

*R. Larson*

Massachusetts Institute of Technology  
Charles Stark Draper Laboratory

23S Memo 71-2 (Revision 2)

TO: Distribution  
FROM: Harry McOuat  
DATE: 20 June 1971  
SUBJECT: Emergency Erasable Updates for Apollo 15

The memo has two parts: the first part concerns Artemis and the second part concerns Luminary.

Distribution:

N. Sears	G. Silver
P. Felleman	R. Lones
S. Copps	G. Edmonds
R. Larson	R. Werner
M. Hamilton	W. Woolsey
B. McCoy	R. White
B. Ostanek	P. Canepa
R. Schlundt	P. Heinemann
R. Bairnsfather	D. Millard

## PART 1

Attached are sheets indicating the proper E-memory load to uplink in-flight for some contingency situations. The situations considered can be summarized as:

1. Continue the lunar mission
2. Abort or return to earth
3. Just entry - ala Apollo #13

A list for entry from earth orbit could be included but it only differs from 2 by about six variables.

The list also shows the nominal pre-launch load and the NASA pre-formatted E-memory update.

The assumed procedure is:

1. Send E-memory update via UPLINK
2. Send regular V71 state vector updates
3. Do onboard platform alignment

The flagbits unaffected by a V36 are discussed separately.

COLOSSUS

		# of words	Nominal (Pre-Launch)	L/O to L. Sphere	Entry (Apollo 13)	Earth Sphere (Abort)	NASA LIST
FLAGWORDS	(Note-A)	4	*	*	*	*	
NO. PASS	(Note-E)	1		*			x
PIPTIME	(Note-B)	2					
PGNCSALT, PADLONG		4					
CDUCHKWD		1		*	*	*	x
RTDE1, P37 RANGE	(Note-C)	3					x
DVTHRESH		1					x
HORIZONTAL, HORISLP	(Note-C)	4				↓	x
ALTVAR		1					x
EMDOT		1				*	x
GYRO & PIPA DATA		15			*	↓	x
TEPHEM, UNIT W		9		↓	*	↓	x
REFSMMAT	(Note-B)	4					
E3J22R2M, E32C31RM	(Note-D)	2		*			x
TRUNSF, SHAFTSF	(Note-E)	2					x
WREND's		2					x
RMAX, VMAX		2					x
WORVEL, WORBPOS, S22WSUBL	(Note-F)	3					x
RPVAR	(Note-F)	2	↓	↓			x

COLOSSUS

		# of words	Nominal (Pre-Launch)	L/O to L. Sphere	Entry (Apollo 13)	Earth Sphere (Abort)	NASA LIST
504LM	(Note-D)	6	*	*			x
EMSALT		2			*	*	x
ATIGINC, PTIGINC		4					x
RLS		6					x
TIMEMO, VECOEM, RESO, VESO, OMEGAES		77			*	*	x
INTVAR		1		↓			x
AZIMUTH, LATITUDE, TAZEL's, LAUNHAZ		10					
WMIDPOS, WMIDVEL		2		*		*	x
RVAR, RVARMIN		5		↓			x
LADPAD, LODPAD, ALFAPAD		3			*	*	x
ETDECAY		1				↓	x
EKPRIME's, EKTLX/I's EREPPFRAC's		7		↓		↓	x
PACTOFF, YACTOFF	(Note-G)	2					
HBN's, HBD's		15		*		*	x
DAPDATR 1, 2	(Note-G)	2					
LEMMASS, CSMMASS	(Note-G)	2					
POLYNUM, RPSTART, POLYSTOP, SATRLRT		19					
SATRATE	(Note-H)	4		Note H			
SATSCALE		1					
LAT(SPL), LNG(SPL)	(Note-G)	4			*		

COLOSSUS

	<u># of words</u>	<u>Nominal (Pre-Launch)</u>	<u>I/O to L. Sphere</u>	<u>Entry (Apollo 13)</u>	<u>Earth Sphere (Abort)</u>	<u>NASA LIST</u>
C31FLWRD(Note G)	1	*				
N26/PRI	1	*	*	*	*	*
N26/2 CAD	2	*	*	*	*	*
EIMP1SEC, EFIMP01, EFIMP16	3	*	*		*	*
DTF, HAMDELH, WRDTIME MINBLKTM, TBEFCOMP, BRNBLKTM, MAXWTIME, FINCMPTM	9	*	*			*
	252	252	197+4	117	150	193

**Notes:**

- A. See expected resultant Flagword settings below.
- B. These are loaded Pre-launch for FSB only.
- C. The second variable is out of order, but listed here because of function.
- D. # Only required for integration within the moons sphere.
- E. # Omission assumes P24 will not be used.
- F. # Omission assumes P22 will not be used.
- G. #'s will be loaded by crew via DSKY.
- H. #'s should be included before TLI?

FLAG	FLAGWORD DATA			Nominal Pre-Launch	L/O to Moon Sph.	Earth Sph/ Abort
	Bit#	Wrd#				
NODO PO 1	12	1		0	1	1
REFSM	13	3	Note-1	0	0	0
LMOON	11	8	Note-2	0	0	0
CMOON	12	8	Note-2	0	0	0
SURF	8	8	Note-3	1	1	1
HDSUP	11	10	Note-4	0	0	0

**Notes:**

1. Assumes that an onboard alignment will always be performed.
2. These flags will be set to the proper sphere by a V71 state vector update. It is assumed that an E-memory load is always followed by a V71 state vector update.
3. This flag is set to inhibit integration of the LM state vector.
4. This flag reflects the desired MINKEY setting for rendezvous. For Apollo 15, zero means heads up. The flagbit does not require updating if no rendezvous is to follow.

## PART II

Attached are sheets indicating the proper E-memory load to up-link in-flight for some contingency situations. The situations can be generally lumped into these cases:

1. Complete the mission
2. Following a successful lunar landing

The list shows: (a) the nominal pre-launch load, (b) the lists for the two situations and (c) the NASA list.

It is assumed that an E-memory in-flight load is always followed by Verb 71 state vector update and onboard platform alignment.

LUMINARY		# of Words	Nominal Pre-Launch	L/O - Lunar Ldg.	Post Lunar Ldg.	N <sub>A</sub> S <sub>A</sub>
FLAGWORDS	(Note-A)	3	*	*		
MASS		2	*	*		
LEM MASS, CSM MASS	(Note-B)	2	*			
E3J22R2M, E32C31RM	(Note-D)	2	*	*	*	x
ELBIAS, AZBIAS	(Note-C)	2	*	*		x
TOO FEW		1	*	*		x
GYRO & PIPA DATA		15	*	*	*	x
GCOMP SW		1	*	*	*	x
TET's		4	*			
X789		6	*	*	*	x
TEPHEM, -AYO, AXO		7	*	*	*	x
REFSMMAT	(Note-E)	18	*	*		
RR Variances		6	*	*	*	x
W Matrix (rendezvous)		2	*	*	*	x
WSHAFT, WTRUN		2	*	*	*	x
RMAX, VMAX		2	*	*	*	x
WSURFPOS, WSURFVEL		2	*	*		x
SHAFTVAR, TRUNVAR		2	*	*	*	x
504LM		6	*	*	*	x
RLS		6	*	*	*	x
TLAND		2	*	*		x
VELBIAS		2	*	*		x
Aimpoint Data		36	*	*		x
GAINBRAK, GAINAPPR		4	*	*		x
TCGFBRAK, TCGIBRAK		2	*	*		x
TCGFAPPR, TCGIAPPR		2	*	*		x
IGN Targets		6	*	*		x
KIGNX/B4, KIGNY/B8, KIGNV/B4		6	*	*		x
LOWCRIT, HIGHCRIT		2	*	*		x
TAUHZ, QHZ, AHZLIM		3	*	*		x
2LATE 466		2	*	*		x
DELQFIX		2	*	*		x
LRVMAX, LRVF, LRWV's		9	*	*		x
ABSC's & SLOPE's		10	*	*		x
RODSCALE, TAURD, LAG/TAU		5	*	*		x



LUMINARY	# of Words	Nominal Pre-Launch	L/O-Lunar Ldg.	Post Lunar Ldg.	N <sub>A</sub> S <sub>A</sub>
MINFORCE, MAXFORCE	4	*	*		x
J PARM's, K PARM's, THETCRIT	10	*	*		x
RAMIN, YLIM, ABTRDOT, COSTHET 1, 2	10	*	*		x
DLAND	6	*	*		x
HIASCENT	1	*	*	*	x
ROLLTIME, PITTIME (Note-B)	2	*			
DKTRAP, DKOMEGAN, DKKAOSN	3	*	*	*	x
LMTRAP, LMOMEGAN, LMKAOSN	3	*	*	*	x
DKDB	1	*	*	*	x
IGNAOSQ, IGNAOSR	2	*	*	*	x
DOWNTORK	6	*	*		x
AGSK	2	*	*	*	x
ATIGINC, PTIGINC	4	*	*	*	x
AOTAZ, AOTEL	12	*	*	*	x
LRHMAX	1	*	*		x
LRWH, LRWH1 (Note-C)	2	*	*		x
ZOOMTIME	1	*	*		x
TENDBRAK, TENDAPPR	2	*	*		x
DELTTFAP, LEADTIME	2	*	*		x
RPCRTIME, RPCRTQSW	2	*	*		x
TNEWA	1	*	*	*	x
CHANBKUP (Note-B)	1	*			
N26/PRI	1	*	*	*	*
N26/2CAD	2	*	*	*	*
	265	265	256	89	233

NOTES:

- A. See next page for expected resultant FLAGWORD settings
- B. #'s will be loaded by crew via DSKY
- C. The second variable is out of order, but listed here because of function
- D. #'s only required for integration within the moons sphere
- E. REFSMMAT is loaded pre-liftoff for use in the event of a docked DPS LOI abort

FLAGWORD DATA

FLAG	BIT #	FLG #		Nominal Pre-Launch	L/O - Lunar Ldg.	Post Lunar Ldg.
NODOPO7	11	3		1	1	1
REFSM	13	3	Note-1	1	1	0
SURF	8	8		0	0	1
LMOON	11	8	Note-2	1	1	1
CMOON	12	8	Note-2	1	1	1
APS	13	10		0	0	1

NOTES:

1. Assumes **that** an onboard alignment will be performed in off-nominal cases.
2. These flags **will** be set to reflect the proper sphere by V71 state vector updates.