THE OFFICE OF THE SECRETARY OF DEFENSE

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From: _____

To: DR McLUCAS

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Comment:

John,

These are the papers that Gardner discussed with you this morning (March 18) The HEXAGON Study was submitted by John Foster to EXCOM and BoB, DIA and Systems Analysis for EXCOM discussion last November.

Herb.

PROPOSED DOD POSITION ON HEXAGON

(1)

I. ISSUES

This paper addresses the following issues:

1. Should the HEXAGON development be continued or should the program be terminated now and our plans modified to depend indefinitely on the current CORONA system?

2. If HEXAGON is continued, should four or five HEXAGON launches be planned for FY 72? (NRO Issue #4).

3. If HEXAGON is continued, should five, six or seven GAMBIT launches be planned for FY 72? (NRO Issue #5).

4. What should be the pace in developing an Indications and Warning System for near real-time readout of intelligence? (NRO Issue #9).

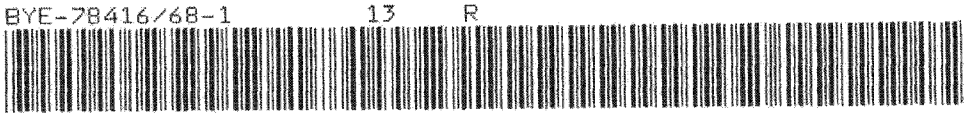
II. SUMMARY OF ANALYSIS, CONCLUSIONS, AND RECOMMENDATIONS

1. We think three options should be considered:

Option I - Cancel HEXAGON. Plan for seven GAMBIT and seven CORONA missions per year. This option will save $183-234 million in FY 68 - FY 70 costs and will save up to $500 million in FY 69 - FY 73 costs. However, it will not provide the significant benefits of HEXAGON for the 70's.

Option II - Austere HEXAGON. In the long run, plan for three successful HEXAGON missions and four GAMBIT launches per year. This option will save $17 million in FY 70 costs and at least $154 million in FY 68 - FY 73 costs. Outyear operating costs for this option are less than those for Option I, but the intelligence value is much higher.

Option III - Planned HEXAGON. Plan for five HEXAGON and five GAMBIT missions per year. This program will cost $74 million more annually in outyear operating costs but produce 30 per cent faster and additional reconnaissance.



2. Table I compares the intelligence performance and cost of these three options. HEXAGON is a more cost-effective search vehicle than CORONA and its higher resolution provides adequate intelligence on one-half to two-thirds of the high resolution targets covered by GAMBIT today. Accordingly, Option II provides better intelligence than Option I (and has an even greater margin over performance projected for FY 69). Compared with Option I, Option II will have fewer 1-2 foot resolution accesses per year to missile test ranges (roughly 20 vs 30 for a typical range) but it will have as many or more than are projected for FY 69. Also, HEXAGON coverage of these ranges should be very productive. We recommend Option II since we cannot justify, at this time, the additional reconnaissance provided by Option III, the planned Program. The remainder of this section expands briefly on this analysis.

3. Last August when we reviewed this problem, we thought that there might be two additional options: (1) develop an IMPROVED CORONA search system with 4.5 foot resolution and (2) delay HEXAGON by a year or more in order to reduce FY68-FY70 commitments. We conclude that neither of these are competitive. Development costs for an IMPROVED CORONA with this resolution would be roughly the same as the development costs remaining for HEXAGON. Delaying HEXAGON would cost almost as much in the short run and 50% more in the long run.

4. Table II compares the current CORONA and GAMBIT systems with the planned HEXAGON and MOL and the potential Unmanned DORIAN and Indications and Warning Systems.

5. The 2.5 to 4 foot resolution of HEXAGON is markedly more productive than the CORONA 7 to 10 foot resolution. DIA, CIA and NPIC studies on the value of resolution indicate that there is a "breakpoint" in resolution productivity at the 3 to 5 foot range. For example, the lower 7 to 10 foot resolution of CORONA will detect the large features associated with ICBM deployment, aircraft, and scarring for construction. On the other hand, HEXAGON-like resolution is needed to identify smaller vehicles, weapons, and specific types of construction. Because of the value of HEXAGON resolution, we conclude that more than half of the targets now covered by the GAMBIT system could be adequately covered by HEXAGON. Also, as long as surveillance is one of its objectives, GAMBIT missions cannot be optimized for high resolution, technical intelligence objectives.

6. We have identified three major contributions to intelligence that are uniquely possible with a HEXAGON system:

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Table I - COMPARISON OF OPTIONS

	FY 69 Projection	I - Cancel HEXAGON	II - Austere HEXAGON	III - Planned HEXAGON
Outyear Launches				
CORONA		7	0 1/	0
HEXAGON		0	3 successful	5
GAMBIT		7	4	5
Intelligence Performance				
Search developed area in six months	74%	74%	82%	94%
1-2 ft. resolution targets per day	30	40	24	32
2-4 ft. resolution targets per day	0	0	200 (Tot = 224)	260 (Tot = 292)
Ground Forces	Poor	Poor	Good	Good
Mobile Systems	Poor	Poor	Good	Good
High Resolution days in orbit	70	108	153	216
Cost				
FY 69-70		~~$ 717 M~~ 617	$ 805 M	$ 812 M
Five Year		~~$1448~~ 1448	~~$1720~~ 1694	$1781
Annual Operating		$ 266	$ 250	$ 324
System Mix Options		Poor	Good	Good

1/ Under this Option, four HEXAGON are launched in FY 71 and five in FY 72. After that, three are launched per year with pipeline launch available in case of failure.

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TABLE II

INDIVIDUAL SYSTEM COMPARISONS

	Current		Planned		Unmanned	Indications and Warning
	CORONA	GAMBIT	HEXAGON	MOL	DORIAN	
Resolution	7-10 ft	1-3 ft	2.5-5 ft			2.5-5 ft
Typical photograph (mi.x mi.)	135x500	5 x 20	60 x 60 265 x 500	2 x 2	2 x 2	3 x 3
Days/Mission	20	18	30-45	30-42	30-45	365
Developed area/quarter	50% (6 mission/year)		75% (4 missions/year)			
Looks, per mission day	0	150	800	100-150	100-150	300
Operating cost per look	--	$8 K	$1.5 K	$50 K	$16 K	$2 K
Development cost Remaining	$0	$10 M	$140 M	$1 B	$150-200 M	$600-1000 M
Cost/Mission	$14 M	$22 M	$35 M	$150 M	$50 M	$150-200 M (per year)

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a. It will improve our ability to search more thoroughly the Soviet Union and China for new activity or to provide confidence that suspicious activity is not under way.

b. It will significantly improve our intelligence on ground forces by providing better and faster understanding of force readiness, logistical support, and major redeployment. It will be particularly helpful in detecting redeployments of Soviet forces towards NATO, China, or Korea, capabilities of Chinese forces and their deployment, and the status of Korean forces. If a satellite is in orbit during a crisis (roughly 50% likelihood with Option II or III), it can provide excellent intelligence, after delays of a few days or a week, of force deployment, buildup, and withdrawal.

c. It will uniquely enable us to detect and assess mobile forces such as ICBM's, IRBM's, and tactical offensive and defensive missiles.

7. We have identified more than twenty cases where less significant improvements in intelligence will be possible and we expect that these would number in the hundreds. Typical examples include the ability to:

a. Reduce peripheral and overhead air reconnaissance.

b. Improve intelligence on regional logistics and transportation.

c. Increase understanding of activities at R&D test facilities and at research institutions.

d. Provide better intelligence by allowing more extensive correlation of COMINT and satellite photography of air and naval activities.

e. Improve intelligence on numbers and locations of air defense radars.

We doubt that these many improvements would, in themselves, justify deployment of HEXAGON but they will provide a significant bonus value if HEXAGON is deployed.

8. In the areas of fixed air or missile defenses, submarines, long range air, atomic energy, and fixed ballistic missiles, we have not been able to identify major intelligence problems for which HEXAGON would contribute significantly. However, the unexpected value of the GAMBIT system to intelligence on ground forces is but one example of the inability to predict the value of a radically new system such as HEXAGON.

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9. With regard to developmental risk, the HEXAGON development is in its third year. All components are designed and engineering models are being completed and tested. There is a general consensus that high risk areas are identified and under control.

10. An advantage of deploying HEXAGON is that it will present more options in the early seventies for mixes of photo reconnaissance systems.

a. If HEXAGON is developed and if the MOL development leads to an operational, very high resolution system, it seems likely that the GAMBIT system may be terminated.

b. The HEXAGON launcher and space vehicle could carry the MOL-DORIAN optics. A development program of $150-200M would be needed to modify and make the two systems. (This does not include development and testing of the optics.) If HEXAGON is cancelled, the option of unmanned system with DORIAN optics won't be available.

c. The CORONA system has reached the limit of its improvement. A significant improvement to the system to bring resolution below five feet would require a new booster and an optical bar camera. This development would entail a development costing several hundred million dollars. On the other hand, there is a very significant potential for evolutionary improvement in the HEXAGON system including longer life and higher resolution.

d. It may be desirable to modify HEXAGON or to increase the number of HEXAGON missions per year so that a HEXAGON vehicle is alort more than 90% of the time. This capability would provide crisis coverage of any area within a week or several days if critical.

11. If HEXAGON is developed, the FY 69-FY 70 technology development for an Indications and Warning (I&W) System should procede at a normal, unaccelerated pace unless one is ready to justify the system solely on the basis of warning value. HEXAGON will provide some of the crisis benefits and most of the peacetime benefits of an I&W system.

III. Current Requirements and Capabilities

The USIB requirements for photo satellites include search, surveillance, and technical intelligence. The NRP operates the CORONA (7 to 10 foot resolution) for search and for surveillance of large complexes; it operates GAMBIT (1 to 3 foot resolution) for technical intelligence and for surveillance of individual targets.

The GAMBIT is limited in area coverage and to a few targets in dense areas; e.g. of 122 targets in the Moscow area, an average of approximately 30 targets per mission are photographed. On the other hand, CORONA photographs approximately eight million square miles per mission. (This product includes much cloud coverage, mapping coverage, and coverage outside the Soviet Union, but represents an area about as large as the Soviet Union).

USIB has identified four major requirements for the CORONA system:

a. Each six months cover 80 to 90 per cent of the developed areas (6.8 million square miles) of the Soviet Union and China. In this role, for example, the system has discovered most starts of fixed ICBM's and SA-5 Tallinn systems.

b. Each twelve months cover 75 per cent of the underdeveloped areas (2.8 million square miles) of the Soviet Union and China. In this role, the system detects developing areas or targets that will require higher resolution coverage. To date, one of the most important results has been to "negate" i.e. indicate that suspicious activity was not taking place.

c. Cover with medium resolution, clusters of targets such as missile ranges or highly developed areas which can only be partially photographed with the higher resolution GAMBIT system.

d. Map or search an additional 12.5 million square miles per year.

The CORONA system has been continually improving during it's lifetime in resolution, mission lifetime, and target capacity as shown in the following table:

	FY 64	FY 68	FY 69 (Projected)
Number of Missions	12	8	7 (6 successful)
Total days on Orbit	48	130	108
Percent coverage of developed areas	30%	70%	80%

A slight additional improvement of CORONA is already planned. 1/

The requirements and capabilities of the GAMBIT system are expressed in terms of a USIB list of targets with known locations. At present, this list includes about 5000-6000 targets in the Soviet Union and China which require coverage for surveillance and technical intelligence.

The USIB requirement expresses the number of quarterly, semi-annual, and annual photographs that are desired of selected targets on this list. At present, 4200 looks per year is the expressed requirement.

The GAMBIT system has been continuously improving, particularly in terms of mission life. Since the quantity of film on board is not a serious limiting factor, longer life means more accesses to targets and better ability to meet the USIB requirement:

1/ Last August, we thought it might be possible to develop an improved CORONA (as a competitor to HEXAGON) that would provide a resolution intermediate to CORONA and HEXAGON. We now conclude that this is not desirable for reasons suggested in the following table:

System	Resolution	New or Remaining Development Costs	Operating Costs	Contract Arrangements
CORONA	7-10 ft	$ 0	$72M/yr	Completed
HEXAGON	2-5 ft	$150-200M	$140M/yr	Completed
Improvement #1	5.5-8 ft	$ 75-100M	$100M/yr	Sole source of CORONA
Improvement #2	4-7 ft	$150-250M	$110M/yr	New competition

The first improvement would provide only marginally better resolution at much higher operating costs. The second would have development costs as high or higher than HEXAGON.

Fiscal Year	Average Life/Mission (days)	Number of Missions	Number of Quarterly Unique Looks
68	10	8	2100
69	10	8	2000
70	15	7 (6 successful)	2600

If the HEXAGON is developed, it will be able to satisfy (1) the search requirement currently satisfied by the CORONA and (2) many of the surveillance targets now covered with the GAMBIT. In addition, its 2 to 4 foot resolution over large areas in a period of 30-45 days will provide a volume of detailed coverage never achieved before. Accordingly, the value of the HEXAGON can only be determined by considering differing mixes, in the short run, of HEXAGON and GAMBIT and, in the longer run, of MOL, unmanned systems using the MOL optics, and continuous surveillance systems for indications and warning.

IV. Short Term Options

We have evaluated three options as follows:

OPTION I - Cancel HEXAGON. Cancel HEXAGON immediately. For FY 70 and after, continue the GAMBIT and CORONA programs each at seven launches per year with six successful expected.

OPTION II - Austere HEXAGON. Phase down the CORONA program as planned and by FY 72 reach a level in the GAMBIT and HEXAGON programs of four launches per year each with an expectation of more than three successful each. Roughly speaking, this option would provide better the same level of search and surveillance as is currently being achieved. (This assumes that HEXAGON will be developed according to plan and that launch failures are not excessive).

OPTION III - Planned HEXAGON. The same as OPTION II, only reach a level in the GAMBIT and HEXAGON programs of five launches per year each with an expectation of more than four successful each. This option would provide significantly better search and surveillance than are being achieved today.

Table III compares the launches and costs for each of these Options.

TABLE III - OPTIONS - LAUNCHES AND COSTS

($ in Millions)

	Fiscal Years					
OPTION I - Cancel HEXAGON	68	69	70	71	72	73
CORONA - launches	8	7	6	7	7	7
- costs	$75	$58	$65	$91	$102	$92
HEXAGON - costs	161	99	-	-	-	-
GAMBIT - launches	8	8	7	7	7	7
- costs	193	178	187	178	154	154
Impact on TITAN	-	10	20	20	20	20
Total Costs	$429	$345	$272	$289	$276	$266
OPTION II - Austere HEXAGON						
CORONA - launches	8	7	6	4	-	-
- costs	$75	$49	$27	$17	$2	-
HEXAGON - launches	-	-	-	4	5	3
- costs	207	203	182	198	191	150
GAMBIT - launches	8	8	7	6	4	4
- costs	193	178	166	136	100	100
Total Costs	$475	$430	$375	$351	$293	$250
OPTION III - Planned HEXAGON						
CORONA - launches	8	7	6	4	-	-
- costs	$75	$49	$27	$17	$2	-
HEXAGON - launches	-	-	-	4	5	5
- costs	207	203	198	233	226	209
GAMBIT - launches	8	8	7	6	5	5
- costs	193	178	167	140	115	115
Total Costs	$475	$430	$392	$390	$342	$324

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These costs are summarized as follows:

TABLE IV - COST SUMMARY
($ Millions)

	FY 69	FY 70	FY 69-FY 73
Option I - Cancel HEXAGON	$345	$272	$1448
Option II - Austere HEXAGON	$430	$375	$1698
Option III - Planned HEXAGON	$430	$392	$1878

Option III is the program recommended by the NRO (with the minor exception that, in Option III, the number of GAMBIT launches is reduced to five per year starting in FY 72 rather than six). Cancelling HEXAGON now (Option I) would reduce the FY 69 and FY 70 budgets by $85 million and $120 million, respectively.

V. Long Term Option

In addition to the CORONA, GAMBIT, and HEXAGON systems, two other systems may be deployed in the 1972-1975 time period:

1. A manned or unmanned follow-on to the MOL development program. This new system would provide resolutions of four inches or better but with a field of view of less than two miles in diameter for each target photograph (compared to five or more miles for the GAMBIT).

2. An Indications and Warning System (I&W) that would consist of one or more satellites continuously in orbit, each capable of transmitting pictures of 100 or more targets per day to ground stations within a day or hours. Such a system could have a best resolution of 1 to 5 feet. There is a consensus that HEXAGON-like resolution (2 or 3 feet at nadir) would be needed and adequate.

At this time there is considerable uncertainty with respect to the need for and feasibility of either system. However, we think it is important to consider the effect of these potential deployments on HEXAGON and, conversely, of HEXAGON on them. If HEXAGON is deployed, it will probably be the search system used (and improved) until at least the late seventies.

If there is a reasonable likelihood that a follow-on very high resolution system will be developed, then this likelihood argues for continued development and deployment of the HEXAGON. The reason is as follows:

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Candidates for follow-on systems range from mating the MOL-DORIAN optics to the HEXAGON Orbit Control Vehicle all the way to continuing indefinitely MOL manned flights. Rough estimates of typical system capabilities are compared in the following table:

TABLE V - SURVEILLANCE CAPABILITIES

System	Successful Missions/year	Operating Cost/year	USIB Targets/year
GAMBIT (without HEXAGON)	6	$154M	16,000
GAMBIT (with HEXAGON)	4	$115M	11,000
Unmanned DORIAN	2-3	$100-150M	6-9,000
Manned MOL	2-3	$300-400M	7-11,000

If HEXAGON is not developed, the GAMBIT program would probably not be stopped even if a very high resolution system is deployed because it would be the cheapest way to get 7-10,000 targets per year not [redacted] resolution. The GAMBIT launches might be reduced to 2-3 per year but this would increase unit costs to $30-40M per launch.

On the other hand, a decision to deploy the HEXAGON will not affect the need for a very high resolution system. The 2.5 foot best HEXAGON resolution will not satisfy the one-foot or better capability that can be provided by the GAMBIT or MOL systems.

With respect to the Indications and Warning System (I&W), a decision to deploy HEXAGON should delay the introduction of such a system to after 1975 unless a very high priority is placed on the development of an I&W system solely for crisis management and strategic warning. $600M - $1B is needed to develop the I&W System and $100 - $200M per year to operate it. The intelligence worth of such a system should be assessed, particularly considering the availability of the SR-71, TAGBOARD and other drones for crisis situations.

An I&W System is particularly attractive if the crisis capability of the system can be used during peacetime, on a daily basis, to cover surveillance targets. For example, in peacetime use, a two-satellite, 2 to 3 foot I&W System might compare with HEXAGON and GAMBIT as follows:

TABLE VI - HIGH RESOLUTION SURVEILLANCE

	GAMBIT	HEXAGON	I&W
Best Resolution	1 ft	2.5 ft	2.5 ft
Successful Missions/year	6	4	2 always in orbit
USIB Targets/year (thousands)	16	50-100	70-140

If an I&W System could be developed by 1972-1974, it would perform the surveillance function of the HEXAGON (but not the search function) and would argue sharply in favor of keeping the CORONA System for the search function. Such a development is highly risky and would cost $600-1000M in one-time development costs. If HEXAGON is deployed, it will provide as many target accesses as an I&W System and will also provide search against unknown targets. Thus, the immediate urgency of an I&W System is reduced at this time.

VI. UNIQUE INTELLIGENCE VALUE OF HEXAGON

Significant intelligence questions exist and others will arise after 1970 which could be better answered or only answered by a capability to examine collectively and nearly simultaneously large geographic areas with high resolution coverage. HEXAGON would support the assessment of the deployment and interrelationship of complex systems of military forces. It would benefit at least three major areas of intelligence: Ground Forces, Mobile Forces, and Broad Area Search. It would also permit the assessment of significant military buildups or changes extending over large areas or involving regions of current national interest. In addition, the value of HEXAGON resolution is such that HEXAGON could provide one-half to two-thirds

of the surveillance coverage currently provided by the GAMBIT System.

1. GROUND FORCES

The HEXAGON System would contribute uniquely to intelligence on Soviet, Chinese, and Korean ground forces. It would raise our understanding of the numbers, capabilities and readiness of these forces to a level comparable with that we have today of operational Air Defense, Missile, Air and Naval Forces.

High resolution GAMBIT photography has become the basic tool for analyzing ground force problems. In the past few years, it has greatly improved intelligence on Soviet and Chinese ground forces in areas such as: identification, type, and location of divisions; amount of heavy equipment possessed by major units; the role of the civil economy in mobilization; and, to a much lesser extent, reinforcement capabilities.

This dependence on the KH-8 is reflected by the fact that Communist ground force installations now comprise 41% of all high resolution targets specified by USIB for coverage. Because of the limited capacity of the KH-8 system and the lower relative priority of ground force installations, the USIB has limited the minimum frequency requirement for ground force installation coverage to once every two years. Moreover, since the requirements for coverage of the major installations alone exceed the KH-8 capability, 7,000 lower priority ground force tactical troop and logistical installations are not targetted.

However, the current photo-satellite program has two basic shortcomings: we can't cover enough units and locations and we can't cover many of them often enough. It is estimated that the Sino-Soviet Bloc contains some 10,000 individual ground force targets requiring coverage. The current mix of satellite photo systems is capable of providing adequate medium resolution coverage of the physical characteristics of military installations but cannot provide the necessary quantity and frequency of high resolution coverage which is essential for the analysis of the military units at these installations.

The resolution (2 to 4 foot) of HEXAGON permits identification of military vehicles and equipment by type (medium tank, truck, artillery pieces, pontoon bridge sections), analyses of activity in training and staging areas, and recognition and general description of open military storage and logistical support activities. Today only GAMBIT resolution will permit these identifications.

Broad area, high resolution concurrent coverage of large military complexes or widely separated installations which are part of the same target system would be possible with HEXAGON. With GAMBIT coverage, it is generally impossible to simultaneously review a large combat unit's disposition in its entirety--for example, the garrison, logistic and training areas of an armored division. Under these circumstances it may, literally, take one to two years to piece together the intelligence base and never be possible to register with high confidence changes which are dynamic.

Repetitive coverage of ground force targets is required to identify the changes in types and levels of equipment which vary among units within the same regional area, the nature of changes to physical facilities, and patterns of activity associated with training and force deployments. High resolution repetitive coverage also would provide for more accurate assessments of the rate of major armaments production and the status of known divisional support units. As an example of the need for repetitive coverage, recent joint CIA/DIA Ground Force studies have started to use extensively and now partly direct the intelligence collected repeatedly by aircraft in the Berlin corridor. However, these units are not typical of those where the greatest uncertainties exist.

This HEXAGON capability would be particularly important for the densely clustered ground force targets located in the western USSR, eastern Europe, China Border, and Korea, where the GAMBIT has been unable consistently to satisfactorily meet the collection requirements. For each military district, the productivity of HEXAGON would permit nearly complete coverage of every important target at least once per quarter and, for certain important targets, higher rates of repetitive coverage as shown in the following table:

TABLE VII - QUARTERLY COVERAGE OF GROUND FORCES

Category	Targets	UNIQUE LOOKS GAMBIT[1]	UNIQUE LOOKS HEXAGON[2]	MULTIPLE HEXAGON
Warsaw Pact	322	48	298	810
USSR	942	220	916	3159
China & North Korea[3]	507	105	486	1698

1/ Six 18-day missions annually
2/ Four 30-day missions annually
3/ All numbers in this row are probably low by a factor of two or more

The timely and in-depth assessment of Bloc Ground Forces capabilities is not only important currently, but will probably increase in relative importance in the post 1970 period. During this time, the HEXAGON would uniquely contribute to the formulation and improvement of intelligence assessments concerning:

1) Peacetime manning levels of active divisions.
2) Strength and status of cadre units and non-divisional support.
3) Logistical capabilities of theater forces.
4) Training levels, tactics, and doctrine.
5) Major Armaments Production.
6) Major ground force redeployments.
7) Rapid redeployments during a crisis.

2. DETECTION OF MOBILE FORCES

Detection and surveillance of mobile forces -- strategic or conventional depends upon establishing the facts simultaneously over a relatively broad area with resolution adequate to identify and differentiate objects such as tanks, trucks, and support equipment. There are three aspects of uncertainty for mobile targets: first, uncertainty as to the location of the target within what may be a relatively broad operational area at any time -- the problem is where to look; second, uncertainty as to the number of targets in the area -- the problem is whether a mobile target seen at a given point is or is not the same one seen previously at a different location; and third, uncertainty as to whether a target exists in the area at all -- the problem is whether the absence of evidence can be certified as the absence of forces.

While earlier Soviet strategic missile systems -- the SS-5, SS-7, SS-8, SS-9 and SS-11 -- were fixed, the newer systems -- SS-12, SS-13 and SS-14 are moveable or mobile. USIB estimates that the solid propellant ICBM - the SS-13 -- for which silos are now being deployed at Yoshkar-Ola, will be deployed in a mobile mode at some time in the future. The IOC is projected as 1970-71 with a force of 50 to 150 mobile launchers.

Today the CORONA Search System, with a resolution of seven to ten feet, adequately provides for the early detection and identification of ICBM silo starts. The average time from start of construction to detection has been about four months for the SS-9 silos and six months for the SS-11 silos. However, these ICBM systems are characterized by large fixed facilities.

Two collection problems would severely complicate U.S. detection and surveillance of mobile systems: The first relates to mobility. We would need prompt detection and general identification of vehicles or rail rolling stock associated with mobile offensive systems deployed over large areas. A resolution of 2 to 3 feet is required. Broad area, high resolution concurrent and repetitive coverage of road and rail nets, such as could only be achieved with HEXAGON, would be required to establish numbers, locations, areas of operation, patterns of deployment and make-up of Soviet mobile systems. Such information would provide the basis for intelligence evaluations and for the aiming of a higher resolution system to determine system details.

In addition to mobile and transportable equipment, it is likely that some fixed and observable facilities will be associated with the deployment of Soviet mobile systems, particularly for logistical support. Such facilities would probably be smaller in size and more widely distributed than current ICBM support bases. The second problem possibly complicating U.S. surveillance of Soviet mobile systems could be the concurrent employment of camouflage and deception to take maximum advantage of the established mobile capability. Logistic support and pre-surveyed road and rail launch positions could be camouflaged or, at the very least, marked by discreetly constructed support, access and security facilities. The resolution of the HEXAGON system might make it possible to discover these facilities.

3. SPECIAL REGIONAL PROBLEMS

The examples of North Korea, China and Crisis support in Czechoslovakia and the Middle East illustrate the above problems.

North Korea

CINCPAC, Commander, US Forces Korea, and DIA question the adequacy of current intelligence on North Korean military forces and the consequent need for an increase in photo coverage of that country. Primary concern is with any significant changes in the capabilities and location of enemy air, naval and ground units, particularly during periods of tension. Since the high priority targets in North Korea are clustered, GAMBIT coverage is limited. Of 79 selected targets requiring coverage during FY 68, only 33 were adequately covered with GAMBIT and of these, only ten were covered at the required frequency. Despite the fact that extensive cloud-free CORONA coverage was acquired over North Korea on several occasions during FY 68, only 27 of the 79 targets covered with CORONA were considered useable for intelligence purposes. The HEXAGON system could cover all of North Korea at least once per quarter at a resolution adequate to detect the current disposition and composition of military units as well as the level of military activity. The area coverage capability would allow comprehensive evaluations of operational capabilities, including reinforcement, support and mobilization.

Crisis Support - Czech Intervention and Middle East War

The CORONA (because of the resolution) and GAMBIT (because of field of view) have only limited capabilities to provide essential current intelligence information under crisis such as the June 1967 Arab-Israeli War, or the August 1968 Soviet occupation of Czechoslovakia. If imagery is to support essential current intelligence assessments, high resolution is mandatory, since such assessments will require data on precise numbers of equipment, by type, in order to identify type and echelon of military units involved.

While unfavorable weather and inability to have daily access, even when vehicles are on orbit, limit the potential of the CORONA, GAMBIT and HEXAGON systems to provide "indications" information, there is nevertheless much significant information which the HEXAGON would provide. HEXAGON coverage of the Sinai Peninsula during the Arab-Israeli War could have permitted an overall assessment of the battle area showing the nature, composition and interrelation of opposing forces, as well as the scale of activity.

With respect to Czechoslovakia, it was known, several weeks before the invasion, that the Soviets were mobilizing forces on a scale which would be consistent with such an invasion. A concerted effort was made to obtain CORONA photography of the border region in an attempt to obtain firm evidence of the status of Soviet forces. Bad weather (which would affect any system) hampered collection to some degree. Resolution, however, also made it impossible to identify Soviet forces in CORONA photography either before or after the invasion. GAMBIT photography was extremely important in those few instances where such was collected. KH-9 photography would have had sufficient resolution as well as the area coverage to have obtained a relatively precise understanding of the location and status of some Soviet units, both adjacent to the border and in the Western USSR during that period.

Soviet Military Build-Up Along the Chinese Border

During the past two years, a significant build-up of Soviet ground, air, and missile forces has been occurring along the border with Communist China. While the CORONA has detected the improvement and new construction of airfields throughout the area, information on the upgrading of equipment of Soviet ground force units and the types of missiles being deployed along the border has been developed primarily from high resolution GAMBIT photography. (FROG missile units and the new Soviet T-62 battle tank are among the items being identified).

Surveillance of this particular area has been complicated by two factors:

(1) The length of the border (2000 miles) from Vladivostok to Afghanistan.

(2) The simultaneity of activity occurring throughout the border region.

Because of the broad area involved, the gradual expansion of our intelligence base over the past two years has been paced primarily by the spacing and capacity of the GAMBIT missions. The availability of HEXAGON would have accelerated the expansion of our data base (as well as our assessment of the build-up) at a pace equal to the dynamic changes underway.

4. BROAD AREA SEARCH

Nominally we would fly six successful CORONA or four successful HEXAGON missions per year. The following table compares the search capabilities of CORONA and HEXAGON. For HEXAGON, two variations are shown: The initial system which shall have a 30-day life and the objective system that should have a 45-day life.

TABLE VIII - PER CENT COVERAGE

	CORONA	Initial HEXAGON	Objective HEXAGON
Quarterly, Built-up Area	50%	75%	84%
Semi-annual, Built-up Area	74%	92%	96%
Annual, Undeveloped Area	90%	98%	99%

In addition, the HEXAGON system will search with 3 to 5 foot resolution. This high resolution and thoroughness of coverage will help to insure early detection and analysis of changed or new military activity. Also important, the search will provide positive negation of suspicious activities reported from other sources. In the formulation of intelligence estimates concerning the strategic threat, negative information has equal value to positive information.

5. PRODUCTIVITY OF HEXAGON RESOLUTION

DIA has reviewed the productivity of varying resolutions to intelligence production. CIA and NPIC have accomplished similar reviews. Table IX indicates for twenty major categories the resolution needed to detect, generally identify, precisely identify, and describe. These categories are defined as follows:

a. Detection - Location of a class of units, objects or activity of posible military significance.

b. General Identification - Determination of general target type.

c. Precise Identification - Discrimination within target type of known types.

d. Description - Precise configuration/layout, dimensional detail, components, construction details (type, materials, hardness), etc.

As a result of this assessment, we estimate that the HEXAGON could assume one-half to two-thirds of the surveillance requirements currently satisfied by GAMBIT.

TABLE IX - RESOLUTION REQUIREMENTS

Category	Detection	General Identification	Precise Identification	Description
Airfields (Facilities)	20'	15'	5'	1'
Bomber A/C	15'	10'	3'	
Fighter A/C	10'	5'	3'	
Naval Bases	20'	10'	5'	1'
Vessels				
a. Surface Ships	25'	15'	2'-3'	1'
b. Surfaced Submarines	10'	5'	2'	
Troop Installations	15'	5'	2'-3'	
Logistic Installations	5'	2'-3'	1'	
Ground Forces Vehicles	5'	2'-3'	1'	
ICBM/MRBM/IRBM/ABM Launch Complexes	30'	10'	2'-3'	1'
SAM/AAA Sites	10'	5'	2'	1'
Radar Facilities	10'	5'	1'	
Telecom Facilities	10'	5'	1'	
Bridges	20'	15'	5'	3'
Highways	30'	20'	5'	2'
Railroads (includes yards, sidings,etc.)	50'	20'	10'	2'
Ports/Port Facilities	50'	20'	10'	2'
Urban Areas	100'	50'	10'	2'
Coasts & Landing Beaches	50'	20'	10'	3'
Production Facilities				
a. Army Materiel	20'	10'	5'	1'
b. Ship Building	20'	10'	5'	1'
c. Aircraft/Missile	20'	10'	5'	1'

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