

~~(S)~~ NATIONAL RECONNAISSANCE OFFICE

WASHINGTON, D.C.



THE NRO STAFF

13 September 1974

MEMORANDUM FOR MR. PLUMMER

SUBJECT: Deactivation of the Kodiak Alaska Tracking Station

The completed NRO Staff Analysis of the potential mission impacts to our systems which could occur from the closure of KODI is at TAB A. General Bradburn's comments are at TAB B.

The AFSCF study indicated a total net savings through FY-77 of \$18.6M. A summary is at TAB C. Of this, slightly over \$6M was for the addition of a wideband capability at KODI. Gen Bradburn states, and I concur, that there is no NRO program requirement for this capability. It therefore appears that there are two issues to be looked at. The first is incorporation of the wideband modification to KODI (potential savings up to \$6M); the second is the deactivation of KODI (potential additional savings of about \$12M).

With regard to the first issue, we should take advantage of the potential savings immediately. I recommend that General Stelling be asked to look at the elimination of the program modification at KODI.

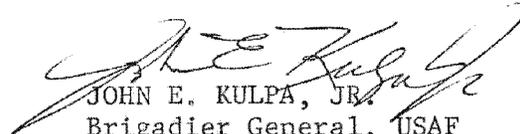
The issue of deactivation of KODI is quite subjective. The analysis looked at this issue in terms of support hours per day, dead revs, recovery operations, and deboost operations. No essential elements of support were identified; however, in each area substantive benefits are being provided. In addition, it is estimated that the deactivation of KODI would result in the decrease of cloud-free photography of approximately one percent for both GAMBIT and HEXAGON missions.

At the present time, I believe that the added operational efficiency, flexibility and confidence provided by the station

GAMBIT HEXAGON

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warrants retention of KODI. If we are forced to make fiscal reductions, the closure of KODI should be looked at again and prioritized with other potential savings.


JOHN E. KULPA, JR.
Brigadier General, USAF
Director



Stalling papers

NRO STAFF ANALYSIS

DEACTIVATION OF THE KODIAK ALASKA TRACKING STATION

1. ANALYSIS OF AFSCF PRESENTATION
2. DEAD REVS
3. RECOVERY AND DEBOOST OPERATIONS

4 SEPTEMBER 1974

TAB A

GAMBIT HEXAGON EARPOP

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ANALYSIS OF AFSCF PRESENTATION

On 22 August 1974, [] presented to Under Secretary Plummer the results of the AFSCF investigation of potential costs savings to be gained from the closure of the Kodiak Tracking Station (KODI) and/or the Indian Ocean Tracking Station (INDI). The briefing addressed the manpower, investment, Air Staff and NRO funding, and the satellite support rendered by each of the two stations. This attachment deals with the latter aspect.

The AFSCF evaluation used "support hours per day" as the key ingredient for determining the goodness of support rendered to the satellite programs. Support hours are composed of the following:

Station Set-Up

Preparation of the tracking station equipment prior to the arrival of the satellite over the station. Most satellites require a unique equipment configuration. Average set-up times vary between 15 minutes to 30 minutes.

Station Real-Time Support

Horizon-to-horizon tracking of the satellite as it passes the region of the tracking station. The station tracks the satellites, transmits commands, and receives and records telemetry data from the satellite. Average real-time passes for low altitude satellites (GAMBIT and HEXAGON) are on the order of five minutes while a real-time pass for a high altitude satellite could last for several hours.

Post-Pass Support

The ground station at the tracking station transmits raw telemetry data or manipulated telemetry data to the STC for detailed vehicle health or subsystem response analysis. In the case of the P-11 satellites, the data relayed to the STC is the raw ELINT intercept data which has been collected. Average

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post-pass support to HEXAGON is approximately one hour per pass while GAMBIT support averages are somewhat higher. Some of the high altitude satellites require no post-pass support.

The data from the AFSCF investigation provides the following averages.*

HEXAGON Support - 1.53 hours per pass

GAMBIT Support - 1.99 hours per pass

P-11 Support - 0.87 hours per pass

*Support refers to set-up, real-time, and post-pass combined.

By using the measurand of support hours per day, the AFSCF analysis indicated that little or no support impact occurs to NRO satellites with the loss of either KODI or INDI. For the remaining "white" satellites, more impact occurs through a deletion of INDI because: (1) its geographical location yields better support to high altitude satellites and (2) the NRO satellites' heavy use of KODI forces the lower priority satellites to the use of other SCF stations, especially INDI which provides very limited support to NRO satellites. Table #1 indicates the support hours per day required by program and the effect upon that support if either KODI or INDI were to be closed.

While a makeshift arrangement was used to simulate dual operations (GAMBIT and HEXAGON on orbit simultaneously), the measurand of support hours per day again indicates that no severe, flight-limiting impacts are sustained by NRO satellites. The impacts on "White" programs become much higher however, and were considered by the AFSCF and program directors to be serious. Table #2 illustrates these factors.

As discussed above, it was not support hours per day which led the program directors to comment on the potential closure of KODI - other factors were involved. A summary of their comments is shown in Table #3.

In the NRO investigation of this subject, an early conclusion resulted which discarded consideration of closing any

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Remote Tracking Station (RTS) other than KODI or INDI. The remaining RTS's are geographically located such that their removal from the AFSCF network would severely impair the operation of NRO satellites. Additionally, the minimal tasking of INDI for support to NRO satellites indicates that no NRO impact would result from its closure - its fate must rest upon the impact statements provided by the program directors of the "White" programs.

While support hours per day is considered to be one indication of loss of support to a program, its use alone is insufficient. The loss of two hours per day of support may or may not represent an impact to an NRO satellite program depending upon the time of day the support was lost, if another station on the same orbital revolution could absorb the support requirement, or if the loss occurred during critical payload or recovery operations. Therefore, the NRO evaluation of the potential mission impacts which could be sustained from a closure of KODI is directed toward:

- Dead-Revs (No support on an orbital revolution).
- Recovery Operations (film capsule recovery).
- Deboost Operations (mission termination by placing the spacecraft into a broad ocean area).

These areas of investigation comprise the remainder of the NRO Staff report and are at Attachments 2 and 3.

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COMPARATIVE SUMMARY BY PROGRAM (HRS/DAY)

	<u>ADJ. REQ'TS</u>	<u>KTS UNAVAIL</u>		<u>IOS UNAVAIL</u>		<u>KTS/IOS UNAVAIL</u>	
		<u>SUPP</u>	<u>LOSS</u>	<u>SUPP</u>	<u>LOSS</u>	<u>SUPP</u>	<u>LOSS</u>
467	29.5	28.4	1.1	29.3	.2	28.2	1.3
989	27.2	26.7	.5	26.5	.7	26.0	1.2
DMSP	3.7	3.6	.1	3.7	-	3.6	.1
DSP	11.2	11.0	.2	10.7	.5	10.5	.7
STP	34.8	30.9	3.9	32.9	1.9	28.6	6.2
777	13.1	13.1	-	9.3	3.8	9.3	3.8
VELA	34.5	31.2	3.3	27.5	7.0	24.2	10.3
SKYNET	1.9	1.9	-	-	1.9	-	1.9
NATO	1.4	1.4	-	1.2	.2	1.2	.2
OV	.6	.6	-	.6	-	.6	-
BALL	.2	.2	-	.2	-	.2	-
TOTAL	158.1	149.0	9.1	141.9	16.2	132.4	25.7

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COMPARATIVE SUMMARY - DUAL OPS - KTS NOT AVAILABLE

	REQUIREMENTS			KTS NOT AVAILABLE			NET%
	TOTAL	ADJUSTED	LOSS	NET SUPPORT	ADD. LOSS	TOTAL LOSS	
467	29.5	29.5		28.4	1.1	1.1	1.9 96.4
110	39.0	39.0		34.1	4.9	4.9	8.9 87.4
989	27.2	27.2		25.1	2.1	2.1	2.8 92.3
DMSP	3.7	3.1	.6	2.8	.3	.9	.9 75.7
DSP	11.2	9.8	1.4	9.7	.1	1.5	2.5 86.6
STP	34.8	25.7	9.1	21.6	4.1	13.2	16.3 62.1
777	13.1	11.4	1.7	11.0	.4	2.1	4.6 84.0
VELA	34.5	28.1	6.4	25.8	2.3	8.7	14.2 74.8
SKYNET	1.9	1.4	.5	1.4		.5	1.9 73.7
NATO	1.4	1.4		1.4			.5 100
OV	.6	.6		.6			100
BALL	.2	.2		.2			100
TOTALS	197.1	177.4	19.7	162.1	15.3	35.0	19.5
					WITHOUT INDI		54.5

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TABLE 3NRO PROGRAM DIRECTORS' COMMENTS

INDI - NO REQUIREMENT

KODI - LOSS WOULD DECREASE FLEXIBILITY, INCREASE RISK
AND CREATE POSSIBLE MISSION DEGRADATION.

"WHITE" PROGRAM DIRECTORS' COMMENTS

KODI - NO REQUIREMENT

INDI - REDUCED BACKUP SUPPORT TO OGS (DSP)

- NO SUPPORT IN 0°-70° DEAD BAND (777 AND FLTSAT)

- NO ASCENT/INJECTION SUPPORT (FLTSAT)

- NO BACKUP SUPPORT AS SPECIFIED IN CURRENT US/UK AGREEMENT

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DEAD REVSMISSION IMPACTHEXAGON

The satellite search mission relies heavily upon the most current weather forecasting availability. Single rev-by-rev command loading provides this capability. This station contact timeline also provides more accurate tracking of the satellite vehicle position.

Analysis of a typical HEXAGON mission, in a sun-synchronous orbit, reveals that 6% of the single rev-by-rev station contacts for over-the-Bloc commanding would be lost if the KODI RTS would be deactivated. The effected revs are considered critical, i.e., they do access the high interest intelligence areas. The weather forecast accuracy would be affected, resulting in a loss of cloud-free photography (approximately 1% over the area of interest).

GAMBIT

Success of the high resolution surveillance system (GAMBIT) depends to a great extent upon the precise positioning of the camera subsystem and the dampening of cross-track image smear degradation. Rev-by-rev loading provides the capability to calculate the minimum time bias to apply to the camera operation so that the least amount of film will be used and also the most current cross-track smear compensation can be loaded during RTS acquisitions.

Analysis of a typical GAMBIT mission shows that 7% of the single rev-by-rev station contacts for over-the-Bloc commanding would be lost if the KODI RTS were to be deactivated. The time bias applied to the camera on/off times would be somewhat longer causing additional film to be used and payload operations would have to be loaded to extend for more than one rev with an attendant loss of vehicle positioning accuracy. Hence, higher image smear could be expected.

Weather forecasting has become a factor in GAMBIT operations. Weather forecast accuracy will be affected by the increased

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timelines caused by a loss of KODI and the mission cloud-free photography could be expected to decrease by approximately 1%.

SUPPORT SHIFTS TO OTHER STATIONS

While the SCF investigation addresses this aspect in but a limited fashion, their analysis did account for the support shifts which would take place if KODI were to be eliminated from the AFSCF network. For example, if HEXAGON were to pass over COOK and KODI on the same orbital revolution it could use either or both stations as long as the program requirements for pass duration were met. Assume for this example that KODI would be used, thus freeing the COOK pass for use by other satellites; probably P-11 satellites. If, however, KODI were not available, then HEXAGON would use COOK and one or more P-11 satellites could be denied the use of that station during the timeframe. If use of the COOK station were denied, the P-11 satellite would search for use of the next adequate station, possibly impacting still other programs in a domino effect.

Even if the timing were such that no real-time support was lost by the lesser priority programs, the telemetry data, recorded during the pass, would face significant delays prior to being transmitted to the STC. HEXAGON program requirements are such that after each station pass, the ground station is occupied for approximately one hour while the telemetry data play-backs are processed. The GAMBIT program requirements are even more demanding upon the AFSCF network and thus, the delay to other low-priority programs is emphasized when GAMBIT is on orbit.

When telemetry play-backs are delayed for GAMBIT or HEXAGON, it results in a longer time interval prior to the contractor or Aerospace vehicle engineer's assessment of subsystems operations. It is difficult to assess the impact of this delay.

When the recorder play-back for P-11 is delayed, the impact

As pointed out during the AFSCF briefing, if dual operations of both HEXAGON and GAMBIT take place, the impact of the elimination of KODI would be severe.

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RECOVERY AND DEBOOST OPERATIONSRECOVERY

The recovery area for the GAMBIT and HEXAGON film capsules is defined as a circle of 800 NM radius centered at approximately 22N and 158W. Coupled with the orbital geometry of the satellites, this recovery zone results in the use of an orbital revolution for the recovery events which usually passes within range of the KODI Tracking Station. Thus, the HEXAGON and GAMBIT recovery operations are controlled and/or monitored by use of KODI capabilities.

Vehicle design feature differences and slightly different operational philosophies between the program offices dictate a different use of KODI for the recovery operations of GAMBIT and HEXAGON.

As the HEXAGON vehicle accomplishes those vehicular events prerequisite to film capsule separation and reentry, the KODI station is used to monitor and record vehicle telemetry. The commands to execute the vehicle events are stored within the satellite computer and no ground control from KODI is exercised. Hence, the recovery operation cannot be aborted in the event of a last-minute vehicle anomaly. The recovery sequence of events for HEXAGON is such that it would not serve any useful purpose to abort capsule reentry for once the sequence is initiated, reentry must occur on that orbital revolution or not at all.

For the GAMBIT program, the recovery sequence of events is not as time consuming and can be initiated totally within the KODI time span of acquisition. Although the commands necessary to accomplish the capsule reentry are stored within the satellite computer (similar to HEXAGON), these commands are prevented from operation until proper ground release signals are transmitted from KODI. Hence, GAMBIT recovery operations use the KODI tracking station to receive satellite telemetry data, verify proper vehicle operation and platform pitch and stability, and perform the last-minute transmission of commands to effect capsule reentry.

HEXAGON GAMBIT

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If the KODI station were to be deactivated, the last-minute control of GAMBIT capsule reentry could not be exercised. Likewise, the telemetry data recorded at KODI for GAMBIT and HEXAGON recovery operations could not be recorded for subsequent analysis unless telemetry aircraft were operational and properly stationed to receive the satellite data. The HEXAGON SPO has indicated that they would not require the use of telemetry aircraft, however, the GAMBIT SPO probably would require such support.

DEBOOST

It is an NRO requirement that both HEXAGON and GAMBIT be deorbited into a broad ocean area so as to ensure a controlled reentry into an uninhabited area. While these operations are executed remote from the KODI station, it is program office practice to select an orbital revolution for deboost operations that passes over KODI. The propulsion system is fired to remove energy from the orbit and effect the vehicle deboost. As the vehicle reenters, the KODI station tracks the vehicle to provide data necessary to ascertain systems operation and eventual impact into the North Pacific Ocean. Additionally, vehicle experiments are conducted and the telemetry recorded by KODI for subsequent analysis at the STC.

In the event of KODI deactivation, no impact would occur to the deboost operations except that the reentry monitoring and telemetry recordings would be shifted to POGO, a station further away from the final ocean impact point. Hence, the final impact point prediction would be somewhat less accurate and some last-minute vehicle experiments could not be performed.

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GAMBIT/HEXAGON

FOR: WHIG/MP PLUNGER/GEN KULPA. FROM GEN BRADBURN.
THE FOLLOWING ARE MY COMMENTS ON THE STUDY TO
INVESTIGATE THE MERITS OF CLOSING THE INDIAN OCEAN OR
KODIAK TRACKING STATIONS.

A. WCHARGE HAS NO REQUIREMENT FOR THE INDIAN OCEAN
TRACKING STATION AND ITS CLOSURE WOULD NOT EFFECT OUR
OPERATIONS.

B. THE LOSS OF KODI WOULD NOT BE SERIOUS FROM OUR
STANDPOINT BUT WOULD HAVE A DEGRADING EFFECT ON THE
PHOTOGRAPHIC MISSIONS IN TERMS OF SLIGHTLY LONGER
TIMELINES, ADDITIONAL DEAD REVS, ADDITIONAL 2 REV LOAD CYCLES

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VERSUS 1 REV CYCLES, AND THE INABILITY TO MONITOR RECOVERY
EVENTS WITHOUT TELEMETRY AIRCRAFT SUPPORT.
THESE FACTORS EXIST FOR THE CASE OF A SINGLE VEHICLE ON ORBIT
AND ARE SLIGHTLY COMPOUNDED WITH TWO VEHICLES ON ORBIT.

C. DURING THE REVIEW WE HAVE NOTED THAT THERE IS NO
PROGRAM REQUIREMENT FOR A WIDE BAND CAPABILITY AT KODI.
THIS PROGRAMMED MODIFICATION SHOULD THEREFORE BE ELIMINATED
TO REALIZE NEAR TERM COST SAVINGS.

D. AFTER WEIGHING THE ALTERNATIVES, I BELIEVE THE
OPERATIONAL FLEXIBILITY AND EXTRA INSURANCE THAT THE
KODIAK TRACKING STATION PROVIDES TO THE PHOTOGRAPHIC
MISSIONS IS WELL WORTH THE EXPENDITURE OF THE CURRENTLY
BUDGETED FUNDS.

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POTENTIAL SAVINGS
KODI CLOSURE 30 JUN 75

	<u>FY 75</u>	<u>FY 76</u>	<u>FY 77</u>	<u>TOTAL</u>
3400 O&M	.334	2.498	2.501	5.333
3500 MILPAY		.041	.042	.083
3300 MILCON		1.378		1.379
3080 PROCUREMENT		1.200	.120	1.320
ARMY PROCUREMENT		1.600		3.900
SAF FUNDING		3.597	3.709	7.306
TOTALS	.334	12.615	6.372	19.321
CONTRACT TERMINATION (SAF)	(.600)			(.600)
DISMANTLE & TRANSPORT EQUIPMENT (3400)	(.075)			(.075)
NET SAVINGS: SAF	(.600)	3.597	3.709	6.706
OTHER	.259	9.018	2.663	11.940
TOTAL	(.341)	12.615	6.372	18.646

TAB C