
STS-128 MOD FRR

FLIGHT DESIGN AND DYNAMICS



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Table of Contents

Shuttle CoFR Status Summary

USA Flight Design and Dynamics

- X Mission Overview Summary
- X Significant Changes Since Design Baseline
- 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 Rescue Mission Status
- X Flight Design and Dynamics Readiness Accountability Statement
- X FDD Declaration of Compliance with CoFR Endorsement Requirements for STS-128 Flight Readiness

DM Flight Design and Dynamics (Trajectory Operations)

- 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-128 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

Launch/Landing Times	Date	GMT	EDT	
Launch Window Inplane	Aug. 18, 2009	08:23:08	04:23:08	(hh:mm:ss)
Launch Window Close		08:28:08	04:28:08	(hh:mm:ss)
Landing Time (KSC)	Aug. 30, 2009		22:26	(hh:mm)

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 **1690 lbs**

Projected APM* **1403 lbs**

* Based on 06/22/09 APM simulation and 06/23/09 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

- **Launch date from July 30 to August 6 to August 7 to August 18, 2009**
- **Mission duration increased to 13+1+2 days with 3 EVAs on OV-103**
- **Consumables offloaded to increase APM**
 - O2 offload of 450 lbm due to availability of SSPTS (CR in work to increase offload to 520 lbm)
 - N2 offload of 67 lbm implemented
- **Rendezvous altitude reduced to 188 nmi to increase APM**
- **Implemented multi-stage deorbit for contingency return case**
- **Incorporated a 3-minute launch window for performance quoting**
- **New MPS inventory implemented**

Significant Mission Firsts and Unique Items

- **First flight of OI-34 Flight Software**

- BFS HUD Capability Updates
 - Incorporated runway length I-Loads, enabled BFS HUD deceleration command indication and added High G-load and Body Flap warnings to enhance crew situational awareness
 - Added BFS I-Loads to define the GPS high-rate update region and frequency to address the potential for BFS HUD data jumps near touchdown
- ENTRY TRAJ 1 Display Update
 - Implemented a display timing check to eliminate the blinking phugoid symbol
- HORIZ SIT Display Update
 - Changed display logic to "park" the HAC at the bottom of the display rather than redrawing at the vertical center of the display

- **New Roll Maneuver Q-Plane (CR #S052550PD)**

- Scheduled for SICB approval on 7/14/09
- No concerns for Flight Design (data change only)

Deviations, Exceedances and Anomalies

Deviation / Exceedances

- **Two contingency cases exceed the nominal EOM downweight limit**
 - No pre-flight analysis is required
 - Exceedance has been documented in the Flight Rules Annex
- **A Contingency Abort Black Zone (CABZ) assessment was performed.**
 - Mass properties meet the CABZ assessment criteria of liftoff weight greater than 259,000 lbm and Xcg aft of 1115.0 in.
 - OCF cycle liftoff weight = 266,855 lbs and Xcg = 1119.0 in.
 - FRR cycle liftoff weight = 267,690 lbs and Xcg = 1117.7 in.
 - Assessment revealed increased 3-engine-out black zones compared to STS-114 baseline
 - Results were reviewed with Flight Director, Crew and Flight Manager
 - Do not plan to pursue any mitigation options

Deviations, Exceedances and Anomalies (continued)

Previous Mission Anomalies

- **Previous mission (STS-125)**

- Entry tracking issues
 - White Sands (WSMR) radar track data software and refraction correction issues on orbits 182 and 183 have been resolved
 - Issues with Edwards landing radars at Vandenberg (VAFB) concerning acquisition data, VDHC biases, and erroneously flagged data have been resolved
- Navigation visits to Dryden and Vandenberg were held during the week of June 22, 2009 to improve communications with the sites to help eliminate tracking issues in the future

- **Previous flight of vehicle (STS-119)**

- TACAN bearing dropout
 - All 3 TACAN LRUs lost bearing data for approximately 30 seconds resulting in NAV EDIT TAC message
 - No dropouts occurred on range data
 - Suspected cause was reflection from the nearby TACAN building; however RF suppression efforts were not successful in eliminating bearing dropouts
- No concerns for STS-128 since alternate TACAN data and GPS data are available, and nav state updates from the ground can be performed

Deviations, Exceedances and Anomalies (concluded)

NCR 015170 I-Load Delivery Error

- **STS-130 I-Load Discrepancy**

- A non-optimal value for the OMS mass I-Load was submitted into the official I-Load database (STAR)
- The discrepancy was caught by Boeing during the Flight Readiness Verification (FRV) process
- The I-Load was updated in STAR prior to I-Load approval

- **No concerns for STS-128**

- The Flight Design I-Load audit and Boeing FRV process confirmed that there were no issues with the STS-128 I-Loads
- The OMS mass I-Load is not recomputed in the Uplink or Day of Launch processes

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**

- FDD AR #2009-CAF043 “Incorrect Orbiter in DSCT29 GRTLS Trajectory” 07/10/09
 - Vehicle swap was not incorporated in DSCT29 GRTLS trajectory verification
 - Customers have been notified to determine if a redelivery is required
- SICB Approval of New Roll Maneuver Q-Plane 07/14/09
- TAO Certification * 07/15/09
- OPS 2 DOL Operator Certification * 07/29/09

** certified backups are available*

Rescue Mission Status

- **STS-129** has been designated as the LON flight for STS-128
- **STS-129** will be ready to launch on 11/12/09, 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-128.

Flight Design and Dynamics	S. A. Anderson Director	<i>Original signed by Greg Schrage for S.A.A.</i> signature	06/19/09 date
Ascent/Descent Flight Design	D. J. Brockway Manager	<i>Original signed by Jerel Davis for D.J.B.</i> signature	06/19/09 date
Orbit Flight Design	R. M. Hill Manager	<i>Original signed by R.M.Hill</i> signature	06/19/09 date
Navigation & Flight Design Integration	G. E. Schrage Manager	<i>Original signed by G.E. Schrage</i> signature	06/19/09 date

Flight Design and Dynamics Declaration of Compliance with CoFR Endorsement Requirements for STS-128 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-LF	June 26, 2009
Flight Implementation Data Pack (FIDP) - Flight Specific	128-BASE-T	June 26, 2009

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-128.

*Original signed by R. M. Hill
for S. A. Anderson*

Director **Date**
Flight Design & Dynamics

DM Flight Design and Dynamics (Trajectory Operations)

Significant Mission Firsts and Unique Items

- **First flight of OI-34**
- **ISS Phasing**
 - Trajectory prediction/planning for STS-128 is difficult due to a number of uncertainties:
 - STS-127 reboosts & induced perturbations
 - Progress and Soyuz operations
 - Drag uncertainty
 - The TOPO's will target the ISS trajectory to maximize the number of consecutive launch opportunities with FD3 Rendezvous.
- **JURe Capability**
 - STS-128 JURe capability will be provided with the Progress 34 engines
- MAUI
- SEITE
- SIMPLEX

Deviations, Exceedances and Anomalies

Anomalies

- **AR 079976 - OMP IMPULSIVE XFER DOES NOT ROTATE PEG7 DV**
 - During an OMP transfer to ephemeris action, the LVLH DV is not rotated to the PEG7 DV when the IMP option is chosen for the OPT/IMP choice.
 - Linux version 10.0.2 and 11.0 Problem
 - Will be corrected and certified for STS-128 (L-30)
 - FDOC projected release on 7/07/09

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**

- Certification – Orbit 2 RGPO * 07/22/09
- Certification – Orbit 3 FDO * TBD
- Currency – Orbit 4 TRAJ * 07/31/09

** certified backups are available*

STS-128 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 June 23, 2009
Barbara A. Conte
Chief, Flight Design Requirements and Integration Branch

Original signed by June 23, 2009
Robert D. Banfield
Chief, Flight Design and Dynamics Division

As compiled by: FDM/Dawn M. Gabriel
FDO/Robert T. Stein

Back-Up

- **Flight Readiness Open Work**
- **Propellant Summary**
- **Items listed below in separate file**
 - Launch Window
 - Abort Regions
 - Nominal ET Impact Area
 - Contingency Abort Black Zone Comparison

Flight Readiness Open Work

Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Standard Open Work:				
DATA43 FDD FRR Data Pack	FDM	06/30/09	06/30/09	Delivered
PROP37 SODB Volume II Amendment	PROP	07/09/09		
FSW Verification Test Results Review	ADFD	07/19/09		
FSW Verification Test Results Review	Orbit	07/19/09		
RNDZ/FDO Phasing Plan Meeting	Orbit	07/19/09		
DATA45 FDD FSW PF Sign-off	FDM	07/20/09		
ONOR29B RNDZ Launch Target Data	Orbit	07/21/09		
PROP06 OMRSD OMS/RCS	PROP	07/21/09		
PROP07 Abort Propellant Dump Tagup	PROP	07/21/09		
L-4 week LDO Database Freeze	ADFD	07/21/09		
PROP02 Mass Properties	PROP	07/24/09		
RNDZ08 RNDZ Phasing Limits	Orbit	07/24/09		
Prop Analyst & Flt Controller Tag-up	PROP	07/27/09		
ONOR37B Daily Planar/Phase Windows	Orbit	07/28/09		
ASCT04 Uplink APM	ADFD	07/28/09		

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	07/28/09		
NAVO18B GPO/ONAV Ops Memo	Navigation	07/28/09		
LDO: L-3 week LDO Checkout/TCDT Sim	ADFD	07/29/09		
ONOR27 Launch and Landing Data	Orbit	07/30/09		
ASCT44 DOL Uplink I-loads	ADFD	08/03/09		
ONOR29C RNDZ Launch Target Data	Orbit	08/10/09		
Dial Down Decision FIDP	FDM	08/10/09		
DSCT17 Landing Site Tables	ADFD	08/11/09		
RNDZ02 Target Drag Characteristics	Orbit	08/11/09		
PROP00A PROP/Ascent Aborts Tagup	PROP	08/11/09		
PERA Pre-Flight Product	ADFD	08/11/09		
ONOR37C Daily Planar/Phase Windows	Orbit	08/12/09		
ASCT99 OMS Assist - ATO Update	ADFD	08/12/09		
C-Band tracking Scheduling Message	Navigation	08/13/09		
RNDZ09 Rendezvous COLA Plans	Orbit	08/13/09		
PROP02A DOL Mass Properties Updates	PROP	08/13/09		

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	08/13/09		
PROP31 ARD Data	PROP	08/13/09		
PROP33 Ferry Data Package	PROP	08/13/09		
PROP34 MCC Data	PROP	08/13/09		
ASCT42 Collision Avoidance Data	ADFD	08/15/09		
ASCT47 Final MCC Trajectory Inputs	ADFD	08/15/09		
DSCT66 Real-Time Support Files	ADFD	08/15/09		
SRB & ET RTLS Impact Point Update Memo	ADFD	08/15/09		
Range Safety Launch Window Cutout	ADFD	08/15/09		
Flight Annex	Navigation	08/15/09		
ASAB32B AME MCC Support Tables	ADFD	08/16/09		
L-2 day DOLILU System Checkout	ADFD	08/16/09		
DSCT05 Maximum Crossrange Capability	ADFD	08/16/09		
ASAB25 ARD Bias Tables	ADFD	08/17/09		

Flight Readiness Open Work - Continued

Work Item	Responsible	Due Date	Closed	Closure Rationale
USA Flight Design Non-Standard Open Work:				
Landing Analyst Certification	ADFD	06/30/09	06/30/09	Completed
Resolution of AR#2009-CAF043 (DSCT29 GRTLS trajectory verification used incorrect orbiter)	ADFD	07/10/09		
SICB Approval of New Roll Maneuver Q-Plane	ADFD	07/14/09		
TAO Certification	NAV	07/15/09		
OPS 2 DOL Operator Certification	ADFD	07/29/09		

Flight Readiness Open Work - Continued

Item	Responsible	Due Date	Closed	Closure Rationale/Status
Trajectory Operations Standard Open Work				
Close to Launch Trajectory Data	OFDO	07/14/09		
TCDT Checkout in Ops Cert Mode	AE GPO	07/29/09		
DOD Support Readiness	LSO	08/03/09		
Flight Load Checklist Complete	Nav	08/03/09		
Flight Load Checklist Complete	DOLILU	08/03/09		
Flight Load Checklist Complete	Entry Support	08/03/09		
Flight Load Checklist Complete	Orbit-RNDZ	08/03/09		
Successful Completion of RNDZ Training	RNDZ Instructor	08/07/09		
EMCC Checkout	AE FDO	08/11/09		
Flight Load Checklist Complete	RGPO	08/12/09		
Flight Load Checklist Complete	AE FDO	08/12/09		
Flight Load Checklist Complete	AE GPO	08/12/09		
Flight Load Checklist Complete	LSO	08/12/09		
Flight Load Checklist Complete	OFDO	08/12/09		

Flight Readiness Open Work - Continued

Item	Responsible	Due Date	Closed	Closure Rationale/Status
Trajectory Operations Non-Standard Work:				
Certification – Orbit 2 RGPO	RGPO	07/22/09		
Certification – Orbit 3 FDO	OFDO	TBD		
Currency – Orbit 4 TRAJ	OFDO	07/31/09		

Flight Readiness Open Work - Concluded

Item	Responsible	Due Date	Closed	Closure Rationale/Status
DM Standard Open Work:				
Orbiter Readiness Statement	FDRIB	07/29/09		
Range Safety Readiness Statement	FDRIB	07/31/09		

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

FRCS = 1912 lbm

ARCS = 4970 lbm

OMS = 22761 lbm

FRR Design Propellant Margins

ARCS/OMS = 39 lbm

FRCS = 4 lbm

FRR Design Assumptions: STS-128 ATL, FRR Cycle Trajectory Inputs - 188 nm RNDZ, 112 sec OMS Assist, 1 mated water dump, multi-stage deorbit implemented for contingency payload return cases