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GEORGE C. MARSHALL SPACE FLIGHT CENTER HUNTSVILLE, ALABAMA

Memorandum

TO: Mr. Kampmeier, R-ASTR-BU

DATE: July 31, 1967

: Chief, Guidance and Control Systems

In reply refer to:
R-ASTR-NG-61-67

RESmith/np/876-4595

Analysis Branch, R-ASTR-NG

SUBJECT:

FROM

Flight control system gain calculations at KSC

- 1. Reference is made to memorandum "Flight Control System Gain Calculations" JF1-320-67-IBM-92, June 14, 1967.
- 2. Vehicle gains during pre-launch checkout should be made on a per actuator basis as this is a rigorous check of the gains through all channels.
- 3. R-ASTR-N holds some reservation concerning gain calculation in the referenced memorandum. Although it is correct in form and method, it does not provide a reliable method of checking the gain through each actuator.

For example

From the equation

$$A_{op} = \frac{\beta_{1}^{+} p^{+} \beta_{2}^{+} p^{+} \beta_{3}^{+} p^{+} \beta_{4}^{+} p^{+} \beta_{-}^{-} p^{+} \beta$$

 $8\psi_1$

 $^{
m A}_{
m op}$ could be 10% low due to each actuator being 10% low or $^{
m A}_{
m op}$ could be 10% low from one actuator being 40% low and all other actuators correct.

From the equation

$$A_{OR} = \sqrt{2}(\beta_{1p}^{+} + \beta_{1y}^{+} + \beta_{2p}^{+} + \beta_{2y}^{+} + \beta_{3p}^{+} + \beta_{4p}^{+} + \beta_{4y}^{+} + \beta_{1p}^{-} + \beta_{1y}^{-} + \beta_{2p}^{-} + \beta_{3p}^{-} + \beta_{3y}^{-} + \beta_{4p}^{-} + \beta_{4y}^{-})$$

 $16\psi_{R}$

 $A_{\mbox{\scriptsize oR}}$ could be 10% low from each actuator being 10% low or $A_{\mbox{\scriptsize oR}}$ could be 10% low from one actuator being 80% low and all other actuators correct.

4. Assuming the above method is to be implemented in the DDAS ground checkout routine as a sole check for A and A gains, then R-ASTR-N considers it an inadequate test. However, it may be used if an overall vehicle gain average is desired, but in no case should it be used alone where any major decision would be based on its result.

In Melvin Brooks

Approval:

Shassaway
F. B. Moore
Chief, Guidance and Control Division

cc:
R-ASTR-FT, Mr. Blackstone
R-ASTR-N, Mr. Moore
R-ASTR-NG, Mr. Brooks
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R-ASTR-NG, Branch file/Record copy
R-ASTR-X, Reference file