

STS-112 Flight Readiness Review Minutes

The STS-112 Flight Readiness Review (FRR) convened at 8:30 a.m. on Tuesday, September 17, 2002, in the Mission Briefing Room at the Kennedy Space Center. The meeting was chaired by W. Readdy, Associate Administrator, Office of Space Flight.

Flight Crew, Ferry Readiness, and DDMS did not have any issues or constraints to flight and did not make formal presentations. Readiness statements were included in the backup package.

The STS-112 FRR presenters were:

Mission Operations - R. Castle (NASA/JSC/DA8)

A. Algate (NASA/JSC/DA8)

T. Sobchak (NASA/GSFC/451)

L. Bourgeois (USA/Houston/USH-421N)

Extra Vehicular Activity - G. Guirgis (Hamilton Sunstrand/JSC/XA-HAM)

G. Lutz (NASA/JSC/SM3/LM)

T. Kott (NASA/JSC/ES2)

Space and Life Sciences - C. Fischer (NASA/JSC/SD)

Program Integration - R. Glavez (NASA/JSC/MA2)

R. White (USA/Houston/USH-700C)

L. Austin (NASA/JSC/MS)

N. Otte (NASA/MSFC/MP31)

T. Sobchak (NASA/GSFC/451)

International Space Station - R. Torcivia (NASA/JSC/OC)

T. Sang (NASA/JSC/OB)

G. Parma (NASA/JSC/EB)

T. Bond (NASA/JSC/EC6)

T. Russell (Boeing/Houston/H020-F502)

W. Mackey (CSA/JSC/OR-CSA)

Payload Processing - G. Caliendo (NASA/KSC/UB-M)

External Tank - J. Pilet (LMSSC/MAF/D4130)

Reusable Solid Rocket Motor - S. Graves (Thiokol/Utah/ Thiokol/Utah/TI-L50)

Solid Rocket Booster - L. Clark (USA/KSC/USK-840)

Space Shuttle Main Engine - D. Wineland (Rocketdyne/Canoga Park/AC38)

Vehicle Engineering - R. Roe (NASA/JSC/MV)

D. White (USA/Houston/USH-601M)

Shuttle Processing - J. Vevera (USA/KSC/USK-229)

G. Crews (USA/KSC/USK-321)

M. Leinbach (NASA/KSC/PH)

Eastern Range - M. Gawel (45RANS/PAFB/DOS)

Safety Reliability & Quality Assurance - M. Erminger (NASA/JSC/MQ)

Mission Operations

The STS-112/9A mission to the International Space Station (ISS) will install the S1 truss containing thermal radiators, deploy the central radiator, transfer crew consumables, install spool positioning devices on the wet ammonia quick-disconnects, and perform three extravehicular activities. Mission requirements, integrated network activity, facility readiness highlighting first flight of the trajectory server, flight rule changes, and ascent performance were presented.

Extra Vehicular Activity (EVA)

Three scheduled EVA's will release radiator launch locks, mate utility trays, install the s-band antenna, connect ammonia tank umbilicals, install spool positioning devices, and bolt S1-to-S0 truss attach fittings. Extravehicular mobility unit (EMU) increased capacity batteries exhibiting less than expected capacities will be recharged and stored using new procedures. Pistol grip tool (PGT) S/N 1007 was found to be out-of-spec for low torque and will cause a re-evaluation of all PGT calibration procedures along with the replacement of tools currently on the Station.

Space and Life Sciences

Status was presented on crew health, detailed supplementary objectives, crew work/rest cycle violations, radiation analysis, and dosimetric support.

Program Integration

An 11-day mission has been baselined. The Space Station arm will perform all S1 truss berthing and EVA support operations. This will be the first flight of the Shuttle observation camera mounted to the ET. Real-time video coverage is planned from Launch-15 minutes through the mission elapsed time of 15 minutes.

International Space Station (ISS)

An overview of the mission objectives and priorities was presented. Crew consumables, payload status, and air purification system repairs were reviewed. Special topics included treadmill vibration isolation system chassis replacement, the potential hydraulic lockup of ammonia quick-disconnects, which will require the installation of multi-size spool positioning devices by EVA, and failure of the control moment gyroscope #1. Post UF-2 flight assessment of the Space Station Canadarm2 wrist roll joint anomaly revealed a short due to a wire fragment in an electrical connector.

Payload Processing

Open work, pad stow schedules, and launch scrub requirements were discussed.

External Tank (ET)

Liquid oxygen tank barrel and dome cap critical wall thicknesses have been increased to accommodate expansion of ullage pressure requirements during ascent. This gives the Orbiter fleet flexibility to use a variety of gaseous oxygen fixed orifice flow control valves. A recent process change features a redesigned composite intertank door using a new graphite/epoxy material. Liquid oxygen feedline foam insulation at station 1129 exhibited low plug pull test values and the insulation was repaired. Impact points on the liquid hydrogen tank aft dome membrane from a dropped disconnect pin have been analyzed and cleared for flight.

Reusable Solid Rocket Motor

A supplier process change uses a new, larger spiral mold for fabricating O-ring cord stock. This produces longer pieces of O-ring cord stock and reduces the number of splices. An audit of STS-112 x-ray films revealed 16 pieces of missing film and five occurrences of incorrect film exposure. Missing film may preclude detection of critical flaws. Flight rationale shows that structural/thermal analysis for assumed defects show positive margin and all materials/processes are in-family.

Solid Rocket Booster (SRB)

Silicone caulking material from ground support equipment was found as foreign object debris in the booster separation motor (BSM) propellant. Analysis and testing show BSM performance is not affected and that other flight elements can withstand debris impacts with no significant damage. A radial crack found in a fuel pump inlet port boss during vendor refurbishment was caused by installation loads and local corrosion pitting.

The presence of a crack with growth beyond a secondary O-ring seal allowing external fuel leakage would be detected by multiple leak verifications. Analysis shows minimal risk of crack growth during flight. Pump configuration has shown a history of high reliability and is safe to fly.

Space Shuttle Main Engine

Major components, ignition margins, predicted performance, and redline margins were presented. A scheduled overhaul of a high pressure oxygen turbo pump revealed cracks and missing material from a turbine outlet seal. No cause for the damage has been determined. However, worst case analysis shows acceptable engine performance and structural margins if a damaged seal is present during flight.

Vehicle Engineering

The Boeing orbiter critical skills transition process was discussed. All STS-110 and STS-111 anomalies (including the left orbital maneuvering system engine nitrogen regulator leakage and flash evaporator system B isolation valve failure) have been addressed. Although not a constraint to the STS-112 flight, numerous reaction control system thruster failures are the subject of a special investigation.

Critical process changes documented the initial release of the V30 structural interval extension review, substitution of O-rings in the thruster fuel and oxidizer valves, and main landing gear wheels with sleeves in the tie-bolt holes. Some of the modifications flying for the first time on STS-112 are: optional installation of sealant on the forward reaction control system pod, redesigned ET cavity ferry door attach fittings, and redesigned Orbiter-to-ET forward attach fitting stud.

Special topics included the inertial measurement unit failures due to slip ring flexure and misalignment, welding repair of the main propulsion system feedline flow liner cracks, and addition of a manipulator positioning mechanism (MPM) block/stop to preclude negative margins of safety during ascent loading.

Shuttle Processing

Repressurization of the auxiliary power unit gearbox and checkout of the Shuttle observation camera mounted on the ET were considered planned processing differences while the hardware modification to the MPM was an unplanned activity that affected pad milestone schedules. The loss of a 4.5-inch long wire cutter during an electrical task in the Orbiter aft compartment was discussed as a special topic. Numerous searches during vehicle processing were unsuccessful and rationale that the tool is not inside the ship was presented. Ground Operations gave a status of crawler/transporter return to operation after broken spherical bearings were replaced in the jacking, equalization, and leveling cylinders.

Eastern Range

The Cape Command Destruct System 1B, which failed in March 2001, has been repaired and certified for launch operations. Eastern Range now has dual redundant command systems.

Safety, Reliability and Quality Assurance

Significant assessments have been performed on the flowliner cracks, inertial measurement unit slip ring broken wires, high pressure oxygen turbo pump turbine outlet seal damage, booster separation motor contamination, auxiliary power unit fuel pump housing crack, solid rocket motor X-ray film discrepancies, crawler spherical bearing repairs, TVIS chassis replacement, and pistol grip tool under torque. Aerodynamic sensitivity of the Shuttle observation camera fairing and antenna have been identified as two new Criticality 1 items for STS-112/9A.

Exceptions/Action Items

There were two Space Shuttle Program certificate of flight readiness (CoFR) exceptions: the pistol grip tool failure (EVA), and incomplete analysis of main propulsion system feedline flow liner gimbal ring loads (Vehicle Engineering). The ISS Program also listed the pistol grip tool failure as an ISS CoFR exception.

Concerning the recent stress analysis negative margins calculated for the MPM, an action assigned to Vehicle Engineering will confirm no possible loss of function of the load relief block due to expected on-orbit thermal environments.

The exceptions and action item will be closed with final flight rationale at the STS-112 Prelaunch Mission Management Team meeting.

Mr. Readdy polled the principal managers and organizations; all responded ready to support the STS-112 mission.



James D. Halsell, Jr.
Colonel, USAF
Manager, Launch Integration

Enclosures:
Agenda
Exception Log
Action Log

STS-112
Flight Readiness Review
September 17, 2002

Agenda

Introduction	Manager, Launch Integration
Mission Operations	Director, Mission Operations APM, Flight Operations, SFOC
EVA	Manager, EVA Project
Flight Crew	Director, Flight Crew Operations
Space and Life Sciences	Director, Space and Life Sciences
Program Integration	Flight Manager Manager, Space Shuttle KSC Integration Manager, Space Shuttle Systems Integration Manager, Space Shuttle Customer and Flight Integration APM, Program Integration, SFOC
International Space Station	Manager, International Space Station Program
Payload Processing	Director of ISS/Payloads Processing
External Tank	Manager, External Tank Project
RSRM	Manager, Reusable Solid Rocket Motor Project
SRB	Manager, Solid Rocket Booster Project APM, SRB Element, SFOC
SSME	Manager, Space Shuttle Main Engine Project
Vehicle Engineering	Manager, Space Shuttle Vehicle Engineering APM, Orbiter Element, SFOC APM, Flight Software, SFOC APM, FCE/EVA, SFOC
Ferry Readiness	Ferry Operations Manager
Shuttle Processing	Director of Shuttle Processing APM, Ground Operations, SFOC APM, Integrated Logistics, SFOC
Range	United States Air Force
DDMS	Director, DDMS
Space Shuttle SR&QA	Manager, Safety, Reliability and Quality Assurance
Exception/Action Summaries	Manager, Launch Integration
Readiness Poll	Associate Administrator, Office of Space Flight

CoFR EXCEPTION LOG

REQUIREMENT/ EXCEPTION NUMBER	ELEMENT	DESCRIPTION OF EXCEPTION	DUE DATE
CoFR REVIEW DATE: 09-17-02 STS FLT NO. STS-112			
001	EVA	8.5.2.1A ALL EQUIPMENT CHANGES APPROVED BY THE EVA CCB AND EVA HARDWARE BOARD ARE INCORPORATED. PISTOL GRIP TOOL FAILURE REQUIRES RESOLUTION, WAIVER ACCEPTANCE OF FAULT TOLERANCE DISCREPANCY, AND APPROVAL OF NEWLY IDENTIFIED CIL.	STS-112 PMMT
002	ORBITER	8.5.18.1 (aa) ALL ANOMALIES THAT POTENTIALLY IMPACT PROCESSING, LAUNCH, MISSION SUCCESS OR LANDING HAVE BEEN REPORTED AND SUCCESSFULLY RESOLVED WITH NASA. THE ANALYSIS TO SHOW POSITIVE MISSION LIFE FOR THE MPS FEEDLINE GIMBAL RING AND YOKE HAS NOT BEEN COMPLETED. ANALYSIS BASED ON NEW MODELS INCORPORATING DATA GATHERED FROM VEHICLE FLOW LINER TESTING AND HIGH FREQUENCY FLIGHT DATA IS CONTINUING. IT IS EXPECTED THAT THIS ANALYSIS WILL YIELD A POSITIVE MARGIN OF SAFETY AND ADEQUATE MISSION LIFE. RESULTS WILL BE PRESENTED AT THE STS-112 PRELAUNCH MMT REVIEW.	STS-112 PMMT

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ACTION ITEM LOG

CONTROL NO.	ASSIGNEE(S)	ACTION	C	DUE DATE	CLOSURE DATE
112-FRR-001	VEHICLE ENGINEERING	CONFIRM NO POSSIBLE LOSS OF FUNCTION OF THE RMS MPM BLOCK DUE TO EXPECTED ON-ORBIT THERMAL ENVIRONMENT. REPORT RESULTS AT THE STS-112 PMMT REVIEW.		STS-112 PMMT	