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CONTROL SYSTEM~~(S)~~ NATIONAL RECONNAISSANCE OFFICE
WASHINGTON, D.C.

THE NRO STAFF

15 July 1970

MEMORANDUM FOR DR. McLUCAS

SUBJECT: GAMBIT Camera Optics Assembly (COA) S/N 005 (FM-27)

BACKGROUND

GAMBIT FM-27 was returned to the factory for repair when an encoder problem precluded its being launched as Mission 4327. The message from General King at TAB A states that due to less than expected peak resolution on Mission 4326, optical acceptance data for FM-27, 28, and 29 has been recalculated. Results were reverified on FM-28 and FM-29; however, FM-27 showed a decrease in expected resolution from 147 lines/mm to 129 lines/mm.

General King proposes to rework FM-27 by replacing the primary mirror which should improve resolution to 150-160 lines/mm. The impact of this action would be loss of pipeline status through Mission 4335, elimination of delivery schedule flexibility at EK, a requirement for total success on the new R-5 lens testing because of the increased load on available skills and facilities, and a \$200K increase in program costs.

DISCUSSION

General King's proposal is a correct one as a project director. Specifically, he has outlined a course of action consistent with the current launch schedule, whereby a known deficiency in the resolution performance of FM-27 can be significantly reduced toward the design goal of 180 lines/mm.

The impact of this course of action may not, however, be acceptable from the overall NRO viewpoint. In the event of a GAMBIT mission failure, the non-availability of a pipeline vehicle could lead to serious difficulties in the adjustment of the total NRO launch schedule and in the continuity of photo-satellite coverage. These areas have been studied in detail by the Satellite Operations Center with the following conclusions:

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a. There is an increasing interrelation between NRP launches in that CORONA/HEXAGON is tied to GAMBIT; GAMBIT [redacted]; and STRAWMAN is tied to CORONA. A slip in one program can cause a major reordering of the others. A loss of GAMBIT pipeline capability will aggravate this already taut situation.

b. In the event of a GAMBIT mission failure or an equivalent no launch situation without a pipeline unit, the annual average quarterly surveillance satisfaction level could drop drastically, with an associated increased gap between GAMBIT days on orbit. For example, a Mission 4330 failure would result in an average satisfaction in the low 70's (percent), and there would be a gap of 144 days between GAMBITS.

The SOC analysis is enclosed at TAB B.

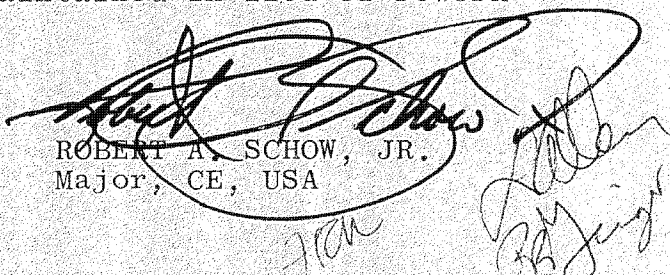
Any disadvantages must be weighed against the expected improvement in the performance of FM-27. General King has indicated that FM-27 flown "as is" would yield best resolutions of [redacted] with about 19 inches average. This is comparable to the performance of Mission 4326 which NPIC rated as having "good" interpretability. Rework of the unit would yield a possible [redacted] peak with 18-19 inches average. Because of the subjective nature of photo-intelligence quality evaluation, any determination of the intelligence benefit to be derived from the above resolution improvement would be at best extremely difficult.

CONCLUSIONS

The rework of GAMBIT FM-27 will improve a known resolution performance deficiency. The impact of this rework would eliminate contractor schedule flexibility and pipeline capability through Mission 4335. Loss of the pipeline could cause serious scheduling problems, significantly reduced surveillance satisfaction, and a severe GAMBIT collection gap.

RECOMMENDATION

That the proposed message at the right to General King directing that the pipeline be maintained in lieu of reworking FM-27 be dispatched.


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

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TAB A, CHARGE 3010 (PROA412)
TAB B, SOC Analysis

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FACTORS TO BE CONSIDERED IN
LOSS OF GAMBIT PIPELINE CAPABILITY
UNTIL FEBRUARY 1972

Summary.

After over two years of effort, a GAMBIT pipeline payload capability was obtained and was utilized by the launch of payload 28 as Mission 4327 in June 1970. The NRO has been losing launch flexibility for about a year now and the outlook is a continuation of that trend because of more complex payloads and cost-saving launch support measures. CORONA/HEXAGON, GAMBIT, [REDACTED], [REDACTED], and STRAWMAN are now closely interrelated and a slip of one can cause a major reordering of the launches of the others.

Without a pipeline vehicle, GAMBIT quarterly surveillance satisfaction will be severely reduced in the event of a failure or the need for a factory rework of a payload; a gap between GAMBIT days on orbit of 144 days could occur in FY 1971.

Background.

Over two years ago, the DNRO directed SAFSP to establish a "backup, spare, or get-well capability" for the GAMBIT program in case of an extraordinary intelligence requirement or the failure of a scheduled mission.

The pipeline concept was thus developed wherein the GAMBIT contractors would have a pipeline vehicle to assure a high probability of meeting a scheduled launch date. The pipeline vehicle was not purchased as an additional line item, but was obtained by adjusting the manufacturing and test sequences such that when one vehicle is in process on the pad, the following vehicle will be in a ready condition to ship to the pad ^{from the factory.} The pipeline vehicle especially covers the situation where the on-pad vehicle encounters difficulties not resolvable in the field, those which must be repaired at the factory under the factory-to-pad concept.

This launch protection became available just recently and was first utilized last month by advancing payload 28, the pipeline vehicle, and launching it within 8 days of the scheduled launch of payload 27, which was returned to the contractor for rework.

Loss of NRP Launch Flexibility.

As previously reported, the new hardware and software introduced with GAMBIT Vehicle 23 (Mission 4323) significantly increase the computer loading at the AFSCF. Concurrent GAMBIT and CORONA/HEXAGON missions are no longer practicable as a result. Additionally, premission rehearsals and postmission solo operations for both programs require about one week of AFSCF support between adjacent photographic missions.

a major rearrangement of subsequent GAMBIT launches. Modifications to the launch pad are already causing a serious interaction between these two programs.

A similar interaction between programs commences 1 October 1970 when the CORONA and STRAWMAN programs begin utilization of a common launch crew rather than the separate ones they now enjoy.

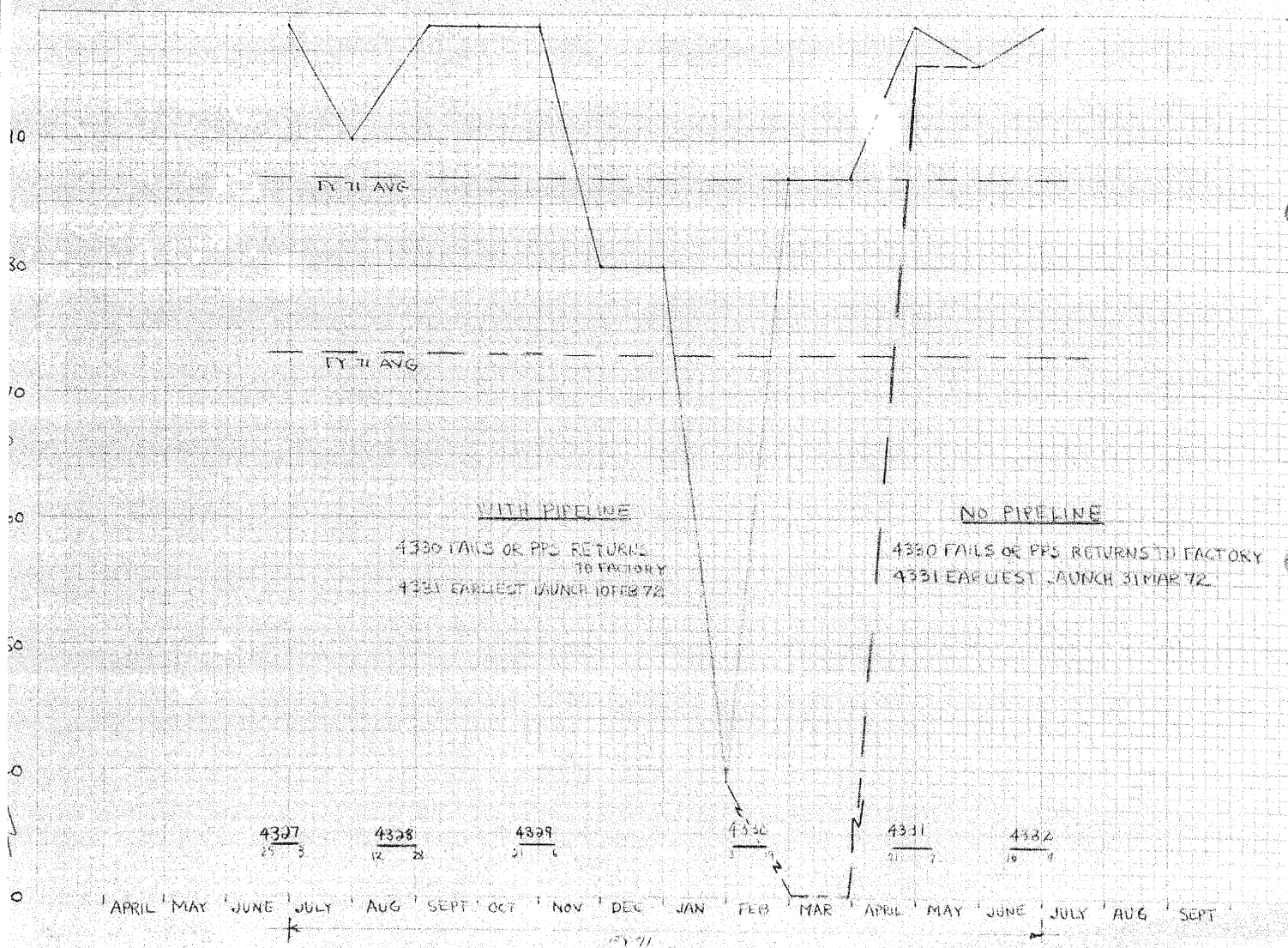
This ties these two programs together with the result that the launch interval between CORONA's must be about 70 days whenever a STRAWMAN is launched between them. Thus, small slips in STRAWMAN when on the pad will cause day-for-day slips of the next scheduled CORONA; large slips in a STRAWMAN launch could cause a rearrangement of subsequent CORONA launches.

The foregoing review of the increasing interrelation between NRP program launch scheduling shows CORONA/HEXAGON tied to GAMBIT, GAMBIT [REDACTED] and STRAWMAN tied to CORONA. A slip in one program can cause a major reordering of the launches of the others. A loss of GAMBIT pipeline capability will aggravate this already taut situation.

Intelligence Requirements Satisfaction.

The present GAMBIT launch schedule and its inherent pipeline capability can be expected to provide an annual average satisfaction level of the most difficult GAMBIT requirement, quarterly surveillance, between 85 and 90 percent for FY 1971. This is an acceptable level to COMIREX, and the attached chart shows this situation in blue. The pipeline payload provides an almost immediate recovery capability in case of a failure or payload rework requirement.

The no-pipeline situation is shown in red on the chart, depicting the effect of a catastrophic failure or situation wherein a payload encounters difficulties on the pad not resolvable in the field. Note that any failure of Mission 4330 will reduce the annual average quarterly satisfaction to the low 70's and will make a gap of 144 days between GAMBIT days on orbit (payload 31 could be launched on 31 March 1971).

3-MONTH CCRP SURVEILLANCE SATISFACTION

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WHIG

GAMBIT

FOR DR. NAKA. FROM GEN KING.

SUBJECT: CAMERA OPTICS ASSEMBLY (COA) S/N 005 (FM-27)

1. POST FLIGHT EVALUATION OF THE 4326 (FM-26) OPTICAL PERFORMANCE INDICATED EXPECTED PEAK RESOLUTION WAS NOT ACHIEVED EVEN THOUGH THE EXPECTED AVERAGE RESOLUTION WAS ACCOMPLISHED. THEREFORE, ALL OPTICAL ACCEPTANCE DATA FOR UNITS REMAINING TO BE FLOWN WERE RECALCULATED USING IMPROVED DATA REDUCTION TECHNIQUES. FOR UNITS FM-28 (FLOWN AS 4327) AND FM-29, THE OPTICAL ACCEPTANCE RESULTS WERE REVERIFIED. FOR FM-27 THE EXPECTED RESOLUTION DECREASED FROM 14.7 LINES/MM TO 12.9 LINES/MM.

2. AS YOU KNOW, BECAUSE OF AN UNRELATED ENCODER PROBLEM DISCOVERED DURING CHECKOUT TESTING AT THE PAD, FM-27 WAS RETURNED TO THE FACTORY FOR REPAIR AND FM-28, THE PIPELINE PHOTOGRAPHIC PAYLOAD SECTION, WAS FLOWN AS 4327. FM-27 IS NOW IN-HOUSE AT THE FACTORY.

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THE CAUSE OF LOWERED OPTICAL PERFORMANCE HAS BEEN IDENTIFIED BY THE CONTRACTOR AS A LESS THAN OPTIMUM ROSS CORRECTOR/ PRIMARY MIRROR COMBINATION, WITH THE PRIMARY MIRROR SURFACE ERROR AS THE PRIME SOURCE OF THE PROBLEM. THEREFORE IT IS POSSIBLE FOR THE CONTRACTOR TO IMPROVE FM-27 PERFORMANCE TO 15.2-16.0 LINES/MM BY REPLACING THE PRIMARY MIRROR.

3. THE SCHEDULE IMPACT OF REPLACING THE PRIMARY MIRROR IS SHOWN IN THE FOLLOWING TABLE. THE CURRENT PROGRAM REQUIREMENT IS FOR THE UNIT TO BE SHIPPED 16 DAYS PRIOR TO THE LAUNCH DATE. THIS REQUIREMENT IS SATISFIED WITH THE NEW AVAILABILITY DATES, HOWEVER, SCHEDULE PADS IN THE MANUFACTURING CYCLE ARE REDUCED SIGNIFICANTLY. REWORK OF FM-27 WOULD BE COMPLETED FOR THE UNIT TO FLY MISSION 4331.

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MISSION NO.	LAUNCH	UNIT AVAILABLE OLD DATE	UNIT AVAILABLE NEW DATE
4328	12 AUG 70	03 JUN 70	23 JUL 70
4329	21 OCT 70	15 JUL 70	16 SEP 70
4330	03 FEB 71	27 OCT 70	20 OCT 70
4331	21 APR 71	20 JAN 71	15 MAR 71
4332	16 JUN 71	07 APR 71	10 MAY 71

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4333	11 AUG 71	02 JUN 71	23 JUL 71
4334	20 OCT 71	28 JUL 71	03 SEP 71
4335	09 FEB 72	06 OCT 71	01 NOV 71
4336	12 APR 72	26 JAN 72	20 DEC 71

IF REPLACEMENT OF THE PRIMARY MIRROR IS NOT ACCOMPLISHED, UNIT FM-27 WOULD FLY MISSION 4329 ON 21 OCT 70.

4. I HAVE CONSIDERED THE POSSIBLE GAIN IN IMAGE QUALITY VERSUS THE PROGRAM IMPACT OF REWORKING FM-27.

A. IF FM-27 WAS FLOWN "AS IS," THE PEAK AND AVERAGE QUALITY WOULD BE COMPARABLE TO 4326, THAT IS, ABOUT 14 INCHES GROUND RESOLUTION PEAK, WITH UP [] POSSIBLE, AND ABOUT 19 INCHES GROUND RESOLUTION ON THE AVERAGE. REWORK OF THE UNIT WOULD YIELD A [] GROUND RESOLUTION PEAK, AND 18-19 INCHES ON THE AVERAGE. SPECTRE RATED THE INTERPRETABILITY OF 4326 IMAGERY "GOOD," EVEN THOUGH THE PEAK RESOLUTION WAS ONLY 14 INCHES, COMPARED TO [] PEAK OF RECENT UNITS.

B. REWORK OF FM-27'S OPTICS WOULD HAVE THE FOLLOWING IMPACTS:

(1) LOSS OF PIPELINE STATUS THROUGH 4335.

(2) ELIMINATION OF SCHEDULE FLEXIBILITY AT BRISK THROUGH 4335.

FOR EXAMPLE, FM-33 (4333) WOULD BE DELIVERED ONLY THREE DAYS

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BEFORE THE DATE REQUIRED TO SUPPORT ITS EXISTING LAUNCH DATE.

(3) REQUIREMENT FOR TOTAL SUCCESS ON THE PRESENT R-5 FORMULA DEVELOPMENT TEST SERIES. BECAUSE OF UNIQUE FACILITIES AND SKILLS REQUIRED, THE R-5 ROSS MATCH TESTS WOULD HAVE TO BE COMPLETED BY DEC 1970 SO THAT TESTING OF REWORKED FM-27 COULD COMMENCE IN TIME TO SUPPORT USE ON 4331, THE LAST R-361 UNIT. THE R-5 OPTICAL SYSTEM IS A SOPHISTICATED ONE, AND COULD BE SUBJECT TO DEVELOPMENT/TEST PROBLEMS.

(4) INCREASE IN PROGRAM COST OF ABOUT 200,000 DOLLARS.

5. ALL FACTORS CONSIDERED I PROPOSE TO TAKE ACTION TO HAVE THE OPTICAL QUALITY OF FM-27 IMPROVED TO BE MORE COMPATIBLE WITH DESIGN SPECIFICATIONS OF THE GAMBIT SYSTEM. THE INCREASED PROGRAM COST IS LESS THAN ONE PERCENT OF THE TOTAL MISSION COST

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AND IS A SMALL EXPENDITURE TO OBTAIN SIGNIFICANT RESOLUTION
IMPROVEMENT IN THE USE OF THIS UNIT. THE PROGRAM OFFICE WILL
MAKE EVERY EFFORT TO ACHIEVE PIPELINE STATUS AS SOON AS POSSIBLE,
WITH EMPHASIS ON COMPLETING THE R-5 DEVELOPMENT TESTING.

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