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11 December 1968

A CENTURY OF CORONA

1960 - 1968

"I wish to thank you on behalf of all of those associated with the CORONA Program for your interest and good wishes on completion of the One Hundredth CORONA Mission; I also wish to express my appreciation for the outstanding support which the CIA has given to this program. The success we have achieved is due in no small measure to this support."

This message from Dr. Flax was delivered in February 1968 to Mr. Helms. It is significant in that it addresses a very unique satellite reconnaissance program, a program which is certainly the workhorse of satellite reconnaissance programs. This program was the first to recover objects from orbit; the first to recover intelligence information from orbit; the first, and to date only, U.S. satellite-borne, panoramic, stereoscopic, reconnaissance system; the first to seek and find the Soviet ICBM deployment; the first to employ longer mission life and multiple reentry vehicles on one mission; and the first, and to date only, satellite reconnaissance program to successfully complete more than 100 missions. Of great significance, moreover, are the contributions from a technical and intelligence standpoint in challenging the unknown by establishing and advancing the "state-of-the-art" in photographic reconnaissance from orbiting satellites.

The Formative Years

When the U-2 Program first got under way, it was anticipated that in one to one and one-half years the Soviets would be able to counter with a surface-to-air missile. It was anticipated, however, that within this period SAMOS would take over the photo reconnaissance collection. However, because of SAMOS development difficulties, the White House approved the development of a satellite-borne camera and recoverable capsule, the beginning of the CORONA reconnaissance program in April 1958.

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The CORONA Program was carried out under the authority of CIA and the Advanced Research Projects Agency (ARPA) with support of the Air Force. Booster proposal work in early feasibility investigations had been performed earlier as part of Air Force Weapons System 117L (Sentry). The CIA was charged with the development of the reconnaissance equipment, security, cover, covert procurement, and collection requirements. In behalf of ARPA, the Air Force contracted for and directed the detailed procurements on the overt side. These included the booster, the AGENA 2nd stage, control networks, launch facilities, and the basic recovery vehicle development.

In February 1959, an inert THOR-AGENA was launched, followed by two non-camera-bearing test vehicles which did not orbit. These were followed by a series of operational failures of the booster or recovery vehicle. In November 1959, the ARPA responsibility was transferred to the Air Force under the direction of the Secretary of Defense. A recovery system diagnostic program was instituted, culminating in August 1960 with the first successful recovery from orbit. Later that month, a camera system was flown, and film was recovered.

The Growth Period

The original CORONA Program was extended through a series of evolutionary system modifications. The C and C' Systems flew from 1960 through 1961. The C''' was first flown in August 1961. The development of a dual camera stereo configuration, using C''' cameras, known as C/MURAL was initiated late in 1961. The first C/MURAL System was flown in February 1962. With that flight the CORONA Program had advanced from a single panoramic camera system, having a design goal for ground resolution of 20-25 feet, to a twin camera panoramic system which produced stereo at essentially the same ground resolution. Within a year, development of a new J System was accomplished. The primary difference between C/MURAL and the J Systems consisted of the addition of a second recovery vehicle. The ground resolution of the CORONA system improved in an evolutionary manner from the 20-25 feet design goal for the C''' to approximately 7-10 feet for the J-1 (KH-4A) system.

Operational control of the CORONA received considerable attention from its inception. Control concepts,

developed for CORONA, led the way for more sophisticated and complex control systems within and outside the program. Control software for creating the camera's command tapes evolved from a simple form into one having the flexibility to choose camera operations of varying lengths over any segment of the earth's surface. This flexibility, achieved by a nine channel pre-programmed command system, has been employed since September 1966. It has provided to the operators the ability of applying cloud cover forecasts, thereby increasing the return of cloud free photography. Auxiliary software has been created for improved management of the CORONA Program. The [redacted] program provides the National Photo Interpretation Center with advanced listings of target locations resulting from the CORONA coverage so that target collateral and historical information can be pre-assembled for the photo interpreter. 25X1 25X1
The [redacted] program provides the Satellite Operations Center with an evaluation of candidate orbits examined against specific mission requirements and aids in the selection of the orbit to be flown on a specific mission.

Maturity

In September 1967, the first improved CORONA J-3 (KH-4B) was launched. This system has achieved the best CORONA resolution, estimated at about 7 feet, and is currently being operated for planned orbital lifetimes of 18-20 days. In addition to the conduct of the normal CORONA intelligence missions, the first five flights of the J-3 system conducted a series of significant experiments. These experiments included tests of adjustable exposure and filter devices and special filters which provide a significant increase in camera flexibility. This flexibility has allowed testing of the Bi-Color technique, faster films, special color films, including Ektachrome, [redacted] 25X1
Adjustments have been made to this system to employ untra-thin base (UTB) film.

A Digital Shift Register Command System has been successfully developed and will be flown for the first time on CR-6, now scheduled for February 1969. This system will allow greater latitude in the selection of camera on-off times. A modification to the orbital timer

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has been completed that allows for a maximum mission control of 20 days on orbit. This timer was implemented commencing with the September 1968 CORONA mission. A new software program, the CORONA Targeting Program (CTP), has been designed and is currently undergoing operational tests and evaluation. This software, in conjunction with the Shift Register, will achieve more efficient and effective operation of the CORONA system by providing orbit-by-orbit camera operation selections based on current weather forecasts.

In summary, during an eight year period CORONA has evolved from a low-resolution single camera system having one-day orbital mission capability to a medium resolution stereo panoramic camera system employing two "bucket" return of the information, and operating on-orbit for a period of approximately 18-20 days.

Contribution to Higher Resolution Systems

By March 1964, the CORONA Program had photographed twenty-three of the twenty-five Soviet ICBM bases; by June 1964, it had photographed all of the existing Soviet ICBM bases. [redacted] 25X1 25X1

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Contributions to National Strategic Intelligence

"No new ICBM complexes have been established in the USSR during the past year. This judgment is based on a recent examination of KH-4 photography dating from June 1967 and covering 90 percent of the main Soviet rail network--more than 70 percent since the start of 1968. All known Soviet ICBM complexes are served by rail, and

a search of the rail network is the basic ingredient in our confidence that the deployment is confined to the 25 complexes already identified."

The above statement appears in the annual intelligence report entitled Search of the Soviet Rail Network for ICBM Deployment, June 1967 - May 1968, dated September 1968. This statement encapsulates the ultimate intelligence contribution made by the CORONA Program in the field of National Strategic Intelligence.

The CORONA Program ability to discover and identify new Soviet silos is unchallenged by any other means of intelligence gathering. Figures 1 and 2 were taken from the USIB COMIREX Collection requirements for High Resolution Imagery Surveillance by Satellite Reconnaissance of Targets in the Soviet Bloc and Communist China. They show only the detection of the most recently deployed Soviet ICBMs. Similar CORONA accomplishments have resulted in the discovery and location of the Soviet deployment of their IRBM and MRBM systems, their total surface-to-air missile defense network, including the SA-3 and SA-5 systems, the ABM installations, the SAM installations in North Vietnam, and the Scaleboard surface-to-surface missile system along the USSR-Chinese Border. CORONA

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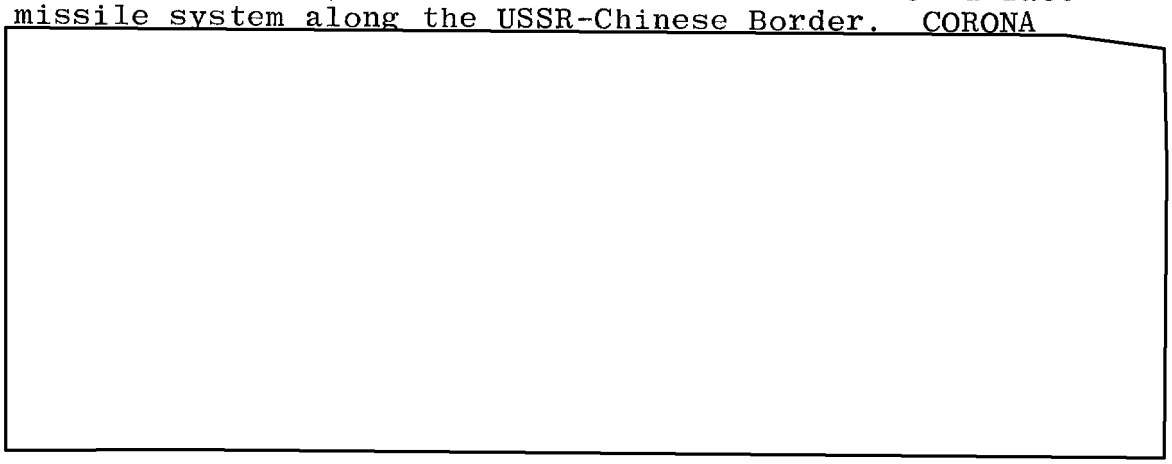

Finally, CORONA is again being tasked to acquire coverage of China in a search for the deployment of the ballistic missiles. When this event occurs, CORONA will again have played the role of pathfinder for the Intelligence Community.

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Contribution to the USIB Search Requirements

A summary of statistics regarding CORONA accomplishments appears in the tables attached to this document. They include the breakdown of the missions flown yearly and the statistical accomplishments per year. An average CORONA mission returns photography of about 10,000,000 square nautical miles, which includes, on the average, 3100 cloud free COMIREX target images. Tables 2 and 3 display the CORONA mission performance in acquiring photography in the conduct of the Semiannual Search Requirement. Tables 4 and 5 display CORONA performance in acquiring photography in the conduct of the Annual Search Requirement. Table 6 displays CORONA mission performance in accomplishing Mapping, Charting and Geodetic coverage.

The Future

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When the final CORONA Mission is flown, history will record the fact that it conquered the initial technological problems of space reconnaissance, produced vital national intelligence information for almost a decade, gave birth to a more sophisticated broad area coverage system, and achieved the distinction of being the program which parted the Soviet and Communist Chinese curtains of secrecy.