
STS-124 MOD FRR

FLIGHT DESIGN AND DYNAMICS

April 29, 2008

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Agenda Item 6A

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- None Special Topics
- None Issues and Concerns
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Shuttle CoFR Status Summary

MOD Requirements Codes *	DM	USA FDD
CRITICAL PROC./APPL	G	G
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	N/A
CERTIFIED FLIGHT CONTROLLERS	Y	Y
CERTIFIED INSTRUCTORS (RNDZ)	G	N/A
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	EDT	
Launch Window Open	May 31, 2008	20:56:50	16:56:50	(hh:mm:ss)
Launch Window Close		21:10:00	17:10:00	(hh:mm:ss)
Landing Time (KSC)	June 13, 2008	16:09	12:09	(hh:mm)

Consecutive FD3 capability is expected through a launch on June 6th.

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

APM (above a 3-minute window centered at in-plane)

I-load Design	1165 lbs	
Projected APM*	1869 lbs	(With Full Cryo Load - 1585 lbp)

- Pending APM Changes and Threats: OMS Ballasting for Full Cryo Load (~150 lbp); OV-103 Weight and CG Report due 5/15 (estimate ~200 lbp); Update to Transition June Atmosphere (~300 lbp)

* Based on 4/15/08 APM simulation and 4/22/08 Green Book

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	= 25 lbm	
	FRCS	= 0 lbm	

** Assumptions: STS-124 ATL, FRR Cycle Trajectory Inputs – 181 nm RNDZ, 149 sec OMS Assist, 1 mated water dump

Significant Requirements Changes Since Design Baseline

- **Launch date from 4/24/08 to 05/25/08 to 05/31/08**
 - 5/31/08 Launch date will be implemented during FDD's standard Uplink design cycle
- **Updates in work to remove cryogenic offload**
 - Full Cryo load will be implemented during FDD's Uplink design cycle
- **Addition of Lightweight Middeck Accommodations Rack (MAR)**
 - Included in the current APM

Significant Mission Firsts and Unique Items

- **60-degree Mated Beta Angle in effect for this flight**
- **Launch Window duration of 3-minutes used for performance reporting**
- **Multi-stage de-orbit was implemented for the Contingency Payload Return Cases**
- **No Flight Day 2 inspection capability due to the unavailability of the OBSS**
- **Public Entry Risk Assessment (PERA) transition from DM42/Descent Analysis to USA Ascent/Descent Flight Design**
 - **USA/FDD is working with DM42 to develop production process with controlled procedures and formal customer agreements.**
 - **The decision as to whether USA/FDD will be the prime product developer or backup/QA for STS-124 is in work (ECD 05/08/08).**

Significant Mission Firsts and Unique Items (concluded)

- **Crew Procedures / Braking Flight Rule (A4-108, A10-146) Updates for STS-124 and Subsequent Missions**
 - Changes due to the Edwards Temporary Runway Analysis were incorporated to all sites to simplify the crew procedures.
 - The crew braking procedure was updated to define the preferred brake initiation at 120 KGS or 5000 ft runway remaining, whichever comes first.
- **Edwards temporary runway (EDT) will be available for use**
 - All Navigation products reflect appropriate changes
 - Flight Rules have been updated for EDT use

Deviations, Exceedances and Anomalies

- **Deviation / Exceedances**

- 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 = 268,936 lbs, Xcg = 1109.8
- No Dock PLS and No Deploy JEM / No Retrieve OBSS downweights exceed the NEOM downweight limit
 - Preflight thermal analysis is not required
 - Real-time analysis will be performed if required
 - Mission-specific flight rule has been submitted

- **Previous Mission Anomalies**

- FOV-1 workarounds in place since STS-121 are still in effect
 - Wallops C-band high-speed refraction correction multipliers set to zero by Nav (documented in console procedure AEGNAV-5B)
 - Post-MECO filter degradation for May launch expected to be ~7 fps (radial)
 - Reduces likelihood of using ground filter, but onboard and GPS available

Deviations, Exceedances and Anomalies (continued)

- **Previous Mission (STS-123) and Previous Flight of OV-103 (STS-120)**
 - None affecting Flight Design
- **Significant ARs**
 - None
- **Non-Conformance Reports (NCRs)**
 - **NCR #012609 – Trajectory Server GPS Time Mis-configuration**
 - For STS-122, the Navigation group MED was incorrectly build with the GPS Offset Days based on year 2008 and the GPS to GMT Time Adjust set to a year of seconds. This caused an additional year to be added to the GPS time conversion computation.
 - STS-124 was never designed outside of 2008; therefore, this NCR does not affect this flight
 - Corrective actions including procedure, QA, and training updates have been completed
 - NCR was closed on 4/15/08

Deviations, Exceedances and Anomalies (concluded)

- **Non-Conformance Reports (NCR) - Continued**
 - **NCR #012698 – STS-123 Trajectory Server Flight Database Configuration Issue**
 - **STS-123 cycle B database installed in the wrong location.**
 - **Flight Solution:**
 - **STS-123 cycle B database copied to the correct location prior to L-1**
 - **IVT conducted post-install configuration**
 - **STS-124 Mitigation: All STS-124 Mitigation Actions have been completed**
 - **Increase SCM GA peer inspection oversight**
 - **IVT conducted post-install configuration test in CDE**
 - **TAO procedures modified to include availability check during 1st CERT simulation**
 - **Long term (post STS-124 installations):**
 - **SCM will develop verification tool to automate install**
 - **TRS GA will conduct post-install configuration test in CDE**
- **Open Risk Assessments**
 - **None**

Exceptions and Standard / Non-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
 - Flight Controller Certifications – Certified back-ups available
 - Range Safety Operator Certification 05/01/08
 - Winds Coordinator Certification 05/16/08
 - Decision on PERA Prime/Backup Role for USA/FDD 05/08/08

Rescue Mission Status

- **Baselined launch date is currently Targeted for August 29, 2008**
- **FDD assessed the expected OV-105 configuration to the existing suite of as-built STS-323 products and I-Loads**
 - **No FDD production updates were identified**
 - **FDD has identified a potential for exceedances of aerodynamic 3rd peak heat rates during powered RTLS trajectories for lightweight LON missions**
 - **Noted as part of STS-400 LON design but was not seen as part of STS-323 LON design or STS-326 assessment**
 - **For STS-326, FDD will address this possible exceedance post-callup as part of the Uplink Cycle**
 - **FDD has identified exceedances of flight control certification envelopes during Glide RTLS trajectories for lightweight LON missions**
 - **Currently working I-Load patch efforts on STS-400 to address noted concerns due to minimal post-callup time on that flight**
 - **For STS-326, FDD will provide flight-specific GRTLS trajectories for Boeing evaluation as part of the post-callup Uplink Cycle**
- **All pre-callup production has been completed**

Flight Design and Dynamics Readiness Accountability Statement

☑Software : All software used to create mission products, and MCC software required for mission support including related ISS software and designated critical processors meets generic and mission-specific Program requirements, and is maintained under configuration control 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 are or will be certified and current prior to supporting mission related activities.

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-124.

Flight Design and Dynamics	A. F. Najarian Director	Original signed by A. F. Najarian <small>Signature</small>	4/16/08 <small>Date</small>
Flight Design and Dynamics Software	F. M. Hamilton Software Project Manager	Original signed by F. M. Hamilton <small>Signature</small>	4/16/08 <small>Date</small>
Ascent/Descent Flight Design	D. J. Brockway Manager	Original signed by D. J. Brockway <small>signature</small>	4/16/08 <small>date</small>
Orbit Flight Design	R. M. Hill Manager	Original signed by R. M. Hill <small>signature</small>	4/16/08 <small>date</small>
Navigation & Flight Design Integration	G. E. Schrage Manager	Original signed by G. E. Schrage <small>signature</small>	4/16/08 <small>date</small>
Trajectory Operations & Software Development	F. M. Hamilton Manager	Original signed by F. M. Hamilton <small>signature</small>	4/16/08 <small>date</small>
Management & Engineering Services	A. T. McDowell Manager	Original signed by A. T. McDowell <small>signature</small>	4/16/08 <small>date</small>

Flight Design and Dynamics Declaration of Compliance with CoFR Endorsement Requirements for STS-124 Flight Readiness

- ☑ **Software** : All software used to create mission products, and MCC software required for mission support including related ISS software and designated critical processors meets generic and mission-specific Program requirements, and is maintained under configuration control 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 are or will be certified and current prior to supporting mission related activities.

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.

<u>DOCUMENT</u>	<u>VERSION</u>	<u>DATE</u>
Flight Implementation Data Pack (FIDP) - Generic	GEN-JS	03-31-08
Flight Implementation Data Pack (FIDP) - Flight Specific	124-BASE-AE	04-21-08

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-124.

Original signed by Angie Najarian on 4/24/08

Director **Date**
Flight Design & Dynamics
Operations Center

DM Flight Design and Dynamics (Trajectory Operations)

Significant Mission Firsts and Unique Items

- **ATV Reboost & Deboost Capability**

- ATV is now docked to the ISS

- **ATV Reboost/Deboost Capability has not yet been demonstrated**

- First test burn (~1 m/s) was completed on 4/21/08 with no issues reported.

- 2nd ATV Reboost (~2.85 m/s) for ISS Phasing is scheduled for 4/25/08

- **ATV Translation Burn Capability is Required for ISS JURE support**

- Available Delta V is TBD, but will be determined following 4/25/08 reboost

- Emergency ATV Departure to Permit ISS SM Burns is not currently an option.

Exceptions and Standard / Non-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**

- **Flight Controller Certifications**

- **ORBIT 1 RPS Certification** 4/28/08
- **ORBIT 1 GPO Currency** 4/28/08
- **ORBIT 4 FDO Flight Controller Physical** 5/02/08

- **FDO STS-124 Annex updates to incorporate STS-122 lessons learned – ECD 5/21/08**

STS-124 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 and trajectory operations. We have determined all applicable responsibilities acceptable for flight pending closure of the identified open work and issues.

Original Signed by Kim W. Anson for Barbara A. Conte

Barbara A. Conte

Chief, Flight Design Requirements and Integration Branch

Original Signed by Gregory T. Oliver

Gregory T. Oliver

Chief, Flight Design and Dynamics Division

As compiled by: FDM/D. Tee
FDO/R. Stein

Back-Up

- **Trajectory Server Open AR Status**
- **Flight Readiness Open Work**
- **Items listed below in a separate file**
 - **Launch Window**
 - **Abort Regions**
 - **Nominal ET Impact Area**
 - **Ascent/Descent Flight Critical Software**

Trajectory Server Open AR Status

- **ARs 064527 and 067175 ISP_STREAM_GNC Process at 100% CPU**
 - **IMPACT: Minimal**
 - Easily recognized
 - Mitigation - terminate and restart processor (2 seconds)
 - **ROOT CAUSE:**
 - Unknown, but may be related to a Linux ISP client AR
 - Linux ISP client AR fix is available with the LY2.3 PSS baseline and beyond
 - Generic SIMs
 - STS-125
 - **LIKELIHOOD: High**
 - Occurred once during STS-122
 - Occurred twice during STS-123
 - Occurred once during STS-124 flight specific SIM
 - **PLANNED ACTIONS:**
 - Developer continues to evaluate the Trj Server ISP processor
 - Developer will evaluate the performance of our ISP processor with regards to the PSS baseline being used
 - **STATUS: Open**

Trajectory Server Open AR Status

- **AR066814 – RTA Queue Message Hang**
 - **IMPACT: Moderate**
 - Prevents O-IGN and O-DAY/O-NIGHT clocks updates
 - Easily recognized
 - Off nominal recovery steps
 - **ROOT CAUSE:**
 - Unknown
 - May be related to ISP_STREAM_GNC at 100% CPU
 - **LIKELIHOOD: Low**
 - Only observed once
 - **PLANNED ACTIONS:**
 - Developer looking at relationship of the queue hang to the 100% CPU problem
 - **STATUS: Open**

Flight Readiness Open Work

Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Standard Open Work:				
DATA43 FDD FRR Data Pack	FDM	4/24/08	4/22/08	Product Delivered
FSW Verification Test Results Review	ADFD	5/01/08	4/24/08	STF #ADFD-08-012
FSW Verification Test Results Review	Orbit	5/01/08		
RNDZ/FDO Phasing Plan Meeting	Orbit	5/01/08		
CM FOE L-30 day audit	Bedford	5/01/08		
ONOR29B RNDZ Launch Target Data	Orbit	5/01/08		
DATA45 FDD FSW PF Sign-off	FDM	5/02/08		
PROP06 OMRSD OMS/RCS	PROP	5/02/08		
PROP07 Abort Propellant Dump Tagup	PROP	5/03/08		
L-4 week LDO Database Freeze	ADFD	5/03/08		
RNDZ08 RNDZ Phasing Limits	Orbit	5/06/08		
PROP02 Mass Properties	PROP	5/07/08		
Prop Analyst & Flt Controller Tag-up	PROP	5/08/08		
ONOR37B Daily Planar/Phase Windows	Orbit	5/08/08		
NAVO16B GPO COTM Data Pack	Navigation	5/09/08		
NAVO18B GPO/ONAV Ops Memo	Navigation	5/09/08		

Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Standard Open Work - Continued:				
ASCT04 Uplink APM	ADFD	5/10/08		
LDO: L-3 week LDO Checkout/TCDDT Sim	ADFD	5/12/08		
ONOR27 Launch and Landing Data	Orbit	5/12/08		
ASCT44 DOL Uplink I-loads	ADFD	5/16/08		
ONOR29C RNDZ Launch Target Data	Orbit	5/20/08		
ONOR37C Daily Planar/Phase Windows	Orbit	5/22/08		
Dial Down Decision FIDP	FDM	5/23/08		
RNDZ02 Target Drag Characteristics	Orbit	5/23/08		
PROP00A PROP/Ascent Aborts Tagup	PROP	5/23/08		
RNDZ09 Rendezvous COLA Plans	Orbit	5/23/08		
DSCT17 Landing Site Tables	ADFD	5/24/08		
C-Band tracking Scheduling Message	Navigation	5/24/08		
ASCT99 OMS Assist - ATO Update	ADFD	5/25/08		
PROP33 Ferry Data Package	PROP	5/25/08		
PROP34 MCC Data	PROP	5/25/08		
PROP02A DOL Mass Properties Updates	PROP	5/26/08		

Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Standard Open Work - Continued:				
Pre-Launch Mass Properties Request	PROP	5/26/08		
PROP31 ARD Data	PROP	5/26/08		
SRB & ET RTLS Impact Point Update Memo	ADFD	5/28/08		
ASCT42 Collision Avoidance Data	ADFD	5/28/08		
ASCT47 Final MCC Trajectory Inputs	ADFD	5/28/08		
DSCT66 Real-Time Support Files	ADFD	5/28/08		
Range Safety Launch Window Cutout	ADFD	5/28/08		
Flight Annex	Navigation	5/28/08		
ASAB32B AME MCC Support Tables	ADFD	5/29/08		
L-2 day DOLILU System Checkout	ADFD	5/29/08		
DSCT05 Maximum Crossrange Capability	ADFD	5/29/08		
ASAB25 ARD Bias Tables	ADFD	5/30/08		

Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Non-Standard Open Work:				
Update DDS Base Elements to remove manual work-around	ADFD	4/25/08		
Range Safety Operator Certification	ADFD	5/01/08		
Decision on PERA Prime/Backup Role for USA/ADFD	ADFD	5/08/08		
Winds Coordinator Certification	ADFD	5/16/08		

Flight Readiness Open Work - Continued

Item	Responsible	Due Date	Closed	Closure Rationale/Status
Trajectory Operations Standard Open Work				
Close to Launch Trajectory Data	OFDO	4/26/08		
L-30 HA Server Audit	TOCSS	5/01/08		
Final Trajectory Parameters Flight Rule CR	AE FDO	5/10/08		
TCDT Checkout in Ops Cert Mode	AE GPO	5/15/08		
DOD Support Readiness	LSO	5/16/08		
Flight Load Checklist Complete	Nav	5/16/08		
Flight Load Checklist Complete	DOLILU	5/16/08		
Flight Load Checklist Complete	Entry Support	5/16/08		
Flight Load Checklist Complete	Orbit-RNDZ	5/16/08		
FS Orbit FDO CHB Annex	OFDO	5/17/08		
PERA Pre-Flight Product	DM42 PERA Lead	5/24/08		
Flight Load Checklist Complete	RGPO	5/25/08		
Flight Load Checklist Complete	AE FDO	5/25/08		
Flight Load Checklist Complete	AE GPO	5/25/08		
Flight Load Checklist Complete	LSO	5/25/08		
Flight Load Checklist Complete	OFDO	5/25/08		

Flight Readiness Open Work - Continued

Item	Responsible	Due Date	Closed	Closure Rationale/Status
Trajectory Operations Standard Open Work				
L-5 HA Server Audit	TOCSS	5/26/08		
Close to Launch Mass Properties	OFDO	5/28/08		
Present new ops notes at Trench tagup	TOCSS	Trench Tag-Up		
Real-time Data Transfer Schedule	OFDO	5/30/08		
Cargo Transfer Spreadsheet	OFDO	5/30/08		
Trajectory Operations Non-Standard Work:				
ORBIT 1 RPS Certification	ORPS	4/28/08		
ORBIT 1 GPO Currency	OGPO	4/28/08		
ORBIT 4 FDO Flight Controller Physical	OFDO	5/02/08		
FDO STS-124 Annex updates for Actions 122-01 and 122-02	FDO	5/21/08		

Flight Readiness Open Work - Concluded

Item	Responsible	Due Date	Closed	Closure Rationale/Status
DM Standard Open Work:				
Orbiter Readiness Statement	FDRIB	5/11/08		
Range Safety Readiness Statement	FDRIB	5/15/08		

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_____