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Dr. John McLucas
Director, National Reconnaissance Office
Washington, D.C. 20301

Dear John:

I appreciate your sending us a copy of Gene Fubini's letter to Mr. Packard on the readout requirements. It obviously reflects some very serious concerns on Gene's part which deserve consideration and comment. More important, however, is the fact that it gives evidence of a great misunderstanding about the meaning of the USIB requirement statement, the manner by which it was derived and the way it interacts with available technology. The attached commentary, prepared by people in CIA concerned with both EOI performance and requirements, may be useful to you as you have further conversations with Gene. In addition, I hope you can find a way of bringing this critique to the attention of Mr. Packard and anyone else who may have received a copy of Gene's letter.

I can add little to the comments in the attachment except to emphasize that the current statement of requirements was evolved over a long period of time and through a great deal of study to insure that they do reflect the coverage needs that have characterized past crisis situations. And, as you know, additional work is now underway to document these, and other scenarios in a more explicit way.

However, there is one additional point I would like to take this opportunity to mention. I have heard the comment made that we should "go slow" and be sure that we know what we are doing. I hope that all of us associated with the NRO programs can make it clear to those who make this point that this is indeed what the current program is doing. For the past two years we have been conducting a very deliberate program which will bring us to a point late next summer when the EXCOM can decide whether or not to go ahead with a near real time system. We still have eight or nine months, therefore, in which to answer any questions or

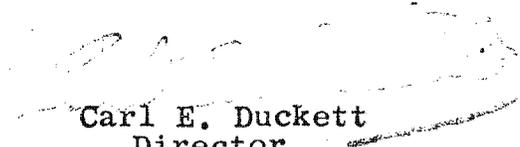
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concerns that might exist among those who will have to help make the decision. I believe you have work underway in the NRO structure which will provide an answer to all the currently outstanding questions, including those raised by Gene Fubini.

Sincerely,


Carl E. Duckett
Director
CIA Reconnaissance Programs

Attachment:
As Stated

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MEMORANDUM FOR: Deputy Director for Science and Technology

SUBJECT: Comment on Dr. Fubini's letter to
Mr. Packard, dated 29 October 1970

The following commentary on the subject letter emphasizes the four major areas of apparent concern to Dr. Fubini: the flexibility of the "requirement", the frame size and the coverage requirement for the Mideast ceasefire, timeliness for data return and the cost of the relay satellite link.

The Flexibility of the Requirement.

1. Dr. Fubini comments that the USIB requirements "are actually a translation of what is technically possible with solid state arrays rather than an optimum trade-off between national needs and costs." This reflects a misunderstanding which may be prevalent among those who are not familiar with the COMIREX studies and the COMIREX/NRO negotiations that preceded the writing of this requirement. It is indeed true that the current USIB requirement was evolved through a relatively detailed interaction between the world of the technically possible and the world of intelligence needs, but the requirement as it now stands "favors" no particular technical device or system. It is worth noting that the basic need for daily coverage of selected small area targets with relatively high resolution for "strategic indications and warning" was developed by COMIREX studies long before current sensor techniques had evolved. Over the past three years there has been considerable liaison between COMIREX and NRO in deriving the currently established requirements and a major objective of that liaison was to insure that the requirements reflected reasonable technical potential and at the same time allowed sufficient flexibility and gave sufficient guidance for performance and cost trade-off studies by the system designer. Even now, COMIREX considers that each one of the requirements are still subject to negotiation with respect to overall system performance and costs, and we are exploring a considerable range of variation in each of these elements.

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The Field of View (or Frame Size).

2. One of the requirements about which Dr. Fubini expresses considerable concern has to do with the 3 x 3 nm frame size, which he believes is too small. First, the "roughly" 3 x 3 square mile frame size was selected by COMIREX after considerable analysis of the nature of the targets that were relevant to strategic indications and warning and to crisis situations. Indeed, virtually every past crisis situation was examined during the evolution of the requirement to assure that a frame size on the order of a few miles was sufficient, in combination with high resolution, to fulfill the need. Second, it is worth noting that there are no significant differences between the technically feasible system competitors from the standpoint of the field of view that can be accommodated. Indeed, the field of view of the solid state system and any of the other possibilities can be made somewhat wider if desired. We have concluded, however, that this is not a sensible systems trade, and are in fact now leaning towards smaller frames than 3 x 3 nm rather than larger. However, the important point to be made is that the final selection will be made in consultation with COMIREX and based on a continuing analysis of the actual targets that need to be covered for indications and warning, crisis reconnaissance, and routine surveillance.

3. To amplify this point a little further, the frame size tentatively selected was one which was large enough to meet the needs of indications and warning and crisis reconnaissance, but small enough to make it possible to select out only those ground areas and targets of specific interest and thereby not expend communications resources transmitting areas or information which are not of interest. A combination of small frame size and good pointing accuracy permits maximum efficiency in this regard. However, it is recognized in the requirements document that areas larger than 3 x 3 will need to be covered from time to time. To meet this need, we have specified that the system must have sufficient agility to permit the building up of larger areas by taking successive and adjacent frames at more oblique angles.

4. Indeed, the EOI system as presently configured does permit a flexible trade between area coverage and image quality. Thus, the 3 x 3 nm frame is the nadir and thus the minimum frame size. As the obliquity angle is allowed to increase, the frame size increases and the image quality decreases (see attached table). The EOI system design has inherent flexibility to collect imagery as far out as the horizon if desired. (Dr. Fubini's implication that system modifications are required to achieve this capability is incorrect.)

Coverage of the Mideast Ceasefire.

5. The probable mode of application of an EOI system where some low resolution area coverage is desired, such as in the case of the Mideast ceasefire zone, would be to use high obliquity frames to cover the area in searching for new activities (such as SAM sites). At the same time, the system would provide daily access to identified activities of interest in the area at obliquities less than 50° and therefore at the high resolution that is required to determine the nature of the target activity. This is precisely the scenario we have explored in some detail against the Mideast ceasefire situation and found that the whole ceasefire zone could be covered on a daily basis at obliquities less than 61° . (The obliquity at the edge of the Hexagon swath is 60°). At 61° , the ground sample dimension (GSD) would be down from nadir GSD by a factor of 4.3, not 6.7 as suggested by Dr. Fubini. In addition, the recently completed NPIC study indicates that from the standpoint of interpretability the GSD has about a one to one relationship to what we traditionally call "ground resolution". However, it is worth noting that a rigorous and simple correspondence between imagery from current systems and sampling systems may not exist.

Timeliness in Data Return and Cost of Relay Satellite.

6. The other area of great concern to Dr. Fubini is the requirement for one hour elapsed time between picture taking and availability of the hard copy for analysis in Washington, a requirement that Dr. Fubini says will cost [] to achieve. Again, the "one hour" is somewhat negotiable in the performance-cost trade-offs and we are treating it as such. But the need for a return time as close to one hour as possible (in order to fit into a total intelligence cycle of less than a day) is quite firm and is well described in Mr. Helms' recent memorandum to EXCOM on this subject; there is little that we can add to that discussion. In any event, it is important to note that all electro-optical imaging systems can meet this timeliness requirement through use of a relay satellite.

7. However, we believe the cost associated with the requirement for "one hour" data return is [] over a ten year period, not [] as Dr. Fubini believes. His comment that the relay satellite segment of the EOI system will cost [] is probably based on a misunderstanding of SAMSO study results. One of the options studied was a multi-user satellite which would serve not only EOI but 647 and several other unidentified systems. It seems very improbable that the Air Force will recommend this approach. A dedicated relay satellite network

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tailored only to the needs of the EOI system can be had for a [] cost in the range of [] For example, using the basic [] spacecraft and developing new electronics and new antennas, gives a cost breakdown as follows:

Nonrecurring electronics development costs

[]

Three sets of electronics and antennas at []

Three Titan 3B Agena launch vehicles at []



This gives a total, assuming the upper limit on nonrecurring, of [] With a two satellite, [] configuration and taking [] operational life per relay satellite, [] systems will provide at least [] of communications for the EOI system. SAMSO is in the process of having Hughes detail the costs for this configuration.

Possibility of Readout to Ground Stations Remote from Washington.

8. Of course, the USIB requirement does not direct that the receiving facility be located [] it simply requires that the imagery be available in Washington, D.C. for analysis on a timely basis. It is entirely feasible to bring the data down from the imaging satellite to some remote facility and then subsequently relay the image data to Washington. As Dr. Fubini pointed out, in view of the large quantities of data involved, a minimum data rate of 50-100 megabits on this relay link would be essential. However, the only way of mechanizing this relay link from a place such as Thule or any place more than a few hundred miles from Washington, is to use a relay satellite. This is, in fact, the way the Compass Link system is configured using the IDCSP satellite. Through that satellite, the maximum data rates are less than a megabit requiring several hours per image -- clearly inadequate for any readout satellite system. In looking at this question in the past, we have been satisfied that if a data relay satellite enters the system, then the best thing to do is to take the data directly from the imaging satellite to a Washington ground terminal. This conclusion applies whether one is mechanizing a "store and forward" system or a direct readout system.

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9. Another option, of course, is to read out a store-and-forward system directly to a Washington vicinity receiving terminal. However, in this case the readout time available per day limits the number of images per satellite to a maximum of 100-150 per day depending on the sophistication of on-board data compression processing. Also, this approach builds in some substantial delays. It is quite clear that the intent of the USIB requirement cannot be met in this fashion.

10. In summary, then, our studies have indicated that eliminating the space-to-space relay link does not eliminate the requirement for a data relay satellite. Thus, there is no need, whatever sensor technology is used, for the Intelligence Community to accept six to twelve hours delay in data return. When the Air Force relay satellite costs are firmed up in the next month or so, we think it will be evident that the cost of developing and operating a data relay satellite supporting direct communications between the imaging satellite [redacted] receiving facility [redacted]

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ZAMAN SYSTEM PERFORMANCE VS OBLIQUITY

Altitude: 283 Circular

OBLIQUITY	MEAN HORIZONTAL GROUND SAMPLE DISTANCE	FRAME DIMENSIONS
Degrees from Nadir	FEET	N. Miles
0		3 x 3
20		3.2 x 3.5
30		3.5 x 4.2
40		4.0 x 5.6
45		4.4 x 6.9
50		5.0 x 8.9
55		5.8 x 12.5
60		7.0 x 20.1
61		7.4 x 22.9
62		7.8 x 26.4
63		8.3 x 31.2
64		8.8 x 38.1

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Executive Session Issues

Reference A: Dr. McLucas' memo raising questions about requirement for near real time system and for crisis response, ocean surveillance, and anti-satellite capabilities.

1. Dr. McLucas says: "The recent reconnaissance problems in the Mid-East and our inability to define what we would really want from a near real time system in such a situation leads me to think that our real needs are not yet clearly understood to justify a system go-ahead."

Comment. On the contrary, we can rather precisely define the kind of coverage we would like to have had in the Mid-East, and we have demonstrated that the near real time system now being designed would have satisfied the need very well.

In addition, virtually every other important past crisis situation has been studied to determine what kind of coverage would have satisfied the analysts and policy makers and you can be assured that the current USIB requirements statement for a near real time system correctly describes the need of each of these crises.

Mr. Inlow is ready to brief Excom members and the NRO on these details at any time.

2. Dr. McLucas suggests Excom consider having Gambits and Hexagons continuously in orbit so that we always have the possibility of bringing back a bucket within one day. "By that means we will always have about one day old information."

Comment. A bucket back within a day means that the film will be processed and analyzed within two to three days. Therefore, one would be operating on the basis of three-day-old information. Moreover, the present satellites access individual target areas only every several days to a week apart depending on latitude.

To be "always" operating on this cycle in a crisis would mean that we would have to be prepared to bring back a bucket each day or so during the time of concern. Six Gambits and six Hexagons a year could not come close to meeting this schedule.

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An examination of past crisis situations leads one to the conclusion that six Gambits and six Hexagons per year would not be a satisfactory solution to the crisis or the strategic warning problem.

3. Dr. McLucas suggests the possibility of a standby Corona for crisis coverage.

Comment. Setting aside difficulties about responsiveness, data turn around time and sustainability, a very clear requirement for all past crises, including the Mid-East ceasefire, is for high resolution coverage. Corona would have have satisfied any of the past situations.

4. Dr. McLucas - whether NRO should develop new satellites for the Navy to perform ocean surveillance or expand capabilities of existing systems.

Comment. We have not heard details about either alternative and suggest that NRO needs to document these for the Excom before any serious discussion on the subject can take place.

5. Soviet anti-satellite capability. Dr. McLucas recommends that white air force build an inspection capability and possibly a deterrent capability.

Comment. You asked that this subject be discussed, primarily to be sure that the Excom satisfied itself that all that is reasonable to do is being done. The value of building an inspection and retaliatory capability should be balanced against the value of building a low vulnerability contingency reconnaissance system. We would have to know more about what is proposed before we could advise you on this matter.

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Reference B: Dr. David's request for a discussion of the film readout and tape storage camera studies.

We recommend you suggest that the staff of the three principals get together and agree on a set of criteria and study guidelines which will satisfy Dr. David.

Reference C through F are those letters referred to in the agenda and are relevant to the points discussed above.