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

IN REPLY REFER TO 70-FM54-124

MAY 25 1970

MEMORANDUM TO: See attached list

FROM : FM5/Chief, Lunar Mission Analysis Branch

SUBJECT : RTCC requirements for Apollo 14 (H-3): XYZT and free-return modes of the translunar midcourse correction processor - Change 1

Enclosed is Change 1 to MSC Internal Note No. 70-FM-15. This change reflects some cleanup to the original documentation plus the addition of the capability to compute the "DPS-monitor ΔV" for option 1 (XYZT mode).

Ronald L. Berry

APPROVED BY:

John P. Mayer
Chief, Mission Planning
and Analysis Division

The Flight Software Branch concurs with the above recommendations.

James C. Stokes, Jr., Chief
Flight Software Branch

Enclosure

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RELEASE APPROVAL

1. Type of Document: Change sheet to Internal note

2. Identification: 70-FM-15 dated February 16, 1970

Page 1 of 1 Pages

TO:

3. FROM:
Division: Mission Planning and Analysis
Branch: Lunar Mission Analysis
Section:

4. Title or Subject: MCC REQUIREMENTS FOR APOLLO 14: XYZT AND FREE-RETURN MODES OF THE TRANSLUNAR MIDCOURSE CONNECTION PROCESSOR

Date of Paper: May 25, 1970

5. Author(s): Quentin A. Holmes and Kenneth T. Seiler

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MSC Form 199 (Rev Dec 63)

CHANGE HISTORY FOR 70-FM-15

Change no.	Date	Description
1	5/25/70	Replace page 12 and add page 12a: Added a branch so that DPS ΔV can be monitored, if desired. Pages 15 and 19: Pen-and-ink changes to eliminate redundant computation. Replace page 35: Added a reference which contains the logic for monitoring the DPS ΔV.

CHANGE SHEET

FOR

MSC INTERNAL NOTE 70-FM-15 DATED FEBRUARY 16, 1970

RTCC REQUIREMENTS FOR APOLLO 14: XYZT AND FREE-RETURN MODES OF THE TRANSLUNAR MIDCOURSE CORRECTION PROCESSOR

By Quentin A. Holmes and Kenneth T. Zeiler

Change 1

May 25, 1970

Ronald L. Berry, Chief
Lunar Mission Analysis Branch

for John P. Mayer, Chief
Mission Planning and Analysis Division

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

After the attached enclosures, which are replacement pages, have been inserted and after the following pen-and-ink changes have been made, place this CHANGE SHEET between the cover and title page and write on the cover, "CHANGE 1 inserted".

1. Pages 15 and 19: delete the block that reads "Compute lunar orbit plane and angular momentum vector".

6.0 XYZ MIDCOURSE MODE

The XYZ midcourse mode will be used to correct a mildly dispersed state vector during translunar coast. The target objectives for this maneuver are generated either in the premission countdown or in earth parking orbit. These nodal targets are computed using either a free-return BAP (option 2 or 3) or a non-free-return BAP (options 4 or 5). The trajectory generated by this mode may or may not be free return.

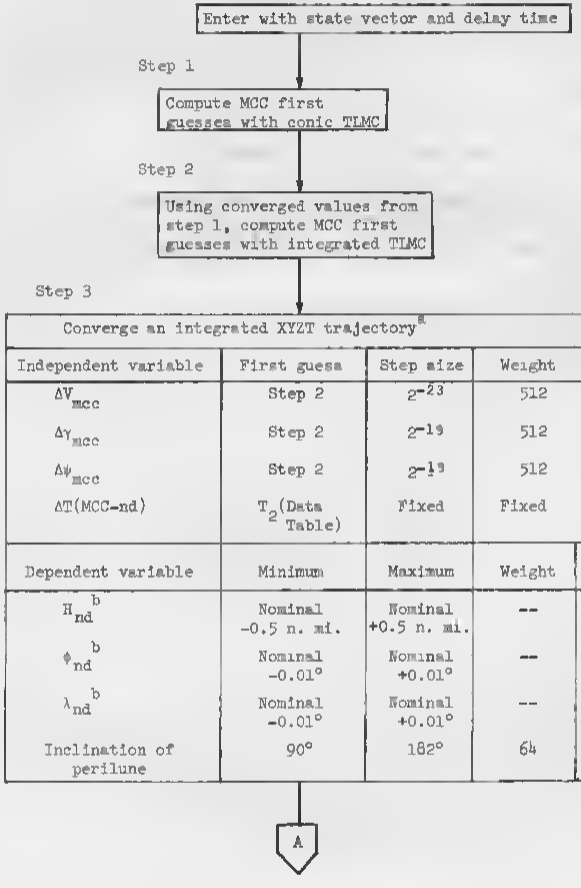
The target objectives for the midcourse maneuver are as follows.

a. The position vector that defines the node between the approach hyperbola plane and the desired LPO plane, where x, y, and z refer to the earth-moon plane longitude, latitude, and radius magnitude of the nodal point, respectively

b. The nominal time of arrival (T) at this node

7.0 COMPUTATIONAL FLOWCHART FOR XYZT MODE

The computation procedure for this mode is as follows.

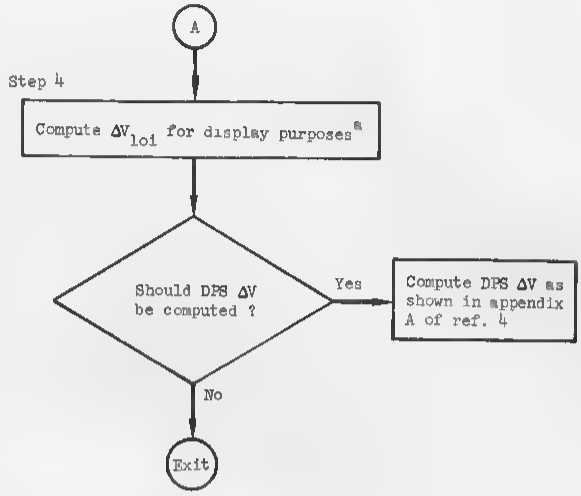


Converge an integrated XYZT trajectory[a]

Independent variable	First guess	Step size	Weight	
ΔV_{mcc}	Step 2	2^{-23}	512	
$\Delta\gamma_{mcc}$	Step 2	2^{-19}	512	
$\Delta\psi_{mcc}$	Step 2	2^{-19}	512	
ΔT(MCC-nd)	T_2(Data Table)	Fixed	Fixed	
Dependent variable	**Minimum**	**Maximum**	**Weight**	**Class**
H_{nd}[b]	Nominal -0.5 n. mi.	Nominal +0.5 n. mi.	--	1
ϕ_{nd}[b]	Nominal -0.01°	Nominal +0.01°	--	1
λ_{nd}[b]	Nominal -0.01°	Nominal +0.01°	--	1
Inclination of perilune	90°	182°	64	2

[a]For a detailed explanation of the program input in terms of independent and dependent variables, see ref. 1.

[b]Earth-moon plane coordinates.



[a] Beginning with the post-midcourse state vector, the trajectory is integrated to γ_{nd}. The three components of the displayed LOI maneuver are as follows.

1. The value of γ_{nd} from step 3
2. $|\Delta V_{LOI}|$ will be the difference between V of the approach hyperbola and V of the resultant lunar orbit at the transfer point.
3. $\Delta\psi_{nd}$ will be obtained from the dot product of the angular momentum vectors of the lunar orbit and the approach hyperbola at the time of landing

REFERENCES

1. Hodge, John D.: RTCC Requirements: AS-504 Midcourse Correction Processing. Flight Control Division memo, March 2, 1967.

2. Holmes, Quentin A.; and Zeiler, Kenneth T.: RTCC Requirements for Mission H-2 Non-free-return Modes of the Translunar Midcourse Correction Processor. MSC IN 69-FM-287, Nov. 13, 1969.

3. Zeiler, Kenneth T.; and Holmes, Quentin A.: RTCC Requirements for Apollo 11 (Mission G) Lunar Flyby Mode of the Translunar Midcourse Correction Processor. MSC IN 69-FM-199, July 7, 1969.

4. Holmes, Quentin A.; and Zeiler, Kenneth T.: RTCC Requirements for Apollo 14: Non-free-return Modes of the Translunar Midcourse Correction Processor. MSC IN 70-FM-14, Feb. 16, 1970.