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RTCC REQUIREMENTS: REVISED TARGET LINES AND REENTRY RANGE FUNCTIONS FOR THE LUNAR LANDING PROGRAM - RETURN-TO-EARTH ABORT PROCESSOR

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PROJECT APOLLO

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HOUSTON, TEXAS

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RTCC REQUIREMENTS: REVISED TARGET LINES AND REENTRY RANGE FUNCTIONS FOR THE LUNAR LANDING PROGRAM - RETURN-TO-EARTH ABORT PROCESSOR

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INTRODUCTION

This document defines the Reentry range functions and the V-γ target lines to be used in conjunction with the RTCC, Lunar Landing Program (LLP), return-to-earth abort processor. This data supersedes that which is found in reference 1.

DISCUSSION

Two V-γ target lines are defined in table I, the primary manned spaceflight network (MSFN) target line and the contingency target line.

For the MSFN target line, two sets of reentry range functions are presented; one for primary G&N reentries and one for backup, constant g reentries. The coefficients representing the functions are defined in table II. It should be noted, that with the exception of the addition of pp_0 and pp_1, the coefficients presented are in the same form as defined in reference 1 and should be used in the manner prescribed in the reference. The pp coefficients represent a new set to be used in the calculation of the reentry time for constant g reentries, $T = pp_0 + pp_1 R$. They replace coefficients ee_0 and ee_1 for this calculation.

For the contingency target line only reentry range functions for constant g reentries are defined. As shown in the following equations, these functions take the same form as the MSFN constant-g range functions and should be used in the same manner.

$$R = ll_0 + ll_1(VI) + ll_2(VI)^2 + \cdots + ll_N(VI)^N + [r_1(VI) + r_2]$$

$$[r_3(L/D - 0.3)]$$

$$T = mm_0 + mm_1 R$$

$$CR = cc_0[T \cos(LAT) \cos(AZ + 0.3\ LAT)] + r_4(L/D) + r_5$$

where

VI = Inertial velocity (fps) at 400 000-ft altitude

AZ = Azimuth (deg) at 400 000-ft altitude

L/D = Lift-to-drag ratio

T = Time (sec)

LAT = Geodetic latitude (deg)

I = Inclination (deg) at 400 000-ft altitude

The coefficients for these functions are defined in table III.

The above range functions were defined by TRW under task A-181 and their derivation and accuracy will be defined under that effort.

TABLE I: ENTRY V-γ FOR THE CONTINGENCY AND MSFN TARGET LINES

Velocity, fps	MSFN Target Line	Contingency Target Line
25.5	-1.35	-3.30
26.0	-1.91	-3.74
26.5	-2.47	-4.04
27.0	-2.91	-4.31
27.5	-3.29	-4.55
28.0	-3.62	-4.78
28.5	-3.91	-4.96
29.0	-4.17	-5.13
29.5	-4.39	-5.28
30.0	-4.59	-5.41
30.5	-4.78	-5.55
31.0	-4.96	-5.66
31.5	-5.12	-5.77
32.0	-5.27	-5.86
32.5	-5.41	-5.96
33.0	-5.54	-6.05
33.5	-5.67	-6.14
34.0	-5.80	-6.21
34.5	-5.92	-6.29
35.0	-6.03	-6.36
35.5	-6.14	-6.43
36.0	-6.24	-6.48
36.5	-6.35	-6.55
37.0	-6.44	-6.61
37.5	-6.54	-6.66

TABLE II.- MSFN TARGET LINE REENTRY COEFFICIENTS

Order	a	Order	b	Order	c	Order	g
0	0.86271602 E 07	0	-0.67986700 E 08	0	0.15230722 E 09	0	0.30968659 E-01
1	-0.14116879 E 04	1	0.11180914 E 05	1	-0.24946368 E 05	1	0.22383735 E 02
2	0.91965293 E-01	2	-0.73032162 E 00	2	0.16206245 E 01	2	-0.21634224 E 03
3	-0.29772698 E-05	3	0.23646102 E-04	3	-0.52092421 E-04	3	0.11173815 E 04
4	0.47808103 E-10	4	-0.37859662 E-09	4	0.82595099 E-09	4	-0.33479617 E 04
5	-0.30377495 E-15	5	0.23892427 E-14	5	-0.51430754 E-14	5	0.59297703 E 04
6	---	6	---	6	---	6	-0.61151108 E 04
7	---	7	---	7	---	7	0.33902317 E 04
8	---	8	---	8	---	8	-0.78039787 E 03

Order	h	Order	j	Order	m	Order	n
0	0.42468309 E-04	0	-0.25961969 E 07	0	-0.10311604 E-04	0	0.81747248 E 06
1	0.50919502 E-02	1	0.45009114 E 03	1	-0.23283242 E-02	1	-0.14306465 E 03
2	-0.24366057 E-03	2	-0.31143738 E-01	2	0.11296509 E-02	2	0.99923256 E-02
3	0.29131934 E-04	3	0.10752998 E-05	3	-0.20341765 E-04	3	-0.34832746 E-06
4	-0.43096550 E-06	4	-0.18528911 E-10	4	0.19976228 E-06	4	0.60627954 E-11
5	0.20752645 E-08	5	0.12749894 E-15	5	-0.81270557 E-09	5	-0.42170442 E-16
6	---	6	---	6	---	6	---
7	---	7	---	7	---	7	---
8	---	8	---	8	---	8	---

TABLE II.- MSFN TARGET LINE REENTRY COEFFICIENTS - Concluded

Order	cc	Order	dd	Order	ee	Order	ff
0	0.105 E 00	0	0.175 E 03	0	0.1175 E 03	0	-0.175 E 03
1	0.0	1	0.0	1	0.2825 E 00	1	0.0
2	---	2	---	2	---	2	---
3	---	3	---	3	---	3	---
4	---	4	---	4	---	4	---
5	---	5	---	5	---	5	---
6	---	6	---	6	---	6	---
7	---	7	---	7	---	7	---
8	---	8	---	8	---	8	---

Order	jj	Order	kk	Order	pp	Order	q
0	0.10718858 E 07	0	0.940890 E-01	0	0.590 E 02	0	0.0
1	-0.16271240 E 03	1	---	1	0.3006 E 00	1	0.555 E-04
2	0.98775571 E-02	2	---	2	---	2	-0.1025 E 01
3	-0.29943037 E-06	3	---	3	---	3	0.400 E 03
4	0.45325217 E-11	4	---	4	---	4	0.335 E 03
5	-0.27404876 E-16	5	---	5	---	5	-0.4215 E 02
6	---	6	---	6	---	6	
7	---	7	---	7	---	7	
8	---	8	---	8	---	8	

TABLE III.- CONTINGENCY TARGET LINE REENTRY COEFFICIENTS

Order	ll	r	cc	mm
0	0.18262030 E 06	---	.105 E 00	.193 E 03
1	-0.27810612 E 02	0.555 E-04	---	0.1795 E 00
2	0.16998821 E-02	-.1025 E 01	---	---
3	-0.51884802 E-07	.70 E 03	---	---
4	0.79087925 E-12	.31 E 03	---	---
5	-0.48128071 E-17	-.45 E 02	---	---
6	---	---	---	---
7	---	---	---	---
8	---	---	---	---

REFERENCES

1. Elyea, R. L.; and Cencioso, J. M.: Transearth Injection Abort Processor Entry Range Functions. TRW Document 67-FMT-586, December 15, 1967.