



Land

THE WHITE HOUSE
WASHINGTON

July 26, 1971

MEMORANDUM FOR

Honorable David Packard
Honorable Richard Helms

SUBJECT: Land Panel Report on FROG and EO1

Attached is a copy of the Land Panel report which I have received recently. Perhaps this will be useful to you at this time.

Edward E. David Jr.
Edward E. David, Jr.
Science Adviser

Attachment
B 11957-71

Cy to
Dr. McLucas

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July 24, 1971

Dr. Dr. David:

Acting for Dr. Land, I am transmitting to you a recent Panel report dealing with the near-real-time photo reconnaissance program. The report has now been signed by James G. Baker, Sidney D. Drell, Richard L. Garwin, Marvin L. Goldberger, Edwin H. Land, Donald P. Ling, Joseph F. Shea.

Dr. Puckett's position cannot be reported so simply. He was not asked to sign the report (7/19/71) when he reviewed it, and after that time he had considerable reservations which he expressed to J. J. Martin and later to me in a telephone conversation 7/21/71. I arranged for him to review the material resolving from actual use of the array elements in a flight test, and to receive a report on the EOI program status from Les Dirks the morning of 7/22/71. Dr. Puckett called me soon afterwards, on 7/22/71, and said "In short, my mind has been relieved as to how ignorant we (or they) are or are not on matters of linearity, correctability, calibration, etc." ... "In conclusion I would be willing to say that the risk in this (EOI) program, on its 42 or 49 month time scale (and from here I really can't tell the difference between 42 and 49 months) is certainly no greater and probably less than that for the FROG on its slightly shorter time scale." (The quotation is as accurate as I could make it from my attempt to take verbatim notes from the telephone conversation.)

Dr. Puckett's position before his review of 7/22/71 can be encapsulated in the following question I asked of him and his answer of 7/21/71:

Question: "Given your view of the relative risks of EOI and FROG (i. e. , that the possible stretch in schedule or increase in cost is fractionally the same for EOI and FROG) and given the climate as put to me by J. J. Martin and other (i.e. , not a brief period of FROG followed by EOI, but essentially FROG or EOI for quite awhile), which would you start -- FROG or EOI?"

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Answer: "I would go ahead with EOI. But I just don't want the report or the Panel to seem excessively optimistic."

I have tried since July 22 to reach Dr. Puckett to ask him, in view of his present position, whether he wishes to sign the report. Unfortunately, he is in Hawaii for a week, and I shall not be able to talk with him before this afternoon or tomorrow.

I hope the Panel's views will be of help to you in this matter.

Sincerely yours,

R L Garwin

Richard L. Garwin

Dr. Edward E. David, Jr.
Director
Executive Office of the President
Office of Science and Technology
Washington, D. C. 20506

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

Report by the National Reconnaissance Panel
to the
President's Science Adviser
July 14, 1971

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:

1. EOI will have a best nadir GSD (ground sample distance) of [] in a 188 by 383 n mi orbit, with a [] mission duration. FROG will have a best nadir GRD (ground resolution distance) of 24" 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 []

[]

limited to roll only, cannot.

2. Near nadir, the FROG has []

[]

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[Redacted]

[Redacted]

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

[Redacted]

[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:

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- 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 G^3 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.

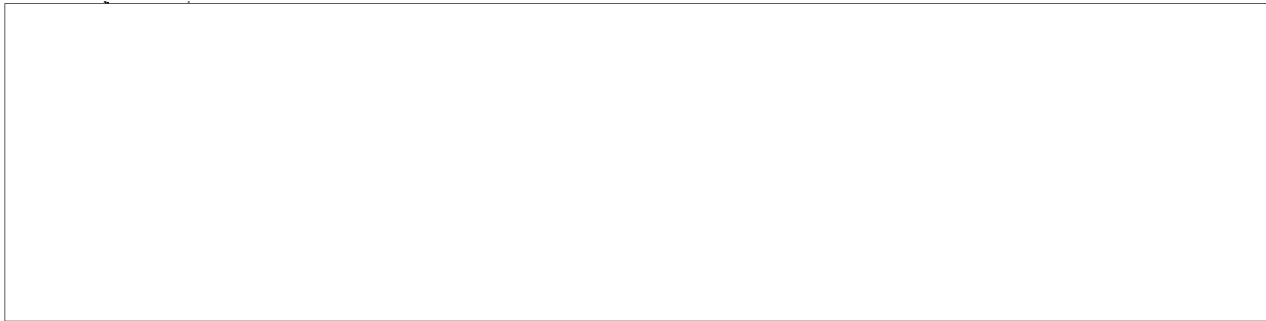
7. It is true that EOI has substantial growth capability which can be accommodated gradually in the present configuration.

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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.

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*

RLG signed- M. L. Goldberger

RLG signed- Don Ling

Signed A. Puckett
for JGee, Jul 23, 1971

signed-Joseph Shea

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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. "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.
3. This conclusion remains true for any reasonable assessment of GSD vs GRD value. In addition, EOI has the other virtues of

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