WORKING PAPER
Destroy or Control
by __________

28 January 1971

MEMORANDUM FOR: Dr. Donald Steininger

SUBJECT : 29 January ExCom

1. I have read through the material attached to the NRP Executive Committee agenda (BYE-12562-71) and can detect no factual problems with this material. It is, of course, sketchy at best and its utility depends upon a good understanding of the subjects discussed on the part of readers.

2. The 400 3 x 3 images per day from the two GAMBIT-3 readout satellites is consistent with the use of two ground stations at two foot nadir resolution. On the order of 500 images can be read out in this way. However, at an image quality of one foot, that number goes down by a factor of four to approximately 125 images per day. This could be brought up to 160 images per day by adding a third ground station. In the case of the EOI system, we are talking about [redacted] images per day at an image quality of better than one foot. This is well beyond the capacity of an existing ground station setup.

3. We still owe you some comments on the EOI capability against a Czech crisis. This work should be finished by first thing

tomorrow morning. I am also working up a series of notes which may be useful during the course of ExCom discussion. These notes identify potential issues or questions together with appropriate comments or answers.

4. The Air Force costs are somewhat low in the nonrecurring area. We had estimated about [redacted] nonrecurring vs. their [redacted] nonrecurring. They have apparently not included money for augmenting the SCF to handle two GAMBIT-3 readouts on-orbit continuously and at the same time support GAMBIT-3 high resolution and HEXAGON missions. I think also they have been a little bit stingy with total operating costs and again not included the SCF costs. The other problem, however, is that the program they have costed is a barebones program. I am quite sure if one embarked on developing a GAMBIT-3 readout cost effective improvements would be identified driving the total program costs up.

5. Attached to this memo is a series of short notes answering the various questions you have asked earlier today. These are

(1) temperature sensitivity of solid state arrays;

(2) geographical coverage of the [redacted] relay satellites;

(3) effect of haze on image quality;

(4) [redacted] EOI 1971 schedules;

(5) program cost comparisons of EOI vs. GAMBIT-3 readout

(6) pros and cons of a Phase II stripping mode study.

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EFFECTS OF TEMPERATURE ON TRANSDUCER CALIBRATION

Temperature sensitivities of the photodetector chips are less than 1% of full scale per degree Fahrenheit for the TRW devices and less than 0.2% of full scale per degree Fahrenheit for the Westinghouse devices. The photosensitivity is approximately 0.2% of full scale in both cases. Accordingly, a requirement has been placed for thermal stability of the TRW chips of $\pm 0.2^\circ$F, and $\pm 1^\circ$F for Westinghouse chips during the periods between calibration and image readout.

Both TRW and Westinghouse have developed thermal designs to meet this requirement and coordinated the interfaces with the optical subsystem and imaging satellite contractors. Thermal models have been constructed and tested to verify the designs.

The TRW design calls for an operating temperature for the detectors in the range of 82°F to 86°F with a stability of $\pm 0.2^\circ$F from a calibration point. To maintain the detectors at a stable temperature an active control system is used consisting of a heater, thermal isolator, and proportional controller, all designed with dual redundancy. The heat sink interface is not to vary outside the range of 68°F to 72°F during operation.

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The Westinghouse system is calibratible over a temperature range of the detectors of 40^{o}-90^{o}F. The thermal design will stabilize the detector temperatures within $\pm 1^{o}$F with the heat sink varying $\pm 20^{o}$F over the orbital period. The design is passive with the capability of turning on heaters of power equivalent to the electronics during periods when the latter are turned off.

Both contractors are producing flight configured development transducer models for delivery in June 1971. These models will be subjected to thermal vacuum environments to verify the predicted performance.

The current baseline calibration procedure employs an on-board illumination source which can be stepped through 10 levels of illumination on the transducer. The transducer can be calibrated in this manner within about 5 seconds, or a normal frame time. The thermal designs are such that calibration should be necessary only once per orbit, but the procedure could be repeated many times per orbit if desired, without affecting the quantity of imagery obtained.

Alternate calibration procedures are under study which will utilize scene data alone, without calibration lights. Controlled scenes are being considered, as well as autocalibration on real targets. Autocalibration employs the statistical properties of the scene.