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(S) NATIONAL RECONNAISSANCE OFFICE

WASHINGTON, D.C.

THE NRO STAFF

19 February 1974

MEMORANDUM FOR MR. SINGEL

SUBJECT: High Oblique Sensor Briefing

Bob:

We have reviewed the briefing charts from [redacted] They are applying contemporary white-world technology to a generalized aircraft problem. A semiconductor array is used to line-scan the scene and the output is stored on magnetic tape. A photodiode array is used to transfer the image back to film for analysis.

The primary customer for the pitch ought to be the Air Force Avionics Lab. The NRO, the Avionics Lab, and OD&E are all aware of the technology evident in this proposal.

For your convenience, the attached sheet summarizes the performance claimed. Note that little technical detail was given - not even the type of semiconductor array nor array geometry.

[redacted]

JOHN E. KULPA, JR.
Brigadier General, USAF
Director

Attachments
Summary Sheet
Additional Considerations

[redacted] CLASSIFIED BY SYEMAN 1 EXEMPT FROM GENERAL DECLASSIFICATION SCHEDULE OF EXECUTIVE ORDER 11652 EXEMPTION CATE ORY 5B2 DECLASSIFY ON IMP DET

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[redacted]

[redacted] SYSTEM

[redacted] IGH OBLIQUE SENSOR

- Scanned array operating in visual region cutting off in blue. Type of semiconductor and array geometry are unspecified.
- Signal-to-noise quoted @ 600:1, but SNR not defined.
- Aperture is 18 inch, 223 inch focal length, f/12.4.
- Resolution appears to b[redacted]et.
- Diode array used to transfer data back to film image.
- Overall Evaluation:

The contractor has applied contemporary white technology of a generalized aircraft problem, and has taken a sensible systems approach. While it is difficult and probably not even productive to attempt to define the detailed operating parameters of the proposed system, the contractor could probably be quite clever, given a specific operational problem.

[redacted] HIGH OBLIQUE SENSOR

ADDITIONAL CONSIDERATIONS

While it is agreed that the fundamental technology noted could be applied, there are some additional pragmatic considerations to address:

1. a. The following table lists various parameters based on the [redacted] paper when applied to aircraft at various altitudes and [redacted] at 50 NM:

A/C ALTITUDE	OBLIQUITY ANGLE AT A/C	GRAZING ANGLE AT TARGE
5 NM (30K ft)	84.5°	5.5°
10 NM (60K ft)	78.5°	11.5°
15 NM (90K ft)	73.5°	16.5°

b. As can be deduced from the table, the 5 NM altitude provides a 5.5° grazing angle at the target. Such a low grazing angle raises several questions as to the imaging effectiveness considering target aspect and ground/object blockage. For instance, at the 16.5° grazing angle, a 100 ft tall object would block the view of an object 300 ft away; or a 10 ft object would block the view 30 ft or less away. At lower grazing angles it is worse.

c. With increasing altitude, the grazing angle becomes somewhat more tractable, although still of concern. However, a new variable is added at the higher altitudes - clouds and cloud heighths. Nominally, cloud tops peak at approximately 50,000 feet. Thus, the range of cloud layering can be portrayed in the 3rd dimension as ranging from nominally 2,000 to 50,000 feet, with individual clouds having thicknesses of nominally 2,000 to 30,000 feet. Thus, the clouds as opposed to haze or gazing angle may block some of the desired high obliquity coverage. There is some evidence that the use of [redacted]

2. It should be noted that the [redacted] proposal for a real-time EOI sensor is a high resolution, low data rate version of an overall approach proposed by LMSC in June 1973. The LMSC version utilized [redacted] as the optical subsystem contractor and based its [redacted] flying the [redacted]

On 12 Feb Secretary McLucas approved a memo which undertook a funded [redacted] investigation of reconfiguring the SR-71/XF-12 for four [redacted] missions. One mission was to "monitor a configuration of Warsaw Pact forces vs NATO foces in Eastern Europe" in a near-real-time context. Program D is the manager.

3. Six more points are germane:

a. LMSC used a 1.8X conversion factor between GSD and GRD. If indeed the LMSC factor holds, then [redacted] effective GRD would approximate [redacted] at 50 NM.

b. The [redacted] approach would not, evidently, be able to image at less than a 25 NM range. This would appear to be an undue operational inflexibility. It leads to a low data rate (56 mbits) which precludes "close in" coverage.

c. It should be recognized that "contrast stretch" enhancement is not the province of EOI alone. A possibly parallel improvement can be realized on film if it is but applied. Note that the [redacted] is assumed at 600:1. This corresponds to 28 db power [redacted] "Everyday" film has 20-25 db. If Free Radical turns out well, it might have a 40-50 db range and very low noise characteristics.

d. [redacted] several comments toward radar; three deserve comment in turn:

(1) [redacted] shown, on the [redacted] records.

(2) [redacted] on the order of [redacted] somewhat out of date.

[redacted]

(3) All systems are [redacted]

4. NRT imaging can be of definite assistance to A/C reconnaissance. Care must be taken, though, in assessing the presumed results and/or effectiveness and the degree to which film is dismissed.