Mission Planning and Analysis Division
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS 77058

REPLY TO
TTN OF FM4 (71-67)

MAY 18 1971

MEMORANDUM

TO: See List Below

FROM: FM/Mission Planning and Analysis Division

SUBJECT: Change for RTCC Offline Formulation for Apollo 15: Star-Horizon Observation Processor

1. Reference: MSC Internal Note No. 69-FM-326, "RTCC Offline Requirements for H-2: Star-Horizon Observation Processor," FM4/P. Flanagan and TRW/R. Kidd, February 24, 1970.

2. The reference internal note should be updated as defined in the attached change sheet, and the RTCC offline star horizon observation processor should be altered accordingly for Apollo 15. The equation for SFOV is currently incorrectly defined.

Emil R. Schiesser
Assistant Chief
Mathematical Physics Branch

The Data Processing Branch concurs with the above recommendation and requests IBM to proceed accordingly.

James J. Stokes, Jr., Acting Chief
Data Processing Branch

APPROVED BY:

John P. Mayer
Chief, Mission Planning
and Analysis Division

Attachment

cc: (See attached list)

FM4/REEckelkamp:fdb:5/5/71

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1. Type of Document: Change sheet to Internal Note

2. Identification: [illegible]-MPA-525 dat February 24, 1

Page 1 of 1 Pages

TO:

3. FROM:
Division Mission Planning and Analysis
Branch [illegible]
Section

4. Title or Subject: MCC OFFLINE REQUIREMENTS FOR S-2: SIXTH-HORIZON OBSERVATION PROCESSOR

Date of Paper: May 18, 1971

5. Author(s): Paul Flanagan, MPA, and Robert Kidd, TRW Systems Group
Change 4 by R. E. Kokelkamp, MPB

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CHANGE SHEET

FOR

MSC INTERNAL NOTE 69-FM-326 DATED FEBRUARY 24, 1970

RTCC OFFLINE REQUIREMENTS FOR H-2:

STAR-HORIZON OBSERVATION PROCESSOR

By Paul Flanagan, MPB, and

Robert Kidd, TRW Systems Group

Change 4

By R. E. Eckelkamp, MSC

May 18, 1971

James C. McPherson, Chief
Mathematical Physics Branch

John P. Mayer, Chief
Mission Planning and Analysis Division

NOTE: A black bar in the margin indicates the area of change.

After the attached enclosure, which is a replacement page, has been inserted, place this CHANGE SHEET between the cover and title page and write on the cover, "CHANGE 4 inserted."

1. Replace page 13-14.

CHANGE HISTORY FOR 69-FM-326

Change no.	Date	Description
1	8/13/70	Replace pages 13, 14: Eliminated some original parameters and added some new parameters. Expanded original pages to include additional discussion. Replace pagea 21, 22: Flow charts added to define new computation logic for parameters mentioned above.
2	12/3/70	Pen-and-ink change for equation defining D_3 on page 14a.
3	2/1/71	Pen-and-ink change for terminator angle check on page 14a.
4	4/18/71	Replace pages 13, 14: Equation for star field-of-view error is redefined.

A priori bTo (MRD), h_o (KM)

σ_{bTo} (MRD), σ_{ho} (KM), ρ_o (correlation coefficient)

For each iteration:

Solution bT (MRD), h (KM)

σ_{bT} (MRD), σ_h (KM), ρ (correlation coefficient)

Iteration number, N

For each observation processed by method 2, five additional quantities will be computed to isolate sources of sighting errors and to evaluate the sighting.

SFOV (DEG)

NROT (DEG)

PLANE ERROR (DEG)

POINT ERROR (MINUTES OF ARC)

TERM ANG (DEG)

These variables are illustrated in the two figures on the following page.

Equations required to define this output are as follows. The star field-of-view error is given by

$$SFOV = -\sin^{-1}(\underline{w} \cdot \underline{U}_B)$$

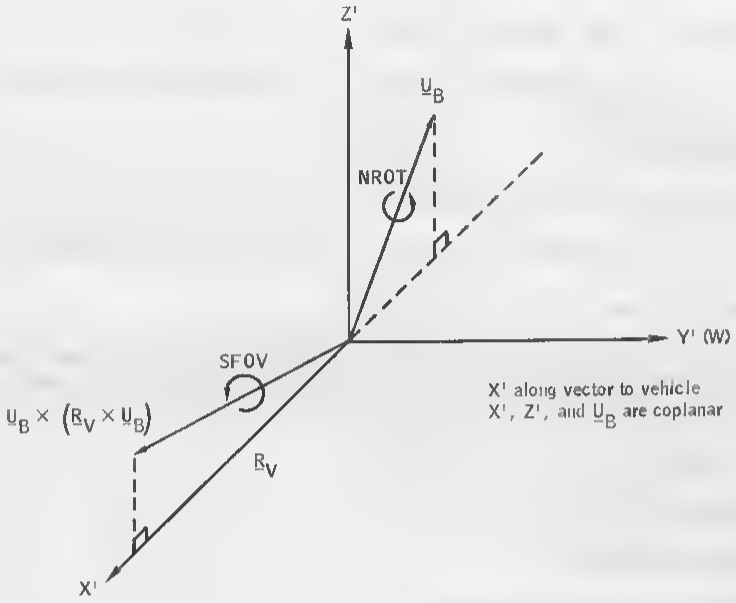
The normal rotation error is given by

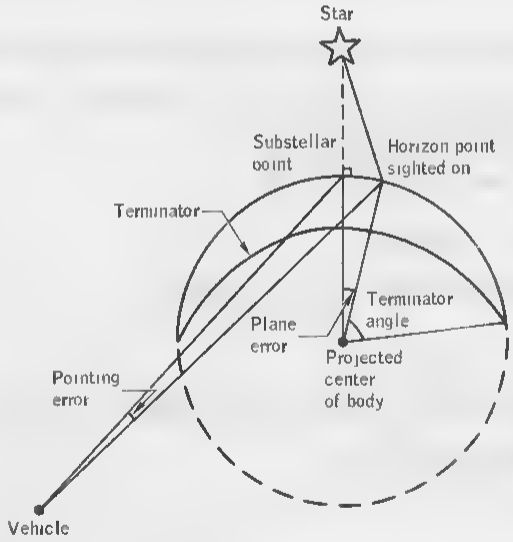
$$NROT = \sin^{-1}\left\{\underline{w} \cdot [\underline{U}_B \times \text{unit}\,(\underline{R}_v \times \underline{U}_B)]\right\}$$

The measurement plane error is given by

$$PLANE\ ERROR = \sin^{-1}\left\{R_v[\cos(SFOV)\ \sin(SFOV)\ \cos^2(NROT)(1 - \cos T_r) - \sin(NROT)\ \sin T_r]\right\}$$

Change 4, May 18, 1971


Z'
$\underline{U}_B$
NROT
Y' (W)
SFOV
$\underline{U}_B \times (\underline{R}_V \times \underline{U}_B)$
$\underline{R}_V$
X'
X' along vector to vehicle
X', Z', and $\underline{U}_B$ are coplanar


Star
Substellar point
Horizon point sighted on
Terminator
Terminator angle
Plane error
Projected center of body
Pointing error
Vehicle