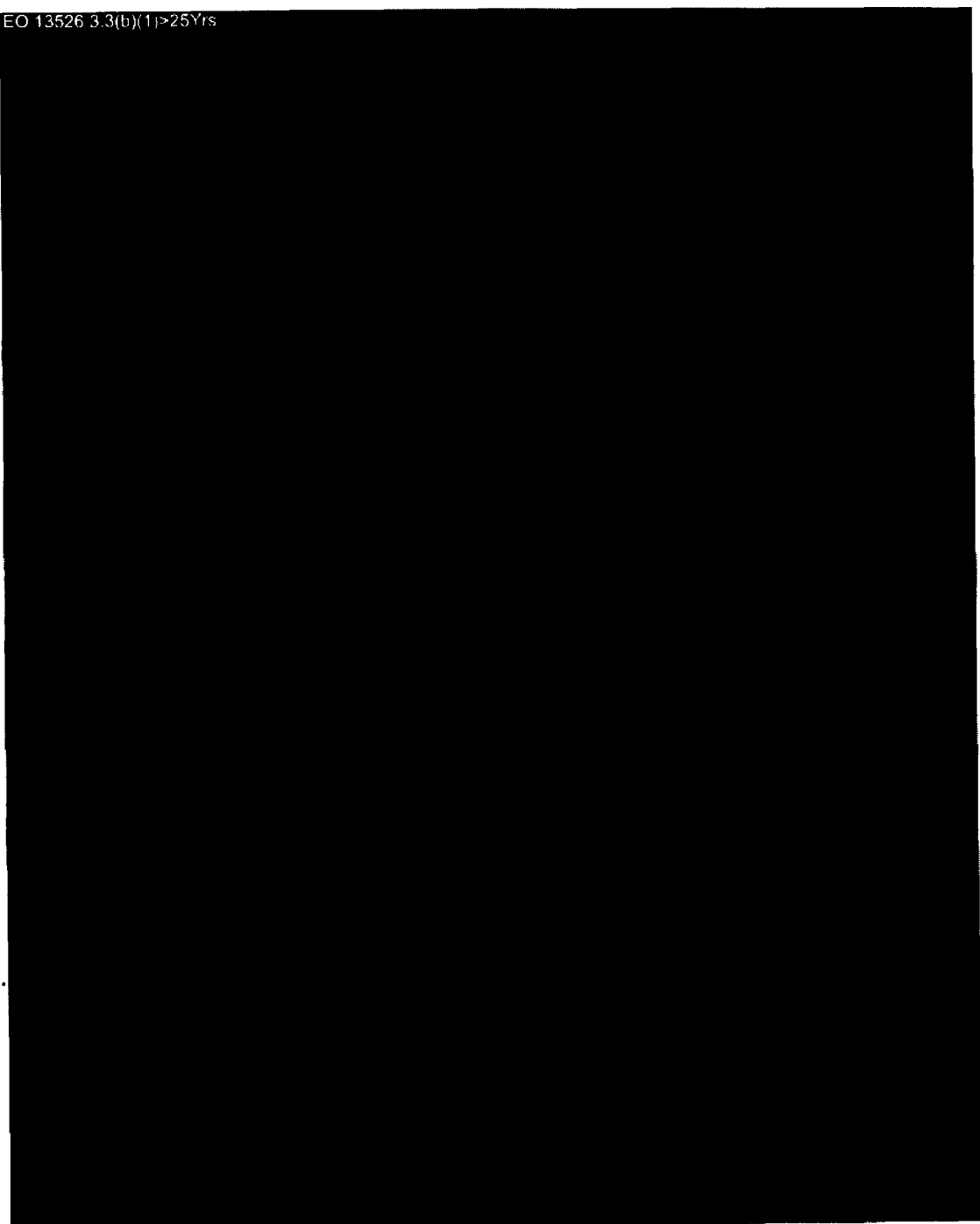
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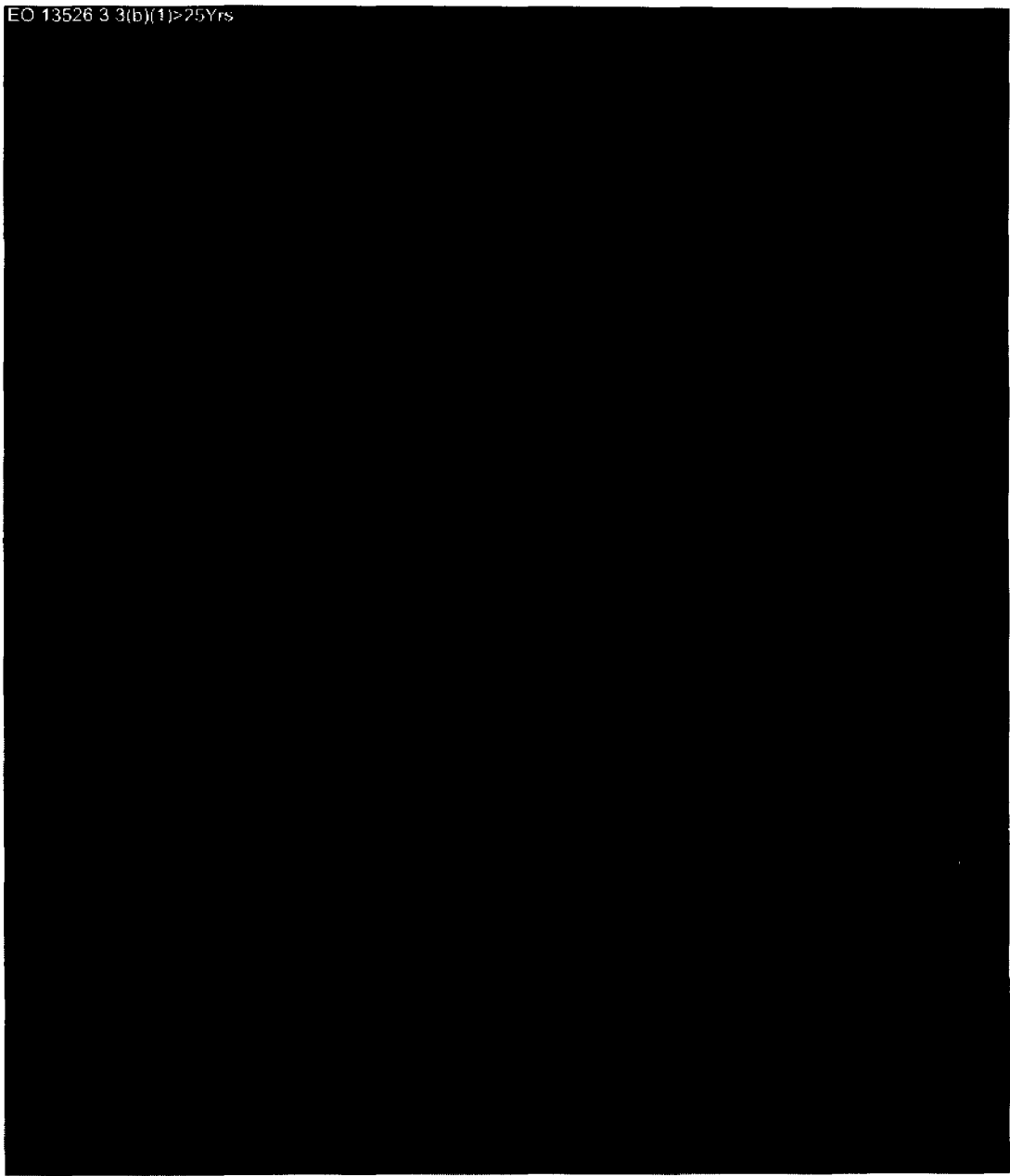
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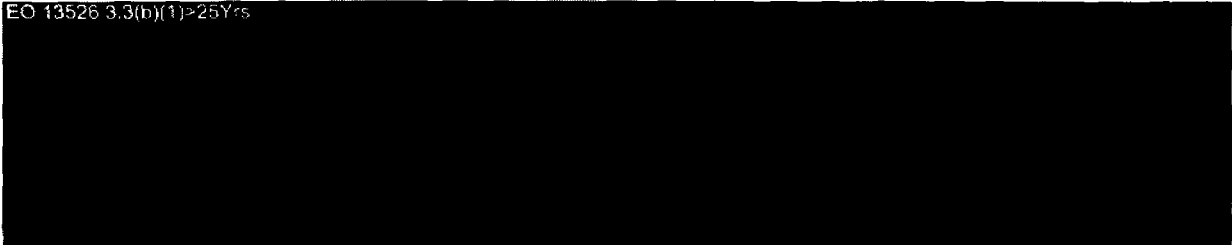
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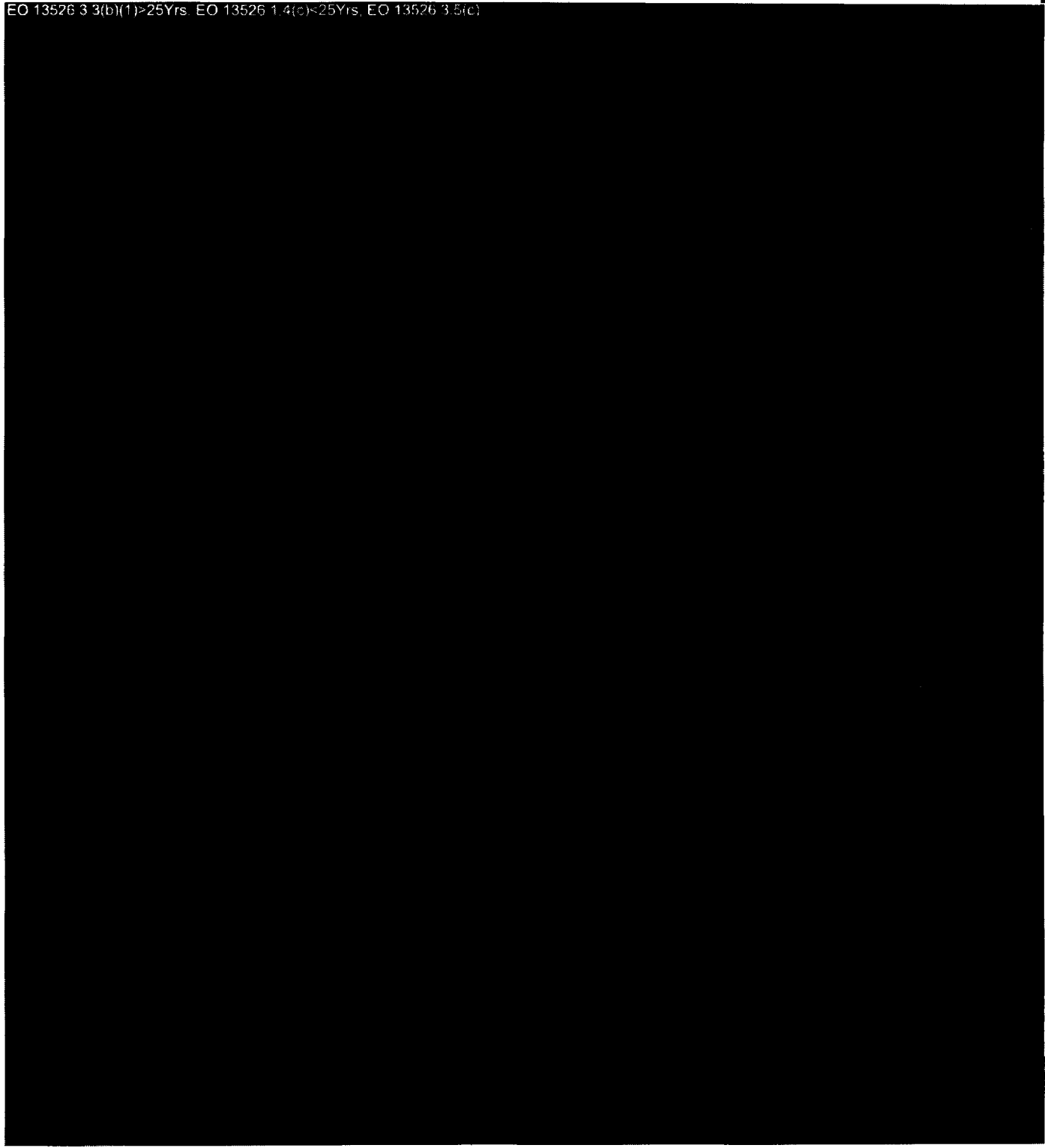


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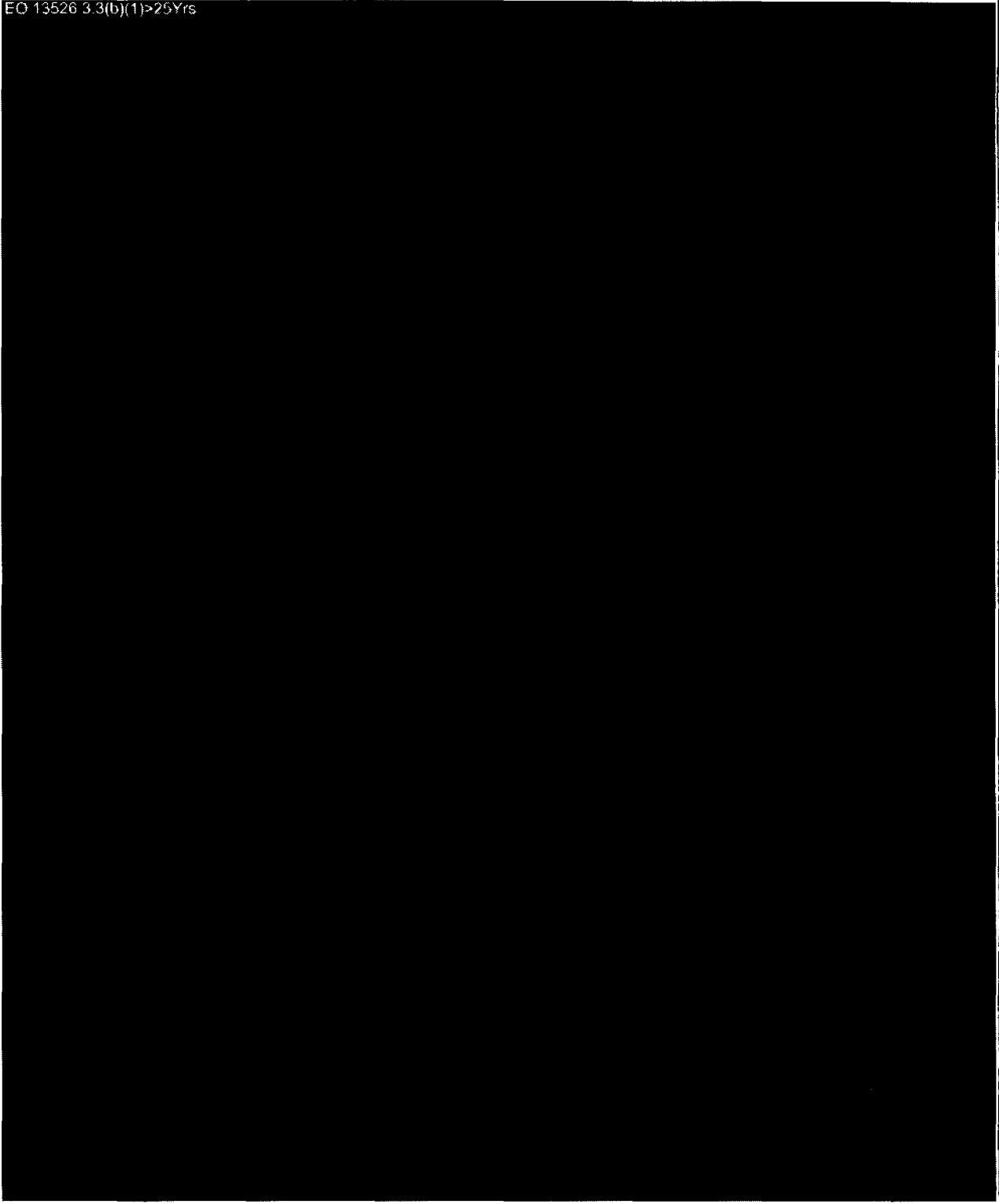
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F Appendix

About the Authors

David D. Bradburn was born in Hollywood, California, on 27 May 1925. He attended South Pasadena High School and the US Military Academy at West Point, New York, where he graduated in 1946. Commissioned a Second Lieutenant in the Army Air Corps, he was transferred into the US Air Force in 1947 and advanced through the ranks to Major General, US Air Force. He holds Master's degrees in engineering from Purdue University and in international affairs from The George Washington University.

His Air Force assignments included 50 missions as a B-26 light bomber pilot in Korea in 1950 and 1951 and a tour as a research and development (R&D) staff officer at Headquarters, Air Research and Development Command (ARDC), in Baltimore, Maryland, from 1952 to 1957. Trained in electrical engineering at Purdue and in R&D staff work at ARDC, he moved to California in 1957 to help Col Fritz Oder set up the WS-117L office. In 1960 he was among the first to join the SAMOS Project Office, again using his R&D and space experience to help BGen Robert E. Greer organize the new "black" Air Force space projects. From 1962 to 1964 Bradburn originated and orbited the QUILL Project, a satellite-borne synthetic aperture radar, which demonstrated the engineering

feasibility of imaging radars in space.

From 1967 to 1971 he was head of

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during the ferment of the ABM problem, and took a major part in the planning and launch

EO 13526 3.3(b)(1)>25Yrs

EO 13526 3.3(b)(1)>25Yrs from 1971 to 1973 he was Director of the Office of Space Systems (NRO Staff); and from 1973 to 1975, he was Director of the Office of Special Projects (SAFSP).

In 1975, just in time for the US Bicentennial and a great time to be in New England, Bradburn moved to Hanscom Air Force Base, Bedford, Massachusetts, as Vice Commander, Air Force Electronic Systems Division. When he retired from the Air Force in 1976 the Bedford Minutemen, a social/historical association, came out to play with fifes and drums. In 1978 and 1979, Bradburn was the Representative of the Joint Chiefs of Staff on the US team negotiating with the Soviet Union on limitations on antisatellite weapons (ASATs). At that time, under the Carter Administration, the United States was opposing the development or use of ASATs, a position consistent with President Eisenhower's Open Skies strategy.

In 1979 Bradburn joined TRW Defense Systems Group in El Segundo, California, as Director of Engineering, concentrating mainly on TRW's project management

methods with Gen Samuel C. Phillips, the expert who managed Apollo. Retired from TRW in 1987, Bradburn volunteered for this assignment as a historian in 1990 and has been busy and happy managing this smaller project ever since!

John Copley was born in Bangor, Maine, on 26 August 1922 at the height of a severe thunderstorm which, some believe, may have shaped certain events in his future. His father was a teacher who, in search of greener pastures (or warmer?), made several career moves in a southerly direction. As a result, Copley's early education was in Massachusetts, but he spent his high school years in New Rochelle, New York, where he graduated in 1940. He attended Williams College, Williamstown, Massachusetts, until November 1942, when he entered the Aviation Cadet Program, eventually piloting a B-24 with the 15th Air Force in Italy during 1944 and early 1945.

The next 12 years were spent in communications and electronics assignments in such locations as Johnston Island and the Korean Peninsula. In 1953 he entered the Air Force Institute of Technology, graduating with a degree in electrical engineering in August 1955. Following two and a half years at Rome Air Development Center, Griffis Air Force Base, New York, in charge of the ground quick reaction capability (QRC) program at the Intelligence and Electronic Warfare Laboratory, he found himself in Inglewood, California, assigned to the Air Force WS-117L Program Office (thanks mostly to the launch of Sputnik I in October 1957). His initial assignment was development of Subsystem H, the

Ground/Space Communications System; however, his SIGINT background prevailed and in July 1958 he was assigned to Subsystem F, the "ferret" payloads. He continued as the SIGINT payload chief for SAMOS and then [REDACTED] when the project was classified as BYEMAN in December 1962.

In July 1964 he was assigned to the Manned Orbiting Laboratory in an attempt to expand the mission into the SIGINT area. When this attempt was terminated in 1967, he became the first National Reconnaissance Office (NRO) assignee to the National Security Agency (NSA). While there he was Chief of K-45 charged with processing the data [REDACTED] EO 13526 3.3(b)(1)>2 [REDACTED] EO 13526 3.3(b)(1)>25Yrs. EO 13526 1.4(c)>25Yrs. EO 13

Copley retired from the Air Force in May 1974. The next 15 years were spent at Rockwell International Space Division where he finally realized a lifelong ambition and was able to actually participate in the engineering development of electronic systems for spacecraft (including the space shuttle). In February of 1990, MGen David D. Bradburn invited him to participate in the writing of this history, after which a third retirement should be in order!

Raymond B. Potts was born in Wellsburg, West Virginia, on 15 September 1931. He graduated from West Virginia University in 1954 with a bachelor of science in electrical engineering, majoring in electronics with a mathematics minor. He also completed the Modern Engineering Management Program at Carnegie Mellon

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University in 1964 and the Federal Executive Institute, Senior Executive Development, in 1982. He served in the US Air Force from 1954 to 1956, attaining the rank of First Lieutenant and later Captain in the US Air Force Reserve in 1957.

His career at NSA actually began while he was in the Air Force, and his first work there involved research on the use of transistors. From 1956 to 1958 he worked on some special R&D projects including the first computer to use transistor logic, SOLO. From 1958 to 1960 he worked on

EO 13526 3.5(c) an effort to solve a major cryptanalytic problem. From 1960 to 1963 he was Chief of the Technical Planning Staff for equipment that required technology beyond the state of the art. He started into the satellite field in 1963 as task leader for the development of the high speed analog-to-digital converter for processing analog data from the Air Force prime payloads in Project 698BK, managed by SAFSP. From 1966 to 1971 Potts was Deputy Chief of the Office of ELINT and Chief of Special Projects; in these jobs he was responsible for NSA participation in the low-orbit SIGINT satellite projects. He managed all the analysis and processing of SIGINT collected data, made agreements with the Strategic Air Command, established the

EO 13526 1.4(c)<25Yrs, EO 13526 EO 13526 1.4(c)<25Yrs, EO 13526 and started the activity of processing SIGINT data by means of a contractor, Lockheed Missiles and Space Company, under an Air Force contract. He also represented NSA in development of the high-altitude SIGINT satellite projects.

After a series of increasingly responsible jobs, including Deputy Assistant Director NSA for Science and Technology, in 1974 Potts became Deputy Director of Training, NSA/Central Security Service/Commandant of the National Cryptologic School, where he managed courses in equipment maintenance through graduate-level language, computer science, and management. From 1980 to 1985 he was Deputy Chief and Acting Chief, Operations and Control, managing SIGINT collection operations via satellites, comsat remotes, high frequency, and embassies. From 1985 to 1987 he was Deputy Chief, Joint Programs, leading the acquisition of major collection systems jointly bought by NSA and the Service Cryptologic Agencies. Potts received the NSA Meritorious Civilian Service award in 1980.

On his retirement in 1987, Potts became a Cryptologic Reservist at the National Cryptologic School at NSA, where he prepared a book on "Lessons Learned in Systems Acquisition" for use in systems acquisition training. He also organized the Acquisition Management Association to provide a forum to exchange information and ideas on acquisition. In 1990 Potts agreed to take a leading role in writing this SIGINT history, which is based to a large degree on his experience and interests, which have kept him at the center of the satellite SIGINT world. With this job done, he plans to spend a lot more time with his family and keep his hand in the SIGINT business from time to time.

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In 1952 he joined NSA as an electronics engineer working on development of microwave antennas and over-the-horizon SIGINT ultra-high-frequency collection equipment. This began a lifelong career in SIGINT. In 1957 and 1958 ^{EO 13526} served in Tokyo as Chief of the R&D staff involved in experimental collection systems; from 1958 to 1964 he was in the technical planning staff, monitoring US Air Force and Navy SIGINT satellite projects; and in 1964 he joined the NRO staff in the Pentagon, helping to tie NSA and NRO interests together. In 1967 he became Chief of R83 at NSA, the office of SIGINT satellite projects; and from 1967 to 1970 he was advisor to the Director, NSA, on SIGINT satellite reconnaissance. From 1970 until 1973 he was Chief of WO5, responsible for ELINT end product reporting. From 1973 to 1976 he was Chief of the NSA group of analysts/linguists integrated in the Central Intelligence Agency

(CIA) headquarters to evaluate special covert SIGINT; from 1976 to 1979 he was Scientific Advisor to the Chief, A6, monitoring special Navy SIGINT; and from 1979 to 1986, ^{EO 13526} was Scientific Advisor to the Chief of A Group, the largest operations group responsible for collection, analysis, and planning for SIGINT on Soviet and East European countries.

Since his retirement from NSA in 1986, ^{EO 13526} has been a consultant for the CIA on advanced SIGINT and related satellite programs. In 1988 he was a volunteer at the Smithsonian Museum of Natural History as a docent for the waterfowl exhibit, and from 1989 to the present he has been a volunteer for Recording for the Blind, Inc., in Washington, DC, reading, monitoring other readers, controlling the master tape recorder, and duplicating tapes on over 100 textbooks for college-level electronics, physics, mathematics, and technical trade school courses. He was awarded the Air Force Meritorious Service Medal in 1966 and the NSA Meritorious Service Medal in 1968. In his retirement ^{EO 13526} has had time to concentrate on a lifelong interest in singing. Since 1972 he has appeared in over 100 concerts with the Paul Hill Chorale in the Kennedy Center in Washington, DC. He volunteered for the assignment as a main member of this SIGINT history team in 1990 and plans to concentrate on singing and summers in Martha's Vineyard in the future.

Appendix

Acronyms and Abbreviations

AAA	antiaircraft artillery
ABM	antiballistic missile
ADCS	analog-to-digital conversion system
ADD/DP	Assistant Deputy Director for Data Processing EO 1352
AD/FO	Assistant Deputy for Field Operations (SAFSP)
ADP	Assistant Director for Production (NSA)
AES	anti-Earth satellite
AFB	Air Force Base
AFBMC	Air Force Ballistic Missile Committee
AFBMD	Air Force Ballistic Missile Division
AFCGM	Air Force Office of Guided Missiles
AFSA	Armed Forces Security Agency (pre-NSA)
AFSC	Air Force Systems Command
AFSCF	Air Force Satellite Control Facility
AFSS	Air Force Security Service
AIL	Airborne Instruments Laboratory
AJOY	analog-to-digital converter and computer system provided by NSA to SAC to process ELINT data
AMC	Army Missile Command
AMIE	analog magnetic instrumentation equipment, a spaceborne, wide-bandwidth, helical-scan magnetic-tape recorder used on Program A SIGINT reconnaissance satellites
APE	analog processing equipment
APL	Applied Physics Laboratory (Johns Hopkins University)
ATIC	Air Force Technical Intelligence Center, Wright-Patterson AFB, Ohio
ARDC	Air Force Research and Development Command
ARPA	Advanced Research Projects Agency
ARS	Advanced Reconnaissance System
ATI	Applied Technology, Inc.
BUWEPS	Bureau of Weapons (Navy)
C-band	radar operating frequency, 4 to 8 GHz
CAMS	computer-aided manual search
CCP	Consolidated Cryptologic Program
CDC	Control Data Corporation
CEP	circular error probable (locations)
CES	Communications Equipment Subsystem
CIA	Central Intelligence Agency

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CIG	Central Intelligence Group
CINCPAC	Commander in Chief, Pacific (US military forces)
CINCPACFLT	Commander in Chief, Pacific Fleet
CNO	Chief of Naval Operations
COMINT	communications intelligence
COMNAVINTCOM	Commander, Naval Intelligence Command
COMOR	USIB Committee on Overhead Reconnaissance
COMSEC	communications security
CONUS	Continental United States
COTR	Contracting Officer's Technical Representative
CSAW	Communications Supplementary Activities, Washington (Navy)
CSWG	COMOR SIGINT Working Group
CVR	continuous video recording
CW	continuous wave (versus pulsed) electromagnetic signal
DACS	Data Acquisition and Control Segment
DAGER	Director's Advisory Group for ELINT and Reconnaissance (NSA)
DAHOPS	Data Handling and Operations Plan
DCI	Director of Central Intelligence
DCS/D	Deputy Chief of Staff for Development (USAF)
DDC	Data Distribution Center
DDI	Deputy Director for Intelligence
DDO	Deputy Director for Operations (NSA)
DDR&E	Deputy Secretary of Defense for Research and Engineering
DDS&T	Deputy Director for Science and Technology (CIA)
DEFSMAC	Defense Special Missiles and Astronautics Center
DF	direction-finding
DIA	Defense Intelligence Agency
DIRNSA	Director, National Security Agency
DNI	Director of Naval Intelligence
DNRO	Director, National Reconnaissance Office
DOD	Department of Defense
DSP	Defense Support Program
DSU	data storage unit
EDL	Electronics Defense Laboratory (Sylvania)
ELINT	electronic intelligence (primarily radars)
ELT	ELINT technical (reporting)
EMPINT	electromagnetic pulse intelligence (nuclear detonation)
EOB	electronic order of battle (radar locations)
ERA	Engineering Research Associates
ERP	effective radiated power
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ESV	Earth satellite vehicle
EW/GCI	early warning/ground-controlled intercept (radar)
EXCOM	Executive Committee of the NRO

FBI	Federal Bureau of Investigation
FDM	frequency-division-multiplex
FIS	foreign instrumentation signals
FM	frequency modulation
FMSAC	Foreign Missile and Space Analysis Center (CIA)
FOC	final operational capability
FOV	field of view
FSK	frequency shift key
FTD	Foreign Technology Division
FY	fiscal year
GCHQ	General Communications Headquarters (UK)
GCI	ground control intercept (radar)
GE	General Electric Company
GHz	gigahertz (one billion cycles per second)
GOR	general operational requirement
GPS	Global Positioning System
GRAB	Galactic Radiation and Background
GS	general search
HF	high frequency (3 to 30 MHz)
HF/DF	high-frequency/direction-finding
HUMINT	human intelligence
Hz	hertz (one cycle per second)
I&W	indications and warning
IBM	International Business Machines, Inc.
ICBM	intercontinental ballistic missile
IEEE	Institute of Electrical and Electronic Engineers
IHF	Intercept History File
IMINT	imagery intelligence
IOC	initial operating capability
IR	infrared
IRINT	infrared intelligence (primarily missile radiation)
ITEP	Interim Tactical ELINT Processing (Equipment)
JAN	Joint Army/Navy (publications, nomenclature, etc.)

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kbps	kilobits per second
kHz	kilohertz (one thousand cycles per second)
L-band	radar operating frequency, 1 to 2 GHz
LMSC	Lockheed Missiles and Space Company
LMSD	Lockheed Missiles and Space Division
LOP	line of position

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MADS	mission and data services (processing)
Mbps	megabits per second
MCC	mission control center
MGS	mission ground station
MHz	megahertz (one million cycles per second)
MOL	Manned Orbiting Laboratory
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NAVSPASUR	Naval Space Surveillance Center
NIC	Naval Intelligence Command
NORAD	North American Air Defense Command
NPIC	National Photographic Interpretation Center
NRL	Naval Research Laboratory
NRO	National Reconnaissance Office
NRP	National Reconnaissance Program
NSA	National Security Agency
NSC	National Security Council
NSCID	NSC Intelligence Directive
NSD	NSA Support Detachment
NSG	Naval Security Group
NSOC	National SIGINT Operations Center
NTPC	National Technical Processing Center
OCMC	Operations Center for Mission Control
OEL	Office of ELINT (CIA)
ONI	Office of Naval Intelligence
OPELINT	operational ELINT
OSD	Office of the Secretary of Defense
OSDBMC	Office of the Secretary of Defense, Ballistic Missile Committee
OSI	Office of Scientific Intelligence
OSP	Office of Special Projects (CIA)
OSS	Office of Strategic Services (pre-CIA)
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PACELINT	Pacific ELINT Center
PAM/FM	pulse amplitude modulation/frequency modulation
PAPS	POPPY Automated Processing System
PCM	pulse code modulation
PDE	priority data extractor
PFIAB	President's Foreign Intelligence Advisory Board
PPM	pulse position modulation
PRC	People's Republic of China
PRF	pulse repetition frequency
PRI	pulse repetition interval
PSAC	President's Science Advisory Committee
PSK	phase shift key
PW	pulsewidth

QRC	quick reaction capability
R&D	research and development
RAND	Research for America's National Defense (the RAND Corporation)
RCA	Radio Corporation of America
RF	radio frequency
EO 13526 3.3(b)(1)>25Yrs	
RTG	Reconnaissance Technical Group
RTS	remote tracking station
RTTY	radio teletype
S	Secret
S-band	radar operating frequency, 2 to 4 GHz
S/S E	Subsystem E (SAMOS photo payload)
S/S F	Subsystem F (SAMOS electronic reconnaissance, or "ferret," system)
S/S I	Subsystem I (WS-117L processing system)
SAC	Strategic Air Command
SAFMS	Office of Missiles and Space (Air Force)
SAFSP	Office of Special Projects (NRO Program A)
SAFSS	Office of Space Systems (NRO staff)
SAFUS	Under Secretary of the Air Force (DNRO)
SALT	Strategic Arms Limitations Talks
SAM	surface-to-air missile
SAMOS	ARPA unclassified designator for former SENTRY Program
SAMS	Signal Activity Monitor System (ELINT)
SAS	Signal Analysis Subsystem (COMINT)
SCA	Signal Analysis Console
SCF	Satellite Control Facility
SDS	Students for Democratic Society
SecDef	Secretary of Defense
SEL	Stanford University Electronics Laboratory
EO 13526 3.3(b)(1)>25Yrs	
SGLS	space-ground link system
SHARS	signal handling and recording segment
SIGINT	signals intelligence
SIOP	Single Integrated Operating Plan
EO 13526 3.3(b)(1)>25Yrs	
SOC	Satellite Operations Center, NSA
SOCOMM	Satellite Operations Communications network (Air Force)
SORS	SIGINT Overhead Reconnaissance Subcommittee (USIB)
SP	SAFSP, including EO 13526 3.3(b)(1)>25Yrs EO 1352
SPO	system project office
SR	system requirement
SRI	Stanford Research Laboratories
SSAT	Special Signals Analysis Team
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SSSC	SIGINT Satellite Support Center (NSA)
STANCIB	State/Army/Navy Communications Intelligence Board (pre-USCIB)
STC	Satellite Test Center

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STIC	Scientific and Technical Intelligence Center (ONI)
STL	Space Technologies Laboratories
STRUM	standard technical report using modules (NSA format)
TAC	Technical Advisory Committee
TAT	thrust-augmented Thor
TCP	Technological Capabilities Panel
TCR	time-critical reporting
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TDY	temporary detached duty
TEBAC	Telemetry and Beaconry Analysis Community
TECHINS	technical instructions
TELINT	telemetry intelligence
THF	technical history file
TI	technical intelligence
TK	Talent-Keyhole security compartment
TOA	time of arrival
TOG	Technical Operating Group
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TS	Top Secret
TV	television
TW	tactical warning
UAR	United Arab Republic
UHF	ultrahigh frequency (300 to 3,000 MHz)
USA	United States Army
USAF	United States Air Force
USCIB	United States Communications Intelligence Board (pre-USIB)
USIB	United States Intelligence Board
USN	United States Navy
USSR	Union of Soviet Socialist Republics
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VAB	vehicle assembly building
VAFB	Vandenberg Air Force Base
VCR	video cassette recorder
VHF	very high frequency (30 to 300 MHz)
WADC	Wright Air Development Center
WDD	Western Development Division (Air Force)
WS-117L	Weapon System 117L
X-band	radar operating frequency, 8 to 10 GHz
YIG	yttrium-iron-garnet

Military Rank Abbreviations

Gen	General
Adm	Admiral
LGen	Lieutenant General
VAdm	Vice Admiral
MGen	Major General
RAdm	Rear Admiral
BGen	Brigadier General
Col	Colonel
Capt	Captain (USN)
LtCol	Lieutenant Colonel
Cmdr	Commander
Maj	Major
LtCmdr	Lieutenant Commander
Capt	Captain (USAF)
Lt	Lieutenant (senior grade)
1Lt	First Lieutenant
Lt (j.g.)	Lieutenant (junior grade)
2Lt	Second Lieutenant
Ens	Ensign

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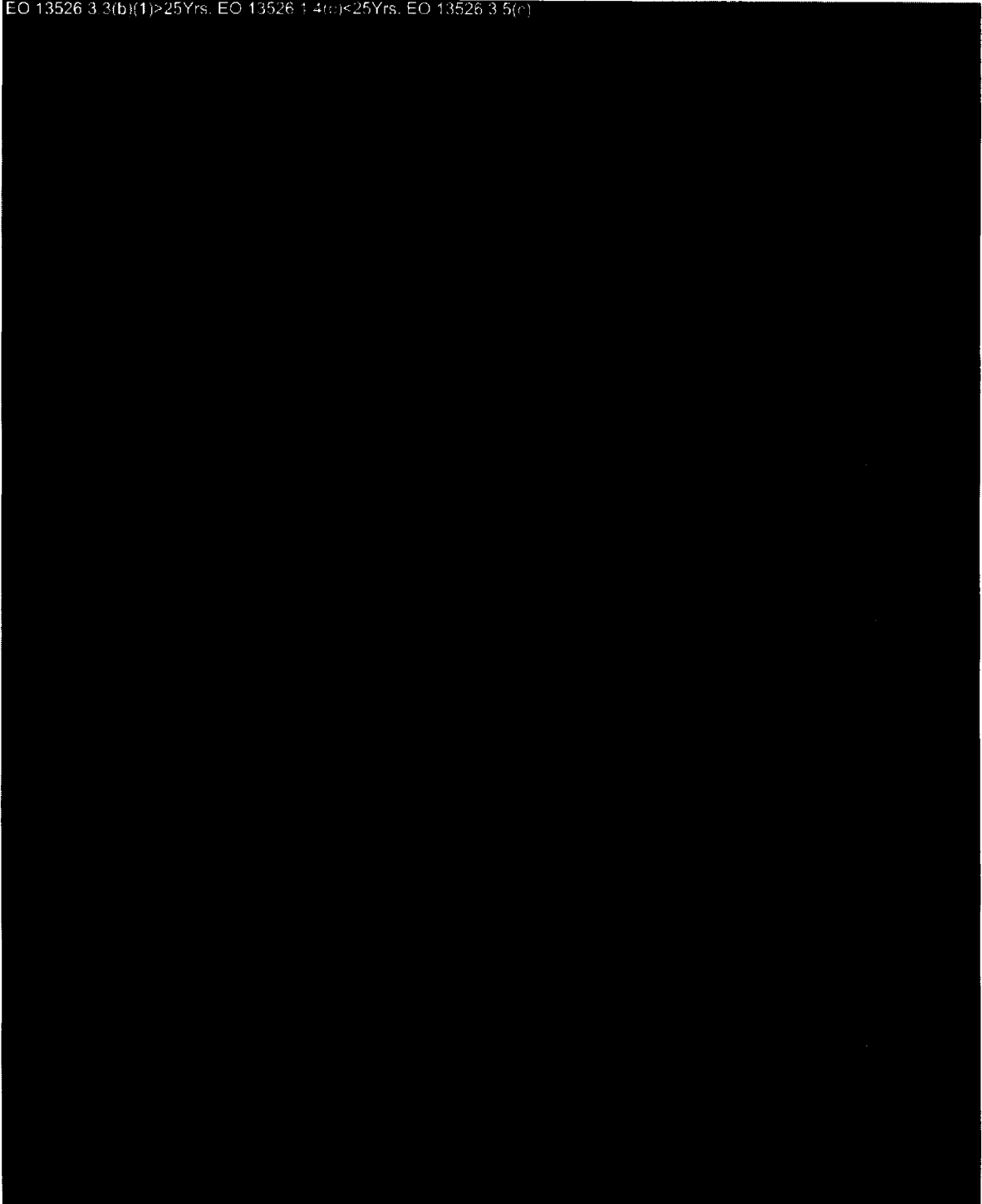
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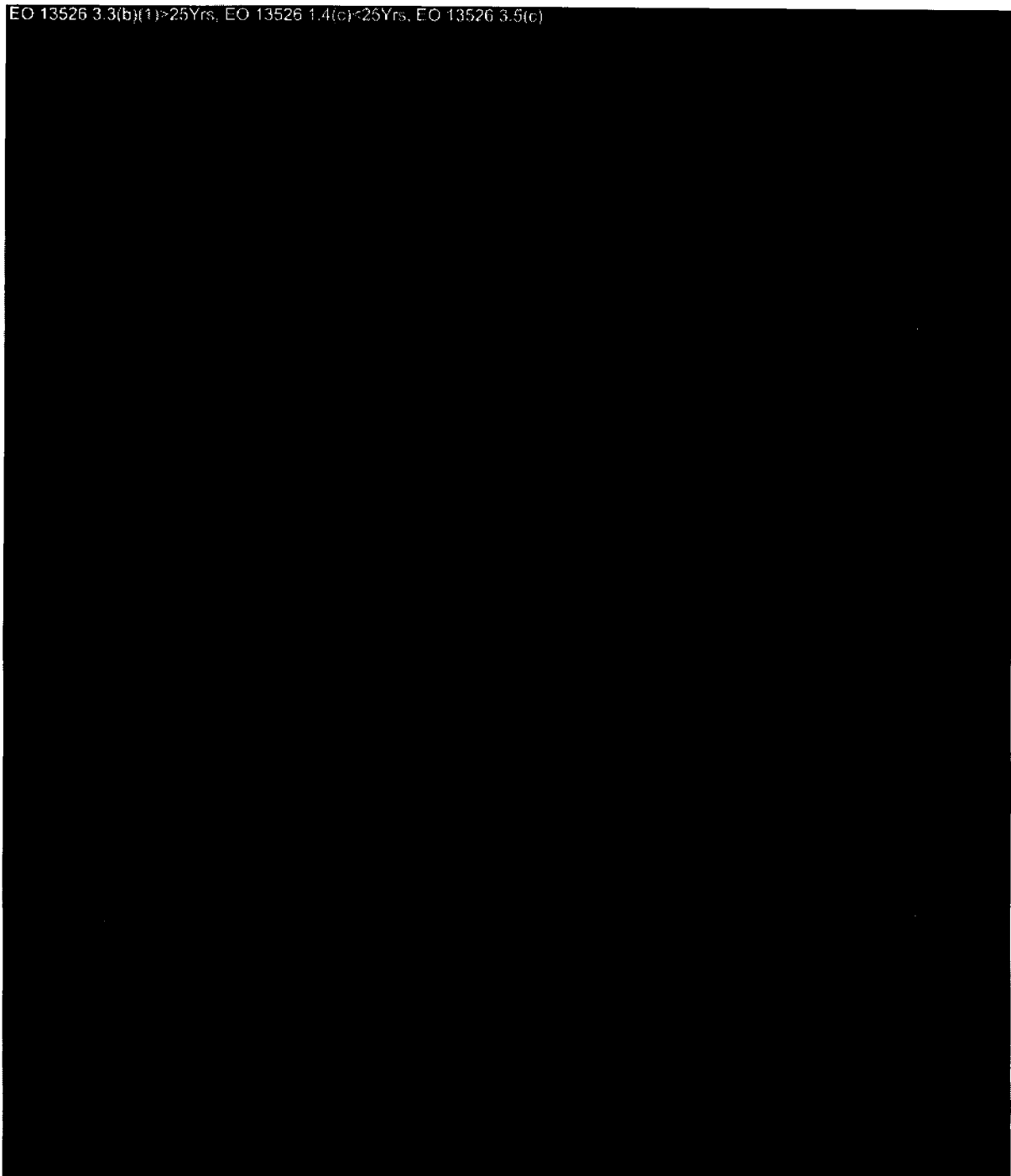


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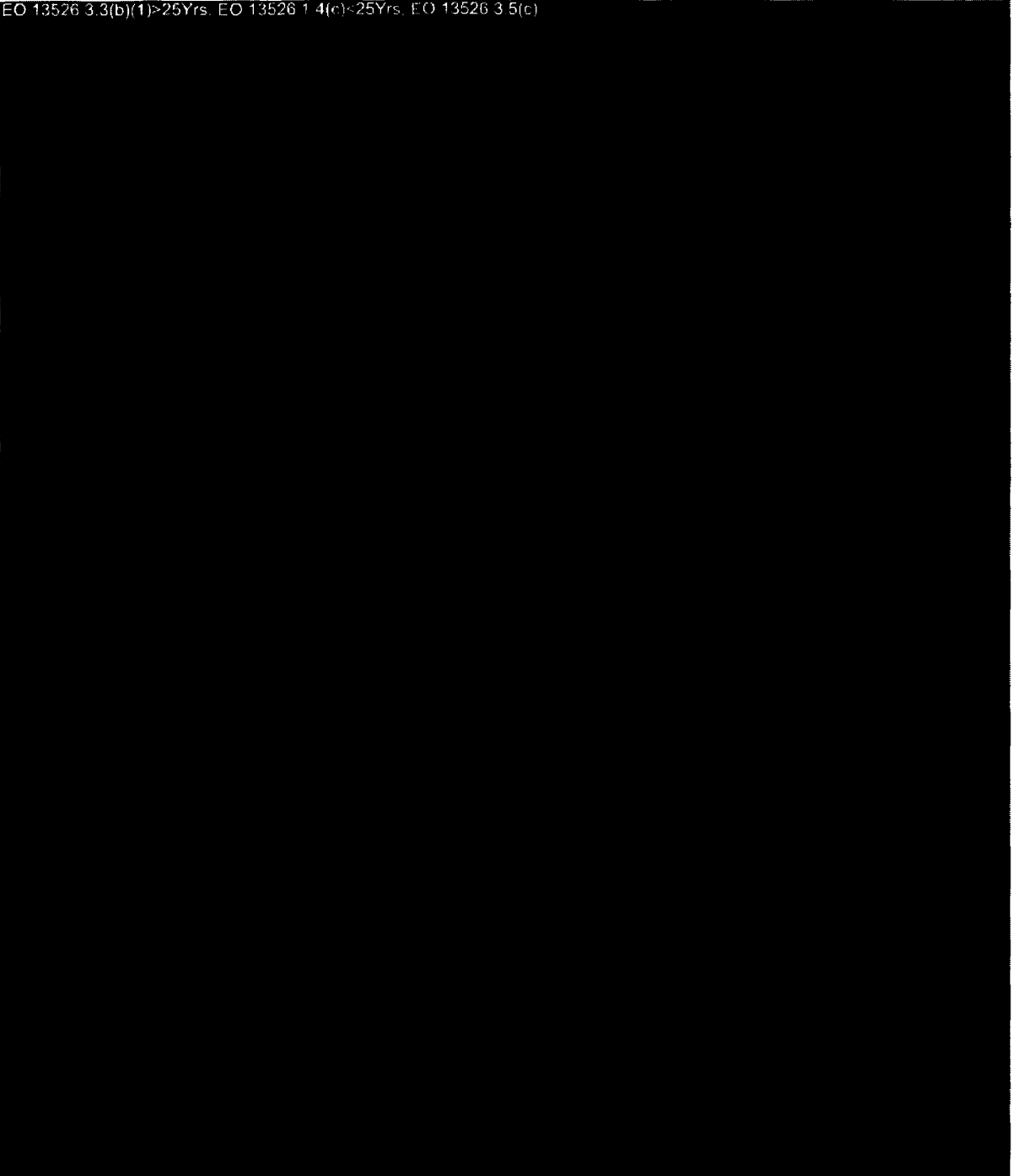


~~Top Secret~~
Handle via BYEM-ON-TALENT-KEYHOLE-
COMINT Control Channels handle
BYF.010-03

~~TOP SECRET~~
~~COMINT~~

PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)-25Yrs. EO 13526 1.4(c)-25Yrs. EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN-TALENT-KEYHOLE-
~~COMINT~~ Control Channels jointly
BYE-919794

Appendix H 401

~~Top Secret~~
~~NOFORN-ORCON~~

PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

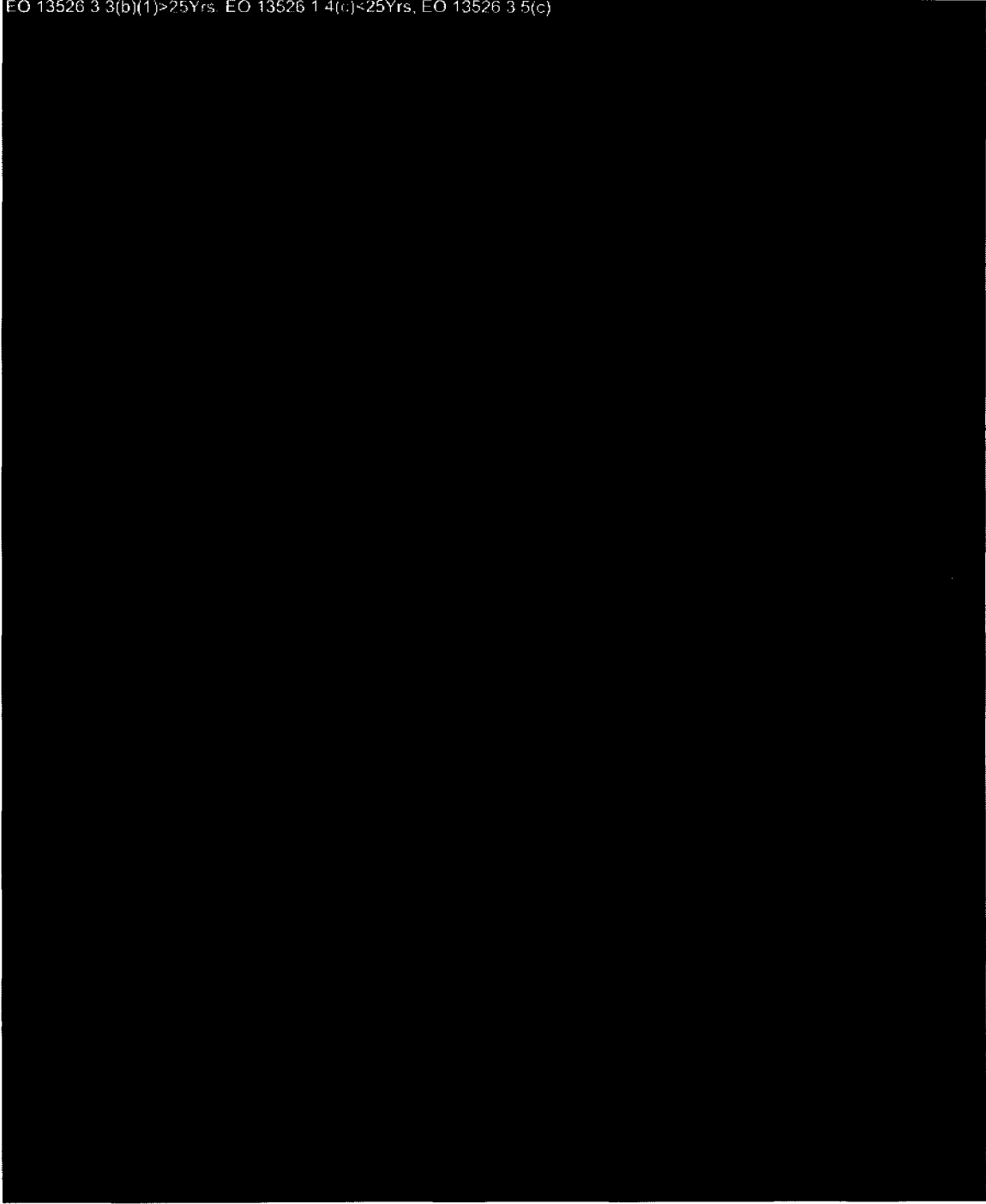


~~Top Secret~~
Handle via BYE-MK-TALENT-KEYHOLE-
~~COMINT Control Channels Jointly~~
BYE-419794

PL 86-36/50 USC 3605

PL 86-36/50 USC 3605
EO 1.4.(c)

EO 13526 3 3(b)(1)>25Yrs EO 13526 1 4(c)<25Yrs, EO 13526 3 5(c)



~~Top Secret~~
Handle via ~~BYE/NO TALENT-KEYHOLE-~~
~~COMINT Control Channels jointly~~
BYE-9197/94

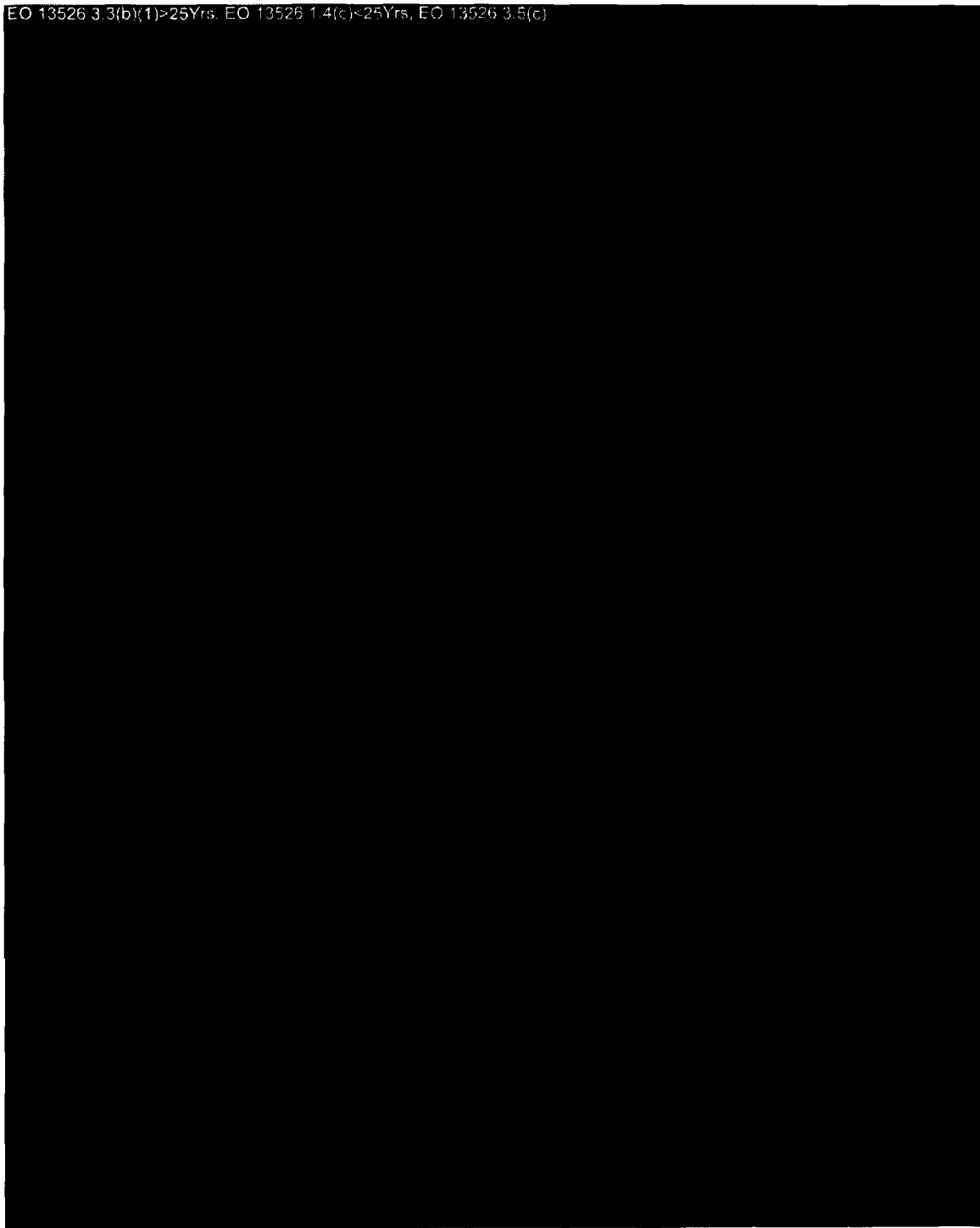
Appendix H

403

~~Top Secret~~
~~NOFORN-ORCON~~

PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
Handle via ~~BYEMAN-TALENT-KEYHOLE-~~
~~COMINT Control Channels Jointly~~
~~RYF-010703~~

~~Top Secret~~
~~NOFORN EXCLUDED~~

PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
Handle via BYE/AN-TALENT-KEYHOLE-
COMINT Control Channels Jointly
BYE-9197/94

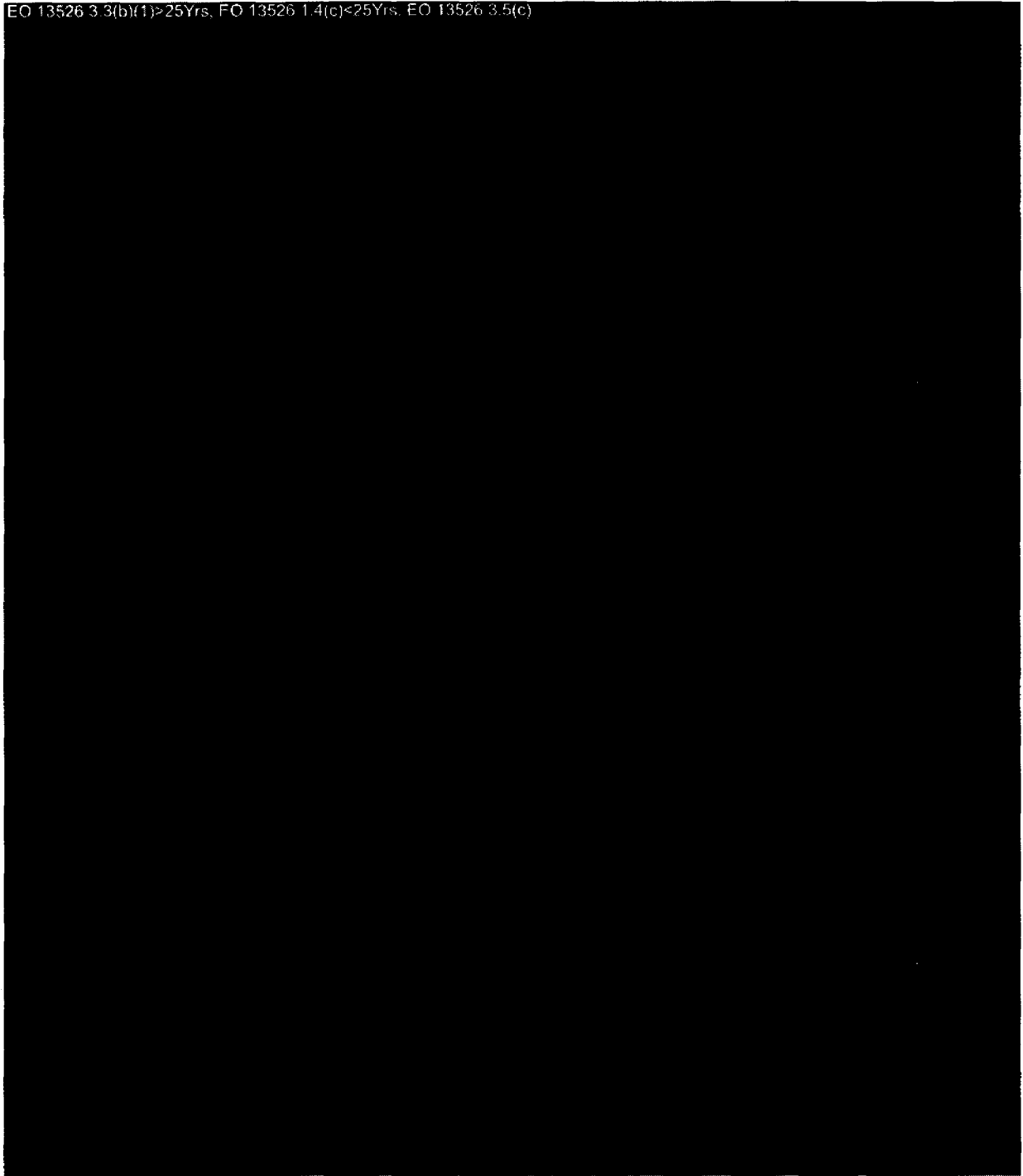
Appendix H 405

~~Top Secret~~
~~NOFORN-NOFORN~~

PL 86-36/50 USC 3605
EO 1.4.(c)

PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)

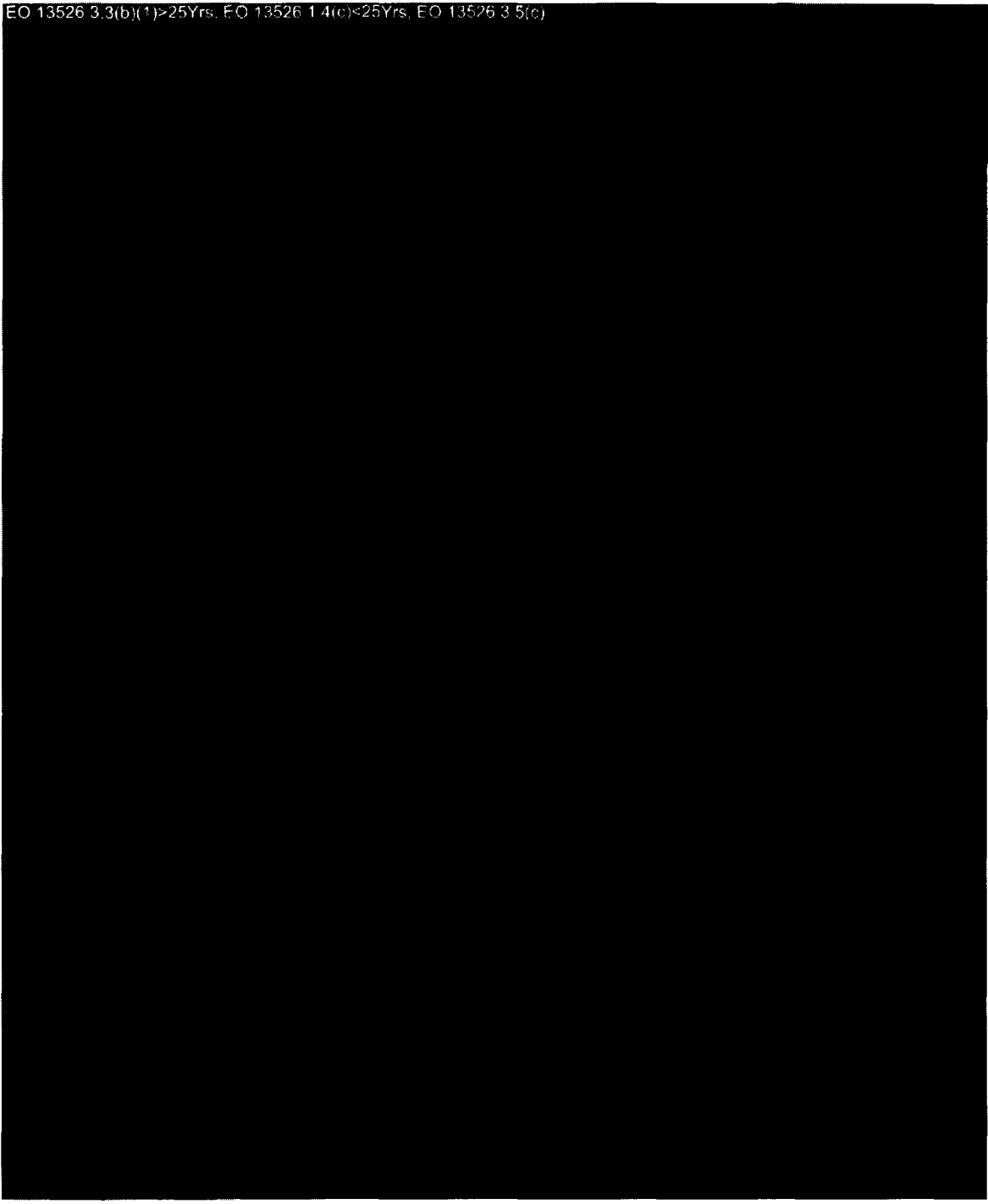


~~Top Secret~~
Handle via ~~BYEAMN-TALENT-KEYHOLE-~~
~~COMINT Control Channels~~ ~~Smith~~
BYF-010-004

~~Top Secret~~
~~COMINT CONTROL CHANNELS~~

PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
Handle via BYEMAN TALENT KEYHOLE-
COMINT Control Channels Jointly
BYE-9197/94

Appendix H 407

~~Top Secret~~
~~NOFORN/NOEYES~~

PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 1.4(c)<25Yrs, EO 13526 3.5(c)



~~Top Secret~~
~~Handle via BYEMANTALENT-KEYHOLE-~~
~~COMINT Control Channels jointly~~
~~REF: 010702~~

~~Top Secret~~
~~NOFORN COMINT~~

PL 86-36/50 USC 3605

EO 13526 3.3(b)(1)>25Yrs, EO 13526 3.5(c), EO 13526 1.4



Reverse side blank

~~Top Secret~~
Handle via BYEMANTALENT-KEYHOLE-
COMINT Control Channels jointly
~~BYE-9197/94~~

Appendix H

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