Photographic Reconnaissance Systems

COMBINED PROGRAM CALL

In August 1969, the CORONA and HEXAGON Project Offices were combined into the single office of Photographic Reconnaissance Systems. This reorganization had a two-fold purpose: (1) to provide a more effective use of technical personnel; and (2) to provide for a smooth transition in the phase-out of CORONA and initial operation of HEXAGON.

The PRS Project Office has been organized as an integrated office with all personnel having responsibilities in both the CORONA and HEXAGON projects. This program call response combines personnel and funding requirements into a single requirement covering both programs. The establishment of HEXAGON as an operating system and the phase-out of CORONA is scheduled for calendar year 1971.

It is planned to relocate the CORONA manufacturing, assembly, and test functions from the present Advanced Projects (AP) facility at Palo Alto, California, to the Lockheed Missile Systems Company complex at Sunnyvale, California. This move will provide for the consolidation of these CORONA and HEXAGON functions in a single geographical area and will permit consolidation of communications and computing requirements. In this submission the CORONA and HEXAGON Projects are discussed separately; however, the resources required are combined into a single requirement.

Progress Towards Objectives

July 1968 - December 1969

PROJECT: CORONA

Overall objectives during the report period were to maintain satellite photographic search and surveillance over denied areas in response to USIB requirements and to make system improvements yielding better product quality, effectiveness and versatility.

During the period ten out of ten CORONA missions (seven J-1's and three J-3's) were successfully launched and recovered. The year 1968 marked the 106 mission for CORONA.

During the 12-month period November 1968 through November 1969, eight CORONA and eight GAMBIT CUBED missions were flown. These 16 missions identified 198 new Soviet ICBM silos of which 121 were identified by CORONA as follows: 44 SS-9 (34 by CORONA), 136 SS-11 (82 by CORONA), and 18 SS-13 (5 by CORONA). In addition, of the 57 new SS-11 silos located in MRBM and IRBM complexes, 40 were identified by CORONA. Mission 1106 in February 1969 alerted us to the first new SS-9 group since May 1968. CORONA continues to supply target location data resulting in increased efficiency in GAMBIT operations.

System adjustments have been made and tested to utilize ultra thin base (UTB) film, which increases film capacity by 50 percent, in the J-3 system. Based on analysis of UTB performance in previous flights and on the findings

of the UTB Task Team, an extensive test program including requalification of the modified UTB-configured payload has been successfully conducted. As a result, it has been recommended to the D/NRO that UTB be flown in the CR-11 flight, and, if successful, be considered the standard film for all future J-3 flights except for CR-10, which is now configured as a Standard Thin Base (STB) payload.

Mission 1104, in August 1968, carried an 800-foot tag-on strip of SO-180 (IR camouflage detection film). This was the first time that this type of photography had been attempted from satellite altitudes. Due to a malfunction, a large portion of this film was degraded; however, on those resolutions not affected by the malfunction, the film performed as expected.

Mission 1105, in November 1968, was the first to carry a full load of UTB, with the exception of a 500-foot tag-on strip of SO-121 Ektachrome color on one side.

This year marked the first use of a significant amount of color film. Flight 1106 carried a 2000 foot tag-on load of SO-121 Ektachrome color, which gave successful results. The collection value of color film in satellite systems is being studies by the intelligence community. A detailed assessment is scheduled for completion in January 1970.

Flight 1106 also marked the successful maiden flight of the Digital Shift Register Command System. The Shift Register allows in-flight selection of camera operating locations, permitting more flexibility in targeting and in capitalizing on weather predictions.

[redacted] Mission 1106 as a launch vehicle.

Objectives and Program Plans FY 72-76

1. Collection of Intelligence

d. Imagery

1) Photographic

PROJECT: CORONA

Objective: The objective is to maintain satellite photographic search and surveillance over denied areas in response to USIB requirements.

Program Plan:

Method of Approach: The space vehicle, which includes the payload and the AGENA control vehicle, is launched from Vandenberg Air Force Base by a thrust-augmented THORAD booster. The payload consists of two 24-inch focal length stereo panoramic cameras, two reentry vehicles, and the structure housing these vehicles and mating with the AGENA. The system is commanded and controlled through the worldwide space tracking network, contains 160 pounds of film, and achieves roughly 10 million square miles of coverage per mission. Recovery of the two CORONA buckets for retrieval of exposed film is generally by air snatch north of Hawaii.

The NRO, with the approval of the EXCOM, has decided the CORONA launch schedule will be stretched out to five (5) launches in FY's 70 and 71 and two (2) launches in FY 72. The CORONA schedule as scheduled by the D/NRO is:

	FY 70	FY 71	FY 72
Launch	5	5	2

Last scheduled launch is November 1971.

During the last half of FY 72, Project CORONA will be closed out, and final disposition of residual material, equipment, and other assets will be made to on-going projects.

Coordination, Joint Planning, and Requirements: The Project is under the direction of NRO, with overall planning and schedule management by the Air Force SPD. Responsibilities are divided between the Air Force and CIA. The former is responsible for the THORAD booster, the AGENA, and the mapping camera, (DISIC) CIA has total payload responsibility, including integration of DISIC into the payload.

Missions are planned in response to USIB requirements.

Risks and Uncertainties: The reliability achieved by the ~~Project~~ SYSTEM has been outstanding. The major area of risk relates to maintaining continuity of intelligence collection. There must be sufficient overlap between CORONA and HEXAGON to ensure that a reliable search and surveillance system is at the disposal of the intelligence community. In the

interim, there will be risk of reliability degradation due to assignment of experienced industry personnel to other programs as CORONA phases out. The Project Office will make a strong effort to keep that risk at a minimum.

The FY 1972 effort is rated as absolutely essential to attainment of the specified objective.

Alternatives Considered: The principal alternatives, insofar as CIA resources are concerned, relate to staffing level in FY 1972. This, in turn, depends upon the need to protect against the contingency of HEXAGON schedule slippage.

Progress Towards Objectives

July 1968 - December 1969

PROJECT: HEXAGON

The overall objective during the period was to proceed with design and development of a follow-on satellite photographic search and surveillance system in accordance with requirements of the intelligence community and NRO directives.

A cost reimbursement-type Facilities Contract with Perkin-Elmer was negotiated and signed for an estimated $17.3 million. This contract included the Government's share in building cost, industrial plant equipment, special test equipment, and large thermal vacuum chambers.

Negotiations with Perkin-Elmer for all of the identified unnegotiated changes were completed. A new target cost for incentive fee purposes was established at $195,000,000. Several changes to the basic contract work statement were included to clarify certain areas of the work statement and to correct deliverables and delivery schedules. In addition, certain modifications were made to the incentive provision of the contract to reflect a change in incentive emphasis on delivery schedule.

The Technical Advisory Committee to the Director of Special Projects reviewed Sensor Subsystem status in January at the Perkin-Elmer (P.E.) facility. The consensus was that good progress had been made since the March 1968 review and that no serious technical problems remained to be solved in achieving specified system performance.

The ad hoc committee of Aerospace Corporation senior management (Donovan Committee), appointed by the SPD to review HEXAGON Program overall status and adequacy of system engineering, completed its technical assessment and reported status of system integration and engineering to be satisfactory.

DD/NRO, assisted by Agency and SAFSP personnel, conducted a study of the HEXAGON cost and schedule status to determine the best plan to accomplish national reconnaissance objectives relative to the HEXAGON and CORONA programs. As a result of his recommendations made to the NRP Executive Committee, it was decided that the CORONA launch schedule would be stretched out to five (5) launches in FY's 70 and 71 and two (2) in FY 72 to provide a greater overlap between the two systems to accommodate any schedule slippage in HEXAGON without a hiatus in photographic search intelligence. Both programs were reevaluated in December 1969.

The number of HEXAGON launches was reduced from five to four per year by the NRP Executive Committee during the Second Quarter of FY 69. A later decision by the EXCOM reduced the number of launches to three commencing in FY 1975.

Reporgramming effort directed by the Program Office to bring FY 69 expenditures within authorized funding resulted in a shift of first flight schedule from October 1970 to December 1970. The D/NRO authorized the schedule change,

and a revised integrated master schedule was developed by SSPO and SPO. The initial Flight Model Sensor Subsystem is on schedule for delivery to the System Integration Facility in April 1970 to support the first launch date of December 1970.

D/NRO directed that SPD had prime responsibility for operational software development. Representatives of the Agency, SOC, SAF, SP, STC participated as a joint Source Selection Board to review and evaluate three proposals for the integrated STC software for HEXAGON. The Board completed the evaluation and submitted the results to the Source Selection Authority for selection of the successful bidder. The contract was awarded to TRW.

A Sensor Subsystem Development Model Critical Design Review (CDR) was held at Perkin-Elmer on 5 and 6 March 1969. CDR's of all major subassemblies has been held prior to this.

The Sensor Subsystem Mass Model was assembled into the SBA center section complete with the supply assembly and subjected to resonant search tests which met or exceeded design requirements. The completed Mass Model/SBA assembly was shipped on schedule to the Satellite Vehicle Integrating Contractor (LMSC) for integrated testing.

The Development Model two camera assembly was successfully operated in air and was installed in the thermal vacuum chamber for qualification and acceptance environmental tests.

All major special test equipments provided by the Government under the facility contract were installed, tested and accepted. The facility for the production and testing of the sensor subsystem was completed and occupied.

The Engineering Model was assembled and tested. This model demonstrated the capability of the system as designed to produce photography of a quality specified for the system. The Engineering Model also served to check out the compatibility of the sensor with various elements of test and handling equipment and to provide confidence in the design and schedule of the flight systems.

Objectives and Program Plans
(Collection of Intelligence Category)

Project: HEXAGON

Objective: To maintain satellite photographic search and surveillance over denied areas in response to USIB requirements; to make system improvements yielding better product quality.

Program Plan:

Method of Approach: This Program is discussed under Research, Development, and Engineering for years prior to FY 1972.

HEXAGON is a follow-on system to CORONA scheduled for first launch in December 1970. The space vehicle, which includes the Satellite Basic Assembly, the Sensor Subsystem, Stellar-Terrain camera system, and Re-entry Vehicles, will be launched from Vandenberg Air Force Base with a TITAN III D booster. The system will be commanded and controlled through the worldwide space tracking network. Recovery will be by air snatch north of Hawaii.

The HEXAGON system is designed to meet USIB requirements with a minimum number of launches. The planned schedule is:

	FY 70	FY 71	FY 72	FY 73	FY 74	FY 75	FY 76
Launch	0	3	4	4	4	3	3

The system is designed to obtain approximately 20 million square nautical miles of stereo coverage and two-to-three foot resolution at nadir for a mission of 30 to 45 days. Twin 60-inch focal-length, stereo, panoramic cameras capable of scanning a 120 degree sector will be used. The system will carry about 1,800 pounds of film.

Substantial development and engineering effort will continue during FY 1972 to FY 1976 to complete development and affect system refinements and improvements. In addition, there will be the normal engineering changes and design improvements expected in a system of HEXAGON's complexity, required to assure compatible interfaces, to reduce weight, and to improve reliability and performance against changing operational requirements.

Coordination, Joint Planning, and Requirements: The Project is under direction of the NRO, with overall management responsibility with the SAFSP SPD. The ~~Air Force~~ SAFSP is responsible for overall system engineering and integration and for the launch vehicle, spacecraft, stellar-index, and re-entry subsystems. CIA has responsibility for the Sensor Subsystem and also for integrating the Sensor Subsystem in the spacecraft and development of software necessary to determine the operational health of the Sensor Subsystem in orbit. SAFSP also has responsibility for providing the necessary targeting software in support of the Satellite Operations Center. The CIA has responsibility for software in support of the SOC.

Design performance characteristics of the Sensor Subsystem is continuously coordinated with NRO and organizations of the intelligence community which will use HEXAGON photography.

Missions will be planned in response to USIB requirements.

Risks and Uncertainties: It is not expected that introduction of a more advanced satellite photographic system will increase world tension or result in political embarrassment even if United States use of the system should be publicly disclosed. The potential capability of this system especially in high resolution search may, in fact, add significantly to a successful resolution of the SALT negotiations.

While there are technical risks in any state-of-the-art advance in complex systems, there does not appears to be any technical design area which would prevent the camera from meeting its performance goals. Ability to meet performance has been demonstrated in development test. Reliability is as yet unproven.

The FY 1972 effort is rated as absolutely essential to attainment of the stated objective.

Alternatives Considered: The principal alternatives, insofar as CIA resources are concerned, relate to staffing levels. The proposed level is considered correct. Reductions would mean that certain functions in product improvement and in system assembly and test would be curtailed below desirable levels. This would add to the risk of successful operation and decrease the rate at which improvements could be introduced.

Resources Required

Shown below are the resources required by the Office of Photographic Reconnaissance Systems to support the phase-out of the CORONA system operation in FY 1972 and the initiation of HEXAGON operations in FY 1971.

Funding: (thousands of dollars)

	FY 1972	FY 1973	FY 1974	FY 1975	FY 1976
Pers Svc.					
Travel	160	145	140	140	140
Other	3	3	2	2	2
	~~165~~	~~148~~	~~142~~	~~142~~	~~142~~

The above figures do not include certain major funding requirements included elsewhere. NRO funding is included in the Annex. Communication costs, such as leased lines and equipment, and personnel are included under PRS Communications Indirect support costs of the PRS Office are under the OSP Office Staff.

Explanation of Increase/Decrease:

FY 1972-1976 salaries reflect an authorized yearly increase of 1.0 per cent for step increases and promotions. Reductions in salaries in FY 1973-1974 are associated with reduction in number of positions shown below. Travel cost reflect the increase in per diem rates.

Positions:

	FY 1972	FY 1973	FY 1974	FY 1975	FY 1976
Ceiling	35	31	27	27	27
Non-Ceiling	1	1	1	1	1
Total	36	32	28	28	28

Explanation of Decrease:

FY 1973 shows a reduction resulting from the phase-out of CORONA (3 positions) and a reduction in engineering effort (1 position). The decrease in FY 1974 is further reduction in engineering support as initial major design changes are complete and initial design deficiencies corrected. FY 1974 and beyond is the sustaining effort required to monitor and direct the production, integration, acceptance and operation of the HEXAGON system.

CIA COMBINED PROGRAM CALL

PHOTOGRAPHIC RECONNAISSANCE SYSTEMS

Positions	FY 1972	FY 1973	FY 1974	FY 1975	FY 1976
Ceiling	35	31	27	27	27
Non-ceiling	1	1	1	1	1
CIA Funds					
NRO Funds					
CORONA ($X1000)	3.07	0	0	0	0
HEXAGON ($X1000)	70.1	60.8	59.2	55.4	53.0