FEB 12 1969

THE NEED FOR THE HEXAGON PHOTOGRAPHIC SATELLITE

There is a major program choice to be made in order to assure the optimum U.S. photographic satellite reconnaissance program at the least possible cost while at the same time preserving the greatest option for future improvement by the introduction of new types of systems in the overall program.

The U.S. photographic reconnaissance program now includes two types of systems with overlapping capabilities. These are:

	Ground Resolution (In. or Ft.)	Ground Swath Width (n.mi.)	Mission Life (Days)
1. Spotting camera systems which have high resolution for surveillance of specified targets:			
- currently operational: GAMBIT-3 (G-3)	13" to 3'	5	14-18
- under development: Manned Orbital Laboratory (MOL) (first launch December 1970)		.9	30
2. Panoramic camera systems which have lower resolution for searching wide areas:			
- currently operational: CORONA	6' to 10'	130	18-20
- under development: HEXAGON (first launch October 1970)	2.7' to 8'*	285	30-45

* Estimated mission environment.

The best resolution of the HEXAGON overlaps the poorest capability of the GAMBIT-3. However, even after the HEXAGON is operational (late 1970), there will still be a need for at least 4 and possibly 5 GAMBIT-3 satellites each year due to its very high resolution for surveillance.

All of these systems are orbiting film recovery systems, which have an inherent delay of several days between a command to take pictures and the delivery of the results to the decision-maker. The delay is longer if a satellite is not on orbit and has to be launched. A system with the capability to be on orbit continuously and to transmit electronically high quality pictures (2-3 foot resolution) to the ground is technically within reach in 3 to 4 years. This is sometimes called a "real-time readout" system (although this system also has some delay).

The issue is: given the continuing need for the improving G-3 surveillance system in the operational inventory, does the HEXAGON system provide enough additional search capability beyond the existing CORONA system to justify additional total costs of $542 million (FY 1970-74) and added FY 1970 budget costs of $231 million? The two alternatives are as follows:

	Annual Total Launches	FY 1970 Budget Costs ($ in millions)	FY 1970-1974 Costs ($ in millions)
ExCom decision			
HEXAGON	4)	$392	$1,696
GAMBIT-3	4)		
Alternative			
CORONA	7)	292	1,404
GAMBIT-3	7)		
Total Savings (including FY 1968 and FY 1969 savings of $81 million)		-181	-373

There is no question that a search-surveillance satellite mix with HEXAGON would provide greater capability than the present combination of CORONA (KH-4B) and GAMBIT-3 (G-3), particularly for search purposes. For surveillance purposes there is no clear need for the HEXAGON, given the high present and even higher future capability of the GAMBIT-3 to meet surveillance requirements. The issue is whether the additional capability and the resulting additional intelligence product of a mix with HEXAGON would warrant at least $216 M more in the FY 1970 budget and $408 M more in the period through FY 1974. The relevant arguments are set forth below.

Value of HEXAGON against ground force targets. The DDR&E staff paper states that the present and improved sampling capability of the GAMBIT-3/CORONA combination is adequate to meet our intelligence needs in the area of the Soviet bloc and Chinese capabilities for air and missile defense, aircraft systems, missile systems, and naval forces (page 5, par 8, BYE-78416/68). The issue has narrowed to the unique capability of the HEXAGON against ground targets and the adequacy of present sampling techniques against such targets, both static and mobile. Pertinent points are:

- At present, the 10-day G-3 is meeting 95-97 percent of ground forces target looks required annually and quarterly (USIB D-46.9/16). If the target deck increases or the present sampling rate is raised, the longer-life (18 day) G-3 will be able to meet such demands. (TAB A).

The sampling rate could be doubled by doubling the perigee altitude of the GAMBIT-3 on some missions.

- The present ground force target deck defined by COMIREX does not omit a significant number of targets of importance to DIA.

- Sampling against static targets by G-3 provides high confidence estimates because of its high resolution and because Soviet and Chinese ground force installations are highly standardized.

- Against mobile ground force targets, the HEXAGON has the clearest added value. KH-4B will be able to monitor activity levels (e.g., reduction or absence of vehicles at fixed installations) and detect field deployed ground force units. However, HEXAGON would be able to distinguish between tanks and trucks and therefore provide a more precise estimate of redeployment at a point in time.

- It is not clear that the HEXAGON would provide any important, "unique" capabilities for understanding manning levels. Such understanding must come from intensive sampling studies based upon other intelligence techniques, such as Berlin air corridor photography of barracks.

- SIGINT and HUMINT provide complementary and sometimes better information about ground force targets, especially training, tactical doctrine, equippage, manning levels, and deployment (e.g., Czech invasion).

- There is a penalty in the reduced amount of highest resolution [redacted] design) surveillance coverage due to the substitution of the HEXAGON for some of the GAMBIT-3 missions.

Timeliness in crisis management. Neither mix has a decided advantage in terms of timeliness for crisis management. Both are constrained by weather and film recovery. During the Czech and Arab/Israeli crisis, targets were photographed by CORONA/G-3, but recovery and readout were too late.

The annual days-on-orbit for the two mixes would be about the same. The normal time between launches would be shorter for the CORONA mix than for the HEXAGON mix.

For crisis capability, it would be cheaper and easier to maintain a standby capability with the less complex CORONA.

Swath width. The 280-mile swath option of the HEXAGON is a significant advantage for covering a wide area which is only very briefly cloud-free. But the 280-mile swath option is costly in terms of film consumption. For example, if the full swath is used for 10 percent of the camera-on-time, 30 percent of the film would be used. The KH-4B is wide enough to photograph adjacent swaths within a 24-hour (16 orbit) period over Moscow and most of the Soviet Union. (For results on an actual recent mission, see TAB B.)

Budget savings. NRO Comptroller cost estimates (TAB C) indicate that the cost difference (savings) between the Executive Committee decision and the HEXAGON termination option is at least $186 M in the FY 1970 budget and $373 M through FY 1974. The difference in costs between this estimate and earlier BOB savings estimates ($250 M in FY 1970 and $470 M through FY 1974) is that NRO Comptroller assumed a higher number (7) of annual G-3 launches in the FY 1970-1974 period than the earlier estimate (6) by the BOB. If the G-3's and CORONA's were held to 6 launches per year, there would be additional savings of $180 million.

It is noteworthy that in the NRO Comptroller estimates the HEXAGON unit costs increase from $35 M, assuming 5 launches annually, to $45 M, assuming 4 launches annually.

Equal cost options. The NRO Comptroller's estimates for "level-off recurring costs per year" (FY 1974) for the Executive Committee decision program are:

	Launches per year	Annual cost
HEXAGON	4)	$293 M
G-3	4)	

Equal cost of CORONA/G-3 mix would be as follows:

CORONA	7)	
G-3	8)	$293 M

The latter option more than meets requirements with less risk of launch failure, more high resolution for technical intelligence, and shorter gaps between search and surveillance missions.

The search area coverage capabilities of these equal cost alternative mixes are as follows:

System	Total Launches	Successful Missions/Yr	Area Coverage Per Mission	Area Coverage Annually
HEXAGON	4	3-4	20 M sq nm	60-80 sq nm
CORONA	7	6-7	9 M sq nm	54-63 sq nm

Of the total area coverage, the percentage cloud-free is essentially the same for both systems.

With regard to surveillance targets, the present 10-day version of the GAMBIT-3 is meeting 92 percent of the quarterly requirements and 98 percent of the annual requirements established by the United States Intelligence Board. The longer-life (14-18 day) version of the GAMBIT-3 to be introduced in July 1969 will provide at least 80 percent more camera actions per mission and a significant increase in cloud-free target looks. Therefore, the 7 launch equal cost option will provide even better performance against current surveillance requirements than the present GAMBIT-3. The 4 HEXAGON, 4 GAMBIT-3 option would exceed by a substantial degree the present surveillance target requirements but the amount of coverage at 1 foot resolution would be reduced.

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Ground Force Targets

Current COMIREX high resolution surveillance deck (CCRP).
6556 total targets
1964 of which are ground forces
1466 are tactical troop, fixed installations
320 major depots and logistical support
41 training areas
65 arms production, R&D
72 additional miscellaneous

(As of 10-31-68)

Total targets (1,964)	Required	Achieved	% Satisfied
Annual looks	1119	1083	97%
Quarterly looks	350	332	96%

The summary of achievements against ground force target requirements in the last two reported quarters is shown in the table below. One of the reasons that the quarterly requirements are not met at 100% in all categories is the relative priority assigned to strategic and naval targets vs. ground forces.

- 12 of 26 categories completely fulfilled for last quarter and last year

- 14 categories partially fulfilled to the following degrees:

	No. of Targets	Percentage of Requirements Fulfilled in Previous Period: Quarterly July 1	Quarterly Oct. 1	12 Mo. July 1	12 Mo. Oct. 1
Tactical Troops E. Ger. (INDIG)	24	100*	30	50	50
Tactical Troops EE (Sov)	133	100	75	60	75
Tactical Troops W USSR	309	100	100*	65	80
Deps & Log Sup EE (Sov)	5	0**	50	30	50
Deps and Log Sup China/N. Korea/ Mongolia	96	100	80	100	100*
Train Areas Ch/NK	3	30	0**	100	50
Other Mil Instl Oth EE Ctrys (INDIG)	3	100*	100	100	65
Other Mil Instl EE Ctrys (Sov)	4	100	0**	60	60
Other Mil Instl Western USSR	3	100	0**	100	100
Other Mil Instl Cent & FE USSR	1	100*	0**	100	50
Other Mil Instl China/N. Korea/ Mongolia	51	100	50	100	100*
Arms Prod/R&D EE	4	100	0**	50	25
Arms Prod/R&D USSR	43	100*	100	65	75
Arms Prod/R&D Ch/NK	18	100	100	70	65
	687				

*Conditionally met--mono photos are substituted for some stereo photos at a 2/1 ratio.
**Small number of targets make required access in short time periods more difficult for any system.

APPROXIMATE COVERAGE OF KH-4 MISSION 1104-2, 14-22 AUGUST OVER EURASIA

ADJACENT AND OVERLAPPING SWATHS ON THREE SUCCEEDING DAYS WITH CORONA SWATH
(August 15-August 17,1968)

TOP SECRET CHESS RUFF
Handle Via TALENT-KEYHOLE Control System Only
KH-4 MISSION 1104-2, 14-22 AUGUST 1968
TCS-2015/68
TAB B

TOP SECRET CHESS RUFF
Handle Via TALENT-KEYHOLE Control System Only
BYE-11682/68

TAB C

COMPARATIVE COSTS FOR ALTERNATIVE COURSES OF ACTION - HEXAGON PROGRAM
(Million dollars)

	FY 68	FY 69	FY 70	FY 71	FY 72	FY 73	FY 74
Case A: Continue HEXAGON (In accordance with 13 Nov 68 ExCom Determinations)							
HEXAGON:							
Launches	-	-	-	4	4	4	4
Costs	$207	$217	$197	$216	$209	$192	$183
GAMBIT:							
Launches	8	8	7	5	5	4	4
Costs	$193	$178	$168	$144	$121	$110	$110
CORONA: (J-1 and J-3)							
Launches	8	7	6	4	-	-	-
Costs	$75	$49	$27	$17	$2	-	-
TOTAL COSTS	$475	$430	$392	$377	$332	$302	$293
Case B: Cancel HEXAGON (Assumes 1 Dec 68 notice to terminate)							
HEXAGON:							
Launches	-	-	-	-	-	-	-
Costs	$161	$182	-	-	-	-	-
GAMBIT:							
Launches	8	8	7	7	7	7	7
Costs	$193	$178	$187	$178	$154	$154	$154
CORONA: (J-1, J-3)							
Launches	8	7	7	7	7	7	7
Costs	$75	$58	$85	$98	$98	$98	$98
Impact on Other Titan Boosters:							
Costs	-	$10	$20	$20	$20	$20	$20
Total Costs	$429	$345	$292	$296	$272	$272	$272
Cost Differential	-46	-35	-100	-81	-60	-30	-21
Cumulative Differential	-46	-81	-181	-262	-322	-352	-373

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