

~~TOP SECRET~~

The Near Real Time Photo-Reconnaissance Program (EOI-FROG)

Report by the National Reconnaissance Panel

to the

President's Science Adviser

July 14, 1971

BYE-11953/71
9
D

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:

- EOI will have a best nadir GSD (ground sample distance) in a 188 by 383 n mi orbit, with a mission duration. (b)(1)
 FROG will have a best nadir GRD (ground resolution distance) of 24" (b)(3) from 170 miles altitude, but it can probably be operated at 85 miles altitude for 15-30 days of its nominal 9 month mission, from which altitude it will have a 12" GRD.

A substantial experiment performed by NPIC has compared 3 examples of best actual G³ imagery with simulated EOI imagery

EOI will have many more accesses at GSD below than does the present G³, at GRD below 14" and can therefore replace G³ (currently costing over \$100M 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.

- Near nadir, the FROG has very little capability to monitor lines of communication (LOC) and can place only 3 to 4 frames of some 3 miles square along a road of 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.

B-11953/71

This document consists of 5 pages
No. 7 of Copies, Series A

EXCLUDED FROM AUTOMATIC DOWNGRADING
AND DECLASSIFICATION

GAMBIT-ZAMAN

Handle via BYEMAN
Control System

~~TOP SECRET~~

[Redacted]

(b)(1)
(b)(3)

3. EOI gives [Redacted]

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. [Redacted]

(b)(1)
(b)(3)

(b)(1)
(b)(3)

[Redacted]

4. The EOI system design now includes an enhanced capability for area and LOC surveillance, achieved by the incorporation in the EOI [Redacted]

(b)(1)
(b)(3)

[Redacted]

We are confident that this work can be performed successfully on the required time scale.

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:

Handle via BYEMAN
Control System

~~TOP SECRET~~
GAMBIT-ZAMAN

B-11953/71
This document consists of 5 pages
No. ___ of ___ Copies, Series 4

GAMBIT-ZAMAN

Handle via BYEMAN

Control System

Page 3

~~TOP SECRET~~

- a. Bimat processing with 1 yr. life, involving thermal control to 1°C accuracy at 0°C.
- b. Laser scanner-film guide
- c. Roll joint modifications
- d. Zero-g propellant requirement
- e. Flexible solar cell array
- f. 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 sub-system 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 experience) 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 stated schedule may well be greater than that associated with EOI on its schedule with operational capability one year later.

5. At 17° 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 30" - 40" GRD to give a product of value to photointerpreters "equivalent" to the EOI 26" GSD product. FROG is thus at least a factor 2 worse in its edge-of-swath resolution.

6. 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.

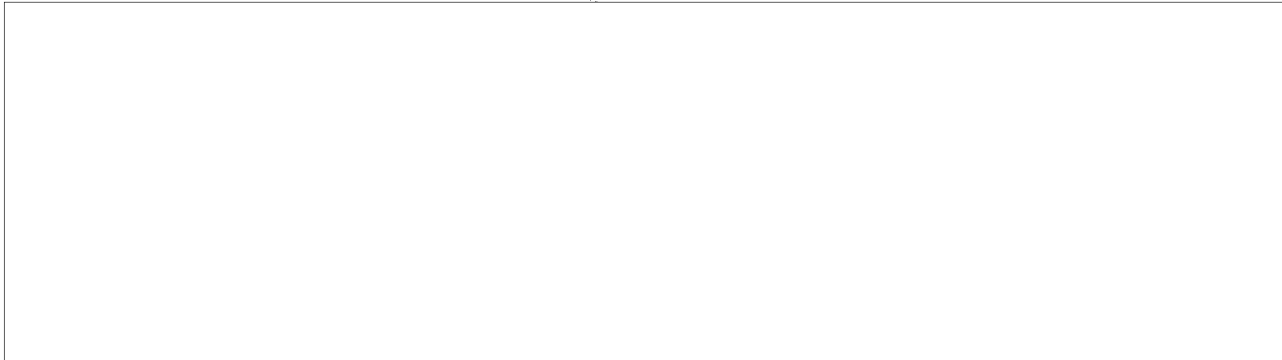
7. It is true that EOI has substantial growth capability which can be accommodated gradually in the present configuration.

Handle via BYEMAN
 Control System

~~TOP SECRET~~
GAMBIT-ZAMAN

B-11953/71
 This document consists of 5 pages
 No. ___ of ___ Copies, Series A

~~TOP SECRET~~



Summary and Conclusion

The comparisons (1) through (5) 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 eventually develop the EOI system. Thus the question is not whether we spend \$675M or more (through 1977) to build FROG to fly end 1973 or or more (through 1977) to fly EOI end 1974. (The stated EOI program cost does not take credit for a saving exceeding \$100M annually, resulting from the replacement of G³ by a very small fraction of EOI observing time). The question is whether it is worth \$675M 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.

(b)(1)
(b)(3)

The Panel believes that recent decisions have been based on two misconceptions:

- (1) that EOI and FROG are sufficiently similar in performance that the two are alternates, and
- (2) 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.

RLGarwin/fn/14Jul71
 Cy 1 File Z
 Cy 2 Ling
 Cy 3, 4 Land
 Cy 5 Goldberger
 Cy 6 Martin

RLG signed- Edwin H. Land, Chairman
 National Reconnaissance Panel
RLG signed- James G. Baker
RLG signed- Sidney D. Drell
RLG signed- R. L. Garwin
RLG signed- M. L. Goldberger
RLG signed- Don Ling
RLG signed- A. Puckett

signed- Joseph Shea
 B-11953/71

~~TOP SECRET~~

Handle via BYEMAN
Control System

GAMBIT-ZAMAN

This document consists of 2 pages
No. ___ of ___ Copies, Series A

GAMBIT-ZAMAN

Clarifying remarks added 7/24/71 by R. L. Garwin after discussion with J. J. Martin (keyed to marginal numerals on page 1)

1. Mean mission duration comparable with FROG is 2.6 years.

2. "best of G^3 " is usually stated to be The MIP frames are commonly judged to be These 3 particular frames were estimated to be in the range. Since the performance of FROG is simply scaled from G^3 , it is more important to recognize that these MIP frames represent the best of G^3 than to assign a numerical GRD to them. (b)(1)
(b)(3)

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.

Handle via BYEMAN
Control System~~TOP SECRET~~This document consists of 5 pages
No. _____ of _____ Copies, Series _____

BYE 11953-71