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# STS-125 MOD FRR

## FLIGHT DESIGN AND DYNAMICS



April 14, 2009

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- X Significant Mission Firsts and Unique Items
- X Deviations, Exceedances and Anomalies
- None Special Topics
- None Issues and Concerns
- X Exceptions and Open Work
- X STS-125 Flight Design & Dynamics Division Readiness Statement

# Shuttle CoFR Status Summary

MOD Requirements Codes *	DM	USA FDD
NON-CRITICAL PROC/APPL	G	G
FD-TRAJECTORY	N/A	G
FD-CONSUMABLES (PROP)	N/A	G
FD-ANALYST CERT	N/A	G
FD-CTF	N/A	G
FDF	G	G
EMCC	G	G
CREW TRAINING (RNDZ)	G	G
CERTIFIED FLIGHT CONTROLLERS	G	G
CERTIFIED INSTRUCTORS (RNDZ)	G	G
FTP-NEW OPS	G	G
FLIGHT ANOMALY RES	G	G
ANOMALY-PROCEDURE	G	G
EX/AI FROM PRIOR READINESS REVIEW	None	None
NO CONSTRAINTS	None	None
LEVEL II (PROGRAM) ACTIONS	None	None
MISSION REQUIREMENTS	G	G
CMD PROC	G	G
EXCEPTION RESOLUTION	G	None
FPPP REQ MET	G	G
CONTRACTOR PROCESS INSIGHT	G	N/A

G	Ready to support flight or standard open work
Y	Non-standard open work with expected resolution
R	Open work without expected resolution
N/A	Does not apply
None	None identified

\* as defined in DA8-020 "MOD Certification of Flight Readiness Process" document  
 Note: CRIT PROC/APPL responsibility has been transitioned to FDOC

# Mission Overview Summary

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Launch/Landing Times	Date	GMT	EDT	
Launch Window Open	May 12, 2009	17:11:12	13:11:12	(hh:mm:ss)
Launch Window Close		18:13:07	14:13:07	(hh:mm:ss)
Landing Time (KSC)	May 23, 2009	13:57	09:57	(hh:mm)

Launch window is approximately 66 minutes in duration. FD3 rendezvous is planned.

**First Stage Design Criteria**      **DOLILU II / High Q**  
**Insertion Altitude/Inclination**    **297 nm / 28.45 deg**

**APM** (absolute at the open of the 66-minute launch window)

**I-load Design**                      **1823 lbs**      (APM curve throughout launch window in back-up charts)  
**Projected APM**                      **- 101 lbs**      (UPLR1 APM sim)  
**Projected APM + holdback**    **- 451 lbs**      (UPLR1 APM sim and -350 lbs holdback for OBMR)

Launch hold capability inside of drainback is dependent upon actual DOL performance.  
Abort coverage has sufficient overlap from liftoff to MECO.

# Significant Changes Since Design Baseline

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- **Launch date changed to May 12, 2009**
  - Launch window was redelivered to incorporate the new date
- **Mass properties updated to add Scientific Instruments Command & Data Handling hardware**
  - Total weight increase was estimated to be ~180 lbm
  - Will be picked up in Uplink cycle
- **Stack swap with STS-119**
  - APM loss of ~1000 lbs resulted in negative performance at the open of the launch window
  - Performance will be regained by setting preferred launch time after window open
  - New stack will be picked up in Uplink cycle
- **SSME controller commanded mixture ratio updated**
  - Implemented to compensate for overboard mixture ratio shift identified in flight reconstruction
  - Will use same MPS propellant inventory (R0701S) as STS-119
  - Recent evaluations supporting development of new inventory (R0901S) indicate that STS-125 engines will result in a relatively high fuel bias and overboard mixture ratio
  - Boeing plans to recommend a performance holdback (-350 lbs) to the SICB (ECD 4/15/09)
  - Flight Design can incorporate this via the DOL TDDP

# Significant Changes Since Design Baseline - concluded

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- **A DOLILU Wind Change Redline update is in work (ECD 4/28/09)**
  - Data has been updated and redefined to reflect seasonal vs. annual variations
  - Will be reviewed by the AEFTP and SICB
  - MSFC Natural Environments will not have the software implemented for STS-125 but could perform a manual check and use the approved CR as waiver rationale for an exceedance of the current annual wind change redlines (which have known conservatisms built in)
- **Orbit Adjust burn was moved to Flight Day 9 (prior to clearing vehicle for entry)**
- **AOA priorities reverted back to EDW as prime since permanent runway is operational**
  - DSCT28/Recovery Pre-bank charts and DATA09/FDF Inputs have been updated

# Significant Mission Firsts and Unique Items

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- **Only one TAL site (MRN) is available** (also applies to STS-400)
  - SSP has approved exceptions (directives S063738 and S063739) to requirements to protect 2 TAL sites in the design
- **A gap exists between the last RTLS and PTA boundaries**
  - Continuous intact abort coverage is provided by TAL capability
  - Gap means that Moron must be GO on day of launch
- **Will lose high-speed filter early since no tracking is available after 07:30 MET** (also applies to STS-400)
  - GPS can be used post-MECO
- **C-Band support capability differs from ISS due to lower inclination** (also applies to STS-400)
  - Maximum elevation at Wallops and Dryden will be significantly lower
  - Some pass durations will be longer (13 vs. 8 minutes)
  - Fewer passes will be available for Wallops and Dryden (4)
  - Not expected to affect Navigation accuracy
- **Will perform Flight Day 2 and late inspections but no RPM**

# Significant Mission Firsts and Unique Items - concluded

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- **Will perform an orbit adjust burn following HST release to reduce MMOD risk**
  - Plan to reduce perigee from ~304 nmi to ~160 nmi
  - Elliptical orbit and timeline constrain landing opportunities
    - Pre-flight propellant budget does not support protecting 2 opportunities to both KSC and EDW each day
    - Real-time orbit adjust strategy will be modified per Flight Rules, if necessary, to ensure 2-2-2 to KSC and EDW
  - Propellant budget does not protect for an anytime emergency de-orbit following the orbit adjust burn
    - Ascent/Entry Flight Techniques Panel accepted the trade between emergency de-orbit capability and MMOD risk reduction
  - SSP accepted these trades
- **First flight of GPS Firmware Link 008**
  - No issue for Flight Design



# Deviations, Exceedances and Anomalies

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## Deviation / Exceedances

- **A Contingency Abort Black Zone (CABZ) assessment is not required.**
  - Mass properties do not meet the CABZ assessment criteria of liftoff weight greater than 259,000 lbm and Xcg aft of 1115.0 in.
  - UPL cycle liftoff weight = 264,176 lbs. and Xcg = 1110.0 in.

# CAF Open Work Summary

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- **Exceptions**

- None

- **Standard Open Work**

- All open work is scheduled to be completed per standard flight template
- Open work tables for STS-125 and STS-400 are included in backup pages

- **STS-125 Non-standard Open Work**

- Resolution of OBMR implementation plan 04/15/09
- Wind Change Redline CR 04/28/09
- GNAV INDAT Certification 05/01/09

# Flight Design and Dynamics Readiness Accountability Statement

☑ **Software** : FDD discipline software used to create mission products meets generic and mission-specific Program requirements and is maintained under configuration control in accordance with the appropriate Software Management Plan.

☑ **Flight Software** : All flight software Principal Functions (PFs) owned by FDD are ready for flight. All Discrepancy Reports and Program Notes and Waivers related to USA-owned PFs have been reviewed and appropriately dispositioned for this flight.

☑ **Anomaly Resolution** : All anomalies that could impact mission support have been closed, or have accepted and approved work-arounds in place.

☑ **Production** : All flight reconfiguration products and real-time console support products meet generic and mission-specific Program requirements.

☑ **Operations** : All mission support personnel and instructors are or will be trained, certified and current prior to supporting mission related activities. All flight-specific rendezvous crew training will be completed prior to launch.

The FDD Flight Readiness Review Process Plan (USA009229) and the Flight Operations Flight Preparation and Readiness Plan (USA008977; Appendix D) which define the processes and products required for a successful flight have been executed and the applicable Program CoFR requirements satisfied.

The undersigned certify that the Flight Design and Dynamics Department, upon satisfactory resolution of any noted exceptions, is ready to support flight STS-125.

<b>Flight Design and Dynamics</b>	<b>S. A. Anderson Director</b>	<i>Original signed by S. A. Anderson</i> <small>Signature</small>	<i>04/02/09</i> <small>Date</small>
<b>Ascent/Descent Flight Design</b>	<b>D. J. Brockway Manager</b>	<i>Original signed by D. J. Brockway</i> <small>signature</small>	<i>04/20/09</i> <small>Date</small>
<b>Orbit Flight Design</b>	<b>R. M. Hill Manager</b>	<i>Original signed by R. M. Hill</i> <small>Signature</small>	<i>04/02/09</i> <small>Date</small>
<b>Navigation &amp; Flight Design Integration</b>	<b>G. E. Schrage Manager</b>	<i>Original signed by G. E. Schrage</i> <small>Signature</small>	<i>04/02/09</i> <small>Date</small>
<b>Trajectory Operations &amp; Software Development</b>	<b>K. W. Fletcher Acting Manager</b>	<i>Original signed by K. W. Fletcher</i> <small>Signature</small>	<i>04/02/09</i> <small>Date</small>
<b>Management &amp; Engineering Services</b>	<b>A. T. McDowell Manager</b>	<i>Original signed by A. T. McDowell</i> <small>Signature</small>	<i>04/02/09</i> <small>date</small>

# Flight Design and Dynamics Declaration of Compliance with CoFR Endorsement Requirements for STS-125 Flight Readiness

- ☑ **Software** : FDD discipline software used to create mission products meets generic and mission-specific Program requirements and is maintained under configuration control in accordance with the appropriate Software Management Plan.
- ☑ **Flight Software** : All flight software Principal Functions (PFs) owned by FDD are ready for flight. All Discrepancy Reports and Program Notes and Waivers related to USA-owned PFs have been reviewed and appropriately dispositioned for this flight.
- ☑ **Anomaly Resolution** : All anomalies that could impact mission support have been closed, or have accepted and approved work-arounds in place.
- ☑ **Production** : All flight reconfiguration products and real-time console support products meet generic and mission-specific Program requirements.
- ☑ **Operations** : All mission support personnel and instructors are or will be trained, certified and current prior to supporting mission related activities. All flight-specific rendezvous crew training will be completed prior to launch.

**Requirements Compliance:** All requirements defined by the documents below (as required by the FIDP Compliance Matrix) have been or will be satisfied prior to flight.

DOCUMENT	VERSION	DATE
Flight Implementation Data Pack (FIDP) - Generic	GEN-KV	3/31/09
Flight Implementation Data Pack (FIDP) - Flight Specific	125-BASE-AU	3/24/09

## Waivers & Exceptions:

**None**

*The FDD Flight Readiness Review Process Plan (USA009229) and the Flight Operations Flight Preparation and Readiness Plan (USA008977; Appendix D) which define the processes and products required for a successful flight have been executed and the applicable Program CoFR requirements satisfied. Pending completion of open work and closure of noted exceptions, if applicable, Flight Design & Dynamics is ready to support STS-125.*

*Original signed by S. A. Anderson      4/07/09*

<b>Director</b>	<b>Date</b>
<b>Flight Design &amp; Dynamics</b>	

# Trajectory Operations Contents

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- **Significant Mission Firsts And Unique Items**
- **Anomalies, Exceedances And Deviations**
- **Exceptions and Standard Open Work**
- **Non-Standard Open Work**
- **STS-125 Flight Design & Dynamics Division Readiness Statement**

# Significant Mission Firsts And Unique Items

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- **Launch Window Duration**
  - **66 minutes presents flexibility for launch but challenges for timeline**
    - **Expecting launch up to 20 minutes after widow open for APM**
  - **Grapple and Release are designed for lighting. For each minute of launch slip, both events move earlier (with respect to MET) by the same amount.**
  - **The timeline is already crowded and taking away timeline is posing unique challenges for FAO and FDO.**
  - **Daily PLS opportunities might also be adjusted to keep deorbit at ~ 22 hours MET each day.**

# Significant Mission Firsts And Unique Items

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- **Collision Avoidance**
  - The HST altitude presents unique challenges for collision avoidance screening and processing – both for FDO as well as USSTRATCOM.
  - HST missions historically have are more objects to assess
    - For STS-109, 13 conjunctions were assessed.
    - For STS-103, 58 potential conjunctions on 14 different objects.
    - For STS-82, >100 potential conjunctions on 39 different objects were worked at the FDO console.
      - Many were the result of different reboost targeting strategies
      - PEGUSUS breakup ~ 2 weeks prior to launch
  - Prelaunch assessment for window open, +1 minute, and +2 minutes will be worked. Instead of open, +15 seconds, and +30 seconds.
    - Based on preliminary testing, we're expecting ~5 objects for each launch time.
    - This requires extensive analysis prelaunch by both FDO and USSTRATCOM
    - Completed two pre-launch sims.
  - Manning for USSTRATCOM will be stretched due to the large number of expected conjunctions for STS-125 as well as normal ops for ISS.

# Significant Mission Firsts And Unique Items

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- **Orbit Adjust for MMOD**
  - For STS-125, a programmatic requirement to reduce the altitude of STS-125 has been added to reduce the risk of Micro Meteor Orbital Debris (MMOD). Due to propellant limitations, lowering circularly is not possible.
  - Intend to lower perigee as low as possible but still adhere to the following constraints:
    - 2-2-2 to KSC and EDW
      - The two opportunities for KSC and EDW must be the last two opportunities of the day from EOM through EOM+2.
    - If entry critical damage is discovered, no orbit adjust will be performed unless it assists in the STS-400 launch window
    - Adhere to rule A4-103 which mandates no more than 3 orbits ELS gap when elliptical
  - The flight plan has been designed to accommodate the OA on flight day 9 ASAP post release.
    - Reduces MMOD risk by ~3% by not waiting until flight day 10



# Significant Mission Firsts And Unique Items

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- **Orbit Adjust for MMOD (con't)**
  - **The plan is to reduce perigee from ~304 nm to 160 nm and has several impacts to trajectory operations.**
    - **Reduces the number of CONUS landing opportunities by 60% to KSC and 50% to EDW. Reduces the number of ELS landing opportunities by 66%.**
    - **Lost CONUS opportunities are not available from a timeline perspective anyway.**
    - **SEP-2 will need to be increased to ~8 fps in order to provide adequate clearance with HST post OA.**
  - **Protecting the last two opportunities will exceed the propellant budget.**
    - **2-2-1 to KSC and 1-0-1 to EDW for the FRR cycle and no propellant margin.**
    - **Using propellant margin that is expected with mean usage throughout the mission, the lost opportunities can be regained.**
    - **If insufficient margins exist to regain 2-2-2 to both KSC and EDW, the post orbit adjust perigee will be increased until the desired landing opportunities are available. If no margin is available, the perigee would be raised to ~200 nm.**

# Significant Mission Firsts And Unique Items

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- **Public Entry Risk Assessment (PERA)**
  - **NPR 8715.5: “The assessed collective public risk for Space Shuttle entries shall not exceed the highest risk associated with the ascending entry trajectories into Kennedy Space Center (KSC) from the International Space station orbit inclination of 51.6 degrees...”**
  - **Current highest risk associated with ascending entry trajectories into KSC from 51.6° is 1800x10<sup>-6</sup> casualties/entry**
    - **Highest risk associated with the entry trajectories into KSC from 28.5° is 2370x10<sup>-6</sup> casualties/entry**
    - **23% of all possible KSC 28.5° entry opportunities are higher than 1800x10<sup>-6</sup>**
  - **HQ approval to use maximum KSC 28.5° (2370 x 10<sup>-6</sup>) as limit for nominal EOM placards, thereby allowing all KSC opportunities**
    - **Consistent with philosophy used for public risk management of ISS flights**
    - **Approval via NASA Interim Directive, NID 8715.5-1, Collective Public Risk for Space Shuttle Entry from the Hubble Space Telescope Orbit Inclination of 28.5 Degrees**
  - **FR 125\_A2-99, ENTRY PUBLIC RISK CROSSRANGE PLACARDS**
    - **Outlines changes to placards listed in generic FR A2-207, LANDING SITE SELECTION**

# Anomalies, Exceedances And Deviations

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- **NAV EDIT TACAN Alarm Annunciated During STS-119 Entry**
  - **After processing good TACAN bearing and range for 4 minutes, all three LRU's experienced intermittent bearing lock for about 30 seconds around 77 kft.**
    - **Due to 2 lock bearing requirement after TACAN bearing returned, bearing was not processed by Nav for ~ 30 seconds.**
    - **Loss of bearing on all 3 LRU's was short in duration (1 sec) and infrequent (3 times).**
  - **No significant navigation degradation**
    - **No impact to Nav due to good Nav state and intermittent lock was for a short period of time.**
    - **Processing single string GPS, TACAN range, and ADTA during this time.**
    - **Shortly after message occurred, processed good TACAN range and bearing all the way to the ground.**
  - **Cause of the dropout is still under investigation.**
    - **A/E GPO group is leading MOD effort to better understand cause.**

# Exceptions and Standard Open Work

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- **Exceptions**
  - None
- **Standard Open Work:**
  - Remaining Integrated Sims
  - Successful Completion of Rendezvous Training
  - CTL Trajectory Data (L-35 & L-7)
  - DOD Support Readiness (L-15)
  - Flight Load Checkouts
    - Orbit FDO, A/E FDO
    - RNDZ GPO, A/E GPO,
    - LSO (L-6)

# Non-Standard Open Work

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- **Deleting the +X Translation post MECO for Rendezvous Under Investigation**
  - Performing the +X translation (~ 5 fps) raises apogee from 293 to 297 nm.
  - For the May 12th and 13th launch dates, orbit alignment of the shuttle orbit and HST orbit makes the NC-4 maneuver magnitude 1 fps if the +X translation is performed.
    - A small NC-4 is undesirable since it is the last opportunity to adjust the trajectory prior to rendezvous operations.
    - NC-4 has a direct impact on propellant usage in the NCC/Ti timeframe.
    - NC-4 also provides ability to correct dispersions the from NH maneuver.
  - In general, an NC-4 maneuver magnitude of 6 fps or greater (posigrade or retrograde) is desired to have adequate control of the trajectory.
  - By deleting the +X translation, NC-4 is projected to be 6 fps.
  - Other options are available but may not be feasible for STS-125
    - Inserting an additional burn on FD1 or FD2 to lower apogee.
    - Two rev transfer from NC-4 to Ti.

# STS-125 Flight Design & Dynamics Division Readiness Statement

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The Flight Design and Dynamics Division has performed the reviews necessary to assess the flight readiness relating to flight design requirements definition, crew and flight controller rendezvous training, and trajectory operations. We have determined all applicable responsibilities acceptable for flight pending closure of the identified open work and issues.

*Original signed by Barbara A. Conte 4/02/09*

**Barbara A. Conte**

**Chief, Flight Design Requirements and Integration Branch**

*Original signed by Robert D. Banfield 4/02/09*

**Robert D. Banfield**

**Chief, Flight Design and Dynamics Division**

**As compiled by: FDO/W. H. Tracy  
FDM/D. M. Gabriel**

# Back-Up

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- **Flight Readiness Open Work**
- **Propellant Summary (no change from previous FRR)**
- **APM Curve**
- **Launch Window**
- **Abort Regions**

# STS-125 Flight Readiness Open Work

Item	Responsible	Due Date	Closed	Closure Rationale
<b>USA Flight Design Standard Open Work:</b>				
PROP37 SODB Volume II Amendment	PROP	-	08/27/08	Redelivery not planned
PROP07 Abort Propellant Dump Tagup	PROP	04/07/09	04/07/09	Delivered
DATA43 FDD FRR Data Pack	FDM	04/09/09	04/07/09	Delivered
PROP02 Mass Properties	PROP	04/10/09		
FSW Verification Test Results Review	ADFD	04/12/09		
FSW Verification Test Results Review	Orbit	-	08/22/08	No new test reports
RNDZ/FDO Phasing Plan Meeting	Orbit	-	08/28/08	No changes
DATA45 FDD FSW PF Sign-off	FDM	04/13/09		
Prop Analyst & Flt Controller Tag-up	PROP	04/13/09		
ASCT43 MPS MINIMUM SIGMA LEVEL	ADFD	04/14/09	N/R	Redelivery not required
ONOR29B RNDZ Launch Target Data	Orbit	04/14/09		
PROP06 OMRSD OMS/RCS	PROP	04/14/09	08/27/08	Redelivery not required
ASCT04 Uplink APM	ADFD	04/14/09		
L-4 week LDO Database Freeze	ADFD	04/14/09		
LDO: L-3 week LDO Checkout	ADFD	04/15/09		



# STS-125 Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
<b>USA Flight Design Standard Open Work - Continued:</b>				
RNDZ08 RNDZ Phasing Limits	Orbit	04/17/09		
NAVO16B GPO COTM Data Pack	Navigation	04/21/09		
NAVO18B GPO/ONAV Ops Memo	Navigation	04/21/09		
ONOR37B Daily Planar/Phase Windows	Orbit	04/21/09		
ONOR27 Launch and Landing Data	Orbit	04/23/09		
ASCT44 DOL Uplink I-loads	ADFD	04/20/09		
ONOR29C RNDZ Launch Target Data	Orbit	05/04/09		
Dial Down Decision FIDP	FDM	N/R	N/R	OMS Assist is 0 seconds
DSCT17 Landing Site Tables	ADFD	05/05/09		
RNDZ02 Target Drag Characteristics	Orbit	05/05/09		
PROP00A PROP/Ascent Aborts Tagup	PROP	05/05/09		
PERA Pre-Flight Product	ADFD	05/05/09		
ONOR37C Daily Planar/Phase Windows	Orbit	05/06/09		
ASCT99 OMS Assist - ATO Update	ADFD	05/06/09		
RNDZ09 Rendezvous COLA Plans	Orbit	05/07/09		
PROP02A DOL Mass Properties Updates	PROP	05/07/09		

# STS-125 Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
<b>USA Flight Design Standard Open Work - Continued:</b>				
C-Band tracking Scheduling Message	Navigation	05/07/09		
Pre-Launch Mass Properties Request	PROP	05/07/09		
PROP31 ARD Data	PROP	05/07/09		
PROP33 Ferry Data Package	PROP	05/07/09		
PROP34 MCC Data	PROP	05/07/09		
SRB & ET RTLS Impact Point Update Memo	ADFD	05/09/09		
ASCT42 Collision Avoidance Data	ADFD	05/09/09		
ASCT47 Final MCC Trajectory Inputs	ADFD	05/09/09		
DSCT66 Real-Time Support Files	ADFD	05/09/09		
Range Safety Launch Window Cutout	ADFD	05/09/09	N/R	N/R for non-ISS missions
Flight Annex	Navigation	05/09/09		
ASAB32B AME MCC Support Tables	ADFD	05/10/09		
L-2 day DOLILU System Checkout	ADFD	05/10/09		
DSCT05 Maximum Crossrange Capability	ADFD	05/10/09		

# STS-125 Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
<b>USA Flight Design Standard Open Work - Continued:</b>				
ASAB25 ARD Bias Tables	ADFD	05/11/09		
<b>USA Flight Design Non-Standard Open Work:</b>				
DSCT28 Recovery Prebank Redelivery	ADFD	04/03/09	04/03/09	Delivered
DATA09 FDF Inputs Redelivery	SDM	04/06/09	04/06/09	Delivered
STS-125 TRS Initial Load Checkout	Navigation	04/07/09		
Resolution of OBMR implementation plan	ADFD	04/15/09		
Wind Change Redline CR	ADFD	04/28/09		
GNAV INDAT certification	Navigation	05/01/09		

# STS-125 Flight Readiness Open Work - Continued

Item	Responsible	Due Date	Closed	Closure Rationale/Status
<b>Trajectory Operations Standard Open Work</b>				
Close to Launch Trajectory Data	OFDO	04/07/09	04/07/09	Published on FDOWeb
TCDT Checkout in Ops Cert Mode	AE GPO	-	-	Not planning TCDT
DOD Support Readiness	LSO	04/27/09		
Flight Load Checklist Complete	Nav	04/27/09		
Flight Load Checklist Complete	DOLILU	04/27/09		
Flight Load Checklist Complete	Entry Support	04/27/09		
Flight Load Checklist Complete	Orbit-RNDZ	04/28/09		
CTL Trajectory Data (L-7 days)	OFDO	05/0/509		
Successful Completion of RNDZ Training	RNDZ Instructor	05/05/09		
Flight Load Checklist Complete	RGPO	05/06/09		
Flight Load Checklist Complete	AE FDO	05/06/09		
Flight Load Checklist Complete	AE GPO	05/06/09		
Flight Load Checklist Complete	LSO	05/06/09		
Flight Load Checklist Complete	OFDO	05/06/09		

# STS-125 Flight Readiness Open Work - Concluded

Item	Responsible	Due Date	Closed	Closure Rationale/Status
<b>Trajectory Operations Non-Standard Work:</b>				
Investigate deletion of ET photo +X translation	OFDO	TBD		
<b>DM Standard Open Work:</b>				
Orbiter Readiness Statement	FDRIB	04/22/09		
Range Safety Readiness Statement	FDRIB	04/24/09		

The Flight Design and Dynamics Division has performed a final review and determined all Division and USA FDD open work and/or actions for this mission are closed or acceptable rationale is provided for proceeding with the flight.

\_\_\_\_\_  
Flight Design Manager

Date\_\_\_\_\_

\_\_\_\_\_  
Chief, Flight Design Requirements and Integration Branch

Date\_\_\_\_\_

\_\_\_\_\_  
Director, Flight Design and Dynamics Department

Date\_\_\_\_\_

\_\_\_\_\_  
Chief, Flight Design and Dynamics Division

Date\_\_\_\_\_

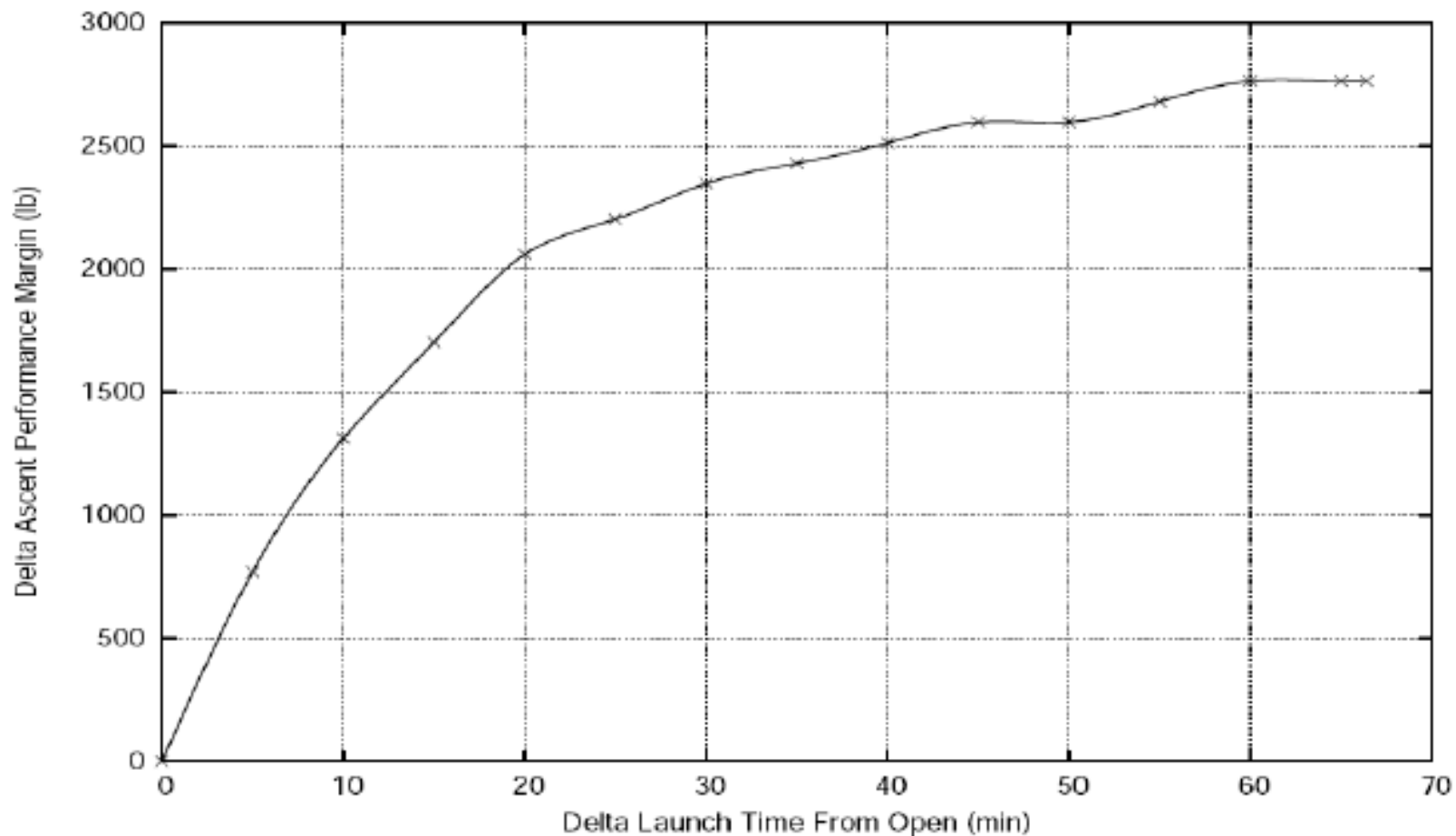
## Propellant Summary

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Propellant Summary	FRCS (lbm)	ARCS (lbm)	OMS (lbm)
Loadings	2446	4970	25063
FRR Design Margins **	220	0	40

\*\* Assumptions: STS-125 ATL, FRR Cycle Trajectory Inputs - 304 nm RNDZ, 0 sec OMS Assist

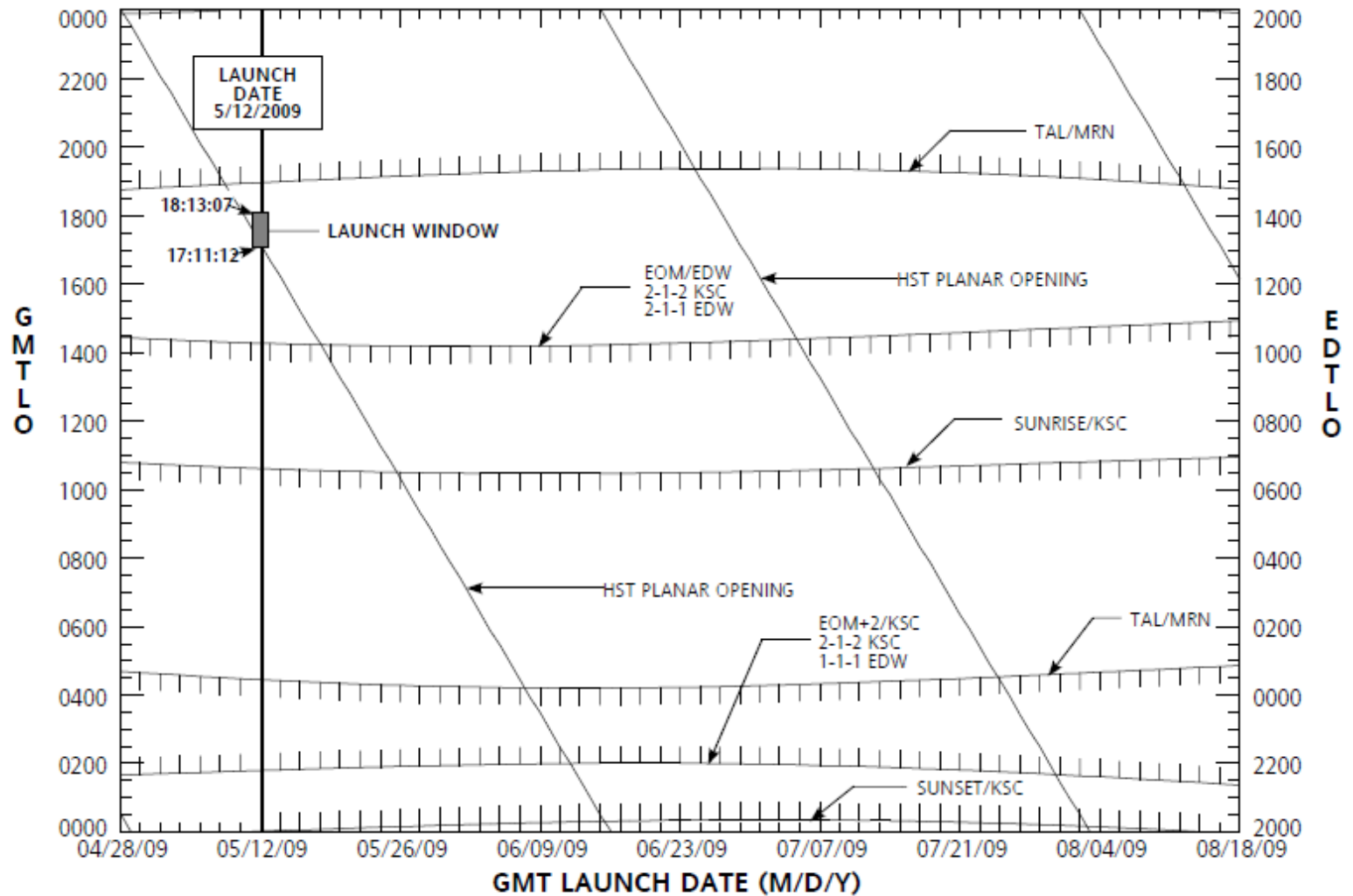
## STS-125 OCF Cycle APM Curve



Mission Duration = 11+0+2  
 Inclination = 28.45°  
 Target ha/hp = 305 x 303 nmi.

## STS-125 LDP LAUNCH WINDOW

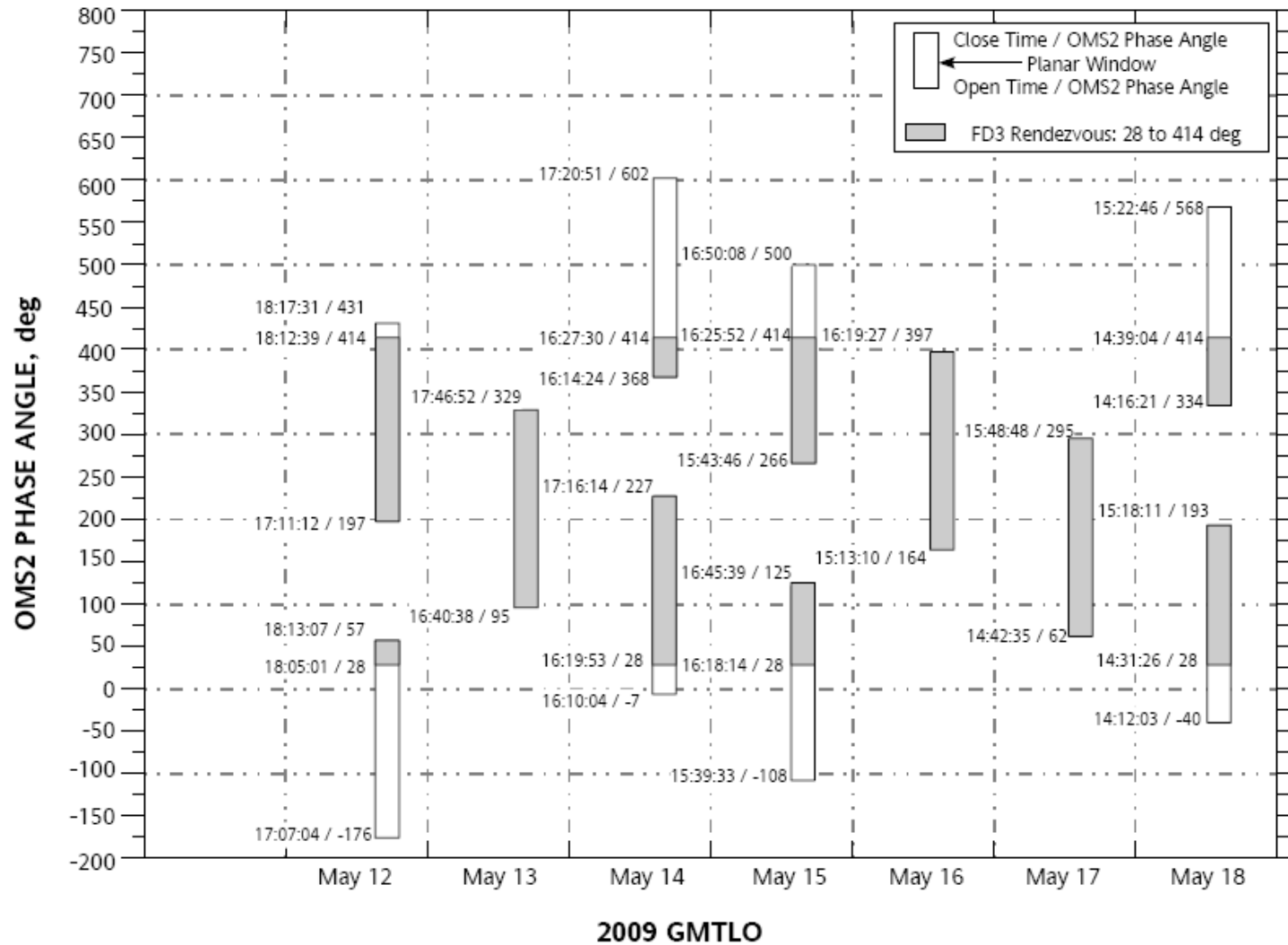
C. Oliver/USH-483L  
 M. Jamroz/USH-483L  
 March 18, 2009



Note: EOM lighting lines, based on an OMS2 phase angle of 197 deg, are representative only.



### STS-125 LDP DAILY PLANAR/PHASE WINDOWS



# STS-125 FRR DIGITAL LAUNCH WINDOW

C. Oliver/USH-483L  
M. Jamroz/USH-483L

NOMINAL FLIGHT DURATION = 10:20:46 (D:H:M) MET

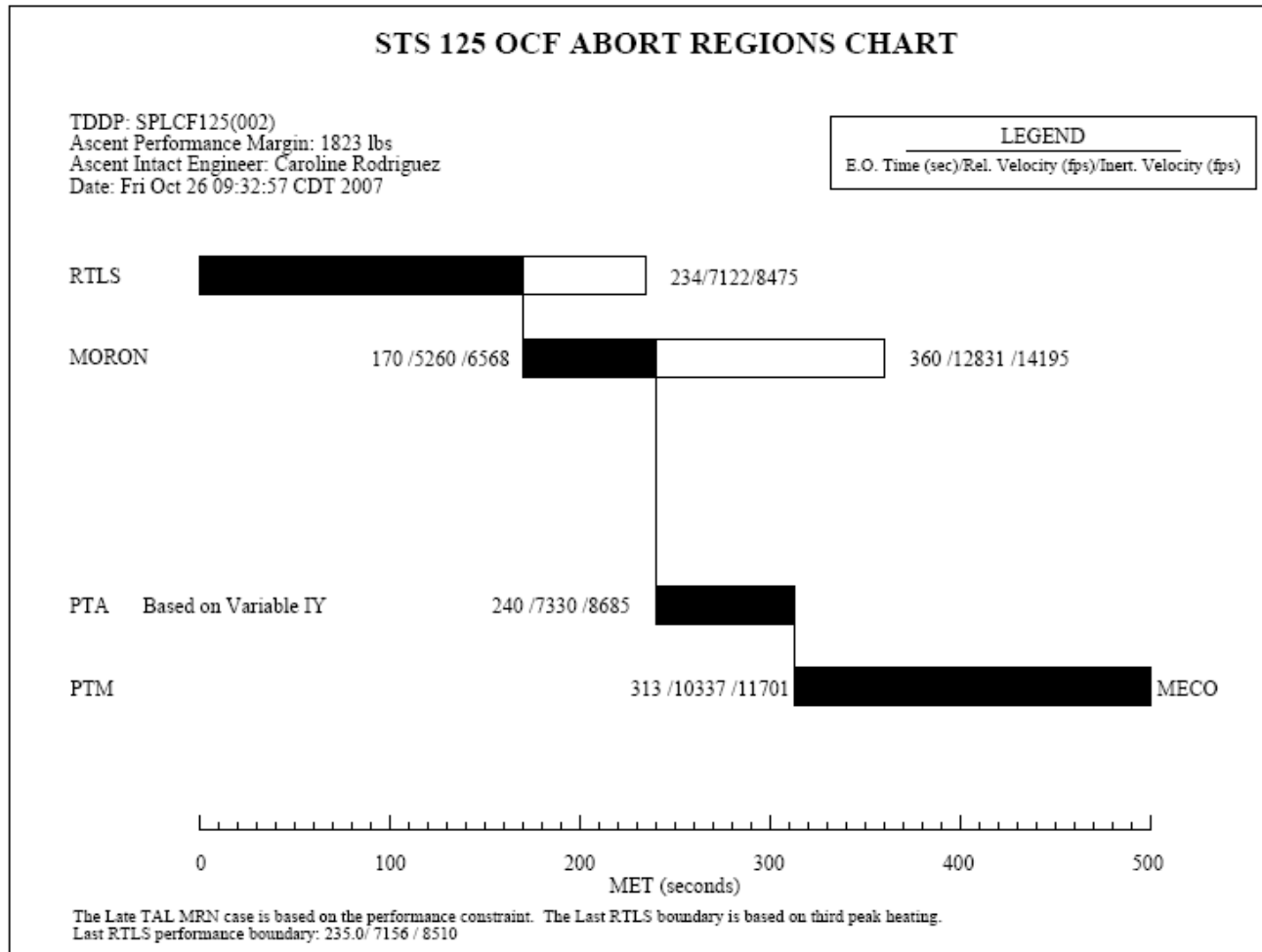
Date At Greenwich (M/D/Y)	WINDOW OPENINGS				WINDOW CLOSINGS			
	1	2	3	4	5	6	7	8
	TAL/MRN SR-15 min GMT (H:M)	KSC Sunrise SR+3 min GMT (H:M)	EOM EDW SR-10 min GMT (H:M)	Planar/ Phase Opening GMT (H:M:S)	KSC Sunset SS-3 min GMT (H:M)	EOM+2 KSC SS+10 min GMT (H:M)	Planar/ Phase Closing GMT (H:M:S)	TAL/MRN SS+15 min GMT (H:M)
05/09/2009	04:30	10:39	14:19	18:38:40	23:59	01:46	19:44:56	18:55
05/10/2009	04:29	10:39	14:18	18:08:18	*	01:46	19:14:17	18:56
05/11/2009	04:28	10:38	14:18	17:41:49	00:00	01:47	18:43:41	18:57
<b>05/12/2009</b>	<b>04:27</b>	<b>10:37</b>	<b>14:17</b>	<b>17:11:12</b>	<b>00:01</b>	<b>01:47</b>	<b>18:13:07</b>	<b>18:58</b>
05/13/2009	04:27	10:37	14:17	16:40:38	00:01	01:48	17:46:52	18:59
05/14/2009	04:26	10:36	14:16	16:14:24	00:02	01:48	17:16:14	18:59
05/15/2009	04:25	10:36	14:16	15:43:46	00:02	01:49	16:45:39	19:00
05/16/2009	04:24	10:35	14:15	15:13:10	00:03	01:50	16:19:27	19:01
05/17/2009	04:23	10:35	14:15	14:42:35	00:04	01:50	15:48:48	19:02
05/18/2009	04:23	10:34	14:14	14:16:21	00:04	01:51	15:18:11	19:03
05/19/2009	04:22	10:34	14:14	13:45:43	00:05	01:51	14:47:36	19:04
05/20/2009	04:21	10:33	14:14	13:15:07	00:05	01:52	14:21:23	19:04
05/21/2009	04:20	10:33	14:13	12:44:37	00:06	01:52	13:50:45	19:05
05/22/2009	04:20	10:32	14:13	12:18:17	00:07	01:53	13:20:09	19:06
05/23/2009	04:19	10:32	14:13	11:47:40	00:07	01:53	12:49:34	19:07
05/24/2009	04:19	10:31	14:13	11:17:05	00:08	01:54	12:23:19	19:07
05/25/2009	04:18	10:31	14:12	10:50:52	00:08	01:54	11:52:42	19:08

The Launch Period begins 10 minutes before Launch Window Open and ends 10 minutes after Launch Window Close

The nominal Launch Window open and close times are shown in boxes

- 1 and 8 protect TAL landings
- 2 and 5 protect daylight launch
- 3 and 6 protect protect 2-1-2 daylight landing opportunities to KSC and 2-1-1 daylight landing opportunities to EDW (based on a representative OM52 phase angle of 197 deg)
- 4 and 7 are based on the planar or phase window (FD3 rendezvous) open and close for a 304 NM target altitude  
Planar window duration is 66 minutes
- \* KSC Sunsets are more than 24 hours apart; therefore, no KSC Sunset for 5/10/09 GMT date exists

# STS-125 Abort Regions Chart



*Note: Due to inherent assumptions made in its creation, this chart may not accurately depict DOL conditions and intact abort boundary times.*