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MINUTES
OF
TECHNICAL DIRECTION MEETING
FOR THE
BETA SYSTEM (HG-469B)

F. Hillman

Prepared in accordance with MSM-M-124, W.S. Item 4.3, and TD 1001C.
Location: MARY Facility
Date: 5 and 6 August 1968

ATTENDEES

CONTRACTOR

- M. Schiffman, Beta Program Manager
- L. Baker, Component Engineer
- R. Miller, Systems Engineering
- M. Levenson, Mathematical Analyses
- J. Testa, Subcontract Project Engineering
- F. Woestemeyer, Systems Engineer

SUBCONTRACTOR

- B. Vinton, Beta Program Manager
- L. Lofftus, Chief Engineer, Special Projects
- G. Schmitt, Beta Project Engineer
- M. Hillman, Sr. Staff Engineer
- P. Shaffer, Consultant
- R. Schliesmann, Mechanical Engineer
- C. Barth, Project Administrator

These minutes do not constitute contract change authorization.
Changes to contract or schedule must be negotiated.

Approved: _____

B. W. Vinton

Subcontractor

Approved: _____

Contractor

MARY
9 August 1968

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AGENDA

TECHNICAL DIRECTION MEETING
5 and 6 August 1968

- 1.0 Introductory Discussion
- 2.0 Status of the Engineering Prototype
 - Hardware Assembly
 - Testing
 - Packaging
 - Size
- 3.0 Herringbone Beta System
 - Dual Path Report
 - Circuitry Definition
 - Testing Plans
- 4.0 In-House Testing
- 5.0 Problem Areas and Action Items
 - A/D Converter
 - Standard Scenes
 - Aperture Shading
 - Slope Limiting
- 6.0 Production Hardware
 - Weight and Cg
 - Power
- 7.0 Tour of Beta Assembly and Test Areas
- 8.0 General Discussion

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MINUTES
TECHNICAL DIRECTION MEETING
5 and 6 August 1968

1.0 Introductory Discussion

B. Vinton opened the meeting with a review of the tentative agenda, which was approved as written. The meeting proceeded accordingly.

2.0 Status of Engineering Prototype

G. Schmitt reviewed the status of Engineering Prototype Evaluation Model (EPEM) manufacture. He stated that assembly of the unit was progressing on schedule. Detailed status is as follows:

- A. Checkout of subsystems is in process, with checkout of the motor-disc, reference amplifiers, and photomultiplier assemblies complete.
- B. Final assembly of the detector is in progress. The optical assembly was received 6 August 1968.
- C. System checkout and test will start 12 August 1968.

All checkout and testing performed to date has been without major problems, except that the crystal oscillators received from the vendor were packaged incorrectly. One of the two received was returned to the vendor for rework while the other will be used as is to avoid a delay in the testing schedule. This test oscillator will be reworked by the vendor later. The EPEM will be basically a Beta breadboard packaged to meet specified interface and envelope requirements. Changes incorporated in the EPEM are limited to improved packaging, producibility, and component substitutions. Produce improvement changes discussed during Technical Direction Meetings have not been incorporated, however, the EPEM can be retrofit with such changes at the Contractor's direction. G. Schmitt asked if additional volume could be allotted the detector to allow deletion of the D-shaped cross-section currently being used. R. Miller stated that vehicle equipment dictates the current detector envelope, which is the maximum allowable.

3.0 Herringbone Beta System

M. Hillman reviewed a lightweight, single-path, herringbone Beta System study report. (See Attachment A.) He indicated that such a system should perform as good or better than the present two-path system, particularly at lower light levels. However, dynamic null errors would continue to be evident in random fashion above 15 degrees stereo angle until minimized by solutions now under investigation.

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A commutative filter with an extremely narrow bandwidth was described by M. Hillman. (See Attachment B.) He stated that such a filter could be a replacement for the crystal filters currently used in the EPEM. These filters can be manufactured as integrated circuits, however, the use of discrete components allows the best matching of capacitance values. Further study of the application of these filters to the Beta System will be performed by Mary and breadboard commutative filters will be fabricated for test in the in-house breadboard unit with the herringbone disc.

Herringbone discs will be received about the third week of September 1968. One of these discs will be installed in the in-house breadboard unit, and tested in both single and dual-path operation. Electronic modifications necessary to accommodate the redesigned disc are under study.

4.0 In-House Testing

M. Hillman briefly described the in-house optical bench tester which closely simulates operation of the dynamic tester at the Contractor's facility. Future test activities planned, utilizing this tester, include practical evaluation of shaded apertures, analysis of single-path, herringbone Beta operation, and measurement of output signals from two different paths for motion in one axis using a herringbone disc.

5.0 Problem Areas and Action Items

R. Miller indicated that the specification for the Contractor-furnished A-D Converters would be provided Mary at the Fact-Finding Meeting. G. Schmitt stated that provisions for mounting this unit in the Beta System include power supply redesign to reduce the number of internal voltages required. R. Miller indicated that the standard scenes were being fabricated and would be ready for delivery in mid-August 1968. Setup and use by Mary of these scenes will require careful attention to scene illumination and haze lighting to assure nearly exact duplication of conditions in-house and at the Contractor's facility.

M. Hillman opened a discussion of shaded apertures with a review of the optics vendor's study report. R. Schliesmann quoted promised shaded aperture delivery of 15 September 1968 for domestic glass and 30 September 1968 for apertures using foreign glass. He added that the aperture mounting technique currently being evaluated could provide apertures as attachments and not as an integral part. This method of mounting will allow varying of aperture shading by substitution of alternate apertures. F. Woestemeyer asked what improvement in system performance could be expected using a shaded aperture. P. Shaffer replied that results of simulated system operation with a

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shaded aperture using the Mary Beta math model indicated that such apertures would eliminate scalloping effects experienced during previous testing. However, its effect on dynamic null errors could not be accurately determined from existing math model computations. Results of previous math model testing have been verified during actual testing of Beta breadboards.

M. Levenson presented the results of Contractor testing of the slope limiting device in the Beta breadboard. He stated that with slope limiting in continuous operation, Beta response took a considerable amount of time to recover from initial velocities recognized. Effectiveness of the slope limiting device was best when operated only at preselected intervals during the span of system operation.

6.0 Production Hardware

B. Vinton briefly discussed a trade-off study of a lightweight two-path Beta System (see Attachment C). He stated that magnesium had been chosen as the appropriate material from evaluation of costs and physical properties of various lightweight materials. No revised cost proposal is to be submitted for this material change since cost reductions from use of castings to minimize machining will cover increased costs of the weight reduction re-design.

R. Miller asked for a description of design changes, if any, which were necessary as a result of the visit to Mary by S. Dodge. G. Schmitt replied that changes consisted of part substitutions due to revisions to the preferred parts lists and reevaluation of a few parts which were considered undesirable by the Contractor.

7.0 Tour of Beta Assembly and Test Areas

The Contractor representatives were given a tour of Beta assembly and test areas where they witnessed the final subsystem assembly and checkout in progress. The Beta optical bench tester was also demonstrated using the in-house breadboard.

8.0 General Discussion

M. Schiffman opened the discussion by stating that the zoom optics approach to dynamic null error solution had been discarded after further Contractor testing. Test results indicate that a zoom optical system would effectively reduce dynamic null errors at the nadir viewing angle only.

Slope limiting was to be discarded as a solution to dropouts due to its minimum effect on overall system performance. R. Miller asked if memory circuitry might be a dropout solution. M. Hillman replied that provisions for memory circuitry had been included in breadboards. Operation of this circuitry would cause the system

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to clamp on the last good signal recognized during dropout conditions. R. Miller stated that such circuitry seemed an effective solution to dropout problems, if fast reacting. M. Hillman indicated that Beta memory circuitry was designed to act as described by R. Miller.

M. Schiffman stated that, at present, the single-path herringbone Beta System was most likely to be the configuration of production hardware.

F. Woestemeyer asked if the effects of aperture shading could be evaluated with the Mary Beta math model including oblique targets. P. Shaffer stated that this evaluation could be done, but some revisions to the existing program would be required. M. Schiffman indicated that Contractor direction would be given if such evaluation was desired.

G. Schmitt asked for information regarding results of Contractor reliability evaluation of the Mary Beta list of materials furnished S. Dodge. M. Schiffman replied that the status of this review would be checked and results would be forthcoming. G. Schmitt asked if Contractor evaluation of the Mary-proposed self-test method had been completed. R. Miller stated that provisions for this method would be added to the specification, however, an upper and lower threshold was necessary due to the go-no-go test capability required by the Contractor.

F. Woestemeyer discussed possible design options to produce a lightweight two-path optical system. M. Hillman stated that such designs had been considered but light path conflict had been encountered. The present design will be reevaluated by the optics vendor, using different minification between the objective lenses as suggested by F. Woestemeyer.

L. Baker stated that results of Contractor testing have indicated placement of aperture shades over photomultiplier inputs was probably unsatisfactory due to the reduction in total light energy input. Following a general discussion on apertures and lightweight systems, the meeting adjourned at 12:00 noon, 6 August 1968.

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