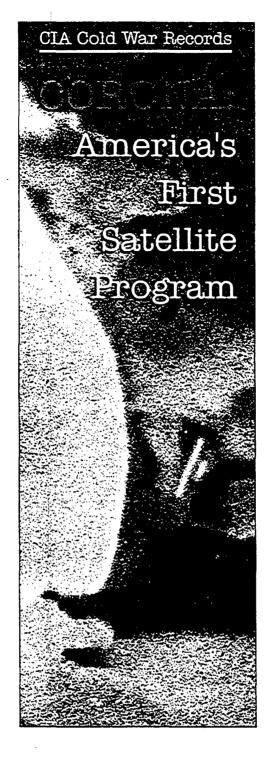


First Image: A Soviet Airfield at Mys Shmidta, 18 August 1960

> Kevin C. Ruffner Editor

CIA History Staff Center for the Study of Intelligence



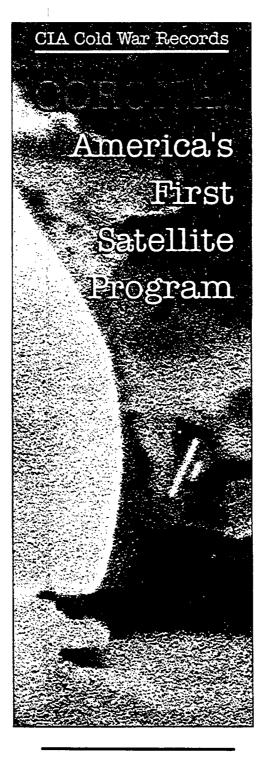
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CORONA: America's First Satellite Program

Foreword

Since the CORONA satellite made its first successful flight in August 1960, the Intelligence Community's overhead reconnaissance programs have been among the nation's most closely guarded secrets. The end of the Cold War, however, has at last made it possible to declassify both information and imagery from the first American satellite systems of the 1960s. To do this, President William Clinton in February of this year ordered the declassification within 18 months of historical intelligence imagery from the early satellite systems known as the CORONA, ARGON, and LANYARD. Because the President's Executive Order 12951 (see appendix) envisions scientific and environmental uses for this satellite imagery, the declassified photographs will be transferred to the National Archives with a copy sent to the US Geological Survey. Vice President Albert Gore, who first urged the Intelligence Community to open up its early imagery for environmental studies, unveiled the first CORONA satellite photographs for the American press and public at CIA Headquarters on 24 February 1995.

To mark this new initiative, CIA's Center for the Study of Intelligence and the Space Policy Institute at George Washington University are cosponsoring a conference, "Piercing the Curtain: CORONA and the Revolution in Intelligence," in Washington on 23–24 May 1995. On the occasion of this conference, the CIA History Staff is publishing this collection of newly declassified documents and imagery from the CORONA program. This is the fourth volume in the CIA Cold War Records Series, which began in 1992 when Director of Central Intelligence Robert Gates launched CIA's Openness Policy and reorganized the Center for the Study of Intelligence to include both the History Staff and a new Historical Review Group to declassify historically important CIA records.

The editor of this new volume, Dr. Kevin C. Ruffner, has an A.B. from the College of William and Mary and an M.A. in history from the University of Virginia. He joined the CIA History Staff in 1991, soon after he received his Ph.D. in American Studies from George Washington University.

The documents and imagery in this volume were reviewed and declassified with unusual dispatch by a special working group of declassification officers from the National Reconnaissance Office, the Central Imagery Office, CIA's Directorate of Science and Technology, and its National Photographic Interpretation Center. The group's prompt work is especially notable since many documents required consultation with the US Air Force, National Security Agency, Defense Intelligence Agency, Department of Energy, Department of State, and CIA's Collection Requirements and Evaluation Staff.

This volume's appearance just three months after President Clinton's declassification order is yet another tribute to the skill and speed that the History Staff of the Center for the Study of Intelligence has come to expect from the Design Center and Publications Center in the Directorate of Intelligence, and from the Directorate of Administration's Printing and Photography Group.

J. Kenneth McDonald Editor in Chief

CORONA: America's First Satellite Program

Preface

The CORONA reconnaissance satellites revolutionized the collection of intelligence in the 1960s. This was a time when it was still extraordinarily difficult to gather information by any other means from "denied areas" including the Soviet Union, Communist China, and their allies. The need for intelligence about Soviet strategic weapon systems and bases dramatically increased after 1 May 1960, when the Soviets shot down an American U-2 aircraft and captured its CIA pilot, Francis Gary Powers. Within a few months, however, on 18 August the United States launched its first successful reconnaissance satellite, which in one mission provided more photographic coverage of the Soviet Union than all previous U-2 missions. On 19 August 1960, the recovery of Mission 9009 with a KH-1 camera marked the beginning of the CORONA reconnaissance satellite program's long and valuable service. The story of this program's success is one of the most remarkable in the annals of American science and intelligence.

The US Government did not acknowledge that it used satellite systems and imagery for intelligence purposes until 1978. Although President Jimmy Carter then announced that the United States used satellites to verify arms control treaties, it has only been the past few years that officials have talked openly about these systems and their intelligence uses.

CORONA, the program name for a series of satellites with increasingly more accurate cameras, provided coverage of the Soviet Union, China, and other areas from the Middle East to Southeast Asia. From its start in the late 1950s until its retirement in 1972, CORONA (in its several versions) both proved valuable in itself and set the stage for the satellite programs that followed it. For the first time US policymakers had encompassing coverage of the Soviet Union and China that was both timely and accurate. Since the 1960s a significant percentage of finished intelligence—intelligence reports sent to policymakers—has been largely derived from reconnaissance satellites. Satellite imagery is used for a variety of analytical purposes from assessing military strength to estimating the size of grain production. Far and away its greatest utility, however, has been to monitor the deployment of Soviet strategic forces and to verify compliance with arms control agreements. While orbiting the earth, CORONA concentrated principally on photographing the USSR and China. One intelligence community study summarized CORONA's efforts over the Soviet Union:

CORONA's initial major accomplishment was imaging all Soviet medium-range, intermediate-range, and intercontinental ballistic missile launching complexes. CORONA also identified the Plesetsk Missile Test Range, north of Moscow. Repetitive coverage of centers like Plesetsk provided information as to what missiles were being developed, tested, and/or deployed. Also, the unequivocal fact of observation gave the United States freedom from concern over many areas and locations which had been suspect in the past.

Severodvinsk, the main Soviet construction site for ballistic-missile-carrying submarines was first seen by CORONA. Now it was possible to monitor the launching of each new class of submarines and follow it through deployment to operational bases. Similarly, one could observe Soviet construction and deployment of the ocean-going surface fleet. Coverage of aircraft factories and airbases provided an inventory of bomber and fighter forces. Great strides were also made in compiling an improved Soviet ground order of battle.

It was CORONA imagery which uncovered Soviet antiballistic missile activity. Construction of the GALOSH sites around Moscow and the GRIFFON site near Leningrad, together with construction of sites around Tallinn for the Soviet surface-to-air missile known as the SA-5, were first observed in CORONA imagery. HEN HOUSE, DOG HOUSE, and the Soviet Union's first phased-array radars all associated with the Soviet ABM program—were also identified in CORONA imagery.

CORONA "take" was also used to locate Soviet SA-1 and SA-2 installations; later its imagery was used to find SA-3 and SA-5 batteries. The precise location of these defenses provided Strategic Air Command planners with the information needed to determine good entry and egress routes for US strategic bombers.

CORONA imagery was also adapted extensively to serve the needs of the Army Map Service and its successor, the Defense Mapping Agency (DMA). Enhanced by improvements in system attitude control and ephemeris data plus the addition of a stellar-index camera, CORONA eventually became almost the sole source of DMA's military mapping data.

Some explanation of the terms used in the CORONA program may be helpful. The imagery acquired from the satellites and cameras that composed the CORONA program had a specific security system called TALENT-KEYHOLE. This added the codeword KEYHOLE, for satellite collection, to the codeword TALENT, which was originally used for imagery collected by aircraft.

The first four versions of CORONA were designated KH-1 through KH-4 (KH denoted KEYHOLE); KH-4 went through three versions. The camera in KH-1—public cover name DISCOVERER—had a nominal ground resolution of 40 feet. (Ground resolution is the ground size equivalent of the

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smallest visible imagery and its associated space.) By 1963 improvements to the original CORONA had produced the KH-2 and KH-3, with cameras that achieved resolutions of 10 feet.

The first KH-4 mission was launched in 1962 and brought a major breakthrough in technology by using the MURAL camera to provide stereoscopic imagery. This meant that two cameras photographed each target from different angles, which allowed imagery analysts to look at KH-4 stereoscopic photos as three-dimensional. In the KH-4, the workhorse of the CORONA system, three camera models with different resolutions were the principal difference between the versions, KH-4, KH-4A, and KH-4B. By 1967, the J-3 camera of KH-4B had entered service with a resolution of 5 feet. This final version of CORONA continued overflights until 1972.

Two other systems, separate but closely allied with CORONA, also operated during this time with less success. The KH-5, or ARGON, performed mapping services for the Army in a few missions in the early 1960s with mediocre results. The same disappointing performance afflicted the LAN-YARD system, or KH-6, which was both begun and abandoned in 1963.

	Camera	Units Launched	Time Period
KH-1		10	1959-60
КН-2	C' (C Prime)	10	1960-61
КН-3	C''' (C Triple Prime)	6	1961-62
KH-4	M (Mural)	26	1962-63
KH-4A	J (J-1)	52	1964-69
KH-4B	J-3	17	1967-72

The following outlines the CORONA versions from 1959 to 1972:

This volume of newly declassified documents and photos is organized in four parts. Part 1 presents the first history of the CORONA program, an article published in 1973 in a classified special supplement to CIA's professional quarterly, *Studies in Intelligence*. Part 2 provides a brief look at how the interdepartmental Committee on Overhead Reconnaissance, formed in 1960 to coordinate satellite collection, implemented the new system. Part 3 includes a number of National Photographic Interpretation Center and other CIA reports on the analysis of CORONA imagery, while Part 4 concludes with an example of a nonmilitary use of satellite imagery. In each part, a brief introduction is followed by the relevant documents in chronological order.

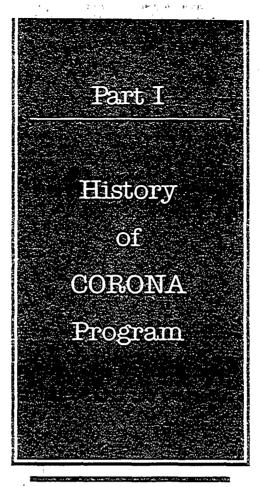
CORONA was the United States' response to a growing need in the 1960s for detailed photographic coverage of countries behind the Iron Curtain. The introduction of newer—and still classified—satellite systems after 1964 further improved the program's utility and performance. The sheer volume of documents and imagery associated with CORONA—its imagery alone is estimated at over 2 million linear shelf feet—made it both important and difficult to select representative samples for this volume.

In the spring of 1992, Robert Gates, then Director of Central Intelligence (DCI), formed the Environmental Task Force to determine how the Intelligence Community could use its technology to assist scientists in studying the environment. Spurred by then Senator Albert Gore, the CIA also formed a DCI Classification Review Task Force to examine the declassification of satellite imagery collected by obsolete, broad-area-search satellite systems. Both the Environmental Task Force and the DCI Classification Review Task Force determined that imagery produced from KH-1 through KH-6 systems offered unusual information for scientists, scholars, and historians. The declassification of this imagery, both panels concluded, presented no threat to national security.

DCI R. James Woolsey approved the recommendations of the two task forces and on 22 February 1995, President William Clinton signed an Executive order directing the declassification of more than 800,000 early satellite images. These images, collected by the CORONA, ARGON, and LANYARD systems, provide extensive coverage of the earth's surface.

This book of documents is but the first installment of information on America's first satellite system. In the years ahead the American public can look forward to a wealth of declassified reports and imagery from the CORONA program.

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Part I: History of the CORONA Program

After the CORONA program drew to a close in 1972, the CIA published a survey account of the program in a special Spring 1973 supplement to its classified professional journal, *Studies in Intelligence*. Kenneth E. Greer's article focuses on the program's early years, its uncertainties and frustrations. CIA manager, Richard M. Bissell, Jr., commented after the second mission—DISCOVERER I—failed in 1959:

It was a most heartbreaking business. If an airplane goes on a test flight and something malfunctions, and it gets back, the pilot can tell you about the malfunction, or you can look it over and find out. But in the case of a recce [reconnaissance] satellite, you fire the damn thing off and you've got some telemetry and you never get it back. There is no pilot, of course, and you've got no hardware, you never see it again. So you have to infer from telemetry what went wrong. Then you make a fix, and if it fails again you know you've inferred wrong. In the case of CORONA it went on and on.¹

In its first years CORONA encountered considerable difficulties, which did not immediately diminish even after the first successful mission in August 1960. Indeed, of the first 30 missions from 1960 through 1962, only 12 were considered productive. The description of the recovery of Mission 1005 in South America illustrates some of the problems that the intelligence community confronted and overcame in developing and employing CORONA.

The *Studies* article also highlights CORONA's considerable achievements. When *The New York Times* on 12 August 1960 reported the safe return of DISCOVERER XIII and its triumphant procession from the Pacific Ocean to President Eisenhower at the White House, the paper immediately recognized that this startling reentry signaled a new era:

The technological feat marks an important step toward the development of reconnaissance satellites that will be able to spy from space. The same ejection and recovery techniques eventually will be used for returning photographs taken by reconnaissance satellites. Indirectly the technique will also contribute to the eventual return of manned spacecraft.

Within a week, Air Force Capt. Harold E. Mitchell and his crew conducted the first aerial recovery when DISCOVERER XIV (or Mission 9009), the first satellite with film, returned to earth on 19 August 1960. Six days later,

¹Quoted in Leonard Mosley, Dulles: A Biography of Eleanor, Allen, and John Foster Dulles and Their Family Network (New York: The Dial Press/James Wade, 1978), p. 432. President Eisenhower and Director of Central Intelligence Allen Dulles inspected the mission's photographs. In films "good to very good," the camera had photographed 1.5 million square miles of the Soviet Union and East European countries. From this imagery 64 Soviet airfields and 26 new surface-to-air missile (SAM) sites were identified. That the first satellite mission could produce such results stunned knowledgeable observers from imagery analysts to the President. 1. Kenneth E. Greer, "Corona," Studies in Intelligence, Supplement, 17 (Spring 1973): 1-37.

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The first photographic reconnaissance satellite

CORONA

Kenneth E. Greer

When the U-2 began operating in the summer of 1956, it was expected to have a relatively short operational life in overflying the Soviet Union—perhaps no more than a year or two. That expectation was based not so much on the likelihood that the Soviets could develop the means of shooting it down, as on their ability to develop a radar surveillance network capable of tracking the U-2 reliably. With accurate tracking data in hand, the Soviets could file diplomatic protests with enough supporting evidence to generate political pressures to discontinue the overflights. As it turned out, the United States had underestimated the Soviet radars, which promptly acquired and continuously tracked the very first U-2 flight over Soviet territory. The Soviets filed a formal protest within days of the incident, and a standdown was ordered.

For nearly four years, the U-2 ranged over much of the world, but only sporadically over the Soviet Union. Soviet radar was so effective that each flight risked another protest, and another standdown. Clearly, some means had to be found to accelerate the initial operational capability for a less vulnerable successor to the U-2. Fortunately, by the time Francis Gary Powers was shot down near Sverdlovsk on 1 May 1960 (fortunate for the intelligence community, that is—not for Powers), an alternative means of carrying out photographic reconnaissance over the Soviet Union was approaching operational readiness. On 19 August 1960, just 110 days after the downing of the last U-2 overflight of the Soviet Union, the first successful air catch was made near Hawaii of a capsule of exposed film ejected from a photographic reconnaissance satellite that had completed seven passes over denied territory and 17 orbits of the earth. The feat was the culmination of four years of intensive and often frustrating effort to build, launch, orbit, and recover an intelligence product from a cameracarrying satellite.

At about the time the U-2 first began overflying the Soviet Union in 1956, the U.S. Air Force was embarking on the development of a strategic reconnaissance weapons system employing orbiting satellites in a variety of collection configurations. The program, which was designated WS-117L, had its origins in 1946 when a requirement was placed on the RAND Corporation for a study of the technical feasibility of orbiting artificial satellites. The first real breakthrough had come in 1953 when the USAF Scientific Advisory Board reported to the Air Staff that it was feasible to produce relatively small and light-weight thermonuclear warheads. As a result of that report, the ATLAS ICBM program was accorded the highest priority in the Air Force.

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Since the propulsion required to place a satellite in orbit is of the same general order of magnitude as that required to launch an ICBM, the achievement of an ICBM-level of propulsion made it possible to begin thinking seriously of launching orbital satellites. Accordingly, General Operational Requirement No. 80 was levied in 1955 with the stated objective of providing continuous surveillance of pre-selected areas of the world to determine the status of a potential enemy's war-making capacity.

The Air Research and Development Command, which had inherited the RAND study program in 1953, assigned the satellite project to its Ballistic Missile Division. The development plan for WS-117L was approved in July 1956, and the program got under way in October 1956 with the awarding of a contract to the Lockheed Aircraft Corporation for the development and testing of the system under the program name

The planning for WS-117L contemplated a family of separate systems and subsystems employing satellites for the collection of photographic, (and infrared intelligence. The program, which was scheduled to extend beyond 1965, was divided into three phases. Phase I, the THOR-boosted test series, was to begin in November 1958. Phase II, the ATLAS-boosted test series, was scheduled to begin in June 1959 with the objective of completing the transition from the testing phase to the operational phase and of proving the capability of the ATLAS booster to launch heavy loads into space. Phase III, the operational series, was to begin in March 1960 and was to consist of three progressively more sophisticated systems: the Pioneer version (photographic and , and the Survel-), the Advanced version (photographic and lance version (photographic, and infrared). It was expected that operational control of WS-117L would be transferred to the Strategic Air Command with the initiation of Phase III.

It was an ambitious and complex program that was pioneering in technical fields about which little was known. Not surprisingly, it had become apparent by the end of 1957 that the program was running behind schedule. It also was in trouble from the standpoint of security. The U-2 program was carried out in secret from 1956 until May 1960. Its existence was no secret to the Soviets, of course, but they chose to let it remain a secret to the general public (and to most of the official community) rather than publicize it and thereby admit that they lacked the means of defending their air space against the high-flying U-2. WS-117L was undertaken as a classified project, but its very size and the number of people involved made it impossible to conceal the existence of the program for long. The press soon began speculating on the nature of the program, correctly identifying it as involving military reconnaissance satellites, and referring to it as BIC BROTHER and SPY IN THE SKY. The publicity was of concern, because the development of WS-117L was begun in a period when the international political climate was hostile to any form of overflight reconnaissance.

It was against this background that the President's Board of Consultants on Foreign Intelligence Activities submitted its semi-annual report to the President on 24 October 1957. The Board noted in its report that it was aware of two

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advanced reconnaissance systems that were under consideration. One was a study then in progress in the Central Intelligence Agency concerning the feasibility of a manned reconnaissance aircraft designed for greatly increased performance and reduced radar cross-section; the other was WS-117L. However, there appeared little prospect that either of these could produce operational systems earlier than mid-1959. The Board emphasized the need for an interim photo reconnaissance system and recommended that an early review be made of new developments in advanced reconnaissance systems to ensure that they were given adequate consideration and received proper handling in the light of thenexisting and future intelligence requirements. The Executive Secretary of the National Security Council on 28 October notified the Secretary of Defense and the Director of Central Intelligence that the President had asked for a joint report from them on the status of the advanced systems. Secretary Quarles responded on behalf of himself and Mr. Dulles on 5 December with a recommendation that, because of the extreme sensitivity of the subject, details on the new systems be furnished through oral briefings.

As a consequence, there are no official records in CIA's Project CORONA files bearing dates between 5 December 1957 and 21 March 1958, but it is clear that major decisions were made and that important actions were undertaken during the period. In brief, it was decided that the photographic subsystem of WS-117L offering the best prospect of early success would be separated from WS-117L, designated Project CORONA, and placed under a joint CIA-Air Force management team—an approach that had been so successful in covertly developing and operating the U-2.

The nucleus of such a team was then constituted as the Development Projects Staff under the direction of Richard Bissell, who was Special Assistant to the DCI for Planning and Development. Bissell was designated as the senior CIA representative on the new venture, and his Air Force counterpart was Brigadier General Osmond Ritland, who, as Colonel Ritland, had served as Bissell's first deputy in the early days of the Development Projects Staff and later became Vice Commander of the Air Force Ballistic Missile Division.

Bissell recalls that he first learned of the new program and of the role intended for him in it "in an odd and informal way" from Dr. Edwin Land. Dr. Land had been deeply involved in the planning and development of the U-2 as a member of the Technological Capabilities Panel of the Office of Defense Mobilization. He continued an active interest in overhead reconnaissance and later headed the Land Panel, which was formed in May 1958 to advise on the development of OXCART, the aircraft planned as the successor to the U-2. Bissell also recalls that his early instructions were extremely vague: that the subsystem was to be split off from WS-117L, that it was to be placed under separate covert management, and that the pattern established for the development of the U-2 was to be followed. One of the instructions, however, was firm and precise: none of the funds for the new program were to come from monies authorized for already approved Air Force programs. This restriction, although seemingly clear at first glance, later led to disagreement over its interpretation. CORONA mangement expected that the boosters already approved

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Corona

for the THOR test series of WS-117L would simply be diverted to the CORONA program; this proved not to be so. As a consequence, CIA had to go back to the President with an admission that the original project proposal had understated the estimated cost and with a request for more money.

Roughly concurrent with the decision to place one of the WS-117L subsystems under covert management, the Department of Defense realigned its structure for the management of space activities. The Advanced Research Projects Agency (ARPA) was established on 7 February 1958 and was granted authority over all military space projects. The splitting off of CORONA from WS-117L was accomplished by a directive from ARPA on 28 February 1958, assigning responsibility for the WS-117L program to the Air Force and ordering that the proposed WS-117L interim reconnaissance system employing THOR boost be dropped.

The ARPA directive ostensibly cancelling the THOR-boosted interim reconnaissance satellite was followed by all of the notifications that would normally accompany the cancellation of a military program. The word was passed officially within the Air Force, and formal contract cancellations were sent out to the prospective suppliers. There was much furore when the cancellations went out: contractors were furious over the suddenness of the action; Air Force personnel were thunderstruck at the abandonment of the WS-117L photographic subsystem that seemed to have the best chance of early success. After the cancellation, very limited numbers of individuals in the Air Force and in the participating companies were cleared for Project CORONA and were informed of the procedures to be followed in the covert reactivation of the cancelled program.

After Bissell and Ritland had worked out the arrangements for the

technical problems associated with the design configuration they had inherited from WS-117L. The subsystem in point contemplated the use of the THOR IRBM as the first stage booster and, as a second stage, Lockheed's modification of a rocket engine that had been developed by Bell Aircraft for take-off assist and auxiliary power applications in the B-58 HUSTLER bomber. It was referred to as the HUSTLER engine during the development phase of WS-117L but soon came to be known as the AGENA—the name it bears today.

One of the very early CORONA plans called for spin stabilization of the payload, with the camera scanning as the payload rotated. The contractors working on this subsystem design were Lockheed on the space vehicle, and Fairchild on the camera. The camera was to have a focal length of six inches, without image motion compensation. Ground resolution was expected to be poor with

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this short focal length, particularly if combined with the readout techniques envisaged by WS-117L.

Several important design decisions were implemented in this organizational period of CORONA. Recognizing the need for resolution to meet the intelligence objectives, it was concluded that physical film recovery offered the most promising approach for a usable photographic return in the interim time period. This resulted in the addition to the design of a recovery pod or capsule with General Electric selected as the recovery vehicle contractor. In retrospect, the decision on film recovery would prove to be one of the most important made in U.S. reconnaissance activities, in that all photo reconnaissance systems developed up to the current time have relied on physical recovery of film.

Another major decision for the new CORONA Program came in late March 1958, following a three-day conference in San Mateo, California, among representatives of CIA, Air Force Ballistic Missile Division, Lockheed, General Electric, and Fairchild. The discussion revealed that, while work was going forward, the design was far from complete. The senior Lockheed representative reported that they had investigated the possibility of building a satellite vehicle shaped like a football, a cigar, or a sphere. They had finally decided, for the original drawings at least, on a football-shaped pod slightly elongated at each end to correct the center of gravity. There was discussion of the need for immediate contractual arrangements with the various suppliers. Bissell remarked that he was "faced with the problem at present of being broke" and would need estimates from all the suppliers as soon as possible in order to obtain the necessary financing to get the program under way. The suppliers agreed to furnish the required estimates by the following week.

The project quickly began taking formal shape following that meeting. Within a span of about three weeks, approval of the program and of its financing was obtained, and the design of the payload configuration evolved into a concept quite different from the spin-stabilized pod. It was at this point in late March and early April 1958 that major complications had arisen in the technical design of the Fairchild camera. Interest shifted to a competitive design submitted by the Itek Corporation, a spin-off of Boston University. Itek proposed a longer focal length camera scanning within an earth-center stabilized pod. The Itek design was based on the principle of the Boston University Hyac camera. Bissell recalls that he personally decided in favor of the Itek design, but only after much agonizing evaluation. The decision was a difficult one to make because it involved moving from a proven method of space vehicle stabilization to one that was technically more difficult to accomplish. It did, however, standardize on the 3-axis stabilization being pursued on the WS-117L AGENA development, and which has been a part of all subsequent photo reconnaissance systems.

Bissell's first project proposal, which was completed on 9 April 1958, requested approval for concurrent development of both the Fairchild and the Itek systems, with the Fairchild configuration becoming operational first and the Itek configuration being developed as a follow-on system. Within two days, however, Bissell had made the final decision to abandon the Fairchild spin-stabilized configuration entirely. He rewrote the project proposal, taking note of the earlier

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configuration and giving his reasons for favoring the Itek approach (principally the better resolution attainable, the lower overall cost, and the greater potential for growth). The proposal was rewritten a second time, retaining the Itek configuration but raising the cost estimate from from to for the total estimated cost, for the proposal represented "a rather arbitrary allowance" for 12 each THOR boosters and Lockheed second stage vehicles, and was to be financed by ARPA through the Air Force. The remaining for the was for the poly CIA of the poly containing the reconnaissance equipment and the recoverable film cassettes.

The final project proposal was forwarded to Brigadier General Andrew J. Goodpaster, the President's Staff Secretary, on 16 April 1958 after having been reviewed by Mr. Roy Johnson and Admiral John Clark of ARPA; Mr. Richard Horner, Assistant Secretary of the Air Force for Research and Development; Brigadier General Osmond Ritland, Vice Commander, Air Force Ballistic Missile Division; and Dr. James Killian, Special Assistant to the President for Science and Technology. The proposal was approved, although not in writing. The only original record of the President's approval reportedly was in the form of a handwritten note on the back of an envelope by General C. P. Cabell, the Deputy Director of Central Intelligence.

Although it may have been the original intent that CORONA would be administered in a manner essentially the same as that of the U-2 program, it actually began and evolved quite differently. It was a joint CIA-ARPA-Air Force effort, much as the U-2 was a joint CIA-Air Force effort, but it lacked the central direction that characterized the U-2 program. The project proposal described the anticipated administrative arrangements, but it fell short of clarifying the delineation of authorities. It noted that CORONA was being carried out under the authority of ARPA and CIA with the support and participation of the Air Force. CIA's role was further explained in terms of participating in supervision of the technical development, especially as regards the actual reconnaissance equipment, handling all

contractor, on 25 April 1958 noted merely that technical direction of the program was the joint responsibility of several agencies of the Government.

The imprecise statements of who was to do what in connection with CORONA allowed for a range of interpretation. The vague assignments of responsibilities caused no appreciable difficulties in the early years of CORONA when the joint concern was primarily one of producing as promised, but they later (1963) became a source of severe friction between CIA and the Air Force over responsibility for conducting the program.

Bissell, the recognized leader of the early CORONA program, gave this description of how the early program was managed:

The program was started in a marvelously informal manner. Ritland and I worked out the division of labor between the two organizations as we went along. Decisions were made jointly. There were so few people involved and their relations were so close that decisions could be and were made quickly and cleanly. We did not have the problem of having to make

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compromises or of endless delays awaiting agreement. After we got fully organized and the contracts had been let, we began a system of management through monthly suppliers' meetings—as we had done with the U-2. Ritland and I sat at the end of the table, and I acted as chairman. The group included two or three people from each of the suppliers. We heard reports of progress and ventilated problems—especially those involving interfaces among contractors. The program was handled in an extraordinarily cooperative manner between the Air Force and CIA. Almost all of the people involved on the Government side were more interested in getting the job done than in claiming credit or gaining control.

The schedule of the program, as it had been presented to the CORONA group at its meeting in San Mateo in late March 1958, called for a "count-down" beginning about the first of July 1958 and extending for a period of 19 weeks. It was anticipated that the equipment would be assembled, tested, and the first vehicle launched during that 19-week period, which meant that the fabrication of the individual components would have had to be completed by 1 July 1958. By the time Bissell submitted his project proposal some three weeks later, it had become apparent that the earlier tentative scheduling was unrealistic. Bissell noted in his project proposal that it was not yet possible to establish a firm schedule of delivery dates, but that it appeared probable that the first firing could be attempted no later than June 1959.

It is pertinent to note here that there was no expectation in 1958 that CORONA would still be operating over a decade later. The CORONA program got under way initially as an interim, short-term, high-risk development to meet the intelligence community's requirements for area search photographic reconnaissance pending successful development of other, more sophisticated systems planned for WS-117L. The original CORONA proposal anticipated the acquisition of only 12 vehicles, noting that at a later date it might be desirable to consider whether the program should be extended—with or without further technological improvement.

Having settled on the desired configuration and having received Presidential approval of the program and its financing, the CORONA management team moved forward rapidly with the contractual arrangements. The team of contractors for CORONA differed from the team on the WS-117L subsystem as a consequence of selecting Itek's earth-center stabilized approach. Itek was brought in as one of the two major subcontractors to Lockheed (General Electric being the other). However, to soften the financial blow to Fairchild, Itek was made responsible for the design and development of the camera subsystem with Fairchild producing the camera under subcontract to Itek. This contractor team continued throughout the CORONA program, although later in the program, the relationship was changed to that of associate contractors. The contractor relationships on the CORONA program were as friendly and cooperative as any that could have been set up, and this team dedication to the success of the program is one of the primary reasons for the success the program enjoyed. The final contractors were selected on 25 April 1958 and a work statement was issued to Lockheed on that date. The contractors began systems design on 28 April

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and completed them and submitted them for first review on 14 May. The designs were frozen on 26 July.



Thus, by mid-1958, the program was well down the road-on the contractors' side-toward meeting the goal of a first launch no later than mid-1959. The Government side, however, was running into difficulties. The first problem was money, the second was cover, and the two were inextricably intertwined. The cost estimate for the 12-vehicle program had assumed that the cost of the THOR boosters would be absorbed by the Air Force by diverting them from the cancelled WS-117L subsystem. That assumption proved to be had to be found to pay for the 12 THORs. incorrect. An additional Further, it had been decided that an additional four launch vehicles would be required for testing of launch, orbit, and recovery procedures and that an additional three would be required for biomedical launches in support of the CORONA cover story. ARPA could not see its way clear to making Defense Department funds available merely for testing or for cover support when there were other DoD space programs with pressing needs for money. Consequently, CORONA management had to go back to the President for approval of a revised estimate.

By August 1958, it had also become apparent to the project's managers that the original, but as yet unannounced, cover story conceived for the future CORONA launchings (an experimental program within the first phase of WS-117L) was becoming increasingly untenable. WS-117L had by then become the subject of fairly widespread public speculation identifying it as a military reconnaissance program. It was feared that linking CORONA to WS-117L in any way would inevitably place the reconnaissance label on CORONA, and—given the hostility of the international political climate to overflight reconnaissance there was the risk that the policy level of government might cancel the program if it should be so identified. Some other story would have to be contrived that would dissociate CORONA from WS-117L and at the same time account for multiple launchings of stabilized vehicles in low polar orbits and with payloads being recovered from orbit.

It was decided, therefore, to separate the WS-117L photo reconnaissance program into two distinct and ostensibly unrelated series: one identified as

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DISCOVERER (CORONA – THOR boost) and the other as SENTRY (later known as SAMOS – ATLAS boost). A press release announcing the initiation of the DISCOVERER series was issued on 3 December 1958 identifying the initial launchings as tests of the vehicle itself and later launchings as explorations of environmental conditions in space. Biomedical specimens, including live animals, were to be carried into space and their recovery from orbit attempted.

The new CORONA cover concept, from which the press release stemmed, called for a total of five biomedical vehicles, and three of the five were committed to the schedule under launchings three, four, and seven. The first two were to carry mice and the third a primate. The two uncommitted vehicles were to be held in reserve in event of failure of the heavier primate vehicle. In further support of the cover plan, ARPA was to develop two radiometric payload packages designed specifically to study navigation of space vehicles and to obtain data useful in the development of an early warning system (the planned to obtain data useful). It might be noted here that only one of the three planned animal-carrying missions was actually attempted (as DISCOV-ERER III), and it was a failure. ARPA did develop the radiometric payload packages, and they were launched as DISCOVERERS XIX and XXI in late 1960 and early 1961.

The photo reconnaissance mission of CORONA necessitated a near-polar orbit, by launching either to the north or to the south. There are few otherwise suitable areas in the continental United States where this can be done without danger that debris from an early in-flight failure could fall into populated areas. Cooke Air Force Base[•] near California's Point Arguello met the requirement for downrange safety, because the trajectory of a southward launch from there would be over the Santa Barbara channel and the Pacific Ocean beyond. Cooke was a natural choice, because it was the site of the first Air Force operational missile training base and also housed the 672nd Strategic Missile Squadron (THOR). Two additional factors favored this as the launch area: the manufacturing facilities and skilled personnel required were in the near vicinity, and a southward launch would permit recovery in the Hawaii area by initiating the ejection/ recovery sequence as the satellite passed over the Alaskan tracking facility.

Unlike the U-2 flights, launchings of satellites from U.S. soil simply could not be concealed from the public. Even a booster as small as the THOR (small, that is, in comparison with present-day space boosters) launches with a thunderous roar that can be heard for miles; the space vehicle transmits telemetry that can be intercepted; and the vehicle can be detected in orbit by radar skintrack. The fact of a launch could not be concealed, but maintenance of the cover story for the DISCOVERER series required that the launchings of the uniquely configured photographic payloads be closed to observation by unwitting personnel. Vandenberg was excellent as a launch site from many standpoints, but it had one feature that posed a severe handicap to screening the actual launches from unwanted observation: the heavily traveled Southern Pacific railroad passes through it. The early launches from Vandenberg had to

*Cooke AFB was renamed Vandenberg AFB in October 1958.

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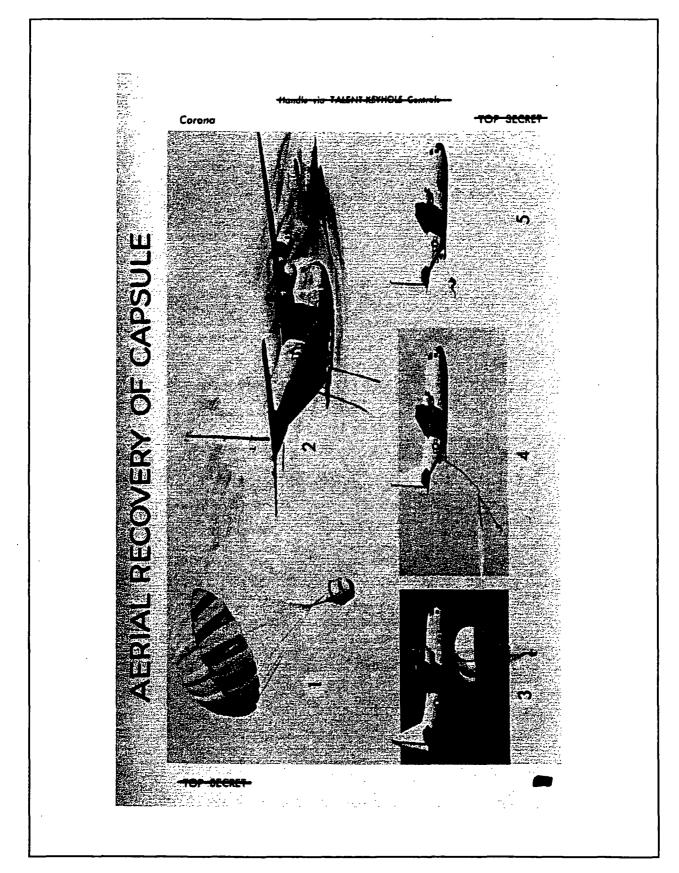
be timed for early afternoon,* and the Southern Pacific schedule broke this period into a series of launch windows, some of which were no more than a few minutes between trains. Throughout its existence, the CORONA program at Vandenberg was plagued by having to time the launches to occur during one of the intervals between passing trains.

The planned recovery sequence involved a series of maneuvers, each of which had to be executed to near-perfection or recovery would fail. Immediately after injection into orbit, the AGENA vehicle was yawed 180 degrees so that the recovery vehicle faced to the rear. This maneuver minimized the control gas which would be required for re-entry orientation at the end of the mission, and protected the heat shield from molecular heating, a subject of considerable concern at that time. (Later in the J-3 design when these concerns had diminished, the vehicle would be flown forward until re-entry.) When re-entry was to take place, the AGENA would then be pitched down through 60 degrees to position the satellite recovery vehicle (SRV) for retro-firing. Then the SRV would be separated from the AGENA and be spin-stabilized by firing the spin rockets to maintain it in the attitude given it by the AGENA. Next the retro-rocket would be fired, slowing down the SRV into a descent trajectory. Then the spin of the SRV would be slowed by firing the de-spin rockets. Next would come the separation of the retro-rocket thrust cone followed by the heat shield and the parachute cover. The drogue (or deceleration) chute would then deploy, and finally the main chute would open to lower the capsule gently into the recovery area. The primary recovery technique involved flying an airplane across the top of the descending parachute, catching the chute or its shrouds in a trapeze-like hook suspended beneath the airplane and then winching the recovery vehicle aboard. C-119 Aircraft were initially used with C-130 aircraft replacing them later in the program. The recovery vehicle was designed to float long enough, if the air catch failed, for a water recovery by helicopter launched from a surface ship.

While the vehicle was still in the construction stage, tests of the air recovery technique were conducted by the 6593rd Test Squadron—with disheartening results. Of 74 drops using personnel-type chutes, only 49 were recovered. Using one type of operational drop chute, only four were recovered out of 15 dropped, and an average of 1.5 aircraft passes were required for the hook-up. Eleven drops with another type of operational chute resulted in five recoveries and an average of two aircraft passes for the snatch. Part of the difficulty lay in weak chutes and rigging, and in crew inexperience. The most serious problem, however, was the fast drop rate of the chutes. Parachutes that were available to support the planned weight of the recovery vehicle had a sink rate of about 33 feet per second. What was required was a sink rate approaching 20 feet per second so that the aircraft would have time to make three or four passes if necessary for hook-up. Fortunately, by the time space hardware was ready for launching,

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^{*}The early THOR-AGENA combination limited film to enough for a 24-hour mission of 17 orbits, seven of which would cross denied territory. Requirements for daylight recovery and for daylight passage over denied areas with acceptable sun angles dictated the afternoon launch time.



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a parachute had been developed with a sink rate slow enough to offer a reasonable chance of air recovery.

The launch facilities at Vandenberg AFB were complete, and the remote tracking and control facilities which had been developed for WS-117L were ready for the first flight test of a THOR-AGENA combination in January 1959. The count-down was started for a launch on the 21st; however, the attempt aborted at launch minus 60 minutes. When power was applied to test the AGENA hydraulic system, certain events took place that were supposed to occur in flight but not while the vehicle was still sitting on the launch pad. The explosive bolts connecting the AGENA to the THOR detonated, and the ullage rockets[•] fired. The AGENA settled into the fairing attaching it to the THOR and did not fall to the ground, but appreciable damage was done.

A program review conference was held in Palo Alto two days after the launch failure to examine the possible causes of the abort and to assess its impact on the planned CORONA launch schedule. Fortunately, the problem was quickly identified and easily corrected, and it was felt that the system was ready for test launches at the rate of about one per month.

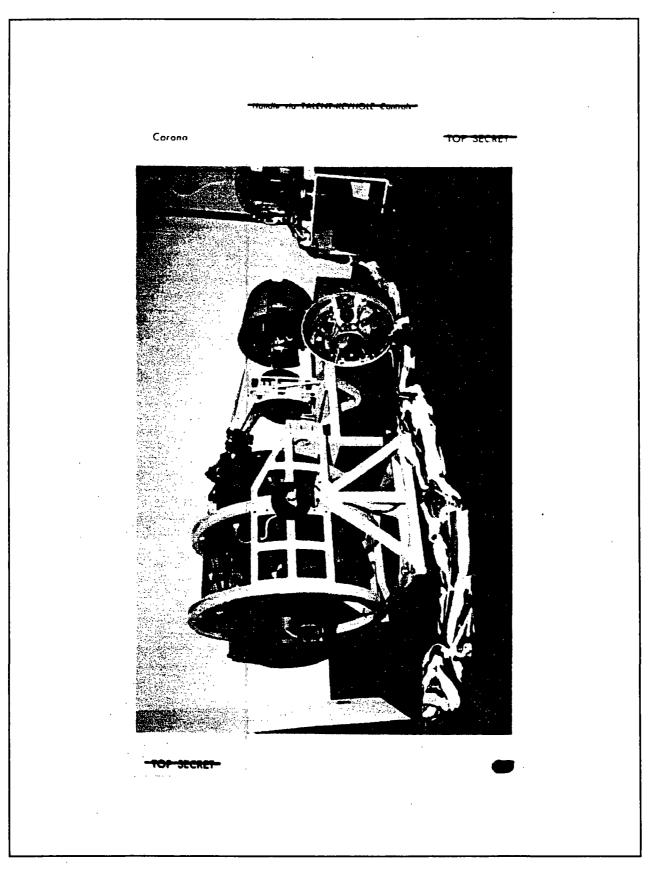
At the review conference, General Electric surfaced a new problem having to do with the stability of the nose cone during re-entry. The cone was designed for a film load of 40 pounds, but the first missions would be able to carry only 20 pounds. CE reported that about three pounds of ballast would have to be carried in the forward end of the cone to restore stability. The program officers decided to add an instrument package as ballast, either for diagnostic purposes or for support of the biomedical cover story, thus converting what could have been dead weight into a net plus for the test program.

The test plan contemplated arriving at full operational capability at a relatively early date through sequential testing of the major components of the system beginning with the THOR-AGENA combination alone, then adding the nose cone to test the ejection/re-entry/recovery sequence, and finally installing a camera for a full CORONA systems test. Just how much confidence the project planners had in the imminence of success cannot now be discovered; however, if the confidence factor was very high at the start, it must soon have begun to wane. Beginning in February 1959 and extending through June 1960 an even dozen launches were attempted, with eight of the vehicles carrying cameras, and all of them were failures; no film capsules were recovered from orbit. Of the eight camera-carrying vehicles, four failed to achieve orbit, three experienced camera or film failures, and the eighth was not recovered because of a malfunction of the re-entry body spin rockets. These summaries of the initial launch attempts illustrate the nature and dimensions of the problems for which solutions had to be found.

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^{*}Ullage rockets are small solid propellant rockets attached to the AGENA. These rockets are fired just prior to ignition of the AGENA engine after its separation from the THOR to insure that the liquid AGENA propellants are pushed against the bottom of the tanks so that proper flow into the pumps will occur.

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DISCOVERER 1

The on-pad failure of 21 January was not assigned a number in the DIS-COVERER series. DISCOVERER I was launched on 28 February 1959 with a light engineering payload as a test of THOR-AGENA performance. No recovery was planned. For a time there was uncertainty as to what had happened to it because no radio signals were received. At the time, it was believed to have obtained orbit with speculation that the protective nose cone over the antennas was ejected just before the AGENA fired and that the AGENA then rammed into the nose cone, damaging the antennas. Today, most people believe the DISCOVERER I landed somewhere near the South Pole.

DISCOVERER II

The second vehicle was launched on 13 April 1959. Orbit was officially announced about two hours later, along with a statement that the capsule carried a lightweight biomedical payload (as indeed it did). The Air Force reported on 15 April that plans to recover the capsule near Hawaii had been abandoned and that the capsule might descend somewhere in the Arctic. The announcement slightly understated the known facts. The capsule had ejected on the 17th orbit as planned, but a timing malfunction (actually a human programming error) had caused the ejection sequence to be initiated too early. The capsule was down, probably somewhere in the near-vicinity of the Spitsbergen Islands north of Norway. In fact, there were later reports that the falling capsule had actually been seen by Spitsbergen residents. The Air Force announced on the 16th that the Norwegian government had authorized a search for the capsule which would begin the following day. Planes scoured the area, and helicopters joined the search on the 20th. Nothing was found, however, and the search was abandoned

DISCOVERER III

Much publicity attended the launching of DISCOVERER III: some of it planned and some uplanned (and unwanted). This was the first (and only) DISCOVERER flight to carry animals: four live black mice. Black mice were chosen in order to ascertain the possible hair-bleaching effects of cosmic rays. The mice were members of the C-57 strain, a particularly rugged breed. They had been "trained," along with 60 other mice, at the Air Force's Aeromedical Field Laboratory at Holloman AFB. They were seven to ten weeks old and

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weighed slightly over an ounce apiece. A three-day food supply was provided, which consisted of a special formula containing peanuts, oatmeal, gelatin, orange juice, and water. Each mouse was placed in a small individual cage about twice its size, and each had a minuscule radio strapped to its back to monitor the effects of the space trip on heart action, respiration, and muscular activity.

The lift-off on 3 June 1959 was uneventful, but, instead of injecting approximately horizontally into orbit, the AGENA apparently fired downward, driving the vehicle into the Pacific Ocean and killing the mice. Looking back on the mission, the attempt to orbit the mice seems to have been jinxed from the very beginning.

Just before the first try at launch, telemetry indicated a lack of mouse activity. It was thought at first that the little fellows were merely asleep, so a technician was sent up in a cherry-picker to arouse them. He banged on the side of the vehicle and tried catcalls, but to no avail. When the capsule was opened, the mice were found to be dead. The cages had been sprayed with krylon to cover rough edges; the mice had found it tastier than their formula; and that was that.

"The Mouse That Poured"

The second try at launch several days later, with a back-up mouse "crew," was a near-abort when the capsule life cell humidity sensor suddenly indicated 100 percent relative humidity. The panic button was pushed, and troubleshooters were sent up to check. They found that when the vehicle was in a vertical position the humidity sensor was directly beneath the cages, and it did not distinguish between plain water and urine. The wetness dried out after a while, all was forgiven, and the vehicle was launched—unhappily into the permanent 100 percent moisture environment of the Pacific Ocean.

Also, the timing of the launch was unfortunate. The monkeys, Able and Baker, had survived a 300-mile flight in a JUPITER nose cone on 29 May in connection with another, unrelated test program. However, Able died during minor surgery on 3 June to remove an electrode that had been implanted under his skin. (This was the date of the DISCOVERER III launch.) The British Society Against Cruel Sports made a formal protest to the U.S. Ambassador, and the press raised quite a stink about the fatal mice flight—comparing it unfavorably with the Russians' successful launching of the dog, Laika, in SPUTNIK II back in November 1957, and demanding that orbit and recovery procedures be perfected before attempting further launches of mice or monkeys.

DISCOVERERS IV-VIII

DISCOVERER IV on 25 June 1959 was the first to carry a camera and thus the first true CORONA test, but the payload did not go into orbit. DISCOVERER V, again with a camera, attained orbit but the temperature inside the spacecraft was abnormally low and the camera failed on the first orbit. The recovery

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capsule was ejected at the proper time, but never showed up; early in 1960 it was discovered in a high near-polar orbit with an apogee of 1,058 miles. Failure of the spin rocket had caused the retro-rocket to accelerate rather than de-boost the package. DISCOVERER VI went into orbit six days later, but the camera failed on the second revolution, and the retro-rocket failed on the recovery attempt.*

DISCOVERER VII on 7 November did not go into orbit. DISCOVERER VIII on 20 November went into an eccentric orbit with an apogee of 913 miles, and the camera failed again. The recovery vehicle was ejected successfully, but the parachute failed to open.

It had become plain by the end of November 1959 that something (or, to be more precise, many things) had to be done to correct the multiple failures that were plaguing the CORONA system. Eight THOR-ACENA combinations and five cameras had been expended with nothing to show for the effort except accumulated knowledge of the system's weaknesses. The project technicians knew what was going wrong, but not always why. Through DISCOVERER VIII, the system had experienced these major failures:

One misfired on the launch pad.

Three failed to achieve orbit.

Two went into highly eccentric orbits.

One capsule ejected prematurely.

Two cameras operated briefly and then failed.

One camera failed entirely.

One experienced a retro-rocket malfunction.

One had very low spacecraft temperature.

A panel of consultants reviewed the various failures and their probable causes and concluded that what was needed most was "qualification, requalification, and multiple testing of component parts" before assembling them and sending them aloft. This called for more money. Accordingly, Bissell submitted a project amendment to the DDCI on 22 January 1960 asking approval of nearly additional to cover the costs of the testing program. He apologized to General Cabell for submitting a request for funds to pay for work that was already under way: "Although such a sequence is regrettable, there has been con-

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[•]One of these early launches tested a system for concealing the tell-tale payload doors from inquisitive eyes near the launch pad. The scheme was to cover them with paper, fastened over two lengths of piano wire with pingpong balls at the front end. The air flow at launch would use the pingpong balls and wire as "ripcords" to strip away the paper. The idea was tested on the side of a sports car simulating launch velocity as nearly as possible on the Bayshore Freeway late one evening. The test proved that the ripcords worked, and that Freeway patrolmen could overhaul a vehicle going only 90 m.p.h. Unfortunately, the ripcords malfunctioned on the next actual launch, and there was no consensus for another test round with the Freeway police.

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siderable confusion in this program as to what the amount of the overruns would be and this has made it difficult to obtain approvals in an orderly fashion in advance."

As of the fall of 1959, major problems remained to be solved in achieving an acceptable orbit, in camera functioning, and in recovering the film capsule. These were the more serious of the specific failures that were occupying the attention of the technicians:

The AGENA vehicle was designed for use with both the THOR and the ATLAS boosters. The ascent technique used by the AGENA vehicle was essentially the same in both combinations, but there were significant differences in the method of employing the booster. In the CORONA program, in order to conserve weight, the THOR booster followed a programmed trajectory using only its autopilot. Also, the THOR thrust was not cut off by command at a predetermined velocity (as in the ATLAS); instead, its fuel burned to near-exhaustion. This relatively inaccurate boosting profile, coupled with the low altitude of CORONA orbits, required great precision in the orbital injection. At a typical injection altitude of 120 miles, an angular error of plus or minus 1.1 degrees or a velocity deficit of as little as 100 feet per second would result in failure to complete the first orbit. This had happened repeatedly. Lasting relief from this problem lay some distance in the future: a more powerful AGENA was being developed, and the weight of instrumentation for measuring in-flight performance on the early flights would be reduced on later operational missions. The shortterm remedy lay in a drastic weight-reduction program. This was carried out in part (literally, it is said) by attacking surplus metal with tin snips and files.

The system was designed to operate without pressurization (again to conserve weight), and the acetate base film being used was tearing or breaking in the high vacuum existing in space and causing the camera to jam. A solution for this problem was found in substituting polyester for acetate base film. The importance to the reconnaissance programs of this achievement by Eastman Kodak in film technology cannot be overemphasized. It ranks on a level with the development of the film recovery capsule itself. The first orbital flight in which the camera was operated with polyester film was DISCOVERER XI (Mission 9008) in April 1960. Although recovery was not successful, one of the major space reconnaissance problems had been solved.

The equipment was built to work best at an even and predetermined temperature. To save weight, only passive thermal control was provided. The spacecraft's internal temperature had varied on the flights thus far, and it was much lower than desired on one flight. An interim solution for this problem was found in varying the thermal painting of the vehicle skin.

The spin and de-spin rockets used to stabilize the recovery vehicle during re-entry had a tendency to explode rather than merely to fire. Several had blown up in ground tests. A solution was found in substituting cold gas spin and de-spin rockets.

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One of the most intractable problems, which was to persist for many months, was that of placing the satellite recovery vehicle (SRV) into a descent trajectory that would terminate in the recovery zone. This required ejecting the SRV from the AGENA at precisely the right time, and decelerating it by retro-rocket firing to the correct velocity and at a suitable angle. There was very little margin for error in this phase: each one-second error in ejection timing could shift the recovery point five miles; a retrovelocity vector error of more than ten degrees would cause the capsule to miss the recovery zone completely.

One might ask why the CORONA program officers persisted in the face of such adversity. The answer lay in the overwhelming intelligence needs of the period. The initial planning of CORONA began at a time when we did not know how many BEAR and BISON aircraft the Soviets had, whether they were introducing a new and far more advanced long range bomber than the BISON, or whether they had largely skipped the build-up of a manned bomber force in favor of missiles. There had been major changes in intelligence estimates of Soviet nuclear capabilities and of the scope of the Soviet missile program on the basis of the results of the relatively small number of U-2 missions approved for the summer of 1957. However, by 1959, the great "missile gap" controversy was very much in the fore. The Soviets had tested ICBM's at ranges of 5,000 miles, proving they had a capability of building and operating them. What was not known was where they were deploying them operationally, and in what numbers. In the preparation of the National Intelligence Estimate on guided missiles in the fall of 1959, the various intelligence agencies held widely diverse views on Sovict missile strength. Nineteen Sixty ushered in an election year in which the missile gap had become a grave political issue, and the President was scheduled to meet with Soviet leaders that spring without-it appeared-the benefit of hard intelligence data. The U-2 had improved our knowledge of the Soviet Union, but it could not provide area coverage and the answers to the critical questions, and it was increasingly becoming less an intelligence asset than a political liability. It was judged to be only a matter of time until one was shot down-with the program coming to an end as an almost certain consequence.

DISCOVERERS IX-XII

A standdown was in effect in CORONA from 20 November 1959 until 4 February 1960 to allow time for intensive R&D efforts to identify and eliminate the causes of failure. On 4 February, DISCOVERER IX was launched and failed to achieve orbit.

The first recovery of film from a CORONA vehicle occurred with the launching of DISCOVERER X on 19 February 1960, but in a manner such that no one boasted of it. The THOR booster rocket began to fishtail not long after it left the launch pad and was destroyed by the range safety officer at 52 seconds after lift-

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off. The payload came down about a mile from Pad 5, was located by helicopter, and the recovery was made by a crew that rode to the scene by Jeep.⁹

DISCOVERERS VII through X carried only a quarter of a load of film (10 pounds) to permit the carrying of additional instrumentation for testing vehicle performance. DISCOVERER XI was launched on 15 April 1960 carrying a camera and 16 pounds of film. A reasonably good orbit was achieved (380 miles at apogee and 109.5 miles at perigee), and the camera operated satisfactorily.** All of the film was exposed and transferred into the recovery capsule. Unfortunately, the problem of the exploding spin rockets, which had been observed in ground tests, occurred during the recovery sequence, and the payload was lost.

Another standdown—a major one—was imposed following the failure of DISCOVERER XI. As of mid-April 1960, there had been 11 launches and one abort on pad. Seven of the launches achieved orbit, but no capsules had been recovered. DISCOVERER XII was planned as a diagnostic flight—without camera payload—heavily instrumented to determine precisely why recovery of capsules had failed previously. The vehicle was launched on 29 June 1960, but the AGENA failed to go into orbit.

DISCOVERER XIII—Partial Success

The next flight, on August 1960, was launched as a repeat of the no-orbit DISCOVERER XII diagnostic flight, without camera and film. The vehicle was launched and successfully inserted into orbit. The recovery package was ejected on the 17th orbit, and retro-firing and descent were normal—except that the capsule came down well away from the planned impact point. The nominal impact area was approximately 250 miles south of Honolulu where C-119 and C-130 aircraft circled awaiting the capsule's descent. The splash-down occurred about 330 miles northwest of Hawaii. The airplanes were backed up by surface ships deployed in a recovery zone with a north-south axis of some 250 miles and an east-west axis extending about 550 miles to either side of the expected impact point. Although beyond the range of the airborne recovery aircraft, the DIS-COVERER XIII capsule descended near enough to the staked-out zone to permit an attempt at water recovery. A ship reached the scene before the capsule sank

^a"This was the first mission on which the camera operated successfully throughout the mission, primarily because of the change from acetate base to polyester base film.



^{*}This was one of the few launch failures for the remarkable Douglas team which prepared the THOR boosters at Vandenberg Air Force Base. The early CORONA launches provided many exciting moments for the Douglas crew, however. Several of the crew were holdovers from the V-2 "broomlighters," who on V-2 launch days would actually ignite reluctant rocket engines with kerosene-soaked brooms. At Vandenberg AFB they did not have to resort to this tactic, but they were required on numerous occasions to return to the launch pad as late as T minus 15 seconds to unfreeze valves with the touch of a sledgehammer. Other members of the blockhouse crew would marvel as the "Douglas Daredevils" would race their vehicles in reverse the entire way from the launch pad to the blockhouse, arriving just as ignition would begin.

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and fished it out of the ocean. Much of the credit for the success was attributed to the inauguration (on the unsuccessful DISCOVERER XII launch) of the cold gas spin and de-spin system.

For the first time ever, man had orbited an object in space and recovered it. This American space "first" beat the Russians by just nine days. The Soviets had tried to recover SPUTNIK IV the previous May but failed when the recovery capsule ejected into a higher orbit. They did succeed in de-orbiting and recovering SPUTNIK V carrying the dogs, Belka and Strelka, on 20 August 1960.

Arrangements were made for extensive publicity concerning this success in recovering an object from orbit—in large measure to support the cover story of DISCOVERER/CORONA as being an experimental space series. News photos were released of the lift-off from Vandenberg, of the capsule floating in the ocean, and of the recovery ship *Haiti Victory*. President Eisenhower displayed the capsule and the flag it had carried to the press, and it was later placed on exhibit in the Smithsonian Institution for public viewing.

In anticipation of the first recovery being a reconnaissance mission, a plan had been developed under which the capsule would be switched in transit through Sunnyvale. Since DISCOVERER XIII was a diagnostic flight, the project office was spared the necessity of executing a clandestine switch of capsules prior to shipment to Washington, and the President and Smithsonian received the actual hardware from the first recovery.

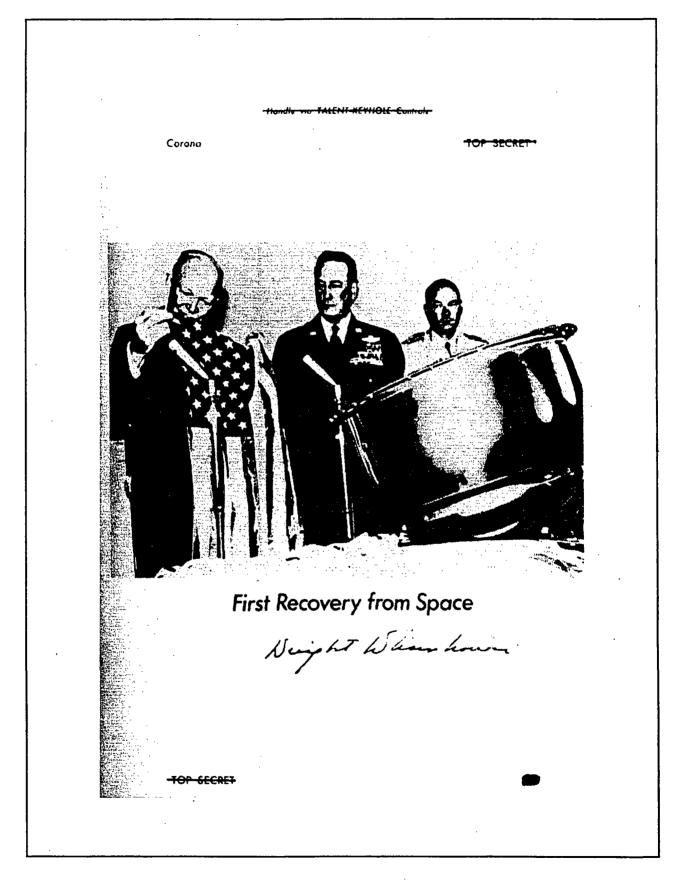
We have all watched television coverage of the U.S. man-in-space programs with the recovery of astronauts and capsules after splash-down in the ocean. A helicopter flies from the recovery ship to the floating capsule and drops swimmers to attach a line to the capsule. After the astronauts are removed, the helicopter hoists the capsule from the water and carries it to the recovery ship. What most of us don't realize is that the recovery technique was developed for and perfected by the CORONA program as a back-up in event of failure of the air catch.

DISCOVERER XIV-Full Success

Success! !! DISCOVERER XIV was launched on 18 August 1960, one week after the successful water recovery of the DISCOVERER XIII capsule. The vehicle carried a camera and a 20-pound load of film. The camera operated satisfactorily, and the full load of film was exposed and transferred to the recovery capsule. The AGENA did not initially position itself in orbit so as to permit the recovery sequence to occur. It was on the verge of tumbling during the first few orbits, and an excessive quantity of gas had to be used in correcting the situation. Fortunately, vehicle attitude became stabilized about midway through the scheduled flight period, thus relieving the earlier fear that recovery would be impossible. The satellite recovery vehicle was ejected on the 17th pass, and the film capsule was recovered by air snatch.

Captain Harold E. Mitchell of the 6593rd Test Squadron, piloting a C-119 (flying boxcar) called Pelican 9, successfully hooked the descending capsule on





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his third pass.* Upon arrival at Hickham Air Force Base, Hawaii, with his prize, Captain Mitchell was decorated with the Distinguished Flying Cross, and members of his crew were awarded the Air Medal for their accomplishments.

The film was flown to the for the formation of the provided to PIC (now known as NPIC) for readout and reporting. The resolution was substantially lower than that obtainable from the U-2, but the photography had intelligence value, and it covered areas of the USSR which the U-2 had never reached. This one satellite mission, in fact, yielded photo coverage of a greater area than the total produced by all of the U-2 missions over the Soviet Union. The only major deficiencies in the photography were plus and minus density bars running diagonally across the format. Some were due to minor light leaks, and others were the result of electrostatic discharge known as corona. These marks showed that the program security officer had had great insight when he named the program. There are two types of corona markings, a glow which caused the most difficulty, and a dendritic discharge which is more spectacular in appearance.

A press release announced the success of the mission but naturally made no mention of the *real* success: the delivery of photographic intelligence. The announcement noted that the satellite had been placed into an orbit with a 77.6 degree of inclination, an apogee of 502 miles, a perigee of 116 miles, and an orbital period of 94.5 minutes. A retro-rocket had slowed the capsule to re-entry velocity, and a parachute had been released at 60,000 feet. The capsule, which weighed 84 pounds at recovery, was caught at 8,500 feet by a C-119 airplane on its third pass over the falling parachute.

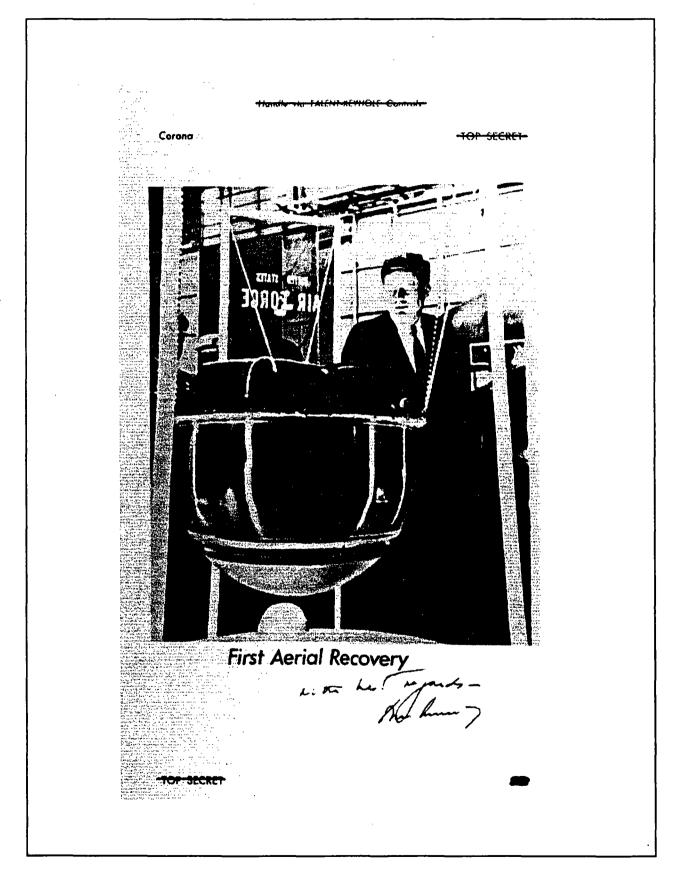
Progress and Problems

The program officers did not take the success of DISCOVERER XIV to mean that their problems with the system were at an end, but many of the earlier difficulties had been surmounted. The orbital injection technique had been improved to a level at which vehicles were repeatedly put into orbit with injection angle errors of less than four-tenths of a degree. The timing of the initiation of the recovery sequence had been so refined that ejection of the DIS-COVERER XI SRV occurred within five seconds of the planned time. Parachute deceleration and air catch of the capsule had been accomplished repeatedly with test capsules dropped from high-altitude balloons. The last two cameras placed in orbit had operated well.

There were other critical problems, however, that remained to be solved. Foremost among them at the time was that of consistently achieving the correct retro-velocity and angle of re-entry of the recovery vehicle. The DISCOVERER

[&]quot;Mitchell had been patrolling the primary recovery zone for DISCOVERER XIII, which was fished from the water by a recovery ship after Mitchell's plane missed it. The Air Force, pride stung, assigned Mitchell to the boondocks some 500 miles downrange for DISCOVERER XIV. The capsule overshot the prime recovery area, where three aircraft were chasing the wrong radar blip. When Mitchell first tried to report his catch, he was told to keep off the air in order not to interfere with the recovery operation.





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XIV capsule was the only one thus far that had descended in the designated impact zone. This was a problem that was to receive major attention during the next few weeks.

Four more cameras were launched within the next four months, with one success and three failures. DISCOVERER XV was sent aloft on 13 September. The vehicle was successfully inserted into orbit, and the camera functioned properly. However, the recovery vehicle re-entered at the wrong pitch attitude, causing the capsule to come down outside the recovery zone and demonstrating that the technicians' concern over the retro-firing sequence was well founded. The capsule was located, but it sank before a recovery ship could reach it. DISCOVERER XVI was launched on 26 October, but the AGENA failed to go into orbit because of a malfunction of a timing device.

The first ten camera-equipped vehicles carried what was known as the C camera: a single, vertical-looking, reciprocating, panoramic camera that exposed the film by scanning at a right angle to the line of flight. DISCOVERER XVI carried the first of a new series of cameras known as the C Prime (C'). The C' differed only slightly from the original C configuration and was essentially little more than a follow-on procurement of the C camera.

The DISCOVERER XVII mission was launched on 12 November and went the full route through successful air catch—except for one mishap: the film broke after 1.7 feet of the acetate base leader had fed through the camera. There is an inconsistency in the records on this and the succeeding mission. The press release concerning this mission announced that the AGENA B, a more powerful second-stage engine, was used for the first time; the project files record the first use of the B vehicle on the following mission. In either event, it was the first of the two-day missions. The capsule was recovered on the 31st orbit.

DISCOVERER XVIII was launched on 10 December 1960 carrying 39 pounds of film. Orbit was achieved, and the camera worked well, exposing the entire film load. The recovery vehicle was ejected on revolution number 48 after three days in orbit, and the capsule was retrieved by air snatch. This was the first successful mission employing the C' camera and the AGENA B second stage. There was fogging on the first, second, and last frame of each photo pass due to mirror light leaks, but image quality was otherwise as good as the best from DISCOVERER XIV.

CORONA in 1961

Of the next ten launches, extending through 3 August 1961, only four were CORONA missions. DISCOVERERS XIX and XXI carried radiometric payloads in support of the CORONA cover story, and they were not intended to be recovered. DISCOVERER XXI included an experiment that was to be of major significance in the later development of CORONA and other space programs: the AGENA engine was successfully restarted in space.

There was another "first" during these 1961 launches. When the film was removed from one of the capsules, the quality assurance inspector found three objects that should not have been there: two quarters and a buffalo nickel. Early

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capsules had contained a flag, so that there would be one to present to President Eisenhower after the first successful recovery. This had apparently inspired program personnel at Vandenberg to make their own payload additions during flight preparation. The Washington program office sent a sharply worded message to the West Coast project office charging it with responsibility for ensuring that the practice of souvenir-launching be stopped. (Years later NASA would find itself in the same position after the Apollo moon flights.)

DISCOVERER XX was the first of a dozen launches extending over a period of three years carrying mapping cameras, a program sponsored by the U.S. Army, which the President had approved for inclusion within the CORONA project. The purpose of the mapping program, which was known as ARGON, was to obtain precise geodetic fixes and an extension of existing datum planes within the Soviet Union. DISCOVERER XX was a bust on a number of counts: the camera failed; there were no shutter firings; and the orbital programmer malfunctioned. This last-named failure led to an important change in control procedures for CORONA. On this and all prior flights the recovery sequence was initiated automatically by an ejection command cut into the program tape. The program timer failed temporarily on orbit 31 of this mission, causing the entire sequence to be about one-half cycle out of phase. The automatic initiation of the recovery sequence was eliminated from the program tape on subsequent missions. Thereafter, the positive issuance of an injection command was required.

Of the four CORONA missions attempted between December 1960 and August 1961, two did not go into orbit as a consequence of ACENA failures, and two were qualified successes. DISCOVERER XXV was launched on 16 June and exposed its full load of film. The air catch failed, but the back-up water recovery was successful. The camera failed on revolution 22 of DISCOVERER XXVI, which was launched on 7 July, but about three-quarters of the film was exposed and was recovered by air catch.

Going into August 1961, a total of 17 camera-carrying CORONA missions had been attempted, and usable photography had been recovered from only four of them. These four successful missions, however, had yielded plottable coverage of some 13 million square miles, or nearly half of the total area of interest.

Camera Improvements

The first substantial upgrading of the CORONA camera system came with the introduction in August 1961 of the C Triple Prime (C'') camera. The original C camera was a scanning panoramic camera in which the camera cycling rate and the velocity-over-height ratio were constant and were selected before launching. Image motion compensation was fixed mechanically to the velocity-over-height ratio. A brief explanation of these terms may be helpful in understanding the nature of the problems with which the camera designers had to cope.

A means must be provided for matching the number of film exposures in a given period of time (camera cycling rate) with the varying ratio between vehicle altitude and velocity on orbit (velocity-over-height) so that

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the ground area is photographed in a series of swaths with neither gaps nor excessive overlapping in the coverage.

If the subject moves just as a snapshot is taken with a hand-held camera, and if the camera shutter speed is not fast enough to "stop" the motion, the photographic image will be smeared. To a camera peering down from an orbiting CORONA space vehicle, the earth's surface appears to be passing beneath the camera at a speed of roughly five miles per second. A camera photographing the earth's surface from a satellite moving at that speed would yield smeared photography if some means were not provided for stopping the relative motion. The technique used in accomplishing this is known as image motion compensation.

The C Triple Prime was the first camera built totally by the ltek Corporation. The C''' was also a reciprocating camera with a rotating lens cell, which exposed the film during a segment of its rotation. The new camera had a larger aperture lens, an improved film transport mechanism, and a greater flexibility in command of camera and vehicle operations—especially as regards control of the velocityover-height factor. The larger aperture lens permitted use of slower film emulsions, which, combined with the improved resolving power of the lens itself, offered the prospect of resolution approximately twice as good as the C and C' cameras.

The first C'' camera system with a 39-pound film load was launched on 30 August 1961. The mission was a success, with the full film load being transferred and with ejection and recovery occurring on the 32nd orbit. All frames of the photography however, were out of focus. The cause was identified and was corrected by redesigning the scan head. Seven more missions were launched during the last four months of 1961, three with the C' camera and four with the C'''. Six of them attained orbit, and the cameras operated satisfactorily on all six. Film was recovered from four of the missions. The last of the four, which carried a C''' camera system, was rated the best mission to date. It also had a cover assignment to carry out: the injection of a secondary satellite, dubbed OSCAR (orbital satellite carrying amateur radio), into a separate orbit. OSCAR was a small radio satellite broadcasting a signal on 145 megacycles for pick-up by amateurs as an aid in the study of radio propagation phenomena.

Slowly but surely the bugs were being worked out, but it seemed that just as one was laid to rest another arose to take its place. Perhaps what was actually happening was that various sets of problems existed simultaneously, but the importance of some of them was masked by others. The elimination of a particular problem made it possible to recognize the significance of another. The recent successes had resulted largely from correcting weaknesses in the payload portion of the system. At the same time, difficulties in the AGENA vehicle began to surface. Of the last seven missions in 1961, four experienced on-orbit difficulties with the AGENA power supply or control gas system.

Power system components for general use in satellite systems were designed, developed, and tested in the CORONA program. Foremost among those components were the static electronic inverters used to convert direct current

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battery energy into the various alternating current voltages required by the other subsystems. Static inverters, which were first flown aboard CORONA vchicles, were considered essential, because they had half the weight and double the efficiency of their rotary counterparts. Unfortunately, they are rather temperamental gadgets. The history of inverter development had been marked by high failure rates in system checkouts on the ground. Despite the lessons that had been learned and the improvements in circuit design that resulted from them, the recent on-orbit power failures demonstrated a need for further research and development.

The Last DISCOVERER

The AGENA failed on DISCOVERER XXXVII, launched on 13 January 1962, and the payload did not go into orbit. It was the last mission to carry the C''' camera system, and with it the DISCOVERER series came to an end. After 37 launches or launch attempts, the cover story for DISCOVERER had simply worn out. With the improved record of success and the near-certainty of an even better record in the future, it seemed likely that there would be as many as a dozen and a half to two dozen launches per year for perhaps years to come.



CORONA Goes Stereo

The 1961 R&D effort was not confined to improving the performance of the existing system. A major development program was concurrently under way on a much better camera subsystem. A contract was awarded on 9 August 1961, retroactively effective to 20 March, for a new camera configuration to be known as MURAL. The MURAL camera system consisted essentially of two C''' cameras mounted with one pointing slightly forward and the other slightly backward. Two 40-pound rolls of film were carried in a double-spool film supply cassette. The two film webs were fed separately to the two cameras where they were panoramically exposed during segments of the lens cells' rotations and then were fed to a double-spool take-up cassette in the satellite recovery vehicle. The system was designed for a mission duration of up to four days.

The vertical-looking C, C', and C''' cameras had photographed the target area by sweeping across it in successive overlapping swaths. The MURAL concept involved photographing each swath area twice. The forward-looking camera first photographed the swath at an angle 15 degrees from the vertical. About a half-dozen frames later, the backward-looking camera photographed the same swatch at an angle also 15 degrees from the vertical. When the two resulting photographs of the same area or object were properly aligned in a stereo-micro-

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scope, the photography would appear to be three-dimensional. Simultaneous operation of both instruments was required for stereo photography. If either camera failed, photography could still be obtained from the other, but it could be viewed in only two dimensions.

The first MURAL camera system was launched as program flight number 38 on 27 February 1962. On the first M flight, an anomaly occurred during re-entry. The RV heat shield failed to separate and was recovered by the aircraft along with the capsule. This anomaly provided valuable diagnostic data on the re-entry effects, which served the program well in later years, when program stretchouts caused shelf life of the heat shields to be a major concern. The twenty-sixth and last in the MURAL series was launched on 21 December 1963. Twenty of the SRV's were recovered, 19 of them by air snatch. The one water recovery was of a capsule that splashed down a thousand miles from the nominal impact point. An interesting aspect of this recovery was that the capsule turned upside down in the water, causing loss of the beacon signals. It was located during the search by an alert observer who spotted the sun shining on the gold capsule. Of the six vehicles that failed, two malfunctioned in the launch sequence, one SRV failed to eject properly, and three capsules came down in the ocean and sank before they could be recovered. Twenty successes out of 26 tries appeared to be a remarkable record when viewed against the difficulties experienced only two years earlier.

The three capsules that sank came down in or near the recovery zone, indicating that the problems previously encountered in the reentry sequence had been solved. They were not supposed to sink so quickly, however. (One of them floated for less than three minutes.) To minimize the chance that a capsule might be retrieved by persons other than the American recovery crew, the capsules were designed to float for a period ranging originally from one to three days and then to sink. The duration of the flotation period was controlled by a capsule sink valve containing compressed salt, which would dissolve in sea water at a rate that could be predicted within rather broad limits. When the salt plug had dissolved, water entered the capsule, and it sank—ingenious but simple.

More Problems, More Answers

Other significant improvements in the CORONA program were inaugurated during the lifetime of the MURAL system. One of them was an aid to photointerpretation. In order to read out the photography, the photointerpreter must be able to determine for each frame the portion of the earth's surface that is imaged, the scale of the photography, and its geometry. In simplest terms, he must know where the vehicle was and how it was oriented in space at the precise time the picture was taken. Until 1962, the ground area covered by a particular frame of photography was identified by combining data provided on the orbital path of the vehicle with the time of camera firing. The orientation or attitude of the vehicle on orbit was determined from horizon photographs recorded at each end of every other frame from a pair of horizon cameras that were included in the CORONA camera system.



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Beginning with the first of the MURAL flights, an index camera was incorporated into the photographic system, and a stellar camera was added a few missions later. The short focal length index camera took a small scale photograph of the area being covered on a much larger scale by successive sweeps of the pan cameras. The small scale photograph, used in conjunction with orbital data, simplified the problem of matching the pan photographs with the terrain. Photographs taken of stars by the stellar camera, in combination with those taken of the horizons by the horizon cameras, provided a more precise means of determining vehicle attitude on orbit.

The photography from program flight number 47, a MURAL mission launched on 27 July 1962, was marred by heavy corona and radiation fogging. The corona problem was a persistent one-disappearing for a time only to reappear laterand had become even more severe with the advent of the complicated film transport mechanisms of the MURAL camera. Corona marking was caused by sparking of static electricity from moving parts of the system, especially from the film rollers. The problem was eventually solved by modifications of the parts them-

selves and by rigid qualification testing of them.



The boosting capacity of the first-stage THOR was substantially increased in early 1963 by strapping to the THOR a cluster of small solid-propellant rockets, which were jettisoned after firing. This Thrust Augmented THOR, or TAT as it came to be known, was first used for the launching of the heavier LANYARD camera system. LANYARD was developed within the CORONA program as a film recovery modification of one of the cameras designed for the SAMOS system and, with its longer focal length, was expected to yield better resolution than the CORONA cameras. It had a single lens cell capable of stereoscopic coverage by swinging a mirror through a 30-degree angle. Three flights were attempted, only one of which was partially successful. The camera had a serious lens focus problem, which was later traced to thermal factors and corrected. The LANYARD program was initiated as an interim system pending the completion of a highresolution spotting system then under development. It was cancelled upon the success of the spotting system. The TAT booster itself was a significant success, permitting the later launching of heavier, more versatile CORONA systems.

The Two-Bucket System

Program flight number 69, launched on 24 August 1963, introduced the first two-bucket configuration-the next major upgrading of the CORONA system.

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(The film recovery capsule is commonly referred to as a bucket, although it more nearly resembles a round-bottomed kettle.) The new modification, which was known as the J-1 system, retained the MURAL stereoscopic camera concept but added a second film capsule and recovery vehicle. With two SRV's in the system, film capacity was increased to 160 pounds (versus the 20-pound capacity of the first few CORONA missions). The two-bucket system was designed to be deactivated or stored in orbit in a passive (zombie) mode for up to 21 days. This permitted the recovery of the first bucket after half of the film supply was exposed. The second bucket could begin filling immediately thereafter, or its start could be delayed for a few days. A major redesign of the command and control mechanisms was required to accommodate the more complicated mission profile of the two-bucket system.

As with each of the major modifications of CORONA, the J-1 program had a few early bugs. On the first mission, the shutter on the master horizon camera remained open about 1,000 times seriously fogging the adjacent panoramic photography, and the AGENA current inverter failed in mid-flight, making it impossible to recover the second bucket. Also, the J-1 system initially experienced a rather severe heat problem, which was solved by reducing the thermal sensitivity of the camera and by better control of vehicle skin temperature through shielding and varying the paint pattern.

Back in 1960 and 1961, the successful recovery of a CORONA film bucket was an "event." A mere two years later, with the advent of the J-1 system, success had become routine and a failure was an "event." By the end of 1966, 37 J-1 systems had been launched; 35 of them were put into orbit; and 64 buckets of film were recovered. There were no failures at recovery in the three years following 1966: 28 buckets were launched, and 28 buckets were recovered. Also, mission duration was greatly expanded during the lifetime of the J-1 system. A mission in June 1964 yielded four full days over target for each of the two buckets. Five full days of operation with each bucket was attained in January 1965. In April 1966, the first bucket was recovered after seven days on orbit. A 13-day mission life was achieved in August 1966, and this was increased to 15 days in June 1967.

The increased mission life and excellent record of recovery resulted from a number of successive improvements that were incorporated into the J-1 time period. Among them was a subsystem known as LIFEBOAT, a completely redundant and self-contained apparatus built into the AGENA that could be activated for recovering the SRV in event of an AGENA power failure (which still happened occasionally). Another improvement was the introduction of the new and more powerful THORAD booster. A third was the addition of a rocket orbit-adjust system. The CORONA vehicles were necessarily flown over the target areas with quite a low perigee in order to increase the scale of the photography, and this led to a relatively rapid decay of the orbit. The orbitadjust system compensated for the decay. It consisted of a cluster of small rockets, known as drag make-up units, which were fired individually and at selected

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intervals. Each firing accelerated the vehicle slightly, boosting it back into approximately its original orbit.

A Maverick

The CORONA camera system was to undergo one more major upgrading but we cannot leave the J-1 program without giving an account of one mission failure of truly magnificent proportions. Program flight number 78 (CORONA Mission Number 1005), a two-bucket J-1 system, was launched on 27 April 1964. Launch and insertion into orbit were uneventful. The master panoramic camera operated satisfactorily through the first bucket, but the slave panoramic camera failed after 350 cycles when the film broke. Then the AGENA power supply failed. Vandenberg transmitted a normal recovery enable command on southbound revolution number 47 on 30 April. The vehicle verified receipt of the command, but nothing happened. The recovery command was repeated from various control stations-in both the normal and back-up LIFEBOAT recovery modes-on 26 subsequent passes extending through 20 May. The space vehicle repeatedly verified that it had received the commands, but the ejection sequence did not occur. After 19 May, the vehicle no longer acknowledged receipt, and from 20 May on it was assumed that the space hardware of Mission 1005 was doomed to total incineration as the orbit decayed.

But Mission 1005, it later developed, had staged its own partial re-entry, stubborn to the end. At six minutes past midnight on 26 May, coinciding with northbound revolution No. 452 of Mission 1005, observers in Maracaibo, Venezuela saw five burning objects in the sky.

On 7 July, two farm workers found a battered golden object on a farm in lonely mountain terrain near La Fria in Tachira State, southwestern Venezuela, a couple of miles from the Colombian border. They reported it to their employer, Facundo Albarracin, who had them move it some 100 yards onto his own farm and then spread the news of his find in hopes of selling it. Albarracin got no offers from the limited market in Tachira, however—not even from the smugglers with access to Colombia—so he hacked and pried loose the radio transmitter and various pieces of the take-up assembly to use as household utensils or toys for the children.

Ultimately word of the find reached San Cristobal, the nearest town of any size. Among the curious who visited La Fria was a commercial photographer, Leonardo Davila, who telephoned the U.S. Embassy in Caracas on 1 August that he had photographed a space object. It was the first bucket from Mission 1005, with one full spool of well-charred film clearly visible.

A team of CORONA officers, ostensibly representing USAF, flew to Caracas to recover the remains. The capsule was lugged out by peasants to a point where the Venezuelan Defense Ministry could pick it up for flight to Caracas. There the CORONA officers bought the crumpled bucket from the Venezuelan government, and quietly dismissed the event as an unimportant NASA space experiment gone awry.

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The story rated only a dozen lines in the New York Times of 5 August, but the local Venezuelan press had a field day. Diario Catolico, of San Cristobal, along with a lengthy report, published three pictures of the capsule showing the charred roll of film on the take-up spool. The Daily Journal handled the story in lighter vein with this parody of Longfellow:

I shot an arrow into the air.

It fell to earth I know not where.

Cape Kennedy signalled: "Where is it at you are?"

Responded the rocket: "La Fria, Tachira."

The CORONA technicians who examined the capsule after its arrival in the States concluded that the re-entry of the SRV was a result of normal orbit degeneration, with separation from the instrument fairing caused by re-entry forces. The thrust cone was sheared during separation but was retained by its harness long enough to act as a drogue chute, thus preventing the capsule from burning up during re-entry and stabilizing it for a hard, nose-down landing.

The Final Touches

The final major modification of the CORONA system got under way in the spring of 1965, when about a dozen and a half of the two-bucket J-l systems had been flown. The J-l was performing superbiy, but it had little potential for within-system growth. The new CORONA improvement program was begun with a series of meetings among representatives of Lockheed, General Electric, Itek, and the various CORONA program offices to examine ways of bettering the performance of the panoramic and stellar/index cameras, and of providing a more versatile command system. These were the resulting design goals established for a new panoramic camera:

Improved photographic performance by removal of camera system oscillating members and reduction of vibration from other moving components. Improvement of the velocity-over-height match to reduce image smear.

Improved photographic scale by accommodation of proper camera cycling rates at altitudes down to 80 n.m. (the minimum J-1 operating altitude was 100 n.m.).

Elimination of camera failures caused by film pulling out of the guide rails (an occasional problem with the J-1 system).

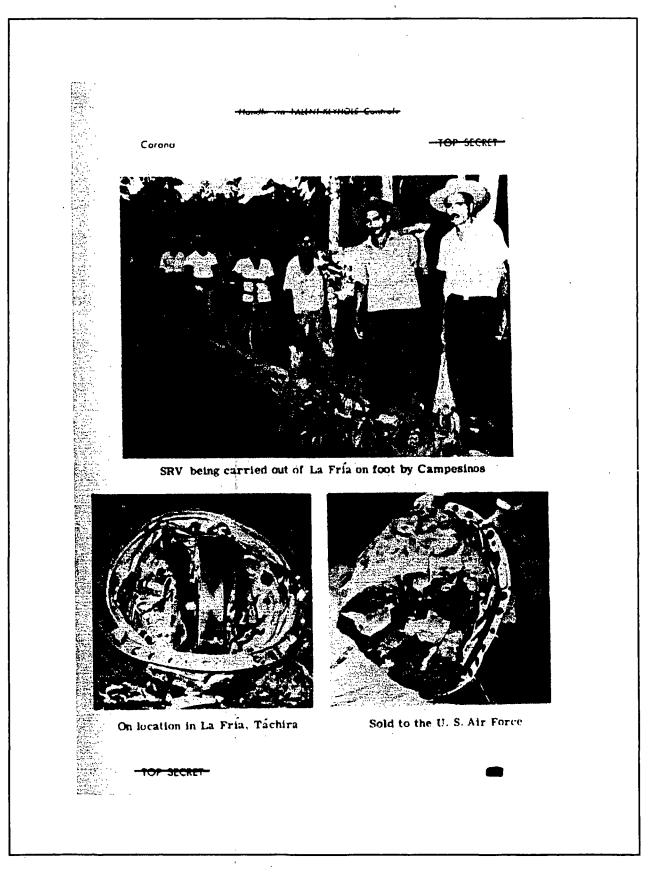
Improved exposure control through variable slit selection. (The J-1 system had a single exposure throughout the orbit resulting in poor performance at low sun angles.)

Capability of handling alternate film types and split film loads. An in-flight changeable filter and film change detector was added for this purpose.

Capability of handling ultra-thin base film (yielding a 50% increase in coverage with no increase in weight).

The panoramic camera that was developed to meet those design goals was known as the constant rotator. The predecessor C''' camera employed a com-

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bination of rotating lens cell and reciprocating camera members. In the constant rotator, the lens cell and the balance of the camera's optical system is mounted in a drum, and the entire drum assembly is continuously rotated, thus eliminating the reciprocating elements from the camera system. The film is exposed during a 70-degree angular segment of the drum's circular sweep. The capability of using ultra-thin base (UTB) film was one of the design goals, but the camera design was not to be constrained by requirements to accommodate the thinner film. UTB was successfully flown on several flights but ground test results showed a loss of reliability and attempts to use it in the contant rotator were eventully abandoned. In all other respects, however, the constant rotator was a resounding success. It yielded substantially better ground resolution in the photography. It also permitted versatility in operation far exceeding that available in the earlier cameras.

The stellar/index camera in use was a delicate instrument with a short (1.5") focal length and a history of erratic performance. The efforts at upgrading the performance of the stellar/index camera resulted in an instrument with a 3" focal length (like ARGON) and a dual-looking stellar element. The new camera had the jaw-breaking designation of Dual Improved Stellar Index Camera, commonly referred to by its acronym: DISIC.

The new payload system, which was designated the J-3, consisted of a pair of constant rotator panoramic cameras, a pair of horizon cameras, and a DISIC. The J-3 system naturally retained the stereo capability begun with the MURAL cameras and the two-bucket recovery concept of the J-1. Apart from the improved picture-taking capability of the hardware itself, the most significant advance of the J-3 was the flexibility it allowed in command and control of camera operations. Any conventional area search photographic reconnaissance system is film-limited. (When the film runs out, the mission is finished—assuming, of course, that other mission-limiting components of the system survive that long.) Consequently, the ultimate goal of all the CORONA improvement efforts was to pack the maximum of the best possible quality of photography of important intelligence targets into each roll of exposed film. The built-in flexibility of the J-3 system greatly increased the variety and degree of controls that could be applied to camera operations, thus substantially boosting the potential intelligence content of the photography.

The first J-3 system was launched on 15 September 1967, and it proved to be the one major modification with no bugs in it. In its nearly five years of operation, it yielded even better photographic intelligence and higher reliability than the remarkably successful predecessor J-1 system.

An early series of tests demonstrated the unusual flexibility of the J-3. It could not only accommodate a variety of film loads, including special camouflagedetection color and high-speed, high-resolution black and white; the camera also had two changeable filters and four changeable exposure slits on each camera.

These tests drew such interest throughout the intelligence community that a CORONA J-3 Ad Hoc Committee was formally convened by the Director of the National Reconnaissance Office on 4 December 1967, and formally constituted in February 1968. Its purpose was to analyze and evaluate the experiments con-

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ducted on these five test flights. Specific findings of the Committee included the recommendations that further testing of color films and techniques should be conducted, against specific intelligence requirements and that a special subcommittee of the Committee on Imagery Requirements and Exploitation (COMIREX) should be constituted to evaluate the utility of satellite color photography; and that a well-planned color collection program be worked out with the close cooperation of the system program offices, the Satellite Operations Center (SOC), the intelligence analysts, and the photo interpreters.

In Retrospect

Looking back on CORONA, it is not always easy to keep in mind that it was merely an assemblage of inanimate objects designed and put together to perform a mechanical task. The program began as a short-term interim system, suffered through adversity in its formative years, and then survived in glory throughout a decade. Those who were associated with the program or came to depend upon its product developed an affection for the beast that bordered on the personal. They suffered with it in failure and revelled in its successes.

The technological improvements engineered under CORONA advanced the system in eight years from a single panoramic camera system having a design goal of 20 to 25 feet ground resolution and an orbital life of one day, to a twin camera panoramic system producing stereo-photography at the same ground resolution; then to a dual recovery system with an improvement in ground resolution to approximately 7 to 10 feet, and doubling the film payload; and finally, to the J-3 system with a constant rotator camera, selectable exposure and filter controls, a planned orbital life of 18 to 20 days, and yielding nadir resolution of 5-7 feet.

The totality of CORONA's contributions to U.S. intelligence holdings on denied areas and to the U.S. space program in general is virtually unmeasurable. Its progress was marked by a series of notable firsts: the first to recover objects from orbit, the first to deliver intelligence information from a satellite, the first to produce stereoscopic satellite photography, the first to employ multiple reentry vehicles, and the first satellite reconnaissance program to pass the 100mission mark. By March 1964, CORONA had photographed 23 of the 25 Soviet ICBM complexes then in existence; three months later it had photographed all of them.

The value of CORONA to the U.S. intelligence effort is given dimension by this statement in a 1968 intelligence report: "No new ICBM complexes have been established in the USSR during the past year." So unequivocal a statement could be made only because of the confidence held by the analysts that if they were there, CORONA photography would have disclosed them.

CORONA coverage of the Middle East during the June 1967 war was of great value in estimating the relative military strengths of the opposing sides after the short combat period. Evidence of the extensive damage inflicted by the Israeli air attacks was produced by actual count of aircraft destroyed on the ground in Egypt, Syria, and Jordan. The claims of the Israelis might have been discounted as exaggerations but for this timely photographic proof.

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In 1970, CORONA was called on to provide proof of Israeli-Egyptian claims with regard to cease-fire compliance or violation. CORONA Mission 1111, launched on 23 July 1970, successfully carried out the directions for this coverage, which brought the following praise from Dr. John McLucas, Under Secretary of the Air Force and Director, NRO, who said in a message to the Director of Special Projects, DD/S&T, on 25 August 1970:

I extend my sincere thanks and a well done to you and your staff for your outstanding response to an urgent Intelligence Community requirement.

The extension of . . . Mission 1111 to 19 days, without benefit of solar panels, and the change in the satellite orbit to permit photography of the Middle East on 10 August provided information which could not be obtained through any other means. This photography is being used as a baseline for determining compliance with the Suez cease-fire provisions.

CORONA's Decade of Glory is now history. The first, the longest, and the most successful of the nation's space recovery programs, CORONA explored and conquered the technological unknowns of space reconnaissance, lifted the curtain of secrecy that screened developments within the Soviet Union and Comnunist China, and opened the way for the even more sophisticated follow-on satellite reconnaissance systems. The 145th and final CORONA launch took place on 25 May 1972 with the final recovery on 31 May 1972. That was the 165th recovery in the CORONA program, more than the total of all of the other U.S. programs combined. CORONA provided photographic coverage of approximately 750.000,000 square nautical miles of the earth's surface. This dramatic achievement was surpassed only by intelligence derived from the photography.

In placing a value on the intelligence obtained by the U.S. through its photographic reconnaissance satellite programs between 1960 and 1970, a first consideration, on the positive side, would be that it had made it possible for the President in office to react more wisely to crucial international situations when armed with the knowledge provided by these programs. Conversely, it can be said that without the intelligence which this program furnished, we might have misguidedly been pressured into a World War III.

The intelligence collected by the reconnaissance programs makes a vital contribution to the National Intelligence Estimates upon which the defense of the U.S. and the strategic plans of the military services are based. Principal among those estimates are the ones which deal with the Soviet and Chinese Communist strategic weapons, space, and nuclear energy programs.

The intelligence from overhead reconnaissance counts heavily not only in planning our defense, but also in programming and budgeting for it. It helps to avoid the kind of floundering that occurred during the time of the projection of the "Missile Gap." Without the kind of intelligence which the CORONA program provided, the U.S. budget for the defense of our own territory, and for military assistance to our allies, would doubtless have been increased by billions.

The total cost for all CORONA activities of both the Air Force and the CIA over the 16-year period was

The CORONA program was so efficiently managed that even the qualification models of each series were refurbished and flown. As a result, there was little



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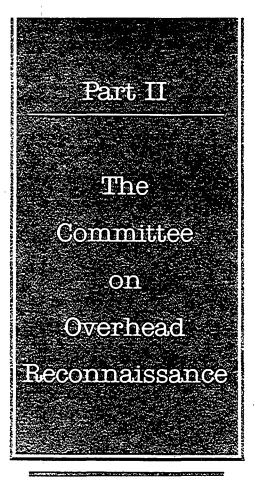
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hardware available at the termination of the program when it was suggested that a museum display should be set up to illustrate and to preserve this remarkable program. Using recovered hardware from the last flight, developmental models from the J-3 program, and photographic records from the memorable flights, a classified museum display was set up in Washington, D. C. In his speech dedicating the Museum, Mr. Richard Helms, the Director of Central Intelligence said:

It was confidence in the ability of intelligence to monitor Soviet compliance with the commitments that enabled President Nixon to enter into the Strategic Arms Limitation Talks and to sign the Arms Limitation Treaty. Much, but by no means all, of the intelligence necessary to verify Soviet compliance with SALT will come from photoreconnaissance satellites. CORONA, the program which pioneered the way in satellite reconnaissance, deserves the place in history which we are preserving through this small Museum display.

"A Decade of Glory," as the display is entitled, must for the present remain classified. We hope, however, that as the world grows to accept satellite reconnaissance, it can be transferred to the Smithsonian Institution. Then the American public can view this work, and then the men of CORONA, like the Wright Brothers, can be recognized for the role they played in the shaping of history.



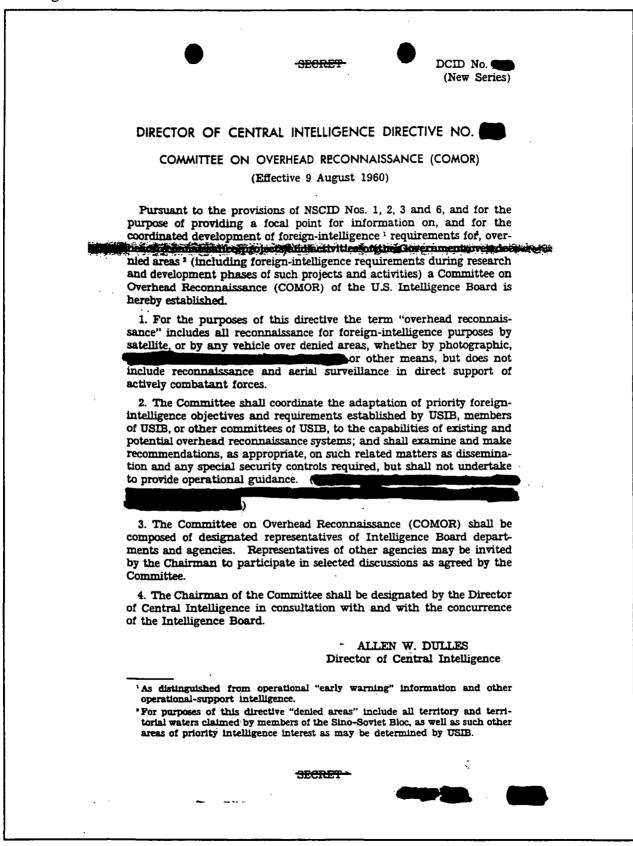
Part II: The Committee on Overhead Reconnaissance

Before 1958, the Director of Central Intelligence's management or coordination of what is now called the Intelligence Community had been unsteady, if not haphazard. In 1956 President Eisenhower formed his own President's Board of Consultants on Foreign Intelligence Activities (PBCFIA), which soon worried that the United States was insufficiently prepared to counter the Soviet missile threat. Out of this concern the Board suggested that the DCI should better coordinate US intelligence efforts for early warning, wartime operational planning, and intelligence on new Soviet weaponry. By the 1960 election year, the "Missile Gap" issue—the charge that the Soviets were about to take a commanding lead over the United States in ballistic missiles—had fostered even greater worries about Soviet intentions and capabilities.

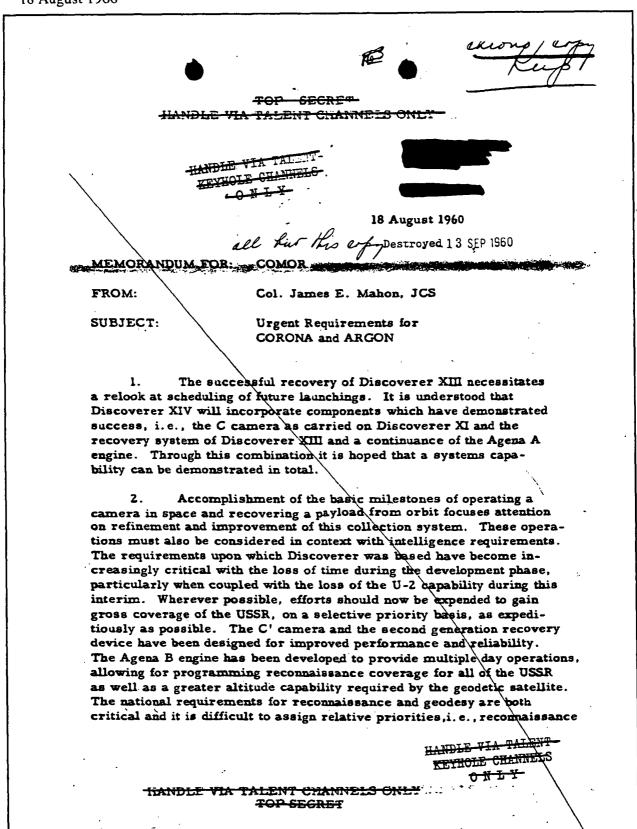
In 1958, after consolidating two principal interdepartmental intelligence committees into a single United States Intelligence Board (USIB), President Eisenhower issued a new National Security Council Intelligence Directive that gave the Director of Central Intelligence (DCI) clear orders to coordinate the foreign intelligence effort of the United States. The DCI was to be responsible for all forms of intelligence collection, including communications, electronic, missile, and space intelligence. In early 1959, DCI Allen Dulles formed the Satellite Intelligence Requirements Committee (SIRC) to manage satellite programs independently of the older Ad Hoc Requirements Committee (ARC), which dealt with collection and exploitation for the U-2 program.

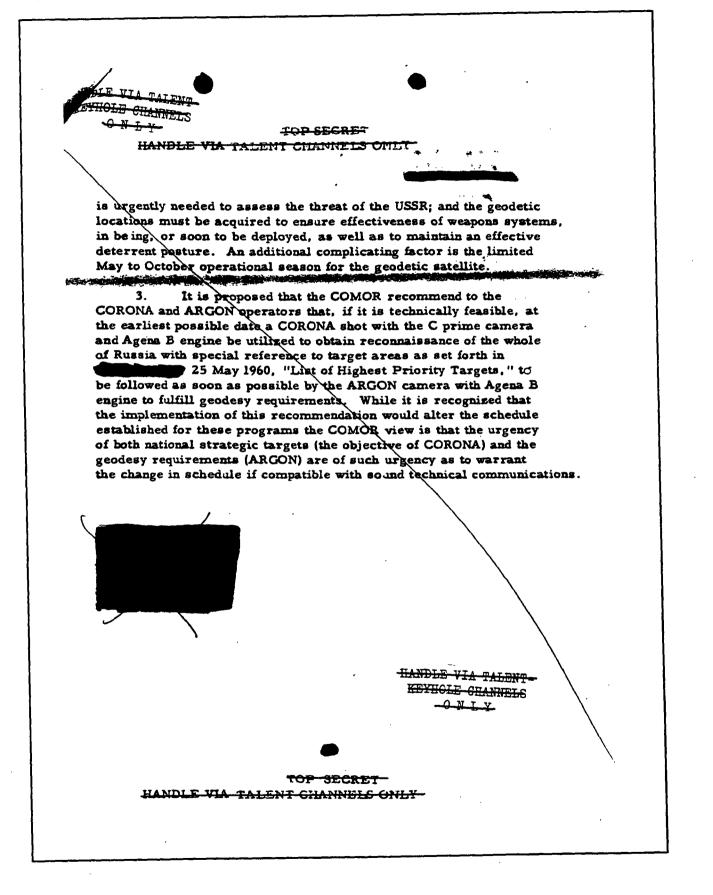
After the Soviets shot down a U-2 over Russia in May 1960, the DCI in August established the Committee on Overhead Reconnaissance (COMOR) to coordinate the development of intelligence requirements for reconnaissance missions over the Soviet Union and other denied areas. COMOR superseded both ARC and SIRC.

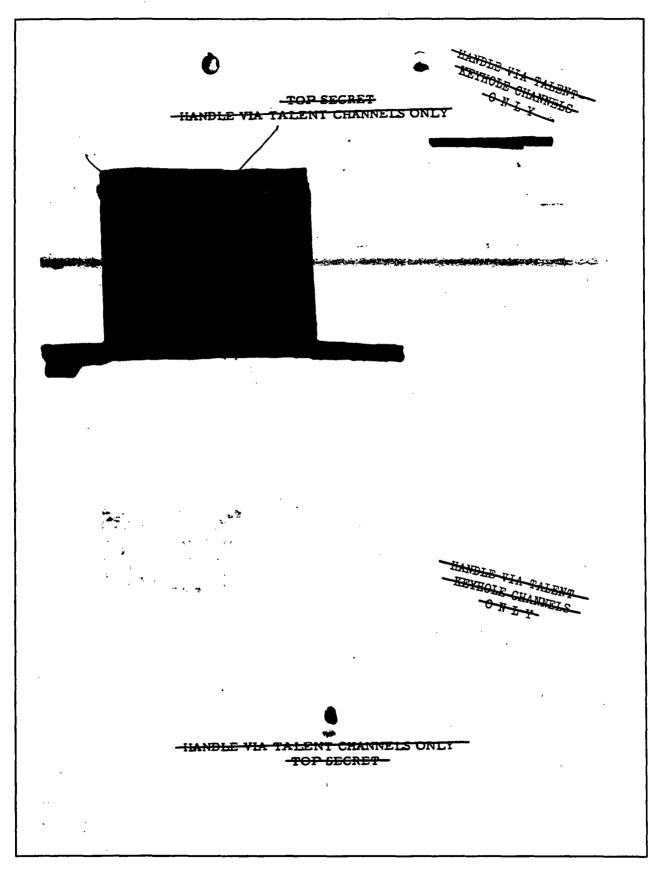
Initially, COMOR's responsibilities were limited, since U-2s could no longer fly over the Soviet Union. This dramatically changed with the success of DISCOVERER XIV, the first CORONA mission to bring back photographs of the Soviet Union. Most of this section's documents offer examples of how COMOR's first chairman, James Q. Reber, set out to coordinate the analysis of CORONA material and establish procedures for handling TALENT-KEYHOLE material. Perhaps the section's most interesting record is Document No. 4, COMOR's 18 August 1960 "List of Highest Priority Targets, USSR," which identified primary targets for the U-2 just as CORONA's KH-1 satellite arrived on the scene. 2. Director of Central Intelligence Directive, Committee on Overhead Reconnaissance (COMOR), 9 August 1960

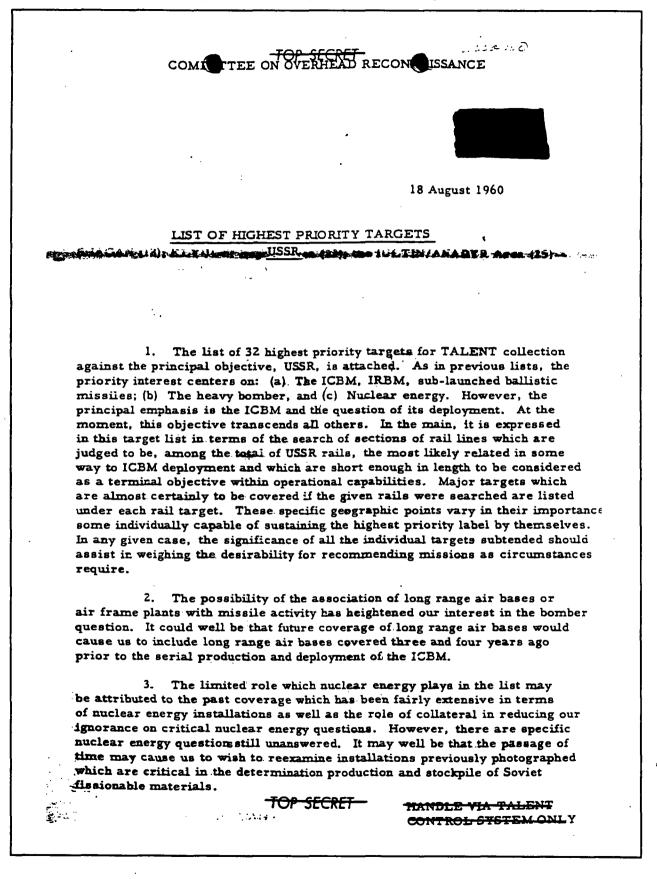


3. Col. James E. Mahon, JCS to COMOR, "Urgent Requirements for CORONA and ARGON," 18 August 1960





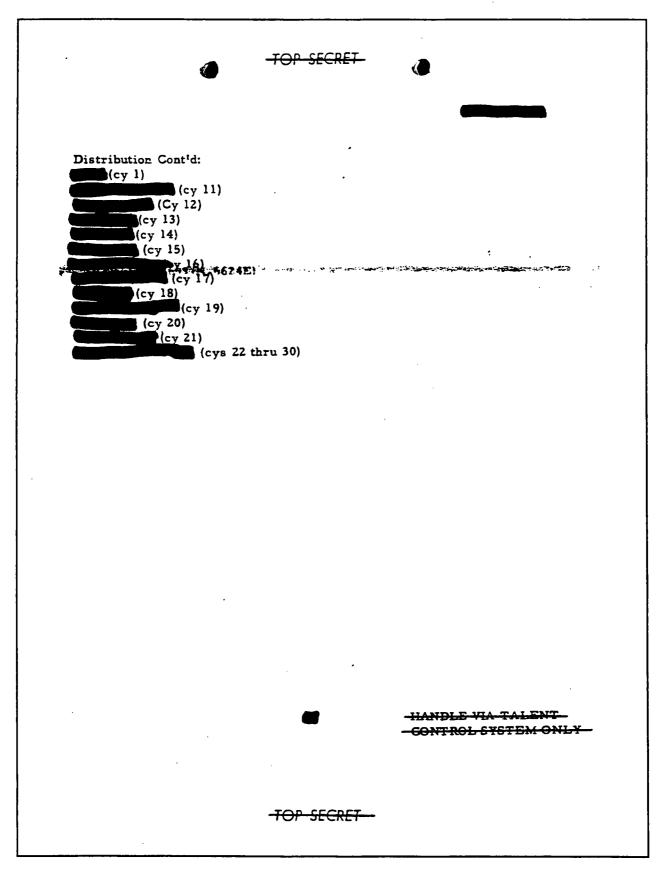




4. James Q. Reber, "List of Highest Priority Targets, USSR," 18 August 1960

-TOP-SECRETŝ Consideration is also now being given the anti-ballistic missile missile problem, this being one of the reasons for recoverage of SARA SHAGAN and of KAPUSTIN YAR Ι. 5. In addition to the remarks above regarding rails, it should be noted that in the attached list there are several area targets, to wit: SARY SHAGAN (12); KLYUCHI Impact Area (23); the IULTIN/ANADYR Area (25)-representing interests which are not confined to single coordinates and where search is required to discover whether suspected developments exist. The Soviet surface to air (SAM) threat has been kept very much 6. in mind in the preparation of the target list because of the evidence of extensive deployment in the vicinity of critical industrial and military centers in the USSR. Complete information on SAM development is recognized as of very high interest to SAC. The collection against this target list should provide extensive information on this high priority requirement. 7. This list differs from previous lists of Highest Priority Targets in that most targets on those lists were supported by considerable firm evidence concerning their importance. Many targets on this list, however, are supported by relatively little firm evidence. They are included here because, on a basis of deductive reasoning, they appear to be the most likely of all known targets to bear upon missile deployment and other highest priority matters at this time. This means that the receipt by the Intelligence Community of a modest amount of firm evidence on a number of problems could cause us to add targets not on the list, or withdraw targets now carried. 8. This paper is for reference and is not intended, in its present form, to indicate an order to priority within itself. Such distinction would be the subject of specific recommendation by the COMOR when required. MESO, REBEI Chairman Committee on Overhead Reconnaissance (cy 2) (cys 3, 4, 5) HANDLE VIA TALENT-CONTROL SYSTEM ONLY (cys 6, 7) (cy.8) (cy 9) (cy 10) TOP SECRET

4. (Continued)



E.	TOP SECRET
1.	Kotlas (6116N-4635E) - Salekhard (6630N-6640E) Rail Line
	Ust Ukhta (6338N-5353E)
	Vorkuta (6730N-6403E)
	Polyarni Ural (6602N-6510E)
	Khal'mer-yu (6757N-6507E)
	Yeletskiy (6710N-6410E)
	Bobskaya (6537N-6624E) - Berger and a second s
	Anderma (6940N-6145E)
	Kara (6915N-6457E)
	Muzhi (6523N-6645E)
	Category of interest: ICBM Deployment
2.	Vologda (5913N-3953E) - Perm (5800N-5615E) Rail Line
	Kirov (5836N-4942E)
	Danilov (5812N-4010E)
	Category of interest: ICBM Deployment
3.	Vologda (5913N-3953E) - Archangelsk (6434N-4032E) Rail Line
	Konosha (6958N-4009E)
	Severodvinsk (6434N-3950E)
	Plesetskaya (6243N-4017E)
	Category of interest: ICBM Deployment, Submarine Launch
4.	Petrozavodsk (5149N-3420E) - Pechenga (6933N-3112E) Rail Line
	Belomorsk (6432N-3447E)
	Olenya (6809N-3315E)
ŧ.,	Murmansk (6858N-3305E)
	Kandalaksha (6709N-3226E)
	Sayda Guba (6915N-3315E)
	Kil'din (6920N-3410E)
	Severomorsk (6905N-3327E)
	Polyarnyy (6912N-3328E)
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E	The Strain Bail Line His (2442N SEER) Orech (SEON 7224E)
5.	Trans-Siberian Rail Line Ufa (5443N-5558E) - Omsk (5500N-7324E)
	Kurgan (5526N-6520E)
	Chelyabinsk (5510N-6124E)
	Zlatoust (5510N-5940E)
	Trans-Siberian Rail Line Novosibirsk (5502N-8253E) - Irkutsk (5216N-1042E)
Y. Andrew	Argarek (5235N-10354E)
	Krasnoyarsk (Dodnovo) (5602N-9248E)
	Belaya (5251N-10333E)
	Categories of interest: ICBM Deployment, Long Range Aircraft Nuclear Energy
7.	Chelyabinsk (5510N-6124E) - Ivdel (7042N-6028E) Rail Line
	Kyshtym (5544N-6033E)
	Sverdlovsk (5650N-6036E)
	Nizhnaya Salda (5805N-6043E)
	Nizhnaya Tura (5837N-5950E)
	Categories of interest: ICBM Deployment, Missile Produc-
	tion, Nuclos,r Energy
8.	Komsomolsk (6115N-13907E) - Vladivostoit (4308N-13150E) Rail Line
	Khabarovsk (4839N-135 2 6E)
	Spaask Dal'Liy (4437N-13248E)
	Khorol (4425N-13204E)
	Kremovo (4402N-13216E)
	Categories of interest: IRBM Deployment, ICBM Deploy- ment, Submarine Launch
.9.	Grodekovo (4425N-13123E) - Kraskino (4243N-13048E) Rail Line
	Slavyan'ka (4929N-13045E)
	Categories of interest: IRBM Deployment
10.	Odessa (4628N-3043E) - Leningrad (5955N-3020E) Rail Line
	Vinnitsa (4913N-2829E)
	Zhitomir (5016N-2840E) HANDLE VIA TALENT
	Mogilev (5355N-3021E) TOP SECRET CONTROL SYSTEM-ONLY

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Vitebsk (5512N-30 Soltsy (5807N-301	
- - -	Categories of interest: IRBM Deployment, Longe Range Aircraft
Gulf of Finland)	4E) - Yyborg (6043N-2844E) Rail Line
Leningrad (5955N- Kronshtadi (5959N	
	Categories of interest: IRBM Deployment, Submarine Launch
12. Berezovka (5112N	-4557E)
	Category of interest: ICBM Deployment
13. Moscow Complex	(5545N-3735E)
Shelkovo Ramenskoye Khimki	
Fili	
	Category of interest: Long Range Aircraft, Missile Production, Missile Research and Development
14. Dnepropetrovsk (4	1828N-3500E)
	Category of interest: Missile Production
15. Tyura Tam Range	head (4555N-6318E)
	Category of interest: Missile Research & Development
16. Gorkiy (5708N-413	5E0
:	Category of interest: Long Range Aircraft
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Category of interest: Long Range Aircraft
17. Mozhayak (5530N-3602E)
Category of interest: Nuclear Energy
18. Tiksi (7135N-1285E)
Categories of interest: ICBM Deployment,
Nuclear Energy
19. Caspian Sea Test Range
Baku (4023N-4955E)
Fort Shevcherko (4430N-5015E) Gurev (4707N-5115E)
Krasnovodsk (4000N-5300E)
Makhachkala (4258N-4730E)
Category of interest: Missile Research & Development
20. Priluki (3035N-3224E)
Category of interest: Long Range Aircraft
21. Black Sea Coastline
Sukhumi (4300N-4101E)
Kerch (4523N-362ćE)
Novorossiysk (4444N-3748E) Odessa (4628N-3044E)
Sevastapol (4437N-3332E)
Balakalave (4430N-3335E)
Ay-Petri (4435N-3412E) Batumi (4139N-4139E)
Yalta (4430N-3410E)
Feodosiya (4502N-3523E)
Nikolayev (4658N-3200E)
Sudak (4458N-3502E) Karangit (4502N-3558E)
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CONTROL SYSTEM ONLY
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-TOP SECRET D Categories of interest: IRBM Deployment, Submarine Launch, Arti-ICBM Research and Development 22. Kluyuchi Impac: Area Uka (5749N-1620E) Khutor (5309N-16205E) Petropaulovak (5300N-15840E) Pescharny (5750N-15205E) Categories of interest: Missile Research & Development, Submarine Launch 23. Baranovichi (5307N-2602E) Category of interest: Long Range Aircraft 24. Anadyr Area Ugolni Kopi (6430N-17758E) Anadyr/Lenizka (6445N-17910E) Ugol'nyy (6225N-17910E) Bukhta Ugolnaya (6258N-17917E) Categories of interest: Missile Deployment, Nuclear Energy, Long Range Aircraft 25. Kapustir Yar (4835N-4545E) - Vladimirovka (4818N-4610E) Rangehead Zone 9, Zone 10 Categories of interest: Missile Troop Training, Missile Research & Development 26. Mukachavo (4826N-2245E) Uzhgorod (4838N-2217E) Svalyava (4835N-2300E) Lvov (4950N-2400E) Stryy (4915N-2352E) Delyatin (4828N-2438E) HANDLE VIA TALENT CONTROL SYSTEM ONLY -TOP-SECRET CONTROL SYSTEM ONLY-

-TOP-SECRET-Categories of interest: IRBM Deployment, Long Range Aircraft 27. Kalingrad/Baltiysk (5443N-2030E) - Riga (5657N-2405E) Tallin (5926N-2444E) Rail Line Leipaja (5632N-2100E) Ventspile (5724N-2134E) Dago Island (asta) (5855N-2240E) Taurage (5515N-2218E) Paplaka (5626N-2127E) Klaypeda (5543N-2109E) Categories of interest: ICBM Deployment, IRBM Deployment, Submarine Launch 28. Vinnitaa (4914N-2828E) - Kharkov (4958N-3615E) Rail Line Borispol (5020N-3057E) Mirispol (4958N-3057E) Poltava (4936N-3434E) Kiev (5037N-3032E) Uzin/Chepalivka (4950N-3025E) Categories of interest: IRBM Deployment, Long Range Aircraft 29. Malaya Sazanka/Ukraina (5114N-12804E) Categories of interest: Long Range Aircraft Nuclear Energy 30. Sukhumi (4242E-4102E) - Dzhulfa (3854N-4538E) Category of interest: IRBM Search 31. Ulyanovsk (5420N-4824E) - Saransk (5411N-4512E) - Murom (5536N-4202E) Rail Line Arzamas (5523N-4305E) Shatk: (5511N-4408E) Tashino (5452N-4349E) HANDLE VIA TALENT -CONTROL SYSTEM ONLY--TOP SECRET-

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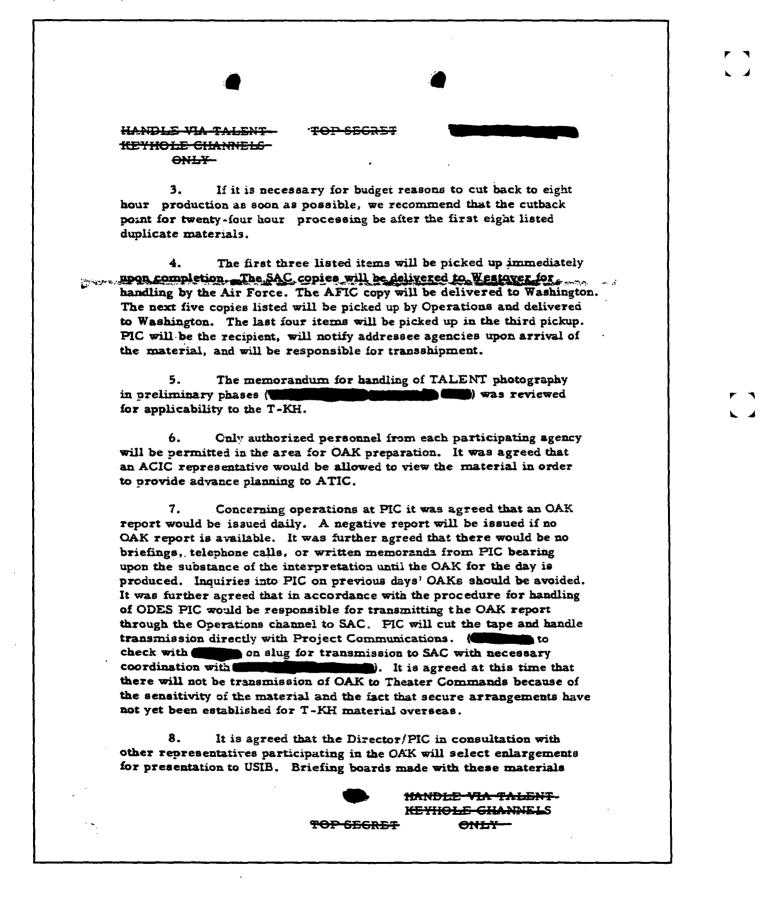
-TOP-SECRET-Categories of interést: ICBM Deployment, Nuclear Energy 32. Sary Shagan (4610N-7355E) 1050 N. M. Impact Area (4617N-7201E) 950 N. M. Impact Area (4653N-6936E) • Sary Shagan Base Area (4610N-7335E) -----Sary Shagan Test Area Installations 20.0000000-000 42 Stor Bart Range Staff Headquarters (4617N-7055E) Vladimiravka Range Outstation (4654N-7047E) Zone B (4550N-7230E) Zone A (4617N-7330E) Zone C (4530N-7250E) Suspect Zone (4652N-7215E) Suspect Area (4530N-7225E) Cztegories of interest: ICBM Deployment, Anti-ICBM Research and Development, ABM Missile, Nuclear Energy. HANDLE VIA TALENI CONTROL SYSTEM ONLY · : · -, -feroronal. -TOP SECRET -CONTROL SYSTEM ONLY

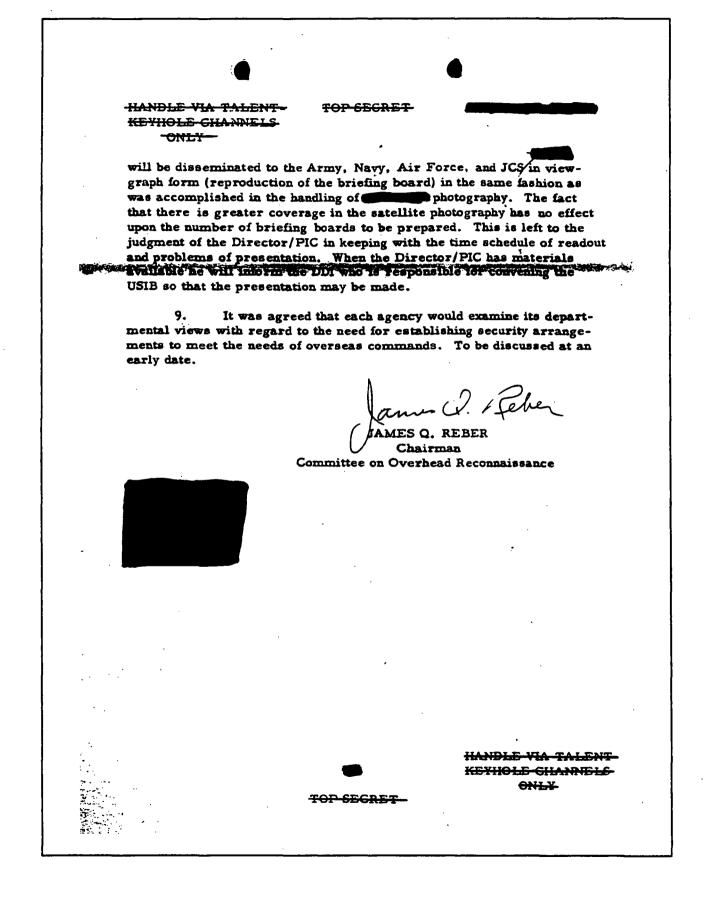
 James Q. Reber, Memorandum of Agreement, "Procedures for the Handling of T-KH Materials," 22 August 1960

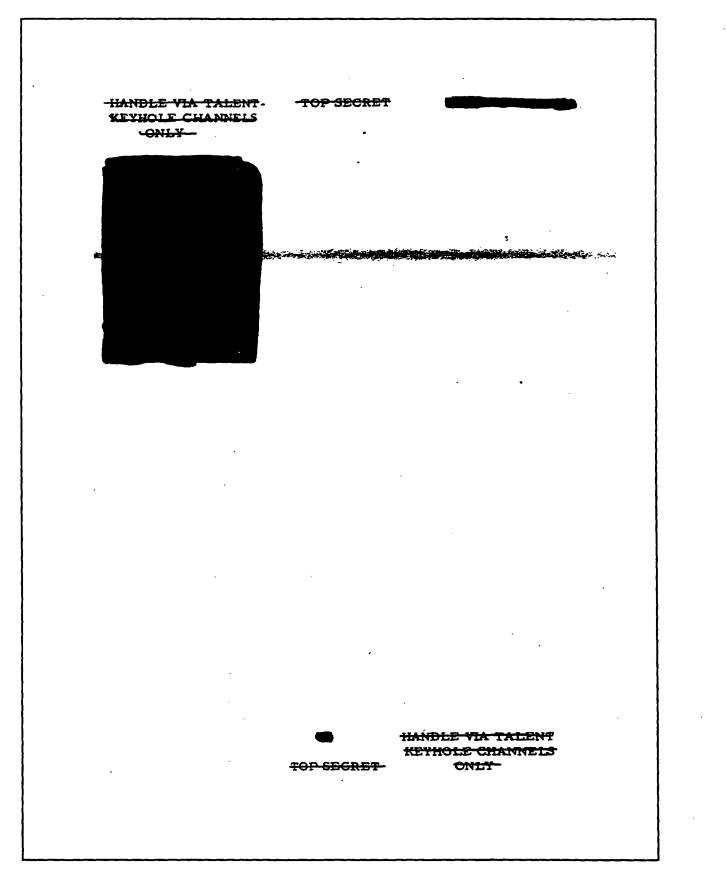
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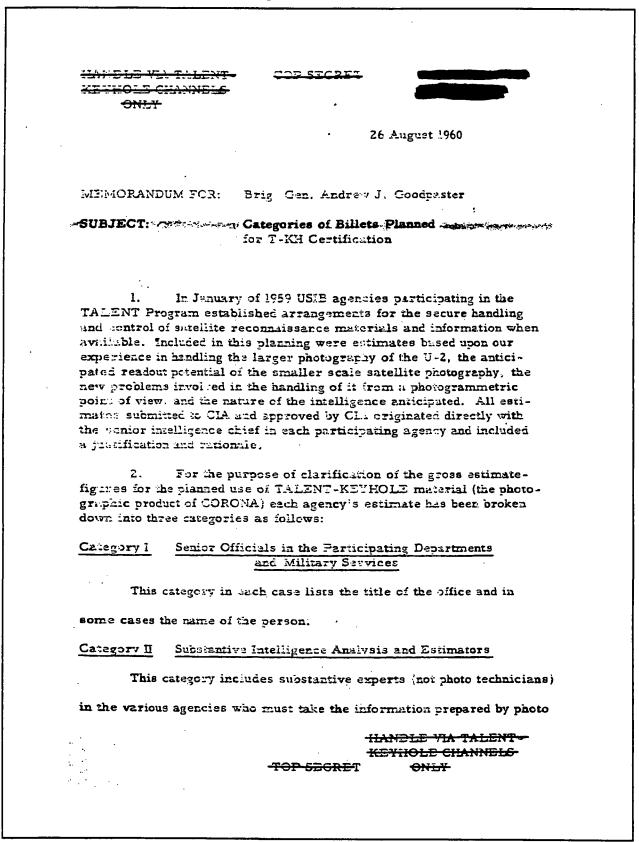
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Navy, Air Ford 2. from T-KH on This is recomm this particular graphic interpr in every center that after the r	ce, and PIC re It is recommend this shot be do rended not onl (ime, but also retation proble r where this m eproduction of	epresentatives. ended that all of the eveloped on a twee ly because of the i o because this ma ers and procedure naterial will be have f the materials for	reached today by Army, ne duplicate materials aty-four hour basis. intelligence urgency at terial is new and photo- es will require attention ndled. It is recommended r joint use in PIC subse- ollowing order of priority:
	SAC 1 DP	1 DN	
· · · ·	AFIC 1 DP		
	Navy 1 DP		
	ATIC 1 DP	1 DN	
	Army 1 DP		
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	AFIC 1 DP		
	Army 1 DN		
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6. James Q. Reber, Memorandum for Brig. Gen. Andrew J. Goodpaster, "Categories of Billets Planned for T-KH Certification," 26 August 1960



6. (Continued)

HANDLE VIA TAL TOD STORES **XETHOLE CHANNELS** ONLY. interpretors, correlate it with other sources, and prepare reports and estimates for the senior intelligence officer or for his reporting to superiors, or contribution to the estimates produced by the United States • Intelligence Board. Category III Photo Interpretation This category includes the technical photo interpretors, administrative, communication. and logistics support personnel handling the TALENT-KEYHOLE materials in the centers of the various agencies considered in this report. James Q. Reben JAMES Q. REBER TALENT Control Officer, CIA PALENT. ETHOLE CHANNELS SECRET TOI ONI: .

HANDLE VIA TALENT- KEVHOLE CHANNELS ONLY	TOP SECRET
Centr	al Intelligence Agency
I. Senior Officials	22
DCI	Mr. Allen W. Dulles
DDCI	Gen. C. P. Cabell
Inspector General 🦛	Mr. Lyman B. Kirkpatrick
SA/DCI	Mr. John S. Earman
DD/I	Mr. Robert Amory, Jr.
A/DDI	Mr. William A. Tidwell
DD/P	Mr. Richard M. Bissell
A/DDP/A	Mr. C. Tracy Barnes
ADD/S	Mr. H. Gates Lloyd
Comptroller	Mr. Edward R. Saunders
C/Budget/Compt.	Mr. Charles W. Mason
General Counsel	Mr. Lawrence R. Houston
	Mr. John S. Warner
D/Communications	
D/Security	Col. Sheffield Edwards
D/Persornel	Mr. Emmett D. Echols
AD/OCI AD/ORR	Mr. Huntington Sheldon Mr. Otto E. Cuthe
AD/ORR AD/OCR	Mr. Otto E. Cuthe Mr. Paul A. Borel
AD/OSI	Dr. Herbert Scoville, Jr.
AD/ONE	Dr. Sherman Kent
D/PIC	Mr. Arthur C. Lundahl
II. Substantive Intelligence	Analysts and Estimators 100
III. Photo Interpretation	. 164
	TOTAL 286
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	Honorable Thomas S. Gates,	:
	Secretary of Defense	AND CONTRACTION OF THE OWNER OWNE
· · · ·	Honorable James H. Douglas, Jr., Deputy Secretary of Defense	
	Honorable Herbert F. York, Director of Research and Engineering	
	Gen. G. G. Erskine, Retired, Special Ass to the Secretary for Special Operations	istant
	Lt. Gen. Donald N. Yates, Deputy Directo Research and Engineering	л г .
	Lt. Gen. William P. Ennis, Director Wea System Evaluation Group	pons .
	Brig. Gen. Austin W. Betts, Director ARI (Advance Research Project Agency)	PA .
	Col. Edwin F. Black, Military Assistant to Deputy Secretary of Defense	o the
	Brig. Gen. George S. Brown, Military As to the Secretary of Defense	sistant
	Brig. Gen. Edward C. Lansdale, Deputy to General Erskine	
	Capt. Means Johnston, Jr., Military Assi to the Secretary of Defense	stant
TANDLE VIA TALENT- LETHOLE CHANNELS ONLT & Dune	Brig. Gen. William T. Seawell, Military, to the Deputy Secretary of Defense H. Billing, Deputy Dructor Cesearch 70	Assistant formed
I. Estim	ators (R&D and Security)	Ma
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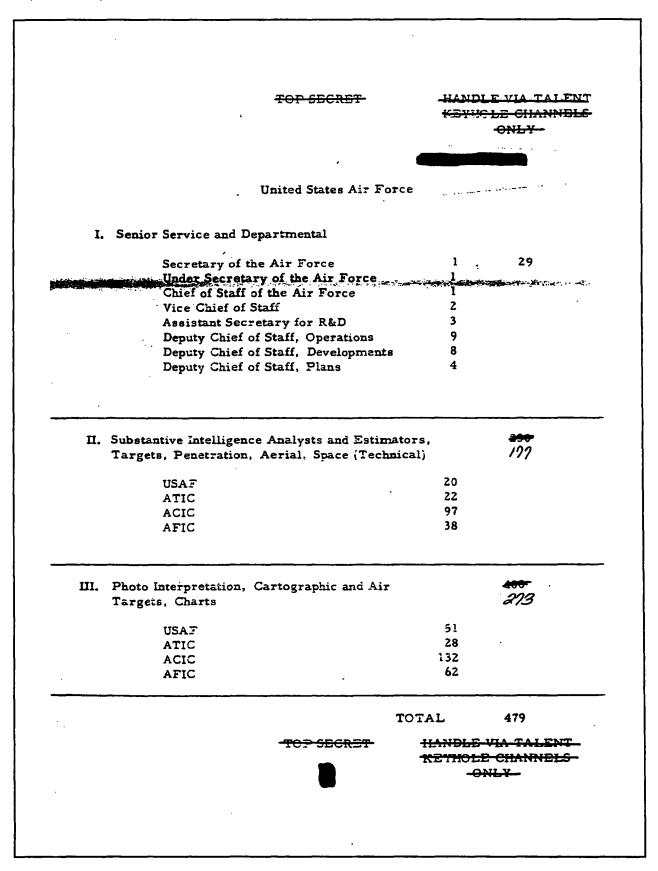
HANDLE VIA TALENT TOP SECRET **KEYHOLE CHANNELS** ONLY. Joint Chiefs of Staff I. Senior Officials General Nathan F. Twining, Chairman Joint Chiefs of Staff Lt. Gen. Earle G. Wheeler, U.S. Army, Director, Joint Chiefs of Staff Maj. Gen. James F. Whisenand, Special Assistant to the Chairman Maj. Gen. Robert A. Breitweiser, J-2 Rear Admiral William S. Post, Deputy J-2 Brig. Gen. James C. Sherrill, Executive to the Chairman Dr. Brace H. Sillings, Deputy Director Research and Engineering all To OSD list II. Estimators 10 2 16-15-TOTAL HANDLE VIA TALENT TOP SECORT KEYHOLE CHANNELS ONLY-

6. (Continued)

TOP SECRET HANDLE VIA TALENT-KEYHOLE CHANNELS -ONLY Strategic Air Command 73 11. Substantive Intelligence Analysts and Estimators . TIII. Photo Interpretation, Cartographic, Targets, Charts • TOTAL 200 HANDLE VIA TALENT -KEYHOLE CHANNELS ONLY TCP SECRET

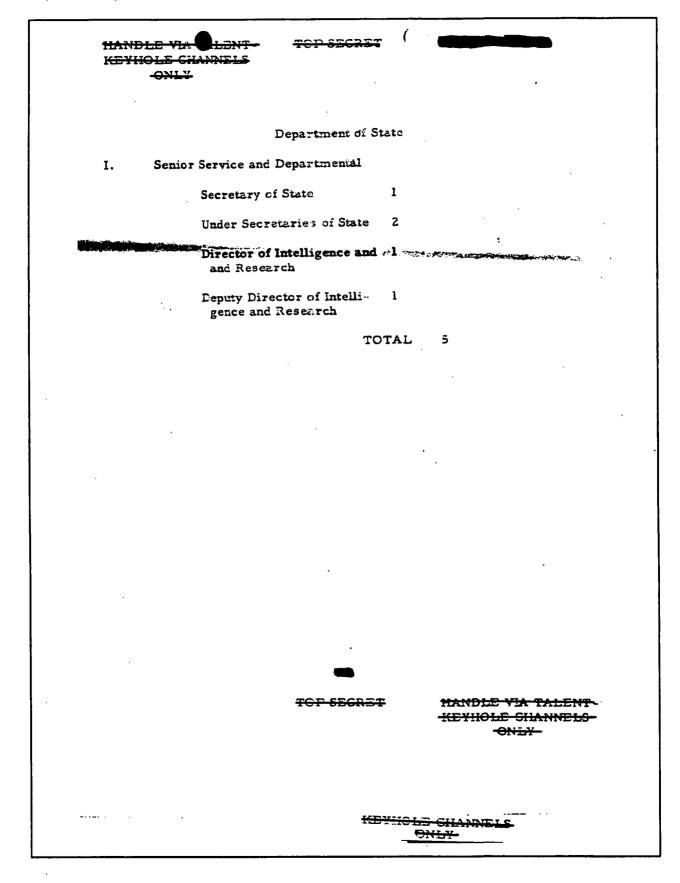
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	United States Army	XEY	HOLE CHANNEL
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Director o	f Research and Develop	ment, Army	
Chief of St	aíf		;
Vice Chief	of Staff		ૹૡૡૡૡ ૡૡ૽ૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡૡ
Secretary	of General Staff		
Comptroll	er of the Army		
Director o	of Army Budget		
Deputy Ch	ief of Staff for Military	Operations	
Chief Rese	earch and Development		
Deputy Ch	ief Research and Develo	pment	
Deputy Ch	ief of Staff for Personne	1	
Deputy Ch	ief of Staff for Logistics		
II. Substantive Intelli	igence Analysts and Est	mators	127
III. Photo Interpretati	non		150
		TOTAL	289
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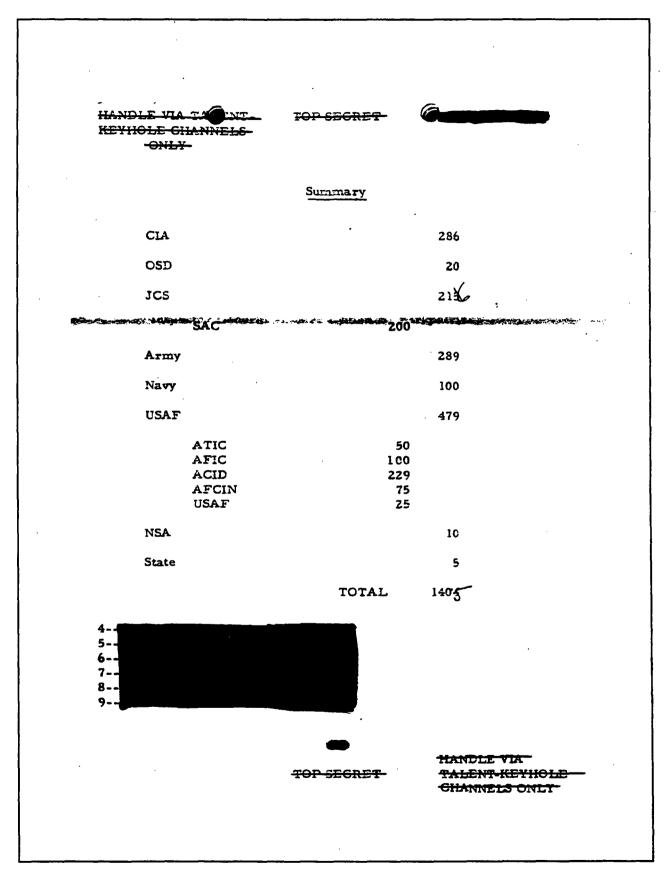
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<i>.</i>	The Assista	ant Secretary of the Na	avy for R3	٥D
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	The Vice C	hief of Naval Operatio	ns	
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	The Deputy	Chief of Naval Operat	tions for 3	lir
	Deputy CNC) for Development		
lī. Substar	ntive Analys	is and Estimators		47
III. Photo I	nterpretors			43
		,	TOTAL	100
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6. (Continued)

	TOP SECRET.	HANDLE KEYHOL	UIA TALENT E CHANNELS ONLY
	National Security Agency		
I. Senior Service an	d Departmental	• •	3
Lt. Genera	al John A. Samford, USAF	, Director NSA	L .
Louis W.	Tordella, Deputy Director	NSA -	·
	Nowlett, Special Assistant		
II. Substantive Intelli	gence Analysts and Estima	ators	7 ·
·		TOTAL	10
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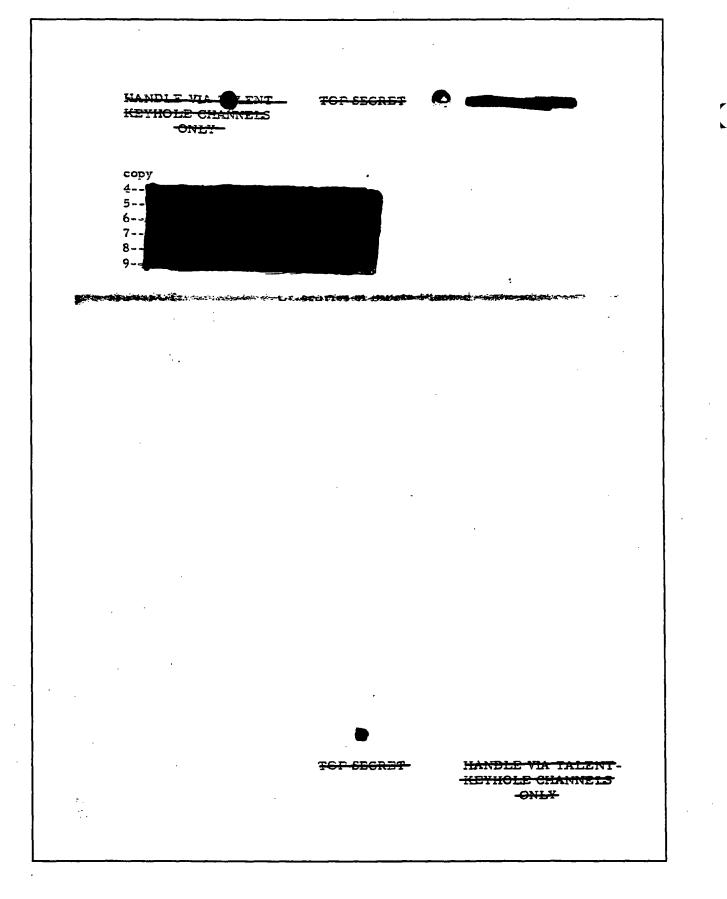
7. Dwight D. Eisenhower, Memorandum for the Secretary of State, et al., 26 August 1960

12.) HANDLE VIA TE ENT KEYHOLE SYSTEM ONLY THE WHITE HOUSE Washington August 26, 1960 MEMORANDUM FOR The Secretary of State The Secretary of Defense* The Attorney General** The Chairman, Atomic Energy Commission The Director of Central Intelligence I hereby direct that the products of satellite reconnaissance, and information of the fact of such reconnaissance revealed by the product, shall be given strict security handling under the provisions of a special security control system approved by me. I hereby approve the TALENT-KEYHOLE Security Control System for this purpose. Within your agency, you shall be personally responsible for the selection of those personnel who will have access to the foregoing information and for determining the scope of that access. Access is to be on a "must know" basis related to major national security needs. A list of those selected shall be furnished to the Director of Central Intelligence, who will maintain and review the control roster. When they are indoctrinated, they shall be informed of my specific direction to them that the provisions of the special Security Control System I have approved be strictly complied with, including the prohibition upon them of imparting any information within this system to any person not specifically known to them to be on the list of those authorized to receive this material. The responsibility for the selection of personnel may be delegated only to the senior intelligence chief or chiefs within the agencies serving as members of the U.S. Intelligence Board. The Director of Central Intelligence, in consultation with the U. 5. Intelligence Board, will be responsible to me for determining all questions involved in the continued protection and control of the foregoing material and information, including the development of a common understanding as to the meaning of the term " 'must know' basis related to major national security needs," and a broad consensus as to the numbers of personnel in each agency comprehended by this term. *For Department of Defense signed Dwight D. Eisenhower including OSD, JCS, Army, Navy, Air Force, and NSA MANDIE VIA TALENT. **For Director, FBI KEYHOLE SYSTEM ONLY TOP SECRET

HANDLE VIA TALENT 207 CERT KEYHOLE CHARRENS ONLY 27 August 1960 MEMORANDUM FOR: General Graves B. Erskine, OSD Major General John Willems, Army Rear Admir 1 Laurence H. Frost, Navy Major General James H. Walsh, US Air Force Brigadier Gineral Robert A. Breitweiser, JCS Lt. General John A. Samford, NSA SUBJECT: TALENT-KEYHCLE Certification Plans 1. In the course of last weeks discussions with General Goodpaster I was requested to submit a breakdown of the planned billets for the handling of EALENT-KEYHOLE material, the form of which breakdown will be raedily evident from the attached paper. These sigures and the names of positions where indicated are details in the custody of TALENT Control Officers in the representative organizations except the State Department. At the USIS meeting in the late afternoon of August 25 the members indicated they would like a copy of this paper. Accordingly, it is sent to you in pursuance of that request. 2. It is understood that by vistue of the President's Directive, the oral instructions of General Guodpaster, and the guideline indicated by the Director of Central Intelligence at the USIB meeting, it is now proper to proceed with the indoctmention of the billets as planned subject to the direction of the serior intelligence chief under the terms of the President's Directive, or in the case of the military services subject to further direction by the Securitary of Defense. 3. After the USIB meeting the necessary parties were informed in order that the duplicate film hitherto impounded would be released to the assigned recipients and the OAK report, the preliminary PI, would be disseminated as it became available through T-KH channels to T-KHcleared people in the various agencies. am JAMES Q. REBER ENT Control Officer, CIA TAT Attachment: TOP SOSI HANDIT IT A TALENT_ KEYHOLE CHANNELS ONLY

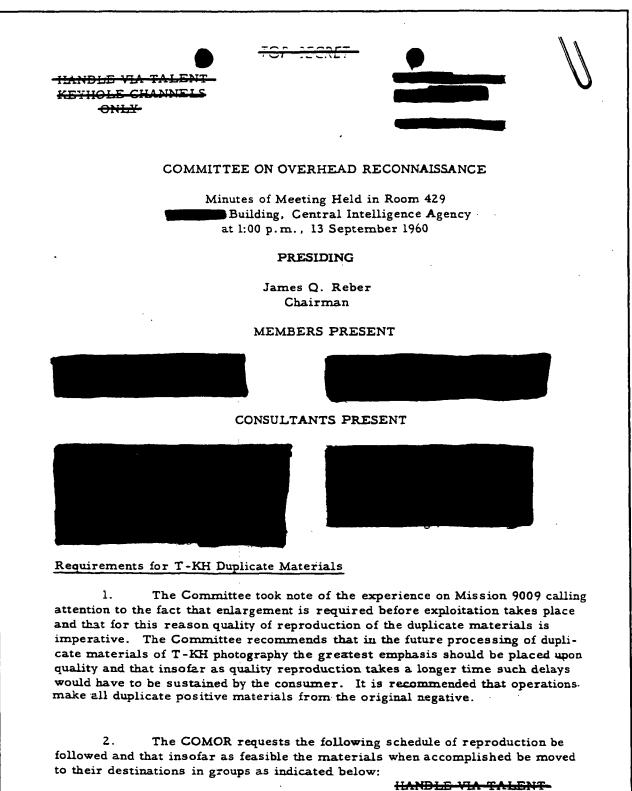
8. James Q. Reber, Memorandum for US Intelligence Board Members, "TALENT-KEYHOLE Certification Plans," 27 August 1960

8. (Continued)



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9. James Q. Reber, "Minutes of COMOR Meeting," 13 September 1960



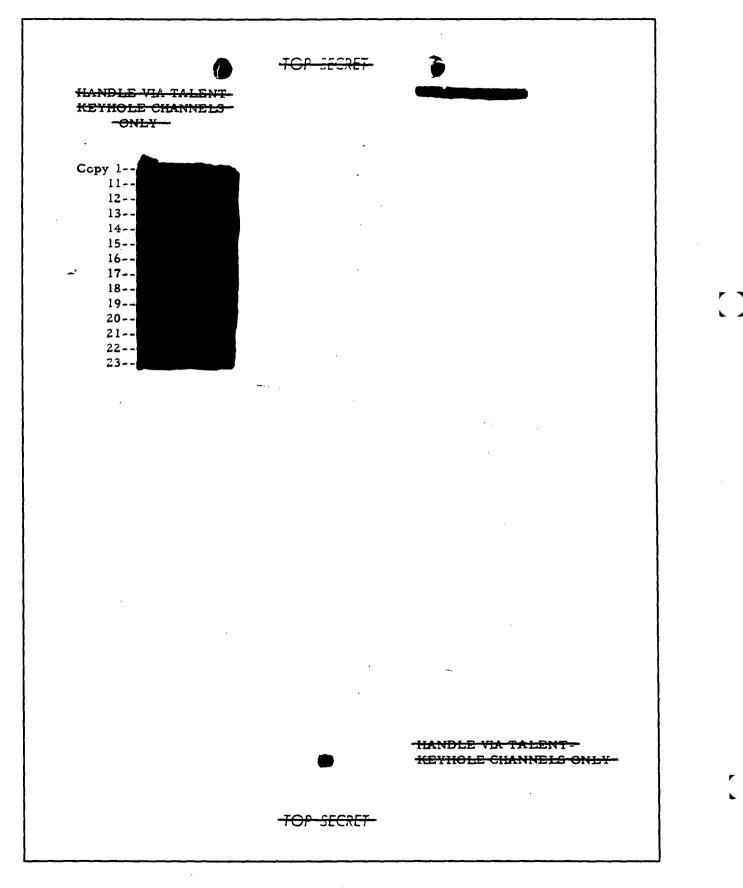
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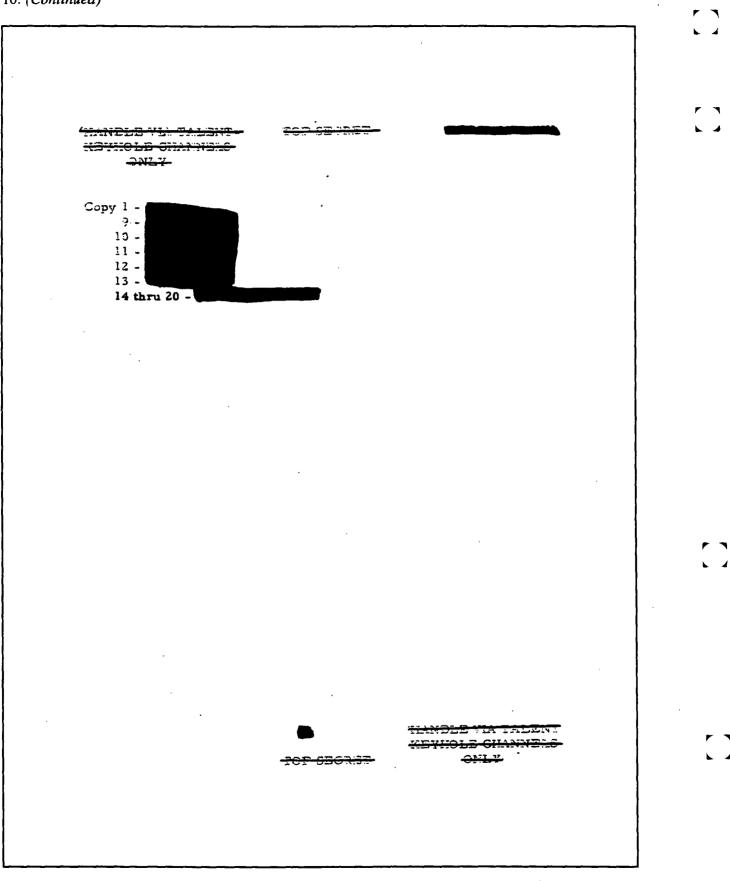
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GROUP I	1 DN for PIC for joint interpretation
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GROUP II	i DP & 1 DN for SAC
	1 DP for AFIC
GROUP III	5 DPs for PIC for joint interpretation
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GROUP IV	l DP for Navy
	1 DP for ATIC
	1 DN for ATIC
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GROUP V	1 DN for AFIC
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GROUP VI	1 DP for SAC
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It is recommended	that all of the foregoing duplicate materials be produced on a
24-hour basis excep	rt Group VI which may be on an 8-hour schedule.
Requirements for F	Suture T-KH Collection
	of PIC/CIA presented a briefing showing the highest
3. 🗰	the USSR in an overlay on the map of Russia along with anoth
priority targets for	
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GECRET TOP HANDLE VIA TALENT-KEYHOLE-CHANNELS--ONLY It was agreed that the principal target for planning multi-day 4. orbit should be Polyarnyy Ural. If however this was confirmed as covered in the last single orbit series shortly to be delivered, then the principal highest priority target for planning purposes should be Ust Ukhta. . ' AES Q. REBER Chairman Committée of Overhead Reconnaissance Copy 2-3, 4, 5 -6,7 -8-9-10-HANDLE VIA TALENT-3 -KEYHOLE CHANNELS ONLY TOP SECRET .



10. James Q. Reber, Memorandum for US Intelligence Board, "Proposed Expansion of Billets for the Exploitation and Use of TALENT-KEYHOLE Materials and Information," 14 September 1960

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-NETHOLE CHANNELS-	
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	14 September 1960
MEMORANDUM FOR: The United St	ates Intelligence Board
MEMORENCEON FOR. The canter of	
	ansion of Billess for the
Exploitation a	d Use of TALENT -
KEYHOLE Ma	terials and Information
1. The OSD, JCS. Army, ?	avy, Air Force, NSA, and CIA
members of the Committee on Overhea	d Reconnaissance have closely
examined the purchases incident to the	roloitation of photography and
the use of the informatica available fro	m Mission 9006 satellite photog.
the use of the informatica available fro	
raphy. They submit for approval of the	Gener conclusion as to the
meaning of this photography for U.S. N	ational Security purposes in the
attached document. Along with this do	cument are annexes devoted to
the individual agencies showing the org	anization units (with their func-
tions) which need to make use of the ph	otography or information derived
therefrom and the number of billets re-	uired in that use.
2. The billet structures pla	med for this purpose prior to
receipt of Mission 9009 are judged by a	
exploitation and use of the maverial. I	be additional billets required by
agencies are summarized in Annex A v	the a recombulation by agency in
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subsequent annones.	
	the USIE approve the attached
document with its annexes.	
	\wedge
	Direct Call
	James X. Jen.
1	JAMES O. REBER
	// Chairman
Commit	se on Cverhead Re connaissance
Attachment: As stated	V
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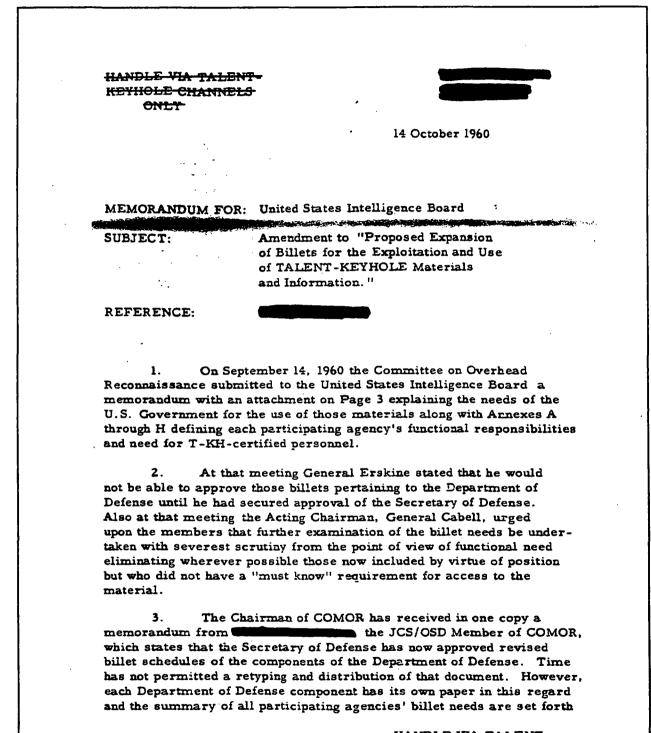


HANDLE VIA TALENT-TOP SEGRET Attachment to KETHOLE-GHANNELS ONLY-Proposed Expansion of Billets for the Exploitation and Use of TALENT-**KEYHOLE** Materials and Information 1. A Presidential Directive recently issued requires that satellite photography must be handled within the TALENT Security -Control System in eseparate compartment known as TALENT-KEYHOLE. It further requires that the United States Intelligence Board shall develop a broad consensus for determining those functions in the United States Government (and personnel within them) which must have access to satellite photography for National Security purposes. 2. The satellite photography from Mission 9009 is in hand and is currently being exploited and used within Washington Headquarters? intelligence agencies, and The Strategic Air Command, Aero-Space Technical Intelligence Center, Aeronautical Chart and Information Center, Army Map Service, and Navy Photographic Interpretation Center. The billet structure within these organizations was planned on an extremely limited basis in advance of the arrival of satellite photography and pending an evaluation of the exploitation potential. 3. For six years the U.S. intelligence agencies have had extensive experience with the larger scale photography from overflight held in the and TALENT Systems. New equipment bearing upon the art of photographic interpretation has clearly expanded the quantity and quality of information derived from that photography. We have seen the extensive uses to which the material and the information derived therefrom can be put for strategic intelligence purposes, emergency war planning, intelligence purposes related to the responsibility of theater commanders, research and development requirements of the Department of Defense, and operational purposes of the military as well as intelligence operations. 4. The examination of satellite photography from Mission 9009 reveals that it can serve essentially the same purposes as the earlier TALENT photography. While it has definite limitations for technical intelligence purposes (as compared with TALENT), it serves those purposes HANDLE VIA TALENT-**KE THOLE GHANNELS** TOP SECRET -ONLY-

10. (Continued)

HANDLE VIA TALENT-TOP SECRET Attachment to KEYHOLE CHANNELS ONLY through comparison with existing TALENT and through the use of collateral intelligence. Its vast geographic coverage clearly enhances our ability to search for guided missile sites of all sorts, and will permit the identification of installations with which we have become familiar under the TALENT Program. In addition to the uses for positive information on the USSR, it will materially assist in refining the targets for other collection programs and improving their potential. 5. The USIE has reviewed U.S. needs for National Security purposes in the light of the capabilities of the available satellite photography and with the purpose and injunction of the Presidential Directive uppermost in mind. The USIB considers the planned increase of TALENT-KEYHOLE billets set forth in the annexes hereto to be necessary and proper in terms of functional use of TALENT-KEYHOLE materials and information and the magnitude of the personnel forces to carry these functions at this time. Annex A Summary of TALENT-KEYHOLE Billets for All Agencies B T+KH Biller C T KH Billets D T KH Brilets E T KH Billets F T-KY Billet G T-KH Billet H TKH Billet HANDLE VIA TALENT **KETHOLE GHANNELS** -ONLY-

 James Q. Reber, Memorandum for US Intelligence Board, "Amendment to 'Proposed Expansion of Billets for the Exploitation and Use of TALENT-KEYHOLE Materials and Information," 14 October 1960

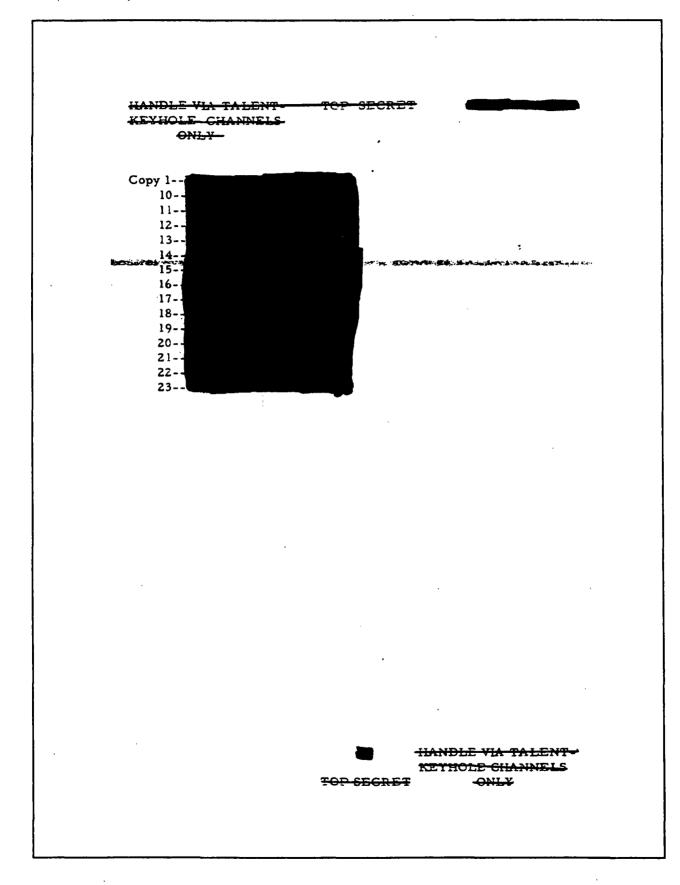


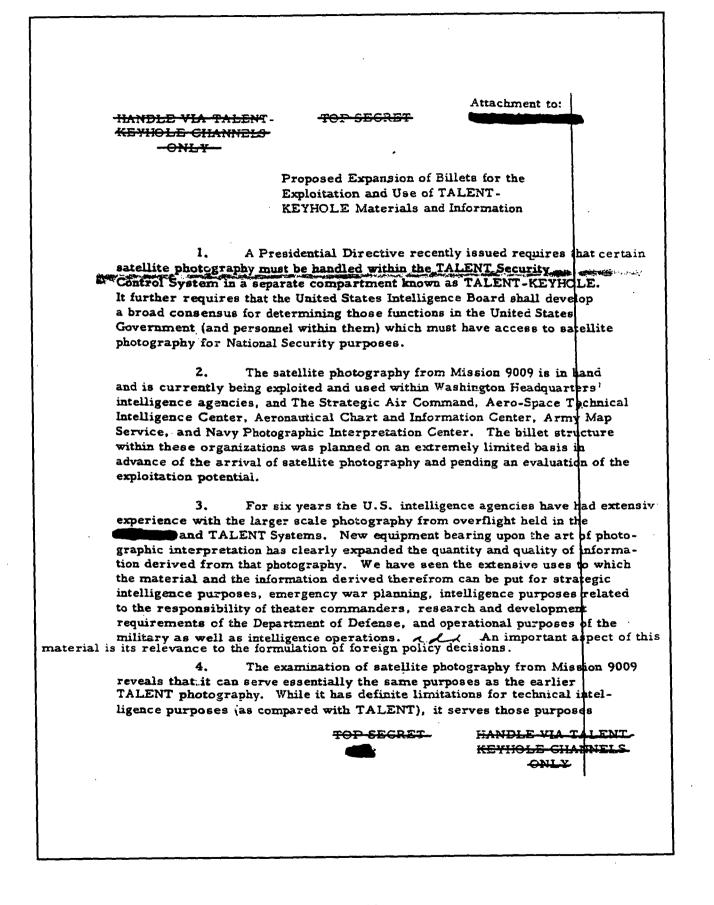
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in Annex A to this documen	t. The effect of the re-examination under-
	B meeting of September 20th is an overall
reduction of between 20% as	nd 25% from the billet needs set forth in the
	e attached paper it is suggested that special
note be taken of paragraph	5. ,
5. Unon USIB a	pproval of the attachment it will be sub-
mitted to the White House f	or comment in accordance with the request
of General Goodpaster.	
6. Recommenda	ation: It is recommended that the United
States Intelligence Board ap	
	James Q. Reber
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	fames
	AMES Q. REBER
	Committee In Overhead Becommission
	Committee on Overhead Reconnaissance
Attachment A	
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	TOP SECRET HANDLE VIA TALENT.
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11. (Continued)





11. (Continued)

HANDLE VIA TALENT TOP SEGRET Attachment to -KEYHCLE CHANNELS -ONLY through comparison with existing TALENT and through the use of collateral intelligence. Its vast geographic coverage clearly enhances our ability to search for guided missile sites of all sorts, and will permit the identification of installations with which we have become familiar under the TALENT Program. In addition to the uses for positive information on the USSR, it will materially assist in refining the targets for other collection programs and improving their potential. A REAL PROPERTY AND A REAL 5.1 The USIB has reviewed U.S. needs for National Security purposes in the light of the capabilities of the available satellite photography and with the purpose and injunction of the Presidential Directive uppermost in mind. The USIB considers the planned increase of TALENT-KEYHOLE billets set forth in the annexes hereto to be necessary and proper in terms of functional use of TALENT-KEYHOLE materials and information and the magnitude of the personnel forces to carry these functions at this time. Annex A Summary of TALENT-KEYHOLE Billets for All Agencies. 4 SECRET HANDLE VIA TALENT-**KETHOLE CHANNELS** -ONLY

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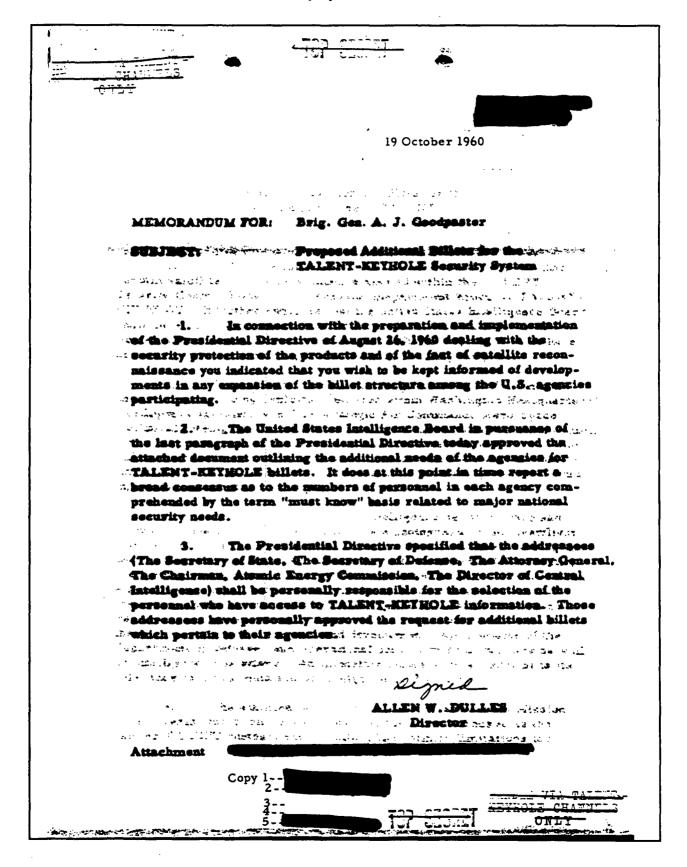
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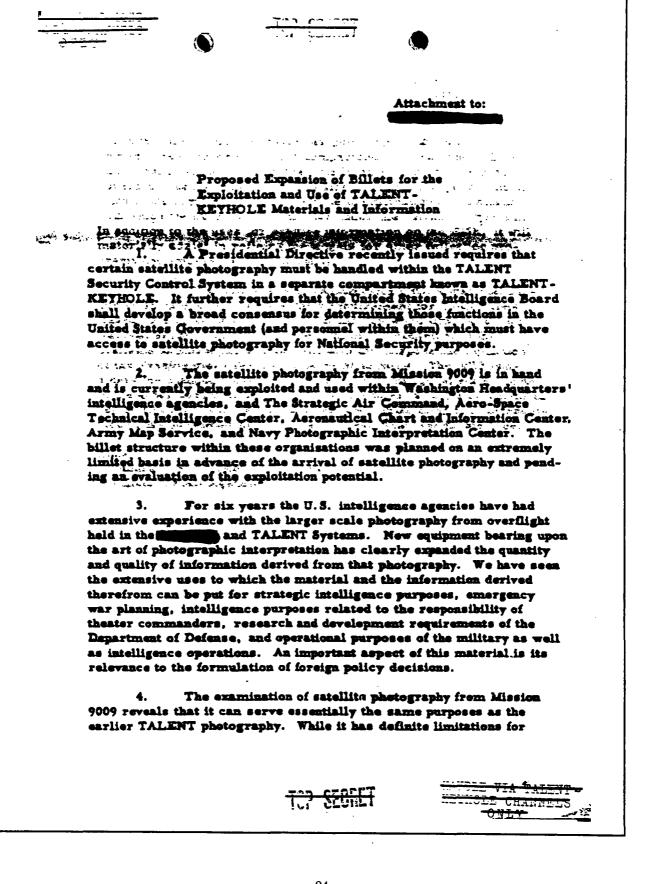
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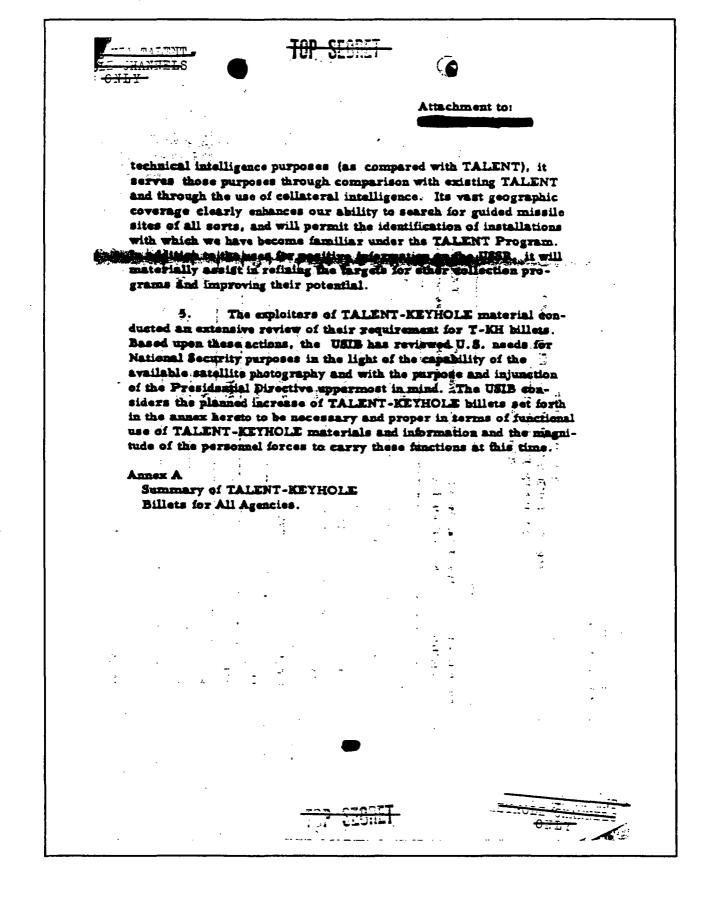
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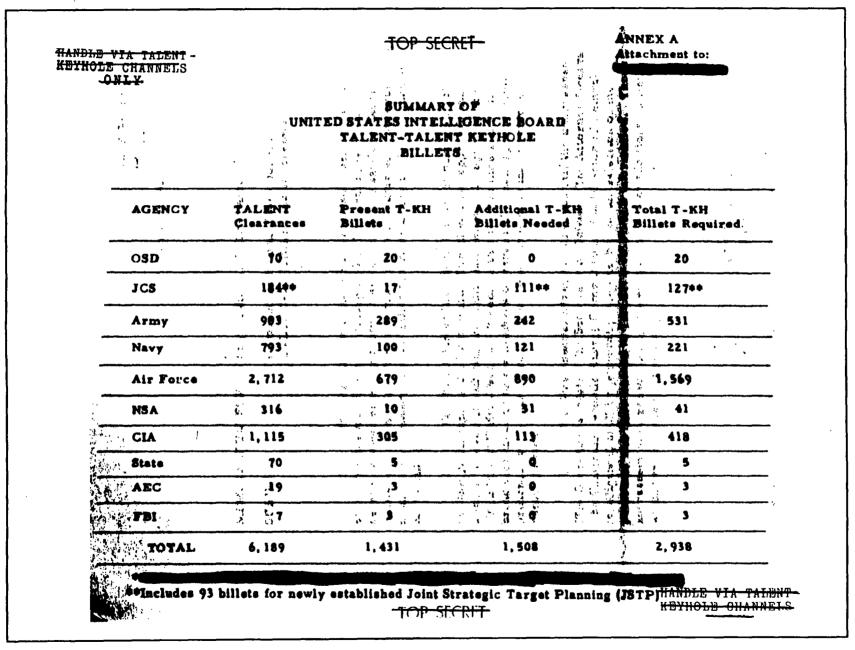
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12. Allen W. Dulles, Memorandum for Brig. Gen. Andrew J. Goodpaster, "Proposed Additional Billets for the TALENT-KEYHOLE Security System," 19 October 1960





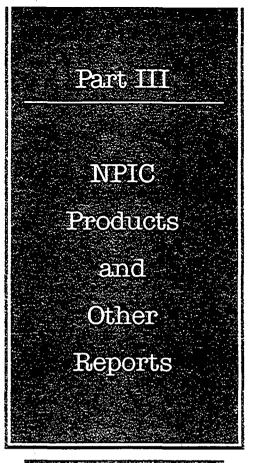




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Part III: NPIC Products and Other Reports

Modern day imagery analysis dates back to the development of aerial reconnaissance during World Wars I and II. The CIA's ability to process and interpret photographs advanced rapidly in its new Photo-Intelligence Division (PID) with the advent of the secret high-altitude U-2 aircraft in the 1950s. By 1958, with some additional Army and Navy photographic support, CIA expanded PID into the Photographic Intelligence Center (PIC). In January 1961, DCI Dulles, consolidated all US photographic interpretation into a single community organization, the National Photographic Interpretation Secret (NPIC). NPIC proved invaluable during the Cuban Missile Crisis of 1962, when it provided key intelligence for the decisions of President Kennedy and his advisers.

Because PIC had the unique experience of processing and interpreting U-2 photographs, it was given a similar role after CORONA began to produce imagery in 1960. An example of CIA's pre-CORONA reporting is Document No. 13, "Visual-TALENT Coverage of the USSR in Relation to Soviet ICBM Deployment January 1959–June 1960," which the Office of Research and Reports produced in conjunction with PIC. This report succinctly summarizes how much CIA knew about the USSR from U-2 photography on the eve of CORONA's first successful mission.

With the advent of CORONA, CIA's reporting requirements surged to keep up with the growing amount of satellite imagery. Document No. 14 is the first Joint Mission Coverage Index of Eastern European targets identified by Mission 9009 in August 1960. Photographic Intelligence Reports (PIRs) described specific targets located during CORONA missions that merited further in-depth analysis. The Committee on Overhead Reconnaissance designated specific targets of interest for satellite reconnaissance. The PIRs integrated imagery from CORONA missions with earlier U-2 material and occasionally also with captured German World War II aerial reconnaissance photographs. In December 1961, for example, Document No. 16, "Uranium Ore Concentration Plant, Steiu, Rumania," drew on imagery from Mission 9009 and other CORONA overflights as well as from 1944 German Luftwaffe photography.

Several PIRs presented here demonstrate how CIA looked all over the world for varying types of targets and how the PIC, and later NPIC, skillfully brought together analysts, cartographers, artists, and modelmakers to produce succinct and accurate analysis.

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A Photographic Evaluation Report (PER) was a "technical publication expressing the photo quality results of a mission of photography." NPIC primarily used PERs to enhance camera resolution for future missions, as Document No. 24, an April 1965 PER, illustrates. A Photographic Interpretation Report, or "OAK report," was a "first-phase photographic interpretation report presenting the results of the initial analysis of a new satellite photographic mission." Although OAK reports concentrated on highest priority COMOR targets, they could also cover other sites. This volume includes excerpts of three OAK reports from one KH-4A mission, which cover the Soviet Union, the Middle East, and Southeast Asia in mid-1967a crucial period just after the Arab-Israeli war and while US combat operations were expanding in Vietnam. NPIC produced several other documents for each CORONA mission, such as Mission Control Plots (MCP) and Orbit Ephemeris Data. Although limitations of space make it impossible to include examples of these lengthy technical documents in this volume, they will be reviewed for declassification along with the rest of the CORONA material from which this collection has been compiled.

NPIC products, primarily basic working documents, were eventually incorporated into the national strategic analysis that formed the basis for National Intelligence Estimates (NIEs). This analysis drew heavily on the steady output from CORONA throughout the 1960s and into the early 1970s.

This section includes the September 1961 National Intelligence Estimate (NIE) 11-8/1-61, Document No. 15, which provided key supplemental information to CIA's earlier estimates of Soviet ICBM strength. This estimate, based primarily on CORONA imagery, offered US analysts and policymakers conclusive evidence about the strength and capabilities of the Soviet long-range ballistic missiles. The NIE answered many questions about the Soviet's strategic forces and put to rest the "Missile Gap" debate within the intelligence community. CIA previously released this estimate to the public with significant omissions for security reasons. Due to the overall downgrading of CORONA material, the Agency is now able to offer historians and other interested readers more information from this important NIE.

In addition, CORONA satellites provided increasingly important intelligence about Chinese nuclear developments in the 1960s. In late August 1964, Special National Intelligence Estimate 13-4-64, Document No. 23, provided clear evidence that the Chinese would soon obtain nuclear status. Indeed, the Chinese detonated their first nuclear device in October 1964, two months after the special estimate. CORONA quickly proved its great value and played a major role in the intelligence revolution. The records in this part—the PIRs, PERs, OAK Reports, and NIEs—all derived their wealth of information from satellite imagery.

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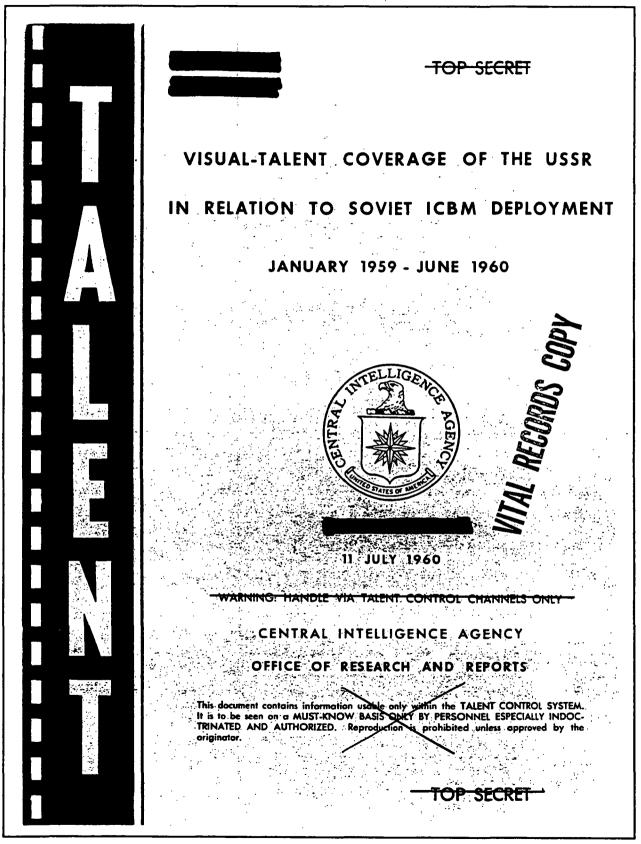
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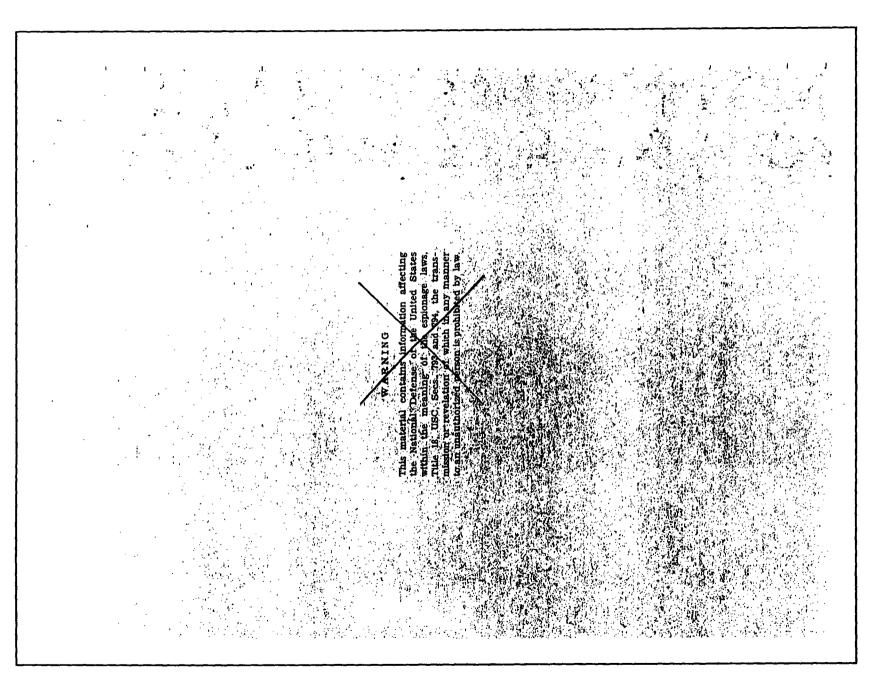
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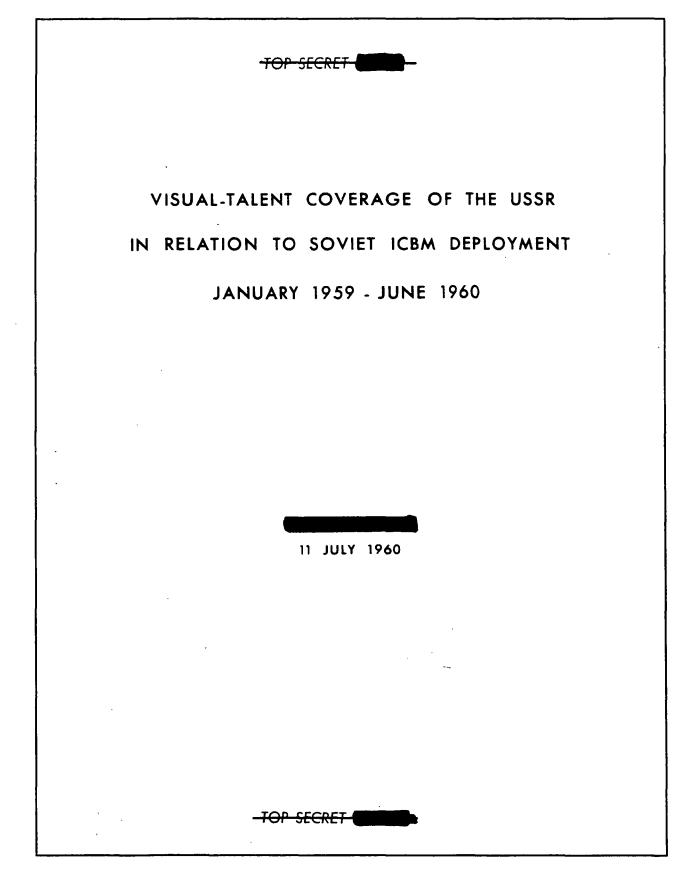
13. Office of Research and Reports, "Visual-TALENT Coverage of the USSR in Relation to Soviet ICBM Deployment, January 1959–June 1960," 11 July 1960

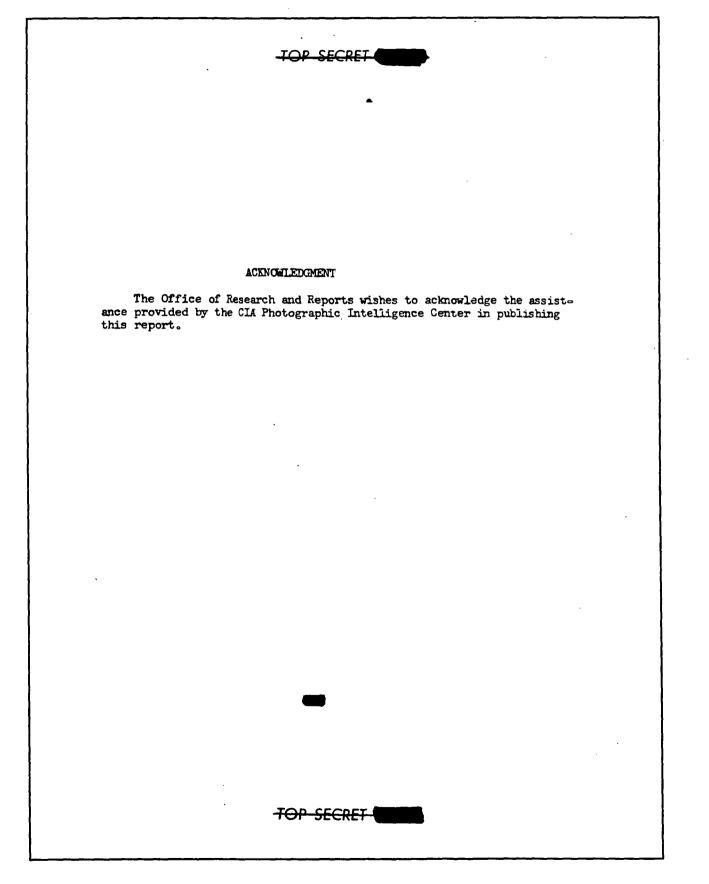


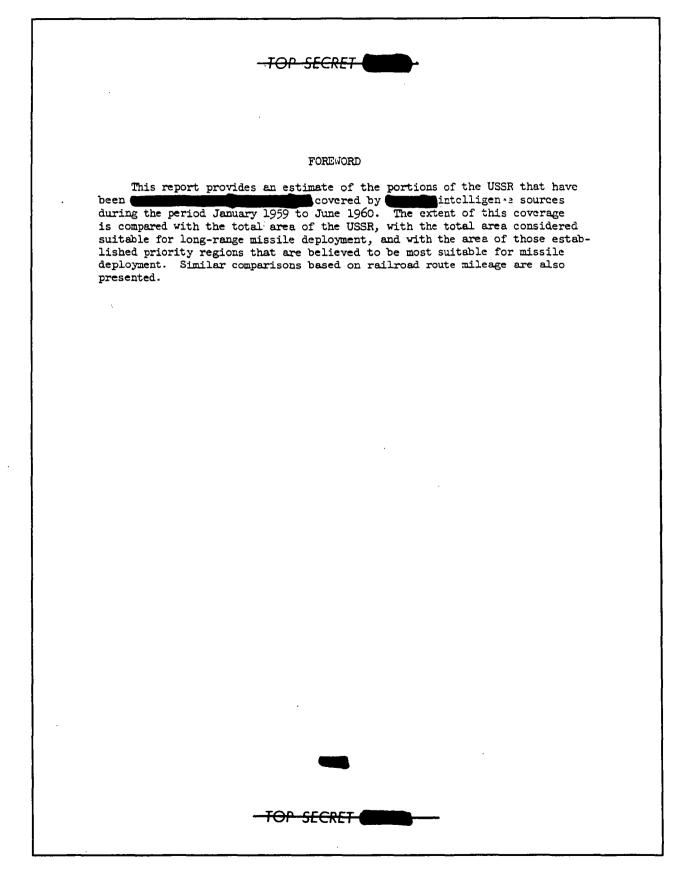


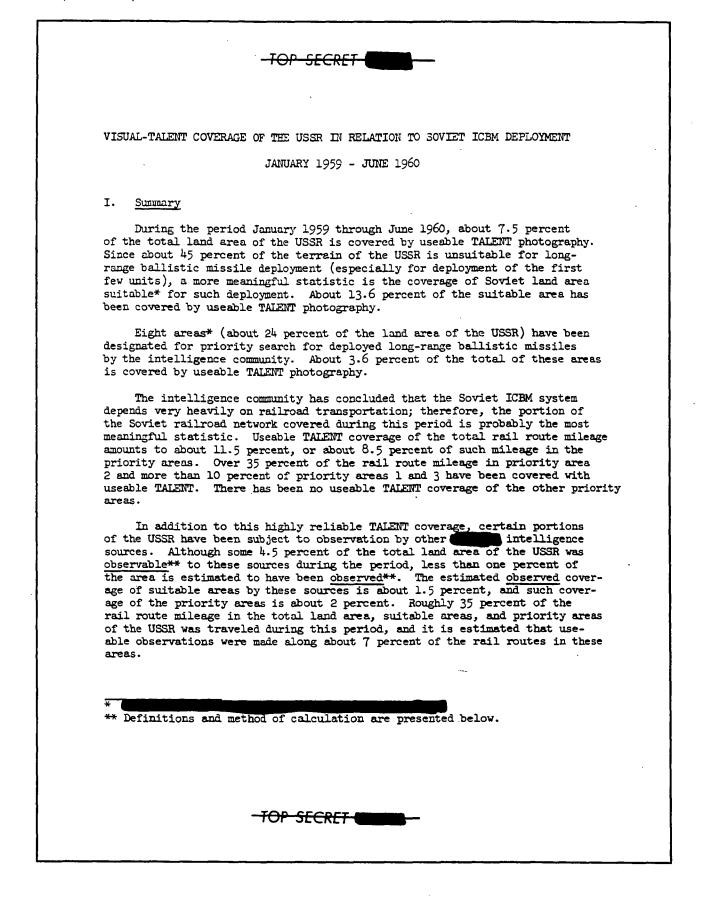
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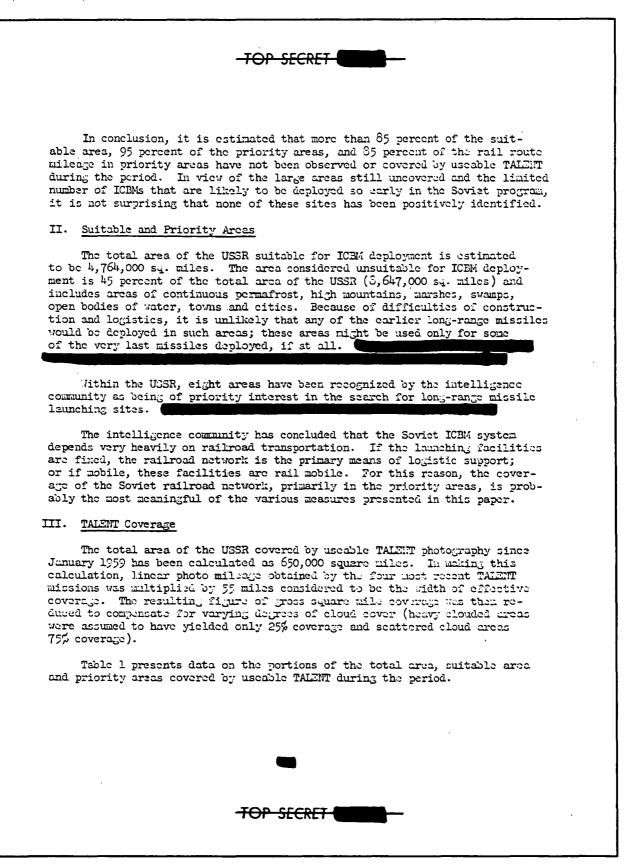






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13. (Continued)



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Table 1

Areas of the USER Covered by Useable TALENT Photography Jakaary 1959-June 1960

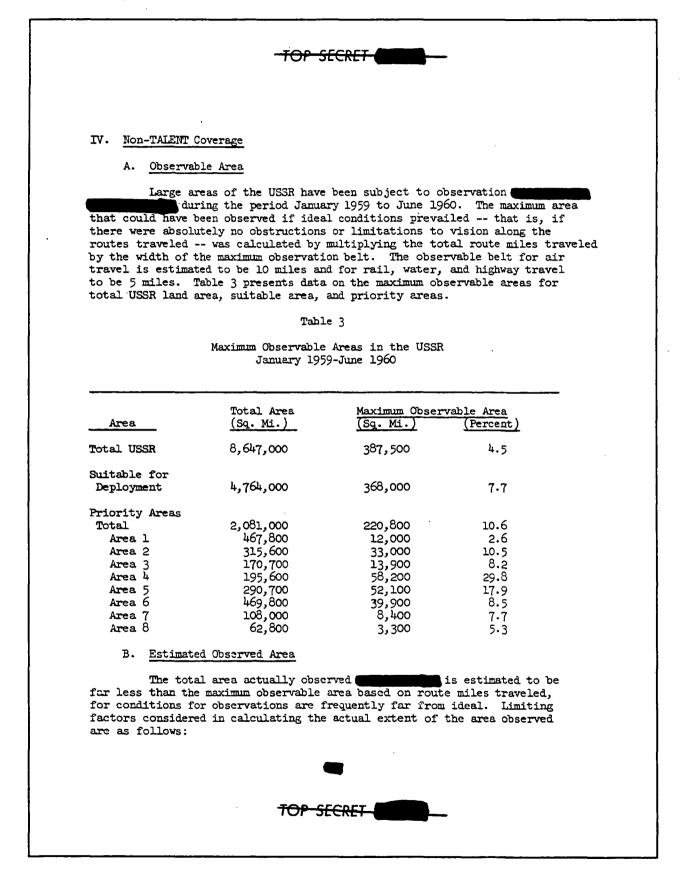
Atrea	Total Land Area (Square Hiles)	Estimated TALEN (Square Miles)	I Coverage (Percent)
Total USSR	3,647,000	650,000	7.5
Suitable for Deployment	¹ ,761,000	650,000	13.6
Priority Areas Total Area 1 Area 2 Area 3 Areas 4-3	2,081,000 467,300 315,600 170,700 1,126,900	75,150 10,750 60,270 4,130 0	3.6 2.3 19.1 2.4 0

. Table 2 presents data on the portions of the rail route mileage covered by useable TALENT photography.

Table 2

Rail Route Mileage of the USSR Covered by Useable TALENT Photography January 1959-June 1960

Area	Total Rail Route (Miles)	Estimated TA (Miles)	LENT Coverage (Percent)
Total USSR	75,900	8,750	11.5
Suitable for Deployment	75,400	8,750	11.6
Priority Areas Total Area 1 Area 2 Area 3 Areas 4-3	46,000 6,200 8,300 3,000 20,500	3,910 620 2,950 340 0	8.5 10.0 35.6 11.4 0
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1. Visibility restrictions, including terrain, vegetation, rain, snow, fog, time of day (light or darkness), and man-made obstacles of various types.

2. Limitation of vision to one side of the vehicle (nullified somewhat if the route is frequently traveled; applies least to auto travel).

3. Limitation to air observation by altitude, cloud cover, and seat location.

4. Speed of travel (particularly by train), which limits the time span for recognition of features, thus reducing the width of the area that can be effectively observed.

5. Harassment by security personnel, which is particularly likely at points where sensitive installations might be observed.

In view of the above limitations, the area observed by travelers was calculated by multiplying the maximum observable area by an estimated percentage of effectiveness of observation. The fact that many routes were traveled a number of times is taken into consideration in determining the percentage of effectiveness. The percentages used to estimate the portion of observable area actually observed are as follows:

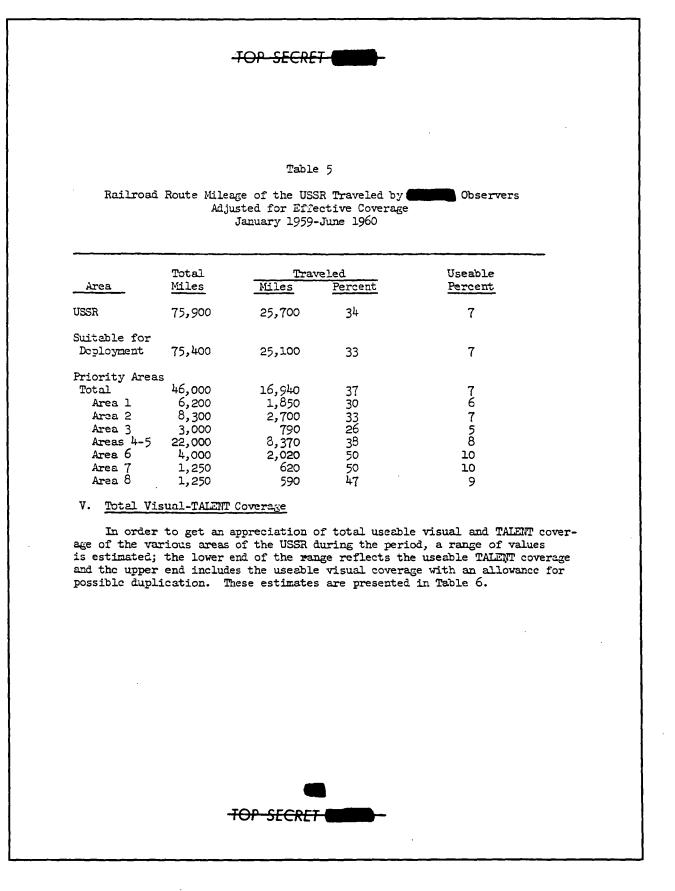
Type of Travel	Effective Observation (Percent)
Air	15
Rail	20
Water	10
Highway	35

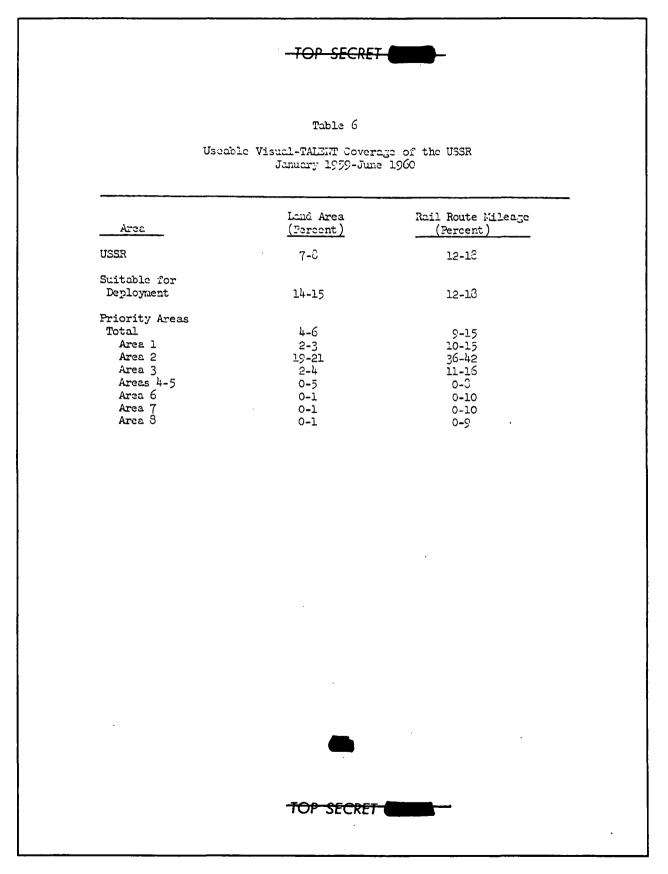
The estimated observed coverage for each type of area under consideration is presented in Table 4.

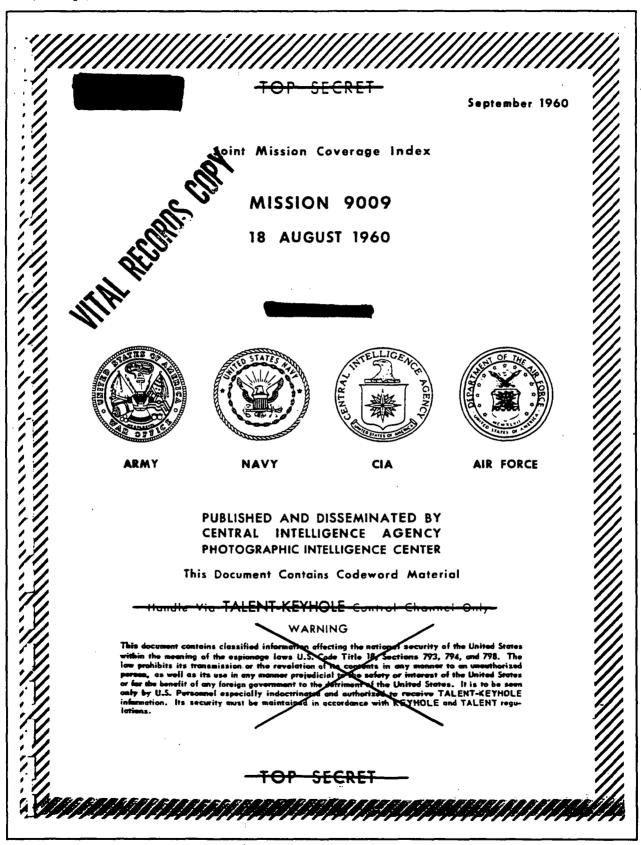
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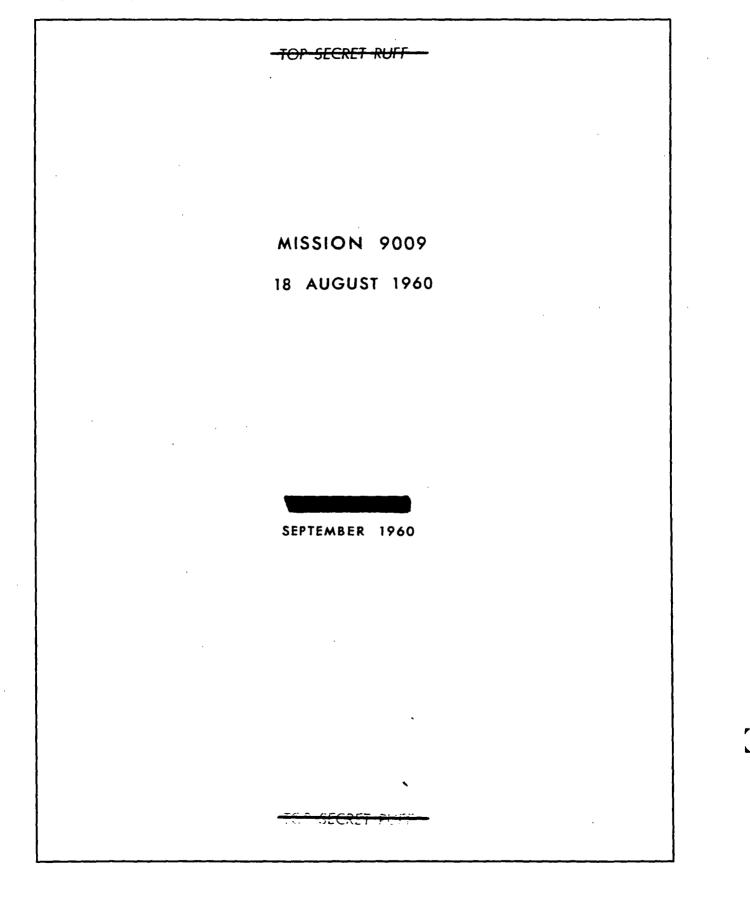
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	Table 4	
	Estimated Observed Are	
	January 1959-Ju	ne 1960
Area	Square Miles	Percent of Area
Total USSR	71,900	0.8
Guitable P		
Suitable for Deployment	68,700	1.4
Priority Areas Total	ha Boox	2.2
Area 1	41,800* 2,300	2.0 0.5
Area 2	2,300 5,800	1.8
Area 3	2,600	1.5
Area 4	11,900	6.1
Area 5	10,500	3.6
Area 6	6,500	1.4
Area 7	1,500	1.4
•		
Area 8	600	1.4
Area 8 C. <u>Railro</u> g	600 M Route Mileage Traveled	1.0
Area 8 C. <u>Railroa</u> Table 5 by Conservations	600 A Route Mileage Traveled 5 presents data on the Sov rvers during the period. 1 difficulties; to arrive	
Area 8 C. <u>Railroa</u> Table 5 by Conservations	600 A Route Mileage Traveled 5 presents data on the Sov rvers during the period. 1 difficulties; to arrive	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler
Area 8 C. <u>Railroa</u> Table 5 by Contract o observationa	600 A Route Mileage Traveled 5 presents data on the Sov rvers during the period. 1 difficulties; to arrive	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler
Area 8 C. <u>Railroa</u> Table 5 by Conservations	600 A Route Mileage Traveled 5 presents data on the Sov rvers during the period. L difficulties; to arrive	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler
Area 8 C. <u>Railroa</u> Table 5 by Conservations	600 A Route Mileage Traveled 5 presents data on the Sov rvers during the period. L difficulties; to arrive	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler
Area 8 C. <u>Railroa</u> Table 5 by Conservations	600 A Route Mileage Traveled 5 presents data on the Sov rvers during the period. L difficulties; to arrive	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler
Area 8 C. <u>Railroa</u> Table 5 by Conservations	600 A Route Mileage Traveled 5 presents data on the Sov rvers during the period. L difficulties; to arrive	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler
Area 8 C. <u>Railros</u> Table 5 by Control observations	600 A Route Mileage Traveled 5 presents data on the Sov rvers during the period. L difficulties; to arrive	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler
Area 8 C. <u>Railroa</u> Table 5 by Conservations	600 A Route Mileage Traveled 5 presents data on the Sov rvers during the period. L difficulties; to arrive	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler
Area 8 C. <u>Railroa</u> Table 5 by Control observations for observations, the	600 A Route Mileage Traveled 5 presents data on the Sov rvers during the period. L difficulties; to arrive	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler s used (see paragraph IV B above).
Area 8 C. <u>Railroa</u> Table 5 by Control observations for observations, the	600 ad Route Mileage Traveled of presents data on the Sov rvers during the period. al difficulties; to arrive be factor of 20 percent was	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler s used (see paragraph IV B above).
Area 8 C. <u>Railroa</u> Table 5 by Constant observations observations, th	600 ad Route Mileage Traveled of presents data on the Sov rvers during the period. al difficulties; to arrive be factor of 20 percent was	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler s used (see paragraph IV B above).
Area 8 C. <u>Railroa</u> Table 5 by Constant observations observations, th	600 ad Route Mileage Traveled of presents data on the Sov rvers during the period. al difficulties; to arrive be factor of 20 percent was	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler s used (see paragraph IV B above).
Area 8 C. <u>Railroa</u> Table 5 by Control observations for observations, the	600 ad Route Mileage Traveled of presents data on the Sov rvers during the period. al difficulties; to arrive be factor of 20 percent was	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler s used (see paragraph IV B above).
Area 8 C. <u>Railroa</u> Table 5 by Constant observations observations, th	600 ad Route Mileage Traveled of presents data on the Sov rvers during the period. al difficulties; to arrive be factor of 20 percent was	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler s used (see paragraph IV B above).
Area 8 C. <u>Railroa</u> Table 5 by Constant observations observations, th	600 Ad Route Mileage Traveled 5 presents data on the Sov Evers during the period. al difficulties; to arrive be factor of 20 percent was been rounded; total is base	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler s used (see paragraph IV B above).
Area 8 C. <u>Railroa</u> Table 5 by Constant observations observations, th	600 ad Route Mileage Traveled of presents data on the Sov rvers during the period. al difficulties; to arrive be factor of 20 percent was	1.0 iet railroad route mileage traveled The mileage traveled is also reduce at an estimate of useable traveler s used (see paragraph IV B above).







14. CIA/PIC, Joint Mission Coverage Index, "Mission 9009, 18 August 1960," September 1960 (Excerpt)



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PREFACE

This Joint Mission Coverage Index (JMCI) furnishes a listing of intelligence targets covered by Mission 9009. All priority items of intelligence significance reported in the six installments of the OAK 9009 immediate report have been included in this index. Detailed descriptions appearing in the OAK Report are not repeated.

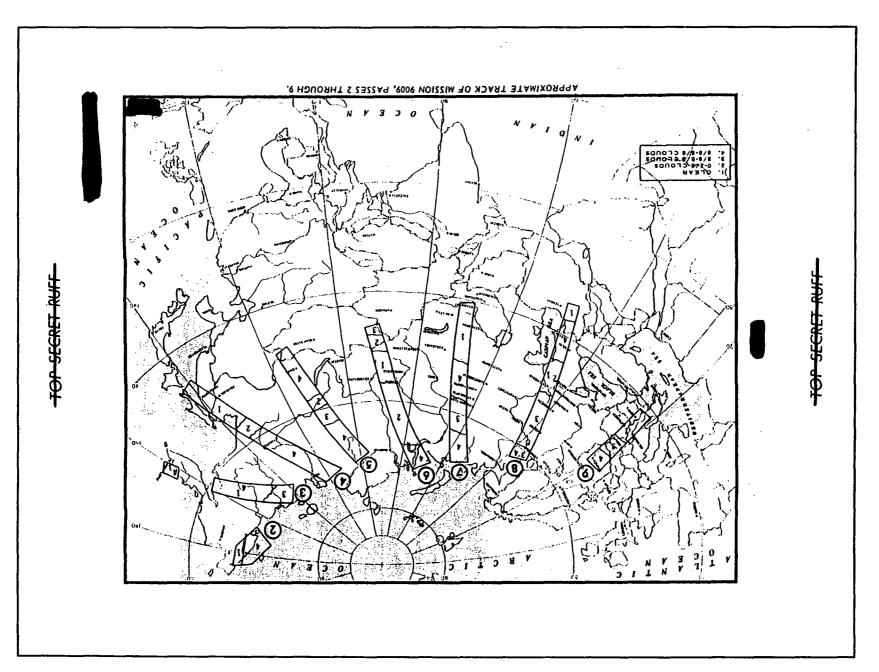
Items are arranged by (1) country, (2) WAC area within the country, (3) subject, and (4) coordinates (grouped by degree square from north to south within the subject grouping).

For an explanation of the codes used in presenting information in this report see the appendix.

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	Listing of I	ntelligenc	e Targets for:			
,	Country	WAC	Page	Country	WAC	Page
	USSR	65		USSR	234	
,		67			23 5	
		93			237	
		100			238	
		102			240	
. '		122			245	
		124			248	
		128			281	
		130			325	
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		158		Bulgaria	332	
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	Subject Inde	ex	• • • • • • • • • • • •	gence targets	• • • • •	Page
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SUMMARY

Mission 9009 was accomplished on 18 August 1960. It consists of eight north-south passes over the USSR and includes portions of China, the Satellites and Yugoslavia (see accompanying coverage map).

Approximately 25 percent of the coverage is cloud free, with lightscattered to heavy clouds covering the remainder of the photography. The PI quality of the unobscured coverage ranges from good to very good.

The scale of the photography is estimated to range from 1:300,000 to 1:450,000. Average ground resolution is in the order of 20 to 30 feet on a side.

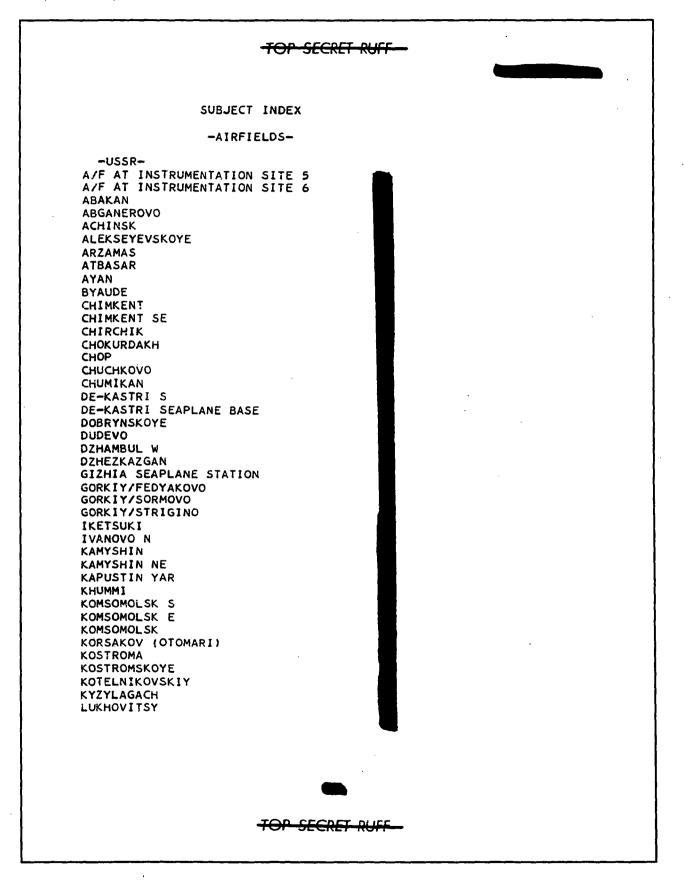
Major items of intelligence significance covered by Mission 9009 include the Kapustin Yar Missile Test Range (KYMTR), the western portion of the presumed 1,050 nm impact area of the KYMTR, 20 newly identified hexadic SA-2 surface-to-air missile sites and six possible SA-2 sites under construction, the Sarova Nuclear Weapons Research and Development Center, several new airfields, and numerous urban complexes.

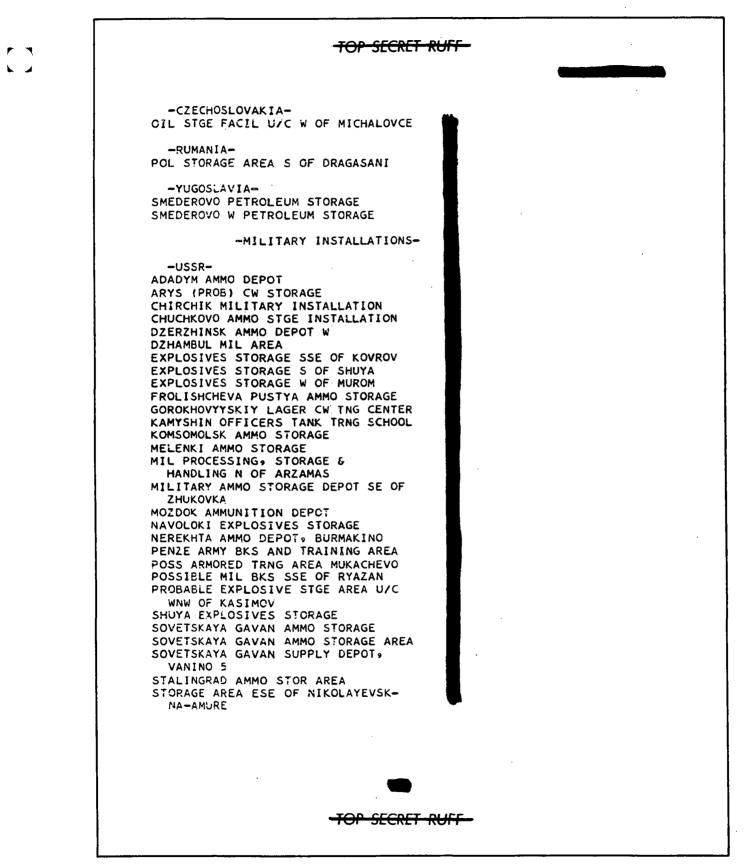


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City	installation		Target No	Coordinates	Sb
	-USSR-	WAC	Target		
UR	MYS SHMIDTA A/F 2/53-62 X10Y2(59) C	65	5 - A	6853N 17924W	0
UR	CHOKURDAKH A/F PROB OPERATIONAL, HARD SURFACED 3/7 X27Y2 H	67	2 - A	7039N 14752E	ø
UR	DUDEVO A/F 3/13-14 X45Y1(14) C	67	3	6913N 14712E	ø
UR	U/I INSTALLATION 8 NM SW OF KADZHEROM ADJACENT TO KOTLAS-VORKUTA RR 7/25-26 X67Y2(25) SC	93	8	6438N Ø5542E	1
UR	U/I CONSTRUCTION ACTIVITY ROAD CONSTR AND OTHER ACTIVITY LOCATED AT POLUNOCHNOYE 7/49-54 X53Y3(51) SC	100	1	6052N 06025E	1
UR	NEW RR SPUR CONST NUMEROUS SPURS, THREE GROUPS OF BLDGS 15 NM SW KONOSHA 8/32-33 X27Y4(32) C	102	3 - C	6048N 04000E	1
UR	KARGOPOL STORAGE AREA 1 NM N OF KARGOPOL 8/27-28 X27Y4{27} SC	102	26	613ØN Ø3855E	1
UR	NYANDOMA (1442(28) SC	102	11	6140N 04013E	1
UR	KONOSHA NEW RR CONSTRUCTION & STORAGE AREAS NO A/F NOTED 8/32 X17Y2 C	102	3 - 8	6058N 04015E	1
UR	U/I INSTALLATION NEW ROADS AND OTHER CONSTR ACTIVITY 8/23-26 X3Y3(25) SC	102	25	6220N 04105E	1
UR	NYANDOMA MINING AREA 4 AREAS. GROUND SCARING. NEW ROAD AND RR. LOCATED 3 NM SW NYANDOMA 8/28-29 X15Y4(28) SC	102	11 - A	6139N Ø4Ø15E	1

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APPENDIX

Explanation of Codes Used in the JMCI

Individual items are, in general, arranged according to the following scheme.

1. Installation Index (First Line)

a. <u>Country</u>: The country is designated by the two-letter code used in the **Country**.

b. <u>Installation</u>: The name will be given, if known. If not, the installation will be titled according to an associated geographic name or according to obvious use, such as storage area, instrumentation station, etc. The **Comparison** when known, will be given.

c. <u>PIC Target Number</u>: PIC Target numbers are comprised of two elements: (1) the WAC number for the area in which the installation lies, and (2) a numerical designation (occasionally followed by capital letters) for the specific target within that WAC area. For example, 246-6 designates target number 6 in WAC 246.

d. <u>Coordinates</u>: Coordinates are given to the nearest minute for the approximate center of the installation.

e. Subject: Thirteen categories are used; they are as follows:

- 1. Airfields
- 2. Atomic Energy
- 3. Electronics and Telecommunications
- 4. Industry
- 5. Liquid Fuels
- 6. Military Installations
- 7. Missiles
- 8. Naval Installations
- 9. Ports and Harbors
- 10. Storage Facilities, General

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- 11. Transportation
- 12. Urban Areas
- 13. Miscellaneous
- 2. Significant Information

A very brief statement of significant information in connection with the installation will appear in the second and subsequent lines.

3. Photo Reference (Last Line)

This line is best explained by using an example:

3/729-31 x42Y3(730) HC

3 designates the pass number.

729-31 shows the frame numbers.

x42Y3(730) gives the Universal Reference Grid coordinates of the installation on frame 730.

HC - This designation indicates cloud conditions as they exist over the installation. The code used is as follows:

C Clear

SC Scattered Clouds

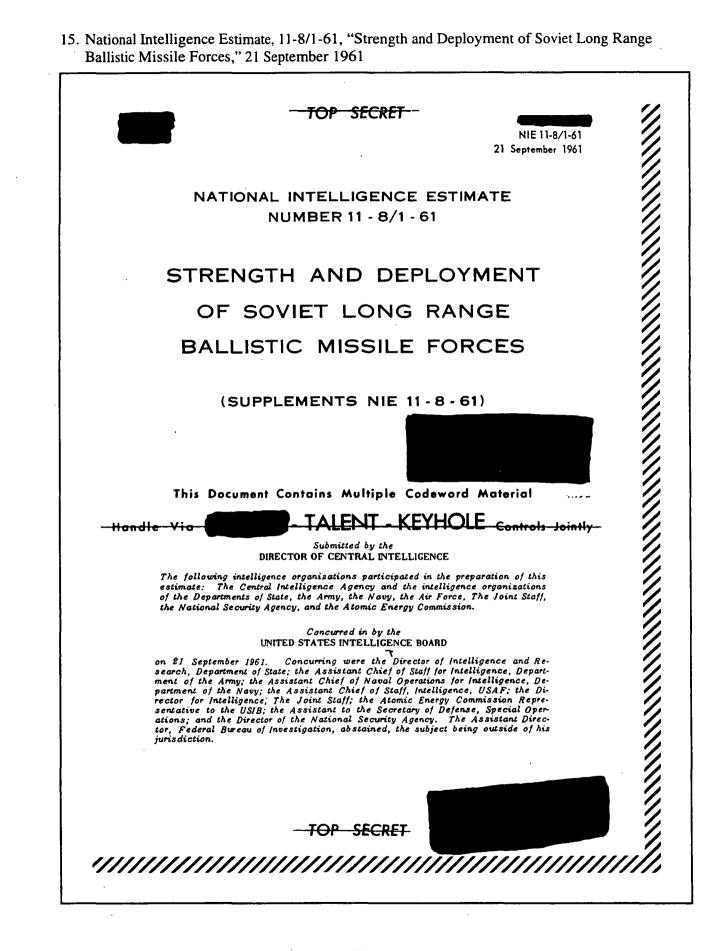
HC Heavy Clouds

0 Overcast

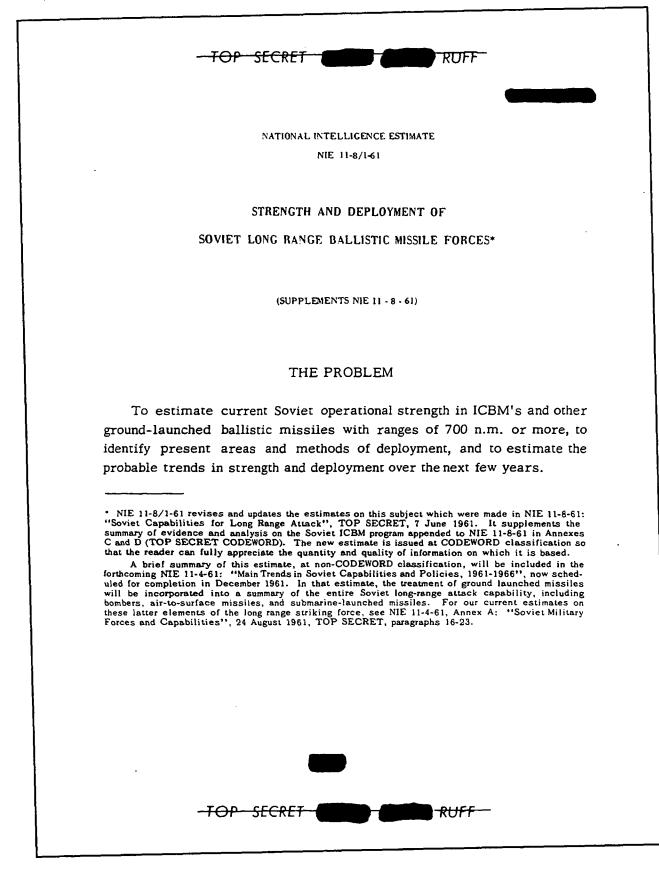
H Haze (includes smoke, blowing snow and dust)

CS Cloud Shadow (cloud shadows cast on ground reducing interpretability)

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CONCLUSIONS

1. New information, providing a much firmer base for estimates on Soviet long range ballistic missiles, has caused a sharp downward revision in our estimate of present Soviet ICBM strength but strongly supports our estimate of medium range missile strength.

2. We now estimate that the present Soviet ICBM strength is in the range of 10 - 25 launchers from which missiles can be fired against the US, and that this force level will not increase markedly during the months immediately ahead. 1/ We also estimate that the USSR now has about 250-300 operational launchers equipped with 700 and 1,100 n.m. ballistic missiles. The bulk of these MRBM launchers are in western USSR, within range of NATO targets in Europe; others are in southern USSR and in the Soviet Far East. ICBM and MRBM launchers probably have sufficient missiles to provide a reload capability and to fire additional missiles after a period of some hours, assuming that the launching facilities are not damaged by accident or attack.

3. The low present and near-term ICBM force level probably results chiefly from a Soviet decision to deploy only a small force of the cumbersome, first generation ICBMs, and to press the development of a smaller, second generation system. Under emergency conditions the existing force could be supplemented somewhat during the first half of 1962, but Soviet ICBM strength will probably not increase substantially until the new missile is ready for operational use, probably sometime in the latter half of 1962. After this point, we anticipate that the number of operational launchers will begin to increase significantly. On this basis, we estimate that the force level in mid-1963 will approximate 75-125 operational ICBM launchers. 2/

^{2/} The Assistant Chief of Staff, Intelligence, USAF, does not concur in paragraph 3. See his footnote following the Conclusions.



^{1/} The Assistant Chief of Staff, Intelligence, USAF, does not concur in this sentence. See his footnote following the Conclusions.

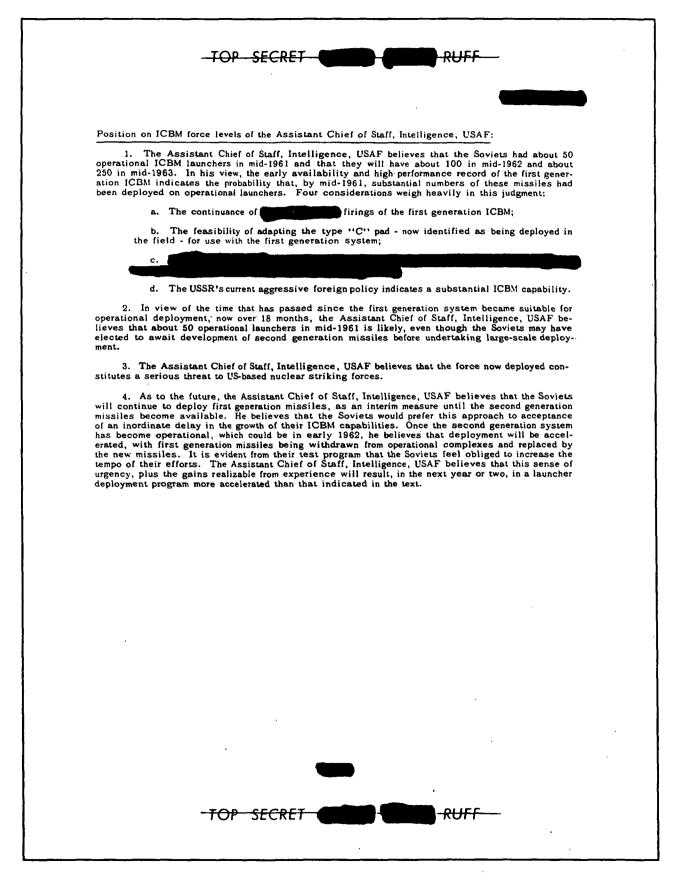
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4. In addition to 700 and 1,100 n.m. missiles now available, the USSR will probably have a 2,000 n.m. system ready for operational use late this year or early next year. The USSR's combined strength in these missile categories will probably reach 350-450 operational launchers in the 1962-1963 period, and then level off.

5. Soviet professions of greatly enhanced striking power thus derive primarily from a massive capability to attack European and other peripheral targets. Although Soviet propaganda has assiduously cultivated an image of great ICBM strength, the bulk of the USSR's present capability to attack the US is in bombers and submarine-launched missiles rather than in a large ICBM force. While the present ICBM force poses a grave threat to a number of US urban areas, it represents only a limited threat to US-based nuclear striking forces. $\underline{3}/$

3/ The Assistant Chief of Staff, Intelligence, USAF, does not concur in paragraph 3 and the last sentence of paragraph 5. See his footnote following the Conclusions.

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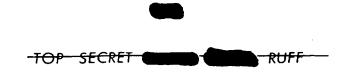
DISCUSSION

6. The requirement to revise our estimates on Soviet long range ballistic missile forces stems from significant recent evidence of three principal types. First, read-out of electronic data on the 1961 activities at the Soviet ICBM and space vehicle test range has provided information on the new types of ballistic vehicles now being developed and on the pace and progress of the development programs. Second, photographic coverage of large regions of the USSR has provided the first positive identification of long range ballistic missile deployment complexes, has given excellent guidance as to Soviet deployment methods, and has permitted detailed search of large areas of the USSR, including many previously suspected to contain missile complexes. Finally, reliable clandestine reports have provided useful evidence on the general status and organization of long range missile forces. Therefore, although significant gaps continue to exist and some of the available information is still open to alternate interpretations, the present estimate stands on firmer ground than any previous estimate on this critical subject.

ICBM Development

7. The test-firing program from the Tyuratam ICBM and space launching rangehead has been much more intensive in 1961, and has at the same time suffered many more failures, than in any other period in its four year history. Thirty-nine launching operations were undertaken between January and 17 September 1961. $\frac{4}{7}$ Of these, 13 involved either first generation ICBMs or space vehicles using essentially the same booster. All but one of these 13 were generally successful. The other 26 operations involved new vehicles not previously observed in range activities. Of these, only about half resulted in generally successful

^{4/} A more recent launching operation on 19 September 1961, which resulted in a failure, cannot as yet be categorized as to type of vehicle.



firings which reached the vicinity of the instrumented impact areas. Of the last seven operations involving new vehicles, however, six have been generally successful. (See Figure 1.)

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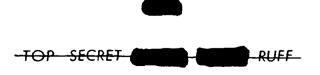
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8. One of the new vehicles (called Category B by US intelligence) is probably a second generation ICBM; the other (Category C) may be a competitive ICBM design or a special vehicle to test ICBM and space components. Both are tandem staged, that is, the upper stage is ignited at altitude as in the case of Titan, rather than at launch as in the case of Atlas and the first generation Soviet ICBM. Our data are sufficient to show that both of the new vehicles are liquid propelled, but not to establish whether the propellants are storable or non-storable. Some aspects of the test is performance of the upper stage of the Category B vehicle are similar to those of the 2,000 n.m. missile, which was tested intensively at Kapustin Yar for some months preceding the Category B operations at Tyuratam. The vehicles fired to a distance of 6,500 n.m.

into the Pacific on 13 and 17 September 1961 were probably Category B vehicles. Some relationship seems to exist between the upper stages of the Category C vehicle and Venus probes. Despite this apparent relationship with space vehicles, it was a Category C firing which immediately preceded Khrushchev's remark to McCloy last July, that a "new ICBM" had been launched successfully. No further details are known about the configuration, propulsion, guidance, range, or payload of the new vehicles. 5/

9. The 1961 tests confirm our previous estimate that the Soviets would develop a new ICBM system, and we continue to believe that a major requirement for such a system is a missile which can be more readily handled and deployed than their original ICBM. This belief is supported by a reliable clandestine source who learned, in 1960 or early 1961, that the Soviet leadership desired an ICBM using higher-energy fuel which

^{5/} We have taken note of Soviet statements concerning a 100 megaton weapon. We do not believe that present Soviet capabilities include a missile warhead with 100 megaton yield or a ballistic vehicle capable of delivering such a warhead to intercontinental ranges. We will examine this matter in fuller detail in an early estimate.

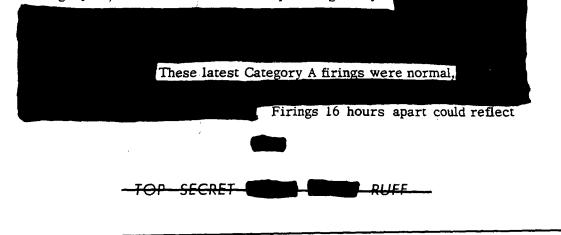


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would require less bulk. In order to be flight tested in early 1961, design work on a new missile was certainly underway in 1958. Nuclear tests appropriate to the development of lighter warheads were conducted in 1957 and 1958; the current nuclear testing program may serve further to prove the warhead design.

10. Although the flight-test failures in the first half of 1961 probably set back the Soviet schedule for development of second generation missiles, it is clear from the test range activities that the R&D program has been pursued with great vigor. The recent successes with the Category B vehicle, and the probable firing of such vehicles to 6,500 n.m. after only about 8 months of testing to Kamchatka, suggest that the initial difficulties with this system may now have been largely overcome. Moreover, it is probable that one or both the new vehicles have borrowed components or at least design techniques from proven systems, thereby aiding the R&D program. We believe that the program will continue to be pursued with vigor, and that a smaller, second generation ICBM will have been proven satisfactory for initial operational deployment in the latter half of 1962.

11. Thus we believe that the first generation system will be the only Soviet ICBM system in operational use for the months immediately ahead and probably for about the next year. Despite its inordinate bulk and the other disadvantages inherent in a non-storable liquid fueled system, the first generation system is capable of delivering a high yield nuclear warhead with good accuracy and reliability against targets anywhere in the US. (For a summary of its estimated operational characteristics, see Figure 2.) Test range launchings of first generation missiles (now called Category A) continued from January through July.



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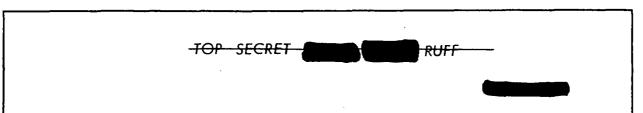
the training of operational crews for launching second salvos, but it cannot be determined whether these firings were from a single pad. Accuracy could not be determined, but reliability continued high. $\underline{6}/$

Utilization of Launching Pads

12. Soviet ICBM capabilities at present depend in part, and in the near future will depend in considerable measure, upon whether or not the deployment complexes now being discovered through KEYHOLE photography can be used to fire first generation missiles, or whether they cannot become fully operational until a second generation missile becomes available. The first generation missile is obviously compatible with massive, fully rail-served launchers similar to those at Tyuratam Areas A and B. But the launchers at confirmed field complexes, whose construction began only in late 1959 or thereafter, resemble the simplified pair of pads at Tyuratam Area C, where missiles are transported to the pad by road and some of the support equipment is mounted on vans. (For artists' conceptions of the launchers at Tyuratam and a layout of the rangehead, see Figures 3-5.)

13. From our examination of the 1961 test firing program, the physical dimensions of various items at Areas A and C, and the requirements for handling and firing the first generation missile, we conclude that the simplified Area C was designed for a new and smaller missile now being test fired. Although it is technically feasible for the Soviets to adapt the rail-based first generation missile to road served launchers of the type at Area C, it would be necessary to redesign much of the check-out, handling, erecting, and fueling equipment. This redesigned equipment would differ from both that at Area A and that designed for use with the

				We
neve that the Sovi	ets can and will p	provide decoy protection	n, should they deem n	
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new missile. Such action might have been taken as an interim measure if a long delay in the advent of the second generation system had been anticipated well in advance.

ICBM Deployment

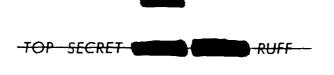
14. Through KEYHOLE photography over the past three months, we have positively identified three ICBM complexes under construction. Two are near Yur'ya and Yoshkar-Ola, in a region several hundred miles northeast of Moscow, and the third is near Verkhnyaya Salda in the Urals. The paired, road-served pads at these complexes closely resemble those. at Tyuratam Area C. Near Kostroma, in the same general region but closer to Moscow, the photography revealed a new clearing suitable for a pair of pads, and we believe this is possibly a fourth complex similar to the others. Portions of the installation at Plesetsk, farther to the northwest, were covered again in mid-1961, but the new photography was too limited either to confirm or rule out this location as an ICBM deployment complex. (The locations of presently known and suspected areas of ICBM deployment activities are shown in Figure 9.)

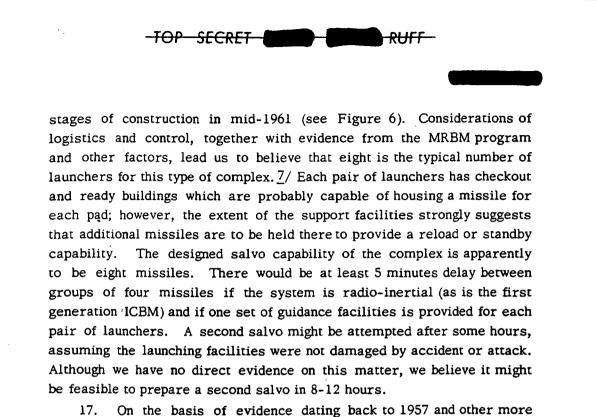
15. The new evidence confirms that the present Soviet deployment concept involves large, fixed complexes, with multiple pads and extensive support facilities. The identified deployment complexes are served by rail spurs which provide their major logistic support. The complexes are highly vulnerable to attack. For example, although the Yur'ya complex is quite large, the entire installation is soft and each pair of pads is separated from its neighbor by only 3-4 n.m.

concealment from ground

observation has been achieved by locating the installations in remote, densely wooded areas. For active defense against aircraft, SA-2 surfaceto-air missile sites are being installed near the complexes.

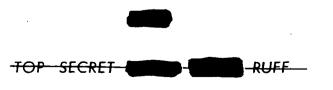
16. At Yur'ya, the confirmed complex whose construction appears most advanced, eight launchers in four pairs were observed in various





17. On the basis of evidence dating back to 1957 and other more recent information, we have estimated that Plesetsk is an ICBM complex with rail-served launchers designed to employ the first generation ICBM. The installation at Plesetsk (see Figure 7) is even larger than the Yur'ya complex. Although the presence of ICBM launchers has not been confirmed, there are SAM sites, several very large support areas, and numerous buildings, including what appears to be housing for some 5,000 to 15,000 persons. The photographic and other evidence is inadequate to establish the number of launchers which may be at Plesetsk. We believe that the number may be as few as two, but four or more is also possible. An ICBM complex involving this much equipment, investment, and personnel would probably have a reload of at least one missile per pad. Based on

 $[\]underline{J}'$ The Assistant Chief of Staff, Intelligence, USAF, believes that this typical number may be larger than eight. Ile agrees, however, that if guidance facilities are provided for each pair of launchers, the sequence of launching would be as described in the text.



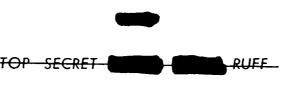
Tyuratam experience, we estimate the time to prepare a second salvo at about 16 hours. 8/

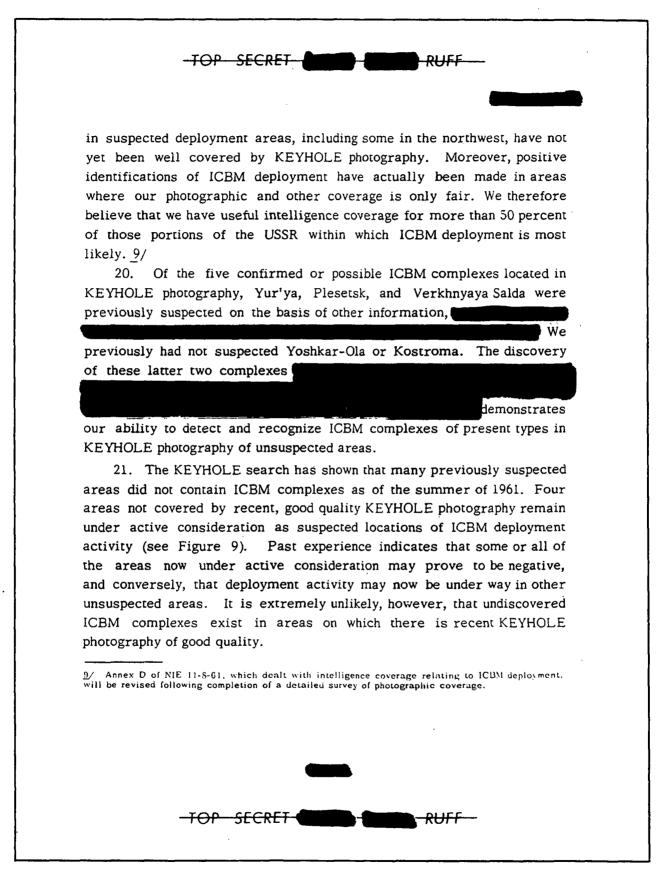
18. The new evidence gives a better measure of the timing of some ICBM deployment activities. Based on its size, the extent of its facilities, and its present state of construction, the Yur'ya complex must have been started in the autumn of 1959, concurrent with or very shortly after the start of construction at Tyuratam launch Area C. Yur'ya is probably one of the earliest complexes of its type. Construction and installation of equipment will probably be completed some time early in 1962. The similar complex at Yoshkar-Ola is many months behind Yur'ya; the evidence is less conclusive with respect to Kostroma and Verkhnyaya Salda, but what can be seen is apparently in the early stages of construction. From the evidence, therefore, we have reasonably firm indications that at least two years were used for the construction of even the simpler ICBM complexes, although this may be reduced to about 18 months as experience is gained.

Adequacy of Recent Intelligence Coverage

19. Through KEYHOLE operations since mid-1960, our coverage of suspected deployment areas in the USSR has been substantially augmented. This photography has been studied in detail by photo-interpreters with knowledge of US and Soviet missile programs. The search has been aided by photography of Soviet missile test range installations, which are now known to bear a close resemblance to deployment sites in the field. On the basis of this activity, combined with other information and analysis, we now estimate that we have good intelligence coverage of approximately 50 percent of the total railroad route mileage in the USSR. This coverage is not uniform, however; certain portions of the railroad route mileage

 $[\]underline{8}$ / The Assistant Chief of Naval Operations (Intelligence), Department of the Navy, believes that evidence of ICBM deployment at Plesetsk is indeterminate but that, in the aggregate, it points against such deployment.





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Probable ICBM Force Levels 10/

22. We believe that our coverage of both test range activities and potential deployment areas is adequate to support the judgment that at present there are only a few ICBM complexes operational or under construction. While there are differences within the intelligence community as to the progress of the Soviet program to date and the precise composition of the current force, we estimate that the present Soviet ICBM capability is in the range of 10-25 launchers from which missiles can be fired against the US. The low side of this range allows for the possibility that the Soviets could now fire only a token ICBM salvo from a few launchers, located at the Tyuratam rangehead and an operational complex, perhaps Plesetsk. The high side, however, takes into account the limitations of our coverage and allows for the existence of a few other complexes equipped with first generation missiles, now operational but undetected.

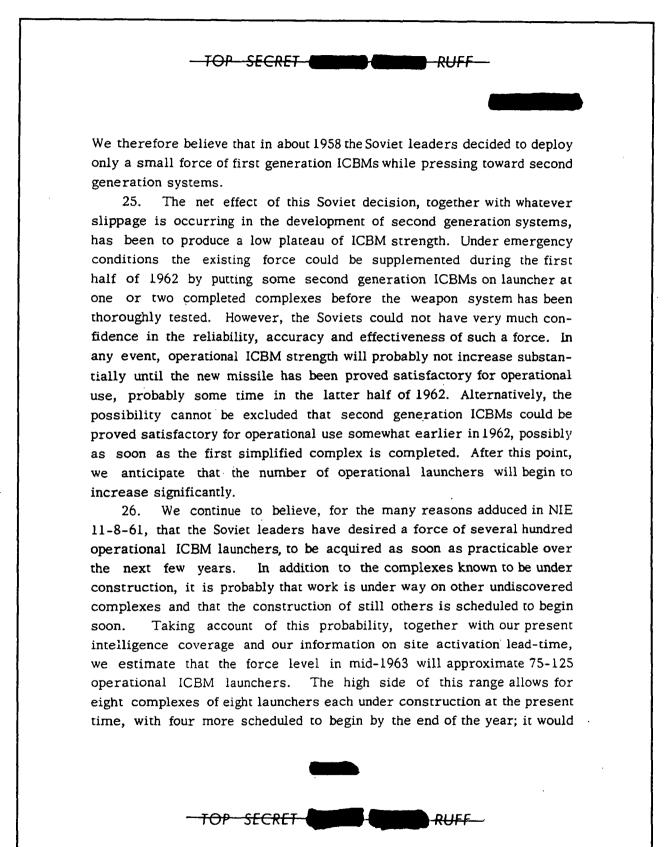
23. The Soviet system is probably designed to have a refire capability from each launcher. The USSR may therefore be able to fire a second salvo some hours after the first, assuming that the launching facilities are not damaged by accident or attack.

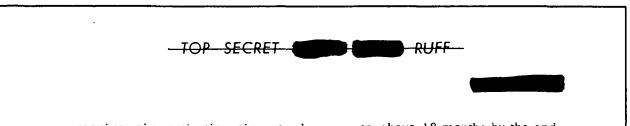
24. The reasons for the small current capability are important to an estimate of the future Soviet buildup. The first generation system, designed at an early stage of Soviet nuclear and missile technology, proved to be powerful and reliable but was probably too cumbersome to be deployed on a large scale. One or more first generation sites may have been started but cancelled.

The urgent development of at least one second generation system probably began in about 1958, and an intensive firing program is now underway concurrent with the construction of simplified deployment complexes.

10/ The Assistant Chief of Staff, Intelligence, USAF, does not concur in the estimate of ICBM force levels. For his position, see his footnote following the Conclusions.

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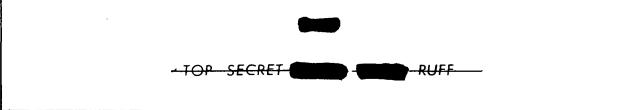


require site activation time to decrease to about 18 months by the end of the year; it builds from a present force level of about 25 operational launchers. The low side of the mid-1963 range would be achieved if six complexes were now under construction, two more were begun by the end of the year, and the present force level were only about 10 launchers.

27. As noted in NIE 11-8-61, Soviet force goals for the period to 1966 will be increasingly affected by developments in US and Soviet military technology, including the multiplication of hardened US missile sites, the possible advent of more advanced Soviet missiles which can better be protected, and by developments in both antimissile defenses and space weapons. The international political situation will also affect Soviet force goals, and there is a good chance that the Soviet leaders themselves have not yet come to a definite decision. We have not been able as yet to review, in the light of the new evidence, these and other considerations pertaining to the probable future pace of the Soviet ICBM Therefore we are unable to project a numerical estimate program. beyond mid-1963. Considering the problems involved in site activation, however, we believe that a rate of 100 or possibly even 150 launchers per year beginning in about 1963 would be feasible. To accomplish such a schedule, the USSR would have to lay on a major program of site construction within the next year, which we believe would be detected through continuing KEYHOLE operations and other means of intelligence collection.

Medium and Intermediate Range Ballistic Missiles

28. Recent KEYHOL E photography confirms the large-scale deployment of 700 and 1,100 n.m. ballistic missiles in western USSR. Through this photography, approximately 50 fixed sites with a total of about 200 pads suitable for launching these MRBMs have been firmly identified in a wide

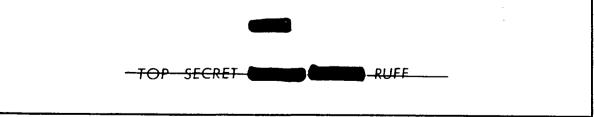


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belt stretching from the Baltic to the southern Ukraine. Since photography establishes that the sites are paired, we are virtually certain that there are about 10 additional sites hidden by scattered clouds. Taking account of indicators pointing to still other locations not yet photographed, we estimate with high confidence that in the western belt alone there are now about 75 sites with a total of about 300 launch pads, completed or under construction. (For known and estimated site locations in this area, see Figure 9.)

29. The new information does not establish whether individual sites are fully operational, nor does it reveal which type of missile each is to employ. At the time of photography (obtained during a 3-month period in the summer of 1961) approximately three-quarters of the identified sites appeared to be complete or nearly so, some were under construction, and the evidence on others is ambiguous. Construction has probably been completed at some sites since the time of photography; the installation of support equipment and missiles could probably be accomplished relatively quickly thereafter, perhaps in a period of some weeks. Three basic site configurations have been observed, all of them bearing a strong resemblance to launch areas at the Kapustin Yar rangehead (see Figure 8). Any of the three types could employ either 700 or 1,100 n.m. missiles, whose size and truck-mounted support equipment are virtually identical. The sites could not employ ICBMs, but one type might be intended for the 2,000 n.m. IRBM which has been under development at Kapustin Yar.

30. On the basis of the new evidence and a wealth of other material on development, production, training and deployment, we estimate that in the western belt alone the USSR now has about 200-250 operational launchers equipped with 700 and 1,100 n.m. ballistic missiles, together with the necessary supporting equipment and trained personnel. From these launchers, missiles could be directed against NATO targets from Norway to Turkey. On less firm but consistent evidence, about 50 additional



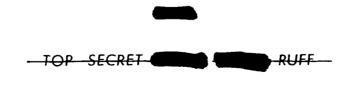
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targets from Suez to Pakistan; and in the southern portion of the Soviet Far East within range of Japan, Korea, and Okinawa. Very recent KEY-HOLE photography confirms the presence of some sites in Turkestan and in the Soviet Far East, north of Vladivostok.

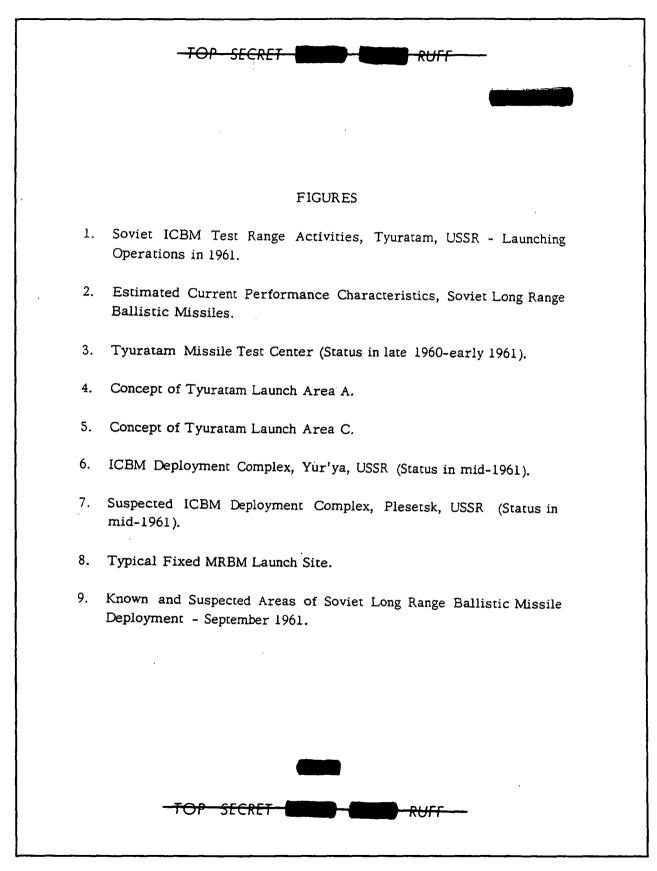
31. On this basis, we estimate that the USSR now has a total of about 250-300 operational launchers equipped with medium range ballistic missiles, the bulk of them within range of NATO targets in Europe. This is essentially the same numerical estimate as given in NIE 11-8-61, but it is now made with greater assurance.

32. Contrary to our previous view that MRBMs were deployed in mobile units, we now know that even though their support equipment is truck-mounted, most if not all MRBM units employ fixed sites. Like the ICBM complexes, these are soft, screened from ground observation by their placement in wooded areas, and protected against air attack by surface-to-air missile sites in the vicinity. The systems are probably designed so that all ready missiles at a site can be salvoed within a few minutes of each other. Two additional missiles are probably available for each launcher; a second salvo could probably be launched about 4-6 hours after the first. There is some evidence that after one or two salvos the units are to move from their fixed sites to reserve positions. Their mobility could thus be used for their immediate protection, or they could move to new launch points to support field forces in subsequent phases of a war.

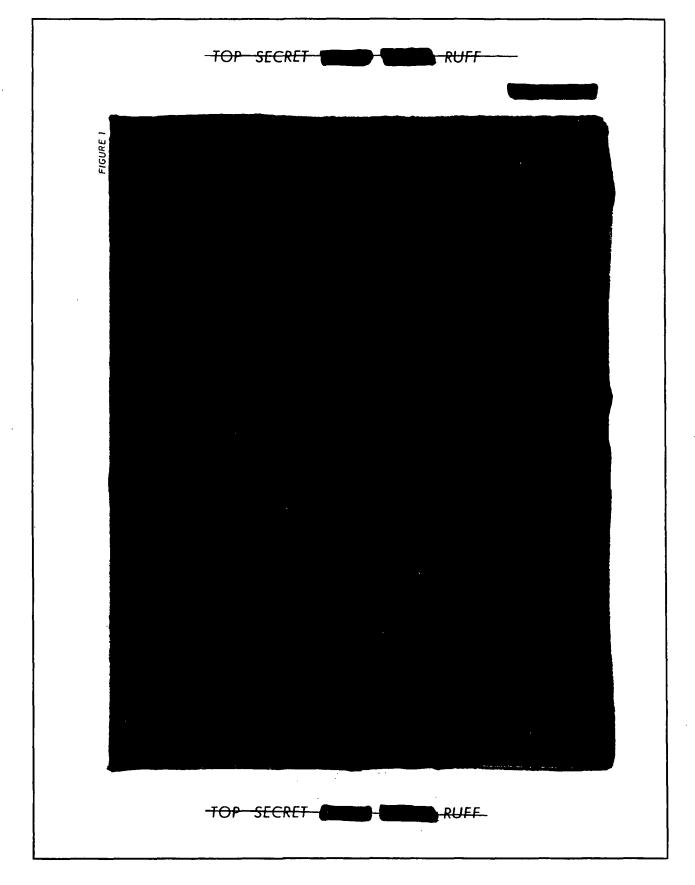
33. The Soviet planners apparently see a larger total requirement for MRBMs and IRBMs than we had supposed. While the rate of deployment activity in the western belt is probably tapering off after a vigorous three-year program, some sites of all three basic types are still under construction. There will therefore be at least some increase in force levels in the coming months. The magnitude of the buildup thereafter will depend largely on the degree to which the 2,000 n.m. system is deployed,



-TOP SECRET RUFF and whether or not it will supplement or replace medium range missiles. 34. With the advent of the 2,000 n.m. IRBM, probably in late 1961 or early 1962, the Soviets will acquire new ballistic missile capabilities against such areas as Spain, North Africa, and Taiwan. To this extent at least, they probably wish to supplement their present strength. They may also wish to deploy IRBMs or MRBMs to more northerly areas within range of targets in Greenland and Alaska. Moreover, evidence from clandestine sources indicates that the Soviet field forces are exerting pressure to acquire missiles of these ranges. In general, however, we believe that the future MRBM/IRBM program will emphasize changes in the mix among the existing systems, and later the introduction of second generation systems, rather than sheer numerical expansion. Taking these factors into account, we estimate that the USSR will achieve 350-450 operational MRBM and IRBM launchers sometime in the 1962-1963 period, and that the force level will be relatively stable thereafter. TOP SECRET

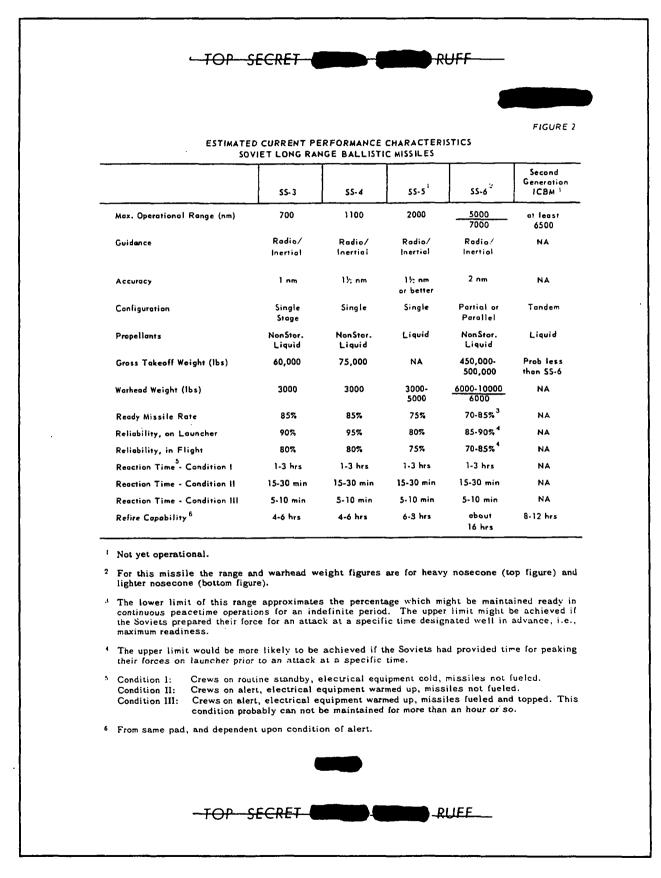


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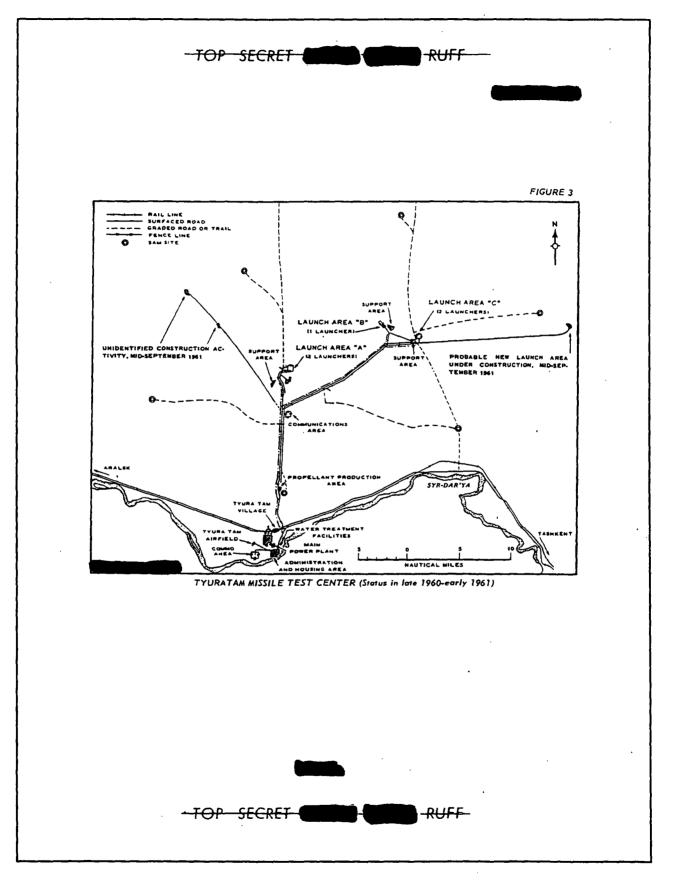
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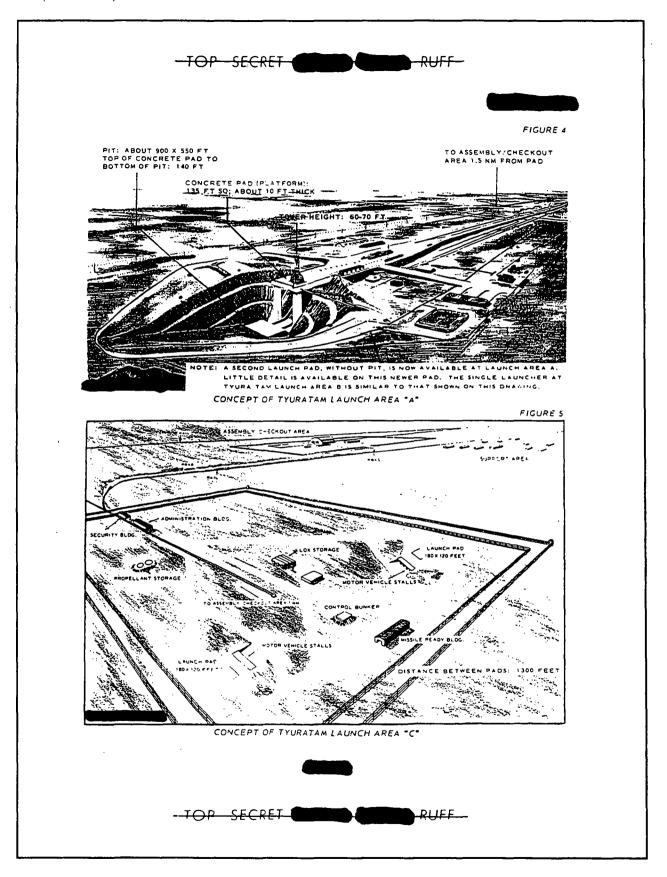
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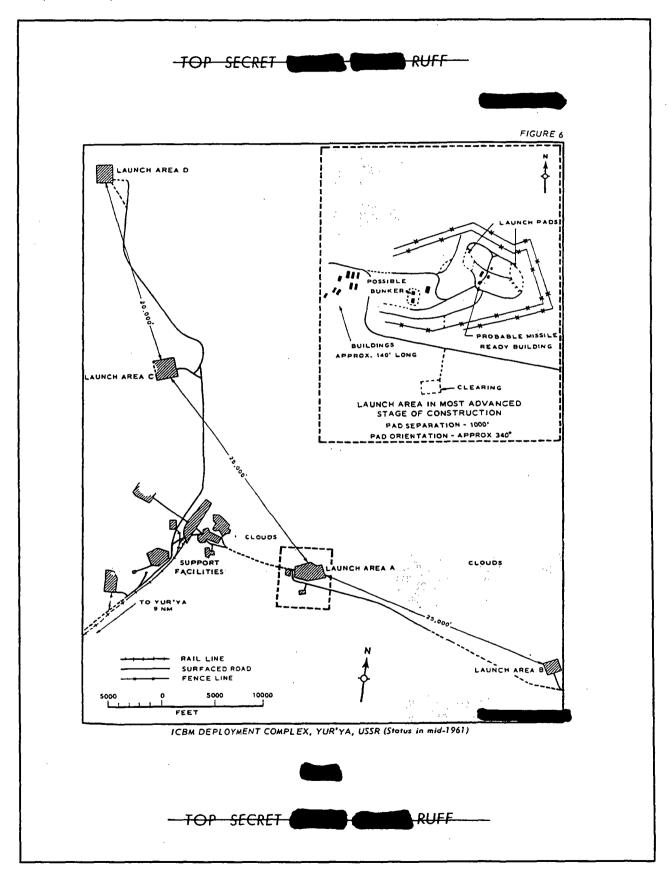
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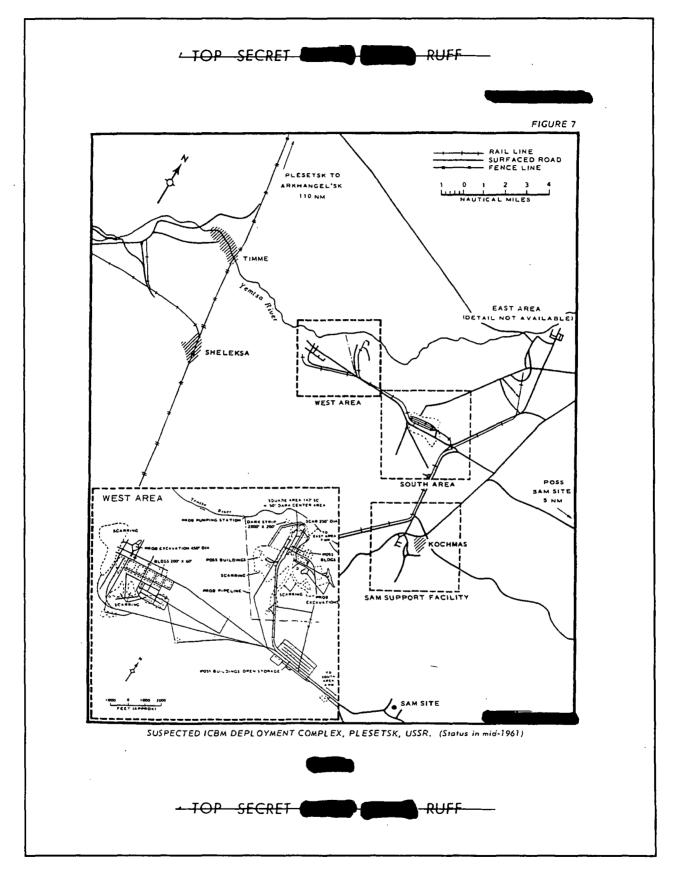
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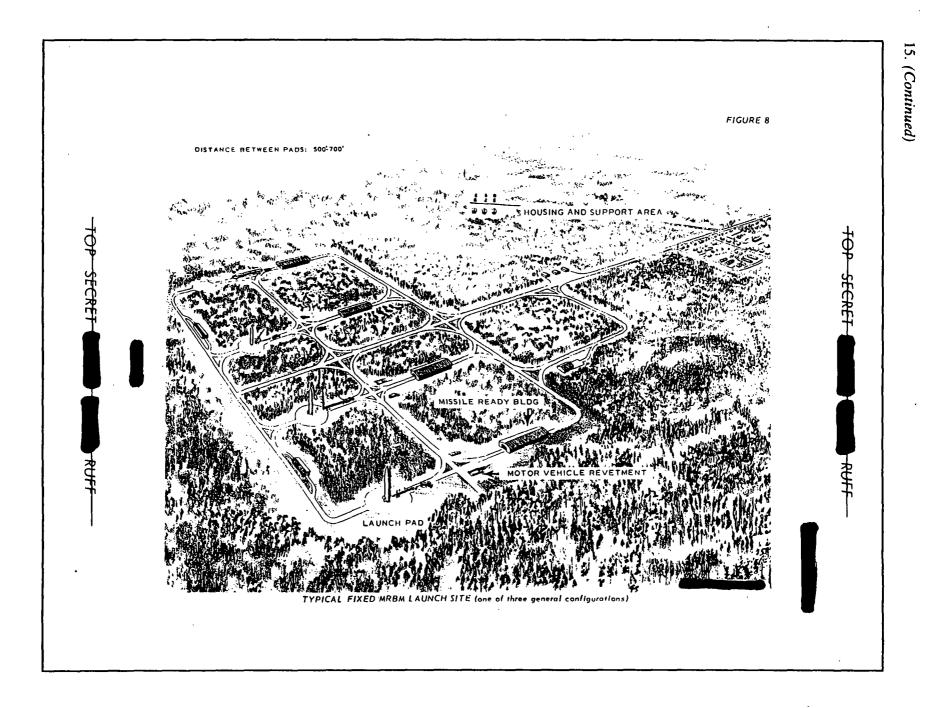


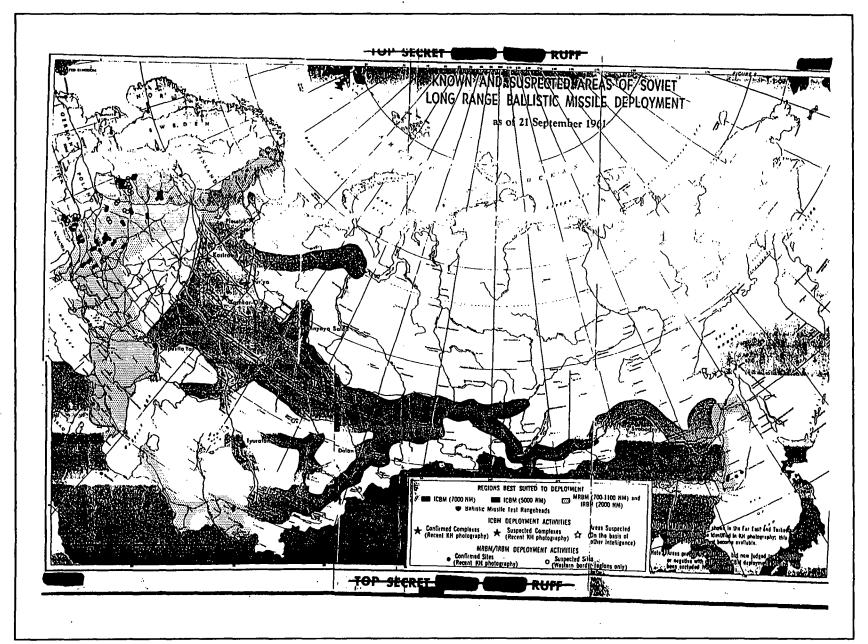
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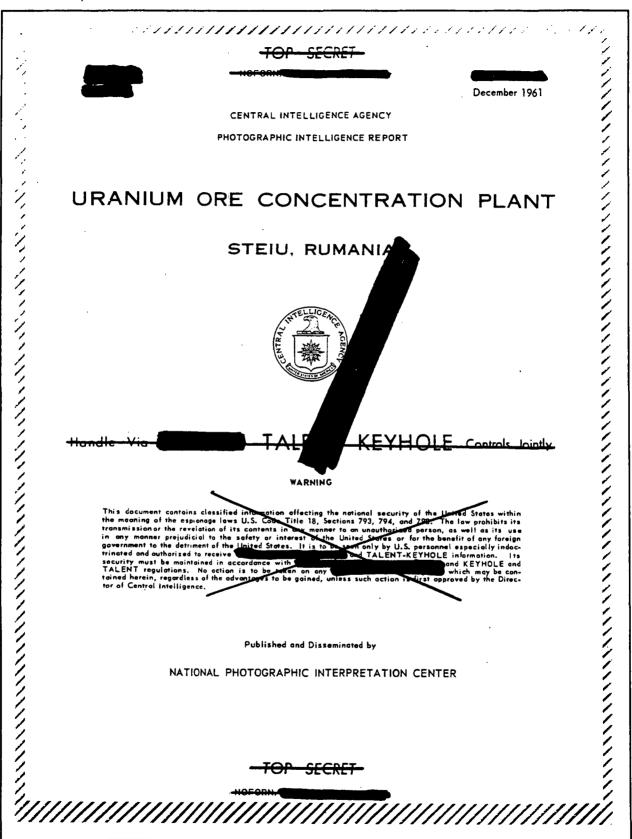




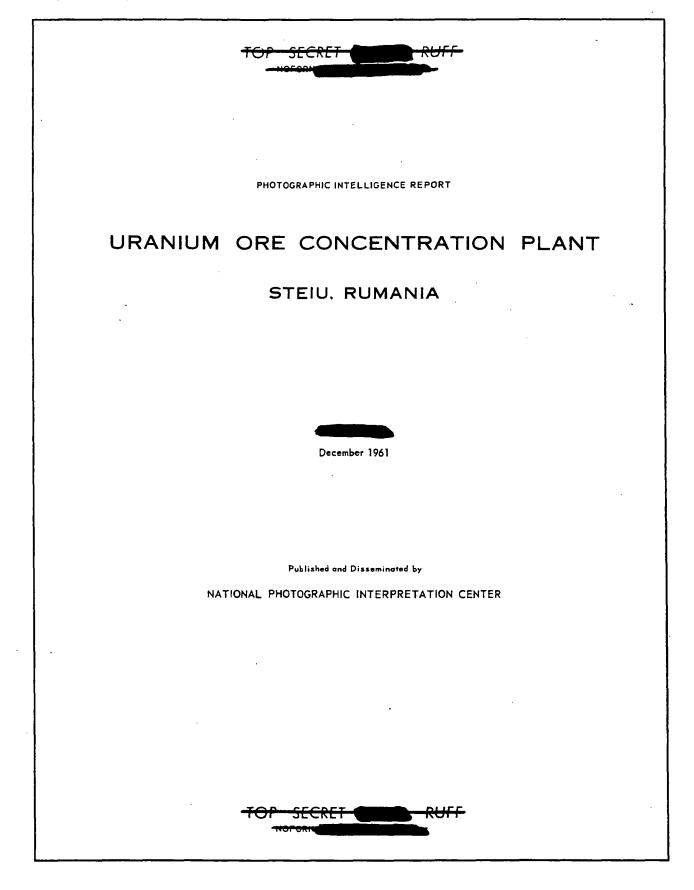


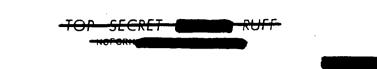






16. CIA/NPIC, Photographic Intelligence Report, "Uranium Ore Concentration Plant, Steiu, Rumania," December 1961



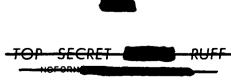


INTRODUCTION

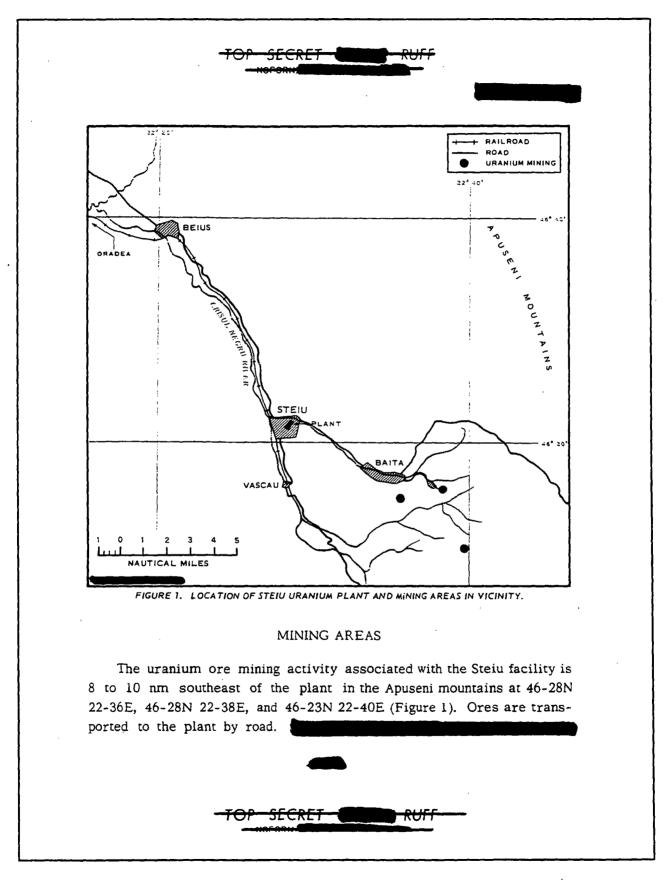
The Steiu uranium ore concentration plant appears on fair KEYHOLE photography of 19 August 1960, 8 July 1961, and 1 September 1961 at 46-31N 22-28E, on the east-central edge of the newly constructed town of Steiu. Steiu is located in a pocketed valley along the Crisul Negru between the Bihorului and Codrului mountains in the northwest part of Rumania, approximately 35 nautical miles (nm) southeast of Oradea and 49 nm west-southwest of Cluj (Figure 1). The Steiu area is served by a good road and a single-track rail line running from Oradea and terminating 3 nm south at Vascau. Only road transportation is available from three mining areas in the vicinity to the plant. Strict security provisions are said to be in effect in the area.

The concentration process at the plant probably involves crushing of the ore, followed by ion-exchange of the solutions from the residue, and finally precipitation of uranium oxide. The uranium oxide is probably then shipped by rail to the Soviet Union, via a transshipment point at Halmeu, Rumania, approximately 87 nm north on the USSR-Rumanian border. An adjacent thermal power plant furnishes power. Possible servicing and repair facilities for the plant and mining areas are adjacent to the plant. A possible research institute is located on the southeast edge of the town. $\frac{1}{2}$ Several storage areas are located throughout the built-up area. $\frac{1}{2}$, $\frac{3}{2}$ west of the plant may be associated with it.

Annual production of the Steiu plant cannot be computed by estimating the volume of material in the possible tailings area and recovery ponds, due to the scale of the satellite photography. The small-scale photography can confirm only the general layout of the plant and provide a clue to the possible functions of the buildings at the plant. Building measurements given in this report are only approximate and their relative degree of error must be assumed to be quite large. Heights cannot be determined at all.



16. (Continued)



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4/ Partial ore concentration would probably then have begun in 1955-56, with full-scale production (mining and concentration) probably being reached in 1957. These are open-pit mining operations, with two of them in the early stages of development. One mine was developed between the August 1960 and July 1961 KEYHOLE coverages. The deposits in the Apuseni mountains consist of siliceous siltstone, coated with flakes of metatorbermite.

year operation. 5/, 6/ Reserves of ore probably are adequate for a 10-

Recovery at the Steiu plant is probably on the order of 90 percent of the uranium present in the ore. If the mill was completed in 1957, it can be assumed that the production process would be comparable to the present US practice of ion exchange for the recovery of uranium oxide.

ORE CONCENTRATION PLANT

The ore concentration plant (Figure 2) occupies an area of approximately 170 acres. It contains four probable main processing buildings, a possible crusher building, associated buildings, and a possible Dorrtype thickener. Figure 2 represents a concept of the plant layout and structure based on the KEYHOLE photography and on the layout of other known plants of the same type. Approximate dimensions of the buildings are contained in the key to annotations accompanying this illustration.

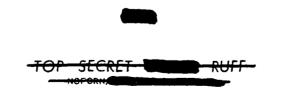
The main structures visible in the plant area are a possible orereceiving building (item 1), a possible ore classification, crusher, and grinder building (item 2), a possible Dorr-type thickener (item 3), and an ion-exchange building (item 4). Other production facilities are two possible final treatment buildings (items 5 and 6) and a possible preparation and packaging building (item 7).



Table 1. Key To Annotations, Figure 2					
Item No	Description	Approximate Dimensions (ft)	Approximate Roof Cover (sq ft)		
1	Poss ore-receiving building	140 × 60	8,400		
2	Poss ore classification, crusher, and grinder building	L-shaped	27,120		
3	Poss Dorr-type thickener	140 diam			
4	Poss ion-exchange building	L-shaped	36,700		
5	Poss final treatment building	300 × 80	24,000		
6	Poss final treatment building	300 × 80	24,000		
7	Poss preparation and packaging building	300 × 95	28,500		
8	Prob storage and shipping building	160 × 85	13,600		
9	Prob administration area (3 bldgs)	240 x 90(1) 65 x 60(2)	28,400		
10	Thermal power plant, with 2 cooling towers, each 35 ft diam, and adjoining stack	300 × 85	25,500		
		Total	216,220		

Other facilities at the concentration plant include a probable storage and shipping building (item 8) and a probable administration area (item 9). A possible tailings area is located adjacent to the western edge of the plant area. An area of possible recovery ponds, with approximately 18 beds, is just north of the plant area. No pipelines are discernible on this photography.

With these facilities, the Steiu mill would appear to be a complex plant for the treatment of probably both uranium ore and concentrates. Both would be brought from the mining areas by truck to the ore-receiving and classification buildings (items 1 and 2).



16. (Continued)

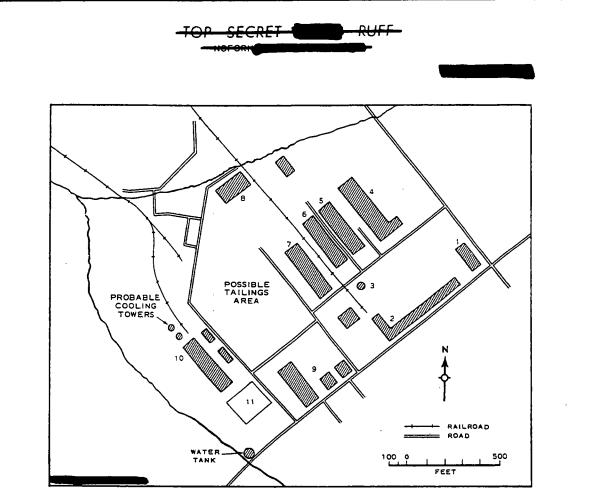
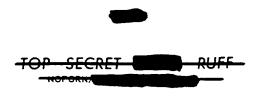


FIGURE 2. URANIUM ORE CONCENTRATION PLANT, STEIU, RUMANIA.

Blended ore would be passed through the crusher and grinder system (item 2), with some ores going to the possible thickener (item 3). All ores would then go to the ion-exchange building (item 4), and thence to the final treatment buildings (items 5 and 6). The waste material or slurry would be piped to the possible tailings pile. The possible recovery pond area is connected to the plant by a probable pipeline. It contains 18 possible settling or evaporation ponds, covering an area 600 by 500 feet.

Uranium concentrates could be shipped directly from the packaging building (item 7) or could be stored in the probable storage and shipping building (item 8) until shipment is made.



Since no solvent-extraction plant is visible in the vicinity of the concentration plant, it is possible that no further upgrading to green salt or metal takes place at the Steiu plant.

Production Estimates

If a plant of this size is treating mostly concentrates and small shipments of ore, its output could represent a considerable production of uranium concentrate.* There is no way of determining what portion of the mill feed is crude ore and what is concentrate from primary mills. The product of the Steiu plant probably is ammonium diuranate containing 75 to 90 percent uranium oxide.

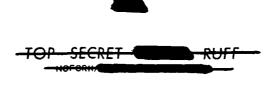
It is very difficult even to attempt an estimate of the possible output of the Steiu plant because the scale of the satellite photography makes it impossible to determine the height of the possible tailings area and the volume of the possible recovery ponds.

TRANSPORTATION AND SECURITY

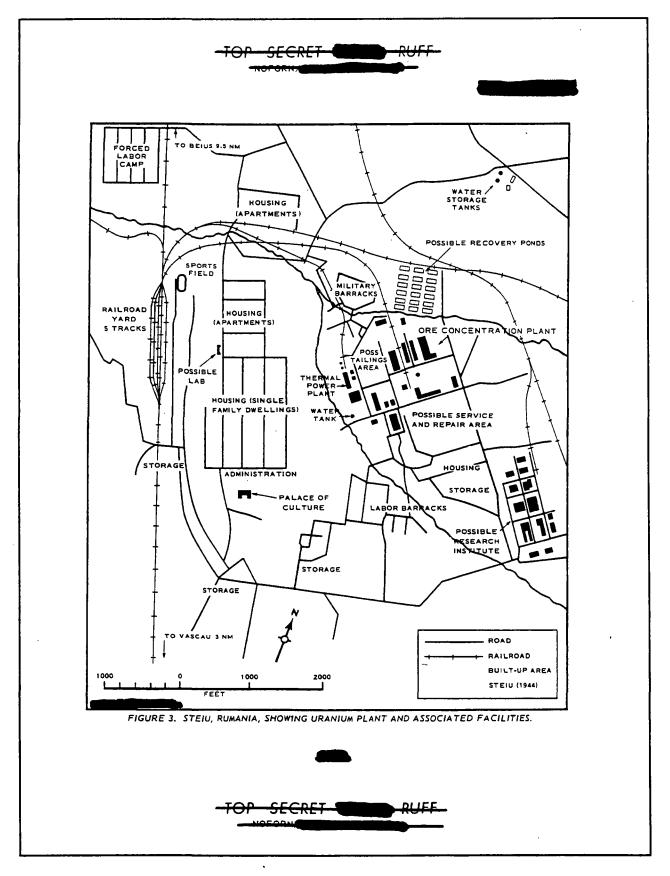
The Steiu uranium concentration plant is served by both road and rail. A single-track spur off the Oradea-Vascau single-track line serves the plant area, with spurs serving the thermal power plant, the possible research institute, and a U-shaped unidentified dead-end spur to the northeast of the built-up area (Figure 3).

A reported five-track holding yard, 1,730 feet long, is on the western edge of Steiu, with a large adjacent storage area parallel to the tracks. There are no rail facilities discernible between the uranium ore concentration plant and any of the mine areas. All transportation of the ores to the plant appears to be by road. Concentrated ores could be shipped to the Soviet Union for further processing through a rail transshipment point at Halmeu, Rumania, on the Soviet border.

• It is felt that, during its first years, the plant's input consisted largely of crude ore, but that the input of concentrates increased steadily, so that the input would now be high in concentrates and low in crude ore.



16. (Continued)



TOP CEOPET

No fences or walls can be seen surrounding the uranium concentration plant, but it is reported that the area is divided into three strictly divided zones of security, with limited access to each zone. People in the various zones are not permitted into all zones, and are very restricted in their movement within the area, as well as in their movement to other parts of Rumania.

SUPPORT FACILITIES

The extensive support facilities seen on the photography could be central facilities for servicing the tributary mines and plants in the area as well as the ore concentration plant.

The rail-served thermal power plant immediately west of the uranium ore concentration plant, contains a boilerhouse and generator hall (item 10, Figure 2), two probable cooling towers, a possible transformer yard (item 11), and a water tank.

A possible service and repair area, adjacent to the south edge of the plant, is probably for both the uranium ore concentration plant and the three mining areas. The area contains 13 buildings of various sizes.

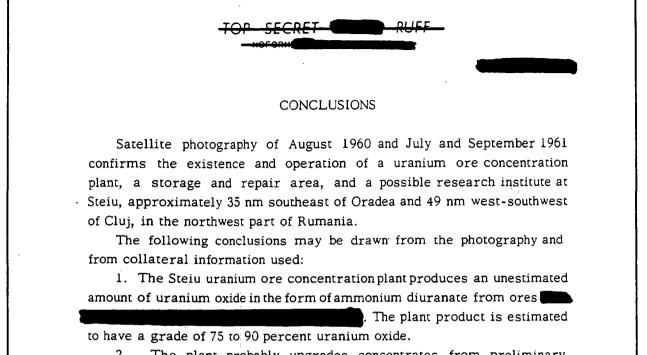
The possible research institute 1/ is located on the southeast edge of the town area. Nothing is known of the work of the institute,

1/, 7/

The town of Steiu has grown tremendously since the original Rumanian agricultural village was seen on German photography of 1944. On the photography of 1960-61, several large areas of multistory apartment buildings, single-family dwelling areas, reported military and labor barracks areas, **Barracks areas**, **Barracks**, **Bar**

Water is supplied from the Crisul Negru, with water storage tanks located at various points throughout the built-up area. The small-scale satellite photography reveals no pipelines.



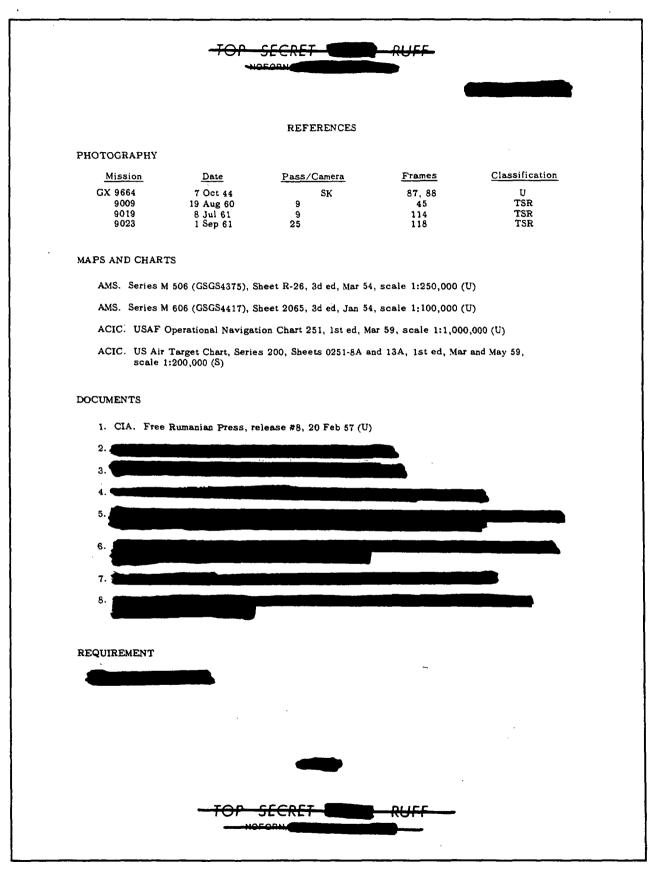


2. The plant probably upgrades concentrates from preliminary processing plants located at three uranium mines. There are three nearby areas of uranium mining, located 8-10 miles southeast and connected by road to the Steiu uranium ore concentration plant.

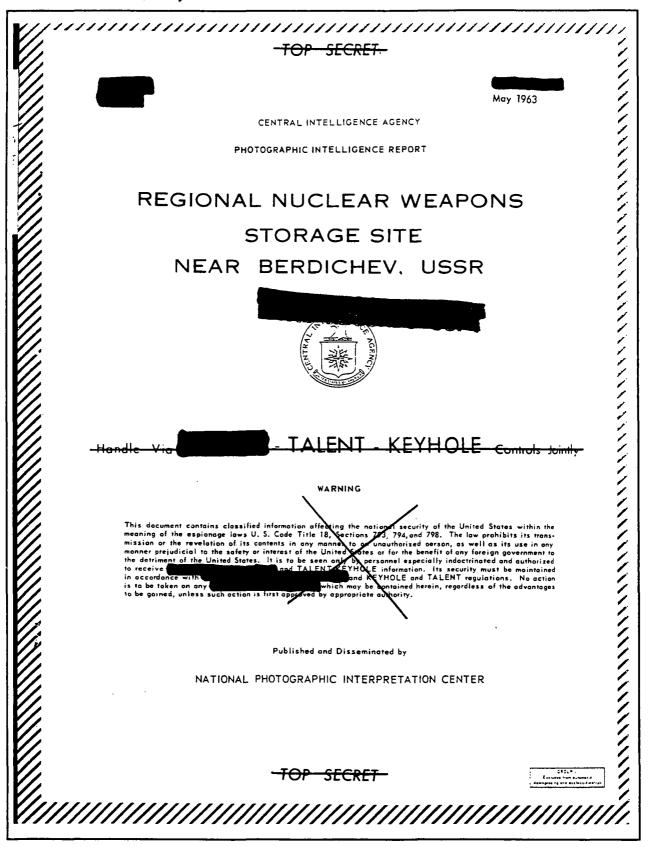
3. A possible storage and repair area is probably associated with the plant and the mining areas.

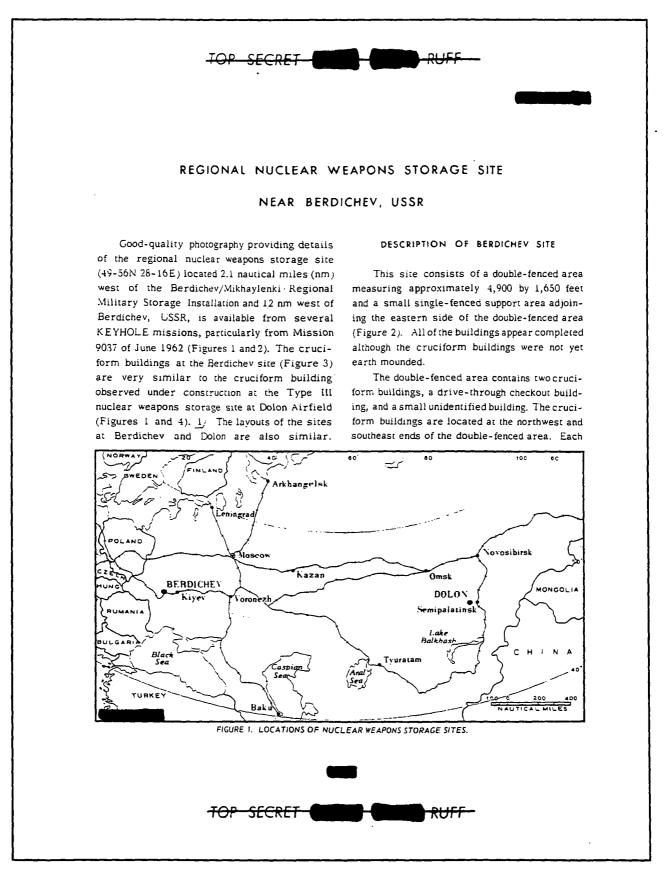
4. A possible research institute, probably connected with the uranium ore concentration plant and the mining areas, is located on the southeast edge of Steiu.





17. CIA/NPIC, Photographic Intelligence Report, "Regional Nuclear Weapons Storage Site Near Berdichev, USSR," May 1963



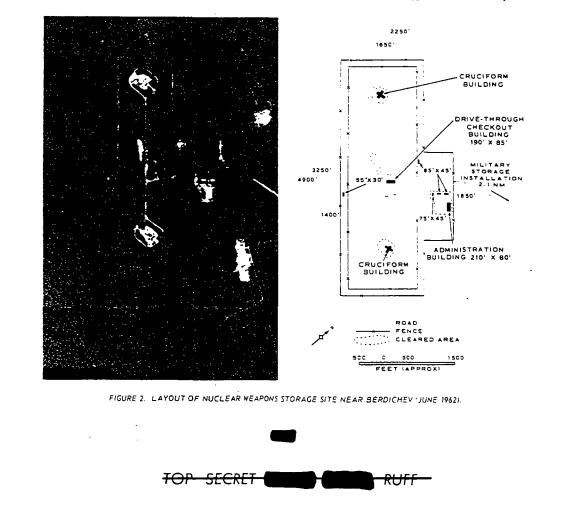


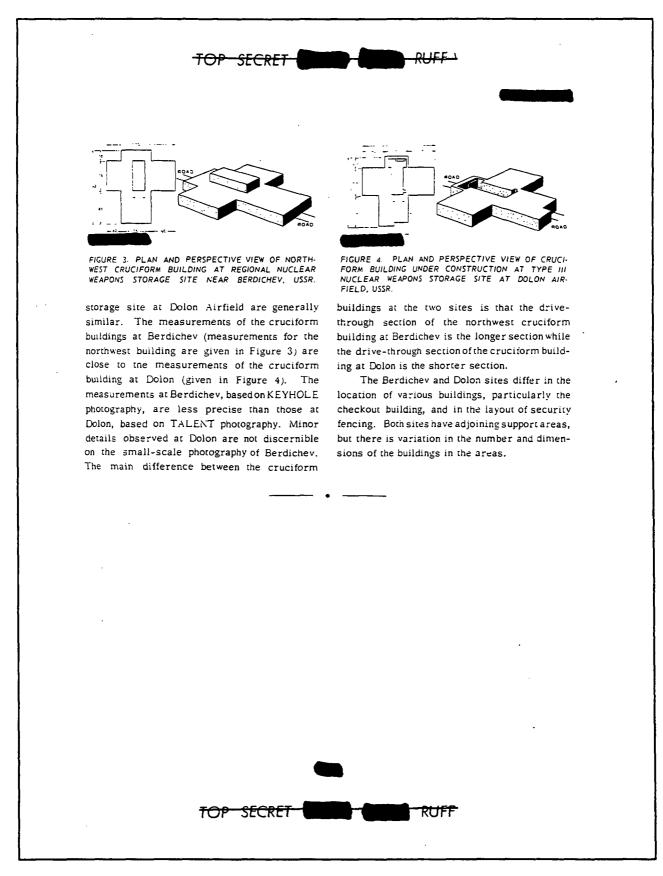


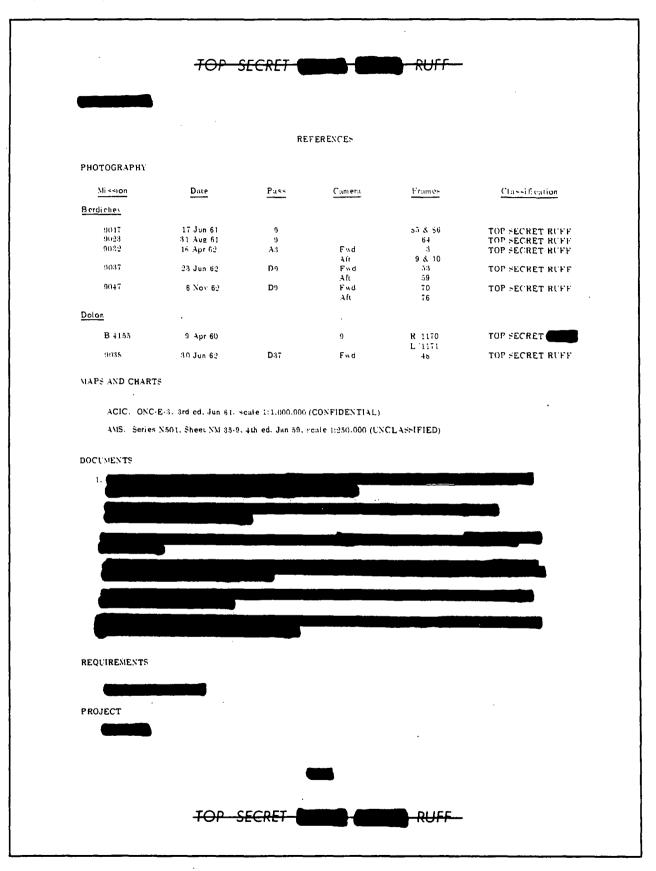
is a heavily constructed drive-through building and is encircled by a road. Photography of November 1962 revealed that the southeast cruciform building, which appeared under construction in June 1962, is complete. The cruciform buildings, located approximately 3,250 feet apart, are connected by road. A drive-through checkout building (190 by 85 feet) is located along this road approximately 1,400 feet from the southeast cruciform building. A road within the area parallels the inner fence and frames the area. A small unidentified building (55 by 30 feet) is located between the inner and outer fences on the southwestern side of the area. The support area consists of an administration building and four support buildings. The administration building measures 210 by 80 feet, three of the support buildings measure 85 by 45 feet, and one support building measures 75 by 45 feet. Except for this small support area, the only transportation, communications, and other support facilities serving the site are located 2.1 nm west at the Berdichev Regional Military Storage Installation.

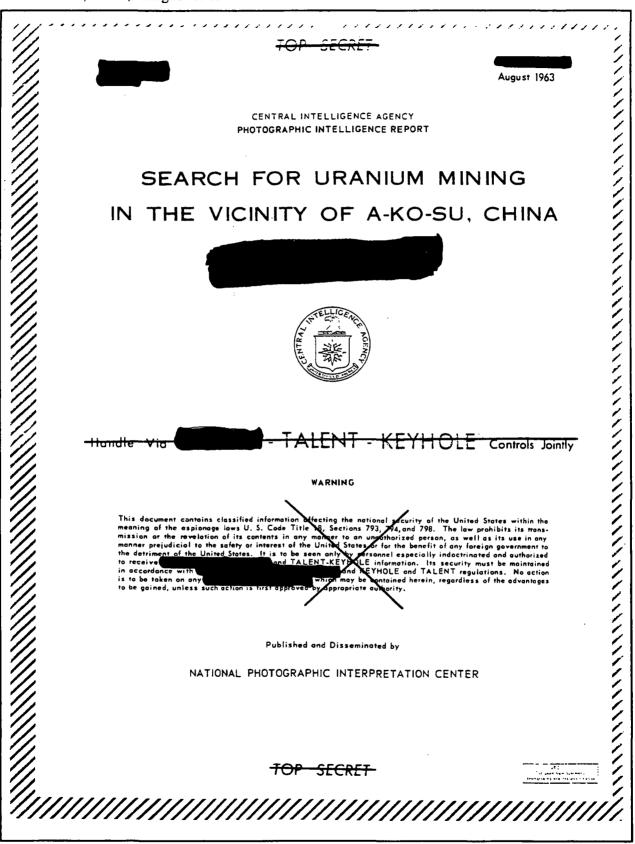
COMPARISON WITH DOLON SITE

The regional nuclear weapons storage site at Berdichev and the Type III nuclear weapons

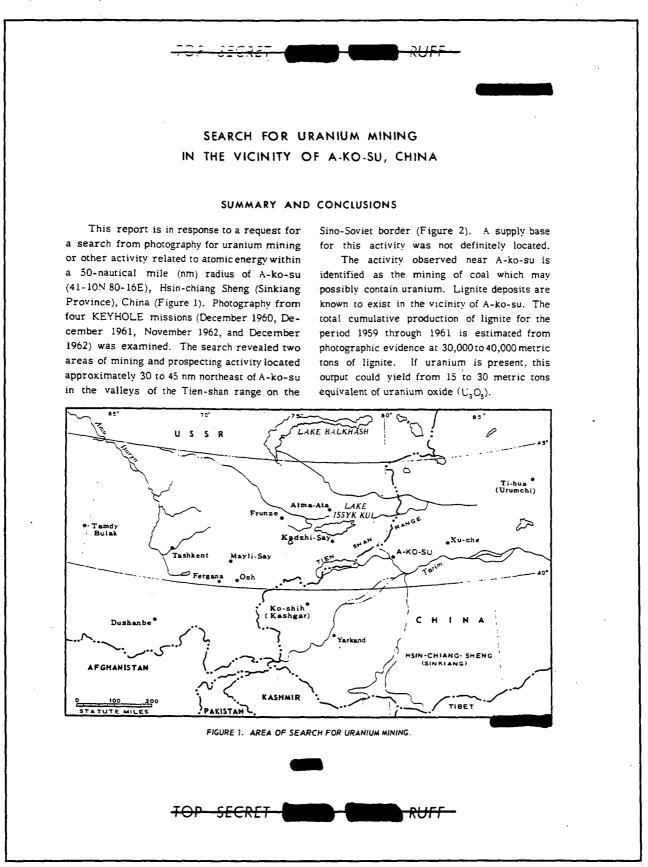


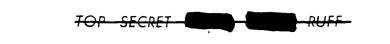






18. CIA/NPIC, Photographic Intelligence Report, "Search for Uranium Mining in the Vicinity of A-Ko-Su, China," August 1963





Although photographic evidence of uranium processing was not observed, the possibility of uranium extraction cannot be discounted. Some evidence of extra security which is usually associated with uranium activity was observed at the mining sites. Observations of some activity at the mines during periods of snow cover is evidence of the priority that would be assigned to uranium extraction.

Commercial-grade uraniferous ore deposits are known to exist on the Soviet side of the Tien-shan range and the presence of uraniferous coal deposits in the A-ko-su region is suspected.

PHOTOGRAPHIC OBSERVATIONS

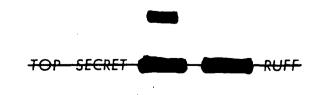
The activity observed in the vicinity of A-ko-su is located in two areas which are designated in this report as the Eastern Area and the Western Area (Figure 2). In the Eastern Area, five mining sites, one prospecting site, a treatment plant, and a possible explosives magazine were observed. In the Western Area, three prospecting sites were observed. For purposes of description, site numbers have been assigned to identify the locations of mines and prospects.

Evidence of Mining. The earliest photography (December 1960) of the mining sites (all in the Eastern Area) showed a cluster of five mines at Site 5, all apparently in production, and two mines--one at Site 1 and another at Site 2--apparently being readied for production. The December 1961 photography revealed all mines in production and the presence of a higher pile of coal refuse, although the pile covered approximately the same area as it had in 1960. Track patterns evident at times of snow cover indicated truck traffic on the roads serving the mines. This also indicated the continuing operation and development of the mines during winter.

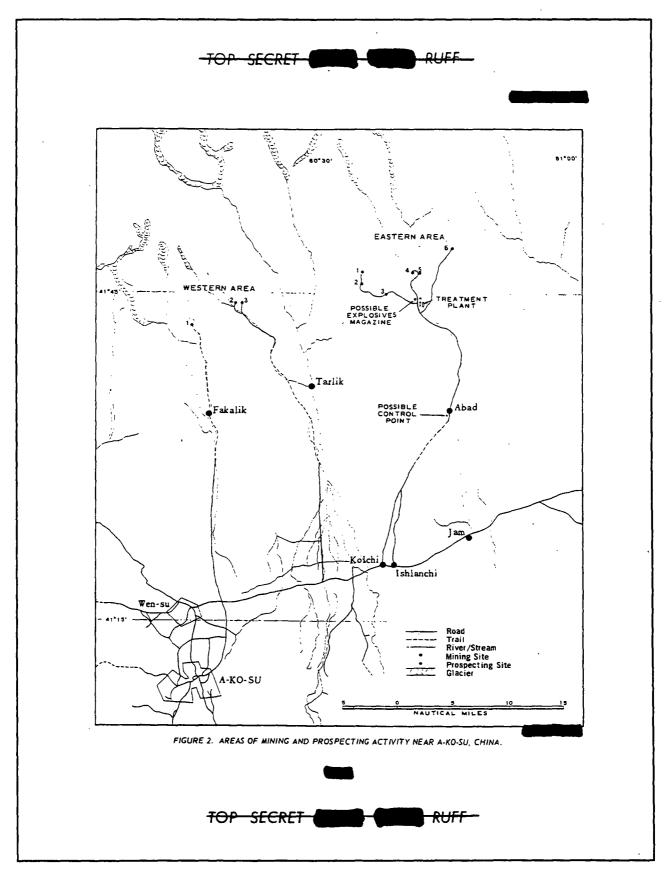
Accumulation of coal in piles for possible reprocessing was observed at the treatment plant in the Eastern Area. The stockpiling of coal at the treatment plant may indicate the possibility that the coal is reprocessed for the extraction of a by-product. A by-product such as uranium could be produced in such small quantities that it would elude photographic observation. It could be transported to a center without perceptible traffic indications. Little or no accumulation of coal or ashes was observed in the towns and villages in the region.

<u>Production Estimate</u>. Based on the observed accumulation of coal refuse at the treatment plant, the total cumulative production of coal in the Eastern Area from 1959 (when digging probably began) to December 1961 is estimated at 30,000 to 40,000 metric tons. Coal production for the period December 1960-December 1961 is estimated at 25,000 metric tons. If the observed mining prospect at Site 2 in the Western Area is developed into a producing mine, the area's annual coal production could increase by an additional 10,000 metric tons. These estimates do not allow for some local consumption of coal.

For an estimate of possible uranium yield, the coal deposits of the A-ko-su area are assumed to resemble other weathered nearsurface deposits of uranium-bearing Jurassic coals, such as those on the Soviet side of the border. These deposits may yield from 0.05 to



18. (Continued)



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tons

TOP-SECRET Called August 2019 Constant RUFF 0.75 percent $U_3 O_5$ equivalent. This could place the area's total cumulative yield of $U_3 O_5$ equivalent through December 1961 at 15 to 30 metric

Evidence of Security. The areas of mining activity are located in remote valleys. To the north is an area of high glacier-covered mountains, and to the south, treacherous sands are found on the alluvial fans at the valley mouths. The valleys physiographically resemble those emptying on the Fergana Valley of the USSR in being deep and narrow at their lower ends. These characteristics permit easy control of entrance to and egress from a valley and allow compartmentalization of operations in a valley. Prison labor could be used at mine sites in these valleys with a minimum of control. Prisoners probably were brought to the mines in 1959 and 1960. Some security precautions were observed in the Eastern Area. A possible control point is located on the access road from Jam near the mouth of the first vallev at Abad. Possible fences were observed at two of the mines (Sites 2 and 5).

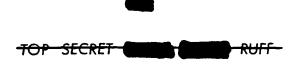
Search for a Support Base. A support base for the observed mining activity was not definitely located. Such identifying features as piles of coal, ashes, or pit props in association with warehouses were not observed. No laboratorytype building was visible in the Eastern or Western Areas. Photography of the principal settlements -- A-ko-su, Jam, and Wen-su--was examined closely. The activity at Wen-su, located in a valley with a steep eastern slope, is probably local in nature and not related to mining. A-ko-su is the most likely location for a general support base. Roads from the prospecting and mining sites converge on A-ko-su. Barnlike buildings on the eastern outskirts of the town and on the road to the mining areas may serve a support function. Traffic in the vicinity of these buildings, as indicated by patterns in the snow,

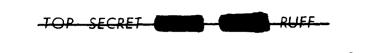
seemed to exceed the level expected from local agricultural activity. However, winter shelter for grazing animals may account for the additional activity. Barracks-type buildings on the large farms (presumably state farms), 21 nm south-southeast of the mines near Jam, may house administrative support for the Eastern Area, and the farms, located on the northern edge of the irrigated plains, may supply provisions for the mining settlements.

EASTERN AREA

The Eastern Area, located approximately . 39 nm north-northeast of A-ko-su, is the principal area of mining activity in the region (Figure 2). A treatment plant and a possible explosives magazine are centrally located with respect to the mining and prospecting sites in the area. Access to the area is by a road from Jam 21 nm to the south-southeast. A possible control point is located 10 nm to the southsoutheast of the treatment plant on the access road and near the mouth of the valley. At the times of snow cover the access road appeared lightly traveled.

Treatment Plant (41-44N 80-42E). This plant is located at the junction of the access road from Abad with the road from the northwestern (Sites 1-3) and northern (Sites 4 and 5) sites and a road from the northeastern site (Site 6). The plant consists of two small adjoining square buildings identified as mills. A small pile of waste is located just south of each mill, a small rectangular building is located southeast of each mill, and a possible storage building is situated east of each mill. Water is piped to the plant from the river which flows from the northwest valley. However, drymilling and manual removal of waste are apparently practiced during periods of freeze. The photography of November and December 1962





during snow cover indicated that the plant was probably operating at a low rate. Tracks in the snow indicated light traffic on the roads serving the treatment plant. Dust and water seepage were evident at the plant's coal pile.

Other features observed near the plant include the following: three medium-sized dormitory-type buildings located just west of the mills; a small square building identified as a possible control building located southwest of the plant on the west side of the access road; and a motor pool and/or equipment park, including a small rectangular building, located in a triangular area across the entrance-exit road.

Possible Explosives Magazine (41-44N 80-41E). This facility is located northwest of the treatment plant off the road to the western sites and near the junction with the road to the northwestern sites. Its location on the route between the mines and the treatment plant would allow trucks to carry return loads of explosives to the mines. The possible explosives magazine is secured and road served. Although this facility appeared on the November 1962 photography to be inactive, light activity indicating partially operating mines was observed on the December 1962 photography.

Site 1 (41-47N 80-35E). This site is located on the eastern side of a valley and contains an opencut mine. A village is located west of the mine in a valley. The December 1960 photography indicated that the mine was being readied for production. The site is the western terminus of a well-traveled road which also serves Sites 2 and 3. The road was not being used extensively in 1960. December 1962 photography revealed that the mine had probably been shut down, although tracks in the snow to the mine were observed.

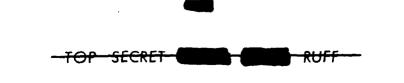
Site 2 (41-46N 80-35E). This site contains an open-pit mine, the largest mine in the area.

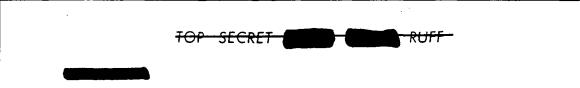
The terrain of a fenced area east of the mine appears broken, apparently caused by slumping from underground mining. A village is located south of the mine. The December 1960 photography showed the mine in production. At that time the road from this site to the treatment plant was well traveled. The December 1962 photography revealed a coal pile below the mine. Tracks in the snow indicating traffic activity at the mine were observed. The road from the site to the treatment plant was open, but the continuation of the road to Site 1 appeared to be inactive.

<u>Site 3 (41-45N 80-38E)</u>. Site 3 consists of two small opencut prospects which are located halfway up the west side of a ridge. The site probably contains only limited reserves of coal.

Site 4 (41-47N 80-41E). This site contains a possible opencut mine and a small housing area. The site is located on a perched upper slope. It is served by a branch from the well-traveled road which also serves Site 5. The mine appeared to be inactive on the December 1962 photography, although tracks in the snow to the mine were discernible.

Site 5 (41-47N 80-42E). This site is the oldest and best developed mining site in the area. It consists of a large portal mine located on the eastern side of a valley and a cluster of four small opencut mines located on the broken western slope of the valley where faults probably limit the availability of reserves. The portal mine may have large reserves. A small pile, probably of coal, is observed on the floor of the narrow valley at the junction of a loop road serving these mines and the road to the treatment plant. A possible housing area is located in the center of the valley. A possible guard fence, with guard towers, crosses the valley below the mines and the possible housing area. A fence partially encloses the portal mine.





Lack of heavy traffic patterns on the road toward the treatment plant at the time of snow cover suggests that coal produced was being stockpiled at the site. The December 1962 photography revealed that the four opencut mines were inactive. Tracks in the snow to the mines showed maintenance activity was in progress.

Site 6 (41-49N 80-46E). Site 6 contains three small opencut mines located halfway up the eastern slope of a ridge. Each mine is served by a steep, well-defined trail. Scattered settlements are located 3 nm down the valley. The December 1962 photography indicated that the mines were inactive, although tracks in the snow to the mine were observed.

WESTERN AREA

The Western Area, located approximately 34 nm north of A-ko-su, contains three prospecting sites (Figure 2). A prospect at one of the sites (Site 2) is being developed for a mine. The sites are served by two separate trails. Routes suitable for vehicle use have been observed. Site 1 (41-42N 80-15E). Site 1 contains a prospect located in a mountain meadow, and

numerous trails leading to cliffs indicate other prospecting activity. Three rows of unidentified objects, possibly huts or stacks of supplies, were observed in a valley west of the prospect. Ten small settlements near the site serve as centers for farming and prospecting. The principal trail serving the site leads southward through the village of Fakalik where it becomes a secondary road leading to the east side of A-ko-su.

Site 2 (41-44N 80-20E). Site 2 contains an opencut prospect which is being cleared for an open-pit mine. This prospect is located at the foot of the western side of a low mountain. Trails lead up the broken slopes of the mountain to small prospects. On the November 1962 photography at the time of snow cover, the prospect appeared as a small dark area, and tracks connected it with a village around the mountain. The December 1962 photography revealed a much wider and darker area at the prospect.

Site 3 (41-44N 80-21E). Site 3 contains five irregularly shaped opencut prospects which are located halfway up the eastern side of the mountain. A trail connects this site with a small settlement in the valley.

BACKGROUND

According to a Soviet geologist, V. M. Sinitsyn, geological reconnaissance of the northwestern part of the Tarim Basin began in 1942-43. $\underline{3}$ / Geological field work continued intermittently until 1952-53 when localized detailed studies were carried out. In 1953 Sinitsyn prepared a geological map of the region as a guide to prospecting, and during 1955-56 he drafted a report on the region. 3/

Photography of December 1960 showed that roads had been built from A-ko-su northward to the mining areas and that opencut mining and treatment of coal had been started. These de-

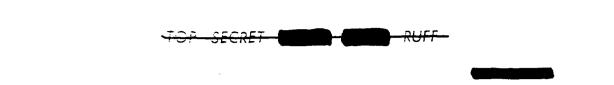
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velopments indicated that initial geological work and prospecting were probably in progress by 1958, if not earlier.

After prospecting during

1956-1957 the accumulation of coal shown by the 1960 reconnaissance indicates that miners were brought to the mines by 1959-1960. The presence of control points and fences in a mountainous

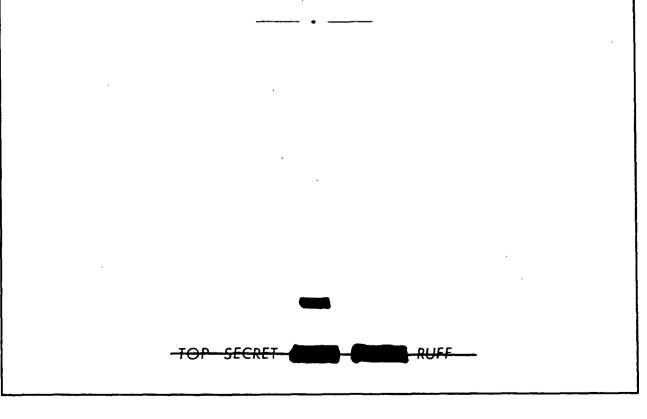


region indicates the miners probably are prisoners.

The usual prospecting practice of trenching, pitting, and drilling was not seen at the prospects near A-ko-su. In order to confirm the size and extent of the deposits exposed at a likely prospect, the exposure of the outcrop is widened by digging away the overburden.

GEOLOGY OF THE A-KO-SU REGION

The geology of the Sino-Soviet border region supports the possibility that uranium is present in the ores mined near A-ko-su. The valleys where mining is observed near A-ko-su are geologically contemporaneous and lithologically similar to those emptying on the Fergana Valley in the USSR where lignite coal of the Jurassic geological age is mined. Likewise, at Kadzhi-Say, USSR. northwest of A-ko-su, lignites also of Jurassic age have been described. <u>4</u>/ The A-ko-su, Fergana Valley, and the Kadzhi-Say regions are seen on photography to have deeply eroded east/west throughgoing fault zones. Such fault or crush zones would facilitate the descent of uraniferous ground water. The broken or faulted lignite seams would provide a reducing environment for the precipitation of the uranium from the percolating ground water. The coal seams north of A-ko-su are broken by a series of north/south faults whose crushedrock zones have been enlarged by swiftly flowing rivers. The broken and faulted character of the A-ko-su mining region limits a knowledge of the reserves and makes prospecting and mining costly and uncertain. Sinitsyn concluded that special work would show the location of the coalbearing zones. 🔚 He stated that the eastern or Kuche (Kuchar) coal basin which includes the A-ko-su region is the counterpart of the western or Yarkand-Fergana basin which extends from southern Hsin-chiang Sheng (Sinkiang) into the USSR. The appearance from photography of the region north of A-ko-su agrees with Sinitsvn's brief generalized geological description.

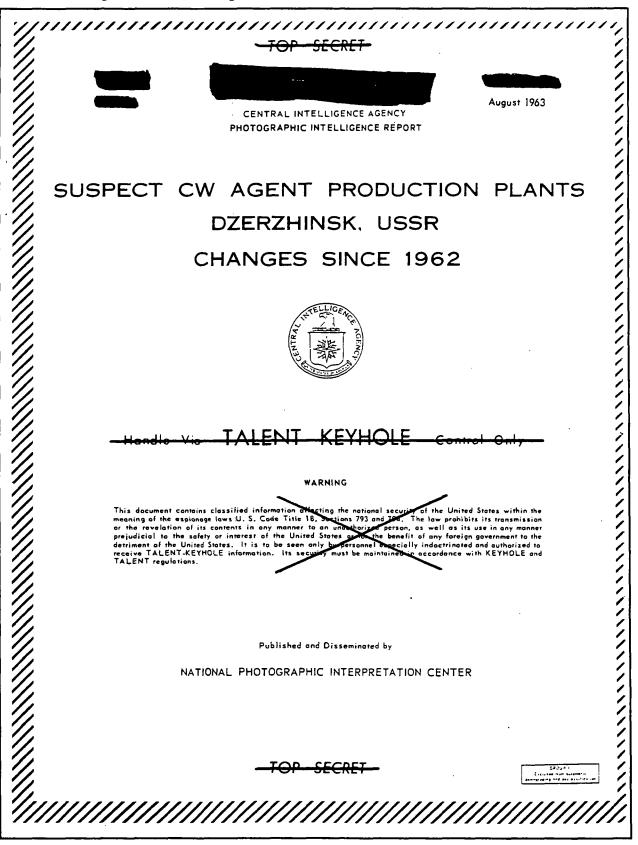


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		1	REFERENCES		
PHOTOGRAPHY					
Mission	Date	Pass	Camera	Frames	Classification
9013	9 Dec 60	22		157-160	TOP SECRET RUFF
9029	15 Dec 61	38		90	TOP SECRET RUFF
9048	29 Nov 62	70	Fwd Aft	190-192 194-196	TOP SECRET RUFF
9050	15 Dec 62	D54	Fwd Aft	86-89 90-93	TOP SECRET RUFF
MAPS OR CHAR	rs				
AMS. Serie	5 ESPA-1, Sheet NK-4	14-8. 1st ed. Au	g 62. scale 1:250.(00 (TOP SECRET	RUFF)
ACIC. US A	ir target Chart, Series	200, Sheet 0329	-19A. Jun 59. sca	e 1:200.000 (SECF	ET)
ACIC. WAC	329. Jui 59. scale 1:1	1,000,000 (CONF	FIDENTIAL)		
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US Geol Surv	. Map of Coal Basins				
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3. Sinitsyn,	V. M. <u>Northwest Part</u>	d Thorium Reso of the Tarim Ba	wres of Communis	t Countries series naya Chast Tarims	. Aug 54 (SECRET) kovo Basseyna),
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3. Sinitsyn, Geologic: REQUIREMENT	V. M. <u>Northwest Part</u> al Institute, Academy	d Thorium Reso of the Tarim Ba	wres of Communis	t Countries series naya Chast Tarims	. Aug 54 (SECRET) kovo Basseyna),

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19. CIA/NPIC, Photographic Intelligence Report, "Suspect CW Agent Production Plants, Dzerzhinsk, USSR, Changes Since 1962," August 1963



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SUSPECT CW AGENT PRODUCTION PLANTS DZERZHINSK, USSR CHANGES SINCE 1962

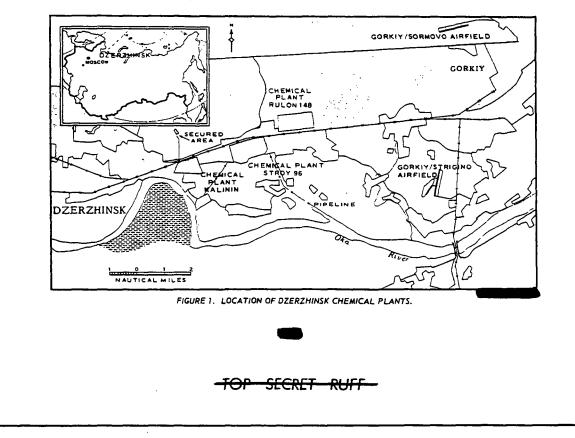
The two Dzerzhinsk Chemical Plants, Stroy 96 and Kalinin, which were described in **Constitution**, are further examined in this report. A third plant, Rulon 148, is also discussed. These three plants (Figure 1), which are part of the Dzerzhinsk Chemical Industrial Complex (56-14N 43-32E), were examined on good-quality KEYHOLE photography from Mission 9053 of 4 April 1963.

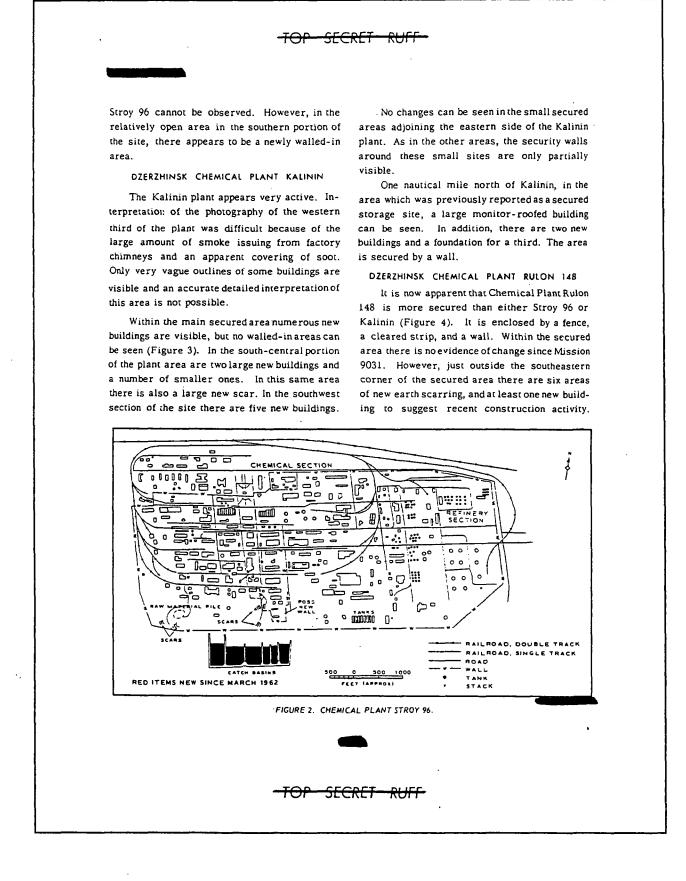
DZERZHINSK CHEMICAL PLANT STROY 96

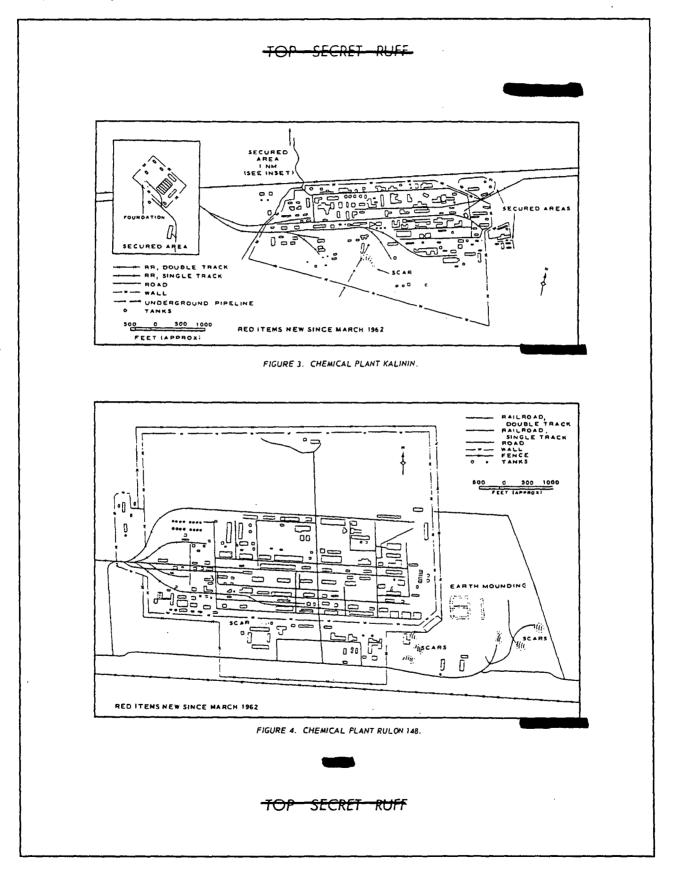
The refinery section of this plant shows little change since March 1962. There has been a slight increase in the storage capacity of the area and one new building has been added (Figure 2). In the chemical production area of Stroy 96, numerous buildings are seen for the first time. However, these may not all be new. It is probable that some had been constructed previously, but were not visible until Mission 9053.

In the southwest corner of the plant, the appearance of new scars indicates possible new construction activity. A new waste heap or raw material storage pile can also be seen in this area.

Because of the small scale of the photography and the numerous buildings within the site, the walls which enclose different areas within

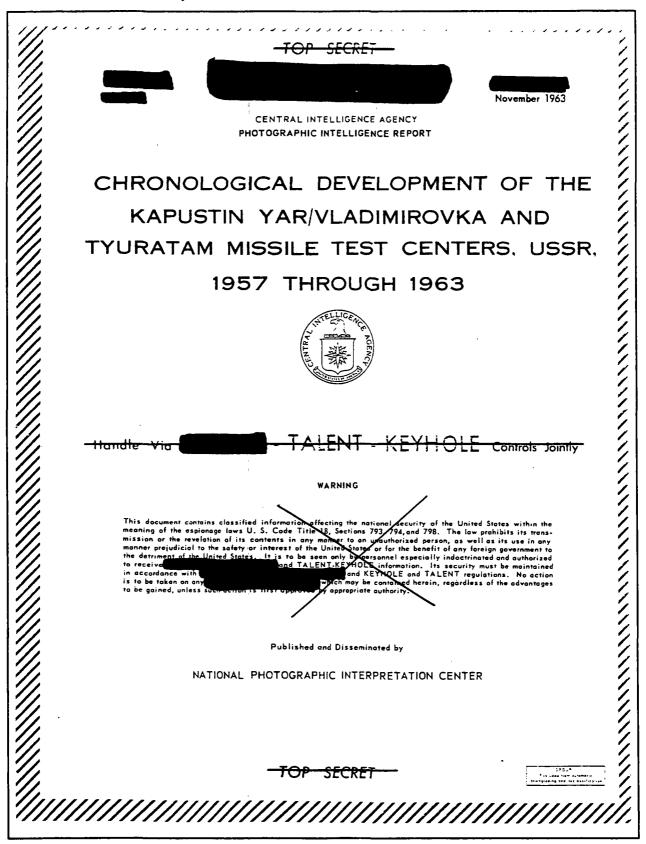




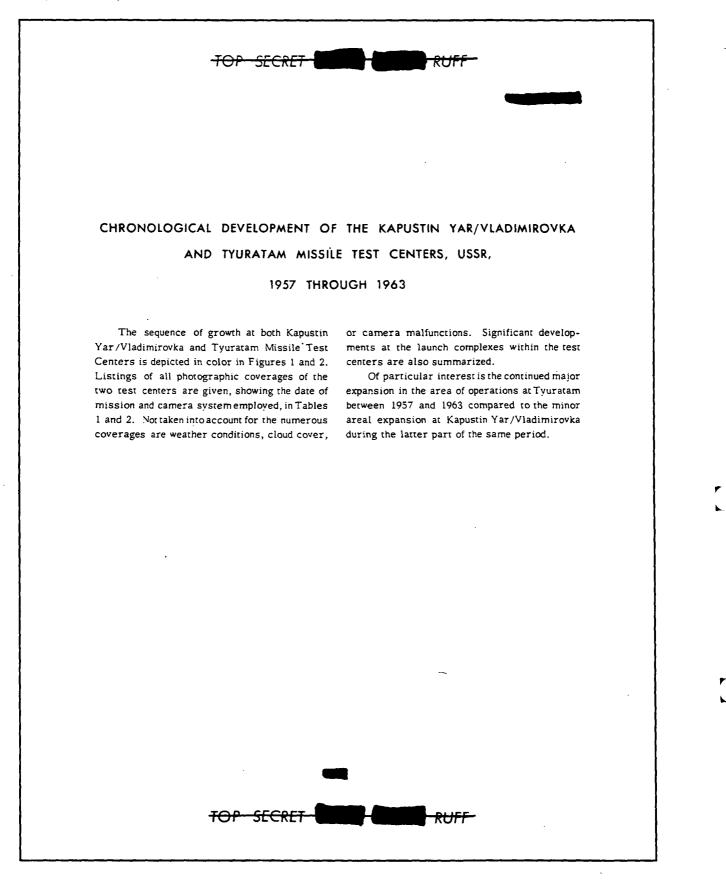


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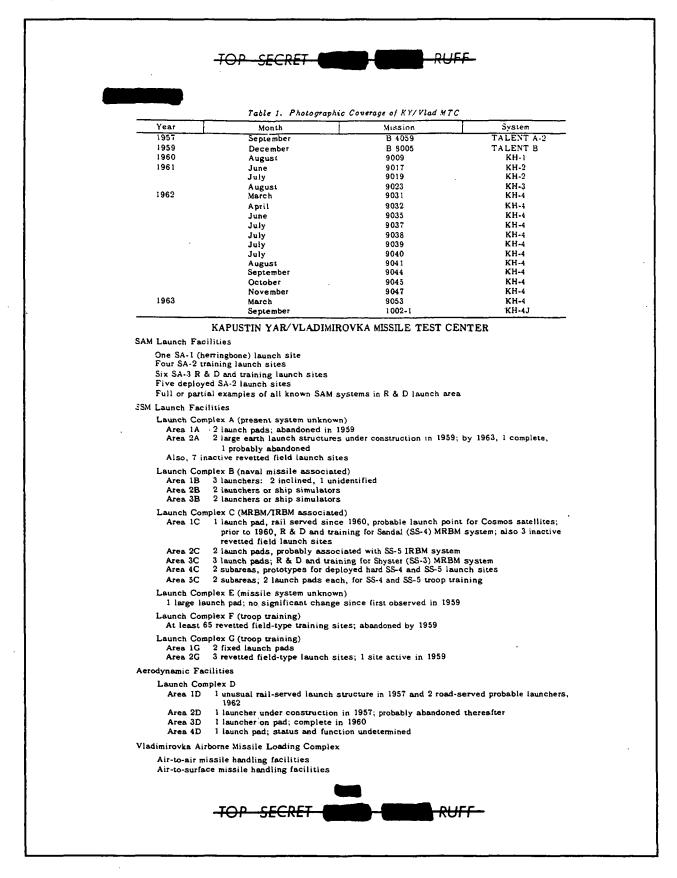
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Mission	Date	Pass	Camera	Frames	Classification
9031	2 Mar 62	40 D	Fwd Aft	82 90	TOP SECRET RUFF
9053	2 Åpr 63	8 D	Fwd Aft	101 105	TOP SECRET RUFF
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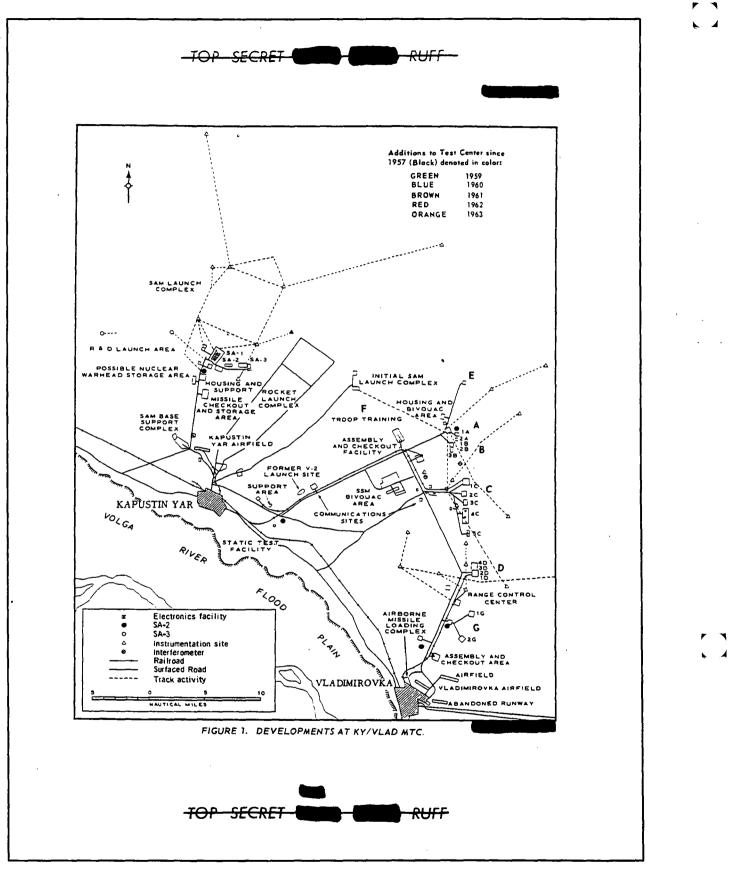


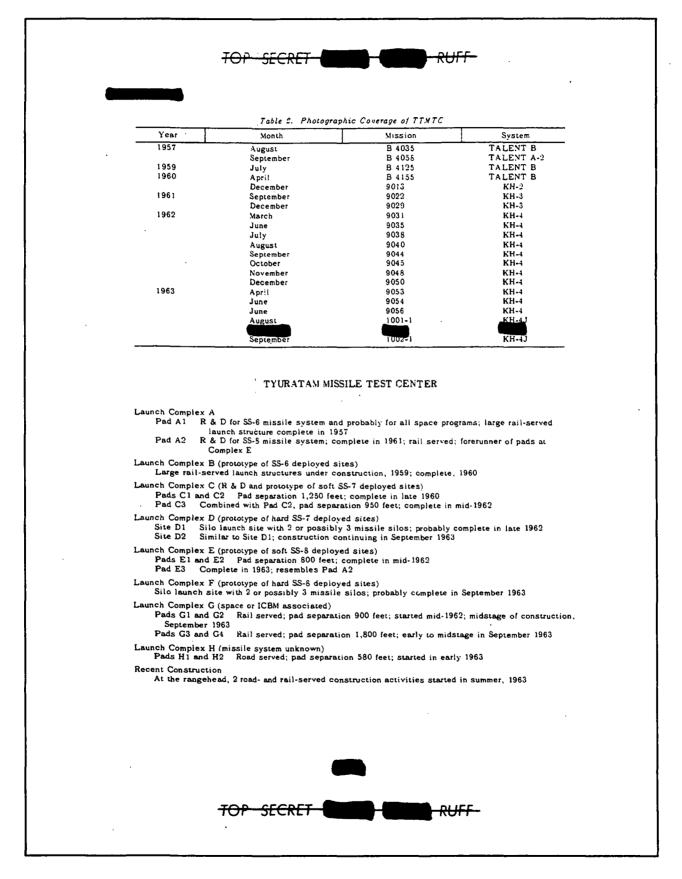
20. CIA/NPIC, Photographic Intelligence Report, "Chronological Development of the Kapustin Yar/Vladimirovka and Tyuratam Missile Test Centers, USSR, 1957–1963," November 1963



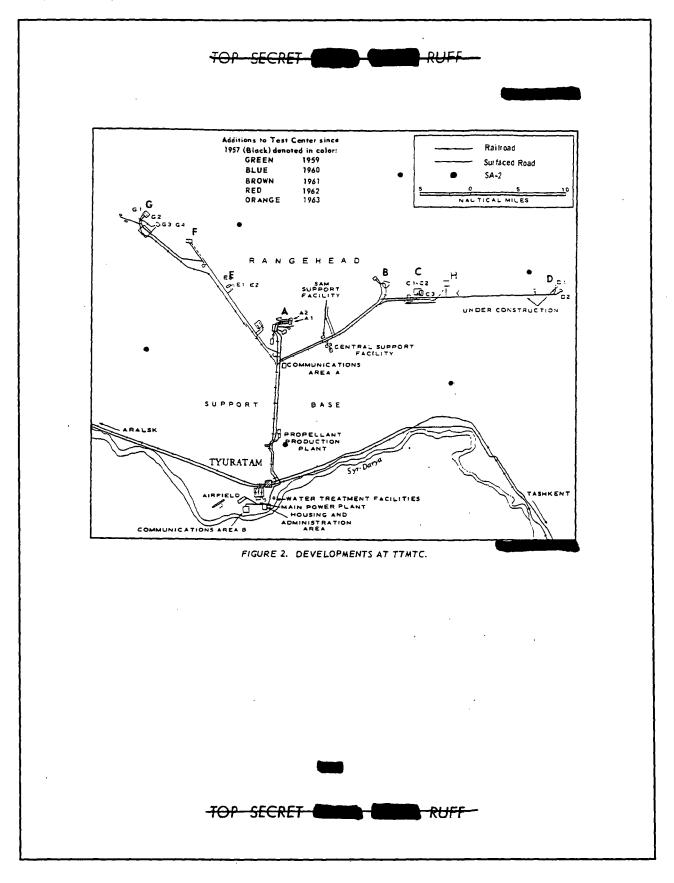
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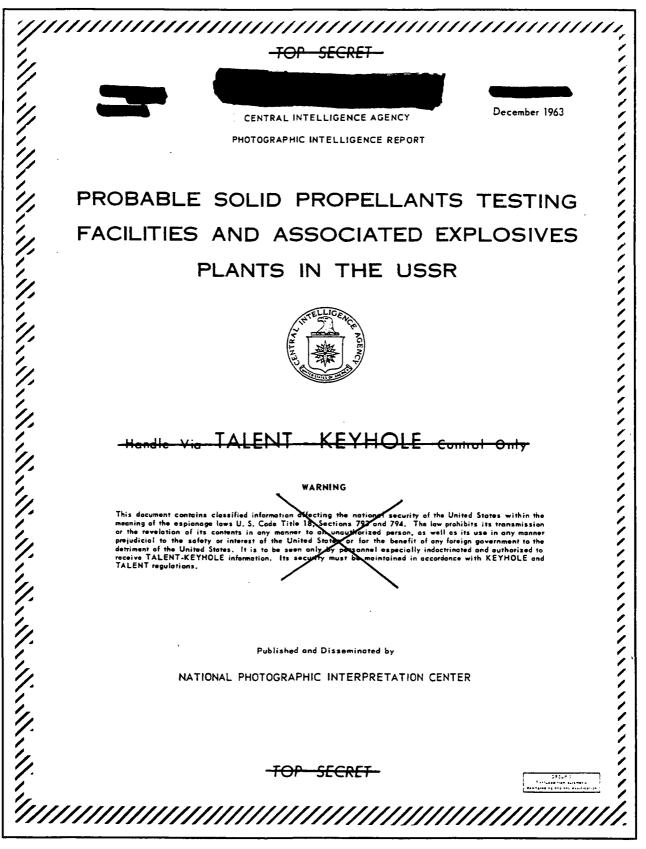




20. (Continued)



21. CIA/NPIC, Photographic Intelligence Report, "Probable Solid Propellants Testing Facilities and Associated Explosives Plants in the USSR," December 1963



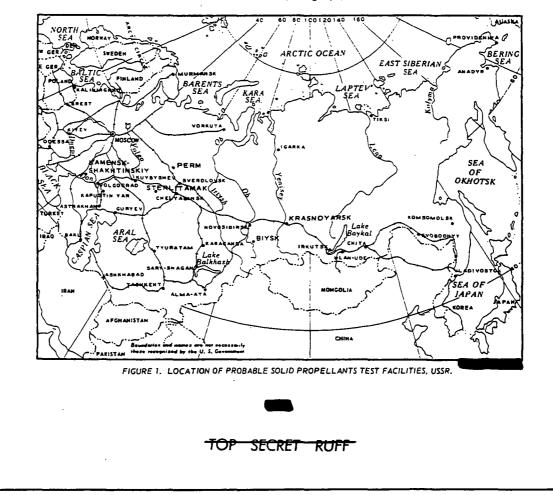


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INTRODUCTION

Highly significant installations associated with the testing and production of unique explosives materials of a probable solid propellant nature have been identified at Biysk (52-31N 85-04E), Kamensk-Shakhtinskiy (48-19N 40-13E), Krasnoyarsk (56-02N 93-02E), Perm (57-58N 55-52E), and Sterlitamak (53-44N 56-00E), all in the USSR (Figure 1). These installations are identical to the extent that they are adjacent to or within explosives/munitions combines producing at least two explosives bases, and each has at least one test cell with a concrete-faced probable bunker/deflector. A total of eight test cells have been identified at the five sites. Photography of these installations is provided by 20 KEYHOLE missions occurring between December 1960 and late August 1963. The quality and small scale of this photography preclude the determination of exact measurements and the assigning of definite functions to most of the buildings. Measurements of these facilities should be considered approximate, although in all cases scale factors were provided by TID/NPIC; where utilized, height factors were also provided by TID/NPIC.

For the purpose of this report, details on the Kamensk-Shakhtinskiy facility will not be included because of a lack of interpretable photography of the site.



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CHRONOLOGY

These facilities appear to be of recent construction, although only the Biysk facility can be negated on recent photography; it was not present in December 1960. The existence of the other four cannot be negated on any available KEYHOLE photography. The Sterlitamak and Kamensk-Shakhtinskiy facilities can be negated on captured German photography of 1942 and 1943, but the facilities at Perm and Krasnoyarsk cannot be negated on any available photography. Confirmation of completion can be made at three of the facilities: Krasnoyarsk (September 1962), Perm (August 1962), and Sterlitamak (July 1963); as of June 1963, the test facilities at Biysk and Kamensk-Shakhtinskiy cannot be confirmed as complete. Criteria for confirmation would include: relative completion of the plant and storage facilities; paving of the large, concrete-faced probable bunker/ deflectors; and completion of the support structures within the test facility.

TEST FACILITIES

BIYSK

The Biysk Probable Solid Propellants Test Facility (Figure 2) is located approximately 5 nautical miles (11m) west of the center of Biysk, USSR. The test facility is road and possibly rail served, and its area of 2,800 by 2,700 feet is secured by a single fence. The facility consists of two completed test cells and a probable third which appears under construction on photography of June 1963; the cells are annotated A, B, and C on Figure 2. A perspective sketch (Figure 3) presents an artist's concept of an oblique view of the test facility. Approximate dimensions of various structures at the Biysk facility can be found in Table 1 which is keyed to Figure 2.

One of the salient recognition features at the Biysk facility is a multi-level H-shaped building (item 1, Figure 2). This structure is similar in appearance and probably identical in function to H-shaped buildings at Krasnoyarsk and Sterlitamak. Because of the unusual configuration, it has been suggested that this building is possibly as many as six different buildings separated by possible blast walls. This structure was noted under construction in December 1961 and confirmed as complete by June 1962.

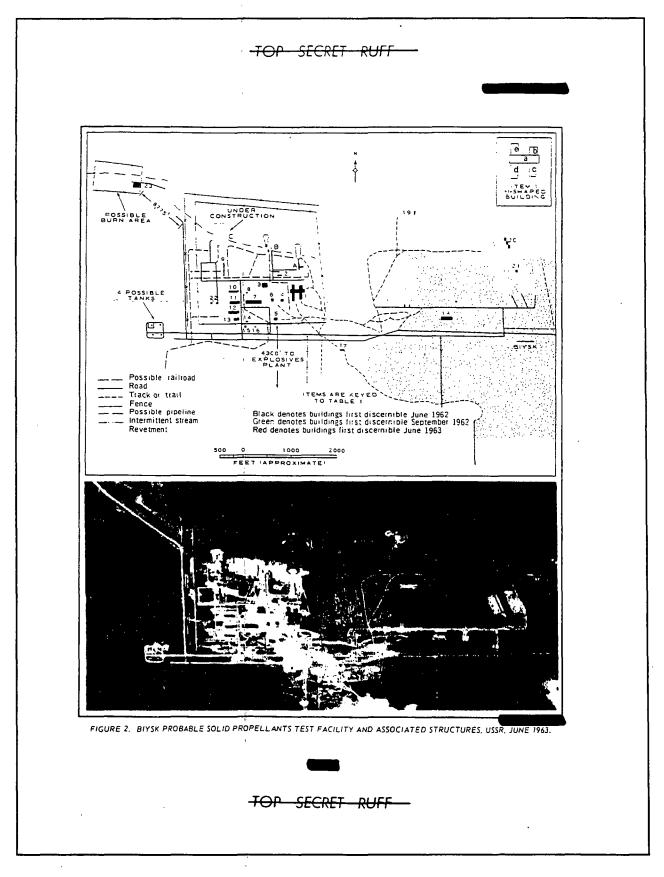
A second significant feature of the facility is the presence of the two completed test cells and the probable third under construction. Cells A and B are approximately 710 feet apart, and cells B and C are about 990 feet apart; the relative positions of the three within the facility can be seen on Figure 2.

Table 1. Associated Structures, Biysk Probable Solid Propellants Test Facility (item numbers are keyed to Figure 2)

Item	Dimensions (ft)	ltem	Dimensions (ft)	
1	d	10	230 x 65	
a	310 x 85	11	230 x 65	
b	95 x 90	12	240 x 65	
с	140 x 75	13	145 x 65	
d	160 x 75	14	65 x 45	
e	120 x 70	15	65 x 65	
2	125 x 40	16	40 x 40	
3	125 x 125	17	90 x 55	
4	60 x 80	18	230 x 65	
5	90 x 75	19	75 x 30	
6	85 x 60	20 (3)	90 x 53	
7	320 x 85	21	60 x 60	
8	55 x 55	22 (2)	55 x 40	
9	290 x 45	23	210 x 100	



21. (Continued)

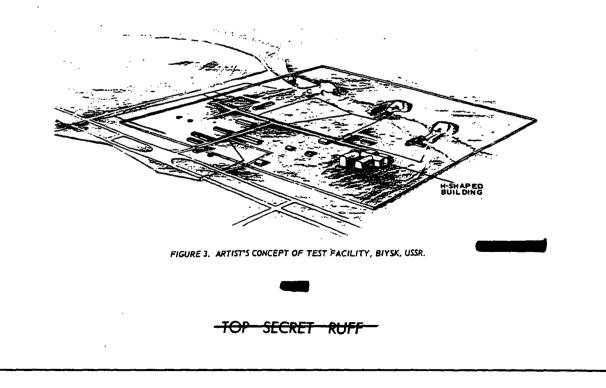


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Test cell A was observed under construction on photography of December 1961; photographic limitations, however, did not permit a confirmation of the physical presence of the cell until June 1962. Cell A is road served from its rear or south end, is in at least three sections, and measures approximately 260 feet in overall length. A large revetment appears immediately to the east of the test cell. Test cell B can be identified as under construction on photography of June 1962 and complete by that of September 1962; it has several of the same features noted at cell A. Cell B is road served from the rear, is in three sections, and has an overall length of 170 feet. A large revetment appears about 25 feet west of cell B; this revetment and the one at cell A could serve instrumentation/ safety functions. Probable test cell C can be identified as under construction in June 1963; no definitive statement or measurements can be made on cell C because of the construction status.

Another salient feature at the Biysk facility (and at every other facility identified thus far) is the concrete-faced probable bunker/deflector which is observed adjacent to each test cell; each is identified with a letter to correspond with the cell it serves. Line drawings of Biysk test cells A and B, their associated probable bunker/deflectors, detailed dimensions, and profile elevation sketches can be found on Figure 4.

Probable bunker/deflector A was observed under construction concurrently with test cell A; however, the concrete facing could not be confirmed until photography of September 1962. It measures about 235 feet from its base to the front end of the test cell; the distance from the nearest end of the H-shaped building to the rear of the probable bunker/deflector is approximately 950 feet. Probable bunker/deflector B, first noted under construction in June 1962, was faced with concrete by June 1963. It measures approximately 135 feet from the base to the front of the corresponding test cell, and the distance between the rear of cell B and the rear of probable bunker/deflector B is approximately 450 feet. Probable bunker/deflector C is visible under construction on photography of June 1963.



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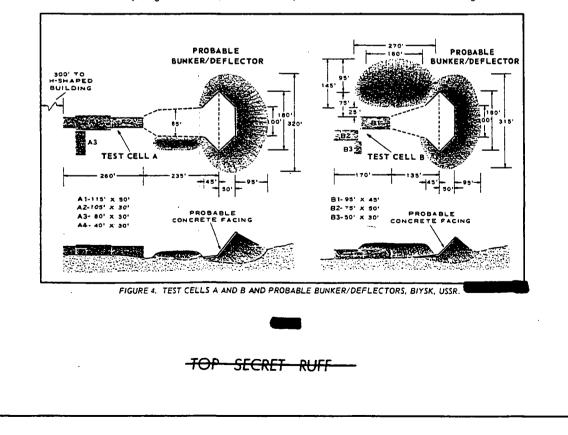
A fourth feature at the Biysk facility is the group of three offset or staggered buildings (item 20, Figure 2) approximately 4,200 feet east of the test facility; they were first observed in June 1963. These buildings are similar in appearance and probably identical in function to comparable structures at Perm, Sterlitamak, and Kamensk-Shakhtinskiy.

Another significant item at Biysk is a secured area of 1,000 by 600 feet located approximately 8,775 feet northwest of the test facility; the area is road served and was first observed in the early stages of construction in June 1962. The purpose of this unidentified, area cannot be adequately explained, although a single heavy revetment suggests a possible burn area where highly combustible material is handled. A similar area is found at the Perm test facility.

KRASNOYARSK

The Krasnoyarsk Probable Solid Propellants Test Facility (Figures 5 and 6) is located near Explosives Plant 580 (not to be confused with the new plant which serves the test facility) approximately 5 nm east of the center of Krasnoyarsk, USSR. Although this facility cannot be negated on available photography, it can be determined that it was in an early/mid stage of construction by June 1961. It consists of two test cells which are approximately 600 feet apart. The Krasnoyarsk facility is road served, and the area of approximately 2,500 by 1,000 feet is double secured; one of the fences is solid.

The Krasnoyarsk test facility has an Hshaped building (item 1, Figure 6) similar in appearance and probably identical in function to the irregular structures found at Biysk and Sterlitamak. The Krasnoyarsk building appeared to be in an early stage of construction in June 1961, and its completion can be confirmed by photography of September 1962. It is approximately 65 feet high at the highest point. Approximate dimensions of this building and other





H C AL



structures at the test facility and explosives plant are given in Table 2 which is keyed to Figure 6.

The two test cells have been annotated A and B on Figure 6, which also illustrates their relative positions at the site. A perspective sketch (Figure 7) presents an artist's concept of an oblique view of the test facility.

Test cell A, the larger and newer of the two cells, was observed under construction and apparently essentially complete on photography of March 1962. The cell is in three sections, has an overall length of 250 feet, and appears to be road served from the rear. The cell is not revetted.

Test cell B, possibly the oldest of the test cells observed in the USSR thus far, appeared essentially complete in September 1961. It measures about 175 feet in overall length, is in three sections, and is connected to a revetted building approximately 300 feet to the rear of cell A by overhead piping or covered walkways. Test cell B is not revetted.

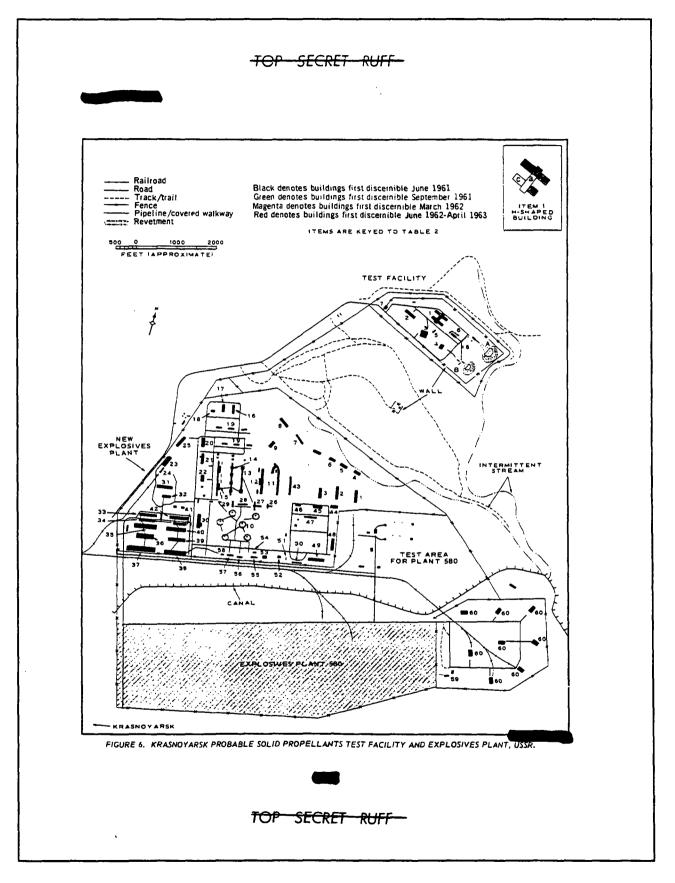
The concrete-faced probable bunker/deflector A (Figure 8) is at least 60 feet high and was first discernible under construction in June 1961; its completion can be confirmed on September 1962 photography. It measures approximately 260 feet from the base to the end of the test cell, and the distance from the nearest end of the H-shaped building to the rear of the probable bunker/deflector is about 1,400 feet. Probable bunker/deflector B (Figure 8) is approximately 45 feet high and can be confirmed as complete in June 1961. The base is about 95 feet from the front of test cell B; the distance from the rear of the cell to the rear of probable bunker/deflector B is approximately 440 feet. A final feature at the Krasnoyarsk test

facility is some scarring observed in front of test cell A on September 1962 photography. Although the funnel shape of this scar suggests

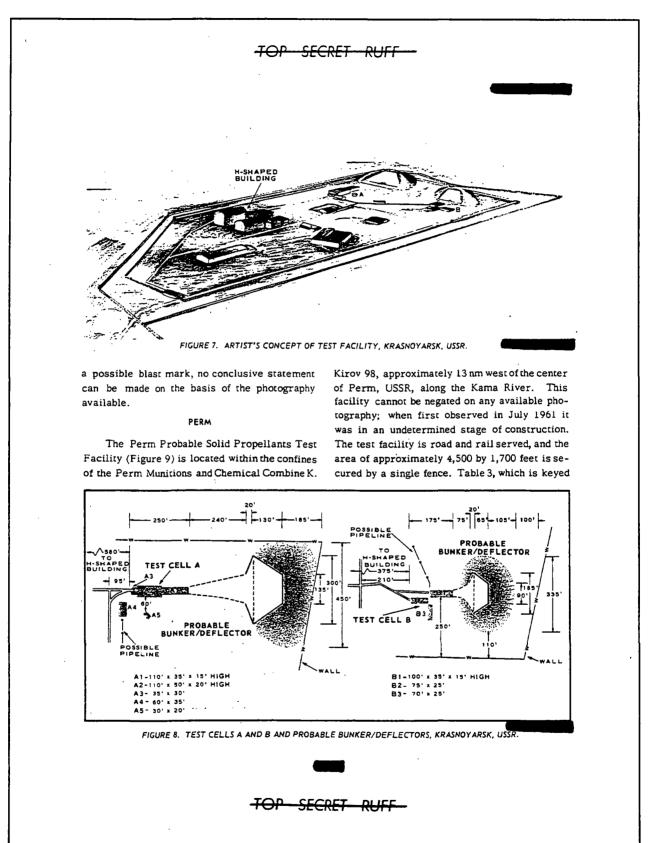
Table 2. Associated Structures, Test Facility and Explosives Plant, Krasnoyarsk (item numbers are keyed to Figure 1)

	Discourse (fr)		0:
ltem	Dimensions (ft)	ltem	Dimensions (ft)
Test Faci	lity		
1		2	316 \ 95
a	300 \ 75	3	200 x 210
ь	100 x 95	{ +	60 x 60
c	145 x 50	5	115 x 55
d	160 x 50 x 65 (h)	6 ,	125 x 75
e	125 x 70		35 \ 70
		à	95 x 60
Explosive	s Plant		
1	355 x 75	25	215 × 65
2	330 x 50	29	165 x 65
3	300 x 75	30	300 x 115
4	190 x 80	31	340×100
5	205 x 80	32	220 x 63
6	195 x 80	33	395 x 60
7	330 x 65 x 20 (h)	34	310 x 60
8	330 x 65 x 20 (h)	35	480 x 50
9	165 x 105 x 45 (h)	36	365 x 73
10	45 x 35	37	645 x 60
11	775 x 30 x 15 (h)	38	525 x 80 380 x 75
12 13	690 x 75 x 25 (h) 695 x 45	39 40	380 x 75 460 x 65
12	end sections (2)	41	300 x 65
	130 x 60 x 35 (h)	42	390 x 80
		43	405 x 63
14	790 x 50 x 40 (h)	+4	215 x 60
15	825 x 75	45	220 x 60
16	205 x 75	46	120 x 50
17	165 x 75	47	315 × -45
18	100 x 75	45	250 x 45
19 (6)	150 x 60	49	410 x 50
20	220 x 65	50	200 x 35
21	225 x 65	51	55 x 35
35	135 x 85	52	100 x 33
23	290 x 110 x 55 (h)	53	105 x 40
24	130 x 65	54	90 x 40
25	280 x 55	53	153 x 60
26	125 x 65	56	120 × 50
07	wing 115 x 80	57	230 x 35
27	120 x 80	58	85 x 40
	wing 160 x 70	59 (2) 60 (8)	
		60 (8)	170 x 55





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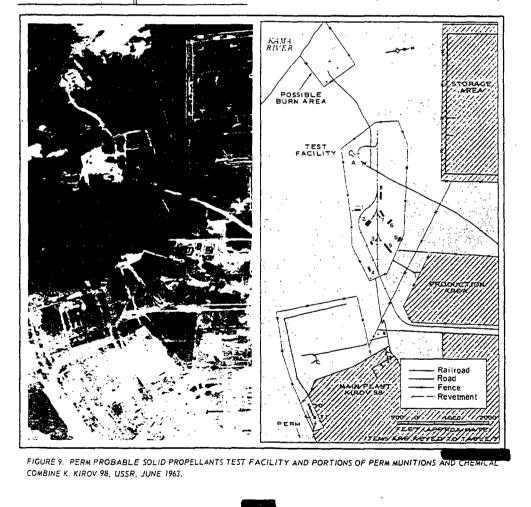
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Table J. Associated Structures. Prom Probable Solid Propellants Test Facility sitem numbers are keyed to Figure 9)

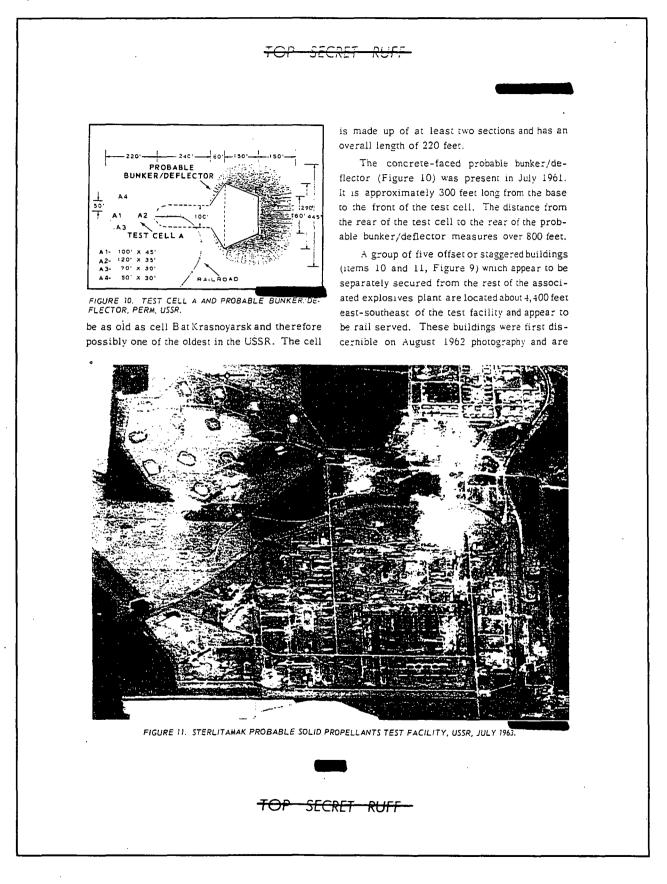
ltem	Dimensions (ft)	Item	Dimensions (ft)
1	175 \ 75	6	190 x 80
2	150 x 140	.	200 x 65
3	60 x 70	Ś	225 x 65
ł	125 x 55	9	300 x 50
5	150 x 70	10 (4)	90 x 55
		11	120 x 55

to Figure 9, includes dimensions of structures at the Perm facility.

One test cell (annotated A on Figure 9) is within the secured area of the Perm test facility. This test cell is rail served to its front, and is the only cell identified thus far in the USSR which is served in this manner. Although the cell cannot be negated on available photography, it can be confirmed as complete in June 1962; it may



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similar in appearance and probably identical in function to those found at Biysk, Kamensk-Shakhtinskiy, and Sterlitamak.

A separately secured area about 1,800 feet west of the test facility measures approximately 1,300 by 1,150 feet. The area has three large, unexplainable, unoccupied revetments; its function may be that of a possible burn area, comparable to the similar area at Biysk.

STERLITAMAK

The Sterlitamak Probable Solid Propellants Test Facility (Figures 11 and 12) is adjacent to Explosives Plant 850, approximately 7 nm north of Sterlitamak, USSR, and about 3 nm west of the Belaya River. Although the test facility can be negated on captured German photography of July 1942, dating of the initial construction at the facility by photography is not possible. The test facility is road served, and its area of approximately 1,800 by 1,300 feet is partially double secured. It is possible that the outer fence is solid; only a single fence separates the test facility from the explosives plant.

The Sterlitamak test facility has an Hshaped building (item 1, Figure 12) which is similar in appearance and probably identical in function to those at Biysk and Krasnoyarsk. It was first discerned in April 1962, and confirmation as complete was possible on July 1963 photography; it is believed that construction of this structure was nearly complete in April 1962. Approximate dimensions of this building and other structures at the test facility and explosives plant can be found in Table 4 which is keyed to Figure 12.

The test cell at Sterlitamak (annotated A on Figure 12) is served from the front by a wide turn radius road; this is the only facility identi-

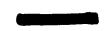
Item.	Dimensions (ft)	Item	Dimensions (ft)	Item	Dimensions (ft)	Item	Dimensions (ft)
1	·	21	125 x 40	±7	350 x 60	69	250 x 70
8	280 x 85	22	165 x 90	48	175 x 65	70	310 x 75
ь	95 x 55	23	175 x 75	49	130 x 80	71.74	310 x 105
с	150 × 80	24	340 x 80	50	170 x 110	72, 73	310 × 90
d	165 x 80	25	525 x 80	51	145 x 60	75	110 x 45
e	125 x 80	26	385 x 70	52	150 x 50		wing
2	110 x 110	27	285 x 70	53	200 x 75		90 x 60
3	110 x 70	28	100 x 30	54	245 x 110	76	365 x 85
4	265 x 90	29	115 x 50	55	255 x 60	77	460 x 110
5 (7)	90 x 60	30	320 x 50	56	250 x 90	78	160 x 90
6	120 x 60	31	110 x 100	57	265 x 60	79	105 x 80
7	100 x 70	32	105 x 40	56	523 x 100	60	80 x 75
8	140 x 70	33	125 x 60	59	150 x 70	81	115 x 65
9	395 x 60	34	175 x 65	60	150 x 50	82	75 x 60
10, 11	170 x 70	35	190 x 90	61 (4)	175 x 45	63	130 x 50
12	105 x 30	36	115 x 90	62 (3)	163 x 40	84	70 x 50
13	220 x 50	37	190 x 40	63 (4)	165 x 70	65	170 x 45
14, 15	170 x 70	36	165 x 80	64	825 x 160	86	85 x 60
16 (2)	each in 2		wing 45 x 45	65	580 x 110	67	200 x 50
	sections:	39	225 x 100	66	280 x 50	58 (12)	210 × 80
	90 x 80,	40	265 x 105	67	2 wings:	89	100 x 60
	90 x 60	41	300 x 140		140 x 20		
17	135 x 65	42	155 x 105		(each)		
18	400 x 50	43	375 x 150		center section:		
19	395 x 60	44.45	1SO x 90		145 x 25		
20(2)	205 x 40	46	380 x 105	68	390 x 85		

Table 4. Associated Structures. Test Facility and Explosives Plant, Steriitamak (item numbers are keyed to Figure 12)



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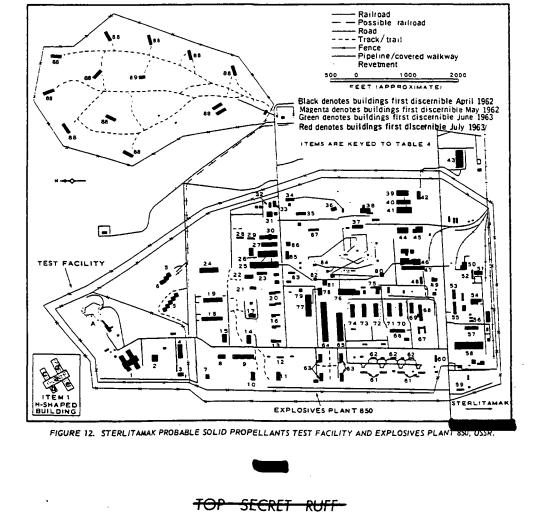




fied thus far in the USSR which is served in this manner. The cell is not revetted or mounded and appeared essentially complete in April 1962. It has at least three sections and measures 250 feet in overall length. The relative position of the cell and other structures at the facility can be seen on Figure 12.

The probable bunker/deflector (Figure 13) can be observed on April 1962 photography; the concrete facing, however, cannot be confirmed until photography of July 1963. The structure is about 260 feet long from the base to the front of the test cell. From the rear of the probable bunker/deflector to the H-shaped building the distance is approximately 1,350 feet. A road serves both the front and the rear of the probable bunker/deflector; this is the only facility in the USSR which has this particular road pattern.

Eight staggered or offset buildings (items 5 and 6, Figure 12) which are possibly rail served are located within the explosives plant and adjacent to the test facility. Three of these buildings were discernible in May 1962, and the others could first be observed on June



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1963 photography. The buildings are similar in appearance to buildings at Biysk, Kamensk-

Shakhtinskiy, and Perm and probably have an - identical function.

THE PLANTS

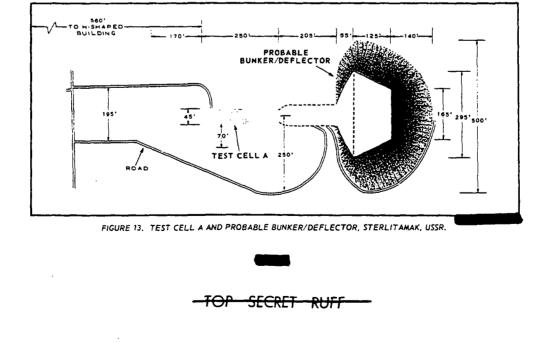
Each of the four test facilities described is adjacent to a plant which has every evidence of producing at least two explosives bases. Although the buildings in the plants have not been identified as to type, it is apparent that mixing, casting, batching, and related functions could be carried on at each facility. All of the plants are road and rail served and are at least single secured; the plants at Biysk and Sterlitamak are double secured.

With the exception of the Perm plant, each explosives plant has shown significant construction since first photographic observation. The Biysk plant has been expanded by the addition of at least two explosives lines and has at least tripled in storage capacity since December 1960. The Krasnoyarsk plant (Figure 6), built adjacent to Explosives Plant 580, cannot be confirmed as completely constructed as of April 1963. The Sterlitamak plant (Figure 12), though showing less construction activity than the Biysk and Krasnoyarsk plants, has had evidences of construction since it was first observed on photography of April 1962.

The proximity of facilities to one another within the explosives plants precludes an unqualified, detailed analysis. Once an explosives line is constructed, it can often be used to work on new explosives bases.

CONCLUSIONS

1. There are test facilities at the following five cities in the USSR: Biysk, Kamensk-Shakhtinskiy, Krasnoyarsk, Perm, and Sterlitamak; the five facilities have a total of eight test cells. 2. Because these test facilities are within or adjacent to explosives plants capable of producing at least two explosives bases, the facilities can be considered probable solid propellants test facilities.



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3. The probable bunker/deflectors at these sites are concrete faced, suggesting the function of deflector. Road service to both the front and rear of the bunker/deflector at Sterlitamak suggests the possibility of an instrumentation role; Sterlitamak, however, is the only facility at which this road characteristic could be noted. 4. These five facilities could be involved in research and development or production or both. The associated plants appear to have the capacity to produce explosives, while the test facilities at each of the installations have slight differences suggesting the possibility of research and development.

		R.	EFERENCES		
TOGRAPHY					
Mission	Date	Pass	<u>Camera</u>	Frames	Classification
<u>Biysk</u>					
9056	30 Jun 63	54D	Fwd	43	TOP SECRET RUFF
• • • • •			Aft	45, 49	
9044	1 Sep 62	53D	Fwd	42	TOP SECRET RUFF
			Aft	49	
9040	25 Jul 62	1A	Fwd	25	TOP SECRET RUFF
			Aft	32	
9038	1 Jul 62	52D	Fwd	24	TOP SECRET RUFF
		•	Aft	29	
	1 Jul 62	46A	Fwd	25	TOP SECRET RUFF
			Aft	33	
	30 Jun 62	31A	Fwd	56	TOP SECRET RUFF
9035	1 Jun 62	45A	Fwd	24, 25	TOP SECRET RUFF
			Aft	30	
9029	14 Dec 61	22		29	TOP SECRET RUFF
9013	10 Dec 60	37		67	TOP SECRET RUFF
<u>Ktasnovarsk</u>					
9057	21 Jul 63	3RD	Fwd	25	TOP SECRET RUFF
•			Aft	34	
9053	2 Apr 63	6D	Fwd	26	TOP SECRET RUFF
			Aft	31	
9047	9 Nov 62	53D	Fwd	20	TOP SECRET RUFF
			Aft	26	
9043	18 Sep 62	6D	Fwd	132, 133	TOP SECRET RUFF
			Aft	138	
9041	3 Aug 62	22D	Fwd	31	TOP SECRET RUFF
			Aft	37	
9040	30 Jul 62	32A	Fwd	14	TOP SECRET RUFF
			Aft	20	TOP SECRET RUFF
9037	24 Jun 62	16A	Fwd	14 20	TOP SECRET RUFF
			Aft		
9031	1 Mar 62	22D	Fwd	21	TOP SECRET RUFF
		(D)	A ft	26	TOD SECRET BUCK
9022 9017	13 Sep 61 18 Jun 61	6D 22		81 84	TOP SECRET RUFF TOP SECRET RUFF
9014	10 Jun 01	22		04	IOF SECKET KOFF
Perm					
1001-1	27 Aug 63	39D	Aft	23	TOP SECRET RUFF
	25 Aug 63	2A	Fwd	17	TOP SECRET RUFF
			Aft	20	

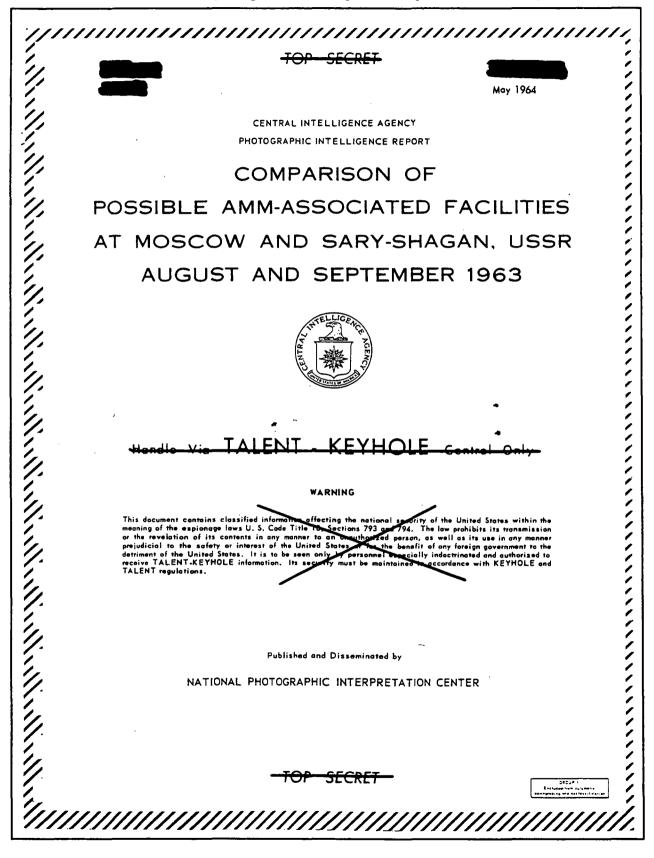
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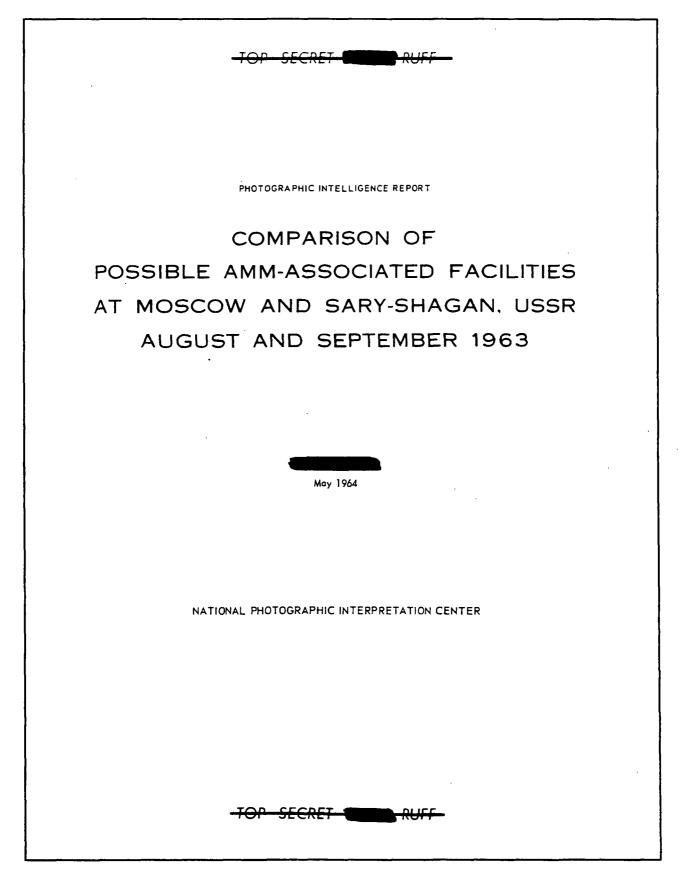


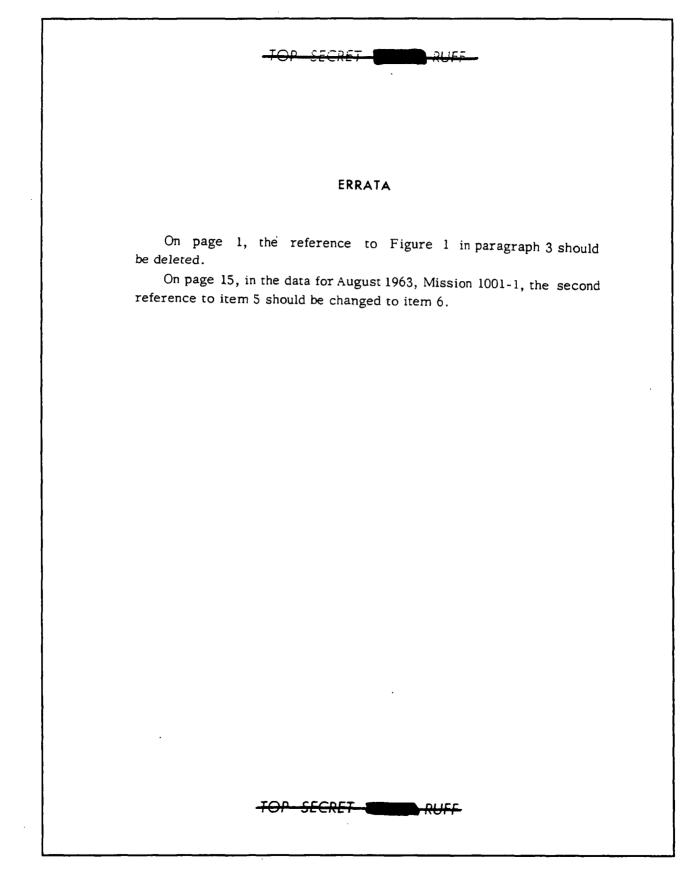
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					,
		REFERE	NCES (Continued)		
PHOTOGRAPHY					
Mission	Date	Pass	Camera	Frames	Classification
9054	16 Jun 63	55D	Fwd	46	TOP SECRET RUFF
9041	3 Aug 62	17A	Aft Fwd	51 16	TOP SECRET RUFF
9038	28 Jun 62	2A	Alı Fwd	22 52, 53	TOP SECRET RUFF
9035	30 May 62	2A	A ft Fwd	60, 61 42, 43	TOP SECRET RUFF
9019	8 Jul 61	1A	Aft	48 94, 95	TOP SECRET RUFF
<u>Sterlitamak</u>					
1001-1 9057	27 Aug 63 19 Jul 63	- 39D - 8D	Aft Fwd	48 49, 50	TOP SECRET RUFF TOP SECRET RUFF
9054	14 Jun 63	17A	Aft Fwd	55 1	TOP SECRET RUFF
9035	30 May 62	2A	Aft F₩d	6 29	TOP SECRET RUFF
9032	18 Apr 62	2A	A ft Fwd	35 22	TOP SECRET RUFF
			Aft	29	_
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22. CIA/NPIC, Photographic Intelligence Report, "Comparison of Possible AMM-Associated Facilities at Moscow and Sary-Shagan, USSR, August and September 1963," May 1964



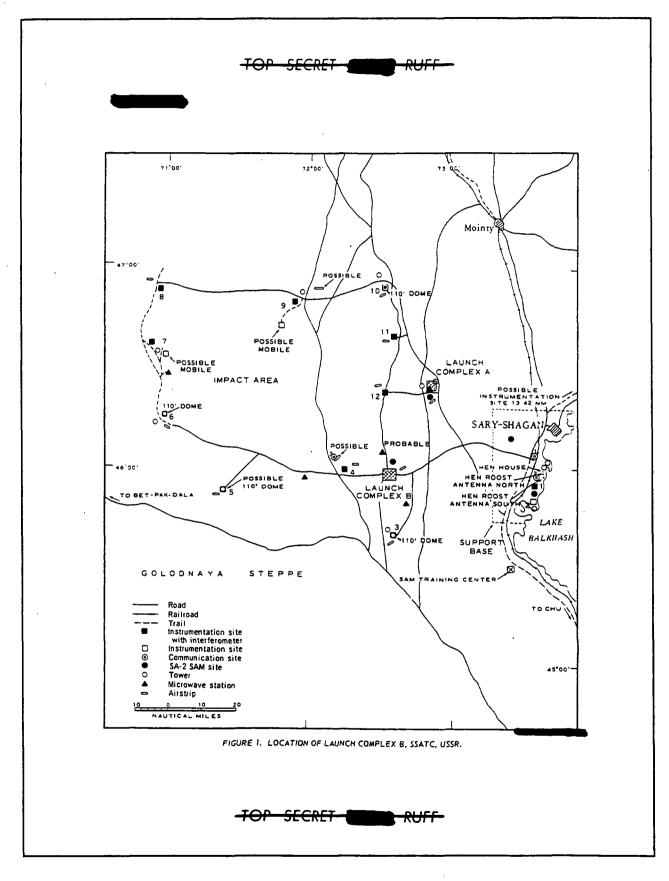




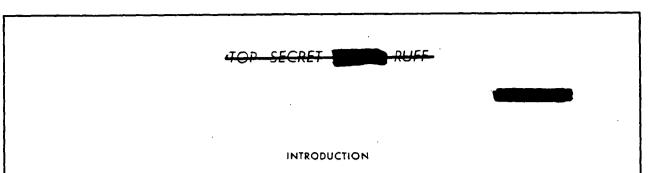
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PREFACE
This report compares developments and configurations at the pos- sible antimissile missile (AMM) associated facilities at Launch Complex B, Sary-Shagan Antimissile Test Center (SSATC), and at one of the four modified SA-1 SAM sites in the Moscow area. The information presented is derived from a study of TALENT and KEYHOLE photog- raphy available as of 25 September 1963. The report is prepared under project for answer to CIA requirement
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22. (Continued)



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A preliminary analysis of the similarities between the possibly AMM-associated, modified SA-1 SAM sites near Moscow and the similar facilities at SSATC as of June 1963 was published in 1/ This report supplements that analysis; it covers changes introduced at the Moscow sites between April 1962 and September 1963, and, particularly, changes discernible in the facilities at SSATC between April 1960 and August 1963.

Construction of all the possible AMM-associated facilities (modified SA-1 SAM sites) near Moscow follows the same general pattern; it probably commenced at approximately the same time and progressed at similar rates. For this comparison, SAM Site E33-1 has been selected as an illustration of all four possible AMM-associated sites in the Moscow area, and it is compared with the relatively new area containing a triad of buildings at Launch Complex B, SSATC. This new area is designated as Facility C. Selected features of the Sary-Shagan facility and the Moscow site correspond to the prototype herringbone pattern at the Kapustin Yar/Vladimirovka Missile Test Center (KY/Vlad MTC), USSR. A chronology of construction activity at Site E33-1 and Facility C is given in Table 3.

POSSIBLE AMM SITE IN THE MOSCOW AREA APRIL 1962 - SEPTEMBER 1963

Moscow SAM Site E33-1 is located at 56-20N 36-48E (Figure 1). Site preparation for the triad of buildings (items 1, 2, and 3, Figure 2) was first discernible on photography of August 1962. Building construction in the support area was observed on photography of April 1962. The buildings constructed in the triad and in the support area at Site E33-1 are typical of the possible AMM sites in the Moscow area. Item numbers are keyed to Figure 2 and Table 1.

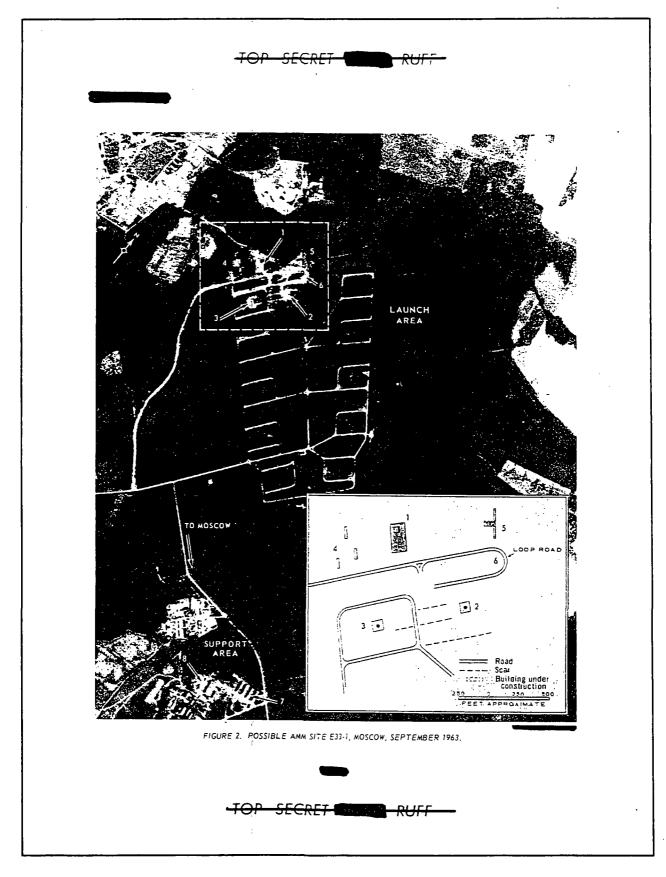
BUILDING TRIAD AREA

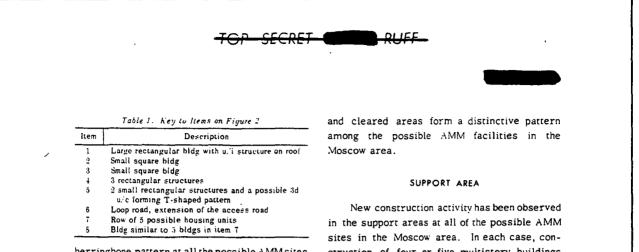
Sites E33-1, E15-1, and possibly E05-1 have a group of three small rectangular structures (item 4) located approximately 500 feet from the large rectangular building (item 1). Sites E33-1 and E24-1 have two small rectangular structures with a possible third under construction (item 5). These three form a T-shaped pattern approximately 800 feet from the large building (item 1). Two structures probably similar to these (item 5) at Site E33-1 are located in a corresponding position at Site E05-1. Although these structures (items 4 and 5) may all be temporary construction support buildings, it should be noted that at Sites E33-1, E15-1, and E05-1 the three small rectangular structures (item 4) occupy the same position relative to the large building (item 1) and to each other. The consistency of this pattern suggests, that these may be integral components of the facility as opposed to temporary construction support facilities.

A raised structure, approximately 70 feet long and possibly square, is under construction on the roof of the large building (item 1). This was observed for the first time on photography of September 1963.

New earth scarring within and near the







herringbone pattern at all the possible AMM sites in the Moscow area and at a number of other SA-1 sites appeared between June and September 1963. (Figure 8 depicts the new activity at Site E33-1.)

The extension of the access road to the building triad area passes south of the three small rectangular structures (item 4, Figure 2) and the large rectangular building (item 1); it extends as far as the T-shaped pattern, then it loops in a wide-radius 180-degree turn (item 6) and returns to a cleared area adjacent to one of the rib roads of the herringbone launch area. The distance between the outside edges of the loop is approximately 260 feet. The road is about 25 feet wide and may be concrete surfaced. A strip 70 to 100 feet wide was cleared for the construction of the road; this includes a strip contiguous to a section of the herringbone road between buildings (items 1 and 3) of the triad. The loop road struction of four or five multistory buildings was apparently planned to begin prior to the commencement of construction on the triad of buildings. The new buildings are approximately 200 by 50 feet and may be three- to five-story structures. The location and appearance of these new buildings and the roads serving them suggest that they may be housing units. At each site four or five buildings are constructed in a row, with another building, possibly serving a different function, located nearby. These new buildings at Site E33-1 (items 7 and 8, Figure 2) have an estimated total floorspace of 180,000 to 300,000 square feet. If they were troop barracks, allowing 60 square feet per person, each could house between 500 and 840 personnel; however, if they were designed as family apartments, the number accommodated would be much smaller.

FACILITY C, LAUNCH COMPLEX B, SSATC

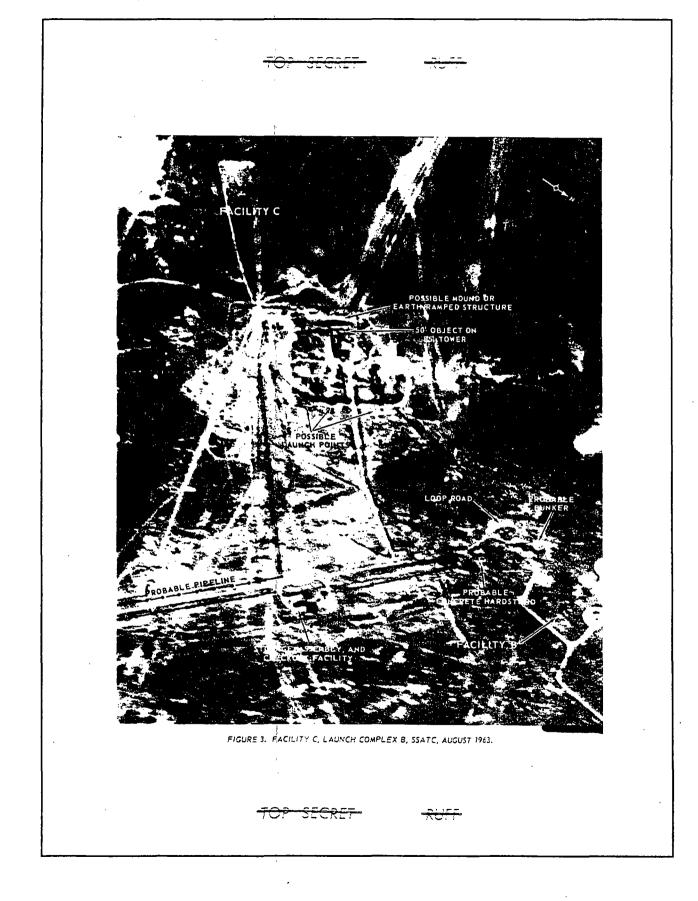
APRIL 1960 - AUGUST 1963

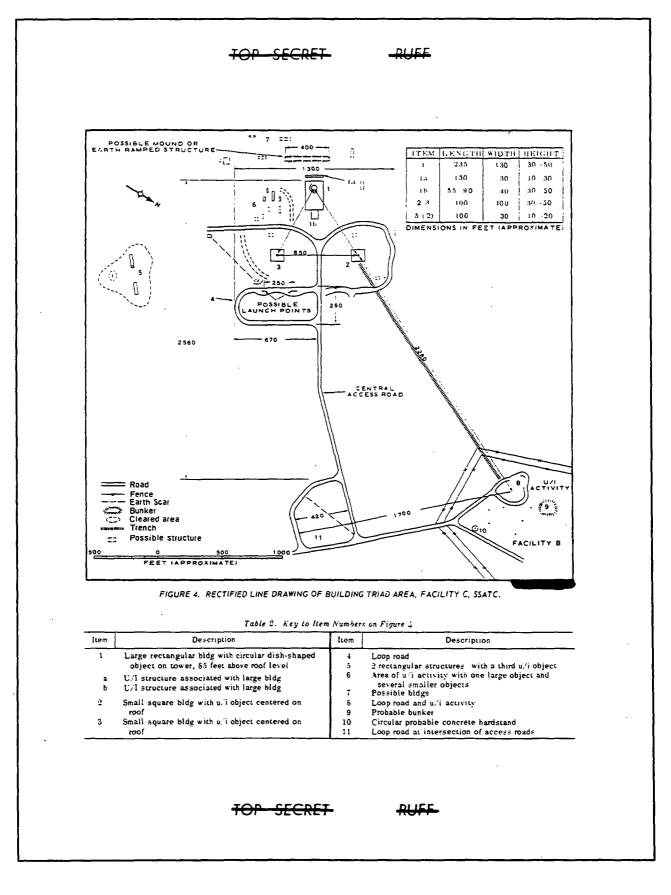
Major components of the four possible AMM facilities at the SSATC follow the same general pattern, with variations probably the result of system development and testing. Significant variations observed at Facility C, Launch Complex B (46-01N 72-29E; facility directly associated with the triad of buildings (Figure 3). Item numbers are keyed to Figure 4 and Table 2.

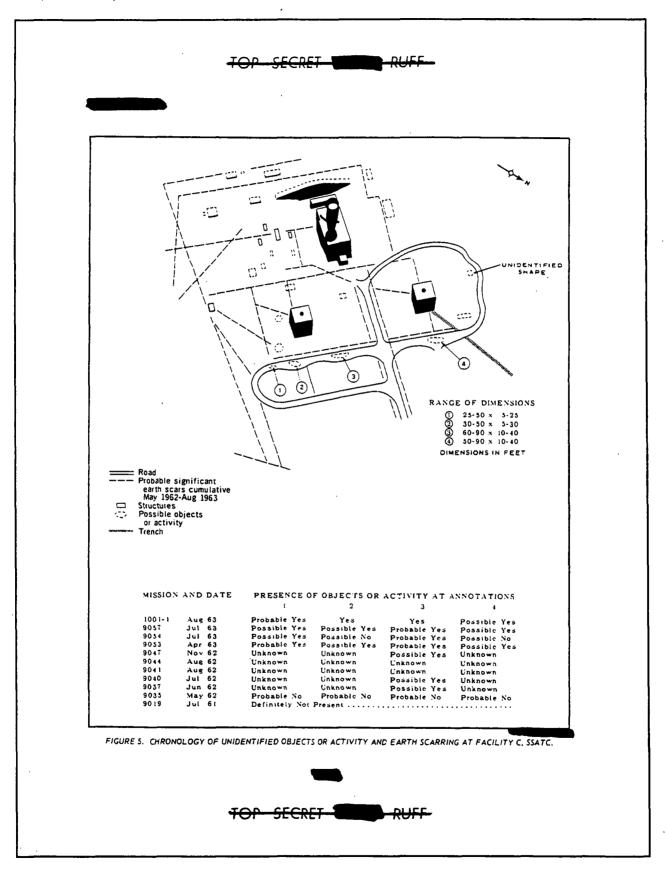
BUILDING TRIAD AREA

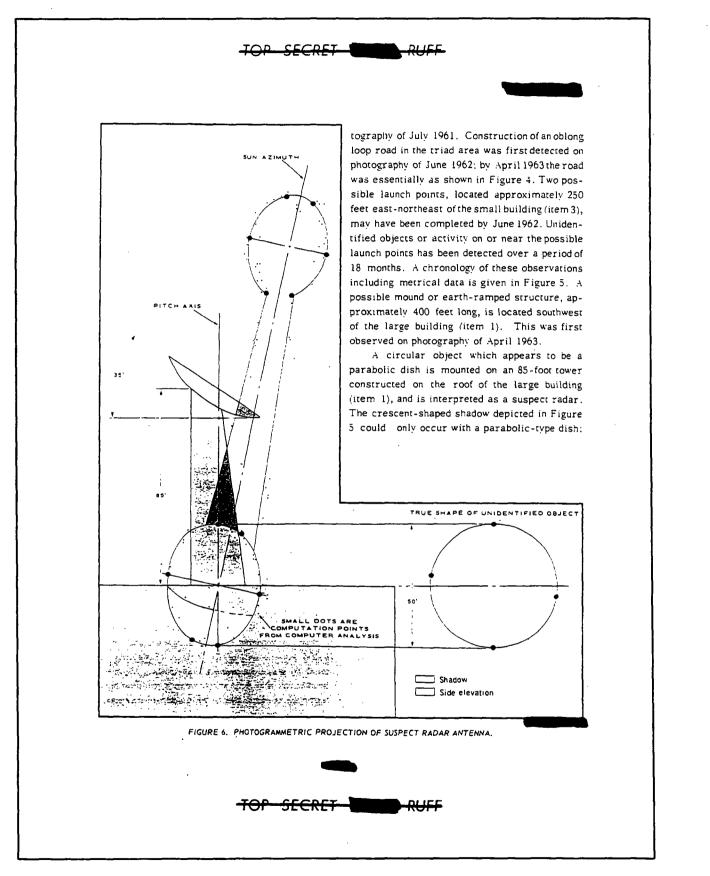
Site preparation for the triad of buildings (items 1, 2, and 3) was first discernible on pho-

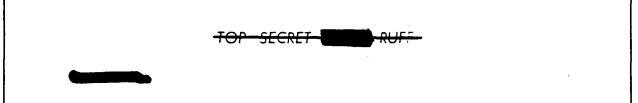
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if the object were spherical, a crescent-shaped highlight would have resulted along the top of the object. A side elevation and plan view projection of the object with metrical data are given in Figure 6. Possibly the same dish was seen on or near the ground and alongside the large building (item 1) in June 1963. The tower was probably under construction at this time.

A possibly raised section on the roof of the large building (item 1) is indicated by the fact that the shadow of the tower breaks as it crosses the roof of the building. The southeastern side of the building appears to curve outward slightly on photography of June and August 1963. This feature (shown in Figure 5) has not been detected at any of the corresponding structures at either SSATC or Moscow.

Several structures are separated from Facility C by a fence and are located within Facility B: however, they are probably associated with the more recently constructed Facility C. A probable bunker (item 9, Figure 4) may have been present in July 1961. A circular probable concrete hardstand (item 10) was present before construction began on Facility C. A possible electronic device was observed on the hardstand on photography of April 1960. A loop road (item 8) is within an area of unidentified activity. A trench connects this loop road with a building (item 2) in the triad area.

An area of unidentified activity (item 6), approximately 200 feet southeast of the large building (item 1) contains several small structures. One low rectangular structure is approximately 90 by 20 feet. Grouped around this structure are three to six 50- by 20-foot suspect footings. Activity has been observed in this area since construction was first identified in the building triad area. A possible structure could be seen in the area on photography of May 1962, and a possible

cable or pipeline was visible entering the area. June 1962 photography revealed an apparent extension of this possible cable or pipeline from the area of unidentified activity to the large building (item 1). Figure 5 depicts all significant earth scars in cumulative portrayal.

A loop road (item 11, Figure 4) at the intersection of access roads, approximately 2,000 feet northeast of the building triad and 400 feet west of an assembly and checkout facility (shown on Figure 3), has been present since May 1962. No structure or activity has been observed in association with this loop road, other than an earth scar running through the enclosed area.

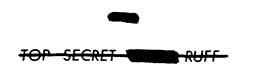
SUPPORT AREA, LAUNCH COMPLEX B

Additions to the Launch Complex B support area (not on graphics) since April 1960 are as follows.

(1) Storage, Assembly, and Checkout Area: Three buildings which are probably single story and have an estimated total floorspace of 4,500 square feet. These buildings were probably in place in December 1960.

(2) Housing Facility: Five two-story and two single-story housing units having an estimated total floorspace of 39,700 square feet. These additions could accommodate 660 persons if they were used as troop barracks, allowing 60 square feet per man. Most of these new buildings were added between April and December 1960.

(3) Possible Technical and Laboratory Facility: A probable single-story warehouse with 8,400 square feet of floorspace which may be used to store flammable materials. The slab foundation and fire walls were visible on photography of April 1960. This addition was probably complete in December 1960.



TOP SECRET COMPANY RUFF

SIMILARITIES BETWEEN THE POSSIBLE AMM FACILITIES MOSCOW AND SARY-SHAGAN

The shape and spacing of two adjacent possible launch points (item 4, Figure 4) at Facility C, SSATC, are similar to the shape and spacing of the launch points at the prototype herringbone launch site at KY/Vlad MTC (Figure 7). The launch points at Moscow Site E33-1 are similar to the launch points at Kapustin Yar in size, shape, and spacing, although the curved prepared areas appear to be less prominent at Moscow than at Kapustin Yar. Figures 7 and 8 are similarly scaled line drawings of these sites with Facility C, Launch Complex B, SSATC superimposed for comparison.

A tower with a parabolic dish-shaped object is mounted on the roof of the large building (item 1) in the triad at Facility C,SSATC, and a raised structure is under construction at approximately the same location on the large building (item 1, Figure 2) at Moscow Site E33-1.

One of the small buildings (item 3, Figure 2) occupies the same relative position with regard to adjacent launch points at Site E33-1 as the corresponding building at Facility C (item 3, Figure 4) occupies with reference to nearby possible launch points. The site of this building at Moscow Site E33-1 was previously occupied by an SA-1 site control bunker.

An oblong loop road with wide-radius turns

is located within the triad areas at both the Moscow and SSATC facilities, although the placement of the road with reference to the buildings of the triad is different.

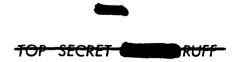
Approximately the same amount of unoccupied terrain surrounds the small buildings (items 2 and 3) at both the Moscow and SSATC facilities.

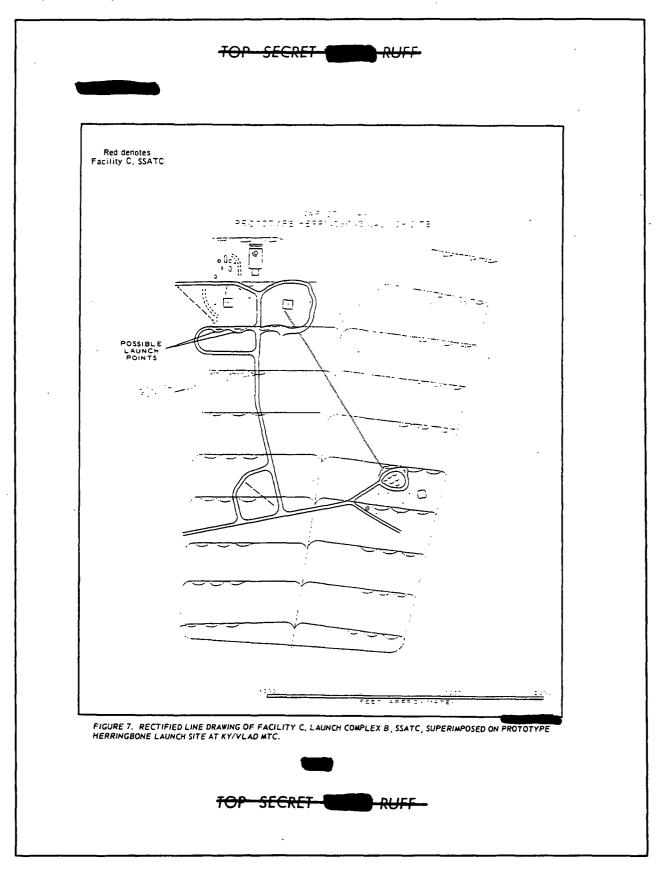
New construction has been observed in the support areas at the possible AMM sites near Moscow and at Facility C. Approximately 180,000 to 300,000 square feet of possible housing space has been added at Site E33-1, and approximately 39,700 square feet of probable housing space has been added to the support area at Launch Complex B, SSATC. However, there is no apparent correlation of size or shape between the buildings constructed at these two facilities.

A trench extending from one of the triad buildings (item 2, Figure 4) to a road-served area of unidentified activity (item 8, Figure 4) at Facility C, SSATC, is comparable to a possible trench at Site E33-1 which extends from the corresponding small building (item 2, Figure 2) to an area of unidentified activity as shown in Figure 8.

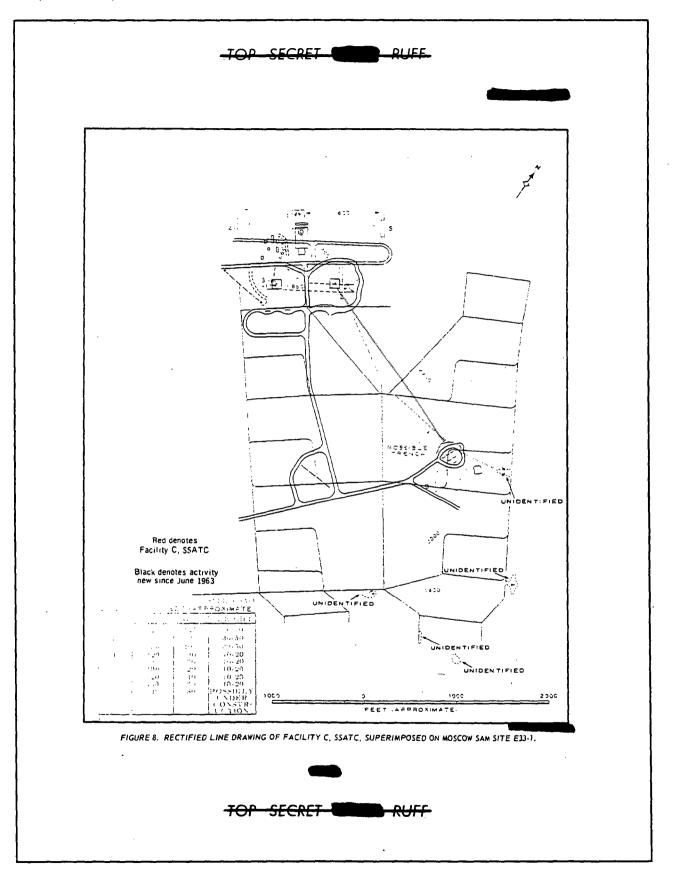
DIFFERENCES BETWEEN THE POSSIBLE AMM FACILITIES MOSCOW AND SARY-SHAGAN

The large building (item 1, Figure 2) at Moscow Site E33-1 does not yet have any associated structures which would correspond to those at Facility C, SSATC (items 1a and 1b, Figure 4). Structures similar to one of these (item 1a) have been observed at all the possible AMM facilities at SSATC; however, they have not yet been constructed at any of the possible AMM sites near, Moscow. The other structure (item 1b) at Facility C is unique.





22. (Continued)



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There is no apparent correlation between the position of the loop road (item 6, Figure 2) with reference to the triad of buildings at Moscow Site E33-1 and the position of the loop road (item 4, Figure 4) within the building triad area at Facility C.

One side of the large building (item 1) at Facility C appears to curve outward, probably as shown in Figure 5. This feature is not discernible at any of the corresponding buildings at the other possible AMM facilities at either Moscow or SSATC.

Structures (items 4 and 5, Figure 2) which are possibly integral components of the triad facility at E33-1 are not discernible at any of the possible AMM facilities at SSATC.

The position of new earth scars within the herringbone pattern at the Moscow facility, as

shown in Figure 8, does not appear to correlate with any significant features or activity observed at Facility C, SSATC.

Unidentified activity or objects have been observed at one or more of the SSATC possible launch points near the two small buildings (items 2 and 3) since June 1962. No similar features have been visible at Moscow Site E33-1.

The large possible mound or earth-ramped structure (Figure 3) at SSATC has no counterpart at any of the other possible AMM facilities at either Moscow or SSATC.

The small rectangular unidentified objects (item 6, Figure 4) located approximately 250 feet from the large building at SSATC have no counterpart at any of the other possible AMM facilities at either Moscow or SSATC.

DISCUSSION

Since this analysis is based primarily on KEYHOLE photography, there may be significant details at both the Moscow and SSATC facilities which escape detection. The launch points at Moscow Site E33-1 may differ considerably in detail from the possible launch points at Facility C, SSATC. Herringbone launch areas, clearly photographed from low altitude near Moscow, consist of regular, concrete, saw-toothed extensions of the access road; each extension is bounded on one side by a prepared area on which possible checkout equipment is located. These prepared areas give the launch points the curved shape which is particularly prominent at the KY/Vlad MTC prototype herringbone site. At Moscow Site E33-1 and KY/Vlad MTC only the road and the launch point extensions appear to have a concrete surface, whereas at Facility C, the entire area appears to be surfaced with concrete.

The areas at Facility C cannot be positively identified as launch points. Since the facility is probably concerned with electronics, another possibility is that they are used as hardstands for electronics equipment. However, if this were accepted as a hypothesis it would be difficult to explain the purpose of a road system with such wide-radius turns. The road pattern at Facility C suggests the necessity for repeated access to the possible launch areas by motor vehicles which cannot readily negotiate turns and require these elaborate provisions. The herringbone road pattern serves such a purpose. If the facilities at SSATC are neither launch points nor hardstands for electronics equipment, there is no apparent explanation for them.

The intersections of a loop road (item 11, Figure 4) and the access roads at Facility C have Y-shaped wide-radius turns. This area could serve as a hold area for transporters





with loads to be delivered to the possible launch points near the two small buildings (items 2 and 3).

The area of unidentified activity (item 6) appears to be an integral part of Facility C, SSATC. The unidentified objects in this area were suspected of being stacked crates and boxes used to transport supplies and equipment during construction of the building triad area; however, a careful analysis of the following photographic evidence tends to discount this possibility:

1. The placement of the large object and the smaller objects grouped around it forms an orderly pattern which does not resemble a dump.

2. These objects cast little or no shadow, as would stacks of crates and boxes.

3. The large central object (approximately 90 by 20 feet) was clearly visible on photography of April and August 1963, and there was no perceptible change in its size, position, or rectangular shape even though activity was apparent throughout the area. Furthermore, the object was possibly in this location as early as May 1962.

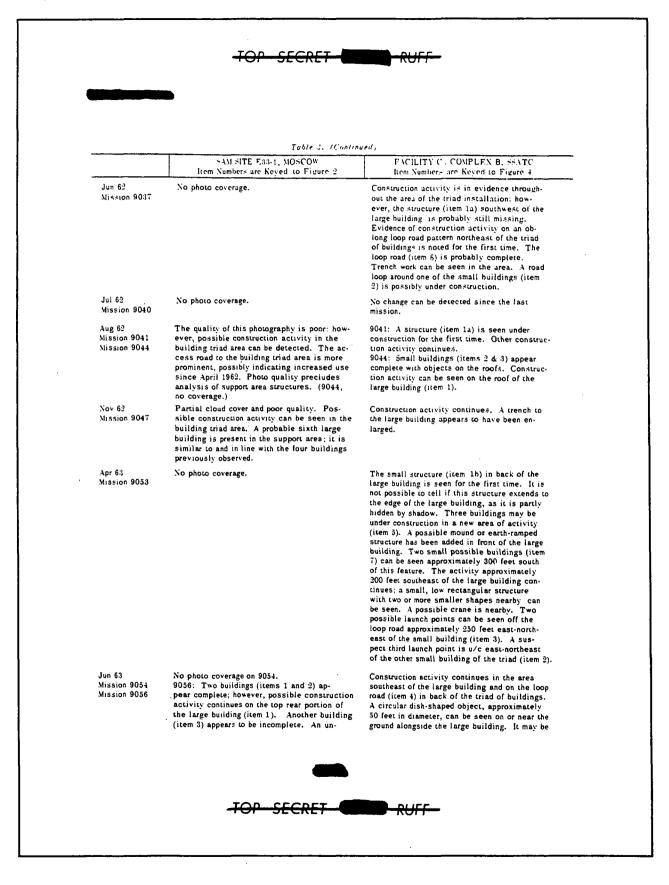
4. A prominent earth scar entering this area, probably a cable or pipeline, was observed on photography of May 1962. An apparent extension of this earth scar, visible on photography of June 1962, appears to connect it with the large building in the triad.

5. A possible construction crane was visible in this area on photography of April 1963.

	SAM SITE E00-1, MOSCOW Item Numbers are Keyed to Figure 2	FACILITY C. COMPLEX B. SSATC Itom Numbers are Keyed to Figure 4
Apr 60 Mission B 4155	No photo coverage	No evidence of construction activity.
Dec 60 Mission 9013	No photo coverage.	No change can be detected.
Jul 61 Mission 9019	Very poor photo quality identification only.	Early stages of site preparation in the triad area with extensive earth scarring, but no evidence of building foundations. A loop road (item 5) is possibly under construction.
Apr 62 Mission 9032	This is the first mission which produced in- terpretable photography. None of the build- ings of the triad are present, nor is there any sign of foundations or footings. However, ground scarring can be detected between the large building (item 1) and the T-shaped pai- tern (item 5). Five 200- by 50-foot buildings are present in the support area. Of these, four are arranged in a row while the fifth is lo- cated nearby. The road leading south from the northwestern corner of the herringbone site is hardly visible and possibly lightly used.	No photo coverage.
MayJun 62 Mission 9035	Portions of the herringbone pattern are cloud covered. The possible construction activity (scarring) noted on Mission 9032 cannot be seen: however, this is possibly due to poor photo quality. A portion of the road leading south from the northwestern corner of the herringbone site is visible. The road is more prominent, indicating a possible increase in its use for access to construction activity in what is now referred to as the building triad area.	Construction on the triad of buildings is ap- parently in advanced stages, with all walls and probably the roofs in place. The small structure (item 1a) southwest of the large building cannot be seen. Unidentified con- struction activity adjacent to the large huild- ing is noted. Trenches in the triad area are visible and a loop road (item 6) is possibly under construction.
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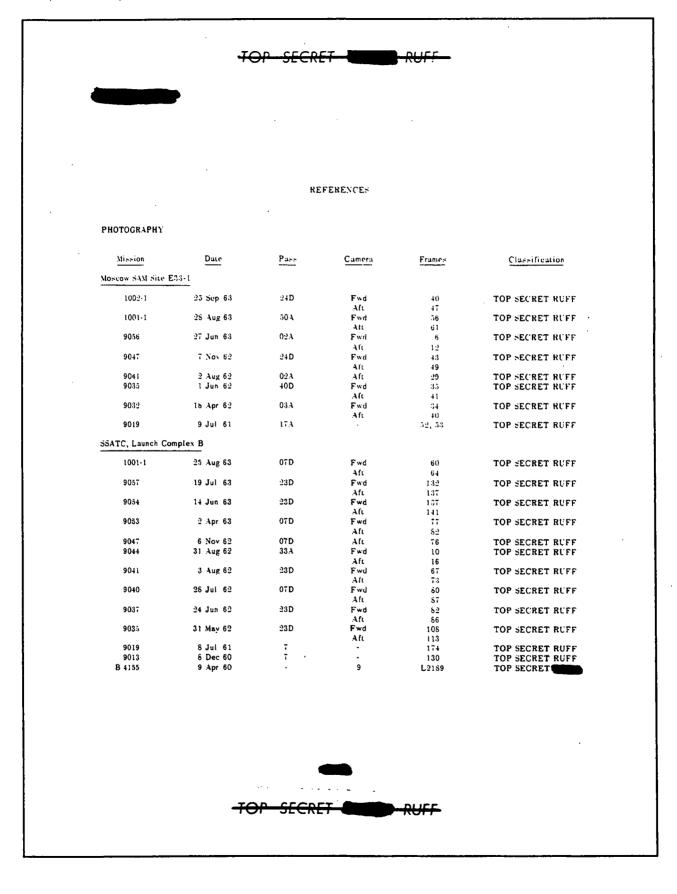
Table 3 Chronology of Construction Activity at Moscow SAM Site E33-1 and Facility C. SSATC

22. (Continued)

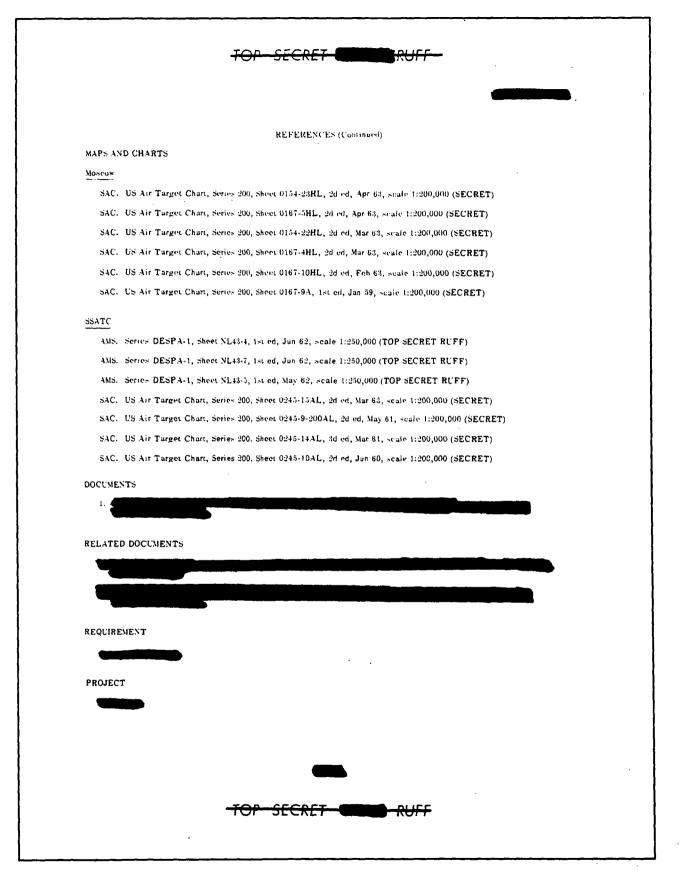


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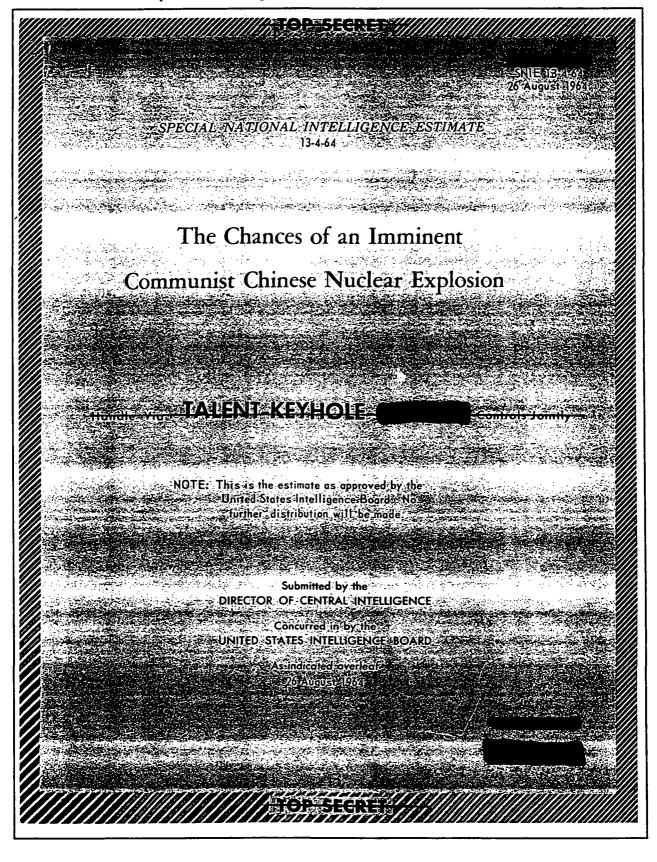
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of one of the small huilding: (icen 3). Positive is bible locatings of foundations for the structure in a T-shaped pattern (icen 3) are in place. There buildings (icen 4) are possible in place. There building is (icen 4) are possible in place. There building is (icen 4) are possible in place. The tow of five large buildings is prominent in the support area, approximately 3000 let submess of the building rain size, is located about 700 feet to the southest. A loop road with a wide-tadius turn is prominent between the large building and the two small buildings in the trad.Construction activity in the area continues. The large building (item 1) is probably complete. A cover is being constructed on the front portion of the roof the large building. The tow approximately 10 feet above roof let el.Aug 63 Mission 1001-1Partial cloud cover and haze limit interpreta- tion. No changes can be seen.Construction activity in the area continues. The large building (item 1) is probably complete. A cover is being constructed on the front portion of the roof the large building. The tower is now approximately 10 feet above roof let el.Aug 63 Mission 1001-1Partial cloud cover and haze limit interpreta- tion. No changes can be seen.Construction activity ontinues. The loop potent of node sit is being constructed on the building at item 2 beds outward, and an un- identified shape can be descred at the loop road encircling the building at item 2 beds outward, and an un- identified shape can be descred at the loop road (item 5). A trench from the building at service are three to 53 50-by 30-foot structures. All three buildings (item 3 2 4 3) have an undentified and lobeic centered on each root. A raised structure, about 70 feet long and possibly square, is being construc- ted on the rease portion of			
Mission 9057The large building (item 1) is probably complete. A tower is being constructed on the front portion of the rouge building. The tower is now approximately 40 feet above root level.Aug 63 Mission 1001-1Partial cloud cover and haze limit interpreta- tion. No changes can be seen.Construction activity continues. The loop pattern of roads in the triad area is now more distinct. Two probable buildings (item 3) are one visible. The loop road encircling the building at item 2 bends outward, and an un- identified shape can be seen just inside this bend. Earth scaring can be detected at the loop road is complete. Ac- tivity in the area southeast of the large building at item 2 to this loop road is complete. Ac- tivity in the area southeast of the large building ing continues (item 5). The corral structures. All structures are low, casting little or no shadow. The tower on the roof of the building discontinues (item 2 bed object at its top. The dish is el- evated at an angle of 35 degrees. No photo coverage.Sep 63 Mission 1002-1All three buildings in the triad appear to be complete. The small buildings (items 2 & 3) have an unidentified small object centered on each root. A raised structure, about 70 feet long and possibly square, is being construc- ted on the rear portion of the large building. The top of the raised structure, is 15 to 30	· · · · · · · · · · · · · · · · · · ·	of one of the small huildings (item 2). Pos- sible looings or foundations for the structures in a T-shaped pattern (item 3) are in place. Three buildings (item 4) are possibly in place. The row of five large huildings is prominent in the support area, approximately 9,000 iter southeast of the building triad area. The stath building, similar in size, is located about 700 feet to the southwest. A loop road with a wide-radius turn is prominent between the large building and the two small buildings	the tower, yet to be completed on the roof of the large building. Construction of a trench hetween a small building (item 2) and the loop road is in progress. A possible trench or ditch can be seen on the south side of the loop road (item 5).
Mission 1001-1tion. No changes can be seen.pattern of roads in the triad area is now more distinct. Two probable buildings (item 3) are now visible. The loop road encircling the building at item 2 bends outward, and an un- identified shape can be seen just inside this bend. Earth scarring can be detected at the loop road (item 8). A trench from the building at item 2 to this loo proad is complete. Ac- tivity in the area southeast of the large build- ing continues (item 3). The central structure in this area is approximately 90 by 20 feet in size. Grouped around this long narrow struc- ture are three to six 50- by 20-foot structures. All structures are low, casting little or no shadow. The tower on the roof of the building is complete. It is 85 feet tall, 40 to 50 feet wide at the base, and has a 50-foot circular dish-shaped object at its top. The dish is el- evated at an angle of 55 degrees from the horizontal, on an azimuth of 85 degrees.Sep 63 Mission 1002-1All three buildings in the triad appear to be complete. The small buildings (items 2 & 3) have an unidentified small object centered on each roof. A raised structure, about 70 feet long and possibly square, is being construc- ted on the rear portion of the large building. The top of the raised structure is 15 to 30No photo coverage.		No photo coverage.	The large building (item 1) is probably com- plete. A tower is being constructed on the front portion of the roof of the large building. The tower is now approximately 40 feet above
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feet above the level of the roof. New track activity and earth scarring are noted in the herringbone pattern since the last mission. This new activity is depicted on Figure 8.		complete. The small buildings (items 2 & 3) have an unidentified small object centered on each roof. A raised structure, about 70 feet long and possibly square, is being construc- ted on the rear portion of the large building. The top of the raised structure is 15 to 30 feet above the level of the roof. New track activity and earth scarring are noted in the herringbone pattern since the last mission.	No photo coverage.



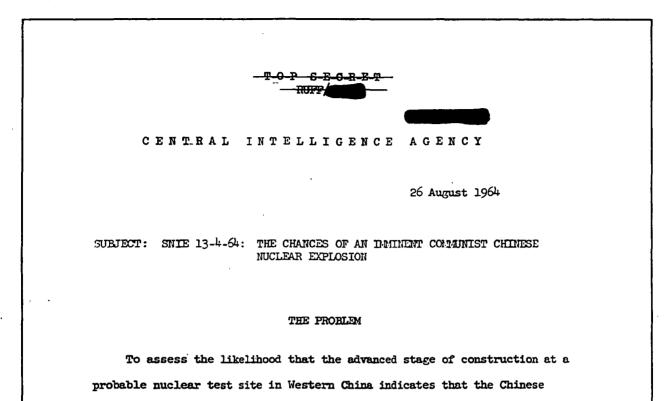
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23. Special National Intelligence Estimate 13-4-64, "The Chances of an Imminent Communist Chinese Nuclear Explosion," 26 August 1964



TOP SECRET The following intelligence organizations participated in the preparation of a second Departments of State, Defense, AEC, and NSA Concurring: Diractor of Intelligence and Research, Department of State Diractory Defense Infelligence Artenay State A conteledency completion Represention (Conteledence) Diractor of the Notonal Scottly Action the same GE. Abstanting Construction Federal Bureau of Jack Stration, the Subject being Construction Strategy of St WARNING State of the second s Interminated and authorized of each in a provide the provide the provided of t **<u>C</u>2C



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CONCLUSION

Communists will detonate their first nuclear device in the next few months.

On the basis of new overhead photography, we are now convinced that the previously suspect facility at Lop Nor in Western China is a nuclear test site which could be ready for use in about two months. On the other hand the weight of available evidence indicates that the Chinese will not have sufficient fissionable material for a test of a nuclear device in the next few months. Thus, the evidence does not permit a very confident estimate of the chances of a Chinese Communist nuclear detonation in the next few

GROUP 1 Excluded from automatic - downgrading and - 6 - E - C - R - E - T declassification

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RUF

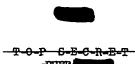
months. Clearly the possibility of such a detonation before the end of this year cannot be ruled out -- the test may occur during this period. On balance, however, we believe that it will not occur until sometime after the end of 1964.

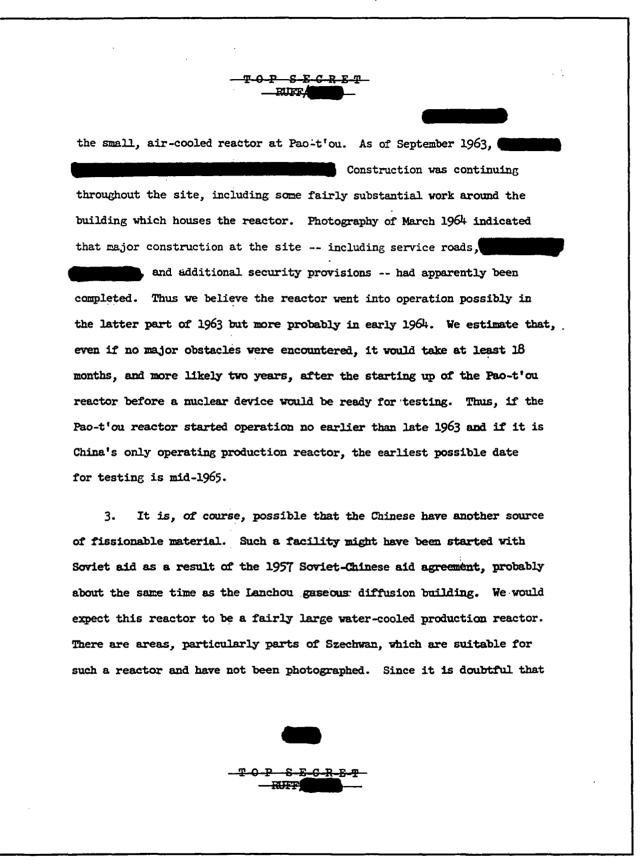
DISCUSSION

1. Overhead photography of 6-9 August shows that the previously suspect facility near Lop Nor in Sinkiang is almost certainly a muclear testing site. Developments at the facility include a ground scar forming about 60 percent of a circle 19,600 feet in diameter around a 325-foot tower (first seen in April 1964 photography), and work on bunkers near the tower and instrumentation sites at appropriate locations is underway.

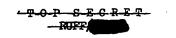
indicate that the site could be ready for a test in two months or so. The characteristics of the site suggest that it is being prepared for both diagnostic and weapon effect experiments.

2. Analysis of all available evidence on fissionable material production in China indicates -- though it does not prove -- that the Chinese will not have sufficient material for a test of a nuclear device in the next few months. The only Chinese production reactor identified to date is





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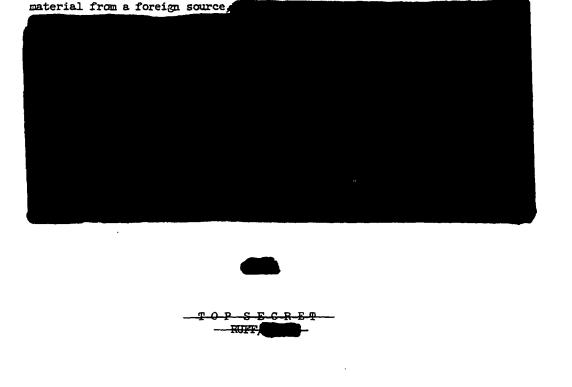


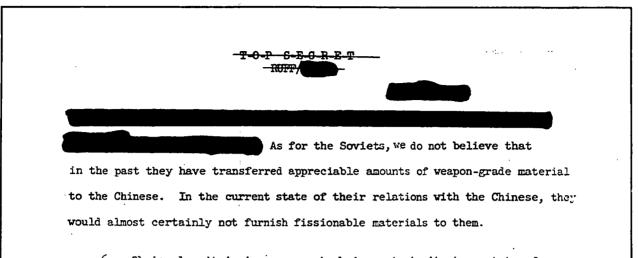
a reactor of this type could have been finished before the withdrawal of Soviet technicians in 1960, its completion would have depended on a native Chinese effort, a difficult but not impossible task. Such a reactor might have started operations in 1962 or 1963, thus making available sufficient plutonium for a test by the end of this year.

4. On the other hand we have photographed much of the area around virtually all locations where A-E activity is indicated

suitable for reactor sites. Apart from Pao-t'ou, no operating production reactor or isotope separation plant has been found. We believe it unlikely -though clearly not impossible -- that such an operating facility exists.

5. It is also possible that the Chinese may have acquired fissionable





6. Obviously, it is incongruous to bring a test site to a state of readiness described in paragraph 1 without having a device nearly ready for testing. It would be technically undesirable to install much of the instrumentation more than a few weeks before the actual test. We cannot tell from available photography whether the installations have yet reached this point -- it seems unlikely that they have, mainly because some heavy construction is still going on. However, it is possible that the basic work: will soon be completed, and that final preparations could be made this fall.

7. On the other hand, in such a complex undertaking as advanced weapons development -- especially when it is almost certain that there is heavy political pressure for at least some results -- it would not be surprising if there were uneven progress among various phases of the program. In a number of instances in the past, Peiping has been unable to prevent -and has seemed willing to tolerate -- uneven development in various important programs. Indeed, in other parts of their advanced weapons program we have already observed this. Some facilities seem to be behind schedule -notably the incomplete gaseous diffusion plant at Lanchou; others are

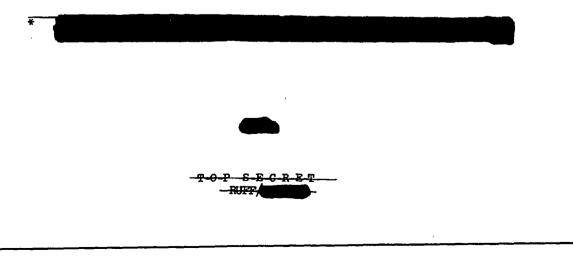


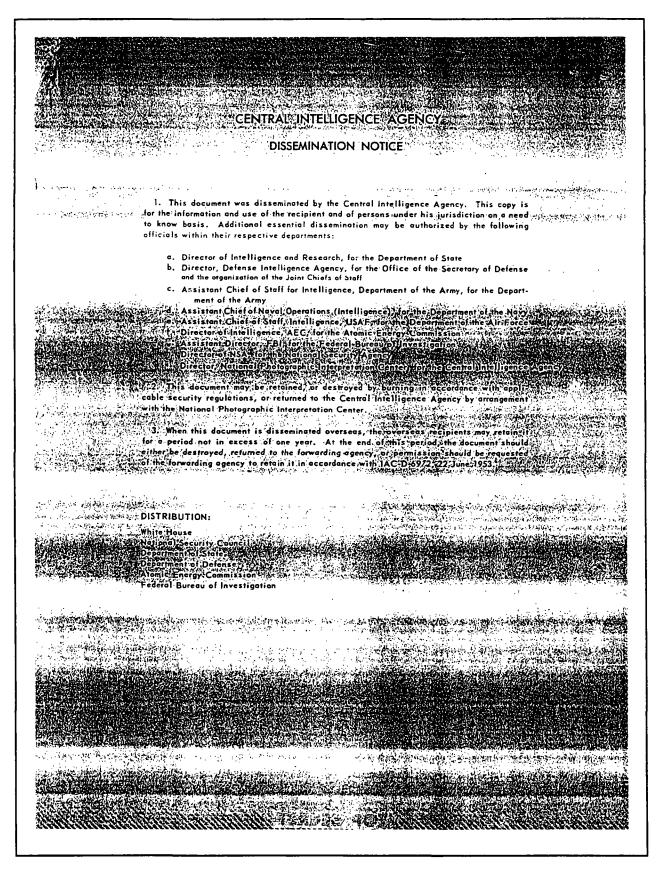
<u>-C.F.C.R.</u>F. - समन

larger and more elaborate than present Chinese capabilities warrant -for example, the possible nuclear weapons complex near Koko Nor.

8. As for the test site itself, Lop Nor is extremely remote, with poor transportation and communication facilities, and we might expect to see the Chinese taking a long leadtime in preparing this installation. They have relatively few men with the necessary scientific competence and and they cannot be fully confident that unexpected difficulties will not appear. We believe the Chinese would do everything in their power to prevent a last minute hitch on the testing facility from delaying, even briefly, China's advent as a nuclear "power."

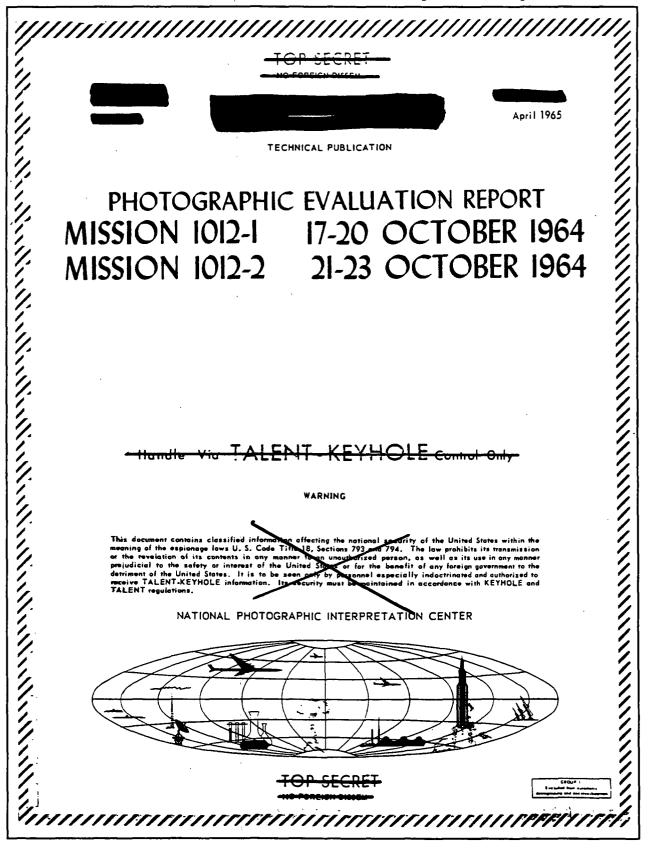
9. The evidence and argument reviewed above do not permit a very confident estimate of the chances of a Chinese Communist nuclear detonation in the next few months. Clearly the possibility of such a detonation before the end of this year cannot be ruled out -- the test may occur during this period. On balance, however, we believe that it will not occur until some-time after the end of 1964.*





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24. CIA/NPIC, Technical Publication, Photographic Evaluation Report, "Mission 1012-1, 17–20 October 1964/Mission 1012-2, 21–23 October 1964," April 1965 (Excerpt)



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SYNOPSIS

Mission 1012 (System No J-13), the twelfth of the "J" reconnaisance series, was launched 17 October 1964 and consisted of 2 operational phases, designated Missions 1012-1 and 1012-2, respectively. Mission 1012-1 accomplished 36 photographic revolutions, including 3 domestic and 3 engineering (dark side) passes. The first-phase payload was recovered by air catch on 20 October and second-phase operations were initiated on the following day. Mission 1012-2 accomplished 17 photographic revolutions, including 1 domestic and 1 engineering pass. Recovery of the second payload on 23 October terminated the mission. The capsule was retrieved from water but subsequent inspection of the contents revealed no immersion damage.

All cameras functioned satisfactorily except in Mission 1012-1, where the stellar/index unit was not operational due to a command system anomaly or program malfunction.

The quality of the panoramic photography is good and is considered comparable with the results achieved in Mission 1008. The next-tolast frames of most passes following 9AE contain light-struck areas. These traces resemble corona static discharges, but investigation has firmly established them to be light leak patterns. In any case, the resultant degradation is relatively slight. The horizon cameras associated with the panoramic instruments produced comparatively good images. Slight vignetting of the format corners does not hamper use of the horizon images for determination of vehicle attitude, which was normal until the terminal revolution, 73D, where an extreme departure from normal occurred.

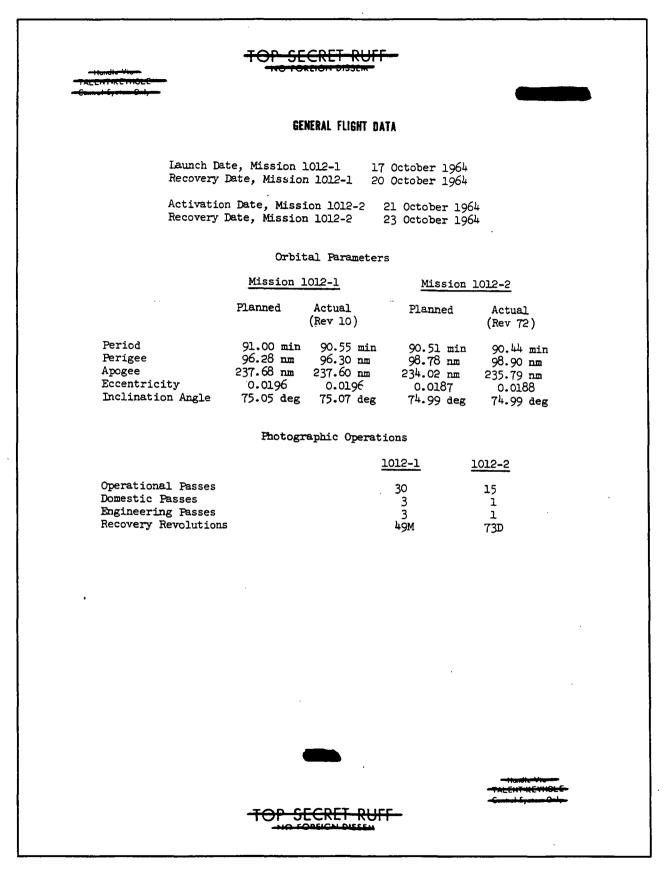
The stellar/index unit operated satisfactorily in Mission 1012-2 and produced good-quality stellar and terrestrial photography. However, the vehicle attitude abnormality in the last photographic pass was responsible for gross overexposure of the last 5 stellar frames and distortion (off-axis photography) of the last 4 index frames, which contain images of the horizons.

Cloud cover obscured approximately 55 percent of the panoramic photography in Mission 1012-1 and 45 percent of Mission 1012-2. Solar elevations ranged from 3 degrees to 42 degrees.



TREENT-REYHOLE

24. (Continued)



1. Summary of	Plottable F		N 1012-1			
Country	<u>Master (F</u> Linear nm	WD) Camera Square nm	Slave (AF Linear nm	T) Camera Square nm	Combined Linear nm	Coverage Square n
USSR China Algeria Cuba Mongolia Rumania Greece Poland Bulgaria Yugoslavia Sweden North Korea Mexico Turkey Nigeria South Korea Afghanistan Albania Czechoslovakia Jamaica Bahama Islands Norway East Germany Cayman Island TOTAL Continental United States GRAND TOTAL	29 .8 9 17,146	1,965,626 280,662 47,264 33,596 33,900 30,464 13,724 29,414 15,688 11,150 1,752 9,360 7,300 9,928 1,168 8,240 3,358 8,240 3,358 8,240 3,358 8,240 2,523,050 <u>78,912</u> 2,601,962	12,525 2,608 428 335 124 123 137 106 95 113 123 39 49 27 21 37 20 25 12 4 16,951 568 17,519	1,916,272 348,510 62,116 33,004 18,500 18,204 20,112 16,292 13,994 16,724 15,288 5,040 7,154 3,942 3,066 5,476 3,040 3,700 900 608 2,511,942 <u>81,792</u> 2,593,734	25,557 4,590 342 326 281 253 201 189 123 123 120 111 95 82 78 70 45 29 25 12 9 34,097 1,116 35,213	3,881,896 629,173 109,380 66,600 52,400 48,662 33,836 45,700 29,682 27,874 15,288 1,753 14,400 14,454 13,877 1,166 11,306 8,833 11,044 4,293 3,700 900 8,610 144 5,034,999 <u>160,70</u> 5,195,69
		78,912 2,601,962		<u>81,792</u> 2,593,734	<u>1,116</u> 35,213	

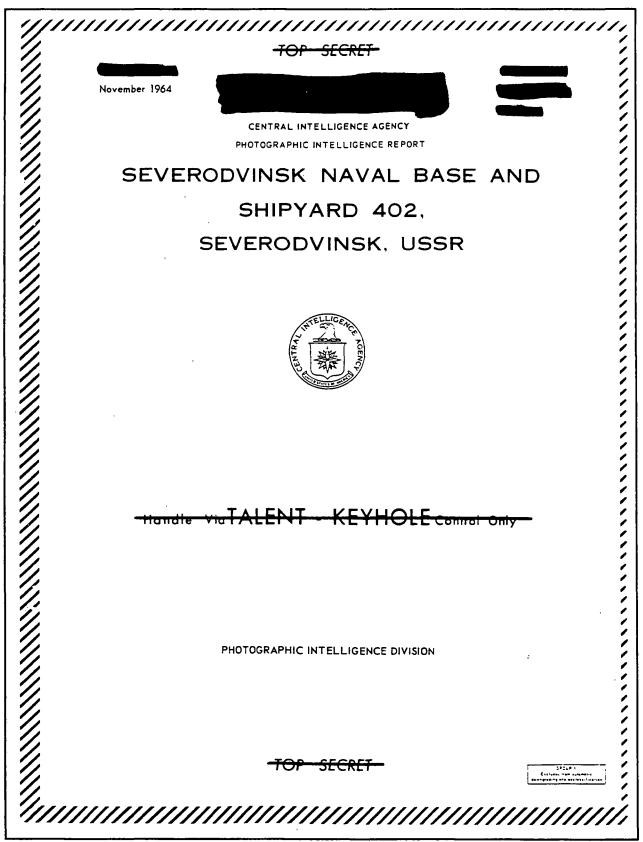
24. (Continued)

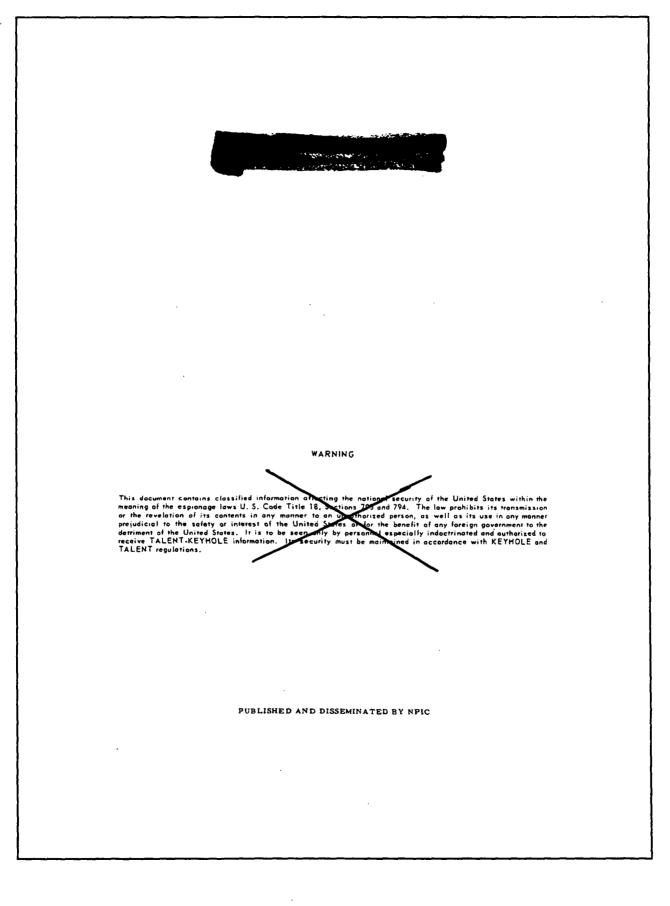
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		MISSION 1012-	2		
Country	<u>Master (FWD) C</u> Linear nm Squa	amera Slave renm Linear	(AFT) Camera nm Square nm	Combined Linear nm	Coverage Square n
USSR China Mongolia Congo North Korea Morocco Rhodesia Algeria North Vietnam Nepal India South Korea Finland Bhutan Pakistan TOTAL Continental United States GRAND TOTAL	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	988,770 283,270 40,878 33,540 6,160 16,008 8,424 6,900 4,620 3,450 1,656 5,550 1,399,778 50,922 1,450,700	14,141 4,125 534 418 263 199 141 133 90 66 53 49 41 14 10 20,277 810 21,087	1,969,09 575,56 74,89 65,20 12,50 27,46 21,99 18,35 12,60 9,10 7,31 2,76 1,93 1,38 2,805,73 95,08 2,900,81
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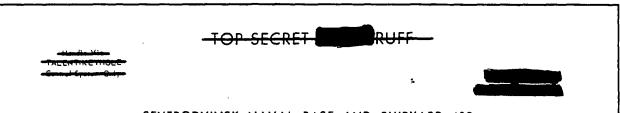
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25. CIA/NPIC, Photographic Intelligence Report, "Severodvinsk Naval Base and Shipyard 402, Severodvinsk, USSR," November 1964







SEVERODVINSK NAVAL BASE AND SHIPYARD 402, SEVERODVINSK, USSR

Severodvinsk Naval Base and Shipyard 402 (65-35N 039-50E;) is located in the city of Severodvinsk, USSR, on the White Sea, approximately 19 nautical miles west of Arkhangelsk (Figure 1). This installation, formerly known as the Molotovsk Shipyard, is situated around a small natural harbor formed by the mainland and Yagry Island. The harbor is dredged periodically to maintain a channel from the sea to the naval facility and city. Components of the naval base and shipyard are shown in Figure 2; item numbers are keyed to Figure 2 and Table 1. This installation is adjacent to Severodvinsk Naval Base Yagry Island

Severodvinsk Naval Base and Shipyard 402 has been greatly expanded since World War II. Comparative photography of 1943 and 1964 is shown in Figure 3. Most of this expansion has taken place on Yagry Island. Shipyard 402 now includes a small shipyard on Yagry Island capable of handling vessels up to 500 feet long. When construction is com-

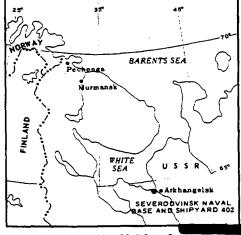


FIGURE 1. LOCATION MAP.

pleted it may be used for maintenance and repair, possibly including the recoring of nuclear submarines. This small shipyard is similar in size and facilities to the Petrovka Shipyard on the Pacific Ocean near Vladivostok, USSR.

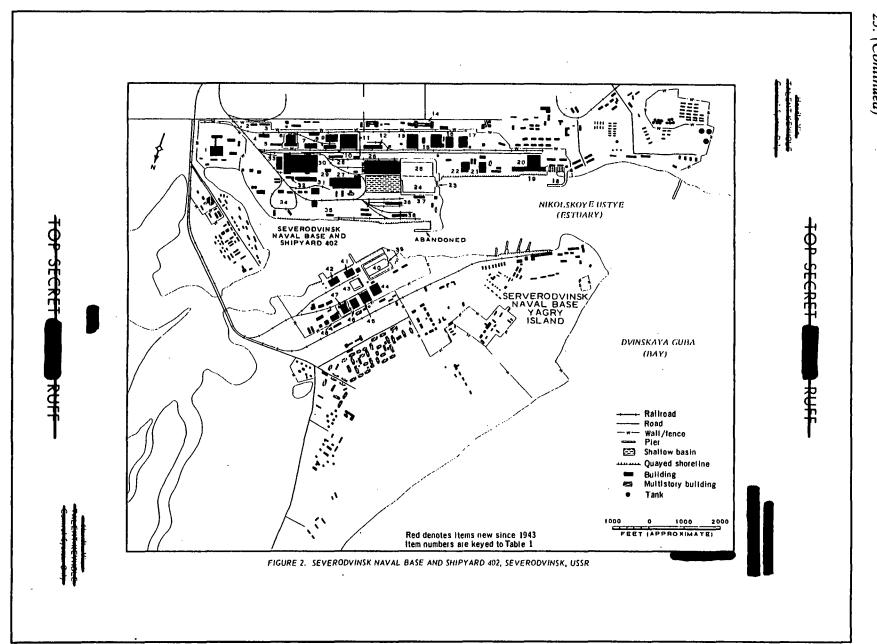
Expansion of Shipyard 402 on the mainland has been principally at the western end with the construction of a fabrication/construction hall (item 20) and adjacent launching way (item 18). Excavations for this building were visible on photography of 1943. The construction way of this building measures 1,040 by. 105 feet and is 115 feet high. The launching way is capable of launching ships up to 500 feet long. The remainder of the shipyard on the mainland is relatively unchanged since 1943 except for the completion of the launching basin, removal of a wharf, and the addition of a few new buildings.

Severodvinsk Naval Base and Shipyard 402 is probably the largest producer of nuclear submarines in the Soviet Union. N-class SSN (nuclear-powered submarine) and E-class SSGN (nuclear-powered guided-missile submarine) have been observed here in recent months. With the exception of Komsomolsk Shipyard Amur 199, which is involved in the E-class SSGN program, $\underline{1}$ / Severodvinsk Shipyard 402 is the only shipyard known to be producing nuclear submarines.

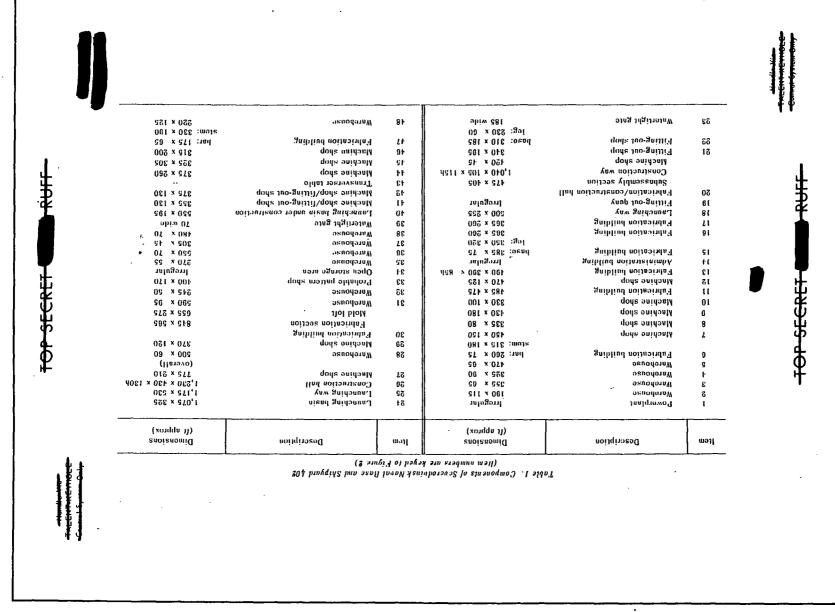
Two of the fabrication buildings (items 6 and 47) are T-shaped, separately secured, and have two white objects on the roof. These objects may be ventilating, air-conditioning, or vacuum units used to create a "clean room" condition which is mandatory when working with the stainless steel piping employed in nuclear propulsion systems. A building identical to these has been identified at Komsomolsk Shipyard Amur 199.

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SECRET I



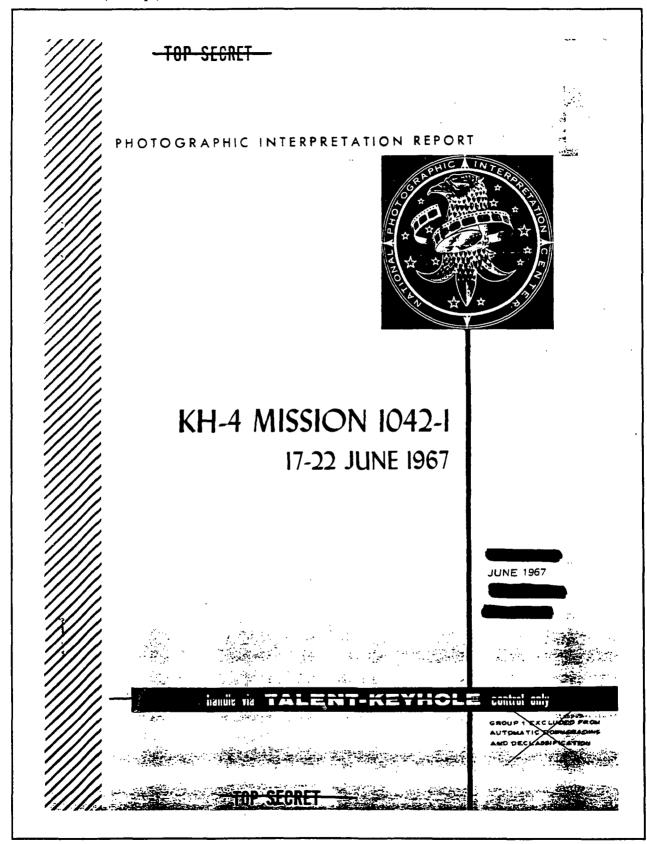


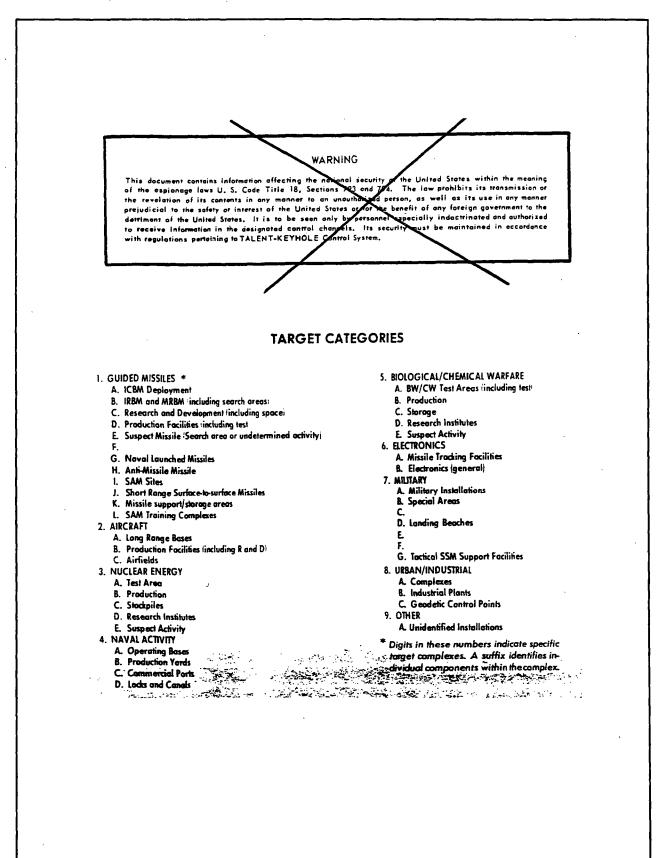




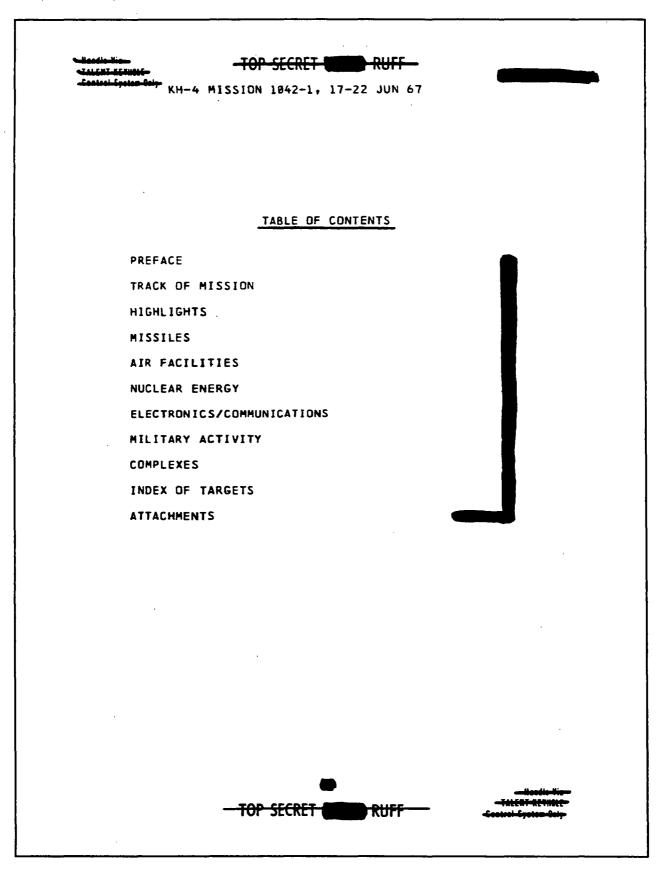
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1005-1	13 Jul 64	40D	A fi. Fwd	60 47	TOP SECRET RUFF
			Aft	53	
1006-2	12 Jun 64	119D	Fwd Aft	3 S	TOP SECRET RUFF
9054	14 Jun 63	18A	Fwd	73	TOP SECRET RUFF
9035	30 May 62	3A	Aft Aft	77 29	TOP SECRET RUFF
	31 May 62	19A	Aft	4ô	
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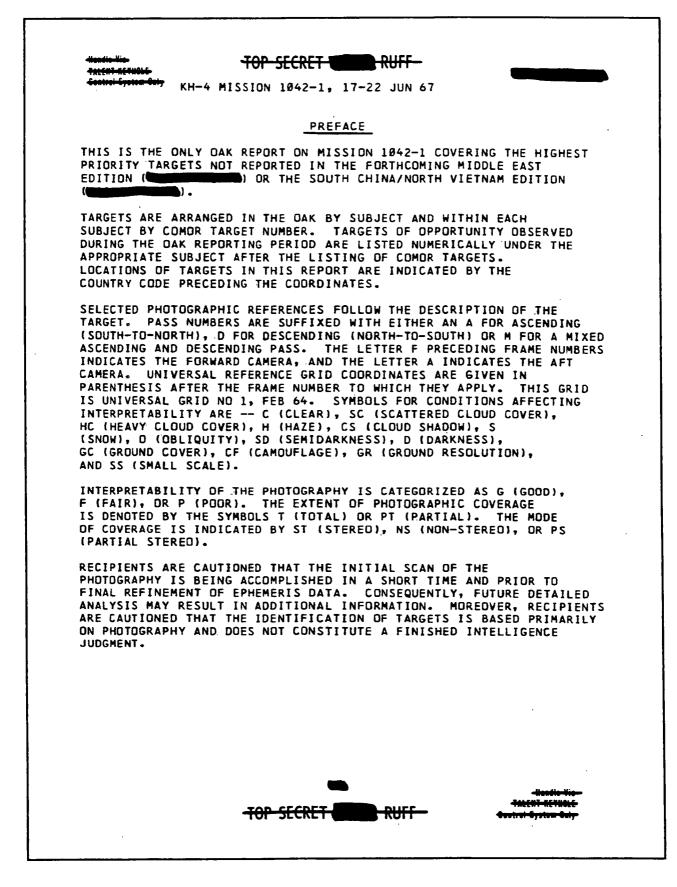
26. CIA/NPIC, Photographic Interpretation Report, "KH-4 Mission 1042-1, 17-22 June 1967," June 1967 (Excerpt)

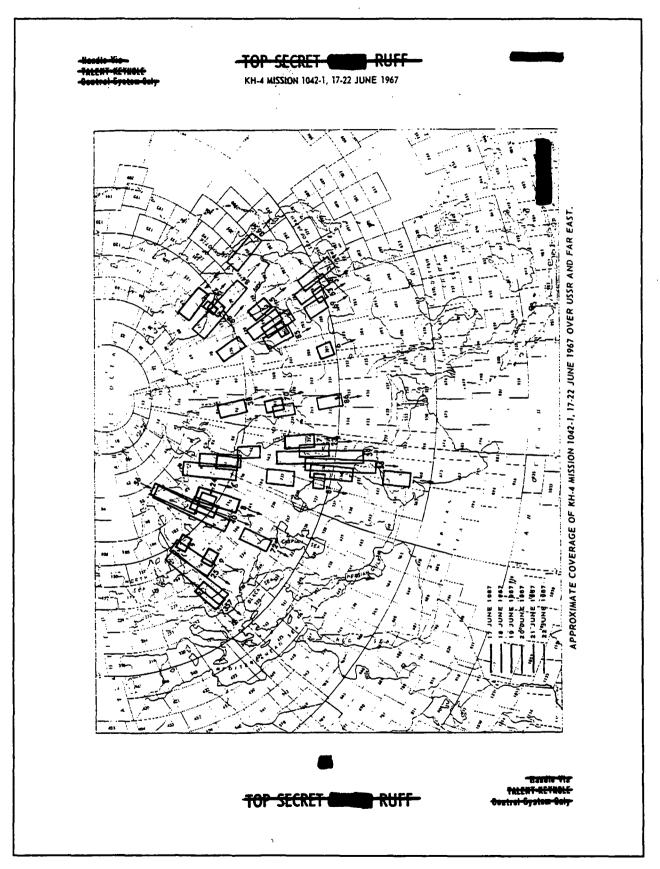


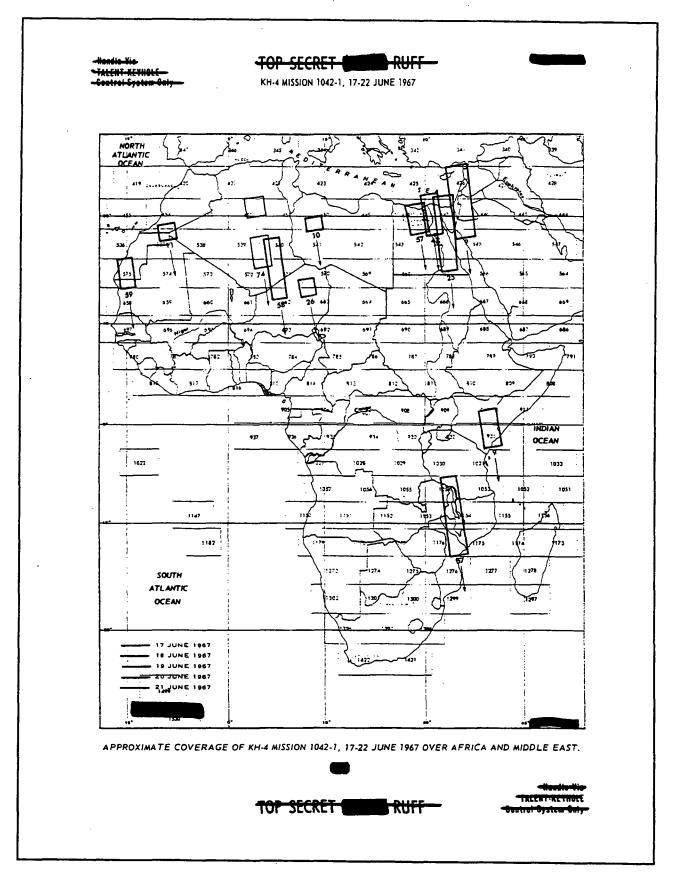


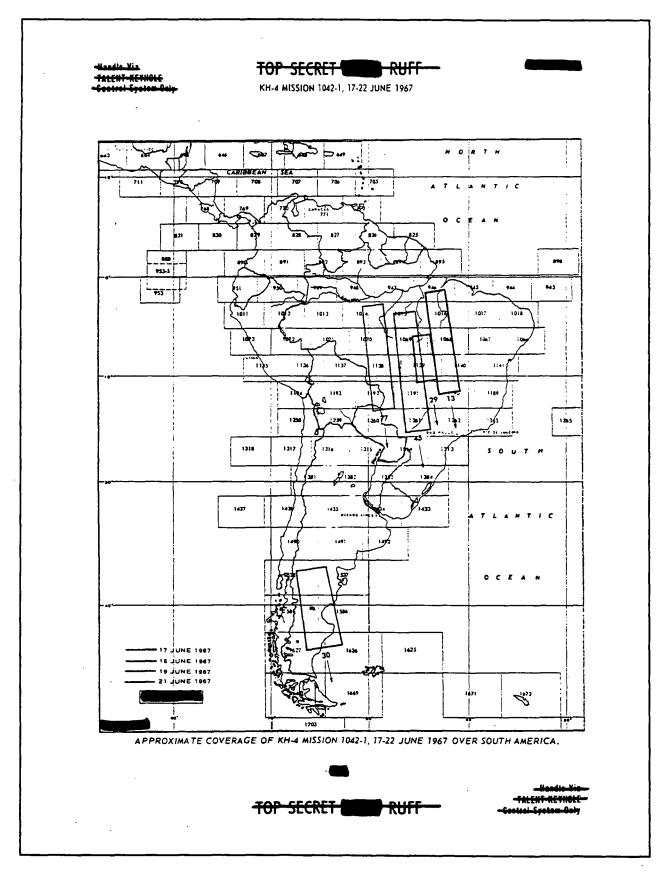
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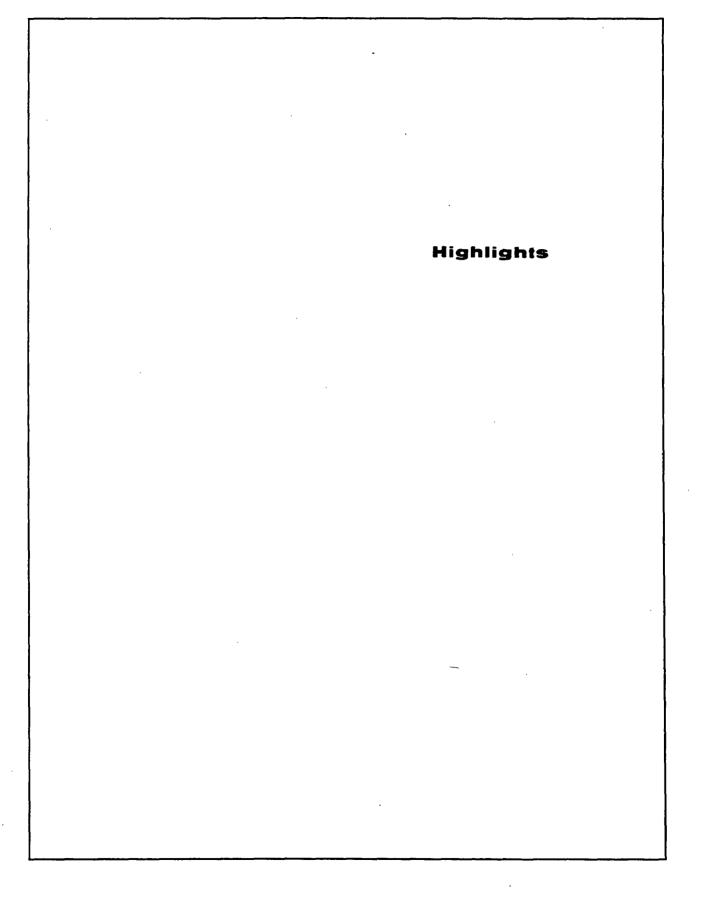




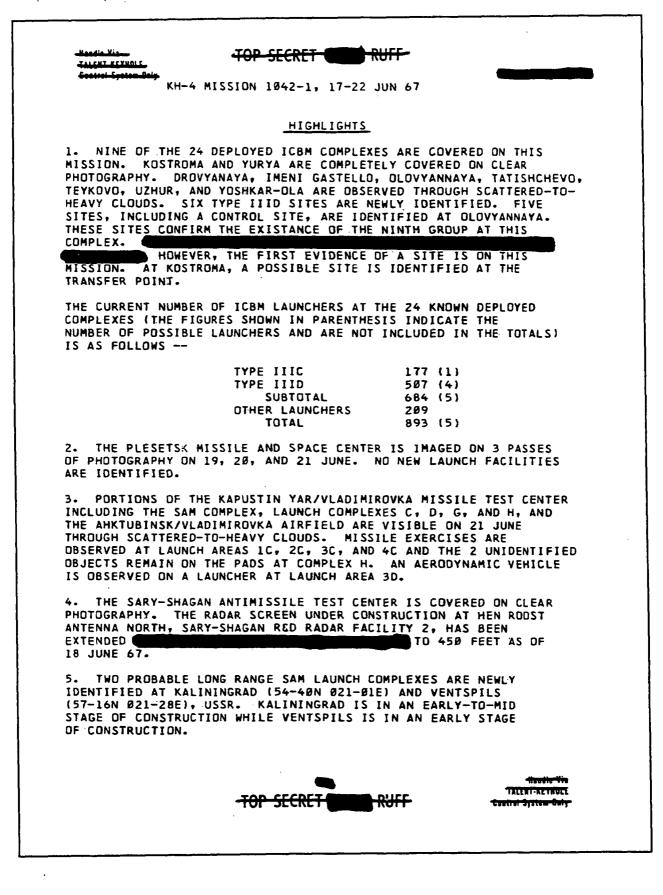


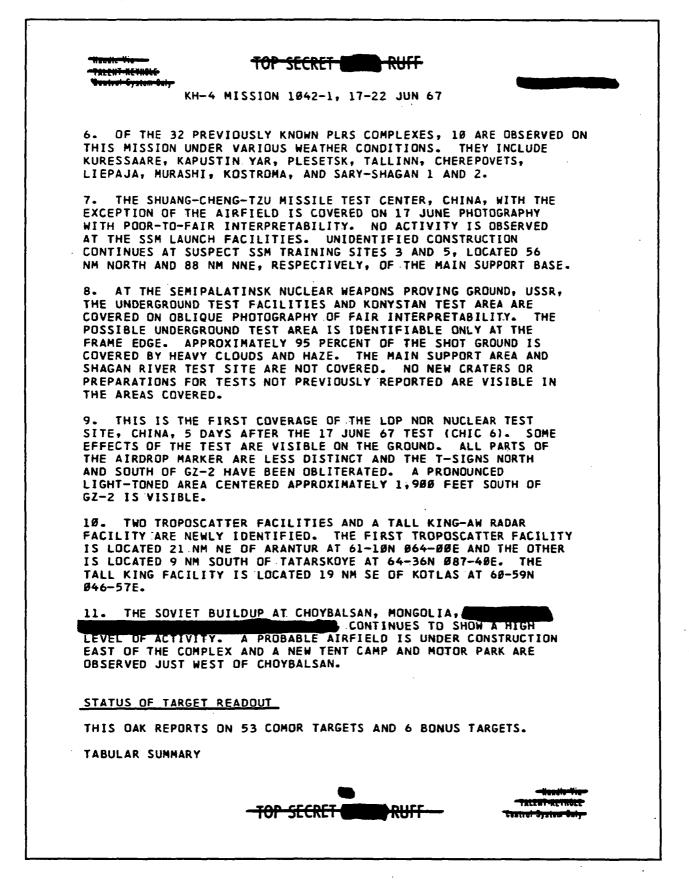


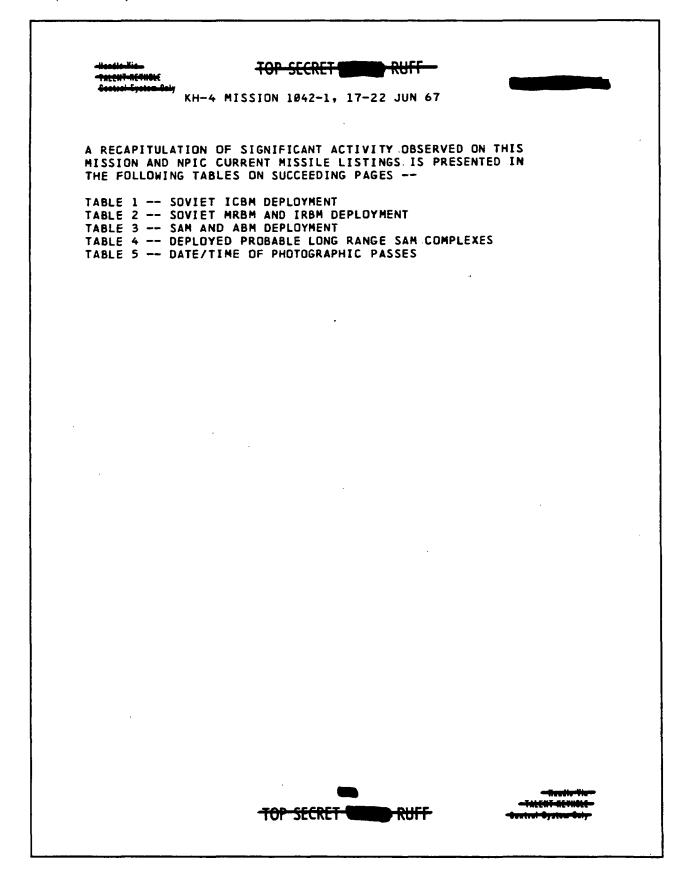


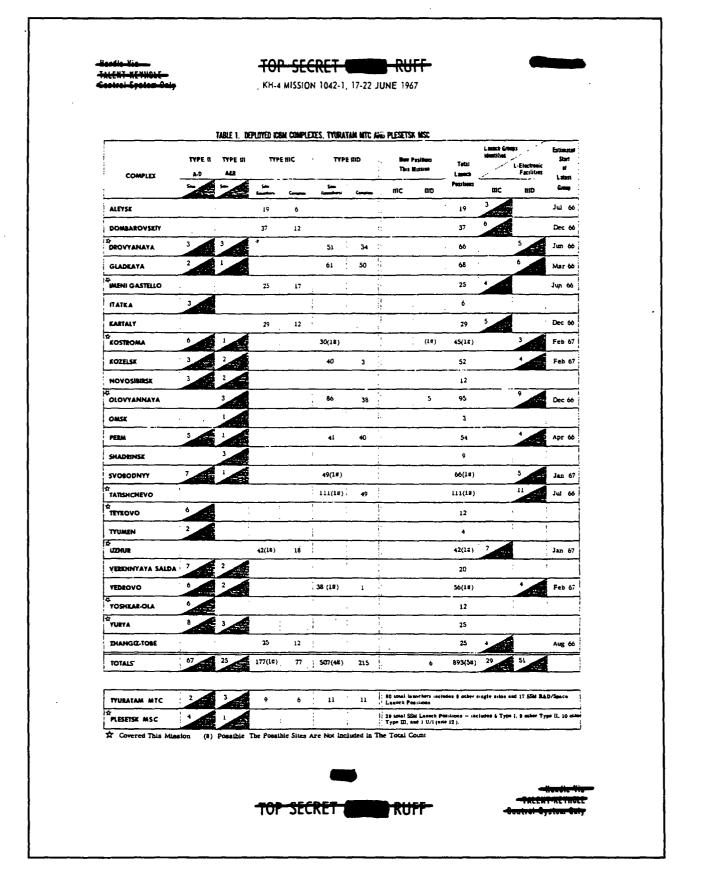


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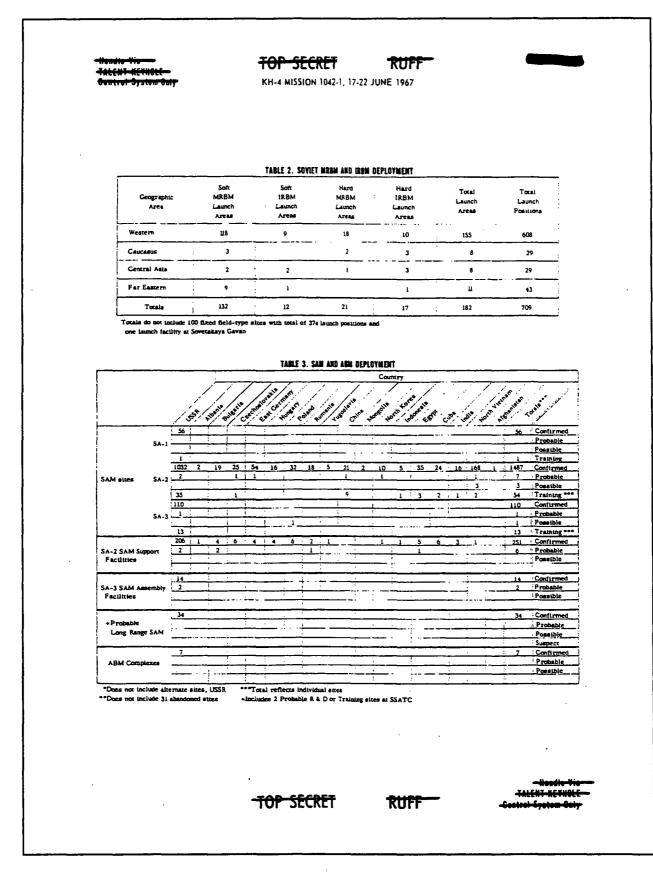


TABLE 4. DEPLOYED PROBABLE LONG RANGE SAM COMPLEXES - -----Tracking/Guidance Facility No of Positions Sites Teaching/Guidance Siles Associated Al Associated Air Complex Orlentation Complex Facility No of Position Orlentation Warning Facility Woining Facility ANGARSK 3 355* LIEPAJA 5 r 244" r 314* MOZHAYSK -1 BABAYEVO 3 3 285° MURASIII BORSHCHEV 5 🖌 Prob 341* 3 298* CHELYABINSK 3 321 * NEYA 3 CHEREPOVETS r 360" NIZHNIY TAGIL 3 5 360* **STANU** TOP SECRET NIZHNYAYA TURA 133* 3 ¥ FEODOSIYA з 3 2081 an des les PERESLAVL ZALESSRIV . WAS 3 - 3 KAUNIN 308* 3 ۲ 323* MITCH 3 KALININORAD PLESETSK r 284* 356* 3 3 at Kal 3 SARY SILAGAN I KAPUSTIN YAR 201 ° Y 2 ACCEPTION OF 3 113° -- 2 237* KHABAROVSK 3 05° SARY-SHAGAN 2 2 r -2 311* SHARYA KIMRY 3 r 2 295* at the set 著干 3 V 230" SVERDLOVSK KIYEV 3 r 325° 3 o n MA . . TALLINN 5 KOSTROMA 337° 3 s r 283* ARR II 3 3 36° TOMSK 342" 3 KRASNOYARSK 3 1.17 208* 3 260° VENTSPILS 3 RURESSAARE 3 26 3 18° LENINGRAD NE VOLGOGRAD 3 5 r 150* .a. . 315* 5 LENINGRAD NW ANDREE 5 205" LENINGRAD SW **NEXTERNA** NITERLINE 111 TOTALS 34 110 13+1 Prob - 11 K A Covered this mission 🖌 Identified at this complex * Probable R&D or training associated

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26. (Continued)

TOP SECRET

KH4 MISSION 1042-1,

17-22 JUNE 1967

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26. (Continued)

	Paes	Date	Carnes	ra ON	Carner	ra OFF	Pass	Data	Came	ra ON	Camer	a OFF
	Paes	Date	Hr(Z)	Min(2)	Hr(Z)	Min(Z)	Paes	Date	Hr(Z)	Min(Z)	Hr(Z)	Min(Z
	4D	17 Jun 67	03	32	03	33	52D	20 Jun 67	03	32 .	03	32
	5D	17 Jun 67	05	05	05	06	53D (Part 1)	20 Jun 67	[:] 05	04	05	06
	6D (Part 1)	17 Jun 67	06	38	06	39	53D (Part 2)	20 Jun 67	. 05	07	05	08
	6D (Part 2)	17 Jun 67	06	43	06	46	53D (Part 3)	20 Jun 67	05	23	05	25
	7 D	17 Jun 67	08	06	08	08	55D (Part 1)	20 Jun 67	08	01	08	02
	8D	17 Jun 67	09	33	09	35	55D (Part 2)	20 Jun 67	08	06	08	10
	9D (Part 1)	17 Jun 67	11	04	11	04	56D	20 Jun 67	09	29	09	32
	9D (Part 2)	17 Jun 67	11	05	11	06	57D (Part 1)	20 Jun 67	11	02	11	05
	9D (Part 3)	17 Jun 67	11	10	11	12	57D (Part 2)	20 Jun 67	11	09	11	10
	9D (Part 4)	17 Jun 67	11	18	11	19	57D (Part 3)	20 Jun 67	11	19	11	22
	10D	17 Jun 67	12	41	12	42	58D	20 Jun 67	12	40	12	42
	IID	17 Jun 67	14	12	14	12	59D	20 Jun 67	14	11	14	12
	13D	17 Jun 67	17	19	17	23					••	
							68D	21 Jun 67	03	30	03	31
							69D (Part 1)	21 Jun 67	05	03	05	04
_	21D	18 Jun 67	05	08	05	10	69D (Part 2)	21 Jun 67	05	05	05	06
	22D	18 Jun 67	06	43	06	44	69D (Part 3)	21 Jun 67	05	22	05	24
	23D (Part 1)	18 Jun 67	08	03	08	05	70D	21 Jun 67	06	32	06	33
	23D (Part 2)	18 Jun 67	08	07	08	09	71D (Part 1)	21 Jun 67	08	00	08 .	01
	24D	18 Jun 67	09	33	09	34	71D (Part 2)	21 Jun 67	08	05	08	07
	25D (Part 1)	18 Jun 67	11	04	11	06	71D (Part 3)	21 Jun 67	08	08	08	10
	25D (Part 2)	18 Jun 67	11	11	11	13	72D (Part 1)	21 Jun 67	09	28	09	32
	26D	18 Jun 67	12	43	12	44	72D (Part 2)	21 Jun 67	09	33	09	34
	29D	18 Jun 67	17	21	17	23	730	21 Jun 67	11	03	11	04
	30D	18 Jun 67	18	59	19	01	74D (Part 1)	21 Jun 67	12	37	12	38
							74D (Part 2)	21 Jun 67	12	39	12	40
	36D	19 Jun 67	03	35	03	37	770	21 Jun 67	17	16	17	20
	37D (Part 1)	19 Jun 67	05	· 02	05	04			• *	10	17	20
	37D (Part 2)	19 Jun 67	05	04	05	06	84D	22 Jun 67	03	27	03	31
	37D (Part 3)	19 Jun 67	05	07	05	09	850	22 Jun 67	05	01	05	02
	38D (1 att 5)	19 Jun 67	06	32	06	33	86D (Part 1)	22 Jun 67	06	30	06	31
	39D	19 Jun 67	08	05	08	10	86D (Part 2)	22 Jun 67	06	33	06	34
	40D	19 Jun 67	09	32	09	33	87D (Part 1)	22 Jun 67	07	56	07	59
	41D	19 Jun 67	11	10	11	11	87D (Part 2)	22 Jun 67	08	Ot	08	02
	45D	19 Jun 67	17	19	17	24	87D (Part 3)	22 Jun 67	08	03	08	03

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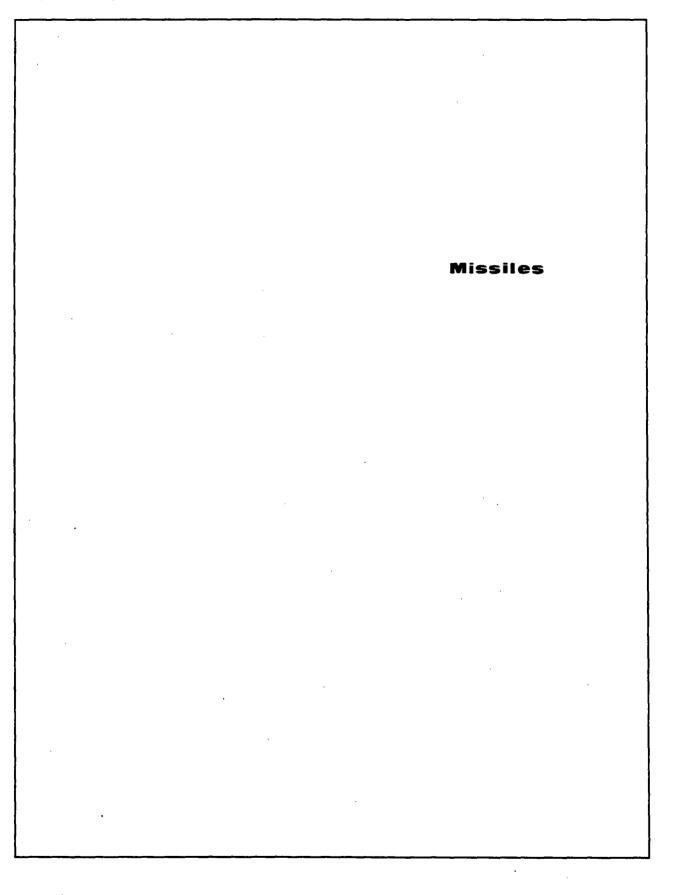
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Handle Vin-TALENT PERMON Convert System Daty

TOP SECRET RUFF

26. (Continued)



Headle-Vie- Fat CNT-KCXHOLC	TOP SECRET CON RUFF
-Destroi - System - D	KH-4 MISSION 1042-1, 17-22 JUN 67
87D F	/72-89 & A/72-89 SC,H F PT PS
TATISHCHEVO	ICBM CDMPLEX UR 5140N 04534E
COVERE AND 8	IMATELY 95 PERCENT OF THE SEARCH AREA IS CLOUD D. NINE TYPE IIID LAUNCH SITES ARE INTERPRETABLE ADDITIONAL SITES CAN BE IDENTIFIED ONLY. NO NEW E ACTIVITY OBSERVED.
72D F PS	/100-109 & A/98-108 HC,H,O P PT
KAPUSTIN YA	R/VLADIMIROVKA MSL TEST CTR UR 4835N Ø4545E
SCATTE SEVERE FACILI	TIRE CENTER IS COVERED ON PHOTOGRAPHY BUT RED-TO-HEAVY CLOUD COVER AND CLOUD SHADOW LY LIMIT INTERPRETABILITY. NO NEW MISSILE TIES OBSERVED IN THE VISIBLE PORTIONS OF THE SEARCH AREA.
720 F PS	/122-129 & A/121-128 SC,CS,H P T
KAPUSTIN YA	R LAUNCH COMPLEX B UR 4841N 84616E
ONLY A	PORTION OF THE LAUNCH AREA IS VISIBLE.
CONSTR	SILES, MISSILE-RELATED EQUIPMENT, NEW UCTION, CHANGES IN FACILITIES, OR PREVIOUSLY RTED FEATURES OBSERVED.
72D F	/125 (71.6-10.9) HC,CS,H P PT NS
KAPUSTIN YA	R LAUNCH COMPLEX C UR 4836N Ø4616E
	RED CLOUDS, CLOUD SHADOW, AND HAZE SEVERELY LIMIT Retation of Launch Complex C.
APPROX REMAIN MISSIL	AREA 1C PAD 1C-1 IS CLOUD COVERED. THE IMATELY 80-FT-LONG RAIL-SERVED CYLINDER-ERECTOR S ON PAD 1C-2. ON PAD 1C-3, A PROBABLE E/ERECTOR IS ERECTED AT THE SAME POSITION. THE IMATELY 44-FT-LONG CYLINDRICAL OBJECT
	TOP-SECRET CALLED RUFF

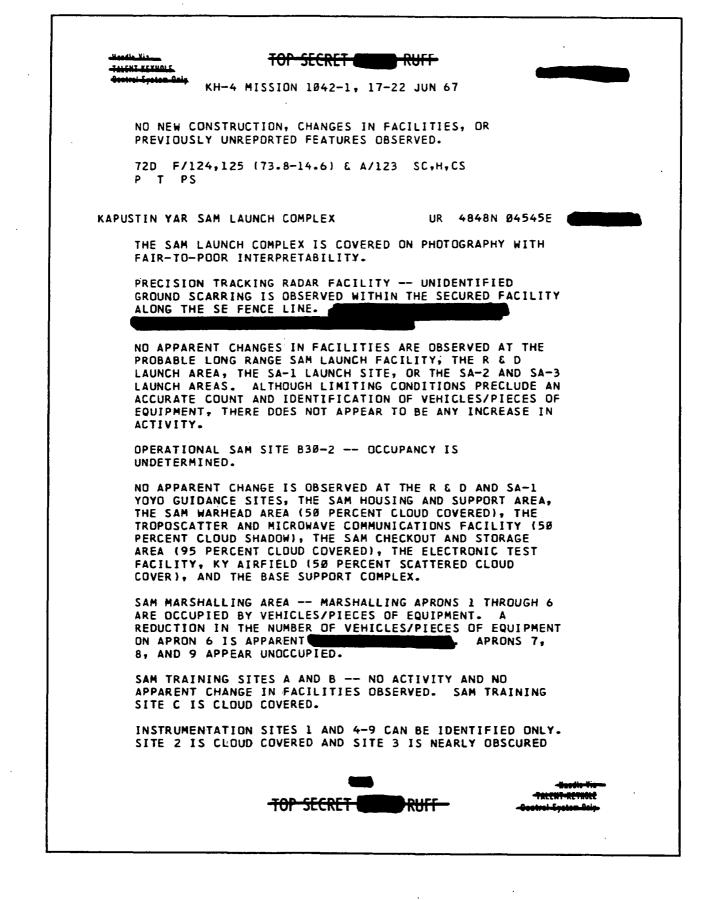
-Handle Yis. -TALENT-KETHOLE	TOP SECRET	RUFF		
-Centrel System Only	KH-4 MISSION 1042-1, 17	-22 JUN 67		
	EA 2C PAD 2C-1 IS CL WITH A PROBABLE TRANSP		· · · · · ·	
	EA 3C A PROBABLE ERE Checkout tent is obser			
OPEN, ALL	EA 4C AT LAUNCH SITE Other Silos Appear Clo SW Silo IS Open, All O	SED. AT LAUNC	H SITE	
LAUNCH AR	EA .5C THE AREA IS CL	DUD COVERED.		
LAUNCH AR	EA 6C CONSTRUCTION C RNIBLE.	DNTINUES. DET	AILS ARE	
72D F/120 P PT PS	5 (71.8-12.8) & A/124,1	25 SC∌H∳HC		
APUSTIN YAR L	AUNCH COMPLEX D	UR 4828	N Ø4618E	
PREVIDUSL' VEHICLES/I	NAMIC VEHICLE, SIMILAR 7, IS ON A LAUNCHER AT PIECES OF EQUIPMENT ARE DUT BUILDING.	LAUNCH AREA 3D	•	
72D F/120 P PT PS	5,127 (71.7-14.3) & A/1	25 SC+H+CS		
APUSTIN YAR L	AUNCH COMPLEX G	UR 4822	N Ø4617E	
A ROW OF THE BARRA	VEHICLES/PIECES OF EQUI CKS AREA.	PMENT IS JUST	NORTH OF	
	NSTRUCTION, CHANGES IN V UNREPORTED FEATURES O			
72D F/12 PT PS	7 (69.9-12.1) & A/125	SC,H,CS P		
APUSTIN YAR L	AUNCH COMPLEX H	UR 4848	N 04620E	
VEHICLES/	PIECES OF EQUIPMENT ARE	ON BOTH LAUNC	H PADS.	
			-ttoodio tic-	
	TOP-SECRET	RUFF	TALENT-RETHOLE	

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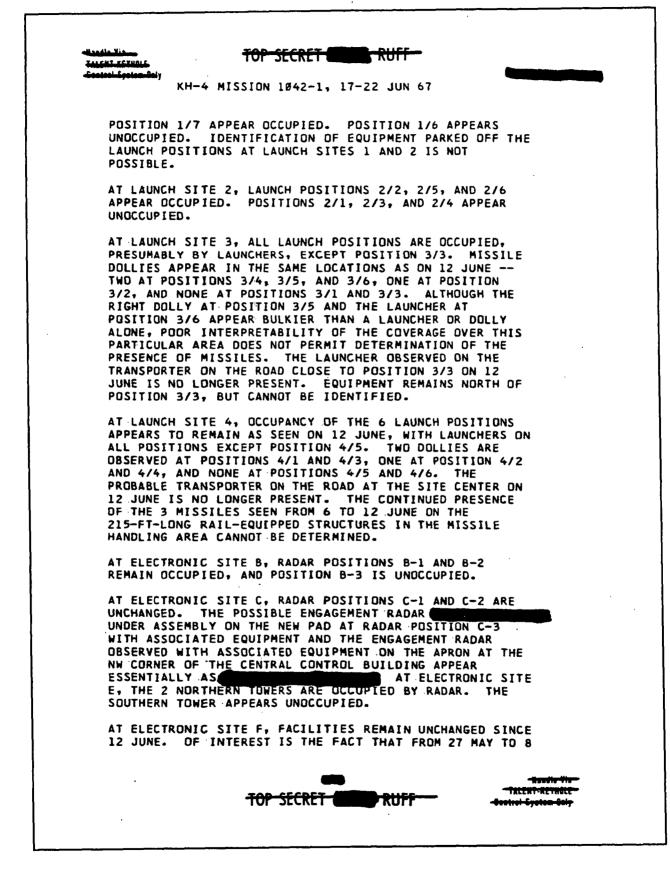
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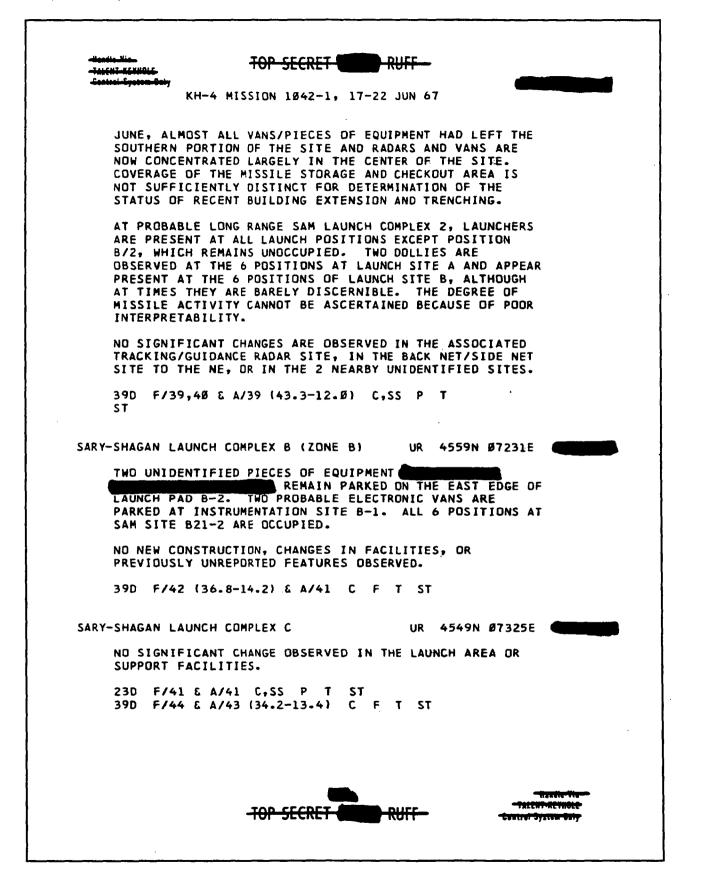
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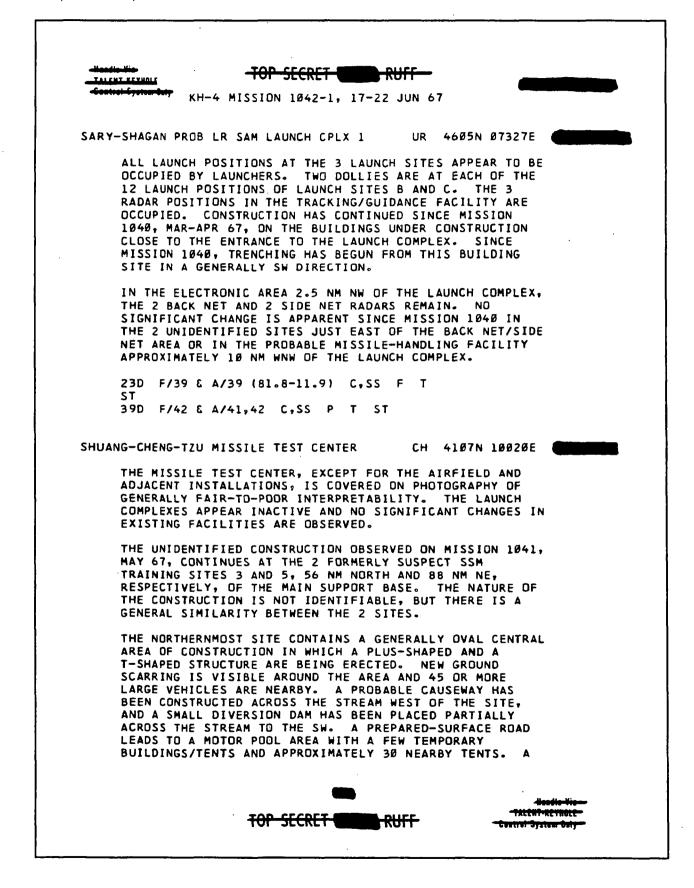


-Hondle Vio- -TALENT NETHOLE - Contest Sector Only	TOP SECRET	RUFF	
KH-4	MISSION 1042-1, 17-	22 JUN 67	
BY CLOUD SHAD	DW.		
72D F/123-12 H,SC,CS P P	5 & A/122,123 { 30.3- T PS	10.3)	
APUSTIN YAR MISSI	LE STOR & HANDLING A	REA UR 4822N Ø4612E	
PROBABLE ASM Previous cove		SAME POSITIONS AS ON	
72D F/127 (6 PS	9.9-12.1) & A/126 S	C F T	
APUSTIN YAR MSL T	EST & SUPPORT COMPLE	X UR 4834N Ø4553E	
CONSTRUCTION,	MISSILE-RELATED EQUI Changes in faciliti Atures observed.		
72D F/126 (6 T PS	3.9-13.9) & A/124 S	C,H,CS F	
ARY-SHAGAN ANTIMI	SSILE TEST CENTER	UR 46Ø2N Ø7334E	
TRACKING FACI Stered Photog	LITIES 6 AND 8 ARE C	AIR INTERPRETABILITY.	5
39D F/34-45	& A/36-45 H,SS F & A/33-41 C,SS F & A/43-45 C,SS F		
SARY-SHAGAN LAUNCH	COMPLEX A (ZONE A)	UR 4625N Ø7252E	
COMPLEX 2 ARE CLEAR, STEREO INTERPRETABIL ELECTRONIC SI THE HEADQUART	TES D AND G, THE SIT	7 ON DNE PASS OF -TO-POOR CHANGES ARE OBSERVED LAUNCH SITES 5 AND 6 E SUPPORT FACILITY, ON AREA, THE ON-SITE	
AT LAUNCH SIT	E 1, LAUNCH POSITION	S 1/1 THROUGH 1/5 AND	
			-liendie-lie- NCCUT-NETHIOLE-
	TOP-SECRET	CUTT terr	al System Buly



26. (Continued)

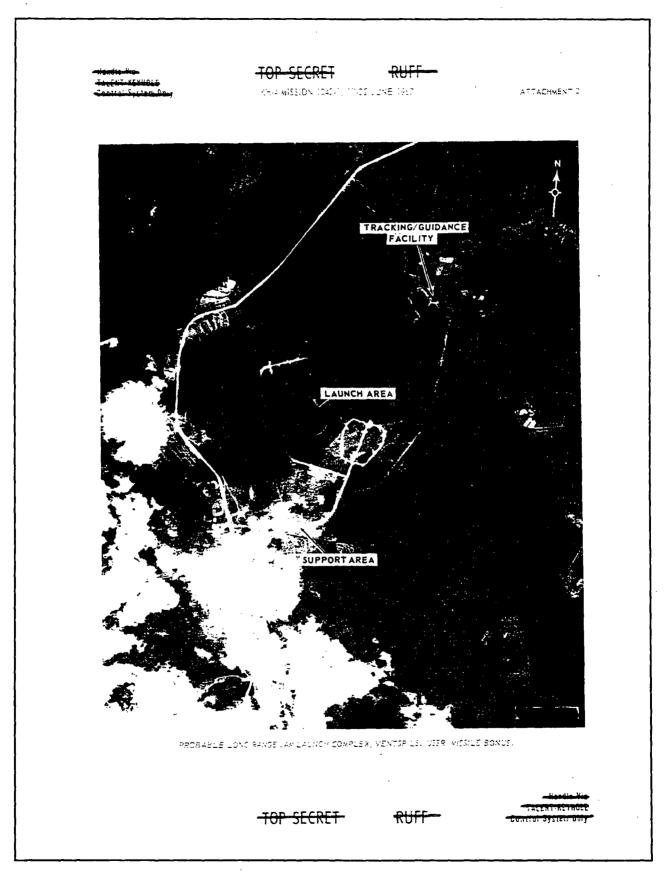




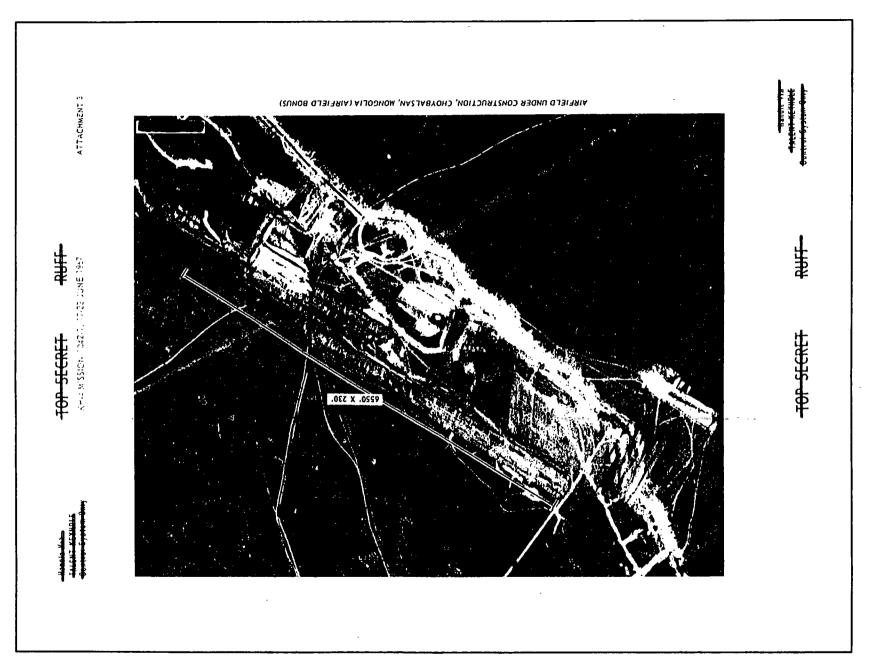
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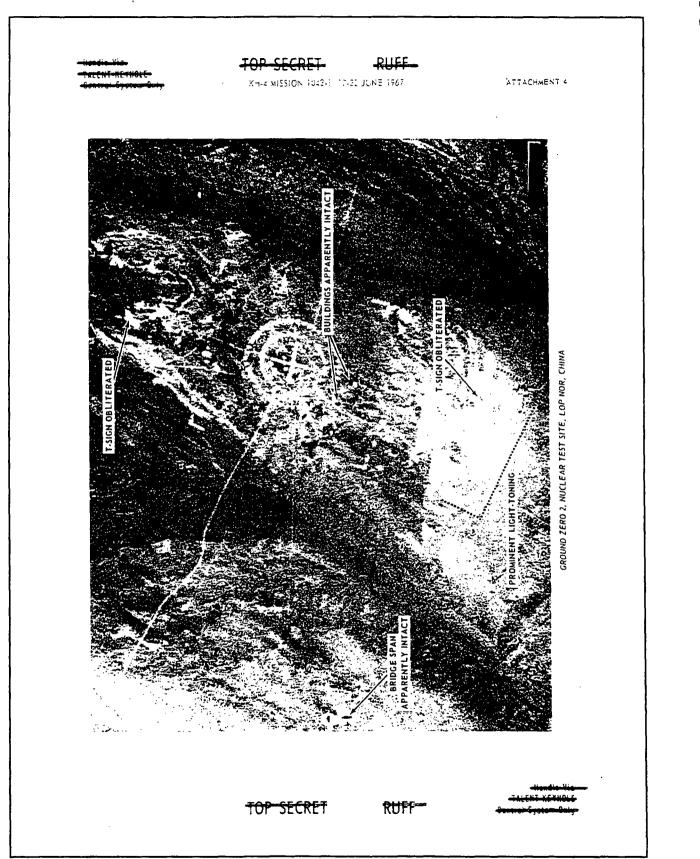
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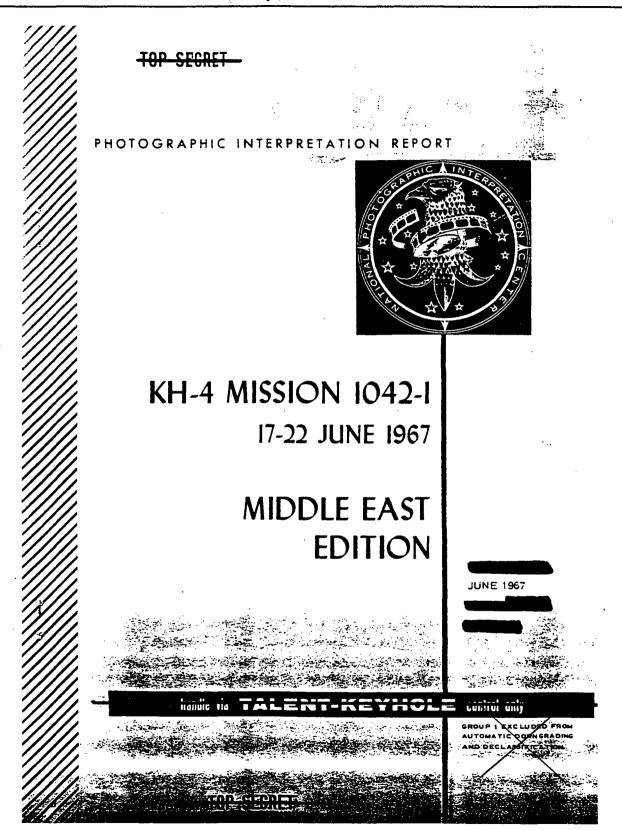


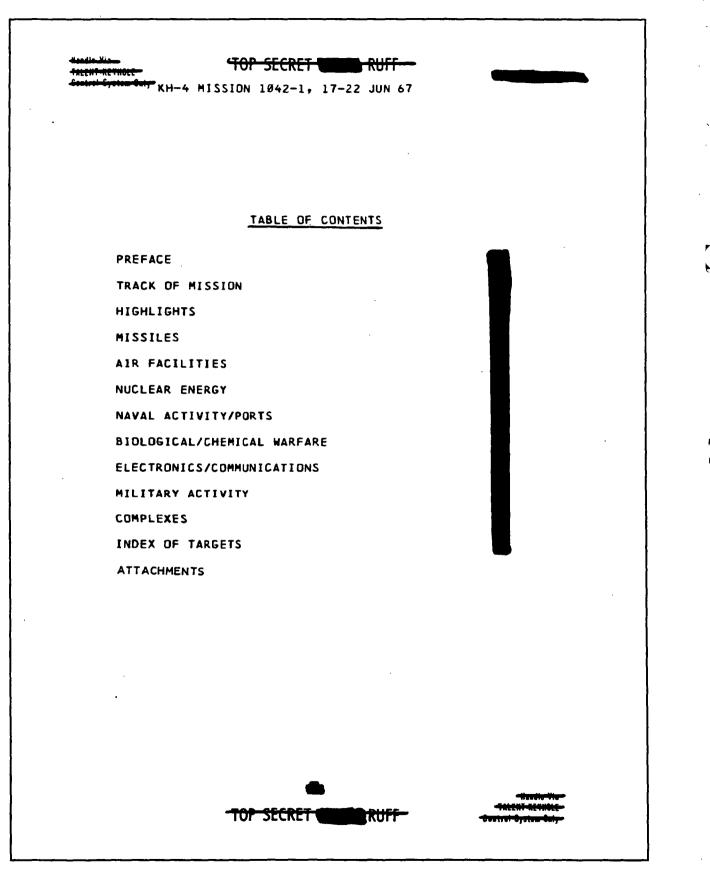


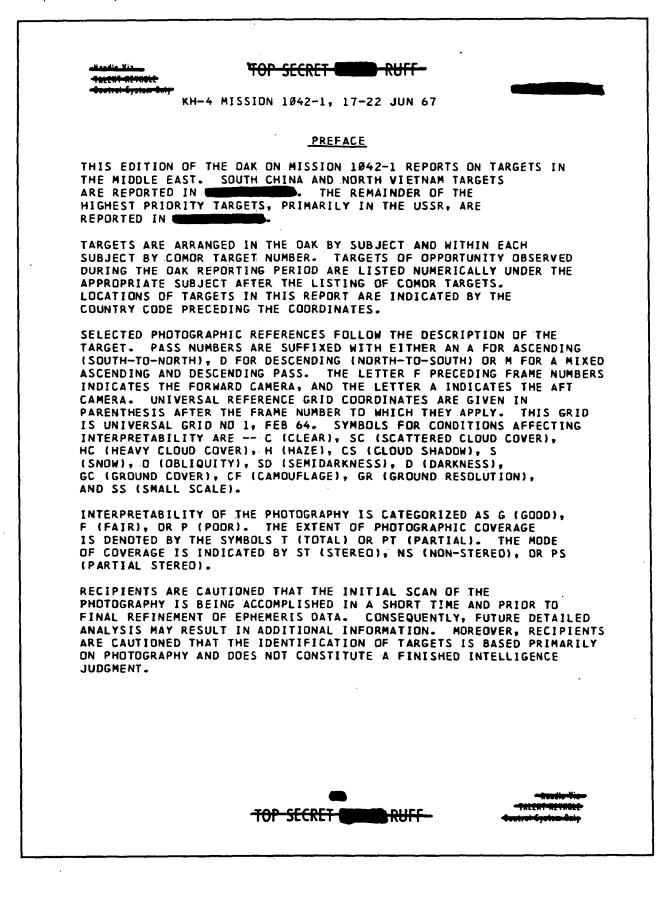


27. CIA/NPIC, Photographic Interpretation Report, "KH-4 Mission 1042-1, 17-22 June 1967, Middle East Edition," June 1967 (Excerpt)

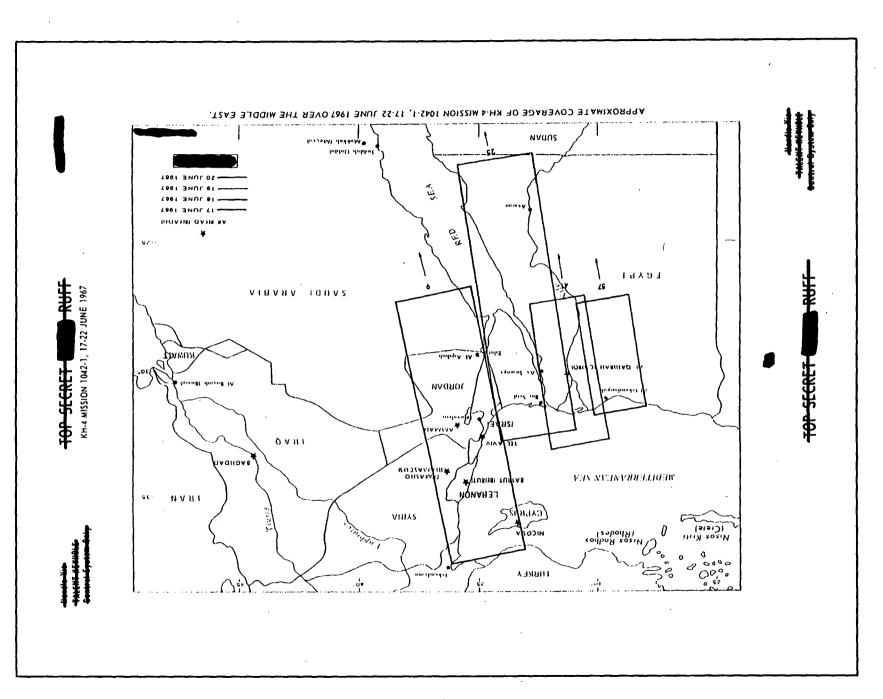
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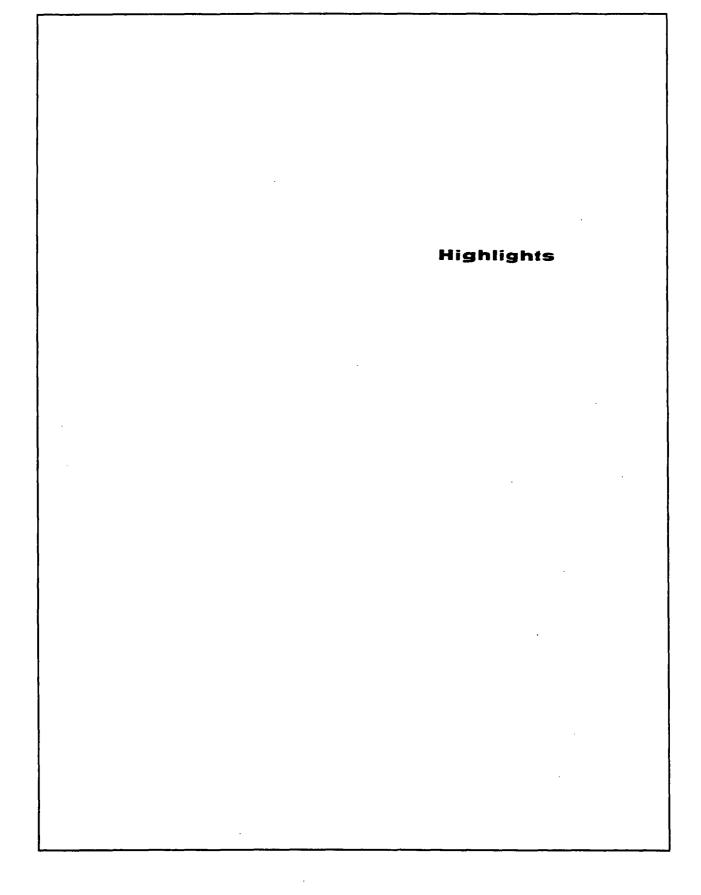
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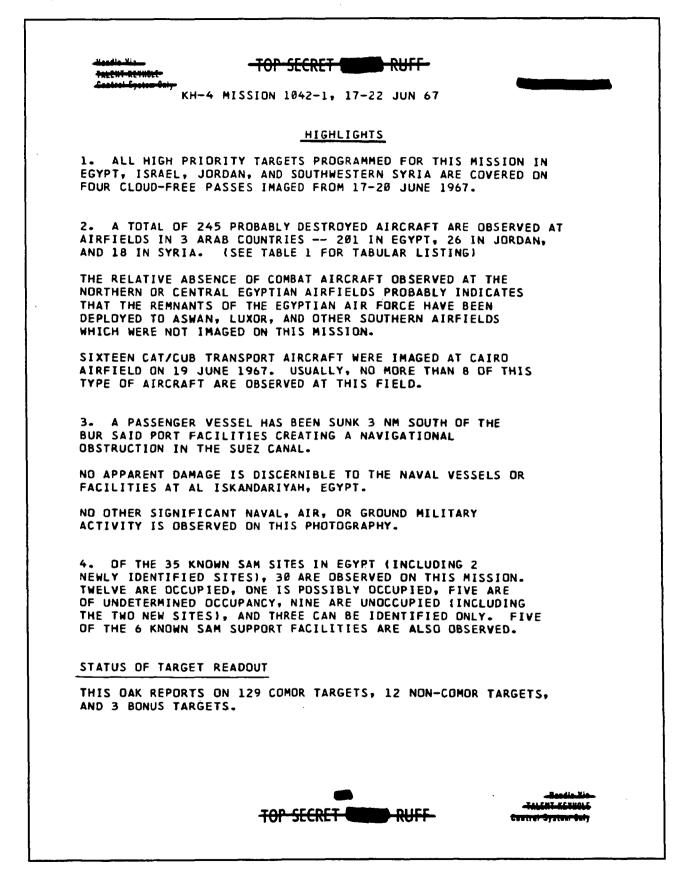


TABLE 1. BOMB DAMAGE, ARAB AIRFIELDS PROBABLE AOB PHOTO DATE RUNWAY DAMAGE AIRFIELD NAME OTHER DAMAGE DESTROYED CN FIGHTERS BOMBERS AIRCRAFT EGYPT ABU SUWEIR 18 & 19 JUNE 67 37 24 CRATERS NONE NONE NONE AL ARISH 18 JUNE 67 6 CRATERS NONE 7 POSS A/C 7 NONE AT LEAST 13 CRATERS BENI SUEF 19 JUNE 67 12 NONE NONE NONE BIR HASANAH NEW 18 JUNE 67 NONE 13 NONE NONE NONE BIR JIFJAFAH 18 JUNE 67 NONE 22 NONE NONE NONE **3 CRATERS** . CAIRO 19 JUNE 67 NONE NONE **1 SMALL SWEPT** NONE 24 CRATERS CAIRO WEST 19 JUNE 67 25 NONE 16 SMALL SWEPT 1 BADGER EL MANSURA 19 JUNE 67 NONE 9 CRATERS NONE NONE NONE (REPAIRED) TOP SECRET FAYID 18 & 19 JUNE 67 14 17 CRATERS/ NONE NONE NONE CHARRED AREAS GAZA 18 JUNE 67 22 NONE NONE NONE NONE HURGHADA NEW 18 JUNE 67 7 NONE NONE NONE NONE 9 POSS CRATERS INCHAS 19 JUNE 67 20 PARTIALLY DE-NONE NONE STROYED HANGAR KABRIT 18 & 19 JUNE 67 22 8 CRATERS NONE NONE NONE NONE CHARRED AREA IN GEBEL LIBNI **18 JUNE 67** NONE NONE NONE SUPPORT FAC ALMAZA 19 JUNE 67 NO DAMAGE OBSERVED 7 SMALL SWEPT NONE NO DAMAGE OBSERVED ISMAIL1A 18 & 19 JUNE 67 NONE NONE PORT SAID 18 & 19 JUNE 67 NO DAMAGE OBSERVED NONE NONE RAS BANAS 18 JUNE 67 NO DAMAGE OBSERVED NONE NONE TOTAL 201 SYRIA PROBABLE, EXTENT UNK NONE NONE DAMASCUS 17 JUNE 67 NONE 9 NONE DUMAYR 17 JUNE 67 NONE NONE 9 NONE NO DAMAGE OBSERVED MARJ RHAYAL 17 JUNE 67 NONE NONE 17 JUNE 67 NO DAMAGE OBSERVED DAMASCUS NEW NONE NONE TOTAL 18 JORDAN 17 PROB CRATERS NONE NONE NONE AMMAN 17 JUNE 67 12 . KING HUSSEIN 17 JUNE 67 14 NONE NONE NONE NONE TOTAL 26 SAUDI ARABIA NO DAMAGE OBSERVED NONE TABUK 17 JUNE 67 NONE

GRAND TOTAL OF ARAB AIRCRAFT PROBABLY DESTROYED: 245

· CARGO AND TRANSPORT AIRCRAFT ARE EXCLUDED FROM AOB COUNT

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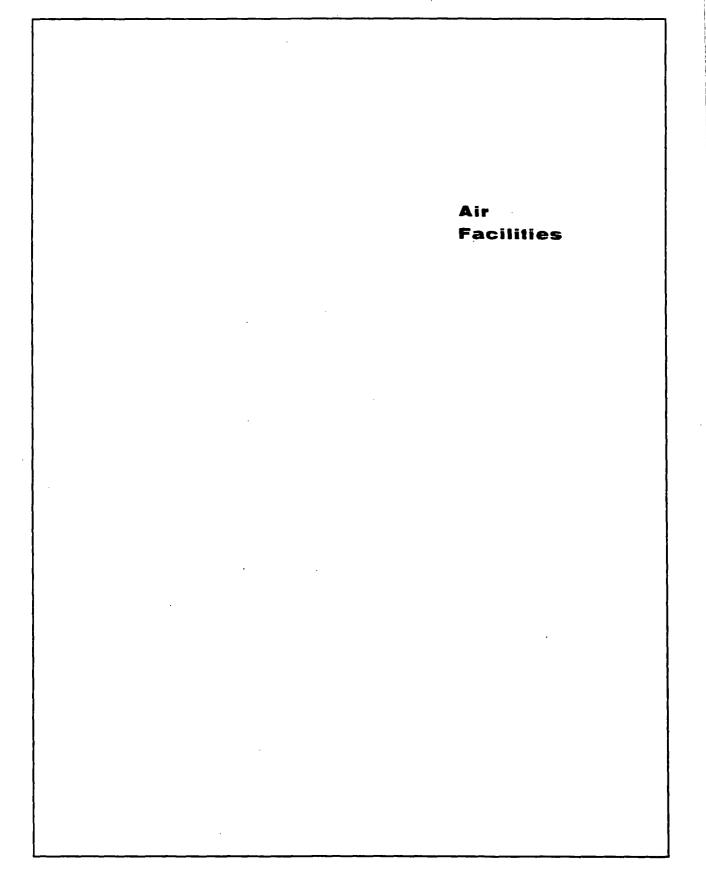
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KH-4 MISSION 1042-1, 17-22 JUNE 1967

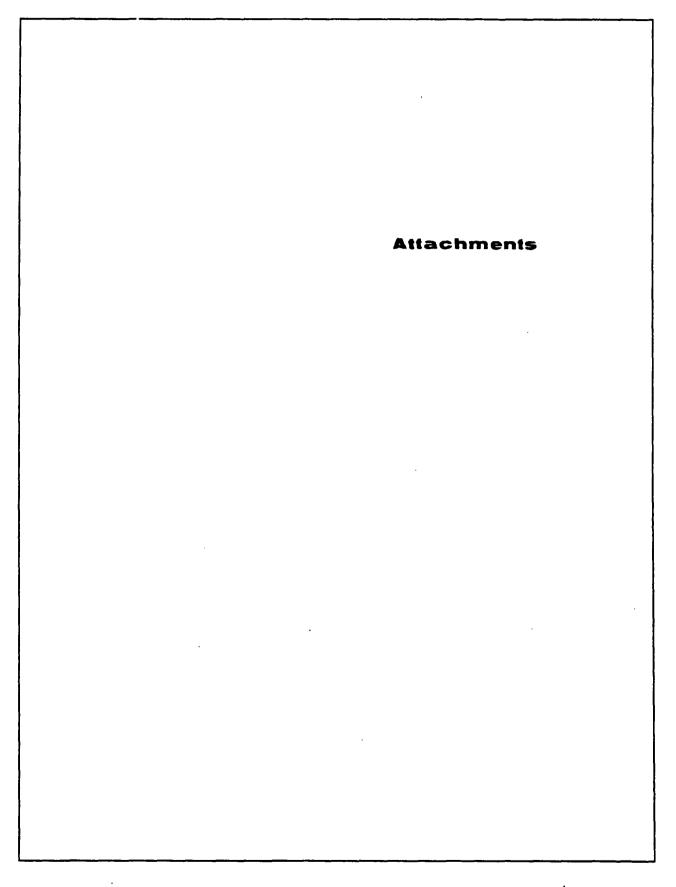
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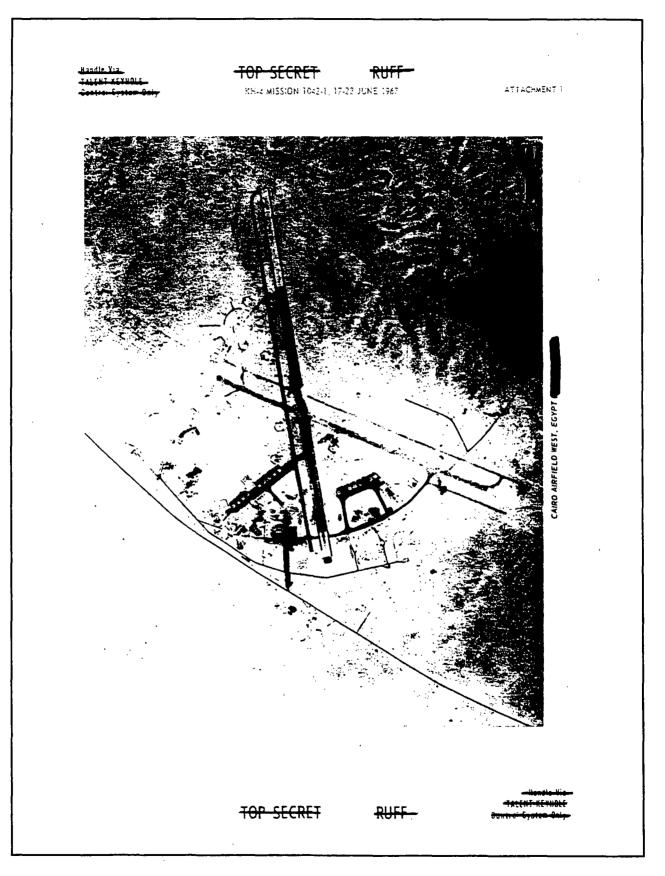
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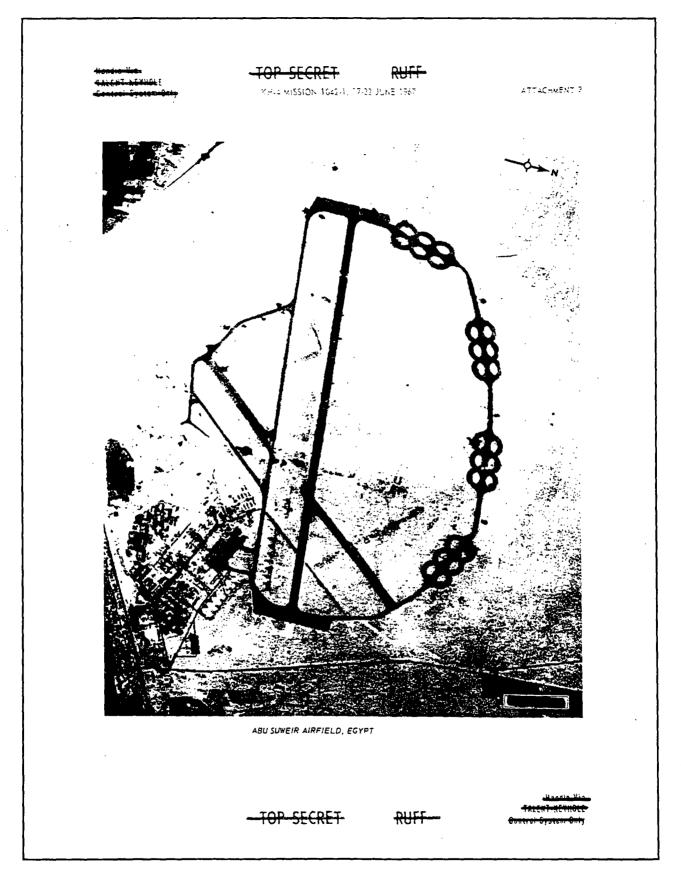


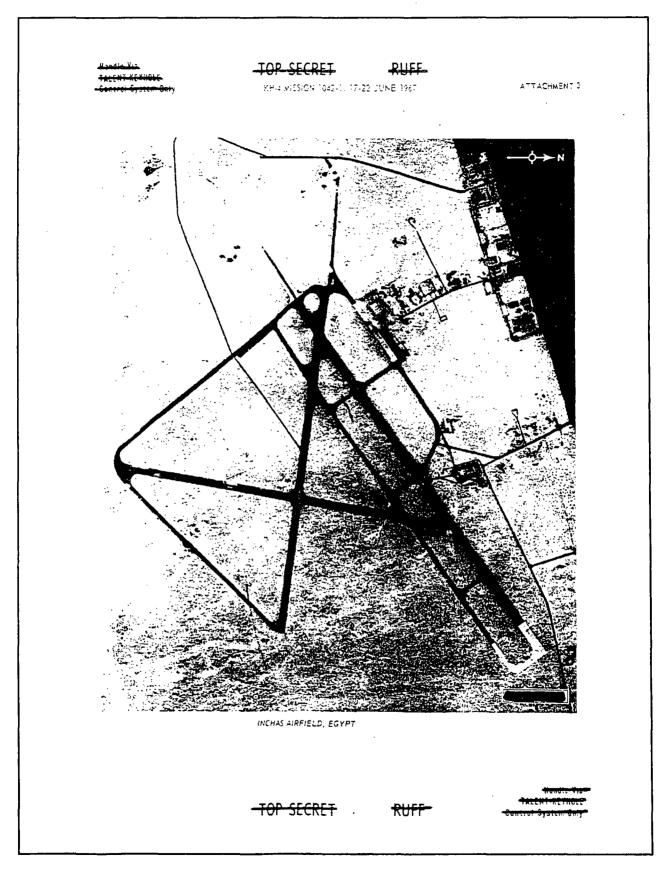
TALENT KETHOLE	
VU-4 4122104	N 1042-1, 17-22 JUN 67
DAMASCUS AIRFIELD	SY 3328N Ø3613E
OB NONE DISCERNIBL	-E•
RUNWAYS AND PARKING A	PROBABLY DESTROYED AIRCRAFT) ON AREAS ARE OBSERVED. THE MAIN VE PROBABLE BOMB DAMAGE.
9D F/38 & A/38 (22+8	3-10.8) H,D,SS P T ST
RAS BANAS AIRFIELD	EG 2358N Ø3527E
OB NONE OBSERVED.	
NO NEW CONSTRUCTION, Previously unreported	CHANGES IN FACILITIES, DR D FEATURES OBSERVED.
25D F/109 (74.2-10.6	5) & A/109 C F T ST
GEBEL LIBNI AIRFIELD	EG 3045N 03345E
OB NONE OBSERVED.	
ONE CHARRED AREA IS O	DBSERVED IN THE SUPPORT FACILITIES.
25D F/63 (56.7-13.1)	& A/62 C,SS P T ST
BIR JIFJAFAH AIRFIELD	EG 3024N 03308E
OB NONE OBSERVED.	
TWENTY-TWO CHARRED AR AIRCRAFT) ARE OBSERVE	REAS (PROBABLY 22 DESTROYED ED.
25D F/65 (35.4-13.Ø)	ε A/64 C F T ST
AL ARISH AIRFIELD	EG 3104N 03350E
OB 7 POSSIBLE AIRC	RAFT.
AREAS (PROBABLY DESTR	ATERS DN NW/SE RUNWAY, 3 CHARRED Royed Aircraft) on the East end of Granred Areas (probably destroyed Are observed.
- TOP	-Headine Hilder

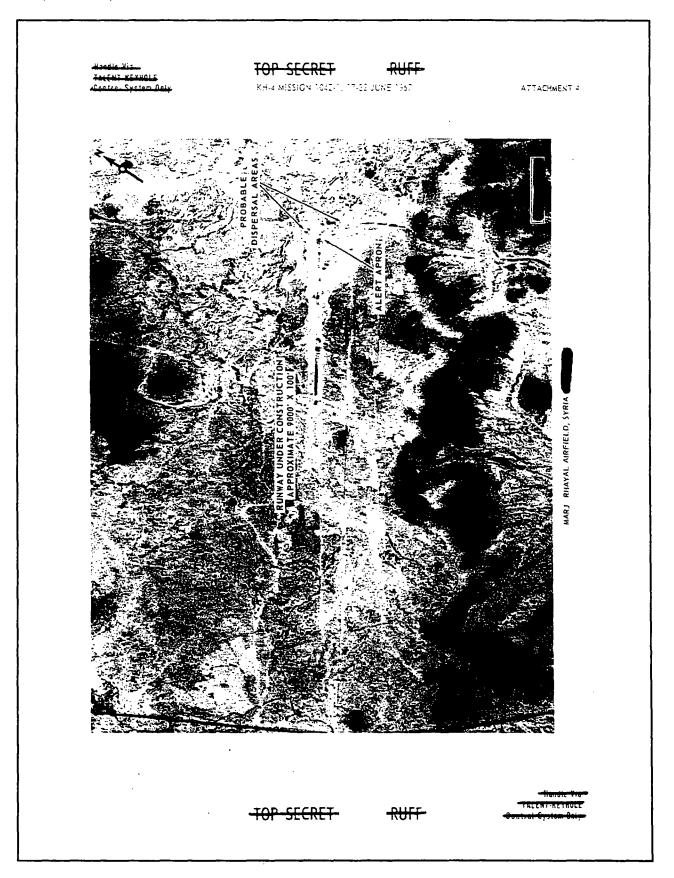


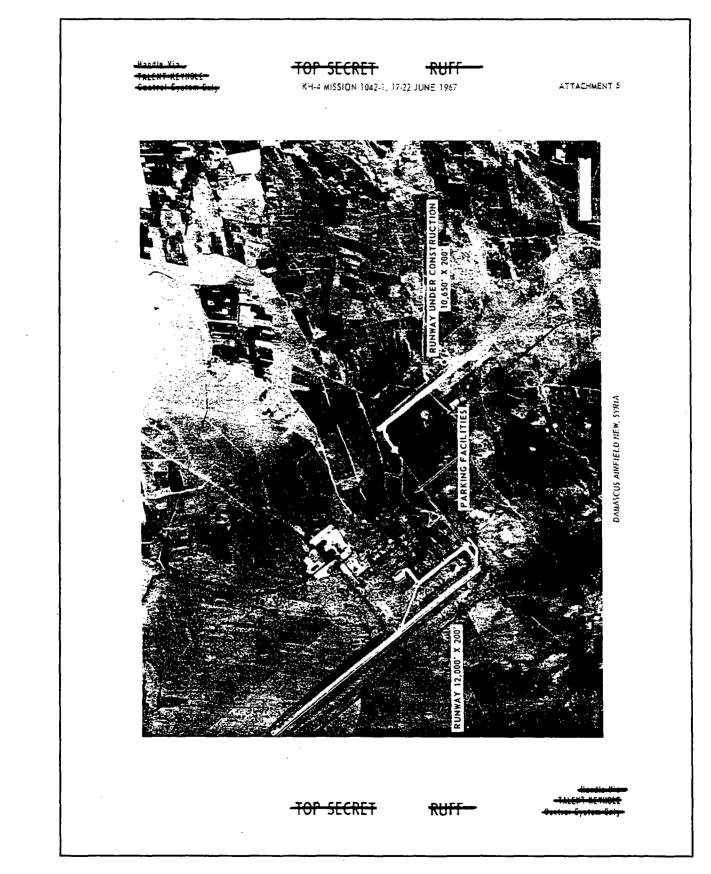
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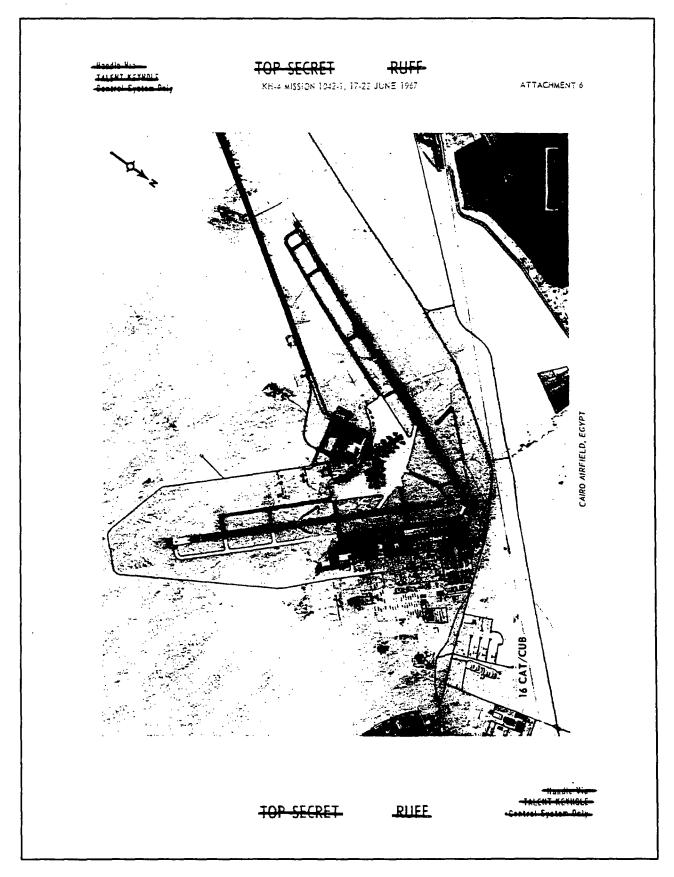




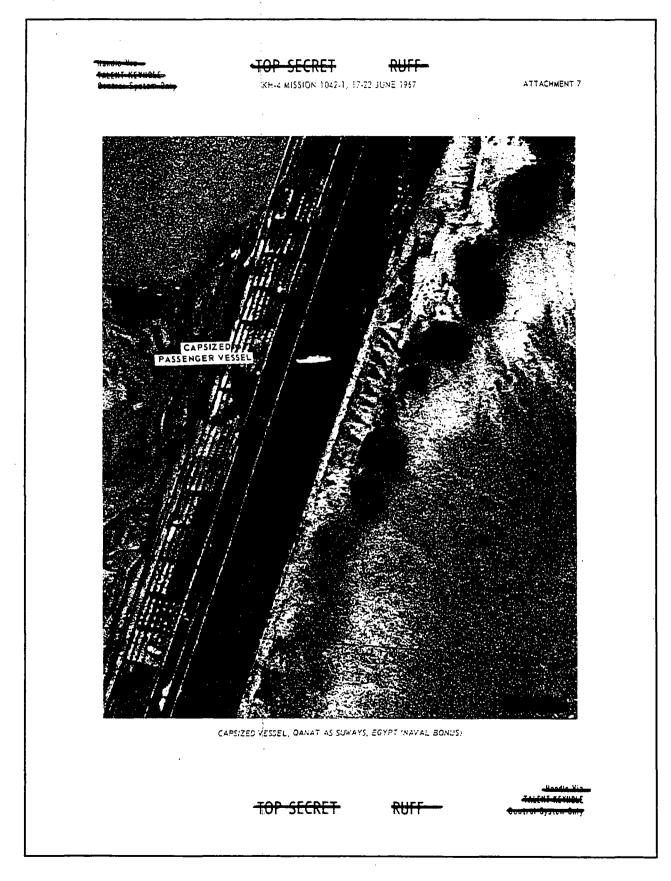


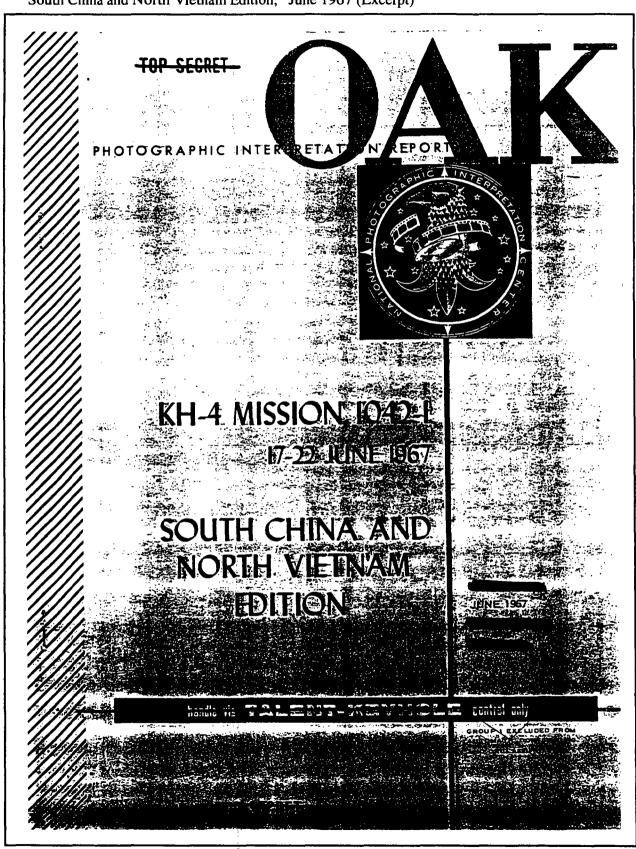






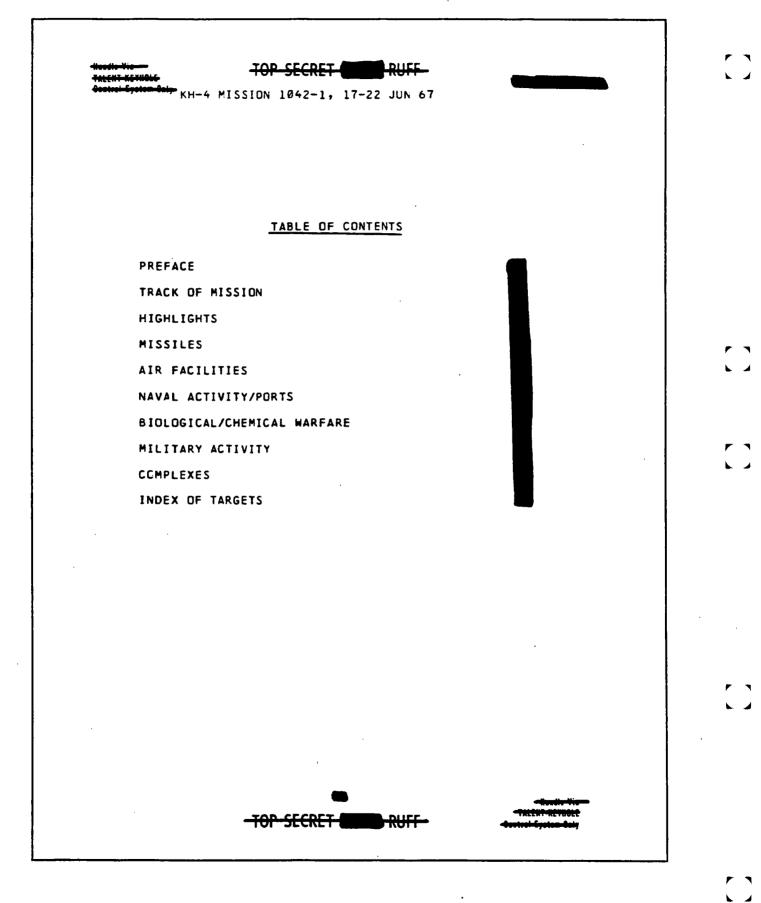
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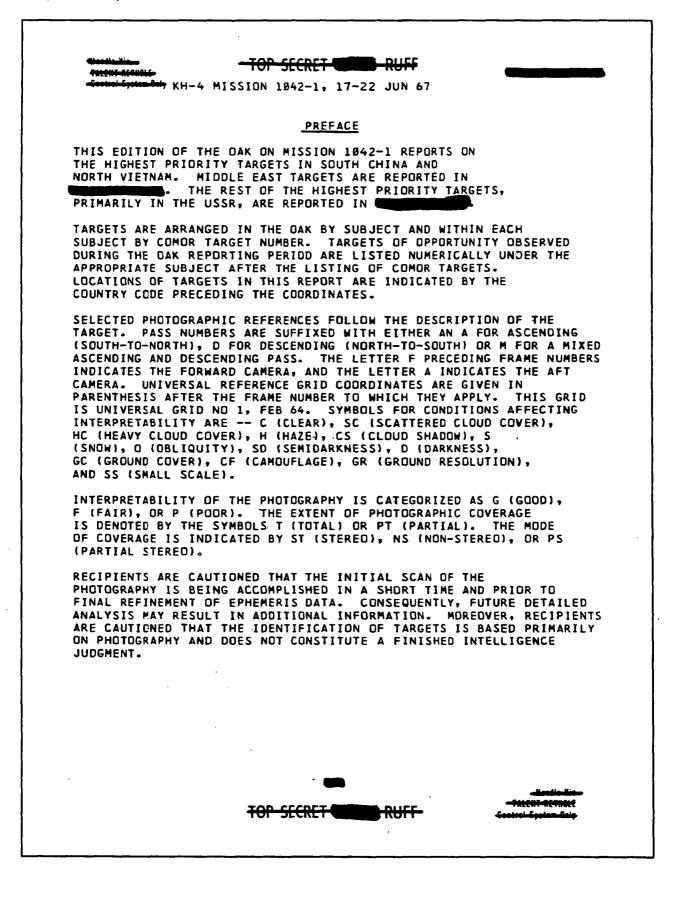




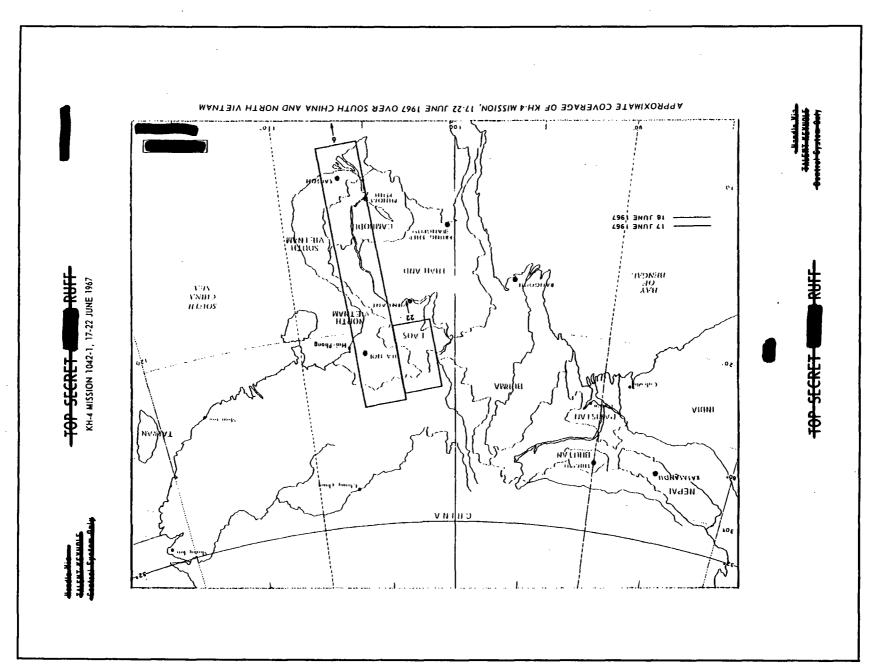
28. CIA/NPIC, Photographic Interpretation Report, "KH-4 Mission 1042-1, 17-22 June 1967, South China and North Vietnam Edition," June 1967 (Excerpt)

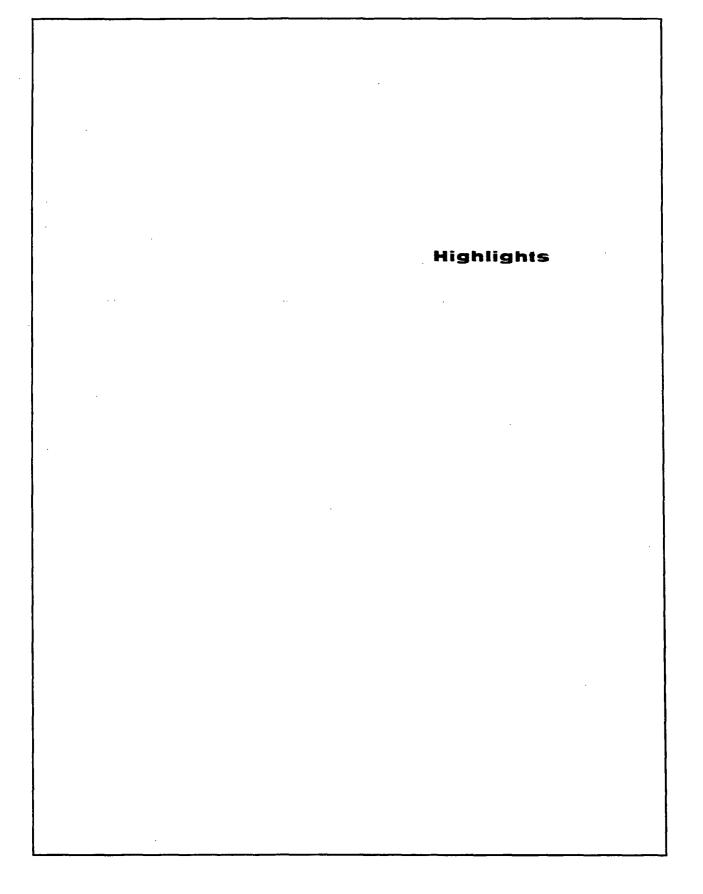
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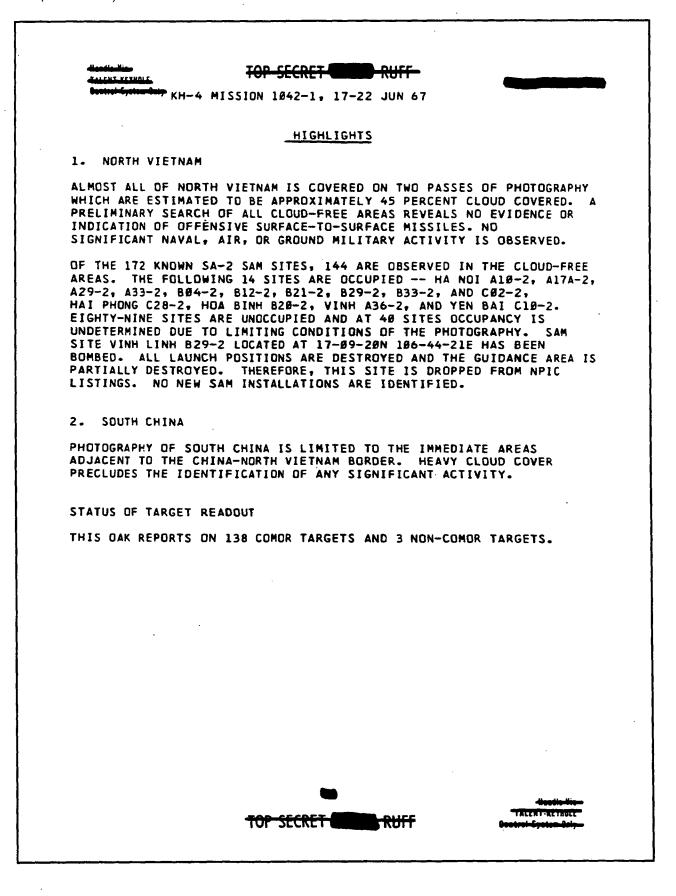




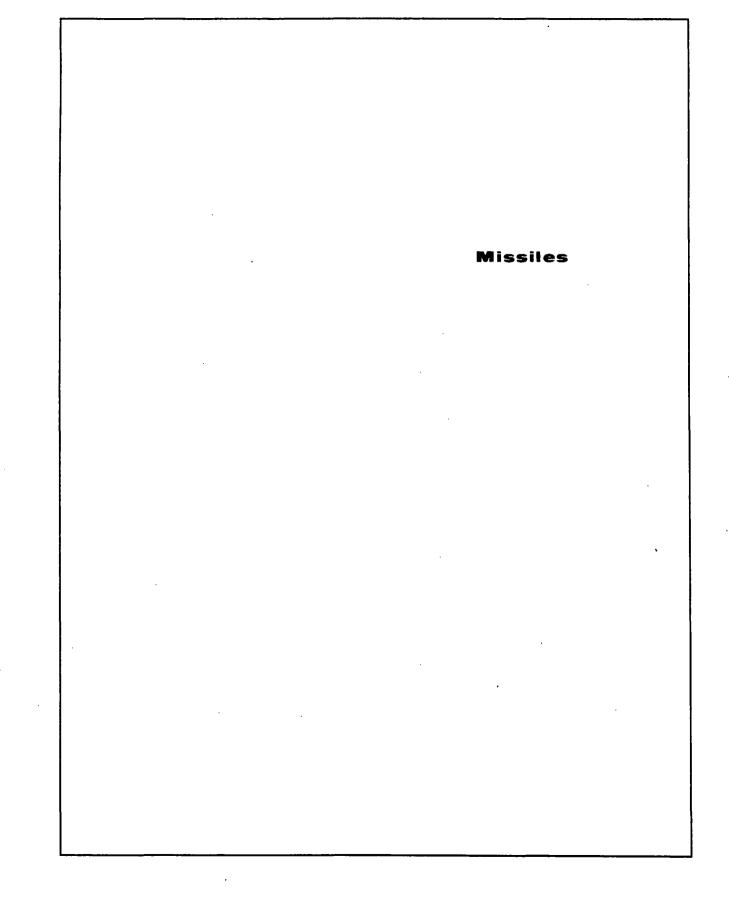




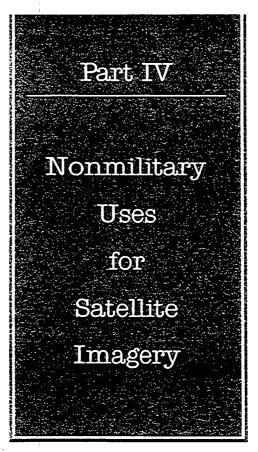




28. (Continued)



-Handle Views -Tatter - Revolut	TOP-SECRET CONTRACTOR
-Control-System-Caly	KH-4 MISSION 1042-1, 17-22 JUN 67
THANH HOA SAM	SITE A19-2 (87) VN 1941N 10546E
CONSTRUCT	LES, MISSILE-RELATED EQUIPMENT, NEW TION, CHANGES IN FACILITIES, OR PREVIOUSLY ED FEATURES OBSERVED.
6D F/45	& A/45 (38.8-10.6) C F T ST
THANH HOA SAN	SITE B28A-2 (100) VN 1950N 10529E
CONSTRUCT	LES, MISSILE-RELATED EQUIPMENT, NEW TION, CHANGES IN FACILITIES, OR PREVIDUSLY ED FEATURES OBSERVED.
60 F/45	& A/44 (47.7-9.5) C F T ST
THANH HOA SAM	SITE B27-2 (109) VN 1948N 10532E
CONSTRUCT	LES, MISSILE-RELATED EQUIPMENT, NEW TION, CHANGES IN FACILITIES, OR PREVIOUSLY ED FEATURES OBSERVED.
6D F/45	& A/44 (46.3-11.1) C F T ST
THANH HOA SAM	SITE A14-2 (111) VN 1945N 10550E
CONSTRUCT	LES, MISSILE-RELATED EQUIPMENT, NEW TION, CHANGES IN FACILITIES, OR PREVIDUSLY ED FEATURES OBSERVED.
6D F/45	& A/44 (36.2-13.8) C F T ST
THANH HOA SAM	SITE DØ4A-2 (112) VN 2020N 10611E
	E HAS BEEN RETURNED TO CULTIVATION AND WAS Ly dropped from NPIC listings.
6D F/42	EA/42 H F T ST
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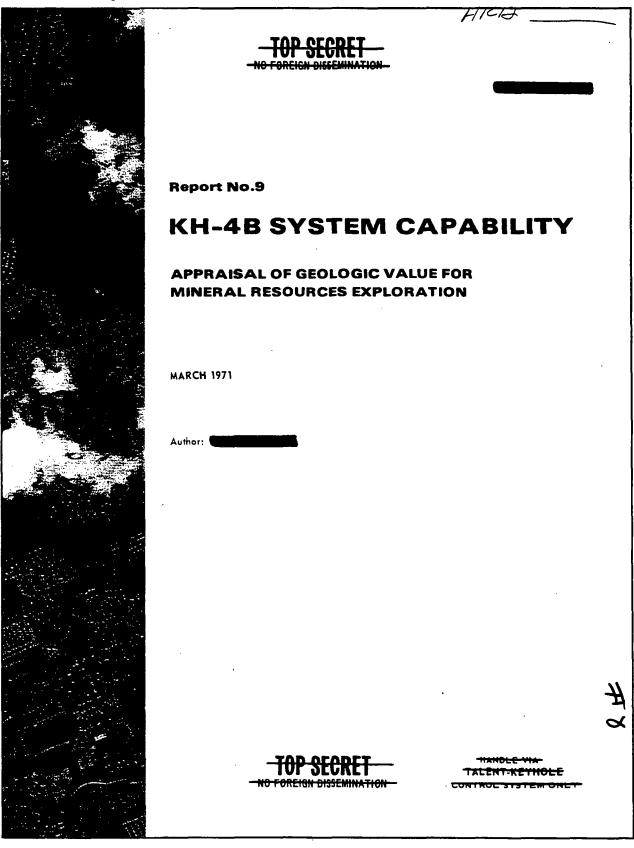
Part IV: Nonmilitary Uses for Satellite Imagery

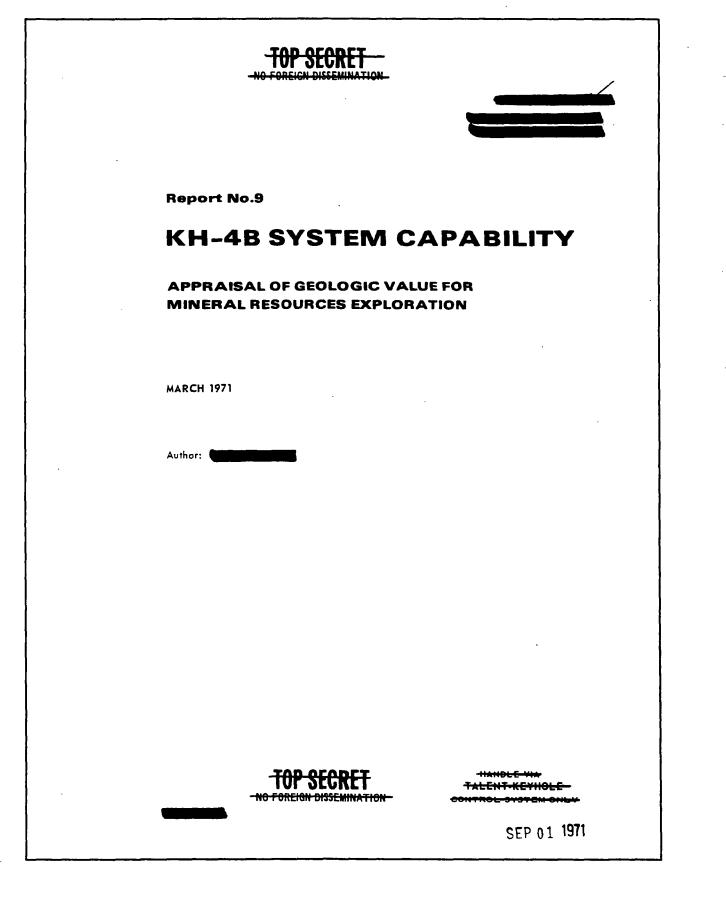
While CORONA was born out of the need for military intelligence, it has proved to have an extraordinary range of other applications. As the system became more reliable and its users became more experienced, CORONA offered unprecedented possibilities. In 1970, when CIA's experimentation with color film in a KH-4B mission proved less than useful for military targets, NPIC reasoned that color film might nonetheless expand coverage for other forms of intelligence. This led CIA to offer a subcontract to a geology firm to assess the use of color imagery for mineral resources exploration. The subcontract resulted in Document No. 29, "Appraisal of Geologic Value for Mineral Resources Exploration."

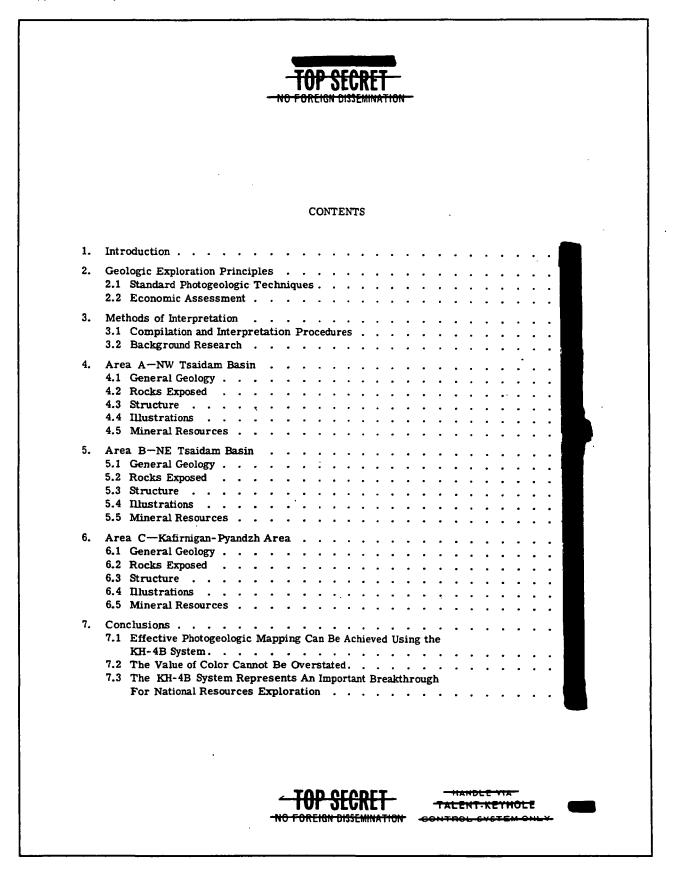
Vice President Albert Gore announced the declassification of CORONA imagery and its transfer to the National Archives and Records Administration in February 1995. A key figure in the formation of CIA's Environmental Task Force, Gore recognized that satellite imagery "recorded, however, much more than the landscape of the cold war. In the process of acquiring this priceless data, we recorded for future generations, the environmental history of the earth."

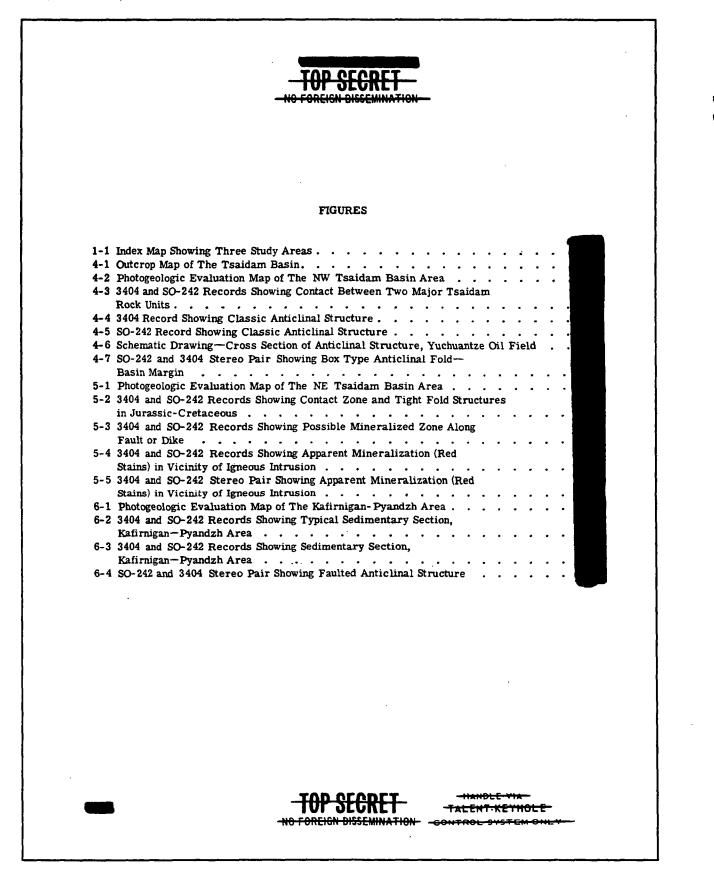
The forthcoming declassification of CORONA's enormous files of global imagery may yet help turn swords into plowshares.

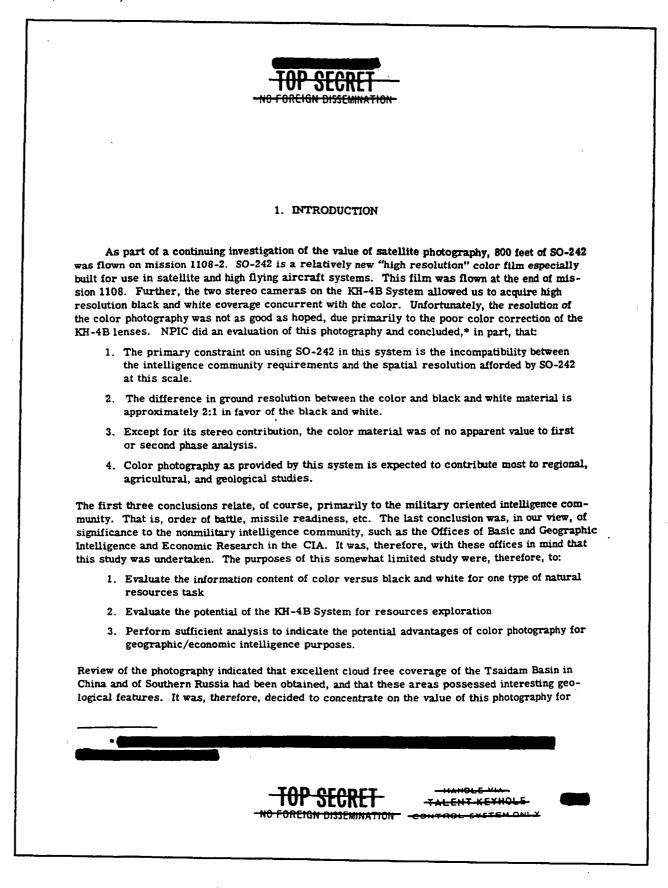
29. Report No. 9, KH-4B System Capability, "Appraisal of Geologic Value for Mineral Resources Exploration," March 1971

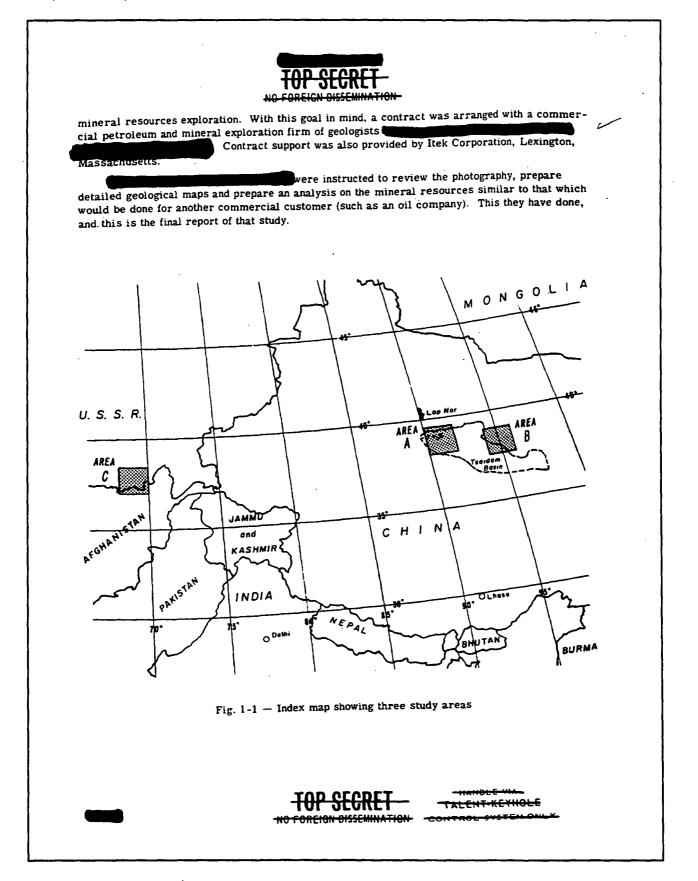


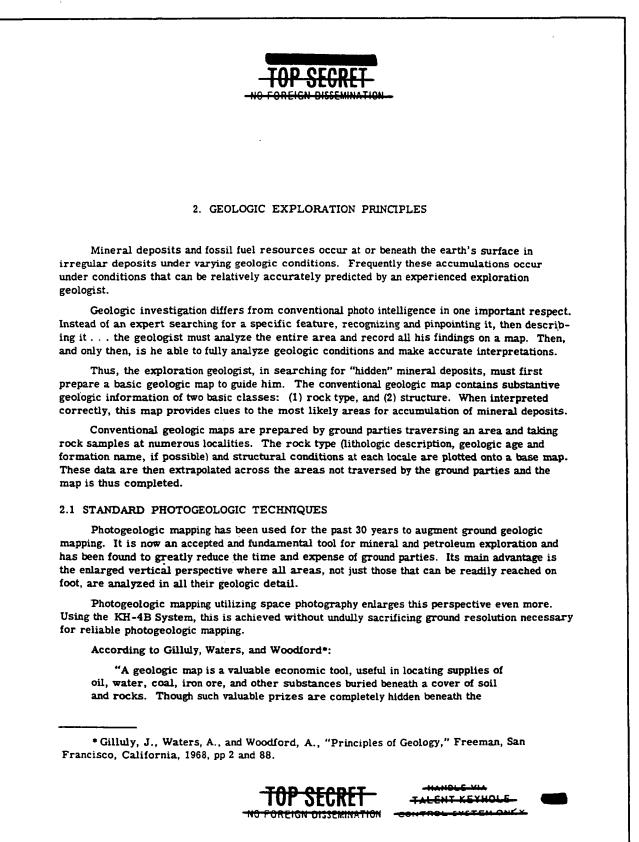














surface, a geologic map often reveals where tunneling or drilling will be successful. The accuracy of such predictions has been proved again and again by discoveries of valuable ores, coal, and petroleum. Geologic maps are indeed the indispensable foundation of all geology—basic to our understanding of all subsurface processes, . . ." "On the international scene, the power and wealth of a nation is largely determined by its endowment of useful minerals, its skill in finding and utilizing them, or in obtaining needed supplies from other lands. In this age of political unrest and readjustment among nations, the vast accumulation of petroleum in such little-industrialized nations as Iran, Saudi Arabia, Iraq, and Kuwait is a potent force in world politics. We shall be wiser in world affairs if we know where and why petroleum occurs, how it is discovered, and how its quantity underground may be estimated."

Photogeologic mapping involves two basic functions: (1) differentiation of rock type, and (2) structural mapping.

2.1.1 Differentiation of Rock Type (lithologic/stratigraphic mapping)

This involves differentiating the various rock units exposed at the surface. In a virtually unmapped area of the world, this will involve distinguishing only between the basic rock types, as follows: (1) igneous (intrusive-granite, extrusive-basalt, etc.); (2) sedimentary (sandstone, shale, limestone, etc.); and (3) metamorphic (schist, gneiss, slate, marble, etc.). Distinguishing between these gross rock units is generally not too difficult for an experienced photogeologist. This is because each basic type usually exhibits an identifying "signature" such as color, texture, land form pattern, etc.

A more useful map will be prepared however, when some ground truth is available (see Section 3.2). Information such as lithologic descriptions of various land specimens from the various formations will be most useful, as will any information regarding the geologic age of individual units.

2.1.2 Structural Mapping

This involves mapping the structural relationships of the various rock units. Structural features, such as folds (anticlines, synclines, monoclines), faults (normal, reverse, thrust, etc.), fractures, joints, etc., are often better observed from the vertical stereoscopic perspective than from the ground. Comprehensive mapping of the structural features permits a proper understanding of the chronology of events affecting the subject area.

2.2 ECONOMIC ASSESSMENT

Interpretation of the geologic map is the next important step. What does all this information mean economically? The exploration geologist looks for certain clues to guide him to hidden mineral or petroleum deposits. For instance, the petroleum exploration geologist knows that oil is found in sedimentary basin areas. He restricts his study to these areas and does not search the mountainous hard-rock (igneous and metamorphic) regions. He knows that for the sedimentary basin area to hold economic petroleum deposits, it must contain: (1) source beds (generally marine shales), (2) reservoir beds (usually porous sandstones or limestones), and (3) traps (many types—the most common are anticlinal folds or faulted anticlines). After he has ascertained that



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conditions (1) and (2) above are met for an area, he focuses his attention toward looking for traps. Surface geological maps are extremely useful for this purpose because many deep-seated structures are reflected in the structural conditions revealed at the surface.

For mineral (other than petroleum) exploration, however, he searches not only the sedimentary basin areas, but more particularly the mountainous "hard-rock" regions, depending on the types of minerals desired. He knows, for instance, that certain metallic deposits are often found in the vicinity of igneous intrusive activity, strong metamorphism, and faulting. Therefore, he searches for significant granitic intrusions within metamorphic rock regions and major fault zones. He does not always, however, restrict his search to the hard-rock regions because many nonmetallic mineral deposits (potash, gypsum, etc.) occur in sedimentary environments.



TALENT-KEYHOLS

3 METHODS OF INTERPRETATION

3.1 COMPILATION AND INTERPRETATION PROCEDURES

Mapping of the three areas under consideration was achieved in the following sequence: (1) Area A—NW Tsaidam Basin, (2) Area C—Kafirnigan-Pyandzh Area, and (3) Area B—NE Tsaidam Basin. This was a matter of convenience rather than design, since that is the order in which the necessary reference and mapping materials became available.

The compilation and interpretation procedures varied slightly from area to area, because of differences in the available base map control, geologic references, and nature of the KH-4B materials. As a result of following these varied procedures, which are discussed in more detail below, it was possible to develop a preferred (optimum) set of procedures for future mapping projects.

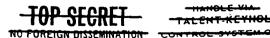
For each area mapped, it was necessary to use photography from both the: (1) convergent panoramic (PAN) camera, and (2) the DISIC framing camera. The PAN photography was used for making the geologic interpretations. The DISIC photography was used for construction of the base maps and compilation of the geologic annotations.

For the purposes of these studies, the optimum mapping scale was determined to be 1:250,000. Each area embraces slightly less than 12,000 miles and includes 2 degrees of longitude and $1\frac{1}{2}$ degrees of latitude. This is slightly larger than the conventional "2° × 1°" format of most 1:250,000 scale maps.

3.1.1 Procedures Used for Area A

Area A is bounded by Latitudes 38°00'N and 39°30'N and Longitudes 90°00'E and 92°00'E. A preliminary (pencil compiled) planimetric map of the subject area was constructed on 0.003inch Herculene film to serve as a base for the photogeologic mapping. This was prepared, due to the lack of available up-to-date 1:250,000 scale topographic maps, in a make-shift manner as follows. A geographic coordinate network of 15-minute intervals was laid out using the Universal Transverse Mercator Projection. A 1:1,000,000 scale topographic map (ONC Chart) was photographically enlarged to the mapping scale of 1:250,000. By overlaying the control grid film onto this enlargement, a preliminary planimetric base map was generated by lightly tracing the major drainage network, roads, railroads, town, and additional cultural data. This provided the gross "horizontal control" for subsequent plotting of geologic detail from the space photography.

Because of the DISIC failure on mission 1108-2 before the SO-242 film was exposed in the panoramic camera, this imagery was not available. The void was filled, however, by bringing together comparable DISIC coverage from previous missions. This DISIC photography (missions 1102 and 1106) was enlarged (approximately $8 \times$) into working prints at the 1:250,000 scale. The adjacent DISIC frames were similarly enlarged and cut into strips roughly equivalent to the width





of two panoramic frames. This provided a crude but effective way to obtain stereoscopy. In this stereoscopic mode, detailed drainage patterns and other topographic and cultural data were plotted in colored pencil onto the enlarged DISIC print. Once completed, these drainage patterns and related cultural information were transferred to the planimetric base film overlay which was held in correct position by the gross drainage patterns plotted in the base film. This completed the planimetric base map preparation phase of the project.

Photogeologic interpretation of the panoramic photography was accomplished utilizing a Richards GFL-940 MCE Light Table mounted with a Bausch & Lomb zoom 70 Microscope modified with a Richards Stereodapter. In this way, the black and white and color records were transported in parallel across the light table and the imagery studied in stereoscopic perspective, one eye viewing the color record, the other the black and white. In this process, it soon became evident that color and stereo are essential requirements to extract the maximum amount of geologic information. Loss of one or the other results in a significant reduction in information content.

Plotting and transferring the geologic interpretations to the base map was a somewhat difficult and cumbersome process. The geologic information observed on the 3404 and SO-242 records had to be visually plotted onto the DISIC print. The adjacent DISIC strips were used to obtain the correlatable image in stereo. To say the least, this was not the most effective way to interpret and plot the observed geologic information.

3.1.2 Procedures Used for Area B

Area B is bounded by Latitudes 37°30'N and 39°N and Longitudes 94°E and 96°E. Preparation of the planimetric base map was achieved utilizing essentially the same procedures as for Area A.

The geologic interpretation and compilation procedures for Area B, however, were considerably improved over those for Areas A and C. The Area B study was begun last, and by this time it was possible to obtain transformed (rectified) and enlarged (2^{\times}) records of the PAN photography. This was accomplished by the Aeronautical Chart and Information Center (ACIC) using the Itek Gamma I Rectifier. These materials were placed in parallel on a standard light table and interpretations were made using an Old Delft scanning mirror stereoscope. Geologic annotations were made directly to acetate overlays, which were later transferred to the preliminary planimetric film by use of a scale-changing Kail Reflecting Projector. These procedures precluded the laborious, inefficient and often inaccurate process of transferring mental images to the DISIC print. Moreover, they allowed for discernment and annotation of considerably more geologic detail than on the earlier studies. It is an understatement to say the the use of the enlarged and transformed PAN imagery is the more desired procedure.

3.1.3 Procedures Used for Area C

Area C is bounded by Latitudes $37^{\circ}00'$ N and $38^{\circ}30'$ N and Longitudes $68^{\circ}00'$ E and $70^{\circ}00'$ E. The mapping and compilation procedures utilized were essentially the same as for Area A with one noteable exception: horizontal control was good. It was not necessary to blow up a small scale 1:1,000,000 map for this project. Classified 1:250,000 scale AMS topographic map sheets were obtained for this area through the assistance of CIA personnel. In this instance, the topographic maps were overlayed by the geographic control grid and the gross planimetric control was lifted off directly. The DISIC photography was enlarged to scale and the detail matched perfectly, confirming that the AMS topographic sheets were of very recent vintage and most accurate.



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3.2 BACKGROUND RESEARCH

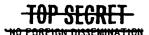
An effective photogeologic evaluation is always significantly enhanced when some basic geologic "ground truth" is available. The type of information most helpful is rock-type (lithologic) descriptions of the various rock units present and their geologic age determinations. From this basic data, a more detailed geologic map can be prepared.

In many areas (as is the case in most of the continental United States) published geologic maps provide an excellent foundation upon which to build a detailed and comprehensive photogeologic study. This fundamental data can be extrapolated to an extensive degree using the space photographs. Thus, the ground-derived information taken from several localities can be used to trace the geologic phenomena across the entire area in question including many locales never visited on foot by man.

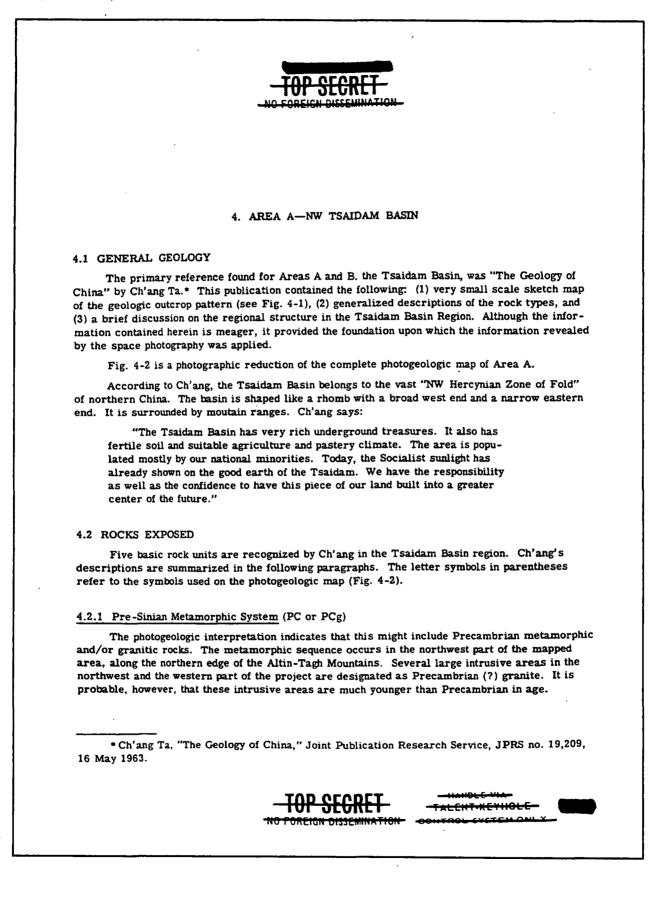
In many regions, geologic maps are either nonexistent or are nothing more than small scale compilations of wide spread observations and are sometimes of questionable accuracy. In areas such as these, the effectiveness of the evaluation will be greatly dependent on the interpreter's degree of experience in photogeologic mapping.

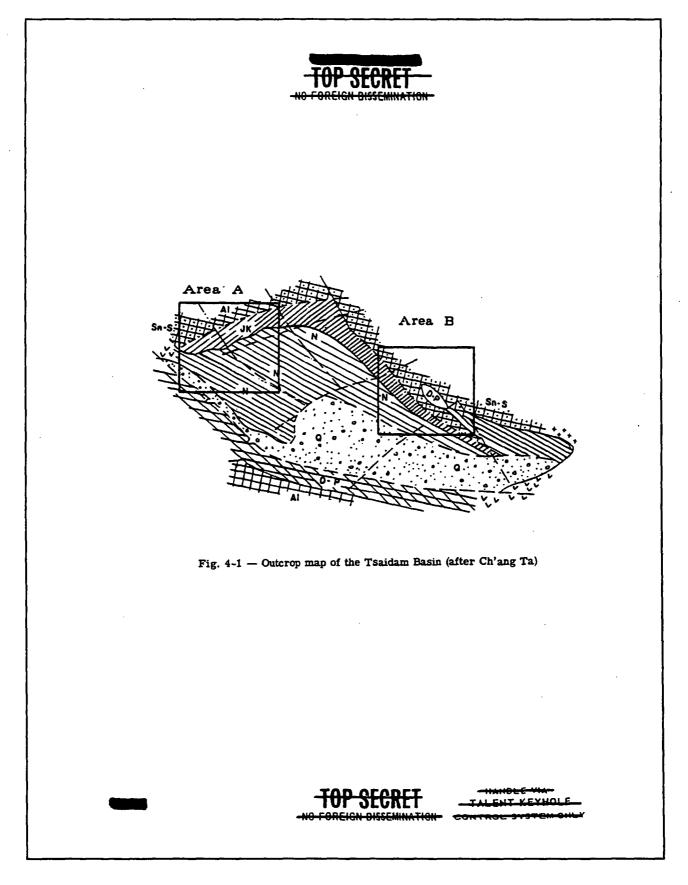
A moderately extensive geologic research effort was undertaken for the three study areas under consideration. Since these areas lie within Iron Curtain countries, the search could not be conducted by the geologists working on the project using standard scientific research procedures without unduly risking a breach of security. Therefore, the research effort was conducted with the assistance of the Office of Basic Geographic Intelligence of the CIA.

A limited amount of useful reference material was found to be available for the subject areas. It is possible that additional published and unpublished reference materials exist; however, the necessity to adhere to strict security procedures, as well as lack of time, precluded a thorough and comprehensive research effort.



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4.2.2 Lower Paleozoic System (Nan-Shan metamorphic rock series-LPm)

This is the "ancient metamorphic rock series" consisting mainly of slates, phyllites, schist, and various types of gneiss. It forms the main rock unit of the northern Altin-Tagh Mountains and occurs in the Kunlun Shan and Ch'i-lien Shan areas. In the latter area, this is called the Nan-Shan system.

4.2.3 Marine Devonian Through Permian Systems (D-P)

This sequence includes more than 2,150 meters of calcareous shale, shale, sandstone. argillaceous limestone, black schist, and light and dark gray limestone. Similar to the Sc. China marine sequence, it occurs along the northern edge of the Kunlun Shan Mountains forming the southern flank of the basin. Within the project area, this sequence is also interpreted to be present in the foothills of the southern Altin-Tagh Mountains in the west central part of the project. A large inferred granite intrusion is mapped here, designated as "PCg" on the map. It is, however, more likely to be post-Permian in age.

4.2.4 Jurassic-Cretaceous System (JK)

This is a continental facies lake basin sequence. It consists of a lower interval, from and to 2,600 meters thick of grayish-green conglomerate, sandstone, black shale, and some coal user. The Cretaceous system consists of as much as 1,800 meters of conglomerate, green sandstone, and purple shale. The Jurassic-Cretaceous beds crop out in the southern foothills of the Altin-Tagh Mountains and form the outer sedimentary rim of the Tsaidam Basin.

4.2.5 Tertiary Kansu System (Tk)

This is a continental facies sequence that represents the most widely distributed and thickest rock unit within the Tsaidam Basin proper. It consists of from 3,000 to 6,000 meters of relatively thin-bedded conglomerate, sandstone, shale, and gypsum strata. This sequence greatly in thickness in different parts of the basin, being thickest in the southeast part.

Above the Kansu System are the Quaternary fluvio-lake accumulations. Quaternary deposits mapped include: lake beds (Q1), sand dunes (Qsd), terrace deposits (Qt), and undifferentiated materials (Q), including alluvium, colluvium, fans, bolson, and aeolian deposits.

In addition to the five basic rock units described above, Ch'ang reports the presence of various igneous bodies, including Caledonian and Hercynian age granites. On the photogeologic map, all apparent intrusive igneous rocks are labeled "PCg." Most of these are probably vour than Precambrian age. Along the northern edge of the Altin-Tagh Mountains a series of toned, resistant beds appear in the stream cuts. These appear to be relatively young (Tertiary ?) volcanic rocks.

4.3 STRUCTURE

A majority of the structural features in the vicinity of the project are aligned toward the west-northwest. The Tertiary beds are considerably deformed into elongated, faulted anticlines and synclines. The Jurassic-Cretaceous rocks exhibit long-axial box and comb folds. The older rock sequences adjacent to the basin exhibit relatively complex folding and faulting with +¹⁻ dominant trends oriented toward the west-northwest.

Ch'ang reports that rift faults are the Tsaidam's most characteristic feature. These are reportedly of the high-angle reverse type, where the older rocks are thrust upon the younger.



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Most major faults and fault systems are aligned toward the west-northwest, generally parallel with the Kunlun Shan and Ch'i-lien Shan Mountains.

A notable exception to this is the outlining structures of the Altin-Tagh Mountains. This range is anomalously aligned toward the northeast and is bounded by major faults. This is probably a relatively young fault system since the strike of the interior folds within the range and schistocity of the older metamorphic rocks are generally aligned toward the older, west-northwest direction.

The geologic history and chronology of geologic events is postulated by Ch'ang. It is beyond the scope of this report to presume to question his findings, at least not until the adjacent areas are studied in more detail.

4.4 ILLUSTRATIONS

The following examples depict some of the more important geologic features revealed by the photogeologic evaluation in the NW Tsaidam Basin Area. They illustrate the value of the KH-4B imagery as well as the effectiveness of the techniques used. Their location is depicted on Fig. 4-2.

Fig. 4-3 is a dual illustration (3404 and SO-242 records) including an interpretation overlay showing the "contact" (interface) between two major Tsaidam rock units, i.e., the lower Paleozoic metamorphics (more resistant, darker colored) and the younger Jurassic-Cretaceous continental sediments (red and reddish-brown banding). Note how the contact is virtually indistinguishable on the black and white photograph, yet easily depicted on the color film. The dark-toned areas might be indicative of basic intrusive igneous rocks. Mineralization might occur along these interfaces, and along the traces of the numerous faults and fractures within the area. The fault zone on the right represents the eastern-most end of the northeastward-trending "major fault zone" rimming the Altin-Tagh Mountains.

Fig. 4-4 is a 3404 record showing a classic anticlinal structure within a central part of the basin proper... the "oil patch." Fig. 4-5 is the SO-242 companion photo of the same area. This well developed structural feature is mapped in thin-bedded Tertiary Kansu strata. The individual beds within this unit are essentially the same color, and hence the SO-242 color photography does not materially enhance the interpretation. This classic anticlinal fold is the type of "trap" that oil geologists continually seek. The circular, arcuate patterns that appear like rings around a tub are, in reality, individual rock layers that have been arched into an anticlinal upwarp and beveled off by erosion. The black dots in the crestal part of the fold are oil wells of the Yuchuantze Oil Field. These, found as a pleasant surprise during the interpretation, indicate that: (1) this is a petrol-iferous providence (petroleum source rocks and reservoir beds are present in the basin), and (2) that the photo resolution is more than adequate for geologic mapping purposes.

Fig. 4-6 is a schematic cross-sectional drawing of the anticlinal structure at the Yuchuantze Oil Field. No specific oil production data is available for this field, but no doubt the oil comes from porous sandstone reservoir beds within the Kansu sequence.

In the typical oil producing region, oil is believed to be formed in the basin deeps from marine shales and is squeezed by pressure into more porous rocks such as sandstone or limestone beds. Water is also often present and, being heavier than oil, pushes the oil up the dip of the porous reservoir bed. If the layer above the reservoir bed is impermeable (the cap rock), the oil continues to move within the reservoir bed up dip until it is trapped in the crest of an anticlinal upwarp, or similar trap.

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Fig. 4-7 is a stereo pair (3404 and SO-242 records) including an interpretation overlay showing a large uplifted anticlinal fold of the box type mapped in the Jurassic-Cretaceous beds along the outer margin of the Tsaidam Basin. The reddish-brown color of the strata is typical of this continental sequence and provides clues regarding the lithologic character of the various strata. Note that these color signatures are lacking in the 3404 record. The stereo pair here gives good evidence of the need for three-dimensional depth perception for accurate photogeologic structural mapping. Note the deep river canyon cut by erosion across the crest of the fold.

4.5 MINERAL RESOURCES

According to Ch'ang, the Tsaidam region offers considerable mineral resources potential. The Tsaidam Basin proper contains thick Mesozoic-Cenozoic oil bearing deposits. Numerous oil seepages have been reported. Other potential mineral resources indicated by Ch'ang are: various metallic mineral deposits, as indicated by the presence of various acidic to basic igneous rock bodies in the mountainous regions adjacent to the basin; coal in the Mesozoic and Cenozoic strata; and salt, soda, and gypsum in the basin interior.

The following general statements are made with respect to the possible mineral and petroleum potential of the subject area in light of the photogeologic study.

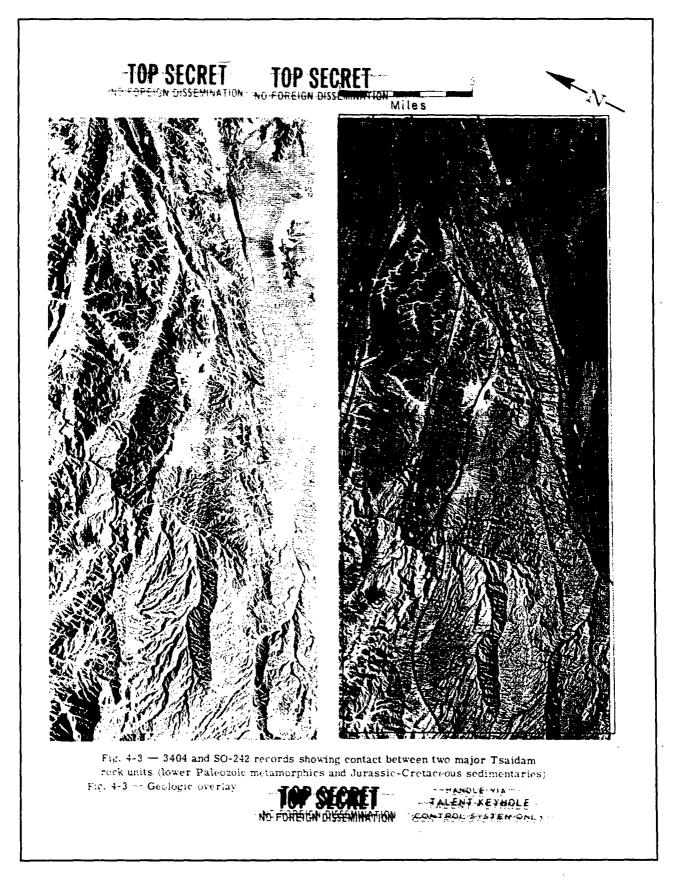
4.5.1 Petroleum

Several producing oil fields are known in the Tsaidam Basin, including the Yuchuantze Oil Field discussed above. No production information was available for the Yuchuantze field. However, the following data for the Leng-Hu Oil Field was found in an **Comparation Compared and C**

way between Study Areas A and B) was discovered in 1958. It produces from a "swell" of about three east-west trending elongated anticlines from numerous, very thin (1 to 3 meters) sandstone layers of Tertiary Oligocene age (Kansu) at depths of about 1,000 meters. Each anticline is about 5 kilometers long and is complicated by numerous faults. The quality of the oil is good. Numerous wells have been drilled but few produce commercially. This is due to a high water/oil production ratio. In 1959/1960, the total output of the Tsaidam Basin was 700 tons (approximately 5,200 barrels) of crude oil per day.

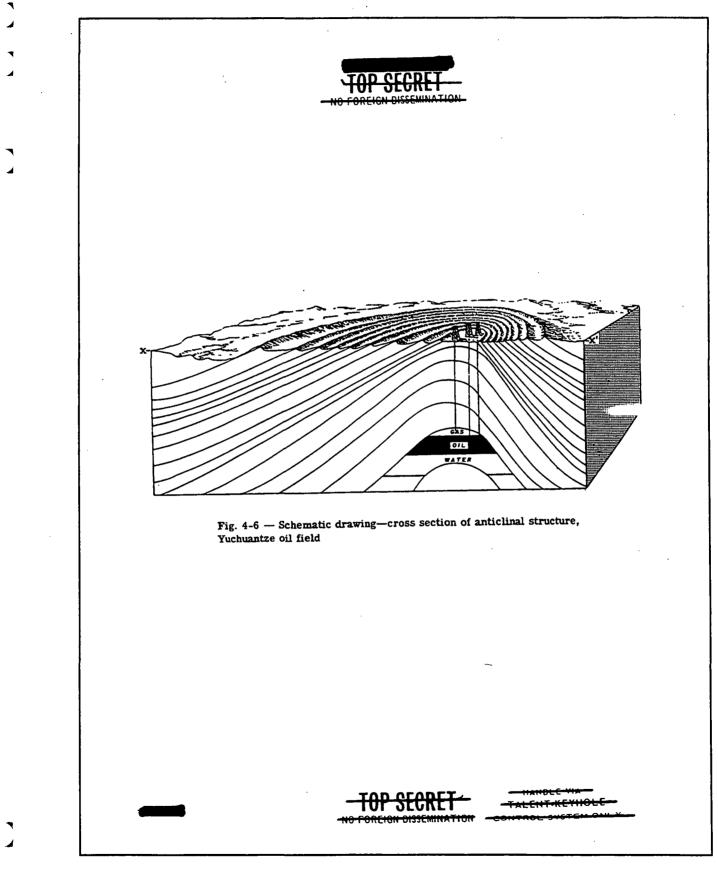
The petroleum potential of Area A is restricted to the sedimentary basin in the southeast part of the map sheet, i.e., that part of the area covered by Tertiary Kansu and Jurassic-Cretaceous rocks. The Yuchuantze Oil Field produces from but one of about nine closed anticlinal folds mapped in the Tertiary rocks within Area A. All of these similar folds can be expected to be prolific in relation to the present production. One of these folds, positioned at approximately Latitude 38°20'N and Longitude 91°30'E, is much better developed than the producing structure. This fold is about 35-kilometers long and 10-kilometers wide, many times larger than the producing Leng-Hu Field east of this area.

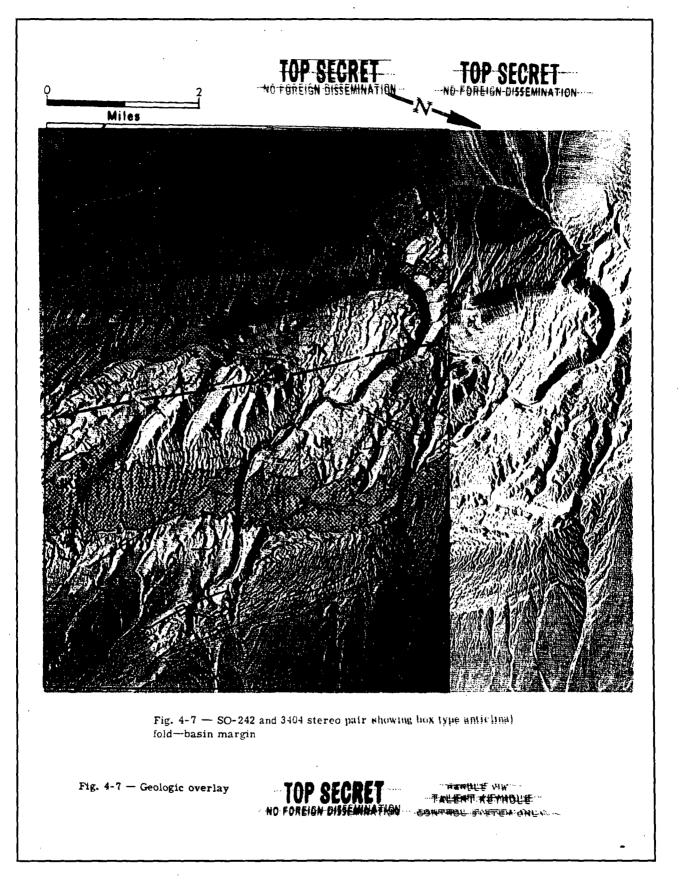
It is possible that some of the box-type anticlinal folds mapped in the Jurassic-Cretaceous beds along the margin of the basin might also prove productive, although the sedimentary section will be thin.













4.5.2 Metallic Minerals

Gold and silver deposits of unknown economic value have been reported^{*} to the west and east of the project. Ch'ang recognizes metallic mineral potential in the vicinity of various igneous rock bodies within the metamorphic rock sequence. From this study, the most favorable areas appear to be along the major fault zones, particularly the northeastward-trending major fault zone crossing the central part of the project, and along the outer edges of the granitic or "PC" zones. dark-toned areas within the Lower Paleozoic sequence might also prove to be favorable areas for metallic mineral concentrations.

4.5.3 Nonmetallic Minerals

Commercial coal bearing beds are reported to occur along the outer edges of the basin within the Jurassic-Cretaceous sequence. Salt, potash, and gypsum in commercial quantities are likely to be found in the vicinity of the modern interior lake basins.

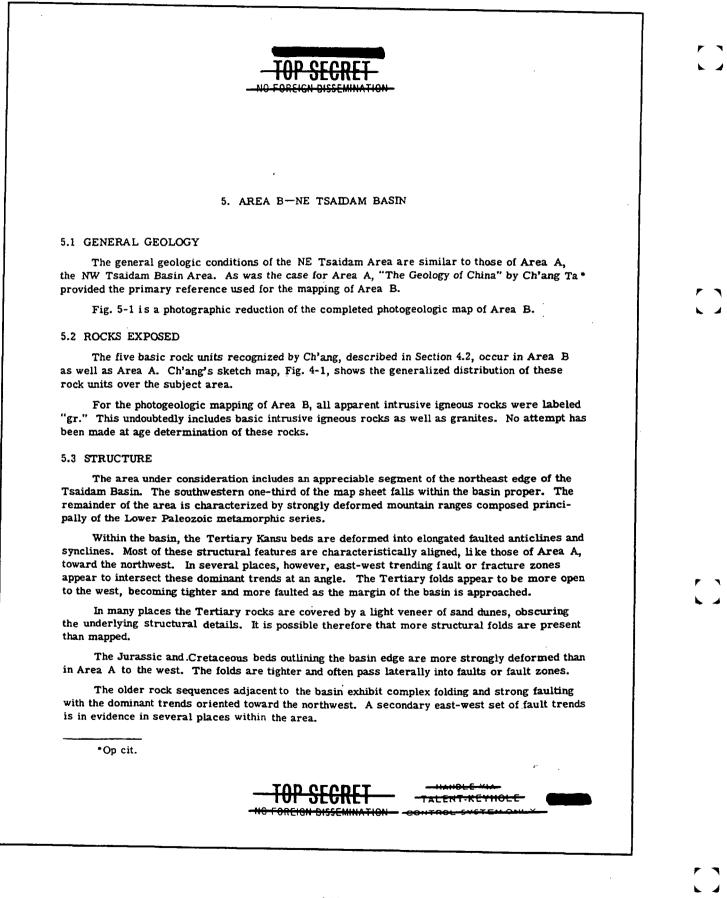
4.5.4 Other

No doubt other mineral possibilities exist in the subject area. The full potential can be thoroughly evaluated by more detailed photogeologic analysis in conjunction with additional ground truth.

*United Nations, "Mineral Distribution Map of Asia and the Far East," 1:5,000,000, 190...



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Major fault zones appear to outline the margins of most of the dominant mountain ranges within the area. These are probably of the high-angle reverse type, with the older rocks thrust upon the younger. The contact relationship between the Lower Paleozoic metamorphic rocks and the Jurassic-Cretaceous basin sediments is probably of this type.

A number of igneous intrusive bodies are mapped within the mountain ranges. These are postulated on the basis of their land form, texture, and color characteristics and appear to interrupt the characteristic metamorphic terrain. These probably include basic igneous rocks as well as granite; their relative ages cannot be determined on the basis of the evidence revealed by the photogeologic study.

The northwestern corner of the project area is a topographically low region covered by various Quaternary deposits. Although no Tertiary or Mesozoic rocks were observed here, it is possible that they are present beneath the superficial deposits and that this area represents an isolated, structural re-entrant of the Tsaidam Basin proper.

5.4 ILLUSTRATIONS

The following examples depict some of the more interesting geologic features revealed by the photogeologic evaluation in the subject area. Their location is depicted in Fig. 5-1.

Fig. 5-2 is a dual illustration (3404 and SO-242 records) including an interpretation overlay showing the contact zone between the Lower Paleozoic metamorphic rocks (dark-toned, mottled, and highly fractured) and the younger Jurassic-Cretaceous sedimentary strata (red, gray, and reddish-brown banding). Note how the distinct color banding highlights the tight folds in the younger beds. Within the older rock sequence, mineralization might occur along the interfaces between the light and dark banding and along the major fault traces.

Fig. 5-3 is a dual illustration (3404 and SO-242 records) and an interpretation overlay showing a possible mineralized zone along a prominent fault or dike. Note the white bleached-out alignment within the dark-toned Lower Paleozoic metamorphic host rock. An area of igneous intrusion is postulated on the upper right. Mineralization might also exist along the interface between the postulated igneous intrusive rock and the metamorphic host rock, as well as along the more prominent fault and fractures. Zones of intersection between the major fracture zones might be the most favorable areas for mineralization.

Fig. 5-4 is a dual illustration (3404 and SO-242 records) and an interpretation overlay of an apparent mineralized area in the vicinity of an igneous intrusion and fault zone. Note the highstanding, dark-toned area in the lower part of the photograph, interpreted to be an area of basic intrusive igneous rocks. This area, occurring within the Lower Paleozoic metamorphic host rock, is encircled by arcuate, annular streams. This is indicative of the uplift and resistant nature of the igneous intrusion. Along the northern edge of the igneous body is a prominent fault zone, oriented in a northwest-southeast direction. Within this zone are numerous areas exhibiting a brick-red staining, distinctly visible on the color film but indistinguishable on the black-and-white record. The red staining suggests a high concentration of iron oxide, possibly accompanying a concentration of other heavy metallic minerals. Note the faint red staining within the alluvium of the main river flood plain. The smaller streams obviously carry the heavy minerals to the main river, dropping their load on the near bank as they reach the lower level. Note the snake-like outcrop in the upper right corner of the photograph. This is interpreted to be a linear zone of folded sedimentary rocks, possible of Devonian-Permian age (designated D-P).

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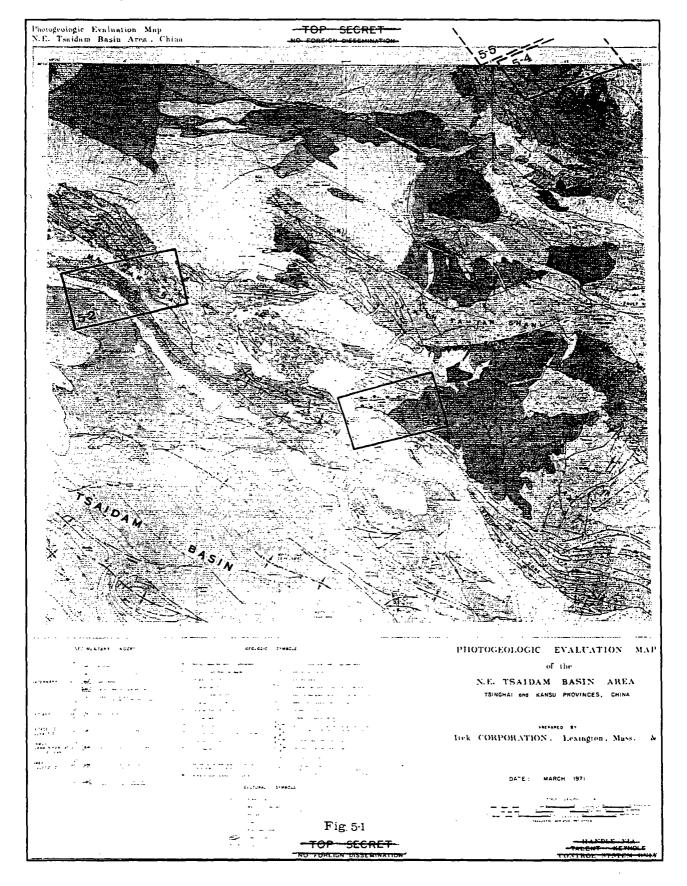




Fig. 5-5 is a stereo pair (3404 and SO-242 records) including an interpretation overlay showing an apparent mineralized area in the vicinity of an igneous intrusion and fault zone. This example is located immediately northwest of Fig. 5-4. It lies along the same fault trend as in Fig. 5-4 and exhibits similar igneous activity and mineralization. This might be only part of a regional northwest-trending mineralized zone along the northeastern edge of the Humboltd Shan, in the northeast corner of the map sheet. The stereo pair depicts the strong relief in the mountains bordering the Tsaidam Basin. It also points out the usefulness of stereoscopy for accurate photogeologic mapping.

5.5 MINERAL RESOURCES

The following general statements are made with respect to the possible petroleum and mineral potential of Area B in light of the evidence revealed by the photogeologic study.

5.5.1 Petroleum

The southwest one-third of the subject area has good petroleum potential. Only that part of the area covered by Tertiary Kansu rocks is considered prospective however. The Jurassic-Cretaceous sequence appears to be too strongly deformed to be prospective. Several broad anticlinal folds mapped within the Tertiary Kansu rocks are considered most favorable as traps for the accumulation of hydrocarbons. Those nearer the southwest edge of the mapped area are broader and appear to be less fault controlled than those situated near the basin margin.

The broad topographically low area in the northwest corner of the map sheet should totally discounted for possible petroleum accumulations. This might be an isolated arm of the Tsaidam Basin and might contain fairly thick sequences of Mesozoic and Tertiary rocks beneath the unconsolidated Quaternary materials.

5.5.2 Metallic Minerals

The mountainous region of Area B offers excellent potential for metallic mineral concentrations. Most of the mountain ranges are composed of Lower Paleozoic metamorphic rocks and have undergone repeated and complex deformation. Considerable igneous intrusive activi, apparent in many areas. The margins of most of the ranges are outlined by major fault zones. The most prospective areas are along the major fault zones and at their points of intersection with secondary fault or fracture belts. The contact, or interfaces, between the postulated intrusive igneous rocks and the Lower Paleozoic metamorphic sequence are likewise most prospective.

Of particular interest are: (1) the northwest-trending mineralized fault zone in the northeast corner of the area, as depicted by Figs. 5-4 and 5-5; (2) the possible mineralized zone shown in Fig. 5-3; and (3) the numerous areas of apparent alteration indicated on the photogeologic maps.

5.5.3 Nonmetallic Minerals

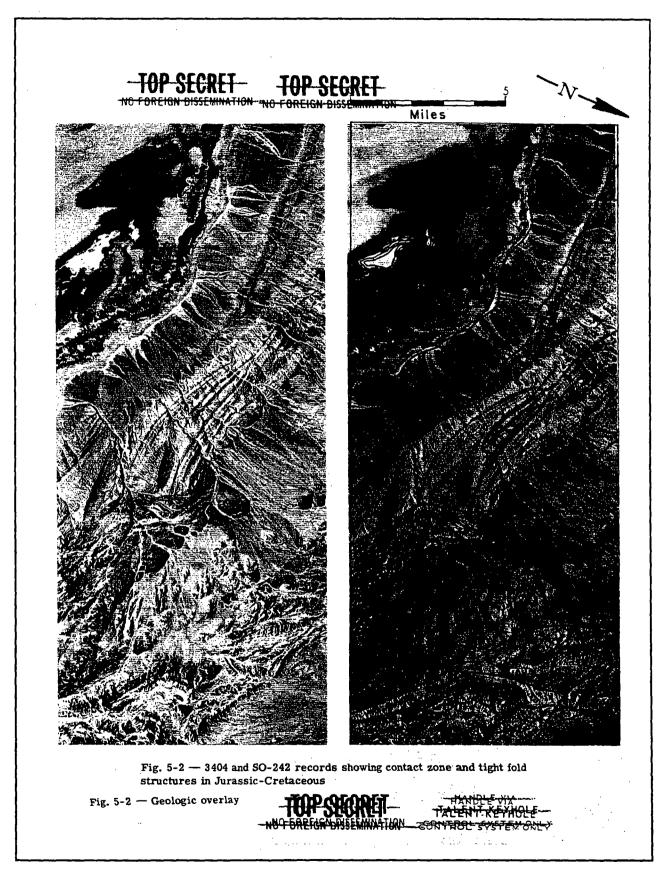
Commercial coal beds might exist in a few places within the Jurassic-Cretaceous sequence rimming the basin proper. Salt, potash and gypsum might be found in commercial quantities in the vicinity of the modern interior lake basins.

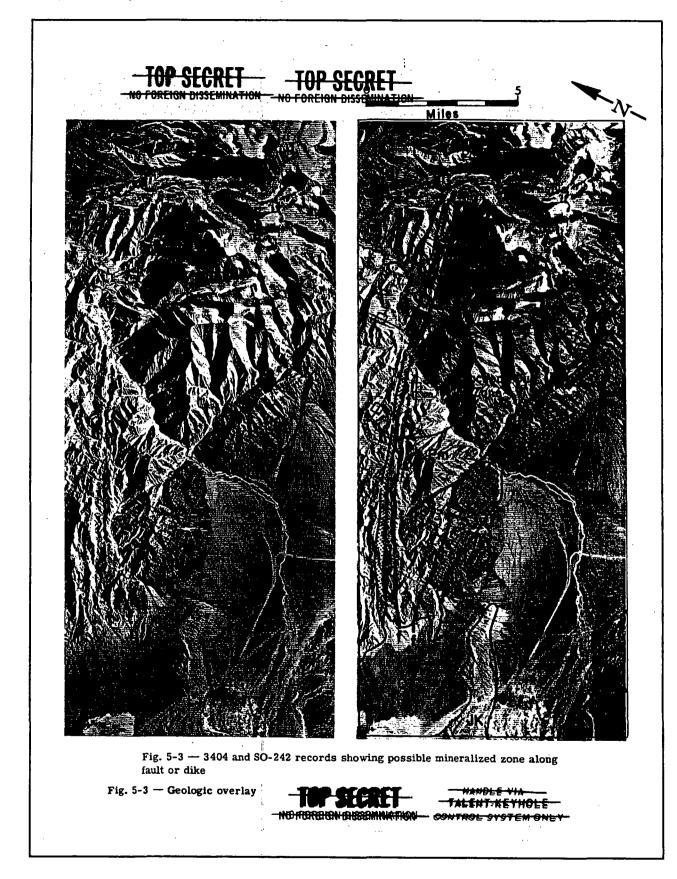
5.5.4 Other

No doubt other mineral possibilities exist in the area. This study could be improved imsurably with any additional ground truth available, such as, any other previous mining activities, information on the composition of some of the rock suites within the Lower Paleozoic metamorphic sequence, etc.

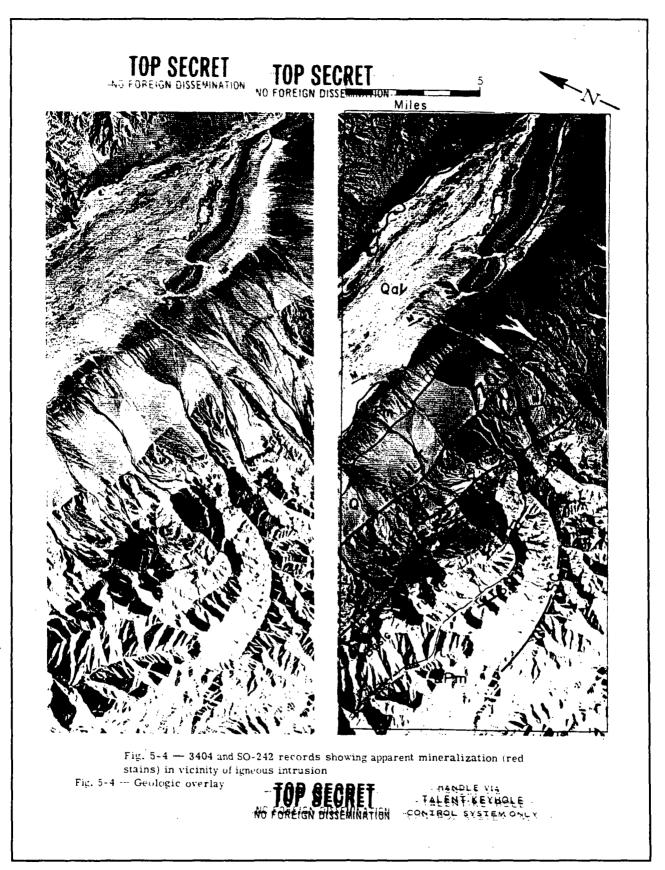


TALENT KEYHOLE

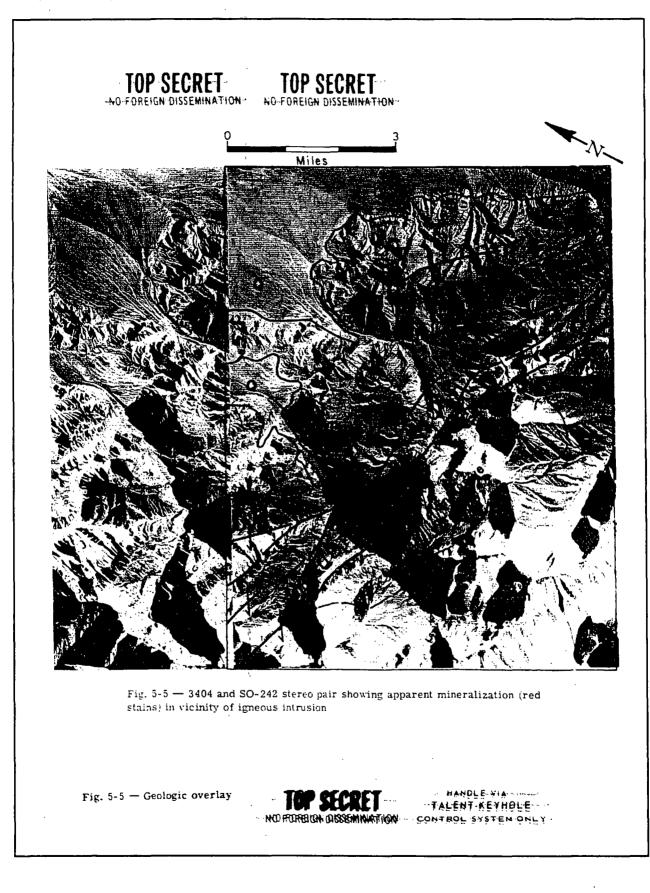




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6. AREA C-KAFIRNIGAN-PYANDZH AREA

6.1 GENERAL GEOLOGY

The Kafirnigan-Pyandzh Area falls principally within the Tadzhik Region of the USSR but includes on the south a small part of Afghanistan. The project name relates to the Kafirnigan River, which crosses the western part of the area, and on the south the Pyandzh River, separating Afghanistan from the USSR.

The background research effort was most fruitful for this study. Personnel from OBGI in Washington, D. C. located and provided an excellent geologic reference for the project, i.e., Terrain Atlas, Kafirnigan Area, USSR (C), 1969, sponsored by the Advanced Research Projects Agency, ARPA Order No. 485. The Atlas was produced to provide earth-science data for evaluating the geologic environment in terms of its potential for secret underground nuclear testing. The report is based largely on previously published earth-science data, and its great value was the synthesis and interpretation of the basic information. Although this reference only covers the northwest part of the area, the ground truth it provided proved an excellent guide to the mapping of the area as a whole.

According to the ARPA Report, the subject area lies within the Tadzhik Depression in the eastern part of the vast Scytho-Turanian Platform. It contains a very thick sequence of Mesozoic and Tertiary sedimentary rocks, marine below and continental at the top. The formations were subject to Alpine folding which in this area culminated in late Tertiary time. Linear elongated folds, associated with high-angle reverse faulting were produced, resulting in a rugged linear terrain. The ridges are closely spaced in the north and tend to diverge farther south. This phenomenon, resembling the spreading fingers of a hand, is called the Tadzhik Virgation.

6.2 ROCKS EXPOSED

Geologically this area is quite different from the Tsaidam Basin. The rocks exposed are entirely of the sedimentary type and no igneous or metamorphic (hard rock) areas are exposed. The sedimentary sequence includes rocks of Jurassic, Cretaceous, and Teritary ages overlain in places by various Quaternary deposits. The sequence is characterized by seven individual formations (or units), each of which has its own identifying lithologic characteristics. The stratigraphic sequence, from oldest to youngest, is as follows.

6.2.1 Upper Jurassic Undifferentiated-(Ju)

This is the oldest sequence in the project. It includes gypsum with thin beds of gypsiferous claystone, and local rock-salt beds (20 to 30 meters exposed). Most exposures are associated with major reverse faults and often occur below an irregular boundary marked by dome-like swellings separated by saddles reflecting in the overlying younger strata.



TALENT KEYHOLE





6.2.2 Lower Cretaceous Undifferentiated-(K1)

This is relatively a thick complex of interbedded red claystone and red and gray sandstone, laterally very variable in lithology and in thickness of individual lithologic units. The total thickness remains rather constant however, from 500 to 700 meters. This sequence is commonly exposed below the Upper Cretaceous in the eroded, eastern flanks of the mountain-forming anticlines.

6.2.3 Upper Cretaceous Undifferentiated-(K2)

This sequence includes largely grayish-claystone commonly interbedded with sandstone or limestone with occasional interbeds of gypsum, capped in places by a thin sequence of interbedded limestone and gypsum. The thickness varies from 400 to 1,300 meters. These beds are generally exposed in the relatively steep east-facing slopes of the mountain ranges, below the Bukhara limestone cap rock.

6.2.4 Bukhara Limestone (Paleocene)-(Tb₁)

This is a hard dense gray limestone with dolomite and gypsum interbeds. This dark-toned, resistant formation is the main ridge-former, capping the crests of nearly all of the anticlinal mountain ranges within the region.

6.2.5 Eocene-Lower and Middle Oligocene Undifferentiated-(Tc)

This sequence is composed primarily of vari-colored marine claystone with occasional beds of limestone, marl, and sandstone. It ranges in thickness from 365 to 500 meters. It is typically light-toned and moderately resistant, often forming V-shaped hogbacks along the western flanks of the Bukhara anticlinal ridges.

6.2.6 Bol'dzhuan Formation (Upper Oligocene-Lower Miocene)-(Tbs)

This is a continental facies sequence composed of maroon, wine-red, or brick-red sandstone and siltstone, often including claystone. Its thickness varies greatly from 220 to 1,000 meters. It usually crops out in bands of varying widths, indicating considerable variation in thickness, on the western mountain slopes above the more resistant marine rocks of the Tc unit.

6.2.7 Garauty Formation (Miocene)-(Tg)

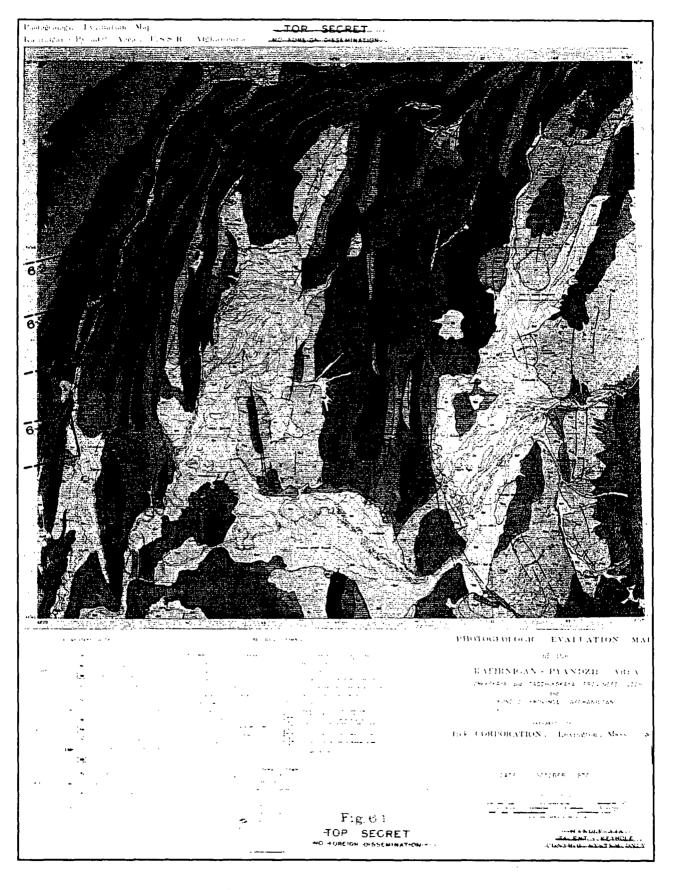
This is a continental sandstone and siltstone sequence, generally light brown to tan in color. It varies in thickness from 435 to 1,800 meters and rests on the eroded upper surface of the Bol'dzhuan formation, generally along the gentle western dip-slopes of the mountain ranges.

Most of these rock units are considerably mantled by various Quaternary deposits, the most widespread of which is the Dushanbe and Ilyak Series, a thick loess deposit.

Although the ARPA Report, from which the above descriptions are summarized, only covers the northwest part of the area under consideration, the ground truth it provided proved an excellent guide to the mapping of the entire area. From the lithological descriptions above, it was possible to identify the various formations outside the area of the ARPA Report and map the entire area, probably more accurately than it had ever been done before. Fig. 6-1 is a photographic reduction of the photogeologic map.

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29. (Continued)



6.3 STRUCTURE

The regional structure of the subject area is relatively simple. In detail it is complicated and only partly understood. The linear, subparallel elongated folds of the region are generally outlined on the east by long, probably high-angle, reverse faults, down-thrown on the east. These faults cut all formations of Tertiary age or older and commonly form rugged fault scarps. A number of normal faults of considerable length were mapped along the west edge of some of the major structures. These linear faulted anticlines are closely spaced in the north but tend to diverge and become more open farther south. In the northern part of the subject area, several east-west trending strike-slip faults were found. These appear to be left-lateral structural features associated with the northern zone of major structural change.

6.4 ILLUSTRATIONS

The following examples depict some of the more important stratigraphic and structural features revealed by the photogeologic evaluation within the subject area. These, more than any others, vividly portray the value of color for photogeologic mapping with the KH-4B System. Their locations are depicted on Fig. 6-1

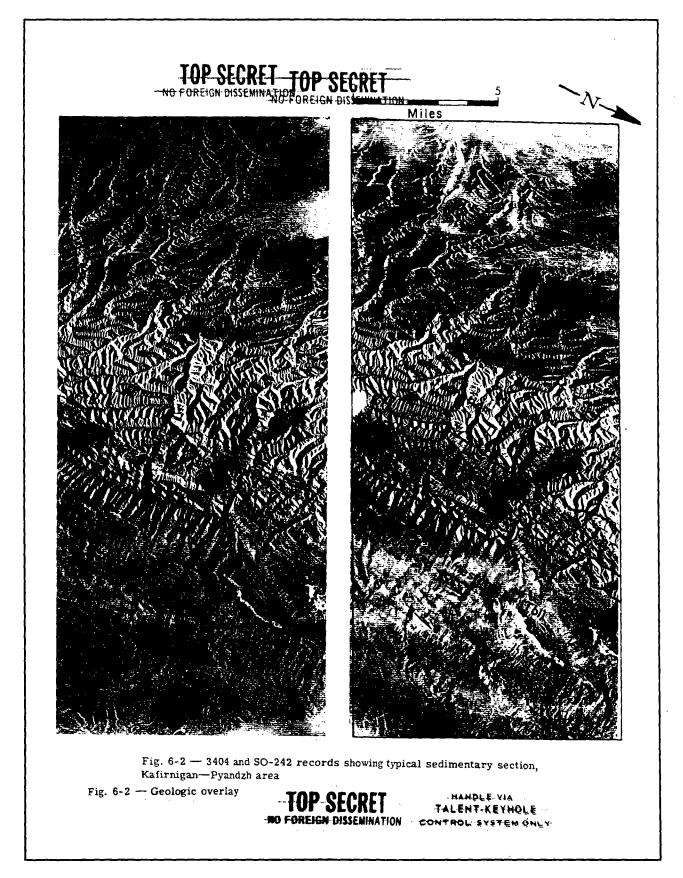
Fig. 6-2 is a dual illustration and interpretation overlay depicting graphically the value of color for distinguishing between the various rock formations within a given area. The black and white photograph on the left is useful up to a point. The bold mountain-forming Bukhara limestone is easily identified by its topographic prominence, as it forms the "backbone" of most of the linear mountain ranges in the region. Likewise, the Eocene claystone unit, labeled "Tc," is identifiable by its V-shaped hogback ridges. Above these marine units the stratigraphic sequence changes to a continental facies. The change in color reflects this characteristic. Note the deep maroon-red color of the Bol'dzhuan formation and how easily it can be distinguished from the overlying Garauty formation on the SO-242 color imagery. This contact (interface) is virtually indistinguishable on the 3404 record on the left. The deep red signature of the Bol'dzhuan formation proved to be the most reliable mapping marker within the project.

Fig. 6-3 is a dual illustration and an interpretation overlay showing essentially the same part of the stratigraphic section as in Fig. 6-2. Observe the continuity of formational color and topographic characteristics. Note how the prominent backbone of the mountain ridge is formed on the characteristic Bukhara limestone. The west flank is the dip-slope and the east flank is the rugged and highly-faulted obsequent slope. The Lower Cretaceous rocks beneath the Bukhara are relatively easily eroded and do not display recognizable identifying characteristics.

Fig. 6-4 is a stereo-pair and an interpretation overlay depicting an elongated, faulted anticline along the west edge of the study area. The bold Bukhara limestone forms the backbone of the anticlinal mountain range. The V-shaped hogbacks etched by erosion on the "Tc" unit encircle the prominent uplift. The reddish-hued Bol'dzhuan formation is apparent on the west flank, even though it is heavily mantled by Quaternary loess deposits.

This structure typifies the characteristic structural forms found within the area. The linear faulted anticlinal ranges broaden toward the south and become more prospective for the entrapmer of hydrocarbons. To the north they become tighter and more highly faulted, thus diminishing their petroleum potential.







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6.5 MINERAL RESOURCES

As a result of the photogeologic mapping together with the information contained in the ARPA Report, the following general statements can be made with respect to the mineral and petroleum potential of the area.

6.5.1 Petroleum and Natural Gas

Oil and gas are being produced from anticlinal structures east and west of the study area. No production data has been obtained for these fields. The numerous elongated anticlinal folds of the region are excellent prospects where closure exists and where faulting is not too severe. Therefore, the southern part of the area is most prospective since the folds broaden in that direction.

6.5.2 Metallic Minerals

The potential for metallic minerals within the region is not known. No igneous or metamorphic rocks have been reported in the area. The greatest potential for metallic mineral concentrations would likely be along the northern margin of the area where the structural deformation is known to be strongest.

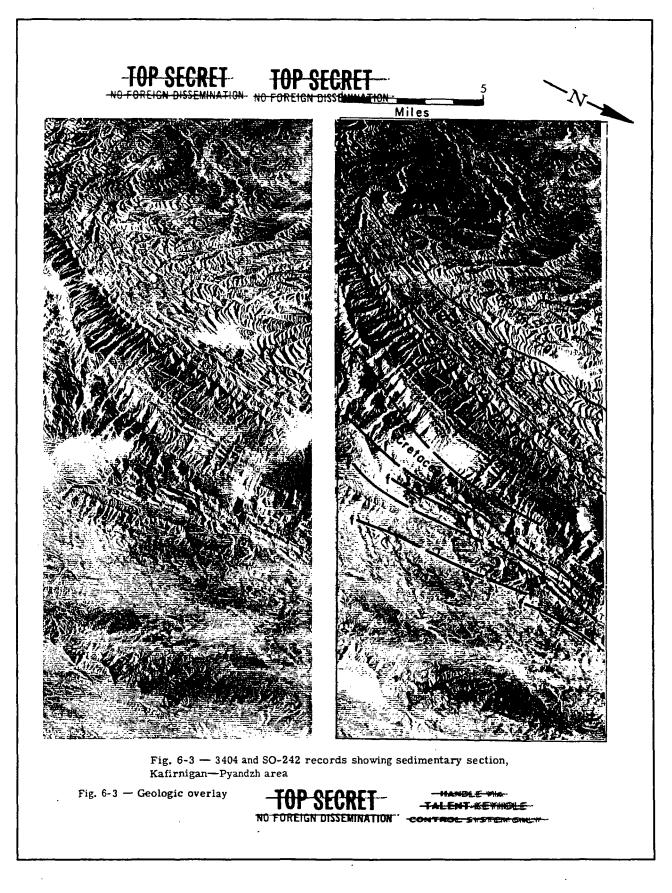
6.5.3 Nonmetallic Minerals

Some local bituminous coal deposits are mined north of the area, but the coal potential for most of the region is slight. Sand, gravel, and loess deposits are plentiful from the various Quaternary materials widely distributed across the area. Brick clay is likely abundant from the upper Cenozoic and Quaternary deposits. Lime, marl, dolomite, and building stone is plentiful from the Bukhara and "Tc" formations. Gypsum and rock salt are available from the Jurassic and Cretaceous outcrops as well as the Bukhara limestone.

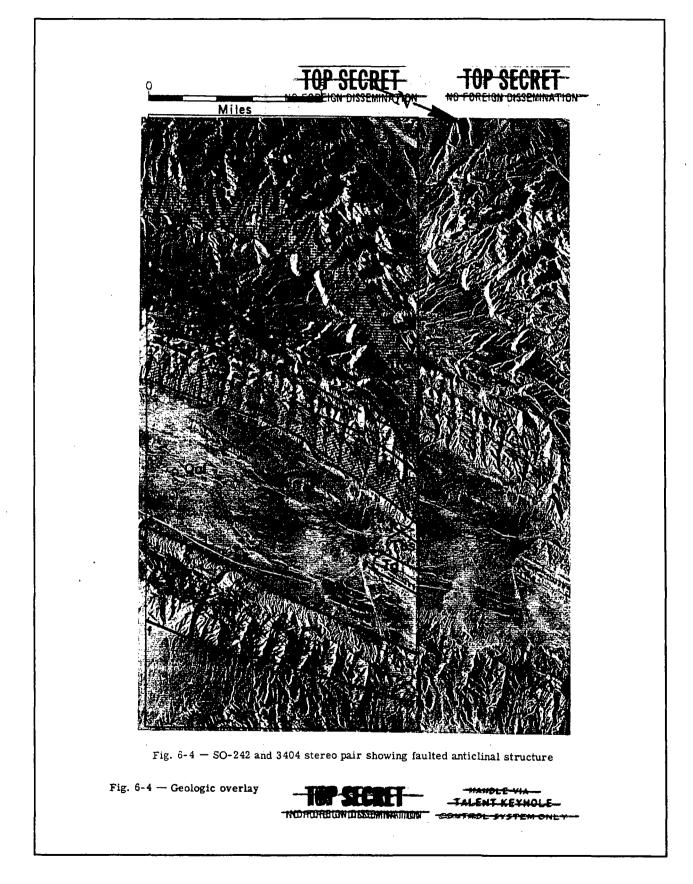
6.5.4 Other

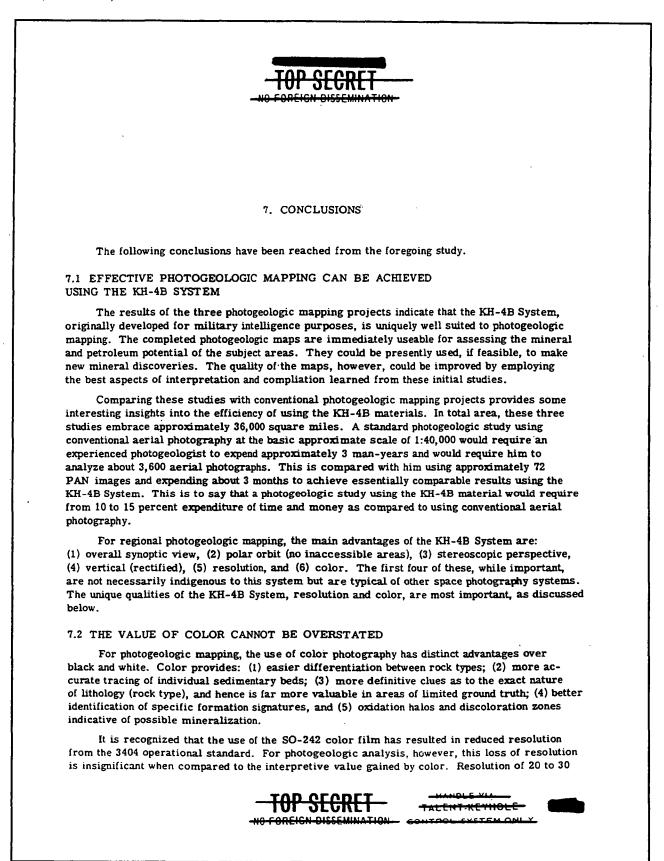
Although doubtless other mineral possibilities exist for the area, they cannot be realistically appraised without additional ground truth.





29. (Continued)







feet is entirely adequate for most regional photogeologic mapping projects, and the SO-242 color film easily meets that standard. By using both the 3404 and SO-242 film in a stereoscopic mode, as was done for this study, the advantages of both are obtained with very little sacrifice of the useful qualities of each type.

7.3 THE KH-4B SYSTEM REPRESENTS AN IMPORTANT BREAKTHROUGH FOR NATIONAL RESOURCES EXPLORATION

The economic and political impact of this cannot be overstated. While the world-wide demand increases dramatically for minerals and fossil fuels (those resources in fixed supply), our ability to locate and harvest these hidden deposits lags far behind.

Experts agree that exploration from space offers a potential breakthrough in large scale exploration techniques. Virtually every major exploration advance in the last 20 years has been on-the-ground detectors of one sort or another. These are detailing geophysical tools, whose use is very expensive in relation to area analyzed, and must be used selectively. A prerequisite to their proper and efficient use is a conduct of effective preliminary reconnaissance studies to localize areas of most promise.

Exploration from space provides an enlarged prospective, a previously unattainable synoptic view of the earth. Though the geologists' discipline is a study of the earth, until now he has never seen it. With his vision broadened from this space perspective, he is enabled to search for oil provinces instead of oil fields and mineral districts instead of mineral deposits.

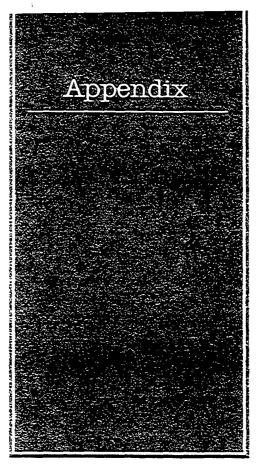
The barrier of inaccessibility has been broken. No area is inaccessible or too remote for the polar-orbiting satellite. Now the entire earth is the geologist's true laboratory. The dramatic oil discovery at Prudhoe Bay, north of the Arctic Circle in Alaska, and the subsequent \$900 million investment in adjacent land by oil companies indicate that no areas are too remote for raw materials exploration.



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Appendix: Executive Order 12951, Release of Imagery Acquired by Space-Based National Intelligence Reconnaissance Systems, 22 February 1995

10789 Presidential Documents Federal Register Vol. 60, No. 39 Tuesday, February 28, 1995 Executive Order 12951 of February 22, 1995 Title 3-Release of Imagery Acquired by Space-Based National The President Intelligence Reconnaissance Systems By the authority vested in me as President by the Constitution and the laws of the United States of America and in order to release certain scientif ically or environmentally useful imagery acquired by space-based national intelligence reconnaissance systems, consistent with the national security. it is hereby ordered as follows: Section 1. Public Release of Historical Intelligence Imagery. Imagery acquired by the space-based national intelligence reconnaissance systems known as the Corona, Argon, and Lanyard missions shall, within 18 months of the date of this order, be declassified and transferred to the National Archives and Records Administration with a copy sent to the United States Geological Survey of the Department of the Interior consistent with procedures approved by the Director of Central Intelligence and the Archivist of the United States. Upon transfer, such imagery shall be deemed declassified and shall be made available to the public. Sec. 2. Review for Future Public Release of Intelligence Imagery. (a) All information that meets the criteria in section 2(b) of this order shall be kept secret in the interests of national defense and foreign policy until deemed otherwise by the Director of Central Intelligence. In consultation with the Secretaries of State and Defense, the Director of Central Intelligence shall establish a comprehensive program for the periodic review of imagery from systems other than the Corona, Argon, and Lanyard missions, with the objective of making available to the public as much imagery as possible consistent with the interests of national defense and foreign policy. For imagery from obsolete broad-area film-return systems other than Corona, Argon, and Lanyard missions, this review shall be completed within 5 years of the date of this order. Review of imagery from any other system that the Director of Central Intelligence deems to be obsolete shall be accomplished according to a timetable established by the Director of Central Intelligence. The Director of Central Intelligence shall report annually to the President on the implementation of this order. (b) The criteria referred to in section 2(a) of this order consist of the following: imagery acquired by a space-based national intelligence reconnaissance system other than the Corona, Argon, and Lanyard missions. Sec. 3. General Provisions. (a) This order prescribes a comprehensive and exclusive system for the public release of imagery acquired by space-based national intelligence reconnaissance systems. This order is the exclusive Executive order governing the public release of imagery for purposes of section 552(b)(1) of the Freedom of Information Act. (b) Nothing contained in this order shall create any right or benefit, substantive or procedural, enforceable by any party against the United States, its agencies or instrumentalities, its officers or employees, or any other person.

Appendix (Continued)

10790 / Federal Register / Vol. 60, No. 39 / Tuesday, Tebruary 28- 1995 / Presidental Doctiments State Sec. 4. Definition. As used herein, "Imagery" means the product acquired by space-based national intelligence reconnaissance systems that provides a likeness or representation of any natural or man-made feature or related objective or activities and satellite positional data acquired at the same time the likeness or representation was acquired. THE WHITE HOUSE. February 22, 1995 FR Doc. 95-5050 Filed 2-24-95; 2:13 pm] Billing:code 3195-01-P

Since the CORONA satellite's first successful flight in 1960, reconnaissance satellite programs have been among the Intelligence Community's most closely guarded secrets. The end of the Cold War, however, made it possible for President William Clinton in February 1995 to order the declassification within the next 18 months of historical intelligence imagery from America's earliest satellite systems. On 24 February 1995, Vice President Albert Gore, who first urged the Intelligence Community to open up its early imagery for environmental studies, came to CIA Headquarters to unveil the first CORONA satellite photographs for the American press and public.

The CIA History Staff is publishing these newly declassified documents and imagery from the CORONA program as the fourth volume in its Cold War Records Series. This publication marks the conference, "Piercing the Curtain: CORONA and the Revolution in Intelligence," cosponsored in May 1995 by the CIA's Center for the Study of Intelligence and George Washington University's Space Policy Institute.

Dr. Kevin C. Ruffner, who compiled and edited this new volume, has an A.B. from the College of William and Mary and an M.A. in history from the University of Virginia. He joined the CIA History Staff in 1991, soon after he received his Ph.D. in American Studies from the George Washington University.