MSG 044A (20-0516A) - FD6 TLI Burn Humor

To commemorate the 40th anniversary of the first Lunar landing by the crew of Apollo 11:

About once every 10 days the Moon moves through the ISS orbit plane. This Zero Moon Beta (ZMB) condition affords the opportunity to target a minimal-propellant transfer departing from the ISS orbit several days earlier. During STS-127/2JA, a ZMB occurs at 206/14:55 GMT (9/16:52 MET), and the crew should see the last quarter Moon rising and setting near the Vbar in this timeframe.

A hypothetical Trans-Lunar Injection (TLI) burn has been targeted from the Shuttle/ISS vicinity with TIG at 201/15:53:30 GMT (4/17:50 MET) on the southbound leg of Shuttle Orbit 76 (ISS Orbit 1122). Posigrade (PEG-7 DVX) velocity change is 10,188.1 ft/s (3105.3 m/s). This impulse could hypothetically place the stack on a free-return cislunar trajectory. Closest approach to the Moon, or pericynthion, would occur at 204/13:24:36 GMT (7/15:21 MET) at a height 100 km (54 nm) above the Moon's farside.

A maneuver PAD is attached along with all pertinent information required to execute the dual OMS TLI. Config 3 reboost has been offered as a downmode if needed. Good luck!!!

ORBIT MANEUVER PAD FOR TLI (Trans Lunar Injection, LUNAR ORB OPS, pg. 9-2)

OMS BOTH	1	X
L	2	
R	3	
RCS SEL	4	

+X / -X / MULTI-AXIS

TV ROLL	5	000
TRIM LOAD P	6	(+)5.8
LY	7	(-)6.4
RY	8	(+)3.0
WT	9	90562
TIG	10	04/17:50:20.5
TGT PEG 7 ΔVX	19	(+)1018.1
ΔVY	20	(+)0191.3
ΔVZ	21	(+)0173.5

BURN ATT

R	24	042
P	25	079
Y	26	041

ΔVTOT	10191
TGO	83:00
VGO X	(+)9836.7
VGO Y	(+)0000.0
VGO Z	(+)2665.2

TGT	HA	HP
	23934	(+)188

NOTES

OMS GMBL CK:

	PRE	POST-BURN
L PRI	X	
L SEC	X	
R PRI	X	
R SEC	X	
NONE		X

RCS I'CNCT:
- [ ] L OMS → RCS
- [ ] R OMS → RCS
- [X] NONE

DOWN MODE OPTIONS:
- [ ] 2 OMS → 1 OMS
- [X] 2 OMS → Config 3
- [ ] 1 OMS → RCS
- [ ] NONE

See attached reboost PAD.

OMS HE REG TEST: [ ] NONE

	L GPC	L OP	L CL	R GPC	R OP	R CL
A		X			X	
B		X			X	

-X RCS BURNS: N/A

ORBIT BURN MONITOR

GPC FILL-INS 1 (3)

- [X] CRIT BURN
- [ ] NON-CRIT BURN

MAX TIG SLIP 40 Yrs — [X] DO NOT UPDATE TIG; [ ] UPDATE TIG AFTER ___ MIN.

FLIGHT NOTES:

Downmode option: 2 OMS to Config 3 reboost - see attached reboost PAD for details.
Expect sloppy control and very large pitch rate due to the OMS engines being unable to trim through the CG.
Expect quantity low alarm
Treat the loss of GPC3 as second gimbal fail on the right.

AUTO REBOOST – CONFIG 3, TLI

CAUTION
Executing this procedure will result in a trans-lunar trajectory.
May cause loads exceedences.
Propellant may not be available for return to earth.
Crew is advised to pack a change of clothes.

NOTE
Allow 5 min between establishing reboost attitude and reboost start time for DAP accelerations to converge.
Steps 1-2 may be performed prior to completion of maneuver to reboost attitude.

1. Select Reboost Configuration

   GNC 20 DAP CONFIG
   REBOOST CFG – ITEM 8 + 3 EXEC
   INTVL – ITEM 9 + 2 . 0 0 EXEC

2. Set up Future Reboost

   NOTE
   START TIME = In attitude MET + 2 minutes.

   √MCC for duration. If no OMS burn is performed prior to downmoding, total reboost duration will be 154/07:20:19.69.

   Due to limitations with reboost duration in the onboard flight software, several reboosts of duration 24:00:00.00 will be required to achieve the required delta V.

   For no preceding OMS burn, 154 reboosts will be required followed by a 155th with a duration of 7:20:19.69.

   GNC UNIV PTG
   DURATION – ITEM 27 + 24 + 00 + 00.00 EXEC
   START TIME – ITEM 1 + _ _ + _ _ + _ _ + _ _ EXEC

   RBST – ITEM 25 EXEC (FUT - ∗)

3. Select appropriate Reboost Rotation DAP

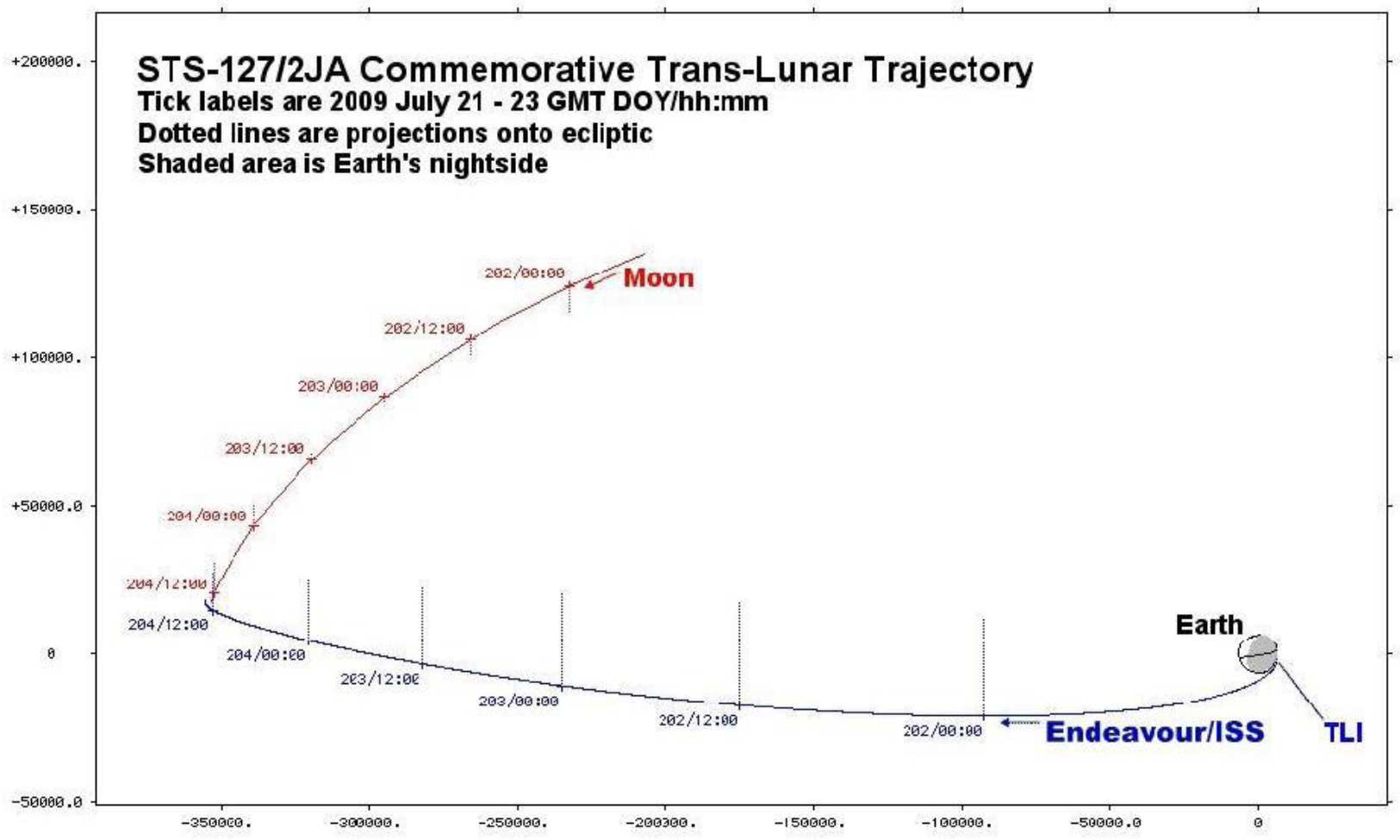
   When in attitude and prior to START TIME,
   C3 DAP: A11/AUTO/VERN

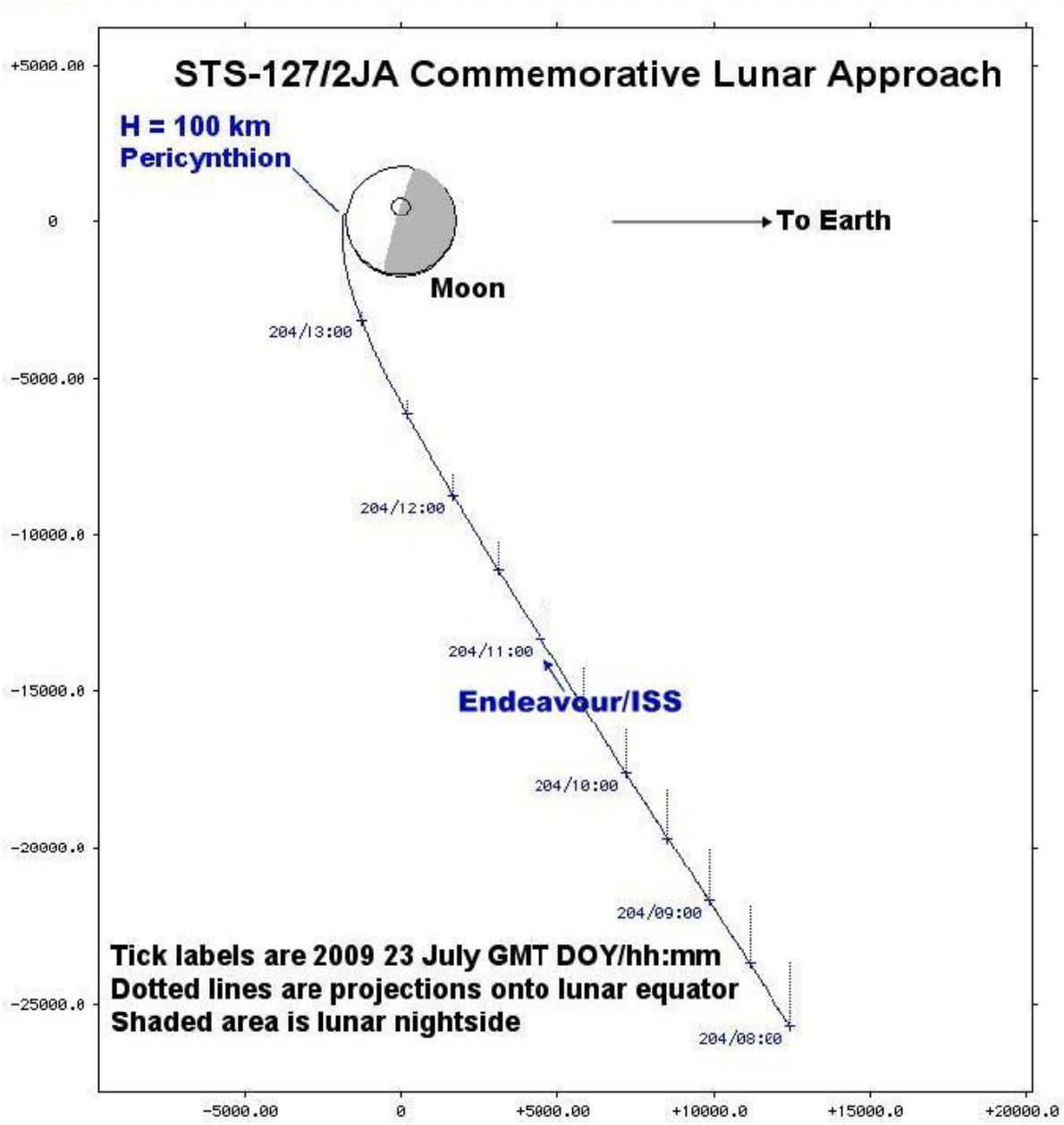
   NOTE
   Reboost can be aborted with an Item 26 on UNIV PTG or by selecting FREE on the DAP

   When desired total delta V achieved continue to step 4.
   If additional delta V required, go to step 2.

4. Post Reboost Configuration

   Load DAP: A12
   Return to FLIGHT PLAN Attitude


STS-127/2JA Commemorative Trans-Lunar Trajectory
Tick labels are 2009 July 21 - 23 GMT DOY/hh:mm
Dotted lines are projections onto ecliptic
Shaded area is Earth's nightside
+200000.
+150000.
+100000.
+50000.0
0
-50000.0
-350000.
-300000.
-250000.
-200300.
-150000.
-100000.
-50000.0
0
202/00:00
Moon
202/12:00
203/00:00
203/12:00
204/00:00
204/12:00
204/12:00
204/00:00
203/12:00
203/00:00
202/12:00
202/00:00
Earth
Endeavour/ISS
TLI
Km Units
View From Y=332.0°, P= 0.0°, R= 65.0°
Sun Illumination
Earth-Centered J2<E Coordinate System
STS-127/2JA mated TLI targeting



Km Units View From Y= 0.0°, P= 0.0°, R= 16.0° Sun Illumination
Moon-Centered EPM Coordinate System @ 2009y 204d (7-23) 13:24:36 UTC
STS-127/2JA mated TLI targeting