DEPARTMENT OF THE AIR FORCE
OFFICE OF THE SECRETARY

MEMORANDUM

Dr. [illegible] —

Here is a summary of present known info on flying Gambit at 500–600 miles. The next step would be to ask SP to initiate detailed studies, costing, etc. to meet desired launch date. We will draft necessary TWX at your request.

Bob [illegible]

DEPARTMENT OF THE AIR FORCE
OFFICE OF THE SECRETARY

MEMORANDUM

8 April 1970

Capt Geiger:

This is as far as I can usefully go on the HIGHBOY question until either: (a) the Hewlett-Packard 9100A is repaired or (b) we get a response to your message to [redacted] and McBride. I have sent a copy of this draft down to [redacted] for comment.

RICHARD L. GEER
Major, USAF

PRO A4d 2

~~TOP SECRET~~

HANDLE VIA BYEMAN CONTROL SYSTEM

~~TSI~~ NATIONAL RECONNAISSANCE OFFICE

WASHINGTON, D.C.

THE NRO STAFF

13 April 1970

MEMORANDUM FOR DR. NAKA

SUBJECT: Higherboy

QUESTION

What is entailed, in terms of modifications and potential results, in flying GAMBIT to get CORONA resolution?

BACKGROUND

Aerospace recently completed a study of flying GAMBIT at 700 NM altitudes to elude the GALOSH (TAB A). A recent message to SAFSP has asked them to investigate the Higherboy concept (TAB B), which might provide some CORONA quality search capability in the 1972 time frame. Their response is at TAB C, and a previous message on Highboy which is heavily referenced in their Higherboy reply is at TAB D.

DISCUSSION

The very best CORONA resolution is about 4.6 feet. The GAMBIT R-5 lens could get that resolution at 576 NM, were it not for the diffraction effects of the small slits required due to lower film velocity. This requires lowering the altitude to 535 NM.*

The orbit I examined for Higherboy is 535 by 100 NM, with perigee at 40° S and 60° inclination. This can be achieved with the current Titan IIIB booster but might use up what would be the Agena deboost propellants. The SAFSP study used a different orbit, depleting the secondary propulsion system (TAB C). The long tank Titan could be used to save Agena and SPS propellants.

* This raises a fascinating point—535 NM is based on 3404, which EK is phasing out in favor of a potentially faster film. We want a slower film. Free radical film has an AEI of 1.0, plus lots higher resolution. This might be an application for non-silver halide technology.

~~CORONA GAMBIT HEXAGON~~

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A 535 by 100 NM orbit with perigee of 40° S guarantees resolution distribution equal or better than CORONA J-3 over the area of interest at all times (see TAB E). At the 535 NM apogee altitude, the satellite would have access to targets 572 NM from the ground track. The swath of a strip would be 27.7 NM wide at nadir. If all photography were done above 520 NM (between 60° N and 20° N), nearly ten million square NM in near nadir strips could be photographed per mission, which is comparable to the J-3 CORONA. However, the satellite will actually be flying lower than that* over some areas of interest, resulting in less area coverage and better overall resolution distribution than bloc coverage alone would provide.

The modification kit required to achieve this capability would consist of:

Camera

1. Modified film drive for accommodation of slower image velocity.

2. Reduced exposure slit width and slower film speed index to achieve same exposure time with reduced film velocity.

3. Disable the slant range compensation mechanism.

4. Modified focus sensor to accommodate increased slant range.

Vehicle

5. Horizon sensor view-angle modification.

6. Possibly a new thermal paint pattern.

Reentry Vehicle

7. Modified inhibit timer for accommodation of changed reentry time profile.

Booster

3. Modified guidance equations.

9. Modified Agena programmer.

Software

10. Modification to the target optimization software.

* It would be lower than 500 NM over eight-tenths of its surface track.

The costs can be expected to be about that of Highboy as outlined in TAB D. Nonrecurring costs to develop the Higherboy capability will be about $3,100K, and recurring costs would amount to about $400K per vehicle converted plus $25K/year/kit in maintenance costs. The target limitation of paragraph 2D, TAB C, may be avoided with the provision of new software at an additional cost of $1 to $2M. It should be noted that Highboy and Higherboy are different configurations and acquisition of both capabilities may cost nearly twice that of acquisition of either. It should also be noted that the Astro-Position Terrain Camera in a Higherboy GAMBIT cannot begin to match the performance of a CORONA DISIC.

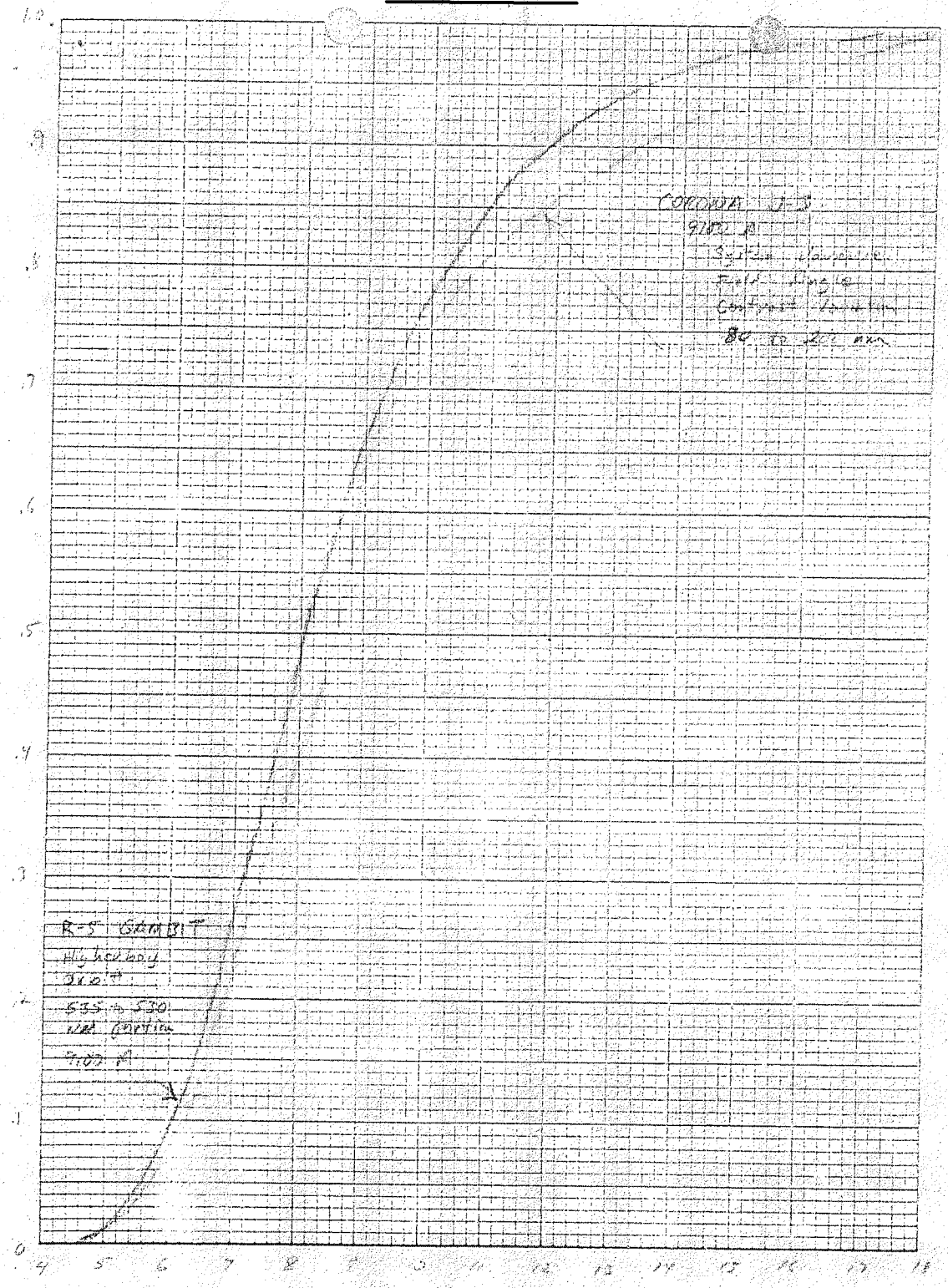
As paragraph 3D of TAB C makes clear, there are many questions that must be answered, at considerable time and expense, before Higherboy feasibility, suitability, and probable cost can be determined. These include range of inclinations, propellant management, reentry constraints, and target limitation trade offs.

RECOMMENDATION

None. For your information.

RICHARD L. GEER
Major, USAF

Atchs
TAB A, BIF 42008A-69 (PRO A4c)
TAB B, WHIG 9936 (PRO A4b)
TAB C, CHARGE 1558 (PRO A4d2)
TAB D, CHARGE 0804 (PRO A4d2)
TAB E, Resolution Distribution Models



RESOLUTION DISTRIBUTION MODELS

~~CORONA GAMBIT~~

PRO A 4.1(2)

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~~(TS)~~ NATIONAL RECONNAISSANCE OFFICE
WASHINGTON, D.C.

THE NRO STAFF

15 September 1970

MEMORANDUM FOR DR. McLUCAS

SUBJECT: GAMBIT Higherboy

BACKGROUND

There has been a continuing dialogue between SAFSP and the NRO Staff since February of this year concerning the practicality of configuring a high flying (HIGHERBOY) GAMBIT to serve as a search system gap-filler in the event the CORONA inventory is exhausted prior to achievement of an acceptable level of HEXAGON success. The message from General King at TAB A outlines the cost and schedule implications associated with achieving a single HIGHERBOY capability. These were furnished at General Allen's request (TAB B), based upon a mutually acceptable orbit (TAB C).

DISCUSSION

The HIGHERBOY approach was developed with the intent of achieving additional insurance against HEXAGON development uncertainties at minimum cost with a maximum retention of flexibility. General King's message indicates that the concept is indeed valid. For the expenditure of approximately $1M, a capability roughly equivalent to one additional CORONA system can be attained. This would extend the time available for achieving full confidence in HEXAGON from November 1971 (the last scheduled CORONA) until about February of 1972. If this capability is expended, the additional impact would be loss of the GAMBIT pipeline vehicle.

Two options are presented for configuring HIGHERBOY. Option II is about $200K cheaper but requires commitment of a vehicle to conversion (and loss of the pipeline) some three months earlier against a given need date. Option I would postpone a HIGHERBOY decision until four months prior to launch. The additional flexibility is well worth the moderate extra cost.

~~CORONA GAMBIT HEXAGON~~
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The schedule outlined specifies a HIGHERBOY availability in November 1971. This would cover the possible contingencies of a CORONA failure or an early CORONA launch against a priority collection requirement or crisis situation.

A separate memorandum is being prepared concerning General King's latest assessment of HEXAGON status. He has indicated that the earliest projected HEXAGON launch date is now March 1971. The need for the insurance HIGHERBOY would provide is clearly on the increase.

CONCLUSION

HIGHERBOY represents an achievable and relatively low cost approach toward offsetting current uncertainties in the HEXAGON development schedule. If not needed for alleviation of the HEXAGON/CORONA overlap, it would still represent a valuable on-the-shelf capability against future collection contingencies.

RECOMMENDATION

It is recommended that the message at the right approving the Option I HIGHERBOY development be signed and dispatched.

ROBERT A. SCHOW, JR.
Major, CE, USA

Atchs
TAB A, CHARGE 4112 (PRO A4d2)
TAB B, WHIG 0635 "
TAB C, CHARGE 3471 "

[redacted]
L. Sweeney
This will also determine our future capability to operate above Galosh altitude.

PRY Jr.

PRO A4d(2)

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Dr Naka		✓
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COMP		✓
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~~S E C R E T~~ 111954Z SEP 70 CITE CHARGE 4112.
WHIG
GAMBIT
FOR DR MCLUCAS FROM GEN KING.
1. HIGHERBOY PROPOSALS FROM CONTRACTORS HAVE BEEN RECEIVED AND EVALUATED. TWO OPTIONS ARE AVAILABLE: OPTION I IS BASED ON BUILDING THE NECESSARY HIGHERBOY COVERSION KITS AND RETROFITTING A PIPELINE GAMBIT VEHICLE FOR HIGHERBOY USE, OPTION II IS BASED ON THE IN-LINE INSTALLATION OF THE HIGHERBOY KITS TO A GAMBIT VEHICLE COMMITTED TO HIGHERBOY USE. THESE PROPOSALS AND COSTS ARE BASED ON A ONE-TIME REQUIREMENT TO FLY A HIGHERBOY MISSION.
2. THE FOLLOWING ASSUMPTIONS AND GROUND RULES WERE USED IN PREPARING THE PROPOSALS:

PAGE 2 CHARGE 4112. ~~S E C R E T~~
A. GENERAL:
EARLIEST LAUNCH DATE - NOV 1971
500 - 525 NM NEAR CIRCULAR ORBIT
INCLINATION 85 DEGREES
Q FACTOR 14.2
PERIOD 98 - 106 MINUTES
BETA PLUS OR MINUS 60 DEGREES
ORBITAL LIFETIME 360 YEARS
NO SATELLITE VEHICLE DEBOOST CAPABILITY
NO ORBIT ADJUST CAPABILITY
18 DAY MISSION: PLANNING WILL BE ACCOMPLISHED

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TO FLY FOR 18 DAYS. WHEN MORE INFORMATION BECOMES AVAILABLE ON POSSIBLE ADDITIONAL POWER REQUIREMENTS DUE TO HIGHER ALTITUDE, A SHORTER LIFETIME MAY RESULT.

B. PHOTOGRAPHIC PAYLOAD SECTION (PPS):

HARDWARE FROM AN EXISTING SPARE CAMERA PROCURED UNDER THE PRESENT CONTRACT WILL BE USED AS PART OF THE HIGHERBOY KIT.

SLANT RANGE COMPENSATION DEVICE WILL BE ELECTRICALLY DISABLED.

FOCUS SYSTEM WILL NOT BE EMPLOYED.

PAGE 3 CHARGE 4112. ~~S E C R E T~~

THE DATA TRACK ON THE HIGHERBOY RECORD WILL BE ILLEGIBLE DUE TO REDUCED FILM SPEED.

C. SOFTWARE:

ALL TARGETING FOR AREA COVERAGE WILL BE ACCOMPLISHED IN A MANNER SIMILAR IN NATURE TO THE LIMITED SEARCH EFFORT PERFORMED BY MAGIC ON NORMAL GAMBIT MISSIONS.

MAXIMUM STRIP LENGTHS WILL BE 99 SECONDS.

NO MISSION CORRELATION DATA MODIFICATIONS WILL BE MADE TO REPORT ON MORE THAN 15,000 POINT TARGETS. THE PRIMARY TARGETING OUTPUT WILL BE THE FOUR FRAME CORNERS.

3. COST AND SCHEDULE CONSIDERATIONS:

A. FOR EITHER OPTION, A 1 OCT 70 GO-AHEAD IS NECESSARY TO BUILD AND INSTALL THE REQUIRED KITS TO MEET A NOVEMBER 1971 LAUNCH DATE.

B. OPTION I CONSISTS OF BUILDING A KIT AND RETROFITTING A PIPELINE GAMBIT VEHICLE TO HIGHERBOY CONFIGURATION AFTER THE CONVERSION KITS ARE AVAILABLE (JUN 1971 WITH A 1 OCT 1970 GO-AHEAD). THE RETROFI REQUIRES A FOUR-MONTH NOTIFICATION PRIOR TO SHIP DATE. THEREFORE TO MEET A NOVEMBER 1971 DATE, A GO-AHEAD

PAGE 4 CHARGE 4112. ~~S E C R E T~~

TO INSTALL THE KIT IS REQUIRED BY 1 JUN 1971. THE COSTS ASSOCIATED WITH OPTION I ARE:

EKC	471K
GE/RESD	215K
LMSC	323K
GE-SOFTWARE	150K
TOTAL	1,159K

C. OPTION II CONSISTS OF COMMITTING A GAMBIT VEHICLE FOR IN-LINE BUILD UP TO HIGHERBOY CONFIGURATION. FOR THE NOVEMBER 1971 TARGET DATE, THIS WOULD NECESSITATE COMMITTING GAMBIT VEHICLE FM 34 BY 1 MAR 1971 TO MODIFY THE IN-LINE FLOW TO INCORPORATE THE HIGHERBOY KIT. THE COSTS ASSOCIATED WITH THIS OPTION ARE:

EKC	364K
GE/RESD	215K
LMSC	233K

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GE-SOFTWARE	150K
TOTAL	962K

D. ONCE CONVERTED TO A HIGHERBOY VEHICLE, A LEAD TIME OF FOUR MONTHS IS REQUIRED TO RETURN THE VEHICLE TO THE STANDARD GAMBIT CONFIGURATION. THE COSTS ASSOCIATED WITH THIS EFFORT ARE:

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PAGE 5 CHARGE 4112. ~~S E C R E T~~

EKC	124K
GE/RESD	7K
LMSC	90K
TOTAL	221K

E. THE FISCAL YEAR COST BREADKOWN IS:

FY-71

	OPTION I	OPTION II
EKC	.337	.332
GE/RESD	.202	.202
LMSC	.212	.212
GE-SOFTWARE	.150	.150
TOTAL	.901	.896

FY-72

	OPTION I	OPTION II
EKC	.134	.032
GE/RESD	.013	.013
LMSC	.111	.021
GE-SOFTWARE	0	0
TOTAL	.258	.066

TOTAL

	OPTION I	OPTION II
EKC	.471	.364
GE/RESD	.215	.215
LMSC	.323	.233
GE-SOFTWARE	.150	.150
TOTAL	1.159	.962

PAGE 6 CHARGE 4112. ~~S E C R E T~~

4. CONCLUSIONS AND RECOMMENDATIONS:

A. THE COST AND SCHEDULE INFORMATION PRESENTED ABOVE IS BASED ON A ONE-TIME REQUIREMENT TO FLY A HIGHERBOY MISSION. THAT IS, THE KITS ARE FABRICATED FROM SPARE HARDWARE PROCURED UNDER EXISTING CONTRACTS. IT SHOULD BE NOTED THAT A SIGNIFICANT COST AND SCHEDULE INCREASE WOULD RESULT IF SUBSEQUENT HIGHERBOY MISSIONS ARE DESIRED.

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B. OPTION I ALLOWS FOR THE LEAST IMPACT TO THE PRESENT GAMBIT SCHEDULE. IT ALSO ALLOWS THE MAXIMUM POSSIBLE TIME FOR DESIGNATION OF A VHEICLE AND ASSOCIATED LAUNCH DATE.

C. OPTION II RESULTS IN THE LOSS OF THE PIPELINE

9-11-008

VEHICLE FOR AN ADDITIONAL FOUR-MONTH PERIOD. ALS
IT RESULTS IN A CONSIDERABLE IMPACT TO THE PRESL
GAMBIT SCHEDULE.
D. WE RECOMMEND, THEREFORE, SELECTION OF
OPTION I. IT PROVIDES MAXIMUM FLEXIBILITY AS WELL AS
RETENTION OF THE PIPELINE CONCEPT FOR THE MAXIMUM PERIOD.
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