

---

# STS-129 MOD FRR

## FLIGHT DESIGN AND DYNAMICS



10/15/09

Jared Renshaw / 281-282-2748

David Tee / 281-282-4083

Roger Rojas / 281- 483-8026

Mark Anderson / 281-483-1915

# Table of Contents

---

## Shuttle CoFR Status Summary

### USA Flight Design and Dynamics

- X Mission Overview Summary
- X Significant Changes Since Design Baseline
- None Significant Mission Firsts and Unique Items
- X Deviations, Exceedances and Anomalies
- X Special Topics
- None Issues and Concerns
- X Exceptions and Open Work
- X Rescue Mission Status
- X Flight Design and Dynamics Readiness Accountability Statement
- X FDD Declaration of Compliance with CoFR Endorsement Requirements for STS-129 Flight Readiness

### DM Flight Design and 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-129 Flight Design & Dynamics Division Readiness Statement

# Shuttle CoFR Status Summary

MOD Requirements Codes *	DM	USA FDD
NON-CRITICAL PROC/APPL	G	Y
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

---

Launch/Landing Times	Date	GMT	EST	
Launch Window Open	Nov. 12, 2009	20:59:21	15:59:21	(hh:mm:ss)
Launch Window Close		21:09:21	16:09:21	(hh:mm:ss)
Landing Time (KSC)	Nov. 23, 2009	16:40	11:40	(hh:mm)

FD3 rendezvous opportunities are anticipated for every day in the November launch period. The 60-degree mated solar beta angle will be violated for launch dates from November 19<sup>th</sup> through December 5<sup>th</sup>, 2009.

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                      1325 lbs

Projected APM\*                    1341 lbs

\* Based on 09/25/09 APM simulation and 10/06/09 Green Book

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

---

- **FRCS load changed from min (1912 lbm) to mid (2175 lbm)**
- **MPS Budget updated from R0701S to R0901S**

# Deviations, Exceedances and Anomalies

---

- **Deviation / Exceedances**
  - **No Dock PLS case exceeds the nominal EOM downweight limit**
    - No pre-flight analysis is required
    - Exceedance has been documented in the Flight Rules Annex
- **Previous Mission Anomalies**
  - None
- **Significant ARs and Disposition**
  - None

# Deviations, Exceedances and Anomalies (concluded)

---

- **Non-Conformance Records**

- **NCR 015170 I-Load Delivery Error – Closed on 09/02/09**

- For STS-130 the value for OMS Mass I-load was submitted without including the OMS amount burned from Nominal OMS Assist burn

- Value assessed against GN&C trajectory and resulted in good ascent Flight Control System SSME trim margins

- Flight Design decided to submit an updated value that included the OMS Assist burn

- OMS Mass I-load value audited for STS-129, no impact to STS-129 flight readiness

- **Open Risk Assessments**

- None

# Special Topics

---

- **Patrick (PATC) down**
  - Undergoing Radar Open System Architecture (ROSA) modifications
  - Preflight interface verification will be completed by 10/30/09
    - Cape Area radars available if problems are identified.
- **FDD is transitioning configuration control and sustaining engineering of discipline software to FDOC per contract agreement.**
  - For STS-129, FDOC will have ownership of a subset (J10-Mod 4 list) of the discipline software.
  - Minimal change to existing process to update transitioned software-FDOC will document prior to flight (10/16/09)
- **DOLILU balloon tracking tool certification**
  - DOLILU balloon tracking tool developed to provide situational awareness for potential conjunctions between balloons and shuttle during ascent
  - Tool will be tested during the TDCT
  - No impact to flight readiness if certification not completed before flight



# Exceptions and Standard Open Work

---

- **Exceptions**

- None

- **Standard**

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

- **Non-standard**

- Entry console Operator/TAL Support Flight Controller Certification 10/16/09
- ONAV 1 Certification 10/16/09
- Dynamics Certification 10/23/09
- OPS 2 DOL Operator Certification TCDT
- Cert DOLILU tracking tool for Asc balloons and potential conjunctions w/shuttle flight path TCDT
- FDOC to document agreement regarding transitioned software 10/16/09
- PATC Interface Check 10/30/09

## Rescue Mission Status

---

- **STS-130 has been designated as the LON flight for STS-129**
- **STS-130 will be ready to launch on 02/04/10, 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 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-129.

<b>Flight Design and Dynamics</b>	<b>S. A. Anderson Director</b>	<i>Original signed by D.J. Brockway for S.A. Anderson</i> signature	<i>09/25/09</i> Date
<b>Ascent/Descent Flight Design</b>	<b>D. J. Brockway Manager</b>	<i>Original signed by D.J. Brockway</i> signature	<i>09/25/09</i> date
<b>Orbit Flight Design</b>	<b>R. M. Hill Manager</b>	<i>Original signed by R.M. Hill</i> signature	<i>09/28/09</i> date
<b>Navigation &amp; Flight Design Integration</b>	<b>G. E. Schrage Manager</b>	<i>Original signed by G.E. Schrage</i> signature	<i>09/25/09</i> date

# Flight Design and Dynamics Declaration of Compliance with CoFR Endorsement Requirements for STS-129 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-LM	9/24/09
Flight Implementation Data Pack (FIDP) - Flight Specific	129-BASE-U	9/24/09

## 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-129.*

*Original signed by D.J. Brockway for S.A. Anderson*

**Director**

**Date: 10/7/09**

**Flight Design & Dynamics**

# DM Flight Design and Dynamics (Trajectory Operations)

## Significant Mission Firsts and Unique Items

---

- **ISS Phasing Strategy**

- No reboost
- Rendezvous altitude will be approximately 185 nm.
- Consecutive launch opportunities with FD3 rendezvous through entire launch season (11/12 – 11/18)

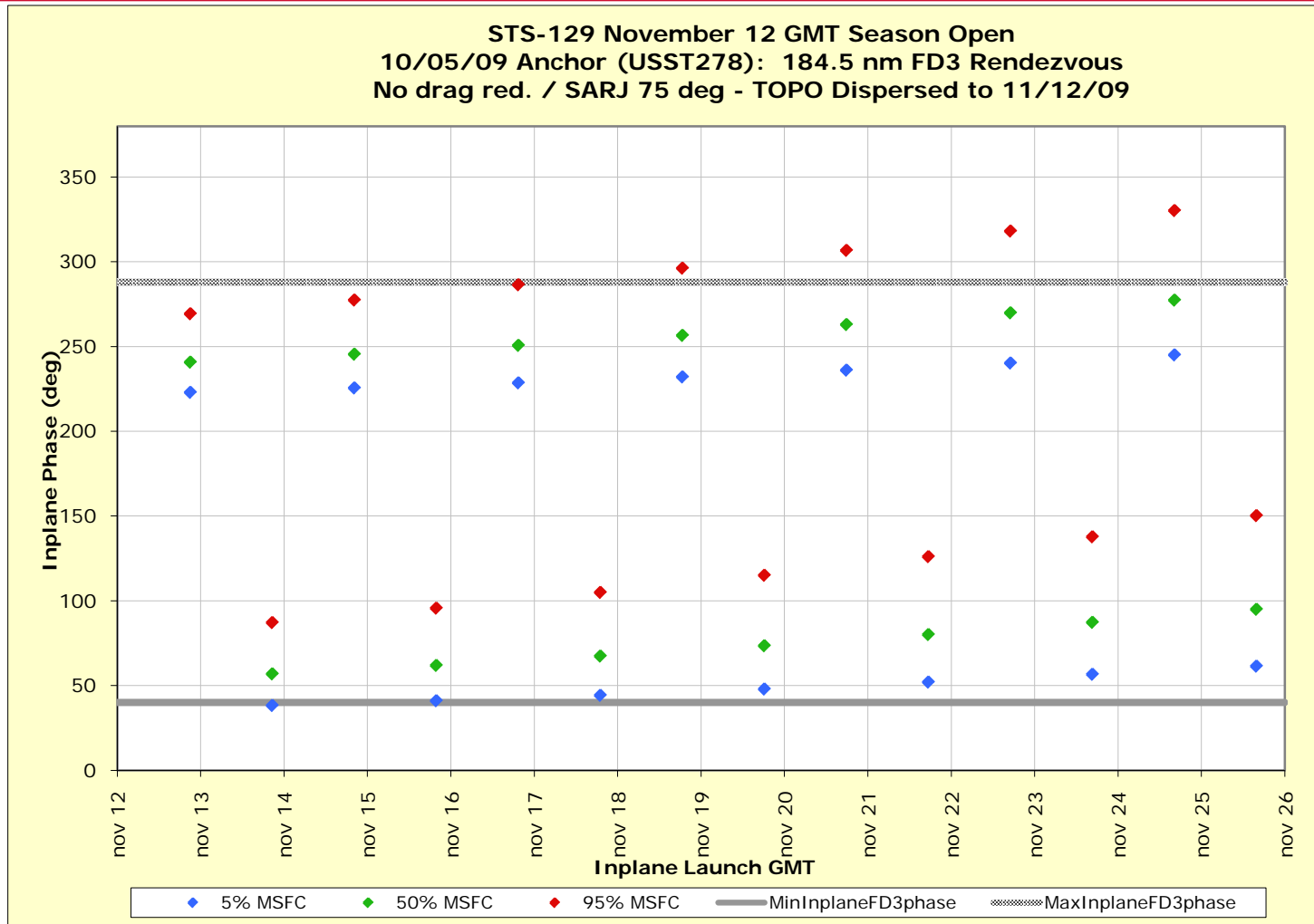
(Dot Chart on next page)

- **There is no Joint Underspeed Recovery (JURe) capability**

- **Payloads of Opportunity**

- MAUI
- SIMPLEX
- SEITE
- RAMBO 2

# Significant Mission Firsts and Unique Items



# 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**
  - None

# STS-129 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.

---

**Barbara A. Conte**

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

---

**Robert Banfield**

**Chief, Flight Design and Dynamics Division**

**As compiled by:      Lead FDO/Rogelio F. Rojas**



# Back-Up

---

- **Flight Readiness Open Work**
- **Propellant Summary**
- **DM Standard Open Work**
- **Separate Back-up File**
  - Abort Regions Chart
  - Nominal ET Impact Area

# 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	10/12/09	10/12/09	Delivered
DATA43 FDD FRR Data Pack	FDM	10/6/09	10/6/09	Delivered
FSW Verification Test Results Review	ADFD	10/8/09	10/20/09	Completed
FSW Verification Level 8 Test Results Review	Orbit	10/8/09	9/28/09	Completed
RNDZ/FDO Phasing Plan Meeting	Orbit	10/12/09	10/06/09	Completed
DATA45 FDD FSW PF Sign-off	FDM	10/14/09		
ONOR29B RNDZ Launch Target Data	Orbit	10/14/09		
PROP06 OMRSD OMS/RCS	PROP	10/15/09		
PROP07 Abort Propellant Dump Tagup	PROP	10/15/09		
PROP02 Mass Properties	PROP	10/20/09		
L-4 week LDO Database Freeze	ADFD	10/15/09		
RNDZ08 RNDZ Phasing Limits	Orbit	10/19/09		
Prop Analyst & Flt Controller Tag-up	PROP	10/21/09		
ONOR37B Daily Planar/Phase Windows	Orbit	10/21/09		
ASCT04 Uplink APM	ADFD	10/22/09		

## Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
<b>USA Flight Design Standard Open Work - Continued:</b>				
NAVO16B GPO COTM Data Pack	NAV	10/22/09		
NAVO18B GPO/ONAV Ops Memo	NAV	10/22/09		
Flight Load Checklist	NAV	10/25/09		
LDO: L-3 week LDO Checkout/TCDT Sim	ADFD	10/22/09		
ONOR27 Launch and Landing Data	Orbit	10/23/09		
ASCT44 DOL Uplink I-loads	ADFD	10/28/09		
DOLILUFlight Load Checklist Complete	ADFD	10/28/09		
Entry Support Flight Load Checklist Complete	ADFD	10/28/09		
Orbit MPSR Flight Load Checkout	Orbit	10/28/09		
ONOR29C RNDZ Launch Target Data	Orbit	11/3/09		
Dial Down Decision FIDP	FDM	11/4/09		
DSCT17 Landing Site Tables	ADFD	11/5/09		
ONOR37C Daily Planar/Phase Windows	Orbit	11/5/09		
RNDZ02 Target Drag Characteristics	Orbit	11/5/09		

## Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
<b>USA Flight Design Standard Open Work - Continued:</b>				
PROP00A PROP/Ascent Aborts Tagup	PROP	11/5/09		
C-Band tracking Scheduling Message	NAV	11/7/09		
PERA Pre-Flight Product	ADFD	11/5/09		
ASCT99 OMS Assist - ATO Update	ADFD	11/6/09		
PROP33 Ferry Data Package	PROP	11/7/09		
PROP34 MCC Data	PROP	11/7/09		
RNDZ09 Rendezvous COLA Plans	Orbit	11/6/09		
PROP02A DOL Mass Properties Updates	PROP	11/7/09		
Pre-Launch Mass Properties Request	PROP	11/4/09		
PROP31 ARD Data	PROP	11/7/09		
SRB & ET RTLS Impact Point Update Memo	ADFD	11/9/09		
ASCT42 Collision Avoidance Data	ADFD	11/9/09		
ASCT47 Final MCC Trajectory Inputs	ADFD	11/9/09		
DSCT66 Real-Time Support Files	ADFD	11/9/09		

## Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
<b>USA Flight Design Standard Open Work - Continued:</b>				
Range Safety Launch Window Cutout	ADFD	11/9/09		
Flight Annex	NAV	11/7/09		
L-2 day DOLILU System Checkout	ADFD	11/10/09		
DSCT05 Maximum Crossrange Capability	ADFD	11/10/09		
ASAB25 ARD Bias Tables	ADFD	11/11/09		

## Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
<b>USA Flight Design Non-Standard Open Work:</b>				
Landing Analyst Flight Controller Certification (Landing)	ADFD	10/6/09	10/6/09	Completed
Entry console Operator/TAL Support Flight Controller Certification	ADFD	10/16/09		
ONAV 1 Certification	NAV	10/16/09		
Dynamics Certification	NAV	10/23/09		
OPS 2 DOL Operator Certification	ADFD	TCDT		
Cert DOLILU tracking tool to track Asc balloons and potential conjunctions w/shuttle flight path	ADFD	TCDT		
Verification of processes for transitioned discipline software performed	J Bedford	10/16/09		
PATC Interface Check	NAV	10/30/09		

## 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 (L-35)	OFDO	10/8/09		
TCDT Checkout in Ops Cert Mode	AE GPO	10/27/09		
DOD Support Readiness	LSO	10/28/09		
Flight Load Checklist Complete	Nav	11/6//09		
Flight Load Checklist Complete	DOLILU	11/6//09		
Flight Load Checklist Complete	Entry Support	11/6//09		
Flight Load Checklist Complete	Orbit-RNDZ	11/6//09		
Successful Completion of RNDZ Training	RNDZ Instructor	10/29/09		
Flight Load Checklist Complete	RGPO	11/6//09		
Flight Load Checklist Complete	AE FDO	11/6//09		
Flight Load Checklist Complete	AE GPO	11/6//09		
Flight Load Checklist Complete	LSO	11/6//09		
Flight Load Checklist Complete	OFDO	11/6//09		
Close to Launch Trajectory Data (L-7)	OFDO	11/5/09		

## Flight Readiness Open Work - Continued

---

Item	Responsible	Due Date	Closed	Closure Rationale/Status
<b>Trajectory Operations Non-Standard Work:</b>				
Orbit 3 FDO certification currency update	FDO	10/9/09		



# Flight Readiness Open Work - Concluded

---

Item	Responsible	Due Date	Closed	Closure Rationale/Status
<b>DM Standard Open Work:</b>				
Orbiter Readiness Statement	FDRIB			
Range Safety Readiness Statement	FDRIB			

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

---

Propellant Summary	FRCS (lbm)	ARCS (lbm)	OMS (lbm)
Loadings	2175	4970	22761
FRR Design Margins **	647	0	149

\*\* Assumptions: STS-129 ATL, FRR Cycle Trajectory Inputs, 195 nm RNDZ, 84 sec OMS Assist, 1 mated water dump