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To: S. M. Tennant
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Subject: ATS Alignment Accuracy

From: D. R. Howard *DR*
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A brief internal review of the ATS Alignment problem has been made. This review was necessarily unsophisticated, since we do not yet have either our boresighting error analysis computer program operational or a complete set of error allocations for use in an analysis. On the basis of this analysis, the following conclusions were made.

The critical ATS Alignments are:

- 1) Internal alignment of the telescope optics.
- 2) Internal alignment of the tracking assembly, including gimbal orthogonality, encoder nulling, and tracking mirror mounting.

Accuracy requirements for the telescope optics are principally a function of allowable resolution loss for these various alignments. Accuracy requirements for the components of the tracking assembly are critical because these parameters are not directly estimated in the boresight alignment procedure. It is estimated that the accuracy required for the internal tracking assembly alignments is approximately 30 arc sec to 1 arc min. All of these alignments can be accomplished on an optical bench prior to installation in the vehicle if the elements are not prealigned prior to receipt at DAC.

The following alignments are not critical:

- 1) Scope to the tracking assembly.
- 2) Scope to the reference system.
- 3) and/or tracking assembly to the reference system.
- 4) Folding mirror to scope and tracking assembly.

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These alignments are compensated by the on-orbit boresighting procedure. The primary factors for consideration in these alignments are:

- 1) Vignetting due to partial obscuration, due to the nominal alignment plus expected on-orbit relative motions.
- 2) Assurance that second order terms remain negligible, since first order approximation equations are used in the estimation procedure.

With respect to item 2), an error of 1 degree misalignment results in a second order effect of 20 arc sec in the worst axis. Expected on-orbit deflections are of the order of 1/2 degree. Therefore, an initial installation accuracy of approximately 1/2 degree for these alignments seems appropriate assuming vignetting is not a more constraining factor. It would seem likely that mechanical jigs could be used for these alignments at DAC.

In summary, there appears to be no need for a sophisticated alignment system for ATS installation in the vehicle. However, an optical bench and necessary optical instruments for alignment of subassemblies prior to installation may be required.

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