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1-2

THE DEPUTY SECRETARY OF DEFENSE
WASHINGTON, D. C. 20301

RETURN PAPERS

MEMORANDUM FOR THE PRESIDENT

SUBJECT: Readout Satellites

We are writing to you in our capacity as members of the Executive Committee for the National Reconnaissance Program. The NRP includes all photographic and signal intelligence satellites, both those developed by the Air Force and those developed by CIA. The program is managed by the NRO, National Reconnaissance Office, staffed and funded jointly by the Department of Defense and the CIA.

Background

As you know we operate two kinds of photographic systems, one optimized for area coverage or search missions and one optimized for high resolution surveillance of selected targets. The search mission has been done for many years by CORONA, a system providing broad area coverage with resolution of 6-10 feet. The GAMBIT system has covered the high resolution surveillance requirement for many years yielding resolutions of [redacted]15 inches. In June of this year, we flew the first HEXAGON mission which will (as its reliability is proven) replace CORONA later this year. As the lifetime in orbit of these systems has increased, we have been able to satisfy our intelligence needs with fewer launches so that in 1972, we plan a total of four search missions and four high resolution surveillance missions providing roughly 200 days on orbit per year. By 1974, through further life extension and no increase in launch rate, we will have either a GAMBIT or a HEXAGON on orbit essentially all the time. Hence, our current systems will provide frequent, regular coverage, something which the intelligence community has come to realize is a very important factor in overhead reconnaissance. This plan will bring back from space one capsule of film every two weeks. This contrasts with current operations wherein we sometimes go for six to eight weeks

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Copy [redacted] of [redacted] Copies
Page [redacted] of [redacted] Pages
Control No. BYE 13011-71

without coverage. Furthermore, because of weather, we frequently go for many months without covering certain areas of high interest. By being on orbit continuously we greatly enhance the probability of seeing targets usually covered by clouds but sometimes open to observation.

Need for Readout System

Within the last two years the intelligence community and some of our principal users have become aware of the desirability of greatly increased timeliness in the return of photography. The Suez crisis last year led to two questions on the part of our principal users--first, why don't we keep satellites up continuously so that they can be immediately targeted to areas of interest--and second, do we have the capability of obtaining photography on a daily basis rather than waiting for film capsules which on the average are available only every few weeks. As you can see, the already planned extension of satellite lifetime takes care of the first question. The second question is not a new one because there have been many crisis situations already, but the question has been asked more and more frequently as the users of our products become more aware of the need to be informed in crises or near-crisis situations, and as they become aware of the improvements in technology which are available to us. Responding to this growing awareness of the usefulness of more timely information, the NRO has examined a large number of proposed systems and has sponsored development activities critical to several promising approaches. Of these approaches, two have been selected for full scale development.

Before describing the two proposed systems, it should be pointed out that all satellite systems are limited in fundamental ways by orbital characteristics, by night and by weather conditions. One must wait until the area of interest on the earth passes under the orbit plane of the satellite. This problem can be alleviated by putting up more satellites in different planes.

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Copy [redacted] of [redacted]
Page [redacted] of [redacted]
Control No. BYE 13011-71

Two Approaches

FROG. Up until recently, the only practical way of returning images frequently from space was to expose photographic film in the usual way, develop the film in the satellite, scan the pictures by electronic means, and send the data by radio link to a ground station which would reconstitute the picture. This is the technique which forms the basis for one of the proposed systems. It would provide for reading out a few times per day to an existing Air Force ground station in New Hampshire. Pictures would be available in Washington about 12-24 hours after passage of the satellite over the target. Such techniques were demonstrated in the Air Force SAMOS program in 1961 and in the NASA Lunar Orbiter in 1966. These systems were limited in quality or duration of coverage or both. Gradual improvements in both quality and coverage have become available so that a film-based system could now be built which would satisfy most but not all of our intelligence requirements, and could return data on a daily basis continuously at a reasonable cost. Such a system, which we call FROG (from Film Readout GAMBIT) is the initial system which would be developed in Option 2.

EOI. The other and more exciting technical approach is what we call the EOI (for Electro-Optical Imaging) system. Somewhat over two years ago the progress being made in solid-state sensors encouraged us to begin component development work and systems studies leading toward an imaging system of a very intriguing nature. During the ensuing two years, we have spent about [redacted] carrying forward development and demonstration work on the essential components of a system which would capitalize on the new solid-state sensor arrays, and we have evolved a system design which we feel confident could meet our requirements for dealing with crises situations. Essentially the system consists of a very large telescope [redacted] long) which can be pointed at targets of interest. Light energy is focussed on an array of solid-state sensors (about [redacted] individual sensors). The resulting signals are processed and relayed to high altitude data communications satellites which would transmit the data [redacted] where the pictures would be printed. By use of the data relay satellites, the picture can be read out [redacted] as the EOI satellite passes over a target on the other side of the world. The

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TOP SECRET

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Control No. BYE 13011-71

advantage of the EOI approach is obvious, in providing [redacted] available imagery. Another advantage of the EOI over the film systems is the broader dynamic range of the sensor elements themselves which make it possible to get better pictures than we now get under conditions of a hazy atmosphere or with low sun angles which exist in northern Russia during most of the year. The EOI promises eventual growth to operation [redacted] as technology continues to improve. There is not much question that eventually we would want to go to the EOI approach; however, EOI is expensive, and although we have demonstrated all essential components of the EOI system, there is considerable work to be done to achieve a working system. Dr. Land has described this system to you and has stated that it could be available by late 1974. We believe that even if we tried for 1974, we are unlikely to achieve an operational system before 1976 at a cost of some [redacted] This difference in views as to how rapidly an entirely new system can be made available is not surprising. Our record in the past contains enough examples of delayed systems that we do not want to promise too much. Thus our Option 1 provides for developing EOI on what we consider a reasonable schedule (available 1976). We would propose that the program, if chosen, be kept under close scrutiny and accelerated to the extent justified by the progress. An accelerated program would require no additional funding in FY 72 but might require funding substantially above [redacted] per year in FY 1973 or FY 1974. The desirability of accelerating the program should be considered on a year by year basis determined by the progress of the development.

If a readout system is desired early (as was stated in the George Schultz letter of April, addressed to the Chairman of our Executive Committee) then we believe that it is better to develop FROG now. Since FROG is based on our current GAMBIT system we believe it can be available in 1974. It is cheaper to develop than the EOI. Our estimate of development cost is about [redacted]

When our ExCom looked at the need for readout systems in April, we decided to develop FROG now for the immediate requirement and develop EOI essentially in parallel with it, to be available in 1976. In discussing our budget proposal,

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BYE 13011-71

it has been clear that some members of the Senate believe that our intelligence programs cost too much and that significant savings should be effected. Because of Senator Ellender's insistence that we not load on to the budget two development programs at once, we have now decided that either we must forego FROG and wait for EOI in 1976, or we must delay EOI, develop FROG now, and once the development costs are behind us (in 1974), initiate development of what we feel is the more advanced system, EOI. Thus we present the two options.

Options

Option 1 - Develop EOI only. We believe that a reasonable program can be carried out for about [redacted] per year. We would review the situation annually, adjusting funding up or down as may be prudent, depending upon technical progress and the evolving needs of the intelligence community. Such an orderly development could assure system availability in 1976. However, we would not arbitrarily delay the system and would of course prefer a 1975 availability if it could be achieved. FY 72 funds would be held to [redacted] for this option.

Option 2 - Develop FROG now and upon completion of FROG development in 1974, initiate system development of EOI. We would continue EOI technology work and systems studies pending a system start. It is assumed that a two-year delay in system start could lead to up to two years delay in availability, but not necessarily, since technology work would have progressed significantly during the two-year holding period.

The choice between these options should consider the different availability dates between the options as well as the capability and cost differences between the two systems, EOI and FROG.

Advantages of Option 1.

1. Provides EOI in 1976 with some possibility of its being available earlier.

2. Avoids FROG development cost of about $200M and some portion of FROG operational costs.

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TOP SECRET

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BYE 13011-71

3. Makes EOI system available sooner than Option 2.

Disadvantages of Option 1.

1. Provides very small probability of bringing in a readout system during term of current Administration.

2. Puts all eggs in one basket, i.e., provides no backup for possibility of excessive delay in EOI for unforeseeable reasons.

3. Does not provide (experience with timely photography the learning which could take place by using FROG) before EOI is available.

Advantages of Option 2.

1. Increases probability of readout system availability during tenure of current Administration (estimated availability 1974)

2. Provides both early availability and possibility for eventual dual approach, if either system got into trouble. This option culminates in the "better" system in any case.

3. In event of further intelligence budget cuts, provides option of going FROG alone, an inherently less costly alternative than either of the proposed options.

4. Provides a system with which we have had some operational experience.

Disadvantages of Option 2.

1. Increases total intelligence expenditures over developing only one readout system.

2. Delays the EOI (potentially the most? capable) system arbitrarily. *

It is very difficult to predict the effects of readout systems on the total intelligence budget. Our estimates of costs associated with FROG and EOI are shown in the attachment. We believe that either EOI or FROG will permit significant reductions in GAMBIT/HEXAGON launches, but these reductions cannot take place until about one year after the first availability of the readout system. We believe that the total annual cost associated with the readout system and other conventional systems will eventually settle out at about the current level of [redacted] per year. Individual satellite costs are estimated at $40M each for FROG and [redacted] each for EOI. FROG is estimated to have a one year life (leading to about two launches per year) while EOI is estimated to have a [redacted] life [redacted]

Recommendations

~~The ExCom~~ recommends that if the most likely availability date of the EOI (1976) is acceptable, that Option 1 be selected. However, if a high probability of achieving a readout capability at an earlier date is desired, ~~the ExCom~~ recommends Option 2.

Packard Chm

Deputy Secretary

READOUT SYSTEMS COST ESTIMATES

OPTION I EOI Only

	FY72	FY72	FY74	FY75	FY76	FY77	TOTAL
EOI Systems Cost							
Data Relay Satellite							
All other							

OPTION 2 FROG now, EOI development begins FY74

FROG	130	150	110	110	100	80	$680M
EOI System							
DRS							
All other							
EOI Total							

EOI + FROG (sum of above columns)

These costs assume no credit for reduced GAMBIT flights in FY74-77. Actually we expect that FROG availability would reduce GAMBIT costs by $150-$200M. EOI will reduce GAMBIT costs similarly, starting two years later.

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Control Number BYE 1301-71

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Attachment 1