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NATIONAL RECONNAISSANCE OFFICE
WASHINGTON, D.C.

OFFICE OF THE DIRECTOR

13 December 1973

MEMORANDUM FOR DR. McLUCAS

SUBJECT: Status of Two NRO R&D Projects

ATMOSPHERIC RESOLUTION LIMITATIONS

Some years ago, a test project involving balloon-mounted cameras was undertaken to attempt to determine empirically any resolution limitations imposed by the atmosphere. Dr. Fubini is familiar with this project and believes the results were at best inconclusive and certainly are not solid enough upon which to base any decisions regarding the feasibility of a VHR system. We agree with Dr. Fubini's conclusions about this data and have undertaken two separate programs to determine the magnitude of atmosphere imposed limitations and the range of values which we could encounter under various climatological conditions.

The first of these programs uses [redacted] with on-board receivers and a ground based laser. Some equipment problems plagued earlier efforts with this experiment, but these have been overcome and good data from four days [redacted] around Wright-Patterson AFB, Ohio, were recently obtained. This data is now being processed and analyzed, and results should be available in about a month. Additional [redacted] tests are programmed for areas in the states of Washington, Alaska, Michigan, and Florida to provide data under various climatic conditions. The program should be completed by fall 1974. [redacted] designed the equipment, [redacted] and [redacted] is doing the data reduction. We do not believe that Dr. Fubini has ever been briefed on this program.

The second test program is similar to the first, except that the laser source is mounted [redacted] and the

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receivers on the ground. This experiment was designed by the [redacted] The laser source will be mounted [redacted] modified by [redacted] Similar results from this experiment will validate the method of the above described test program. For this reason, only [redacted] in the Arizona area are programmed during the summer of 1974.

We agree with Dr. Fubini that this is an important question, but we feel that we have a well-planned test program to obtain the necessary answers to atmospheric imposed resolution limitations in the near future.

FREE RADICAL FILM

The Staff has just concluded an intensive review of the status and prognosis of this development program. Since the program's inception nearly five years ago, the NRP has conducted a careful, systematic development program with [redacted] We have roughly doubled funding each year and will expend [redacted] in FY-74. Each step of the program has been designed to answer these basic questions: Can we make a free radical material which (a) has the physical properties which we desire for satellite use, (b) remains stable for the required period of time, and (c) is manufacturable. We have high confidence that we have affirmative answers to the first two questions and have high confidence that we will have the answer to the third question by the end of the present contract [redacted] This contract calls for [redacted] free radical film to be provided by the contractor for NRP test purposes. These will be produced by a small laboratory coating machine built by [redacted] Consistent high quality material of the desired properties from this machine will indicate and provide guidance for manufacturability.

Assuming the success of producing the [redacted] lab coatings, our thinking is that the FY-75 program should concentrate on three areas:

a. Continued work on improving the properties of the material.

[redacted]

[redacted]

[redacted]

[redacted] [redacted] CONTROL SYSTEM

b. Detailed analysis and testing of material.

c. Initiating pilot production of Free Radical Film.

We believe that a above should continue to be done at [redacted]. The expertise that has been built up a[redacted] cannot be found elsewhere, and to bring another firm up to speed would be a long and expensive proposition. We do not believe that such an effort would accelerate the program nor have a good probability of increasing the chances of the program's success. Unless problems develop at [redacted] we do not feel that it is necessary to undertake a parallel development program at this time.

We do concur, however, that an independent entity should be retained to do evaluation and testing of the free radical material. This firm would validate the test results obtained by [redacted] and, in addition, perform detailed measurements of photographic parameters beyond the measuring equipment capabilities of [redacted]. We have employed [redacted] to perform this function in the past. Whether we employ [redacted] or another contractor to perform this evaluation work has not yet been decided.

The third goal of the FY-75 program, as we now see it, is to undertake production of free radical film to obtain sufficient quantity for full-scale aircraft and on orbit testing of the material. We have been considering several alternatives to do this. Among these are:

a. A joint venture between [redacted] and one of several firms with film production expertise. These discussions are going on at this time. While results to date have not been encouraging, the possibility of arriving at a mutually satisfactory arrangement is not out of the question.

b. Modification of existing facilities at [redacted] to permit pilot production of [redacted] material. While this interim step would not provide a full-scale production facility, it would provide a sufficient quantity for NRP test purposes. Further, a demonstrated success in pilot production would most certainly enhance the attractiveness of a joint venture with the other film producers as outlined above.

[redacted] [redacted] [redacted]

[redacted] [redacted]

c. Establishing a government-owned facility for manufacturing the material. Clearly this is the most expensive alternative and would only be done as the last resort.

In summary, we believe that we have an adequate test program underway to determine atmospheric resolution limitation under various climate conditions from which we will begin receiving data in a short time. We will validate these results with a separate experiment next summer. We agree that the Free Radical Film program has great potential and far-reaching implications for the NRP. We agree that an independent entity must be engaged to evaluate the material's properties and plan to do this in our FY-75 program. Because of the unique expertise available at [redacted] and because the program is going well there at this time, we do not believe it is necessary to begin a parallel development program elsewhere. We feel the first priority should be to attain a capability to produce the material in sufficient quantity for exhaustive test. We would be happy to brief Dr. Fubini in greater detail on these subjects at your request.

[redacted]

LAWRENCE E. PENCE
Major, USAF

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(S) NATIONAL RECONNAISSANCE OFFICE

WASHINGTON, D.C.

OFFICE OF THE DIRECTOR

January 10, 1974

MEMORANDUM FOR DIRECTOR, DEFENSE INTELLIGENCE AGENCY

SUBJECT: Concerns of the SAC Imagery Panel

This is in response to your November 12, 1973 memorandum expressing the concerns of the DIA/SAC Imaging Panel regarding our knowledge of resolution limitations imposed by the atmosphere, and the plans for development of free radical film.

We agree with Dr. Fubini that results of earlier atmospheric limitation tests were inconclusive. Our questions concerning the validity of these tests have prompted the NRO to undertake additional testing as a part of the FY-73 and 74 NRP R&D programs. Data from the first of these tests have just become available and look encouraging. Details are included in the attached memorandum. Since Dr. Fubini had not received a detailed description of the tests, we provided him with such a briefing on January 7, 1974.

Regarding free radical film, we have made outstanding progress during the last year. [redacted] the developer of this material, is performing well and we have every indication that they will meet their contract goals. We plan to engage an independent firm to evaluate the performance of the material and its photographic properties. The primary problem which we see for the FY-74 program is pilot production, and we are currently considering several options to achieve this capability. These options are discussed in detail in the attached memorandum. While we are far from having all the problems solved, the material shows great promise, and we are confident that we should move to a pilot production and testing phase.

[redacted]

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[redacted] [redacted]

The attached memorandum discusses both the resolution tests and free radical programs in detail. If you have further questions, we would be pleased to brief you at your convenience.

[redacted]
James W. Plummer

Attachment
NRO Staff Memo
dtd 13 Dec 73

cc: ASD(I)

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