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19 January 1965

MEMORANDUM FOR THE RECORD

SUBJECT: FULCRUM Status Briefing

PLACE: Burlington Facility, ITEK Corporation

DATE: 18 January 1965

PRESENT:

CIA	Mr. John A. McCone Dr. Albert D. Wheelon Mr. Jackson D. Maxey Mr. John J. Crowley Mr. Leslie C. Dirks Mr. John N. McMahon
DOD	Dr. Eugene Fubini Dr. Brockway McMillan Brig. Gen. James Stewart Col. David Carter
	[redacted]
ITEK	Mr. Richard Lindsay Mr. Walter Levison Mr. Richard Philbrick Mr. Edward Campbell Mr. John Wolie Mr. Frank Madden Mr. Cal Mercer and Project Staff
Other	Dr. Edwin H. Land

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SUBJECT: OUTLINE FOR MR. McCONE'S FULCRUM BRIEFING AT ITEK

I. Objectives of Phase I, i.e., Feasibility Demonstration - Mr. Maxey

II. Description of Camera System

1. Camera
   1.1 Optical System Description
   1.2 Camera Configuration Description
      1.2.1 Rotating Optical Bar
      1.2.2 Cut and Splice
      1.2.3 Recovery
2. Performance Summary

III. Film Drive

A. Velocity
B. Flatness Chart
C. Possible Requirement for "GAS STEERING"

IV. Brassboard

A. Velocity
B. Flatness
C. Synchronization
D. Registration

V. Preview for Review

A. Loft
B. Mock-Up
C. Brassboard
D. "Gas Steering"

VI. Program

A. Facilities at ITEK
B. Schedule for Phase II

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SUBJECT: FULCRUM Status Briefing

1. General Introduction: Key ITEK personnel were introduced to visitors, seating provided in conference room, and meeting was underway ahead of schedule at 0920.

2. Opening Remarks:

A) Mr. Lindsay made a few general remarks after welcoming the guests. He indicated that ITEK was dedicated to development of recon systems and had been engaged in design studies on this one for five years. He said their assets are their people, a knowledgeable, experienced, dedicated team, and the physical assets to build them up. His remarks were in low key and significant more in what he did not say than in what he did. He never mentioned the name FULCRUM, he never expressed confidence or belief in the specific design, and he never mentioned the assets which ITEK is acquiring in Chicago (Chicago Aerial Survey) and on the Pacific Coast. He completed his remarks by stating that the briefing had tight time limits. Mr. McCone immediately stated that he had time limits but that they did not apply to the others.

B) Mr. Maxey then took the floor and as soon as he did so Dr. Fubini interrupted to ask, "Who is giving the briefing? I came here to listen to ITEK. I can talk to Maxey in Washington." Dr. Wheelon suggested that Dr. Fubini wait and see what the program would be and Mr. McCone stated he had asked Mr. Maxey to give a 15 minute briefing to be followed by the ITEK presentation "and that's the way I want it to be." Dr. Fubini subsided and Mr. Maxey took over.

SUBJECT: FULCRUM Status Briefing

It was now established that this was a meeting to be run by Mr. McCone, that Dr. McMillan would be quiescent, that Dr. Fubini would be vocal and insist on his prerogatives, and that ITEK would walk the "tight rope."

3. The Presentation:

A) As soon as Mr. Maxey began his briefing, Dr. Fubini asked questions on dimensional characteristics of the system - primarily to set his pattern. Mr. Maxey answered and proceeded. Dr. Fubini then raised a question on film path and Mr. Maxey said it would be discussed later. Mr. Maxey's last chart was on the weight budget and indicated that ITEK agreed with the weights presented.

Mr. McCone observed that the weights and margins were the same as he had seen six months ago and questioned if we "have further verification or was it the same data?" Mr. Maxey replied that the weights have had a good deal of analytical work and re-evaluation in them and that they appeared to be hard numbers, furthermore we had high confidence in them. At this stage Mr. Maxey introduced Mr. Wolfe of ITEK.

B) Mr. Wolfe and Mr. Maxey uncovered the camera cutaway and Mr. Wolfe commenced an extremely smooth presentation. His first interruption came one moment later from Dr. McMillan (his first and last question during the formal briefing.) He asked for the per cent obscuration of the big flat. Mr. Wolfe, with John Watson's aid, advised Dr. McMillan that it was a most encouraging 14 per cent.

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SUBJECT: FULCRUM Status Briefing

As soon as Mr. Wolfe reached the camera details, Dr. Land queried him relative to the film path, and Mr. Wolfe's step-by-step tracing through the cutaway brought everyone in the front row to the model for a detailed dissertation and private questions and answers.

As soon as the formal presentation resumed, questions were raised about the image motion compensation (IMC). Mr. Maxey, noting time passage and aware of the security problem associated with timing the tour to occur when ITEK personnel were elsewhere, asked for a speed up, and Mr. Wolfe went on. Immediately Dr. Fubini raised questions. He was not about to be cut off. (In his behalf, however, the comment as to reasons for holding the tour schedule - security - was not given until we were on the tour). Dr. Fubini and Dr. Wheelon interchanged remarks as to whether or not Dr. Fubini's questions were diversionary and then Dr. Fubini asked Mr. Wolfe for spacecraft contributions to positional errors. Mr. Wolfe said he understood the yaw accuracy to be about .03 per cent. Mr. Maxey stated very concisely that if we could achieve navigational accuracies similar to those of CORONA, that such errors would be insignificant.

Mr. Wolfe went on to describe the film drum test. Dr. Fubini immediately asked for the frequency distribution of the error. He was told it was a step function. Dr. Fubini asked if there was a dynamic problem and had we checked as to internal resonances. Mr. Wolfe said that we had completed the breadboard testing and that our data would be further enhanced when the brassboard testing would be an accomplished fact.

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SUBJECT: FULCRUM Status Briefing

Mr. Wolfe next presented the "Flashbrenner" test. Dr. Fubini followed closely, inserting himself into the center of the discussion. When told the precision and accuracy were .0001 inches, Dr. Fubini said, "We need both, very good, very good." Then Mr. Wolfe showed the "out of flatness" chart and Dr. Fubini said Mr. Maxey had presented this chart at the Pentagon but now he understood how it was designed. Here Dr. McMillan made some comment to Dr. Fubini about it being a D.C. analysis, and Dr. Fubini said, "D.C., A.C., what difference?"

Mr. Wolfe went to the experimental investigation programs. Doing very well, time 0956, as he hit the brassboard description. He indicated, as per the chart, that there were three ways in which it differed from the cutaway. Mr. Maxey indicated that it was as good a simulation as appeared necessary and as could be achieved within the time and dollar constraints. Dr. Fubini raised the question as to film handling, and Mr. Maxey said whereas the brassboard demonstrates one method, we actually have three and we would be willing to present these later. (Later, when the query arose as to presenting it at ITEK, the proprietary issue was raised and the other methods were not discussed).

Mr. Wolfe picked up quickly and discussed the fiduciary system and remarked "We are nearly on time." Dr. Fubini exploded that he was being shut off. (Mr. Snouffer of ITEK discussed tour timing with Mr. Maxey at this point and Mr. Wolfe went on to answer Dr. Fubini's question on CORONA.) He said it was a question of selection of material. They were aware of the problem and had just conducted an intensive experiment in winding and unwinding on cassettes several thousand feet of film at a rate of 200 inches/sec with no static problems. Mr. Maxey added that our use of air bars would probably insure a pressure of up to 10 microns which should suppress any CORONA discharge.

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SUBJECT: FULCRUM Status Briefing

Again Mr. Wolfe said "We are close to our time" and Mr. McCone said in effect "Don't worry about it." (He was unaware also of the need to leave the laboratory for the tour.)

4. The Tour: A full scale cutaway of the camera system was displayed in the loft and after a few introductory remarks Mr. Morser went through the system with emphasis on the film dynamics. Here the need for logistic timing was stated and Dr. Fubini seemed relieved. Dr. McMillan retained throughout a detached attitude. Questions on film travel, film path, dynamic balance momentum conservation and structure were well handled.

The full scale mockup was used efficiently to show film path and how film proceeds from spacecraft to "cut and splice" thence to the recovery bucket. All seemed intrigued with the mock-up and searching questions were asked and answered.

In demonstrating the breadboard in operation, the guests were told that it was too early to give full scale demonstrations but film was moved at about 170 feet per second. When completely debugged, testing and data analysis would be accomplished.

Considerable interest was evidenced by the working model of the air bars. It was a good dynamic presentation. Mr. Jules Cohen called it a backup effort if needed. Generally it was said air bars could be used where change of direction was required and where bearing on emulsion surface was indicated. If air bars were used FULCRUM would need up to 32 air bars. Again the relative premature viewing of the experiment was indicated.

Generally the audience was impressed with the tour, and it left one basic unmistakable impression, that the activities of the past few months were rapidly focusing towards completion, yet time was extremely tight.

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SUBJECT: FULCRUM Status Briefing

5. Postlude:

A) The Probe: Following the tour, the group reassembled in the conference room and immediately Dr. Fubini dug into "limiting factors" in the development. He asked why is it so necessary to limit the effort or complete it by January 31 (1 February). Mr. Wolfe said, of course, manpower is time limited and men are being layed off now. Dr. Fubini asked if money were needed. Mr. Wolfe said they had enough money to finish the tests. Mr. Madden was indefinite as to when they would finish because that depended upon the imponderables as to what debugging would occur. Dr. Fubini made several points. "The climax of our effort is that breadboard. It should be tested sufficiently and the data analyzed. Key men should be reserved to do so. Were we dollar limited? Should we be time limited? The current lay off of other project men not directly associated with the breadboard was another problem and should be considered seperately." Mr. Maxey indicated that although ITEK had not been officially notified they would get an extension to 5 February.

Mr. McCone then said he wanted answers to four specific questions:

(1) Best estimate of time to complete appropriate breadboard testing in demonstrating FULCRUM feasibility.

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SUBJECT: FULCRUM Status Briefing

(2) Best estimate of costs to maintain key people throughout the project.

(3) Best cost estimate to provide for a minimum effort in essential areas, conceding a day-for-day slip in the program.

(4) Best estimate of cost for a program which remains poised for a full-scale developmental program and lessens slippage by procurement of some long-lead items.

Mr. Maxey said we have worked the problem, not only at ITEK, but for all associates, and that he could have the answers to Mr. McCone within 24 hours.

Dr. Wheelon indicated that we had a tight program, that it was purposely so directed since money was limited, and the project had to be rigorously controlled. Dr. Fubini again restated his question of where do we stand now and what do we need in time and money to get the required tests done. Thus, in effect, Dr. Fubini attempted to prolong the critical elements of the effort without in any way giving release to the kind of funds needed to keep the program elements in place, and hence promoted delay. Our position was that few, if any, programs had been as tightly run, had obtained as much progress with as little money, and that we were essentially on schedule.

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BYE-0027-65

SUBJECT: FULCRUM Status Briefing

Mr. McCone raised the question of the resolution figures and the degree of confidence one put on them. He asked Dr. McMillan if he had gone over these figures and was answered, "No." Mr. McCone asked if they were measured straight down and what happened during pan. A general discussion followed during which the trend of analysis discussed, the range of values (2.3 ft.-4.1 ft.), the meaning, the signs, etc. Finally Mr. Maxey said that we had far higher confidence in these figures as they are evolved than for any other similar figures in comparable programs at this stage in program evolution.

B) At this point in the discussion, Mr. McCone remarked to Dr. Fubini regarding a comment Dr. Fubini had made to Dr. Land. Dr. Land said, "Gene said it's a good system and worth exploitation." Dr. Land continued that we must evaluate the results of the brassboard tests. Dr. Fubini then said he did not mean "full speed ahead," but felt we must exploit our gains. Again Dr. Fubini said "What does it take to keep going with key men? I didn't mean to scare Mr. McCone." (This was out of context to the recorder and obviously was a follow-up on some remarks of Dr. Fubini to Dr. Land and Mr. McCone during the tour.)

Again Mr. McCone came back to the resolution figure. He stated that we need a high resolution and high area coverage for a search system. He asked what the limitations were. Mr. Wolfe said CORONA was now limited by

SUBJECT: FULCRUM Status Briefing

focal length, though it has shown great improvement from the original version; further, that we could not expect similar improvement from FULCRUM because "we've learned many lessons." Film is the real arena. He said that the FULCRUM system design was 160 L/MM. Optically we could do 500 L/MM (about 1 ft. resolution), but film limits us. Mr. McCone tried again for an average resolution figure at 80 N. M. nadir and Dr. Fubini said "say 3 feet and that's good." Dr. Land agreed.

C) Mr. McCone then asked ITEK if this system was the best they could do. Mr. Lindsay took the question and sparred for time. He said he would first talk for himself and then asked comments from others in ITEK. For himself it was a question of how big a step one should take. He felt FULCRUM was a practical compromise between reaching out far enough to have technical gains realizable in a practical time. They had looked at lots of configurations, and it was a question of judgement. Not a perfect system but another year of study would only produce marginal gains. Not worth the time lost. Dr. Fubini said two problems need solving (a) get high resolution and high coverage simultaneously and (b) better film.

Mr. Levinson said we should increase the diameter of the system by a factor of three to get the high resolution and to a first approximation

that could mean a weight increase of 27. Mr. Dirks added that the spacecraft would go up in the same order and weight would be out of boost even with the Titan IIIX.

Mr. Maxwy claimed that the step was a logical compromise between technical growth and time availability for use. Dr. Fubini saw that as a commercial plug and Mr. Maxwy laughingly agreed. Dr. Wheelon said careful evaluation of the need, the technical progress, operational readiness et al, had been made and the technical step forward had been determined. Dr. Fubini then commented that the "results expected were achieved."

Mr. McCone probed further. He asked ITEK if some other approach was favorable. "Is this the best approach?"

Mr. Lindsay's answer to Mr. McCone was "Yes, but considering the constraints." Mr. Wolfe said "Yes, at the moment." Mr. Levinson said, "Within a given set of constraints this comes close to optimum, considering technical reach, manufacturability and operability." "The techniques developed in the pursuit of FULCRUM are now open for further improvements if certain system limitations are removed. Three foot resolution is the right goal in the time zone." Then Mr. Lindsay said "It is not a dead end. We should shoot for one foot as a goal."

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SUBJECT: FULCRUM Status Briefing

Dr. Land asked if basic design led to ease of scaling up. When Mr. Maxey started to answer, Dr. Land shifted the question directly to Mr. Levison, indicating he wanted an ITEK answer. Mr. Levison said, "At that time other factors would come in." Dr. Wheelon summarized our position, i.e., "design and configuration chosen to provide maximum growth potential."

At this junction, Mr. Cohen (ITEK) interrupted saying if one wished to provide growth potential "within system constraints of weight and volume" we should consider one camera (delete stereo). This hit hard on a tender spot. When Mr. Levison and Mr. Dirks indicated the gain would not be proportional, Dr. Land asked Mr. Levison to get on his feet and so state because he (Dr. Land) might need backing. Mr. Levison stated that when all factors were considered, payload wise, the gain would only be 20 to 25 per cent.

Dr. Land made a point on stereo. He claimed that photo interpreters should be taught to use stereo to search for information not just to interpret information obtained monoscopically. Mr. McCone indicated that this was a new problem of a different dimension - namely training P.I.'s.

Dr. Land indicated no one would really dare to drop stereo. He stated biologically that decision was made some millions of years ago when man was given two eyes and not one large one.

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SUBJECT: FULCRUM Status Briefing

Mr. Mauzy stated that ITEK should not be held too closely accountable for the configuration of the camera, that said configuration was really determined by the Agency after considerable analysis and with much consultation with ITEK. This remark seemed to raise no hackles.

Mr. McCone then said, "Brock, you have been singularly quiet. Don't you have questions?" Dr. McMillan said, unfeldingly, "I haven't seen any error budgets." Mr. Wolfe said we have not prepared these on a suitable chart and Mr. Mauzy said, "We have them. Let's dig up what we have." Charts, in much smaller print, were then brought and as the presentation disintegrated into small groups, Dr. McMillan went to the chart and discussed it with ITEK and our personnel. Gen. Stewart did not go up and Mr. McCone asked him if he shouldn't look the data over critically as he "might have to make some decisions." Gen. Stewart joined the group at the chart.

The formal briefing ended. The thrust had been made. ITEK had been forced to say the technical step was the right magnitude and the approach was optimum. Dr. McMillan had remained non-committal and Dr. Fubini was sparring for time.

(Signed) John M. McMillan

for JOHN J. CROWLEY
Special Projects Staff
Directorate of
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