



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

IN REPLY REFER TO: 70-FM54-112

MAY 25 1970

MEMORANDUM TO: See attached list

FROM : FM5/Chief, Lunar Mission Analysis Branch

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

Enclosed is Change 1 to MSC Internal Note No. 70-FM-14. This change includes the addition of the capability to compute the "DPS-monitor ΔV " for both non-free return options (options 4 and 5) of the translunar midcourse correction processor. Also included are some minor cleanup items relevant to the original documentation.

Ronald L. Berry
 Ronald L. Berry

APPROVED BY:
John P. Mayer
 John P. Mayer
 Chief, Mission Planning
 and Analysis Division

The Flight Software Branch concurs with the above recommendations.

James C. Stokes, Jr.
 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 **70-76-14 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 **EPIC REQUIREMENTS FOR APOLLO 14; NON-FREE-
RETURN MODES OF THE TRANS-LUNAR MIDCOURSE CORRECTION PROGRESSOR**

Date of Paper

May 25, 1970

5. Author(s)

Quentin A. Bolner and Kenneth T. Seiler

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See attached memo

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CHANGE HISTORY FOR 70-PM-14

Change no.	Date	Description
1	5/25/70	<p>Page 8: Pen-and-ink change to eliminate redundant computation.</p> <p>Replace pages 15 and 23: Added a branch so that DPS ΔV can be monitored, if desired.</p> <p>Add pages 24 and 25: Added appendix to present the logic for computing the velocity increment (DPS ΔV monitor) for returning the spacecraft to earth in the event of no burn at LOI on a non-free-return trajectory.</p> <p>Page 26: Changed number of reference page.</p>

CHANGE SHEET

FOR

MSC INTERNAL NOTE 70-FM-14 DATED FEBRUARY 16, 1970
MDOC REQUIREMENTS FOR APOLLO 14: NON-FREE-RETURN MODES
OF THE TRANSLUNAR MIDCOURSE CORRECTION PROCESSOR

By Quentin A. Holzes and Kenneth T. Zeller

Change 1

May 25, 1970

Ronald L. Berry
Ronald L. Berry, Chief
Lunar Mission Analysis Branch

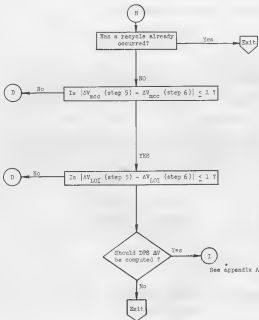
John P. Mayer
for John P. Mayer, Chief
Mission Planning and Analysis Division

Page 1 of 6
(with enclosures)

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

After the attached enclosures, which are replacement pages and added 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".

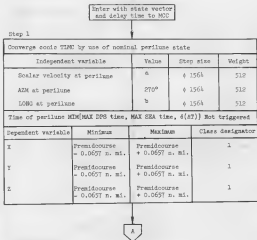
1. Delete from page 8 the block that reads "Compute lunar orbit plane and angular momentum vector".
2. Change number of reference page to 26.



Flow chart 1.- Concluded.

Change 1, May 25, 1970

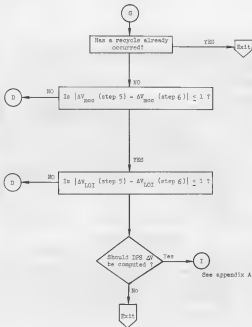
Option 5: Free orbit non-free-return BAP



^aComputed as
$$v = \sqrt{18406305 + .9530804/r_{po}} - .0022(8T) - 13.5(i_{po} - 180^\circ)$$

^bComputed as
$$\lambda = 3 - 1 - 0.25(8T)$$

Flow chart 2.- Free orbit nonfree return BAP.



Flow chart 2.- Concluded.

Change 1, May 25, 1970

APPENDIX A
DPO AV HOBBINS

I

Enter with delay time from perils to DPO abort and pick up non-free-return perils state from completed non-free-return midcourse computation (options 4, 5, or 1).

Step 1

Select and optimize (200 iterations maximum) a conic transearth trajectory

Independent variable	First guess	Step size	Weight	
AV at TEI	0	2^{-21}	5	
Δ flight-path angle at TEI	0	2^{-21}	5	
Δ AM at TEI	0	2^{-21}	1	
Dependent variable	Minimum	Maximum	Class	Weight
HT of entry	64.096513 n. mi.	67.566513 n. mi.	1	--
IRL of return	0°	40°	2	1
Characteristic velocity at TEI	0	0	3	--

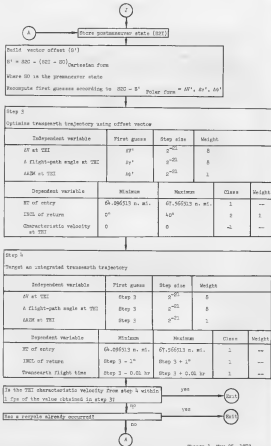
Store postmaneuver state (DPC)

Step 2

Select an integrated transearth trajectory to the end conditions obtained in step 1

Independent variable	First guess	Step size	Weight	
AV at TEI	(Step 1 + 100 fps)	2^{-21}	5	
Δ flight-path angle at TEI	Step 1	2^{-21}	5	
Δ AM at TEI	Step 1	2^{-21}	1	
Dependent variable	Minimum	Maximum	Class	Weight
HT of entry	64.096513 n. mi.	67.566513 n. mi.	1	--
IRL of return	Step 1 - 1°	Step 1 + 1°	1	--
Transearth flight time	Step 1 - 0.01 hr	Step 1 + 0.01 hr	1	--

J



REFERENCES

1. Zeiler, K. T.: Lunar Accessibility of the Hybrid Mission. MSC memo 69-PN52-223, June 28, 1968.
2. Morrey, B. F.; McCaffety, B. O.; and Morrey, A. E.: WFOC Requirements for Mission G: The Translunar Midcourse Correction Processor. MSC IN 68-PN-193, August 9, 1968.
3. Sears, G.; and Redwine, W.: Optimum Translunar Flight Times for Premature TLI Shutdown. YOC 3423.8-25, April 20, 1967.