
STS-119 MOD FRR

FLIGHT DESIGN AND DYNAMICS

January 16, 2009

Agenda Item 6

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- None Special Topics
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Shuttle CoFR Status Summary

MOD Requirements Codes *	DM	USA FDD
CRITICAL PROC./APPL	N/A	N/A
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

Mission Overview Summary

Launch/Landing Times	Date	GMT	EST	
Launch Window Open	Feb. 12, 2009	12:23:37	07:23:37	(hh:mm:ss)
Launch Window Close		12:33:37	07:33:37	(hh:mm:ss)
Landing Time (KSC)	Feb. 26, 2009	07:19	02:19	(hh:mm)

Reboost plan is expected to provide 7 consecutive FD3 rendezvous opportunities

First Stage Design Criteria **DOLILU II / High Q**
Insertion Altitude/Inclination **122 nm / 51.6 deg**

APM (above a 5 minute window centered at in-plane)

I-load Design **2156 lbs**

Projected APM* **1303 lbs**

* Based on 01/07/09 APM simulation and projected OMS Assist Timer increase

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

Propellant Summary

Propellant Summary	FRCS (lbm)	ARCS (lbm)	OMS (lbm)
Loadings	1912	4970	22761

FRR Design Margins **ARCS/OMS = 28 lbm**
FRCS = 2 lbm

** Assumptions: STS-119 ATL, FRR Cycle Trajectory Inputs – 195 nm RNDZ, 88 sec OMS Assist, 2 mated water dumps

Significant Changes Since Design Baseline

- **Launch Date Updates**
 - Moved from November 6, 2008 to December 4, 2008 to February 12, 2009
- **Mission Duration updated from 13+1+2 to 14+1+2 Days**
- **Mated Beta Angle Constraint changed from 65° to 60°**
- **SSME Controller Mixture Ratio Software Update**
 - Update implemented to correct LH/LOX mixture ratio shift observed in flight reconstruction
 - No impact to standard design process
 - Same implementation as STS-126
- **Stack Swap with STS-125**
 - STS-125 stack is a better performing stack than STS-119 original stack
- **Removed the GN2 offload due to APM gains from the Stack Swap**
- **Implemented Multi-Stage De-Orbit for contingency payload return cases**

Significant Mission Firsts and Unique Items

- **First Flight of DTO 854, Boundary Layer Transition (BLT) Flight Experiment**
 - No issues for FDD with the experiment
 - Supported by the Entry GN&C Panel and the AEFTP
- **First Flight of EMCC Linux Hardware**
 - Tracking checkout of New Linux Hardware as non-standard open work
- **DOLILU Block Update 2009.01**
 - Networking hardware rack equipment (switches and routers) have been relocated in the MCC
 - End-to-end testing and ISVT testing have been completed with no issues.
- **Permanent Runway at Edward's Air Force Base will be operational for STS-119**
 - FAA plans to certify the MLS on both ends of the runway on January 16 – 18, 2009
 - The temporary runway Flight Rules will still be available in the Annex, if required.

Deviations, Exceedances and Anomalies

- **Deviations/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.
- FRR cycle liftoff weight = 266,398 lbs. and Xcg = 1110.8 in.

- **No Dock PLS exceeds the Nominal End of Mission downweight limit by 1,836 lbm**

- Preflight thermal analysis is not required
- Real-time analysis will be performed if required
- Mission-specific flight rule has been submitted

- **No Significant ARs**

- **No NCRs or Open Risk Assessments**

Deviations, Exceedances and Anomalies (concluded)

- **Previous Mission Anomalies (STS-126)**

- **TRS Backup Unexpected Shutdown (AR 075970)**

- Power cycling of failed Data Distribution Switch.
- Memorandum of Agreement in work for coordination between Navigation and FSM.
- Tracking as non-standard open work

- **Rendezvous Radar Issues**

- During undock the Ku Radar to provide corrupted, unusable data.
- Suspected Shuttle hardware issue, no impact to STS-119
- Rendezvous ONAVs were briefed on events during STS-126

Exceptions and Standard Open Work

- **Exceptions**
 - None
- **Standard Open Work (complete listing in backup charts)**
 - All open work is scheduled to be completed per standard flight template
 - No issues have been identified

Non-Standard Open Work

No concerns identified for completing any of the open work

- DOL Loads QA Operator Certification 01/21
- DOL OPS 2 Operator Certification 01/21
- Landing Analyst Certification 01/21
- MARS Orbit 3 Support Certification 01/31
- NAV/FSM Memorandum of Agreement 01/31
- Rendezvous ONAV Certification 01/31

Rescue Mission Status

- **STS-127 has been designated as the LON flight for STS-119**
- **On January 23, 2009, the Program will decide whether STS-125 or STS-127 launches in May**
 - If STS-127 launch date slips then MOD's flight production plan will continue to support a May launch date to protect an LON call-up
- **All rescue mission-specific analyses will be performed after call-up**

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 FDD Software Management Plan. All FDD software transitioned to FDOC on 1/01/09 in support of STS-119 met requirements and was maintained in accordance with the FDD 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 FDDOC Flight Readiness Review Process Plan (USA009229) and the Flight Operations Flight Preparation and Readiness Plan (USA008977; Appendix D and E) which defines 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-119.

Flight Design and Dynamics	S. A. Anderson Director	<i>Original Signed by S.A. Anderson</i> Signature	<i>1/06/09</i> date
Flight Design and Dynamics Software	F. M. Hamilton Software Project Manager	<i>Original Signed by F.M. Hamilton</i> signature	<i>1/06/09</i> date
Ascent/Descent Flight Design	D. J. Brockway Manager	<i>Original Signed by D. J. Brockway</i> Signature	<i>1/06/09</i> Date
Orbit Flight Design	R. M. Hill Manager	<i>Original Signed by R. M. Hill</i> signature	<i>1/06/09</i> date
Navigation & Flight Design Integration	G. E. Schrage Manager	<i>Original Signed by G.E. Schrage</i> signature	<i>1/06/09</i> date
Trajectory Operations & Software Development	F. M. Hamilton Manager	<i>Original Signed by F.M. Hamilton</i> signature	<i>1/06/09</i> date
Management & Engineering Services	A. T. McDowell Manager	<i>Original Signed by A. T. McDowell</i> Signature	<i>1/06/09</i> date

Flight Design and Dynamics Declaration of Compliance with CoFR Endorsement Requirements for STS-119 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 FDD Software Management Plan. All FDD software transitioned to FDOC on 1/01/09 in support of STS-119 met requirements and was maintained in accordance with the FDD 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-KL	12/22/08
Flight Implementation Data Pack (FIDP) - Flight Specific	119-BASE-AJ	12/23/08

Waivers & Exceptions:

None

The FDDOC Flight Readiness Review Process Plan (USA009229) and the Flight Operations Flight Preparation and Readiness Plan (USA008977; Appendix D and E) which defines 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 Operations Center is ready to support STS-119.

Original Signed by S.A. Anderson 01/09/09
Director **Date**
Flight Design & Dynamics
Operations Center

DM Flight Design and Dynamics (Trajectory Operations)

Significant Mission Firsts and Unique Items

- **ISS Phasing Strategy**

- 1/14/09 burn: Posigrade 9.8 fps (3.0 mps).
- 2/4/09 burn: Posigrade 5.2 fps (1.6 mps).
 - Burn combination designed to maximize consecutive launch opportunities with FD3 rendezvous capability for STS-119 as well as provide acceptable Progress 32P launch opportunities.

- **Reboost/Deboost Capability**

- STS-119 JURE capability will be provided with the SM engines
 - Propellant available for one full burn and a second half burn
 - Takes 4 days to refill SM fuel tanks after a full burn
 - 2 days will provide enough fuel for half a burn
 - Full burn provides 25.5 fps delta velocity
- Mated Reboost being assessed
 - Not in timeline or prop budget
 - If prop becomes available and timeline supports (>FD9)

Significant Mission Firsts and Unique Items

- **Visiting Vehicle Traffic during STS-119**
 - Progress 32P Launch on 2/10/08; Dock on 2/13/08 (STS-119 FD2)
 - Docking is ~ 8 hours prior to NC3 – NC3 cannot be cancelled
 - Pre-Day of Rendezvous relative motion analysis will include Shuttle, ISS, and Progress trajectories
- **Jettison of S6 Thermal Covers (4) on FD5 (end of EVA1)**
 - Same jettisons that occurred on STS-117/13A (S3/S4)
 - Covers re-entered within 10 days; tracked by USSTRATCOM
 - TOPO jettison analysis shows safe long term relative motion with ISS
 - Covers expected to be far in front at deorbit TIG – no concern
 - Orbit adjust planning will have to consider relative motion with thermal covers
- **SEITE/MAUI/SIMPLEX payload of opportunity**
 - 2nd flight for SEITE opportunity
 - Lessons learned from STS-126 incorporated during a pre-coordination tagup with DoD representatives

Exceptions and Standard Open Work

- **Exceptions**
 - None
- **Standard Open Work (complete listing in backup charts)**
 - All open work is scheduled to be completed per standard flight template
 - No issues have been identified

Non-Standard Open Work

- **Real-time RADAR Tracking Request Coordination**
 - **FDO CHB Annex procedures update** 01/29/09
- **Middeck Mass Transfer Coordination**
 - **FDO CHB updates** 02/05/09
- **EMCC #2 Checkout** 02/05/09

STS-119 Flight Design & Dynamics Division Readiness Statement

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 B. Conte

Barbara A. Conte

Chief, Flight Design Requirements and Integration Branch

Original signed by G. Oliver

Gregory T. Oliver

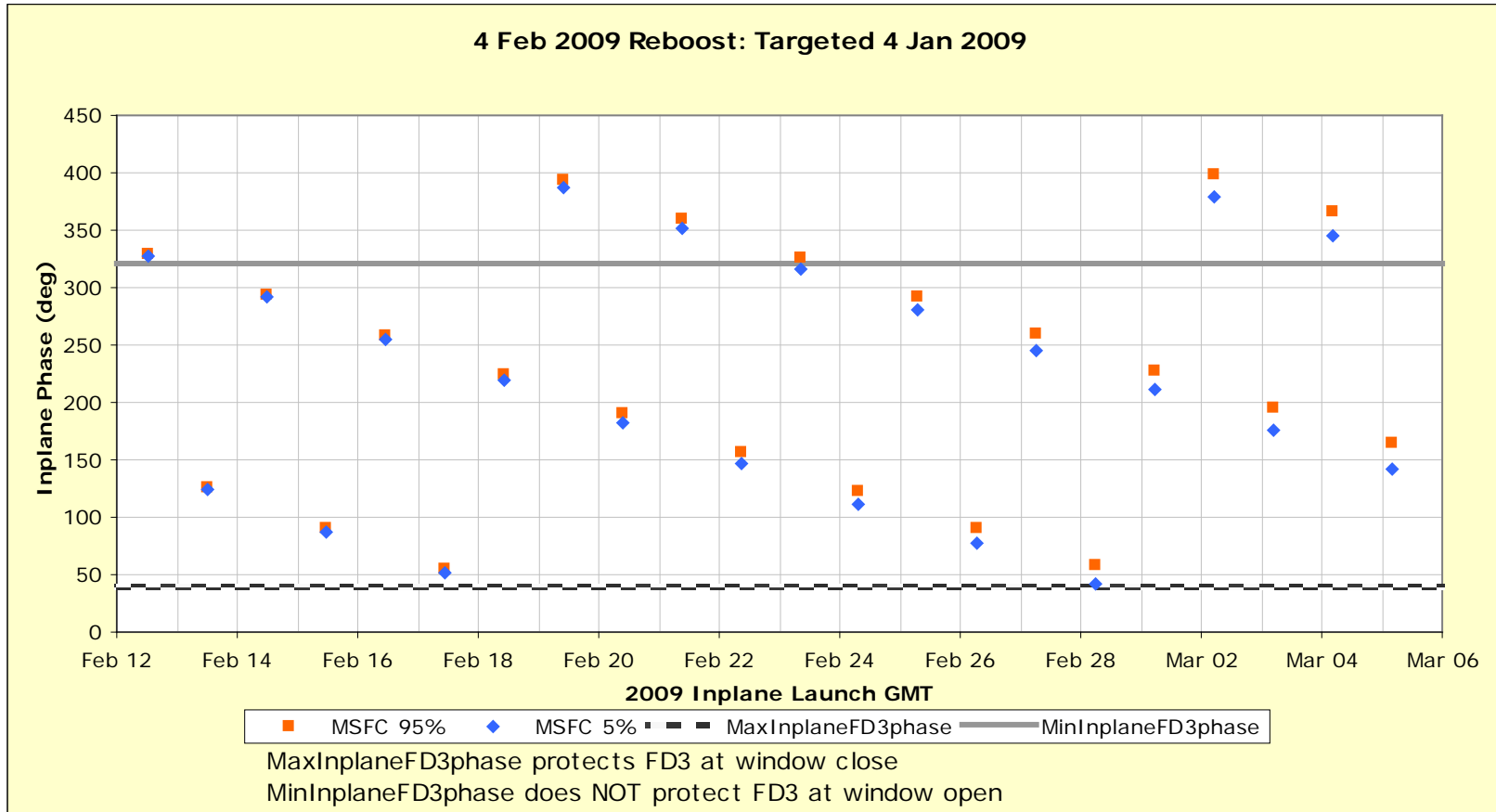
Chief, Flight Design and Dynamics Division

**As compiled by: FDM/J. Flinn
FDO/D. Mayhew**

Back-Up

- **Launch Window “DOT” Chart**
- **Flight Readiness Open Work**
- **Items listed below in a separate file**
 - **Launch Window**
 - **Abort Regions Chart**
 - **Nominal ET Impact Area**

Launch Window "DOT" Chart



Flight Readiness Open Work

Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Standard Open Work:				
FSW Verification Test Results Review	Orbit	01/13/09	01/13/09	
RNDZ/FDO Phasing Plan Meeting	Orbit	01/13/09	01/13/09	
DATA45 FDD FSW PF Sign-off	FDM	01/14/09	01/14/09	
ONOR29B RNDZ Launch Target Data	Orbit	01/14/09		
DATA43 FDD FRR Data Pack	FDM	01/15/09	01/14/09	
PROP06 OMRSD OMS/RCS	PROP	01/15/09		
PROP07 Abort Propellant Dump Tagup	PROP	01/15/09		
FSW Verification Test Results Review	ADFD	01/17/09		
L-4 week LDO Database Freeze	ADFD	01/19/09		
RNDZ08 RNDZ Phasing Limits	Orbit	01/19/09		
PROP02 Mass Properties	PROP	01/20/09		
Prop Analyst & Flt Controller Tag-up	PROP	01/21/09		
PROP37 SODB Volume II Amendment	PROP	01/21/09		
ONOR37B Daily Planar/Phase Windows	Orbit	01/21/09		
NAVO16B GPO COTM Data Pack	Navigation	01/22/09		

Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Standard Open Work - Continued:				
NAVO18B GPO/ONAV Ops Memo	Navigation	01/22/09		
ASCT04 Uplink APM	ADFD	01/22/09		
ONOR27 Launch and Landing Data	Orbit	01/23/09		
LDO: L-3 week LDO Checkout/TCDT Sim	ADFD	01/25/09		
ASCT44 DOL Uplink I-loads	ADFD	01/28/09		
ONOR29C RNDZ Launch Target Data	Orbit	02/02/09		
Dial Down Decision FIDP	FDM	02/03/09		
PROP00A PROP/Ascent Aborts Tagup	PROP	02/05/09		
RNDZ02 Target Drag Characteristics	Orbit	02/05/09		
DSCT17 Landing Site Tables	ADFD	02/05/09		
ONOR37C Daily Planar/Phase Windows	Orbit	02/05/09		
C-Band tracking Scheduling Message	Navigation	02/05/09		
PERA Pre-Flight Product	ADFD	02/05/09		
ASCT99 OMS Assist - ATO Update	ADFD	02/06/09		
RNDZ09 Rendezvous COLA Plans	Orbit	02/06/09		
PROP33 Ferry Data Package	PROP	02/07/09		

Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Standard Open Work - Continued:				
PROP34 MCC Data	PROP	02/07/09		
PROP02A DOL Mass Properties Updates	PROP	02/07/09		
Pre-Launch Mass Properties Request	PROP	02/07/09		
PROP31 ARD Data	PROP	02/07/09		
SRB & ET RTLS Impact Point Update Memo	ADFD	02/09/09		
ASCT42 Collision Avoidance Data	ADFD	02/09/09		
ASCT47 Final MCC Trajectory Inputs	ADFD	02/09/09		
DSCT66 Real-Time Support Files	ADFD	02/09/09		
Range Safety Launch Window Cutout	ADFD	02/09/09		
Flight Annex	Navigation	02/09/09		
ASAB32B AME MCC Support Tables	ADFD	02/10/09		
L-2 day DOLILU System Checkout	ADFD	02/10/09		
DSCT05 Maximum Crossrange Capability	ADFD	02/10/09		
ASAB25 ARD Bias Tables	ADFD	02/11/09		

Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Non-Standard Open Work:				
RTLS Dump Configuration FIDP Advisory	FDM	01/13/09	01/09/09	Generic FIDP Released
DOL Loads QA Operator Certification	ADFD	01/21/09		
DOL OPS 2 Operator Certification	ADFD	01/21/09		
Landing Analyst Certification	ADFD	01/21/09		
MARS Orbit 3 Support Certification	Orbit	01/31/09		
NAV/FSM Memorandum of Agreement	Navigation	01/31/09		
Rendezvous ONAV Certification	Navigation	01/31/09		

Flight Readiness Open Work - Continued

Item	Responsible	Due Date	Closed	Closure Rationale/Status
Trajectory Operations Standard Open Work				
Close to Launch Trajectory Data	OFDO	01/08/09	01/08/09	
TCDT Checkout in Ops Cert Mode	AE GPO	01/27/09		
DOD Support Readiness	LSO	01/28/09		
Flight Load Checklist Complete	Nav	01/28/09		
Flight Load Checklist Complete	DOLILU	01/28/09		
Flight Load Checklist Complete	Entry Support	01/28/09		
Flight Load Checklist Complete	Orbit-RNDZ	01/28/09		
Flight Load Checklist Complete	RGPO	02/06/09		
Flight Load Checklist Complete	AE FDO	02/06/09		
Flight Load Checklist Complete	AE GPO	02/06/09		
Flight Load Checklist Complete	LSO	02/06/09		
Flight Load Checklist Complete	OFDO	02/06/09		

Flight Readiness Open Work - Continued

Item	Responsible	Due Date	Closed	Closure Rationale/Status
Trajectory Operations Non-Standard Work				
Lead FDO Certification	OFDO	01/13/09	01/13/09	
FDO Transfer presentation at Transfer Summit	OFDO	01/13/09	01/13/09	Presented at Summit
Radar Tracking FDO CHB Updates	OFDO	01/29/09		
FDO CHB updates for real-time transfer issue	OFDO	02/05/09		
EMCC #2 Checkout	OFDO	02/05/09		

Flight Readiness Open Work - Concluded

Item	Responsible	Due Date	Closed	Closure Rationale/Status
DM Standard Open Work:				
Orbiter Readiness Statement	FDRIB	01/23/09		
Range Safety Readiness Statement	FDRIB	01/27/09		

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_____