

MISSION OPERATIONS DIRECTORATE FLIGHT DIRECTOR OFFICE



STS-111/UF2 MISSION OPERATIONS

FLIGHT READINESS REVIEW

May 16, 2002

**DA8/R. E. Castle
DA8/P. Hill**

Agenda

- Mission Summary
- Shuttle Flight Software
- Flight Design & Ascent Overview
- Flight Procedures
- Joint Operations Integrated Procedures
- Crew Training
- Flight Controller Training
- Significant Flight Rules
- Special Topics
- Open Work
- Network
- USA Flight Operations
- Readiness Statements

* Backup Material Included.

To Be Presented

No Issues

No Issues*

No Issues

To Be Presented

To Be Presented

Included



MISSION OPERATIONS DIRECTORATE
Flight Director Office
NASA Johnson Space Center, Houston, Texas



Mission Summary

STS-111/UF2 Shuttle Overview

OV-105 – Endeavour

Crew

– Shuttle:

- CDR – Ken Cockrell PLT – Paul Lockhart
- MS1/EV2 – Phillipe Perrin MS2/EV1 – Franklin Chang-Diaz

– Arriving ISS Crew:

- CDR – Valeri Korzun FE1 – Peggy Whitson FE2 – Sergei
Treschev

– Departing ISS Crew:

- CDR – Yuri Onufrienko FE1 – Carl Walz FE2 – Dan Bursch

Mission Duration 12+0+2

Three planned EVAs, no unscheduled EVA without deleting some scheduled activity.

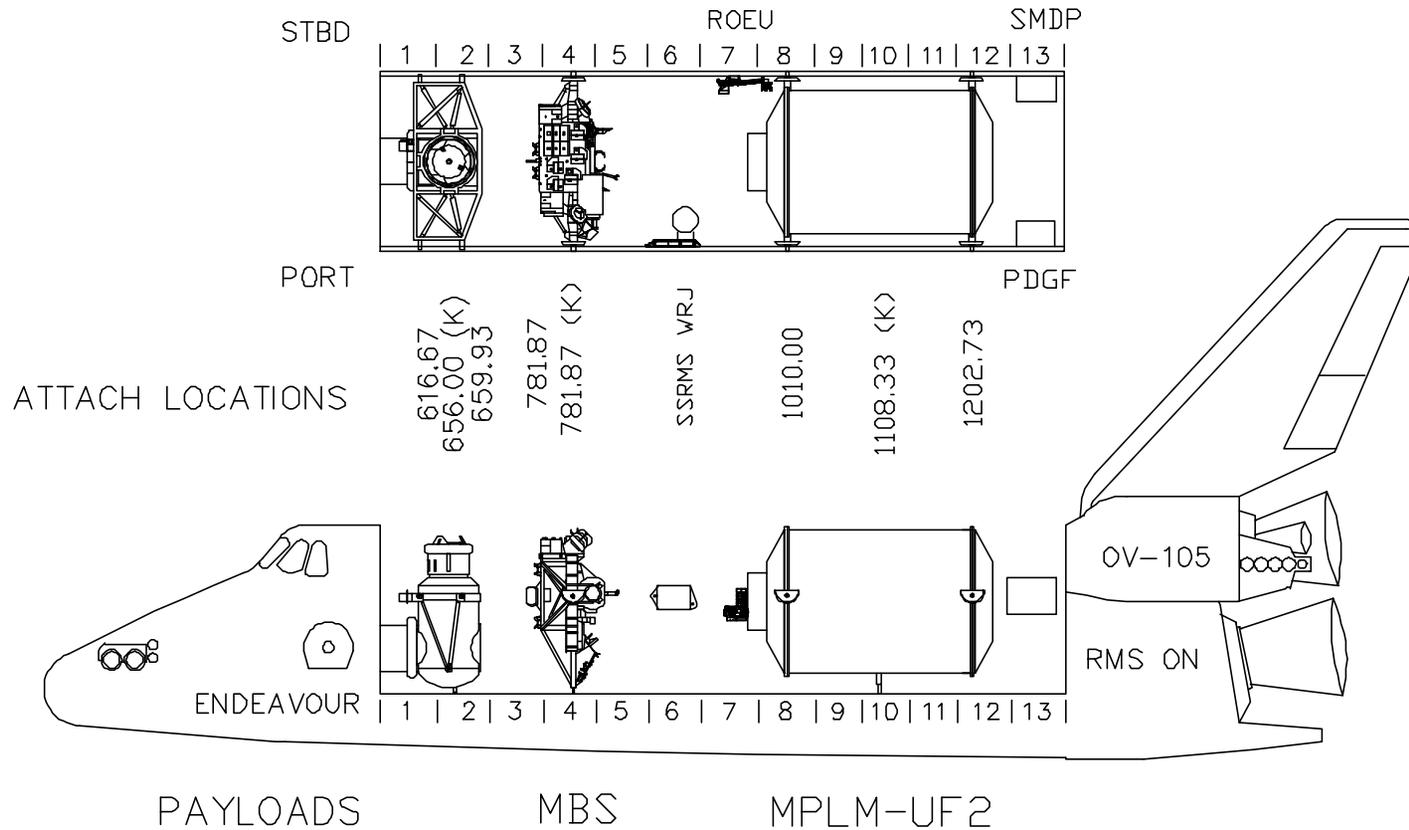
6 N2 tanks

5 Cryo Tanks sets: ≥ 48 hr pad hold time.

Propellant acceptable

- Total aft ~ 750 lbm, FRCS ~ 300 lbm margin
- 2-2-2, reboost, fly-around, RAMBO all covered

STS-111/UF2 Cargo Configuration



STS-111/UF2 Mission Priorities

Primary objectives for STS-111, in priority order:

- Transfer critical ISS crew consumables and rotate the ISS crews
- Transfer MPLM and middeck h/w
- Install MBS
- Return ISS h/w (Layer 1)
- SMDP and P6 PDGF
- Replace the SSRMS wrist roll joint
- Return more ISS h/w (Layers 2 and 3)

EVA Strategy:

- Prep MBS for transfer
- Transfer SSRMS WR joint, SMDP and PDGF
- Connect MBS umbilicals to MT
- R&R SSRMS WR
- Complete MBS outfitting (POA, bolts, camera deploy, extension bag)

UF2 Mission Overview

FD1

- Launch 2338Z, 1838 CDT
- Checkout APCUs and OIUs
- Activate MPLM and SSRMS joint heaters

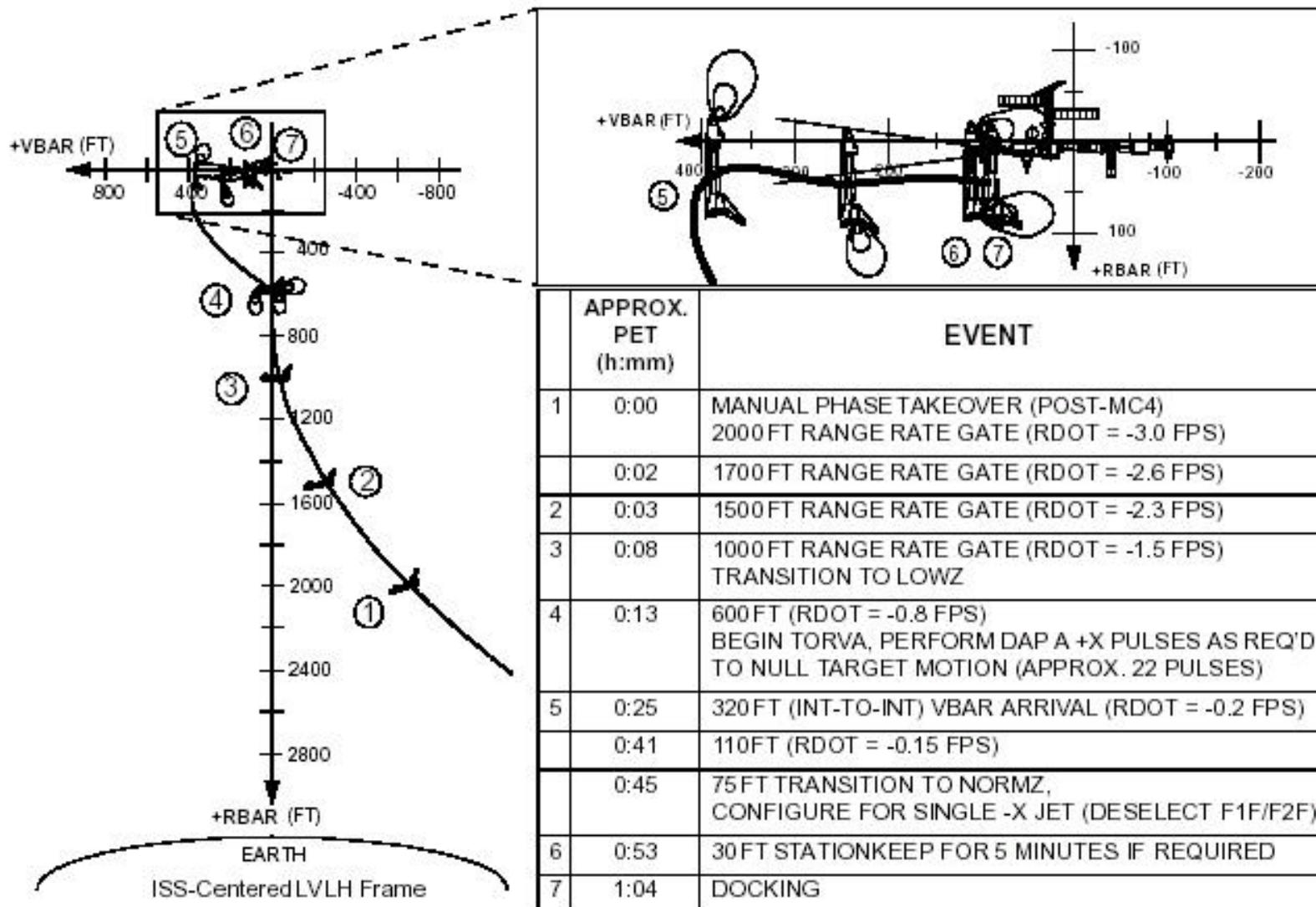
FD2

- Checkout SRMS
- Checkout EMU
- Checkout Orbiter Docking System
- Off duty

FD3

- ISS Maneuver to Docking Attitude
- ISS Feather Solar Arrays for Docking (P6, FGB, SM)
- +Vbar ISS rendezvous, docking to PMA2
- Transfer IELKs and other middeck items.
- ISS handover

TERMINAL PHASE, TORVA, AND VBAR APPROACH



UF2 Mission Overview

FD4

- Install MPLM using SRMS
- More middeck transfers and handover
- EVA prep

FD5

- EVA-1: Transfer P6 PDGF
 - Transfer SMDP
 - Remove MBS Thermal Blankets after survival heaters active
- SSRMS support throughout the EVA
- Unberth MBS and translate to the pre-install position using SSRMS
- Activate MBS (while on the SSRMS)
- MPLM transfers to ISS
- ISS handover

UF2 Mission Overview

FD6

- Install MBS on MT using SSRMS
- MPLM transfers to ISS
- Begin MPLM return transfers
- EVA prep
- Reboost

UF2 Mission Overview

FD7

- EVA-2: Connect MBS-MT umbilicals
 - Switch MBS from SSRMS to umbilical power
 - Rotate POA
 - Drive MBS-MT bolts
 - Deploy MBS camera and MSS extension bag
- SRMS support during EVA
- More return transfer and ISS handover

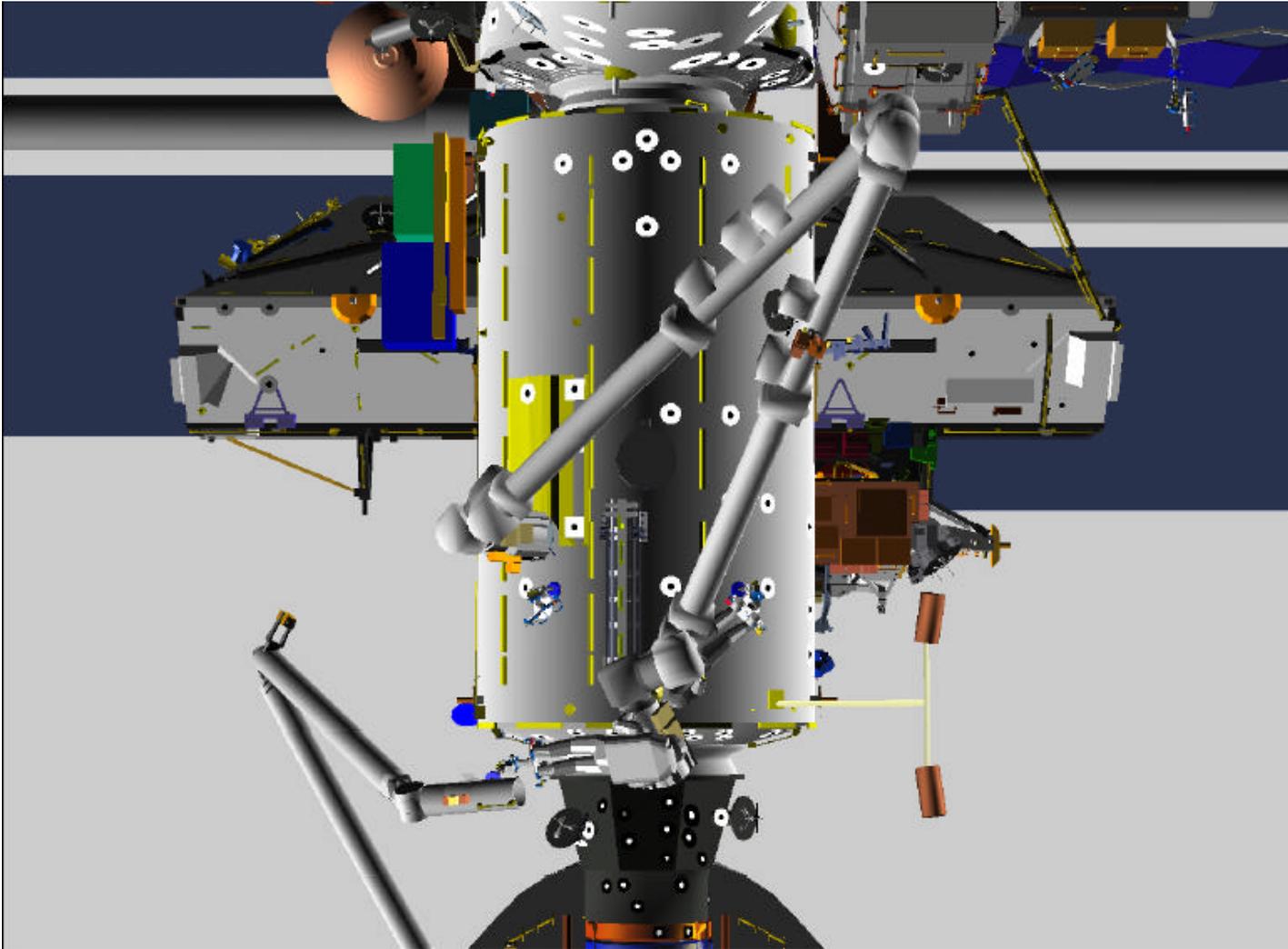
FD8

- Reboost
- More return transfer
- EVA prep

FD9

- EVA-3: Replace SSRMS WR joint
- SRMS support throughout EVA
- More return transfers and ISS handover

UF2 EVA 3/ WR R&R Position



UF2 Mission Overview

FD10

- Reboost
- Final return transfers and ISS handover
- MPLM return to payload bay with SRMS

FD11

- Close hatches
- Undock, flyaround, separate
- GPS Ops2 test
- Half day off duty

UF2 Mission Overview

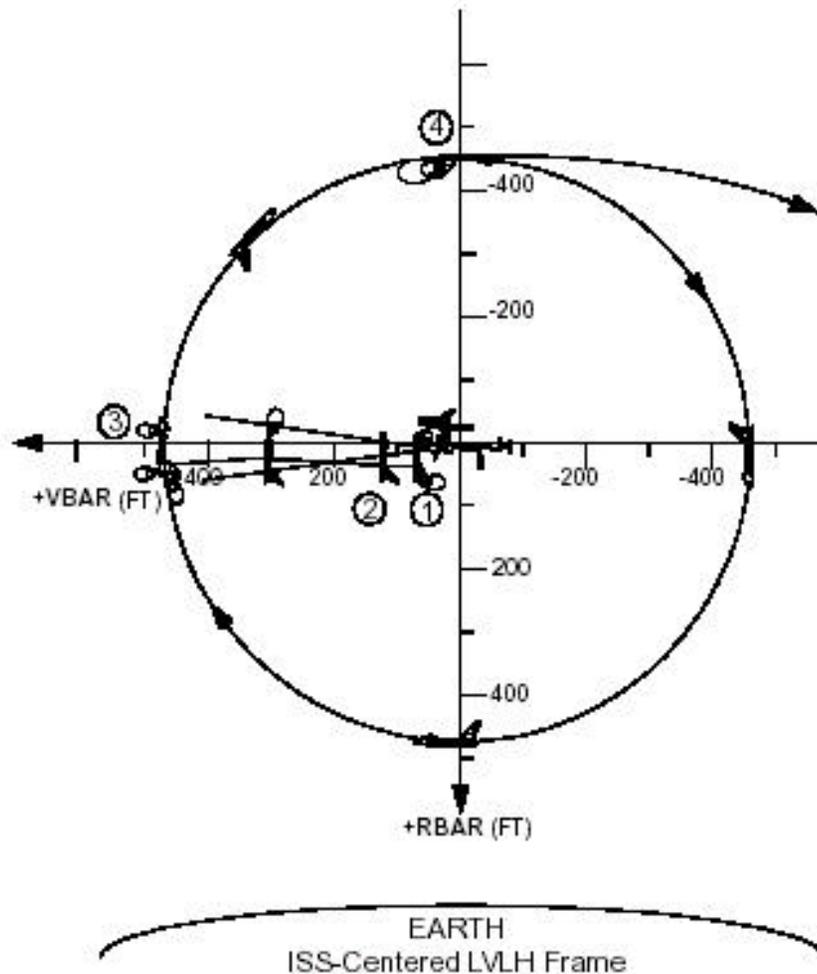
FD12

- Half-day off-duty
- FCS C/O, RCS hot-fire, cabin stow
- Cabin Stow
- RAMBO

FD13

- D/O Prep
- Landing 11/19:04, ~18:30Z / 13:30 CDT

UNDOCKING, TORF, AND FINAL SEPARATION



	APPROX. PET (h:mm)	EVENT
	-0:03	ORBITER AND ISS IN FREE DRIFT TO BEGIN UNHOOKING PROCESS (ISS LVLH 0,0,0 ATTITUDE)
1	0:00	UNDOCKING AT 5S-10 MIN; AT 2 FT MODE TO LVLH HOLD AND PERFORM 4 DAP B +Z NORMZ BURNS SEPARATED BY 10 SEC; 3 MIN LATER PERFORM +Z NORMZ BURNS OUTSIDE 30 FT TO BUILD OPENING RATE TO 0.15 FPS; MAINTAIN 8 DEGREE CORRIDOR
	0:04	OUTSIDE 50 FT, RESELECT -X JETS (F1F, F2F)
2	0:07	AT 75 FT, MODE TO LOWZ
	0:14	AT 150 FT, MANEUVER BACK TO UNDOCKING ATTITUDE IN AUTO; MAINTAIN CORRIDOR AND APPROX. RATE OF 0.15 FPS TO R < 500 FT (CG-TO-CG)
3	0:46*	INITIATE TORF AFTER SUNRISE AND WHEN RANGE IS BETWEEN 400 FT AND 500 FT (CG-TO-CG); CONTINUE TORF FOR 1 & 1/4 LAP
4	1:44*	FINAL SEP BURN; 3 FPS RETROGRADE +X LOWZ A SECOND -R BAR CROSSING

*BASED ON ZERO DEGREE BETA ANGLE

STS-111/UF2 New or Unique Operations

MBS Constraints

- For passive thermal control, the stack is constrained to LVLH attitudes until the MBS is installed on FD6.
 - Solar beta will be ~60 degrees and decreasing at docking, requiring a 10° ISS roll bias for solar array pointing and a 1 kW US power down when not in XPOP.
 - The power down is no impact, achieved primarily from lights, CDRA and shell-heaters
 - Only required for 3 docked days.
- After thermal blankets are removed, MBS must be powered either via the SSRMS or the MT, and must remain in the payload bay, at pre-install or on the MT.
- Docking and undocking are supported by:
 - SSRMS holding the MBS
 - 3 of 4 bolts MBS-MT bolts
 - MT capture latch supports undocking but not docking.

STS-111/UF2 New or Unique Operations

EVA Bingos

- EVA-1: Limited to 7 hr PET, with time reserved for MBS blanket removal.
- EVA-2: Limited to 7 hr PET.
- EVA-3: Will consider extending based on suit consumables, with time reserved for powering all MSS hardware.

RMS Contingencies

- The only SSRMS WR rotations required for MBS installation are performed over the payload bay providing SRMS and EVA access if required for manual drive.
- The SRMS will be used to install the MBS after a full SSRMS failure (both strings).
- The SSRMS will be used to install the MPLM after significant SRMS failures.

STS-111/UF2 New or Unique Operations

Oxygen Transfers

- Preflight margins do not protect any O2 transfer to ISS, e.g. for EVA.
 - Will turn off FES while docked and power off the APCU except during MPLM environment checks to save ~40 lbm Shuttle O2.
 - Powering off SSRMS WR joint and MPLM heaters gains another ~20 lbm.
- An on time launch will provide sufficient margin for all mission requirements, including 2-2-2 deorbit, the docked EVAs and ~60+ lbm margin.

Minimizing ORCA Run Time

- Planned docked EVA usage from the ISS O2 tanks is ~75 lbm.
- Two methods are available for using Shuttle O2 during EVA pre-breath.
 - These provide a 30 and 85% reduction respectively in ISS O2 use and the resulting ORCA run time, although total O2 used is the same.
 - The 85% option was successfully tested at JSC 5/10, and planned for UF2.

Timeline Margin

The flight plan has very little white space.

- Crew scheduling constraint waivers are primarily the standard days on ISS flights (rendezvous and EVA days).
- In general, all pre-sleep, post-sleep, meals, off-duty, etc are protected.
- Some of the ISS handover is accounted for while the crew members are working together, e.g. MPLM outfitting and SSRMS ops.

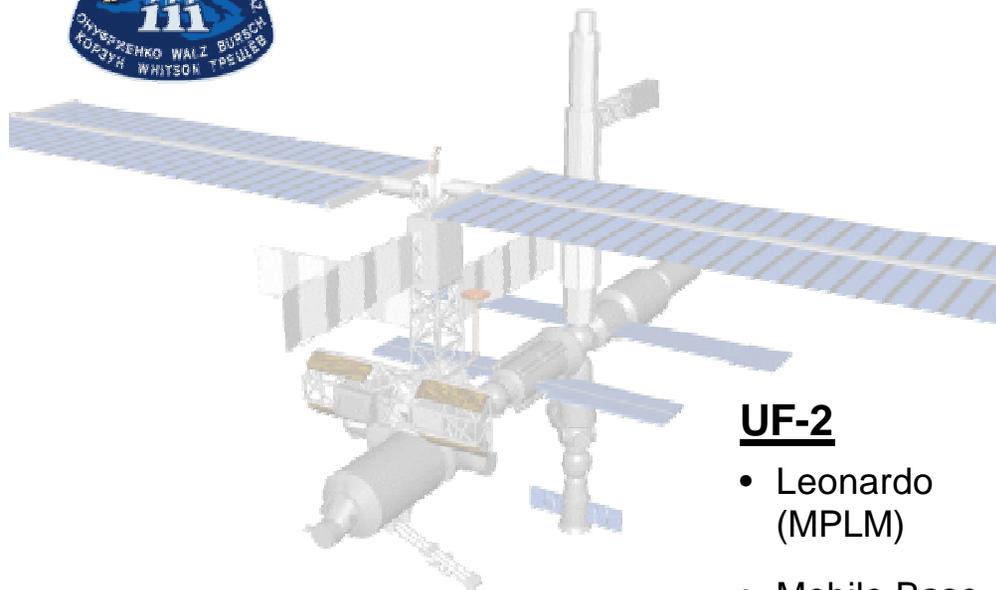
Summary of transfer time from the final flight plan:

• Type	Required	Planned
	hr / CTB	hr
• Middeck	26 /	30
• Layer-1	96 / 50	96
• Layer-2	15 / 32	15
• Layer-3	~9 / 18	5.5



STS-111/UF-2 Flight Readiness Review

Networks



UF-2

- Leonardo (MPLM)
- Mobile Base System (MBS)

Agenda

- Other SN Supported Launches
- Significant Changes
- Special Topic

Ted Sobchak
Network Director
GSFC/Code 450
May 16, 2002



STS-111/UF-2 Mission and Data Services



Other SN Supported Launches

- The following SN supported launch is planned during the STS-111/UF2 mission
 - SEALAUNCH/GALAXY 3C launch planned no earlier than 06/02/02
 - Uses 2 TDRS West SA's
 - TDRSS Resource conflicts expected for Pacific node satellites.
 - Working advance schedule with high priority customers
 - Virtual Spacecraft (STS/ISS) events may be used to alleviate impacts to lower priority customers
 - Ten events were used to resolve TDRS conflicts during STS-110



STS-111/UF-2 Mission and Data Services



Significant Changes

- **Space Network**

- **WSC**

- TDRS F8 is the operational spacecraft at the TD-171 location (since 4/23)

- F7 (storage mode) is backup with 4 hours switchover if required

- **DSMC (Data Services Management Center)**

- Network Scheduling functions are transitioning from the GSFC NCC to the DSMC at WSC.

- Training and flight following activities have been completed

- Space Network (SN) and Ground Network (GN) scheduling will be performed by the DSMC

- There will be backup staffing at the NCC and an NCC operator at DSMC to assist with the transition

- **Ground Network**

- **DFRC**

- One of two S-band tracking sites (ATF-1) has a planned overhaul 5/28 - 6/8/02

- No impact, ATF-2 will be prime.

- One of two C-Band radars planned for maintenance 5/28 - 6/10

- No impact, Edwards radars available



STS-111/UF-2 Mission and Data Services



Significant Changes

- **NISN**
 - **Small Conversion Device (SCD) software version 5.2 deployment**
 - **No changes for Space Shuttle support. Seals potential system compromises due to remote access vulnerabilities.**
 - **Testing completed. SCD version 5.2 will be used on alternate paths for GN command and telemetry data.**



STS-111/UF-2 Mission and Data Services



Special Topic: Ponce De Leon (PDL) Antenna

- Issue
 - After station hours on May 8 the antenna went into a runaway condition and exceeded cable wrap limits.
 - RF Cables (9), control cables (9), S-Band waveguide, bulk head connector and manual brake release cable were destroyed.
 - The cause is unknown at this time. Current indications point to the commercial power source.
- Corrective Action
 - Damaged equipment being replaced. Estimate to complete repair is May 17. Validation testing and S/C tracks will be performed.
- Risk
 - No Constraint.
 - Separate system at JDIF will provide S-Band telemetry and separate UHF system at PDL will supply voice during 90 sec. plume blockage at MIL



Space Communications and Data Systems



Certificate of Readiness

Pending completion of flight readiness preparations, remaining standard work and closure of all action items, NASA dedicated elements and all CSOC resources are ready to support the STS-111 - 14th ISS Flight (UF-2)/MPLM

P. E. Liebrecht 5/10/02
P. E. Liebrecht Date
Associate Director, Program Manager for Mission Services
Goddard Space Flight Center

G. Morse 5/8/02
G. Morse Date
Manager, Space Operations Services
Johnson Space Center

(Original signed by) _____
D. Tighe Date
CSOC Program Manager

Presenter:

R. Gest

Organization/Date:

Flt Ops 5/16/02

STS-111 / UF2
Flight Readiness Review
5/16/02
USA Flight Operations

AGENDA

Presenter:

R. Gest

Organization/Date:

Flt Ops 5/16/02

- Facilities Readiness
- Out of Family - None
- Special Topics - None
- CoFR Statement

FACILITIES READINESS

Presenter:

R. Gest

Organization/Date:

Flt Ops 5/16/02

- Mission Control Center (MCC)
 - Trajectory Services Upgrade (TSUP)
 - Project re-hosted MOC trajectory functionality from IBM mainframe to UNIX servers and workstations on the MCC distributed network
 - Flight following completed in Ops environment
 - STS-108, all flight phases, uncertified mode
 - STS-109, completing for all flight phases, certified mode
 - Over 1000 hours of user testing / evaluation received in OPS mode
 - Training and simulations / no impacts
 - 67 Generic sims supported
 - 12 Flight specific sims supported
 - TSUP successfully supported as the prime trajectory processor for STS-110 orbit and entry phases, and performed flight following during ascent.
 - STS-111 TSUP will be the prime trajectory processor for ascent, orbit and entry.
 - TSUP Flight Rules and LCC have been written
 - Server failure fallback plan and procedures are in place
 - Switchover back to MOC transition occur within 1 hour

<p>STS-111/UF2</p> <p>Certification of Flight Readiness</p>	<p>Presenter: R. Gest</p>
	<p>Organization/Date: Flt Ops 5/16/02</p>

- The USA Flight Operations FRR, NASA MOD FRR, and USA SFOC Pre-FRR have been completed
- All Contractor Accountable Functions (CAF) have been completed, or are scheduled for completion, in accordance with NASA requirements and the applicable portions of the Space Flight Operations contract Flight Preparation Process Plan (NSTS 08117, section 8.5.18 and appendix “R”).
- All required products have been or are scheduled to be delivered per requirements.
- All facilities have been configured and are ready for mission support.
- All CAF personnel are trained and certified or will be trained and certified prior to flight.
- The Flight Crew has been trained.
- There are no open issues.
- Pending completion of the defined open work.

**USA FLIGHT OPERATIONS IS READY
TO SUPPORT THE STS-111/UF2 MISSION**



C. Knarr
Associate Program Manager, Flight Operations

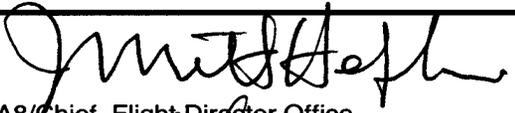
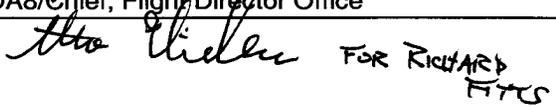


MISSION OPERATIONS DIRECTORATE
ISS CERTIFICATE OF FLIGHT READINESS (CoFR)
STS-111/UF2 REQUIREMENTS

ISS REQUIREMENTS

<p>Critical Processors/Applications; Non-Crit Processors/Applications; Flight Rules; EMCC; Trng-MCC /POIC/POCC; JOP-New Operations; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Program Actions; Mission Requirements; Exception Resolution; CMD Proc; Contractor Process Insight</p>	<p><i>[Signature]</i> DAS/Chief, Flight Director Office</p>
<p>Crit Processors/Applications; Non-Crit Processors/Applications; ODF/SODF; EMCC; TRNG-MCC/POIC/POCC; LCC; JOP-New Ops; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Program Actions; Mission Requirements; CMD Proc; EVA Hdwr; Contractor Process Insight</p>	<p><i>[Signature]</i> DF/Chief, Systems Division</p>
<p>EX/AI from Prior Reviews; No Constraints; Program Actions; Mission Requirements; Contractor Process Insight</p>	<p><i>[Signature]</i> DL/Chief, Flight Avionics Division</p>
<p>Crit Processors/Applications; Non-Crit Processors/Applications; TRNG-MCC/POIC/POCC; JOP-New Ops; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; No Constraints; Program Actions; Mission Requirements; CMD Proc; FD-Flight Mechanics, FD-Analyst Cert. FD-CTF</p>	<p><i>[Signature]</i> 5/3/02 DM/Chief, Flight Design and Dynamics Division</p>
<p>Crit Processors/Applications; Non-Crit Processors/Applications; ODF/SODF; ODF/SODF Manage; EMCC; TRNG-MCC/POIC/POCC; JOP-New Ops; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Program Actions; Mission Requirements; CMD Proc; Contractor Process Insight</p>	<p><i>[Signature]</i> 5/3/02 DO/Chief, Operations Division</p>
<p>EX/AI from Prior Reviews; No Constraints; Program Actions; Mission Requirements; Contractor Process Insight</p>	<p><i>[Signature]</i> DT/Chief, Space Flight Training Division</p>
<p>The SSTF maintains a training load consistent with the last training environment for the increments in progress which can, on demand be loaded and updated to the required onboard configuration for any necessary procedure development; contractor process insight.</p>	<p><i>[Signature]</i> DV/Chief, Advanced Operations & Development Division</p>
<p>FAC-NBL; FAC-SVMF; FDF; TRNG-Crew Trng; TRNG-MCC/POCC; TRNG-EVA/MARS; LCC; FTP-New Ops; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Level II Actions; Mission Requirements; Engineering Drawings; CMD Proc; EVA Hardware Integration; Contractor Process Insight</p>	<p><i>[Signature]</i> DX/Chief, EVA, Robotics, & Crew Systems Operations Division</p>
<p>FAC-MCC; FAC-Network Interface; FAC-IPS; Crit Processors/Applications; Non-Crit Processors/Applications; ODF/SODF Fabrication; Flight Anomaly Res; Anomaly-Proc; Ex/AI from Prior Reviews; No Constraints; Program Actions; Mission Requirements; Exception Resolution; CMD Proc</p>	<p><i>[Signature]</i> Associate Program Manager, Flight Operations, SFOC</p>
<p>NETWORK; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; No Constraints; Program Actions</p>	<p><i>[Signature]</i> 5/3/02 Network Director, SSP, ISS, GSFC</p>
<p></p>	<p><i>[Signature]</i> Mission Operations Director</p>

MISSION OPERATIONS DIRECTORATE
SHUTTLE CERTIFICATE OF FLIGHT READINESS (CoFR)
FLIGHT: STS-111/UF2 REQUIREMENTS

Critical Processors/Applications, Non-Crit Processors/Applications; Flight Rules: EMCC: Trng-MCC /POCC; FTP-New Operations; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Level II Actions; Mission Requirements; Exception Resolution; CMD Proc; FPPP Requirements Met; Contractor Process Insight	 DA8/Chief, Flight Director Office
Crit Processors/Applications; Non-Crit Processors/Applications; FDF; EMCC; TRNG-MCC/POCC; LCC; FTP-New Ops; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Level II Actions; Mission Requirements; Engineering Drawings; CMD Proc; FPPP Requirements Met; Contractor Process Insight	 DF/Chief, Systems Division
Crit Processors/Applications; Non-Crit Processors/Applications; FDF; EMCC; RECON-Flight SW (MMU); TRNG-MCC/POCC; FTP-New Ops; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; No Constraints; Level II Actions; Mission Requirements; CMD Proc; FPPP Requirements Met; Contractor Process Insight	R.C. Epp 5/3/02 DM/Chief, Flight Design and Dynamics Division
Crit Processors/Applications; Non-Crit Processors/Applications; FDF; FDF Manage; EMCC; PGSC; TRNG-MCC/POCC; FTP-New Ops; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Level II Actions; Mission Requirements; Engineering Drawings; CMD Proc; FPPP Requirements Met; Contractor Process Insight	 DO/Chief, Operations Division
EX/AI from Prior Reviews; No Constraints; Level II Actions; Mission Requirements; FPPP Requirements Met; Contractor Process Insight	 DT/Chief, Space Flight Training Division
FPPP Requirements Met; Contractor Process Insight	 DV/Chief, Advanced Operations & Development Division
FAC-NBL; FAC-SVMF; FDF; TRNG-Crew Trng; TRNG-MCC/POCC; TRNG-EVA/MARS; LCC; FTP-New Ops; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Level II Actions; Mission Requirements; Engineering Drawings; CMD Proc; EVA Hardware Integration; Contractor Process Insight	 DX/Chief, EVA, Robotics, & Crew Systems Operations Division
FAC-MCC; FAC-Network Interface; FAC-SMS; FAC-SPF; FAC-IPS ; Crit Processors/Applications; Non-Crit Processors/Applications; FD-Trajectory; FD-Consumables; FD-PDRS; FD-Analyst Cert; FD-CTF; FDF Manage; EMCC; RECON-STAR/MASTII/CD ROM Products; RECON-MCC; TRNG - Crew Trng; TRNG-MCC/POCC; TRNG-SMS; FTP-New Ops; Flight Anomaly Res; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Level II Actions; Mission Requirements; Engineering Drawings; Exception Resolution; CMD Proc; FPPP Requirements Met	 Associate Program Manager, Flight Operations, SFOC
EMCC; NETWORK; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; No Constraints; Level II Actions; FPPP Requirements Met	Ted Siskind 5/3/02 Network Director, Shuttle, GSFC
	 Mission Operations Director

STS-111/UF2 FLIGHT READINESS STATEMENT



THE MISSION OPERATIONS FLIGHT PREPARATION PROCESS PLAN DOCUMENTED IN NSTS 08117, REQUIREMENTS AND PROCEDURES FOR CERTIFICATION OF FLIGHT READINESS, HAVE BEEN SATISFIED. REQUIRED PRODUCTS AND OTHER RESPONSIBILITIES FOR MISSION OPERATIONS (NSTS 08117, SECTION 8, PARAGRAPH 8.5.7) HAVE BEEN OR WILL BE PRODUCED OR COMPLETED. ALL AREAS ARE READY. MISSION OPERATIONS IS PREPARED TO SIGN THE CERTIFICATE OF FLIGHT READINESS FOR STS-111/UF2.

A handwritten signature in black ink, appearing to read "Robert Castle", is written over a horizontal line.

R. E. CASTLE
MISSION OPERATIONS DIRECTOR

Backup

ISS State Vector
 source: TOPO
 received: 5/2/02
 ha/hp: 213 x 200 nmi

STS-111 DAILY PLANAR/PHASE WINDOWS

C. Osgood/USH-483L
 J. Ollivierre/USH-483L
 May 10, 2002

