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26 July 1968

To: M. Gibbs/E. Jones
From: B. Siegel
Subject: Field Curvature Bench Test Results

Attached is a list of comments on the field curvature tests conducted at Itek on the Bench. The major points to note are:

1. The matrix of points taken is insufficient and not compatible with the GE/SPO agreed upon matrix as per TWX 3409, March 27, 1968.
2. Data taken at the reticle plane is invalid due to a poor relay.
3. Resolution data is not compatible with previous data taken during qualitative testing.
4. Field curvature at the reticle and eyepiece planes is unacceptable for proper ATS simulation.
5. There is severe loss in resolution off axis.

It is recommended that a meeting be held with GE/Itek personnel to review the results of this test. I would also recommend sending a copy of the attached comments via TWX to GE.


B. Siegel

Attachment

cc: D. L. DuMond
J. A. Abrahamson
F. F. Doppelt

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Attachment

COMMENTS ON FIELD CURVATURE TEST - 7/12/68

1. The test conditions/procedures are defined in an Itek document of 4/9/68 which we never saw or agreed to.
2. Precise location of measurements across field at reticle and eyepiece planes are not defined.
3. Measurements at the eyepiece plane were taken with a 3X telescope. At our review in May, this scope was so poor that better results were obtained with the unaided eye.
4. The explanation is given that the depth of field is so great that it is difficult to define the best focus location. If this is the case, how come the "best quality focus" locations, which are within the depth of field range, give different resolution readings than the best focus position.

Itek ran a photographic test to determine if the photographic depth of field was comparable to the visual depth of field. They compared one case on axis on a subjective basis (see p. 26) and concluded they were comparable. We need an explanation of p. 26 comments and the meaning of the resolution readings on that page.

5. Itek took data on what was called "best quality focus" as well as "best focus". Need explanation of criteria for "best quality".
6. At the reticle plane, how does one convert from "micrometer reading" to diopters? Subsequent data appears to indicate that the micrometer readings are in inches. Is this correct?
7. In general, for all figures, curves are not faired through data points, see especially p. 22.
8. Based on the data, the following conclusions can be drawn:

Reticle Plane

- a. This field is not flat nor symmetric. For no anamorph, the field is right/left symmetric in the horizontal plane, but apparently skewed up in the vertical plane. For 1:1 anamorph, the field is skewed to the right in the horizontal plane. Going to 2:1 anamorph flattens the field and skews to the left in the horizontal plane. Changing objective lens changes field curvature substantially. Initial calculations indicate a reticle plane curvature of several diopters. Such curvature is clearly unacceptable.

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b. There is great variation in resolution off axis with best resolution usually not obtained on axis. There is also significant variation between tangential and saggital readings off axis. In general, higher resolution is obtained in the horizontal plane than in the vertical plane. It is disturbing to note that previous off axis readings taken during the qualitative test give much better resolution readings than this test.

c. It should be noted that all reticle plane data was taken with a relay lens that was later shown to be performance limiting.

d. Recommend that all reticle plane data be taken again and, in addition, measurements be taken of the complete vertical plane. Also, data should be taken with both objective lenses.

Eyepiece Plane

a. This field is highly curved and non-symmetrical. Decreasing magnification increases symmetry. Even for low magnification, the curvature from on axis to the field edge is close to 5 diopters. Such curvature appears unacceptable.

b. There is severe off-axis resolution loss. In addition, the resolution results for 3.6X are incomprehensible. Resolution values 7-8 times those obtained in the qualitative test are shown. Not even a 3X telescope can do that.

c. Recommend this test be repeated with a full matrix of points including no anamorph, 2:1 anamorph, horizontal and vertical plane, etc.

9. For information prupose, this test was run April 20-24, the document was published May 20 and signed June 4. We received the data around mid-June.

Reference document should be cited!

Amg
8/6/68

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