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GAMBIT
SECTION 1 OF 2
FOR GENERAL ALLEN FROM DR. NAKA
SUBJECT: LAND PANEL REPORT ON EOI VS FROG-GAMBIT IN THE NRT PHOTO RECONNAISSANCE ERA

1. IN ACCORDANCE WITH YOUR REQUEST, THE SUBJECT REPORT ON THE RECONNAISSANCE PROGRAM (EOI-FROG) IS HEREWITH PROVIDED. ANY QUESTIONS CONCERNING THIS REPORT SHOULD BE ADDRESSED TO MAJ D. ALSER (WHIG).

2. TITLE "THE NEAR REAL TIME PHOTO-RECONNAISSANCE PROGRAM (EOI FROG)" REPORT BY THE NATIONAL RECONNAISSANCE PANEL TO THE PRESIDENT'S SCIENCE ADVISOR, 7 JULY 1971 (BYE-11953-71).

3. " AT YOUR REQUEST WE HAVE REVIEWED THE NEAR REAL TIME PHOTO-RECONNAISSANCE PROGRAM, BOTH EOI AND FROG. THE PANEL MEETING

OF JUNE 11, 1971 WAS SUPPLEMENTED BY FURTHER DISCUSSIONS AND VISITS. WE HAVE JUDGED THE EXPECTED PERFORMANCE AND RELATIVE PROGRAM RISK OF EOI AND FROG, AS FOLLOWS:

A. (1) EOI WILL HAVE A BEST NADIR GSD (GROUND SAMPLE DISTANCE) OF [redacted] IN A 198 BY 393 N MI ORBIT, WITH A [redacted] MISSION DURATION. NOTE 1. FROG WILL HAVE A BEST NADIR GRD (GROUND RESOLUTION DISTANCE) OF 24" FROM 175 MILES ALTITUDE, BUT IT CAN PROBABLY BE OPERATED AT 85 MILES ALTITUDE FOR 15-30 DAYS OF ITS NOMINAL [redacted] MISSION, FROM WHICH ALTITUDE IT WILL HAVE A 12" GRD.

(2) A SUBSTANTIAL EXPERIMENT PERFORMED BY NPIC HAS ACOMPARED 3 EXAMPLES OF BEST ACTUAL G3 IMAGERY WITH SIMULATED EOI IMAGERY OF [redacted] AND 12" GSD (AT EOI SIGNAL-TO-NOISE RATIOS ("SNR") OF 3 AND 5). EOI AT [redacted] (AND EITHER SNR) WAS JUDGED CLEARLY SUPERIOR TO THE BEST OF G3 USUALLY STATED TO BE [redacted] NOTE 2 EOI AT [redacted] WAS JUDGED SOMEWHAT INFERIOR TO THE BEST OF G3.

(3) EOI WILL HAVE MANY MORE ACCESSES AT GSD BELOW 12" THAN DOES THE PRESENT G3, AT GRD BELOW 9" [illegible] AND CAN THEREFORE REPLACE G3 (CURRENTLY COSTING OVER $ 150M ANNUALLY - THE RECURRING ANNUAL COST OF EOI), WHEREAS FROG CANNOT. EOI CAN PROVIDE MULTIPLE VIEWS OF THE SAME STRUCTURE FROM A RANGE OF ANGLES ON A SINGLE PASS. FROG,

LIMITED TO ROLL ONLY, CANNOT.

B. (1) NEAR NADIR, THE FROG HAS VERY LITTLE CAPABILITY TO MONITOR LINES OF COMMUNICATION (LOC) AND CAN PLACE ONLY 3 TO 4 PHOTOS OF SOME 3 MILES SQUARE ALONG A ROAD APPROXIMATELY E-W DIRECTION, AND WOULD BE THUS LIMITED AT TIMES TO PHOTOGRAPHING AS LITTLE AS 10-20 MILES OF LOC PER PASS. AT LARGE OBLIQUITY, FROG HAS GREATER LOC

COVERAGE, BUT AT SUBSTANTIAL SACRIFICE IN RESOLUTION.

(2) THE EOI SYSTEM, EVEN IN ITS ORIGINAL FRAMING MODE, COULD LAY SOME 25 FRAMES ALONG EVEN AN EAST-WEST ROUTE FOR A COVERAGE OF SOME 60 MILES LENGTH (MINIMUM) PER PASS.

(3) IN THE STRIPPING MODE, WITH THE [redacted] WHICH CAN BE INCORPORATED WITHOUT CHANGE OF SCHEDULE, SOME 450 MILES OF TYPICAL LOC CAN BE COVERED PER PASS.

C. EOI GIVES IMMEDIATE RETURN OF IMAGERY TO WASHINGTON (FEW SECONDS) WITH IMAGERY ROUTINELY AVAILABLE LESS THAN 1 HOUR AFTER ACCESS. FROG WITH THE PLANNED CONTINENTAL U.S. SITES WILL HAVE A 12-HOUR DELAY AFTER PHOTOGRAPHING EUROPEAN RUSSIA, THE SUEZ, OR EASTERN EUROPE. NORMAL SUN-SYNCHRONOUS ORBITS PHOTOGRAPHING THESE REGIONS AT LOCAL NOON (ABOUT 5 A.M. WASHINGTON TIME) CAN RETURN EOI IMAGERY IN AMPLE TIME FOR A FULL DAY'S REVIEW BY U.S.

GOVERNMENT LEADERSHIP, WITH RESULTANT TASKING OF THE NEXT DAY'S TAKE (PICTURES ON THE DESK AT OPENING OF BUSINESS THE FOLLOWING DAY). A 12-HOUR DELAY IN RETURN OF IMAGERY WOULD LEAD TO A 2-DAY CYCLE IF THE SYSTEM WERE TO SERVE DIRECTLY THE NEEDS OF GOVERNMENT LEADERS.

D. THE EOI SYSTEM DESIGN NOW INCLUDES AN ENHANCED CAPABILITY FOR AREA AND LOC SURVEILLAND, ACHIEVED BY THE INCORPORATION IN THE EOI FOCAL PLANE OF A [redacted] ELEMENTS WITH NADIR GSD OF 26' AS COMPARED WITH THE OTHER [redacted] ELEMENTS EACH WITH BEST NADIR GSD OF [redacted] NO CHANGE IN TECHNOLOGY WAS REQUIRED. THUS THE EOI PROGRAM HAS DEMONSTRATED THE PERFORMANCE OF THE DEVELOPMENTAL ITEMS WHICH HAVE BEEN EXPOSED TO CRITICAL APPRAISAL FOR AT LEAST THE LAST 2 YEARS. CERTAIN TASKS REMAIN TO BE ACCOMPLISHED, E.G.:

(1) ADEQUATE THERMAL CONTROL OF THE DETECTOR ARRAY,

(2) CHOICE OF THE OPTIMUM MEANS OF CONTINUOUS CALIBRATION OF EACH DETECTOR,

(3) DEMONSTRATION OF THE VEHICLE STABILIZATION ACHIEVABLE WITH THE [redacted]

WE ARE CONFIDENT THAT THIS WORK CAN BE PERFORMED SUCCESSFULLY ON THE REQUIRED TIME SCALE.

E. ON THE OTHER HAND, FROG WILL REQUIRE THE DEVELOPMENT OR ADAPTATION OF MANY TECHNIQUES AND PIECES OF EQUIPMENT NEW TO THE PROGRAM AND TO THE CONTRACTORS:

(1) BIMAT PROCESSING WITH [redacted] INVOLVING THERMAL CONTROL TO 1 DEGREE C ACCURACY AT 0 DEGREE C.

(2) LASER SCANNER-FILM GUIDE

(3) ROLL JOINT MODIFICATIONS

(4) ZERO-G PROPELLANT REQUIREMENT

(5) FLEXIBLE SOLAR CELL ARRAY

(6) IN GENERAL, THE MANY SYSTEMS RESPONSIBLE FOR RAISING THE NUMBER OF "RELAY-DRIVER PAIRS" FROM 220 IN THE G SYSTEM TO 760 IN THE PROPOSED FROG.

ACCORDING TO AN AIR FORCE SPOKESMAN, "EVERY AGENA SUBSYSTEM IS NEW," AS IS THE FILM-ELECTRONICS MODULE. THESE CAPABILITIES APPEAR POSSIBLE OF ACHIEVEMENT, NO INVENTIONS APPEAR TO BE REQUIRED, BUT OUR EXPERIENCE WITH ANALOGOUS DEVELOPMENT PROGRAMS (BOTH IN THIS FIELD AND IN THE CONTEXTS IN WHICH WE INDIVIDUALLY HAVE EXPERIENCED) CAUSES US TO REGARD THE SUCCESSFUL ACHIEVEMENT OF ALL THESE CAPABILITIES ON SCHEDULE AS A SUBSTANTIAL RISK.

WE CONCLUDE THAT THE RISK ASSOCIATED WITH FROG ON THE

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SECTION 2 OF 2.
STATED SCHEDULE MAY WELL BE GREATER THAN THAT ASSOCIATED WITH EOI ON ITS SCHEDULE WITH OPERATIONAL CAPABILITY ONE YEAR LATER.
F. AT 17 DEGREE N LATITUDE, THE EDGE OF SWATH RESOLUTION IS:
EOI - 26" GSD (GROUND SAMPLE DISTANCE, GEOMETRIC MEAN)
FROG - 84" GRD (GROUND RESOLUTION DISTANCE, GEOMETRIC MEAN)
SCALING FROM THE EXPERIMENT PERFORMED BY NPIC COMPARING THE BEST OF G3 PHOTOGRAPHY WITH SIMULATED EOI PHOTOGRAPHY, FROG WOULD HAVE TO SHOW ABOUT 36" - 46" GRD TO GIVE A PRODUCT OF VALUE TO PHOTOINTERPRETERS "EQUIVALENT" TO THE EOI 26" GSD PRODUCT. FROG IS THIS AT LEAST A FACTOR 2 WORSE IN ITS EDGE-OF-SWATH RESOLUTION.

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G. WE BELIEVE THAT EOI DESIGN WILL NOT BENEFIT FROM OPERATIONAL EXPERIENCE OF FROG BECAUSE SUCH EXPERIENCE WILL NOT BE AVAILABLE TO ANY SIGNIFICANT EXTENT UNTIL MID-1975, AND TO DELAY THE EOI PROCUREMENT UNTIL THEN WOULD POSTPONE EOI OPERATION TO 1978 OR 1979.
H. IT IS TRUE THAT EOI HAS SUBSTANTIAL GROWTH CAPABILITY WHICH CAN BE ACCOMMODATED GRADUALLY IN THE PRESENT CONFIGURATION.
PROBABLY THE IMPROVED CAPABILITY OF GREATEST INTEREST IS [redacted] THIS WILL REQUIRE SUBSTANTIAL IMPROVEMENT IN THE STATE OF THE ART AND IN OUR OPINION WOULD BE OF RELATIVELY SMALL IMPORTANCE COMPARED WITH [redacted] EOI PRODUCT. THERE IS SOME REASON TO BELIEVE THAT IR IMAGERY CAN BE ACCOMMODATED IN THE PRESENT EOI CONFIGURATION, BUT THE RELATIVE VALUE OF SUCH IMAGERY IS NOT SUCH AS TO MAKE IT ADVISABLE TO DELAY THE EOI PROGRAM TO DETERMINE THIS TECHNICAL DETAIL.
I. SUMMARY AND CONCLUSION
(1) THE COMPARISONS A THROUGH F SHOW THE PERFORMANCE OF FROG TO BE SUBSTANTIALLY INFERIOR TO THAT OF EOI. THE OPERATION OF FROG WOULD ONLY BE AN INTERIM PROGRAM. THE LONGER EOI IS DELAYED, THE LONGER WE WILL BE DENIED THE MUCH SUPERIOR EOI PRODUCT, BUT WE SHALL

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EVENTUALLY DEVELOP THE EOI. STILL, THE QUESTION IS NOT WHETHER WE SPEND [redacted] OR MORE (THROUGH 1977) TO BUILD FROG TO FLY END 1973 OR [redacted] OR MORE (THROUGH 1977) TO FLY EOI END 1974. (THE STATED EOI PROGRAM COST DOES NOT TAKE CREDIT FOR A SAVING EXCEEDING [redacted] ANNUALLY, RESULTING FROM THE REPLACEMENT OF G3 BY A VERY SMALL FRACTION OF EOI OBSERVING TIME). THE QUESTION IS WHETHER IT IS WORTH [redacted] ADDITIONAL TO HAVE AN INFERIOR PRODUCT ONE YEAR SOONER (WITH SUBSTANTIAL RISK) AND WITH WHAT WE REGARD AS PROBABLE RESULTING DELAY OF THE SUPERIOR CAPABILITY.

(2) THE PANEL BELIEVES THAT RECENT DECISIONS HAVE BEEN BASED ON TWO MISCONCEPTIONS:

(A) THAT EOI AND FROG ARE SUFFICIENTLY SIMILAR IN PERFORMANCE THAT THE TWO ARE ALTERNATES, AND

(B) THAT THE RISK IN DEVELOPING FROG IS SUBSTANTIALLY LESS THAN THAT IN BUILDING EOI.

THE PANEL IS UNANIMOUS IN ITS JUDGMENT THAT THE FROG PROGRAM HAS THE HIGHER RISK. WE RESPECTFULLY URGE THAT FROG BE DROPPED AND EOI ACQUIRED ON A SCHEDULE TO RESULT IN FIRST FLIGHT NOVEMBER 1974.

J. NOTES

CLARIFYING REMARKS ADDED 7/24/71 BY R.L. GARWIN AFTER DISCUSSION

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WITH J.J. MARTIN.

1. MEAN MISSION DURATION COMPARABLE WITH FROG IS [redacted]
2. "BEST OF G3" IS USUALLY STATED TO BE [redacted] THE MIP FRAMES ARE COMMONLY JUDGED TO BE [redacted] THESE 3 PARTICUALR FRAMES WERE ESTIMATED TO BE IN THE [redacted] RANGE. SINCE THE PERFORMANCE OF FROG IS SIMPLY SCALED FROM G3, IT IS MORE IMPORTANT TO RECOGNIZE THAT THESE MIP FRAMES REPRESENT THE BEST OF G3 THAN TO ASSIGN A NUMERICAL GRD TO THEM.
3. THIS CONCLUSION REMAINS TRUE FOR ANY REASONABLE ASSESSMENT OF GSD VS GRD VALUE. IN ADDITION, EOI HAS THE OTHER VIRTUES OF INTENSITY RESOLUTION AS WELL AS SPATIAL RESOLUTION, LOW SUN ANGLE, ETC.

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