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Memorandum

LARSON

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TO : See list attached

DATE: SEP 8 1969

In reply refer to:
69-FS55-30

FROM : FS/Chief, Flight Support Division

SUBJECT: LUMINARY 1B updates (mission H_1)

The enclosure to this memorandum gives the standard updates for the LUMINARY 1B program (LUMINARY Revision 116) to be used on H_1 mission. Erasable memory addresses, scalings, coordinate systems, order of transmission, and a brief description for the parameters are also included.

for Lynwood C. Dunseith

Enclosure

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LUMINARY 1B Updates (Mission H_1)

1. The following is a list of the erasable complete starting addresses (ECADR), with associated program names, required for the standard LGC updates that are defined for the LUMINARY 1B program.

a.	CSM/LM state vector	UPSVFLAG	1501	(VERB 71)
b.	REFSMMAT (actual)	REFSMMAT	1733	(VERB 71)
c.	REFSMMAT (preferred	XSMD	3606	(VERB 71)
d.	LGC external delta-V	DELVSLV	3433	(VERB 71)
e.	LGC landing site	RLS	2022	(VERB 72)
	.....	TLAND	2400	

2. The following pages give scaling, coordinate systems, order of transmission, and a brief parameter description for the above updates.

ENCLOSURE

A. LGC CM/LM State Vector Update (Verb 71)

1. Update quantities

		Scale Factor
(a)	Index (1SP)	units/2^{14}
(b)	Starting Address (1SP)	(ECADR form)
(c)	State Vector Identifier (1SP)	(units/2^{14})
(d)	Position Components	earth - (meters/2^{29}) moon - (meters/2^{27})
(e)	Velocity Components	earth - (meters/centisecond)/2^{7} moon - (meters/centisecond)/2^{5}
(f)	State Vector Time (1DP)	centiseconds/2^{28}

Note: The scaling as indicated gives the units and the number by which the true value must be multiplied in order to force the value to be less than one.

2. Order of uplink transmission

Octal Identifier	
1	index ($0002l_8$)
2	1501
3	state vector identifier
4	most sig. part of X position
5	least sig. part of X position
6	most sig. part of Y position
7	least sig. part of Y position
10_8	most sig. part of Z position
11_8	least sig. part of Z position
12_8	most sig. part of X velocity
13_8	least sig. part of X velocity
14_8	most sig. part of Y velocity
15_8	least sig. part of Y velocity
16_8	most sig. part of Z velocity
17_8	least sig. part of Z velocity
20_8	most sig. part of time
21_8	least sig. part of time

3. Definitions

(a) The index is the total number of data lines (a data line being a 5-octal character uplink word group) in the update. For the state vector update the index must be equal to 17_{10}, transmitted as 00021_8.

(b) The quantities beginning with the state vector identifier will be placed, in sequence, into erasable memory beginning at the location specified by the starting address. The address must be in an "ECADR" form.

(c) The state vector identifier is used to indicate which vehicle state vector is to be updated and where the coordinate system is centered. This is accomplished by setting the identifier to one of the following values.

State Vector to be updated	Coordinate System Center	
	Earth	Moon
CSM	+1(00001_8)	+2(00002_8)
LM	-1(77776_8)	-2(77775_8)

(d) The position and velocity components must be in reference (Besselian) coordinates (may be either geocentric or selenocentric) with the time referenced to the computer clock.

B. LGC Lift-off Time Update (Verb 70)

1. Update quantities

	Scale Factor
Time Increment (1DP)	centiseconds/2^{28}

2. Order of uplink transmission

Octal Identifier	
1	time increment MSB
2	time increment LSB

C. LGC Time Increment Update (Verb 73)

1. Update quantities

	Scale Factor
Time Increment (1DP)	centiseconds/2^{28}

2. Order of transmission

Octal Identifier	
1	time increment MSB
2	time increment LSB

D. LGC REFSMMAT Update (Verb 71)

1. Update quantities

	Scale Factor Units/2^{14}
(a) Index (1SP)	
(b) Starting address (1SP)	ECADR form
(c) Elements of matrix (9DP)	units/2^{1}

2. Order of transmission

Octal Identifier	
1	index (0002_4_8)
2	1733
3	row 1 column 1 MSB
4	row 1 column 1 LSB
5	row 1 column 2 MSB
6	row 1 column 2 LSB
7	row 1 column 3 MSB
10_8	row 1 column 3 LSB
11_8	row 2 column 1 MSB
12_8	row 2 column 1 LSB
13_8	row 2 column 2 MSB
14_8	row 2 column 2 LSB
15_8	row 2 column 3 MSB
16_8	row 2 column 3 LSB
17_8	row 3 column 1 MSB
20_8	row 3 column 1 LSB
21_8	row 3 column 2 MSB
22_8	row 3 column 2 LSB
23_8	row 3 column 3 MSB
24_8	row 3 column 3 LSB

A. LGC Preferred Alignments (Verb 71)

1. Update quantities

	Scale Factor
(a) Index (1SP)	units/2^{14}
(b) Starting address (1SP)	ECADR form
(c) Elements of matrix (9DP)	units/2^{1}

2. Order of transmission

Octal Identifier	
1	index (00024_8)
2	3606
3	row 1 column 1 MSB
4	row 1 column 1 LSB
5	row 1 column 2 MSB
6	row 1 column 2 LSB
7	row 1 column 3 MSB
10_8	row 1 column 3 LSB
11_8	row 2 column 1 MSB
12_8	row 2 column 1 LSB
13_8	row 2 column 2 MSB
14_8	row 2 column 2 LSB
15_8	row 2 column 3 MSB
16_8	row 2 column 3 LSB
17_8	row 3 column 1 MSB
20_8	row 3 column 1 LSB
21_8	row 3 column 2 MSB
22_8	row 3 column 2 LSB
23_8	row 3 column 3 MSB
24_8	row 3 column 3 LSB

F. LGC External Delta V (Verb 71)

1. Update quantities

		Scale Factor units/2^{14}
(a)	Index (1SP)	
(b)	Address of DELVSLVX (1SP)	(ECADR form)
(c)	DELVSLV's (3DP)	(meters/centisecond)/27
(d)	TIG (1DP)	(centiseconds/2^{28})

2. Order of transmission

Octal Identifier	
1	index (00012_8)
2	3433
3	X component of DELVSLVS (MSB)
4	X component of DELVSLVS (LSB)
5	Y component of DELVSLVS (MSB)
6	Y component of DELVSLVS (LSB)
7	Z component of DELVSLVS (MSB)
10_8	Z component of DELVSLVS (LSB)
11_8	TIG (MSB)
12_8	TIG (LSB)

3. Definitions

(a) The index is as defined previously for the state vector update; the value for the External Delta V update is 10_{10} transmitted as 00012_8.

(b) The address of DELVSLVX must be in ECADR form.

(c) The DELVSLV's specify the required velocity change in local vertical coordinates at the time of ignition.

(d) TIG is the time of ignition, reference to the computer clock.

H. LGC Landing site vector update
(Verb 72)

1. Update quantities

		Scale Factor (units/2^{14})
1	Index (1SP) (00021_8)	
2	2022	
3	RLS X component (MSB)	
4	2023	All addresses are in ECADR form.
5	RLS X component (LSB)	RLS double precision components are scaled meters/2^{27}.
6	2024	TLAND is a double precision quantity scaled (centiseconds/2^{28}).
7	RLS Y component (MSB)	
10_8	2025	
11_8	RLS Y component (LSB)	
12_8	2026	
13_8	RLS Z component (MSB)	
14_8	2027	
15_8	RLS Z component (LSB)	
16_8	2400	
17_8	TLAND (MSB)	
20_8	2401	
21_8	TLAND (LSB)	

2. Definitions

(a) The index is the total number of data lines (a data line being a 5-octal character uplink word group) in an update. For the LGC landing site update the index is 17_{10} transmitted as 00021_8.

(b) A 5-character core address location will precede each 5-character uplink data word in a "verb 72" format (see Sect II of Guidance System Operation Plan). All addresses are in ECADR form.

(c) RLS is the landing site position vector in moon fixed coordinates (see part 5.1.4.5 of Sect V of the Luminary Guidance Systems Operation Plan).

(d) TLAND is the predicted time of landing.