
STS-132 MOD FRR

FLIGHT DYNAMICS DIVISION

April 1, 2010

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DM Flight Dynamics (Trajectory Operations)

- X Significant Mission Firsts and Unique Items
- None Deviations, Exceedances and Anomalies
- None Special Topics
- None Issues and Concerns
- X Exceptions and Open Work
- X STS-132 Flight 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	G	G
CERTIFIED FLIGHT CONTROLLERS	G	G
CERTIFIED INSTRUCTORS	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

Launch/Landing Times	Date	GMT	EDT	
Launch Window Open	May 14, 2010	18:14:59	14:14:59	(hh:mm:ss)
Launch Window Close		18:24:58	14:24:58	(hh:mm:ss)
Landing Time (KSC)	May 26, 2010	14:02	10:02	(hh:mm)

FD3 rendezvous opportunities are anticipated for nearly every day in the May launch period (2 days FD4 rendezvous only)

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 **2,570 lbs**

Projected APM* **4,620 lbs**

* Based on 03/25/10 APM simulation

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

- **Mission Duration increase from 11+1+2 to 12+0+2**
- **Maximum Rendezvous Altitude decrease from 200 N.Mi. to 190 N. Mi.**

Significant Mission Firsts and Unique Items

- **Launch opportunities from 5/14 through 5/23, and 6/1 through 6/12**
 - Launch cutout from 5/24 through 5/31
 - Avoids Dual Docked Operations (DDO) scenario with Soyuz 21S undock
 - Propellant was budgeted to protect for possible Dual Docked Operations (DDO) for 23S docking
 - DDO scenario for launch dates from 6/8 through 6/12
 - Mated Beta angle will be violated from 6/13 through 6/28

Special Topics

- **Upgrade to TSEP v3.8.1**

- Update was not approved by the Orbiter Configuration Control Board (OCCB) in time to support upgrade for STS-131
- Approved at the 3/23 OCCB for STS-132 and subs
- Will be tracked and completed as Non Standard Open Work (ECD 4/30/10)

- **Kwajalein (KWAJ) C-band tracking support could become unavailable due to the Information Assurance (IA) policy in June 2010**

- DM has requested an extension of waiver to the IA policy
- Navigation analysis has concluded that the impact to tracking would be minimal due to the loss of KWAJ

Special Topics (conc.)

White Sands Missile Range (WSMR) C-band tracking support

- **2 of 3 sites have been recertified based on successful testing on STS-130**
 - Complies with the Flight Rule requirement for dual source tracking
- **Post STS-130, a computer software fix has been implemented to provide the correct time tag for a midnight rollover date stamp issue**
 - Required tests for HOLC, WSSC and WSMC have been scheduled for April 1st
 - Will be tracked and completed as Non Standard Open Work
 - If tests are successful, all three sites will be considered recertified with the latest version of the software.
 - Currently verifying with the Network that White Sands can revert to the STS-130 version of the software, if required.

Exceptions and Standard Open Work

Exceptions

- None

Standard Open Work

- All open work is scheduled to be completed per standard flight template
- Open work table in backup pages

Non-standard Open Work

- White Sands test to verify time tag software update post STS-130 04/01/10
- Targeting Console Operator Certification 04/22/10
- TSEP 3.8.1 04/30/10

Rescue Mission Status

- **STS-134 has been designated as the LON flight for STS-132**
- **STS-134 will be ready to launch on 07/29/10, if required, with the cargo element installed**
- **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 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 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-132.

Flight Design and Dynamics	S. A. Anderson Director	<i>Original signed by S. Anderson</i> Signature	<i>03/26/10</i> date
Ascent/Descent Flight Design	D. J. Brockway Manager	<i>Original signed by Jerel Davis for D. Brockway</i> Signature	<i>03/26/10</i> date
Orbit Flight Design	R. M. Hill Manager	<i>Original signed by R. Hill</i> Signature	<i>03/26/10</i> date
Navigation & Flight Design Integration	G. E. Schrage Manager	<i>Original signed by G. Schrage</i> signature	<i>03/26/10</i> date

Flight Design and Dynamics Declaration of Compliance with CoFR Endorsement Requirements for STS-132 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 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-MA	03/19/10
Flight Implementation Data Pack (FIDP) - Flight Specific	132-BASE-V	03/24/10

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-132.

Original signed by S. A. Anderson 03/26/10
Director **Date**
Flight Design & Dynamics

DM Flight Design and Dynamics (Trajectory Operations)

Significant Mission Firsts and Unique Items

ISS Phasing Strategy

- Two ISS Reboosts scheduled prior to STS-132
 - 4/24 – 9.8 ft/s (3 m/s)
 - 5/5 – Small burn if required
 - Delta-v's will be updated after STS-131/19A docking
- Rendezvous altitude will be approximately 190 nm.
- FD3 rendezvous 5/14 through at least 6/3
- Beta cutout 6/13-6/28 and 8/13-8/24
- Window open on small phase angle days limited by minimum of about 37 deg

Significant Mission Firsts and Unique Items (cont.)

Joint Underspeed Recovery Capability

- No capability for 5/14 Launch Date
- 21S on SM Aft prevents SM burn
- 27P on DC-1 Nadir can't perform >1 mps.

Development Test Objectives

- N/A

Significant Mission Firsts and Unique Items (conc.)

Changes to the Go/No-Go for RPM

- Loss of 1 FxD jet caused the RPM to be no go because the loss the second FxD on the same side caused the rendezvous for that day to be lost
- PRCB has decided to accept the risk of losing the second FxD during the RPM
 - Window of exposure is small (~10 seconds at start of RPM)
 - Provided next day re-rendezvous capability exists
- Rules and procedures are updated

No Planned Hardware Jettisons

No Deployable Payloads

Payloads of Opportunity

- MAUI, SEITE, SIMPLEX, RAMBO 2

Exceptions and Open Work

Exceptions

- None

Standard Open Work

- Remaining Integrated Sims
- CTL Trajectory Data (L-35 & L-7)
- TCDT Checkout in Ops Cert Mode (L-16)
- DOD Support Readiness (L-15)
- Remaining Crew Rendezvous Standalone Lessons (L-14)
- PERA Pre-Flight Product (PERA Lead) (L-7)
- EMCC Checkout (L-7)
- Flight Load Checkouts
 - Orbit , Ascent, A/E GPO, Entry, LSO (L-6)

Non-Standard Open Work

- None

STS-132 Flight Design & Dynamics Division Readiness Statement

The Flight Dynamics Division has performed the reviews necessary to assess the flight readiness relating to flight design requirements definition, crew and flight controller 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 Bill Powers for B. Conte

Barbara A. Conte

Chief, Ascent & Descent Flight Dynamics Branch

Original signed by C. Reichert

Christine M. Reichert

Chief, Orbit Flight Dynamics Branch

Original signed by R. Banfield

Robert D. Banfield

Chief, Flight Dynamics Division

As compiled by:

FDM/Jennifer Flinn

FDO/Rebecca Cutri-Kohart

Back-Up

Flight Readiness Open Work

Propellant Summary

Separate Back-up File

- **Launch Window**
- **Abort Regions Chart**
- **Nominal ET Impact Area**

Flight Readiness Open Work

Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Standard Open Work:				
PROP37 SODB Volume II Amendment	PROP	04/02/10		
DATA43 FDD FRR Data Pack	FDM	04/07/10		
FSW Verification Test Results Review	ADFD	04/13/10		
FSW Verification Test Results Review	Orbit	04/14/10		
RNDZ/FDO Phasing Plan Meeting	Orbit	04/14/10		
ONOR29B RNDZ Launch Target Data	Orbit	04/14/10		
DATA45 FDD FSW PF Sign-off	FDM	04/15/10		
L-4 week LDO Database Freeze	ADFD	04/15/10		
PROP06 OMRSD OMS/RCS	PROP	04/16/10		
PROP07 Abort Propellant Dump Tagup	PROP	04/16/10		
RNDZ08 RNDZ Phasing Limits	Orbit	04/19/10		
PROP02 Mass Properties	PROP	04/21/10		
ONOR37B Daily Planar/Phase Windows	Orbit	04/21/10		
Prop Analyst & Flt Controller Tag-up	PROP	04/22/10		
LDO: L-3 week LDO Checkout/TCDT Sim	ADFD	04/22/10		
ASCT04 Uplink APM	ADFD	04/23/10		

Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Standard Open Work - Continued:				
NAVO16B GPO COTM Data Pack	Navigation	04/23/10		
NAVO18B GPO/ONAV Ops Memo	Navigation	04/23/10		
ONOR27 Launch and Landing Data	Orbit	04/23/10		
ASCT44 DOL Uplink I-loads	ADFD	04/29/10		
ONOR29C RNDZ Launch Target Data	Orbit	05/04/10		
Dial Down Decision FIDP	FDM	05/06/10		
ONOR37C Daily Planar/Phase Windows	Orbit	05/06/10		
PERA Pre-Flight Product	ADFD	05/07/10		
DSCT17 Landing Site Tables	ADFD	05/07/10		
RNDZ02 Target Drag Characteristics	Orbit	05/07/10		
PROP00A PROP/Ascent Aborts Tagup	PROP	05/07/10		
RNDZ09 Rendezvous COLA Plans	Orbit	05/07/10		
Flight Annex	Navigation	05/07/10		
ASCT99 OMS Assist - ATO Update	ADFD	05/08/10		
C-Band tracking Scheduling Message	Navigation	05/09/10		

Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Standard Open Work - Continued:				
PROP02A DOL Mass Properties Updates	PROP	05/09/10		
Pre-Launch Mass Properties Request	PROP	05/09/10		
PROP31 ARD Data	PROP	05/09/10		
PROP33 Ferry Data Package	PROP	05/09/10		
PROP34 MCC Data	PROP	05/09/10		
SRB & ET RTLS Impact Point Update Memo	ADFD	05/11/10		
ASCT42 Collision Avoidance Data	ADFD	05/11/10		
ASCT47 Final MCC Trajectory Inputs	ADFD	05/11/10		
DSCT66 Real-Time Support Files	ADFD	05/11/10		
Range Safety Launch Window Cutout	ADFD	05/11/10		
ASAB32B AME MCC Support Tables	ADFD	05/12/10		
L-2 day DOLILU System Checkout	ADFD	05/12/10		
DSCT05 Maximum Crossrange Capability	ADFD	05/12/10		
ASAB25 ARD Bias Tables	ADFD	05/13/10		

Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Non-Standard Open Work:				
WSMR test to verify time tag software update	Navigation	04/01/10		
Targeting Console Operator Certification	ADFD	04/22/10		
TSEP 3.8.1	ADFD	04/30/10		

Flight Readiness Open Work - Continued

Item	Responsible	Due Date	Closed	Closure Rationale/Status
Trajectory Operations Standard Open Work				
Close to Launch Trajectory Data	OFDO	04/09/10		
TCDT Checkout in Ops Cert Mode	AE GPO	04/27/10		
DOD Support Readiness	LSO	04/28/10		
Flight Load Checklist Complete	Nav	04/29/10		
Flight Load Checklist Complete	DOLILU	04/28/10		
Flight Load Checklist Complete	Entry Support	04/28/10		
Flight Load Checklist Complete	Orbit-RNDZ	04/29/10		
Successful Completion of RNDZ Training	RNDZ Instructor	05/05/10		
Flight Load Checklist Complete	RGPO	05/08/10		
Flight Load Checklist Complete	AE FDO	05/08/10		
Flight Load Checklist Complete	AE GPO	05/08/10		
Flight Load Checklist Complete	LSO	05/08/10		
Flight Load Checklist Complete	OFDO	05/08/10		
Trajectory Operations Non-Standard Work:				
None				

Flight Readiness Open Work - Concluded

Item	Responsible	Due Date	Closed	Closure Rationale/Status
DM Standard Open Work:				
Orbiter Readiness Statement	DM	04/24/10		
Range Safety Readiness Statement	DM	04/28/10		

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_____

 STS Integration Manager
 Date_____

 Director, Flight Design and Dynamics Department
 Date_____

 Chief, Flight Dynamics Division
 Date_____

Propellant Summary

Propellant Summary	FRCS (lbm)	ARCS (lbm)	OMS (lbm)
Loadings	2175	4970	22761
FRR Design Margins **	516	0	9

** Assumptions: STS-132 ATL, FRR Cycle Trajectory Inputs -190 nm RNDZ, 99 sec OMS Assist, 1 mated water dump