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STS-102/5A.1 Flight Readiness Review EVA Project Office

**George G. Guirgis
Johnson Space Center
February 27, 2001**



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EVA Mission Overview

- **EVA Capability**
 - Two scheduled EVA's at 10.2psi
 - Two Unscheduled EVA at 14.7psi for ISS Contingencies
 - Two Contingency EVA's for Orbiter, RMS, & ODS contingencies
- **Training**
 - Crew to be fully trained on all EVA tasks by February 27, 2001
 - Training ratio of 10:1 met
 - All planned tasks can be accommodated within scheduled 6:30 timelines for both EVA's



EVA Mission Overview

- **EVA 1 (Flight Day 4) - 6:30**
 - Disconnect/Stow PMA3 to Node 1 Umbilicals (5A.1 MPLM Berthing)
 - Remove Port Node 1 ECOMM Antenna (5A.1 MPLM Berthing)
 - Lab Cradle Assembly (LCA) Transfer (6A SLP Berthing)
 - Rigid Umbilical Install (6A SSRMS Ops)
 - Rigid Umbilical Connect (6A SSRMS Ops)
- **EVA 2 (Flight Day 6) - approximately 4:45**
 - External Stowage Platform (ESP) Remove & Install (Critical Spare Stowage)
 - Pump Flow Control System (PFCS) Transfer & Install (Critical Spare)
- **Get Aheads (Scheduled in Nominal Timeline):**
 - Preposition gap spanner for STS-100/6A use (EVA 1)
 - Preposition two APFR's for STS-100/6A use (EVA 2)



EMU & SAFER Logistics

- **2 EMU's Manifested/ 1 EMU On-orbit**
 - One medium and one large planar hard upper torso (HUT) plus the utilization of one large orbital replacement Unit (ORU), which was left behind on STS-98/5A
 - Additional space suit assembly hardware to support any combination of two of the four eligible EVA crewmembers
- **Two SAFER's Left On-Orbit by STS-97/4A**
 - S/N 1005 and 1007
 - SAFER Logistics plan- STS-100/6A will return S/N 1005 and 1007 and leave two new units
- **EMU/SAFER FIAR's or Cert Issues**
 - Glove Heater issue- See Special Topics
- **EMU & SAFER First Flight Hardware**
 - None



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EMU & SAFER Logistics (cont'd)



- **EMU & SAFER hardware left on ISS after STS-102/5A.1**
 - One large ORU EMU (from STS-98/5A)
 - Two SAFER's (from STS-97/4A)
 - Expedition 2 EVA Hardware (Prepositioning for post 7A EMU EVA Capability)
 - One Arm Sizing Ring Kit
 - Four Phase VI Gloves
 - Two MAG's
 - Two Comfort Gloves
 - Two Disposable Insuit Drink Bags (DIDB)
 - One DIDB Restraint Bag



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EVA Tools & Crew Aids Manifest Summary



- **EVA Tools & Crew Aids First Flight Items**
 - None
- **Non-GFE EVA Hardware First Flight Items**
 - Three LCA Lugs (Part of the LCA Installation)
 - Two Nominal; One spare unit
- **Standard contingency tools in Port TSA plus ISS EVA cheater bar**
- **Sill-Mounted PFR Configuration**
 - Full stack (Bay 2 Port Location)
- **Standard complement of slide wires, safety tethers, crew hook locks, and winches in PLB**
- **All EVA hardware was on dock at KSC on February 22, 2001**



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EVA Tools & Crew Aids Manifest Summary



- **EVA Tools & Crew Aids Left On-Orbit**
 - EVA Installed
 - Two LCA Lugs
 - Wire Ties (Using approximately 6 of 36 flown)
 - Four Electrical Connector Covers (Installed after the PMA3 to Node1 Umbilicals are disconnected)
- **EVA Tools & Crew Aids Swapped On-Orbit**
 - Two PGT Batteries (swapped with Two left on STS-98/5A)
 - Two Retractable Equipment Tethers (On-orbit are at the end of their on-orbit life)
- **EVA Tools & Crew Aid Returned**
 - None



- **Tool-to-Tool Fit Checks (328 total interfaces)**
 - 98 percent total complete (311 of 317)
 - 14/14 Payload Bay = 100 percent
 - 103/103 LWTSA = 100 percent
 - 194/200 Middeck = 97 percent
 - Six fit checks not performed on the Torque Multiplier to Modular Mini-Workstation (MMWS) Gimbal.
 - » Interface which was not checked is for stowage of the Torque Multiplier to MMWS during transition to a worksite. Tether points exist on the TM as a redundant means for stowage during translation.
- **Tool-to-Interface Fit Checks (25 total tasks)**
 - 22/25 completed = 88 percent
 - The following will not be completed:
 - ESP to Common Structural Interface (CSI): Dispositioned based on fit check between Class I Square Grid and Flight CSI. Accepted by ISSP.
 - 6A Direct Current Switching Unit interface (Flight Releasable Attachment Mechanism-FRAM) to ESP: Will complete fit check between Class I Square Grid and Flight FRAM upon completion of FRAM construction. Accepted by ISSP.
 - Lab Heat Exchanger (Critical Spare): Launched in the MPLM and stowed IV- (4) 7/16” bolts will be fit checked on-orbit via request. Accepted by ISSP.



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EVA Sharp Edge Inspections



- **Sharp Edge Inspections**
 - 100 percent complete on ICC and all five ICC Mounted Items
 - Will be completed by pad walk down on March 5, 2001



Loose Weld Plug From EMU Fan/Pump/Separator



- **Background**

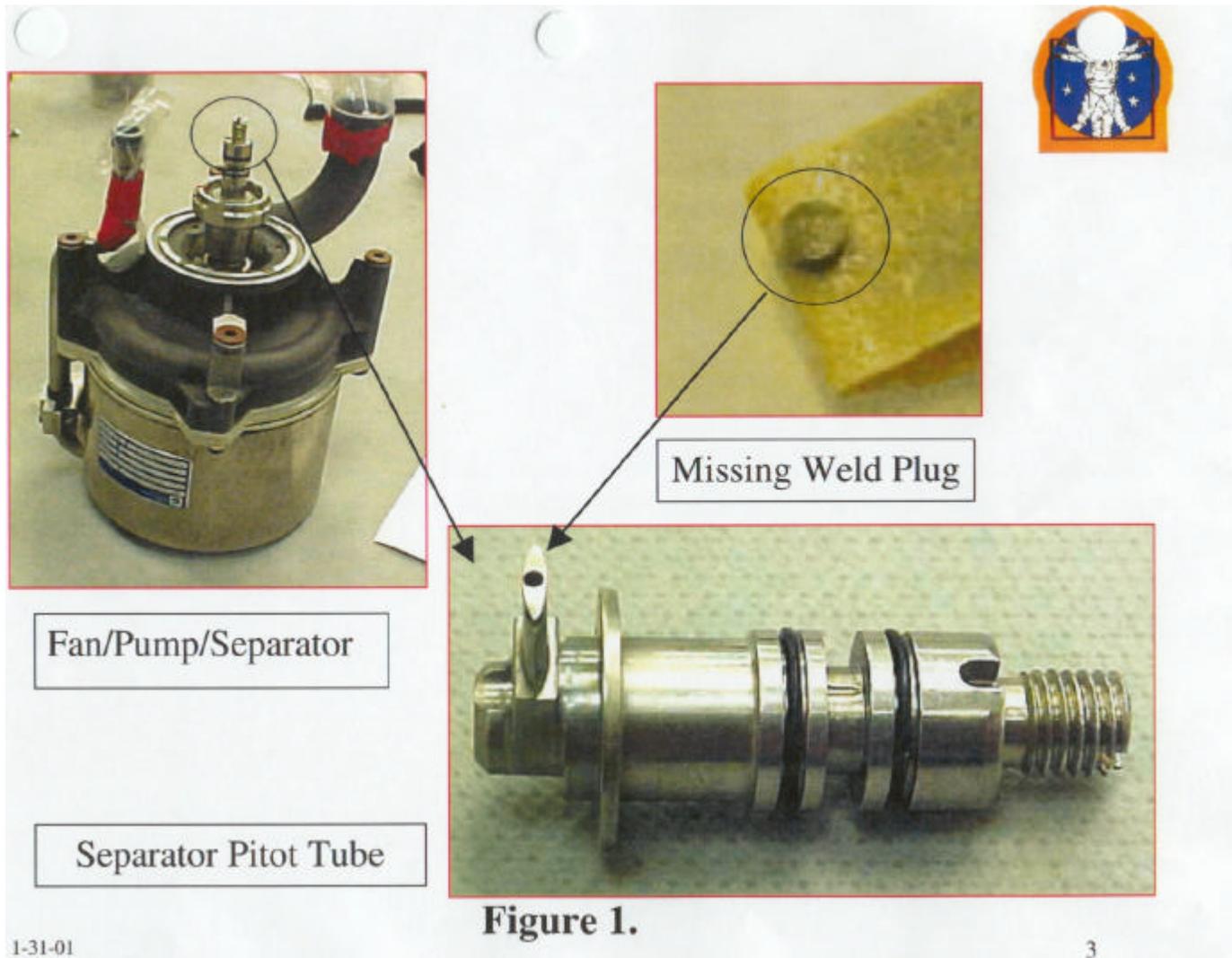
- S/N 017 Fan/Pump/Separator (FPS) failed during in-process testing after refurbishment at Hamilton Sundstrand, Windsor Locks.
 - Welded plug which sealed drilled passage in pitot blade of water separator came loose
 - As experienced symptoms were water carryover into vent loop with corresponding high current draw

- **Mission Impact (EVA)**

- Jamming of rotating drum or impeller by loose particle – could cause the fan to stop resulting in loss of vent flow and water cooling
- Fan motor is low torque (1.7 in-oz) and high speed (~17K RPM)
 - With loss of fan CO₂ removal capability will also be lost, requiring opening of display and controls module (DCM) purge valve
 - Mission rules dictate EVA termination on Secondary Oxygen Pack (SOP) with open purge valve. (Time to ingress airlock approximately 30 minutes)



Fan/Pump/Separator Failure





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Loose Weld Plug From EMU Fan/Pump/Separator



- **Recovery Plan STS-102**

- SEMU's for STS-102 have FPS's with a welded plugs that have been verified good
 - Unit left on ISS from STS-98 was verified to have fan/pump/separator with exonerated welded plugs



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Phase VI Glove Damage From 12-Volt Heaters



- **Background**

- Following crewmember Forrester's human rated thermal vacuum chamber run, all 10 heater elements had bonded to the restraint fingernail re-enforcement
- Subsequent inspection found glove bladder (Urethane) deformation from over heating

- **Mission Impact (EVA)**

- As experienced – none
- Worst Case
 - If bladder softens to the point of causing a hole – external leakage
 - In unlikely scenario that a hole does develop SOP would be activated to make up loss



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Phase VI Glove Damage From 12-Volt Heaters



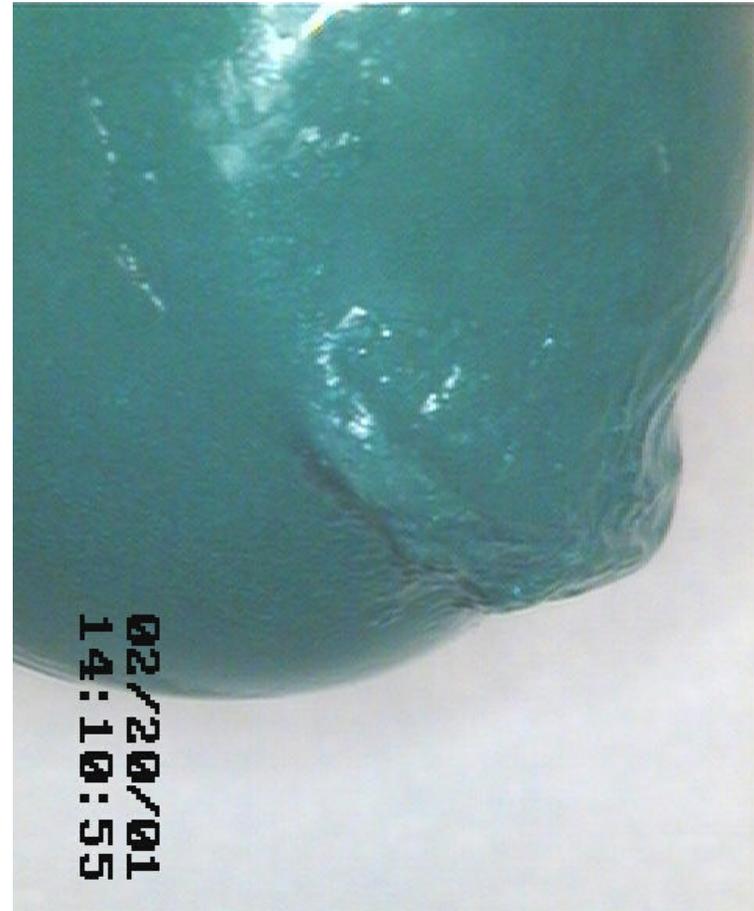


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Phase VI Glove Damage From 12-Volt Heaters



Bonded Heater



Damaged Bladder



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Phase VI Glove Damage From 12-Volt Heater



- **Recovery Plan STS-102**

- STS-102 gloves (five pairs) have not been exposed to “heater on” time sufficient to incur any damage.
- STS-102 thermal analysis predicts a benign thermal environment with use of heater gloves not nominally expected
- Based upon recent testing that determined what “heater on” time is required to reach bladder temperatures of concern (above 170° F). A use cycle (heater on) operational constraint will be used to control this hazard.
 - Control REBA battery voltage to 11 volts (12.5 nominal)
 - Pre-condition crew to warm side of comfortable
 - Use heaters only if necessary to recover from cold
 - Manage heater “on time” with margin (4.0 safety factor) to control temperature below the temperature that could deform bladder
 - Position other crewmember to turn off REBA switch as backup for unlikely failed-on heater switch



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STS-102/5A.1 Planned Forward Work



CoFR1 Item ID	Title/Description	Plan to Close	Resp. Org	ECD	Risk to Flight
SOW	V1103	V1103	EC/MOD	2/28/01	Low
PFW	Sharp Edge Inspection	Plan to be completed during Crew PLB Walkdown	VITT/CB	3/5/01	Low

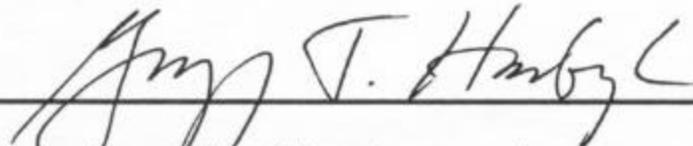


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STS-102/5A.1 FRR



- There are no EVA exceptions for STS-102/5A.1 FRR
- The EVA Project Office is ready to proceed with 5A.1 launch and on-orbit stage operations pending completion of the planned forward work
- All open work will be closed or dispositioned by L-2



Gregory J. Harbaugh
Manager, EVA Project Office



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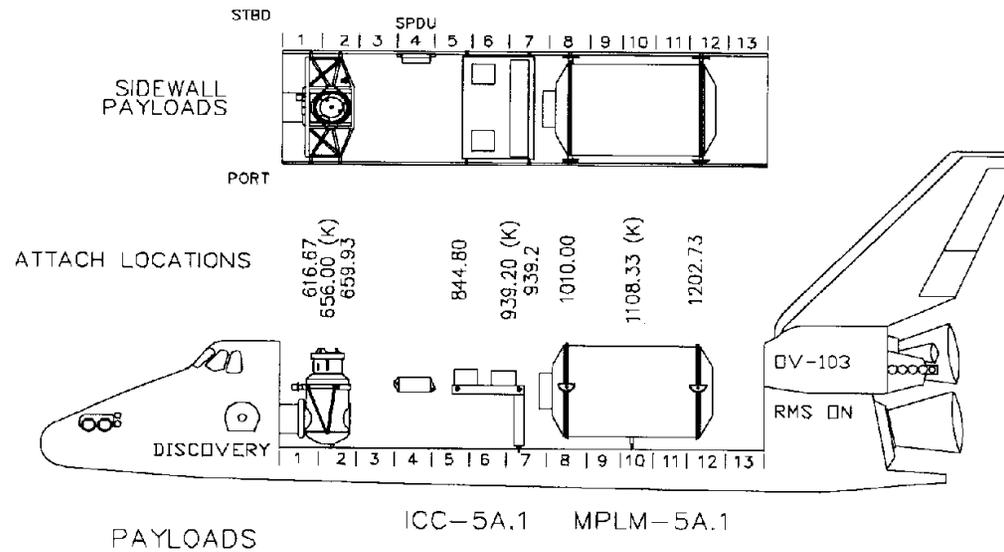
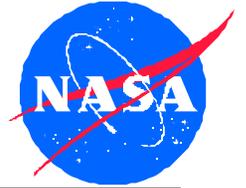


Backup Charts



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Payload Bay Configuration

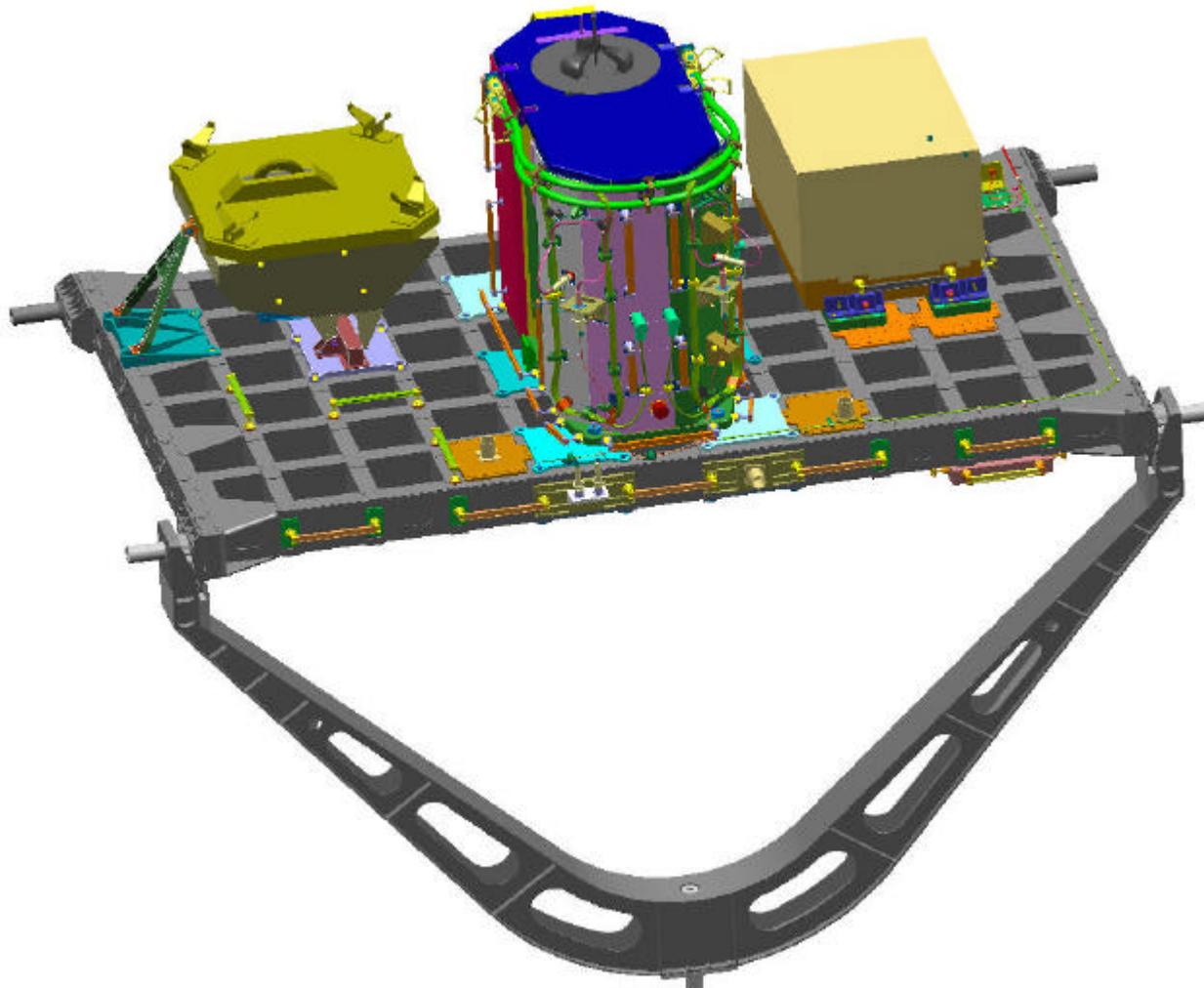
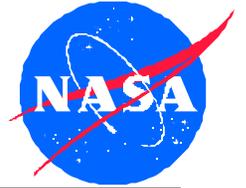


ISS ICC configuration release drawing not available.



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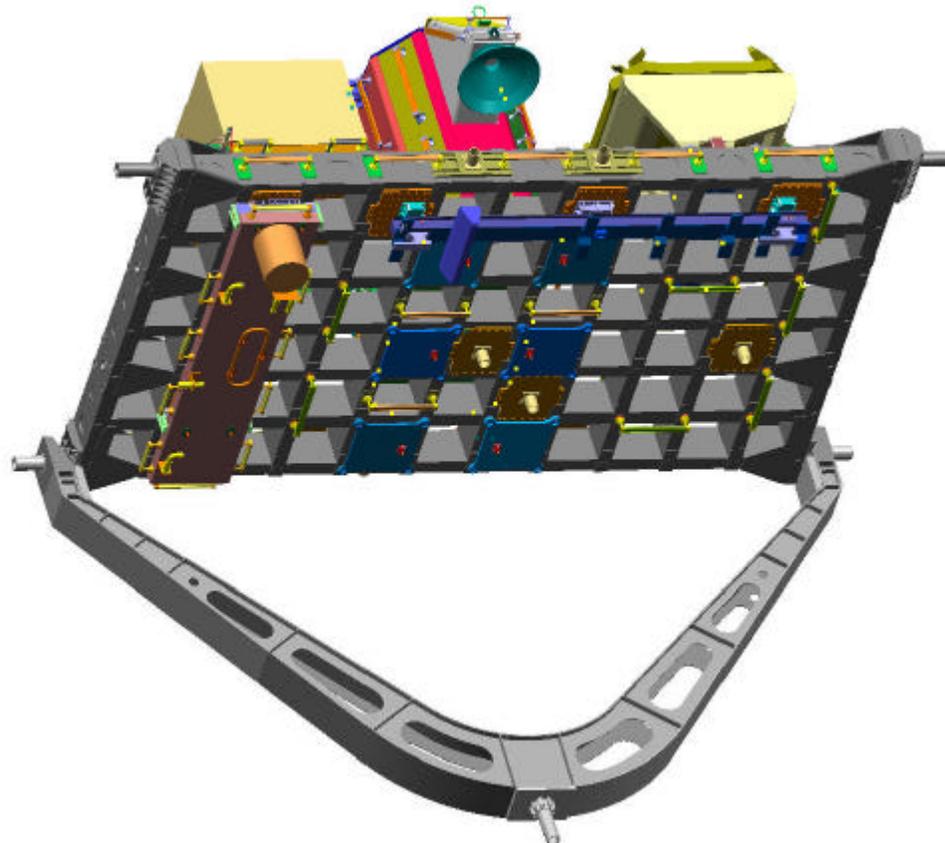
ICC in Launch Configuration Topside





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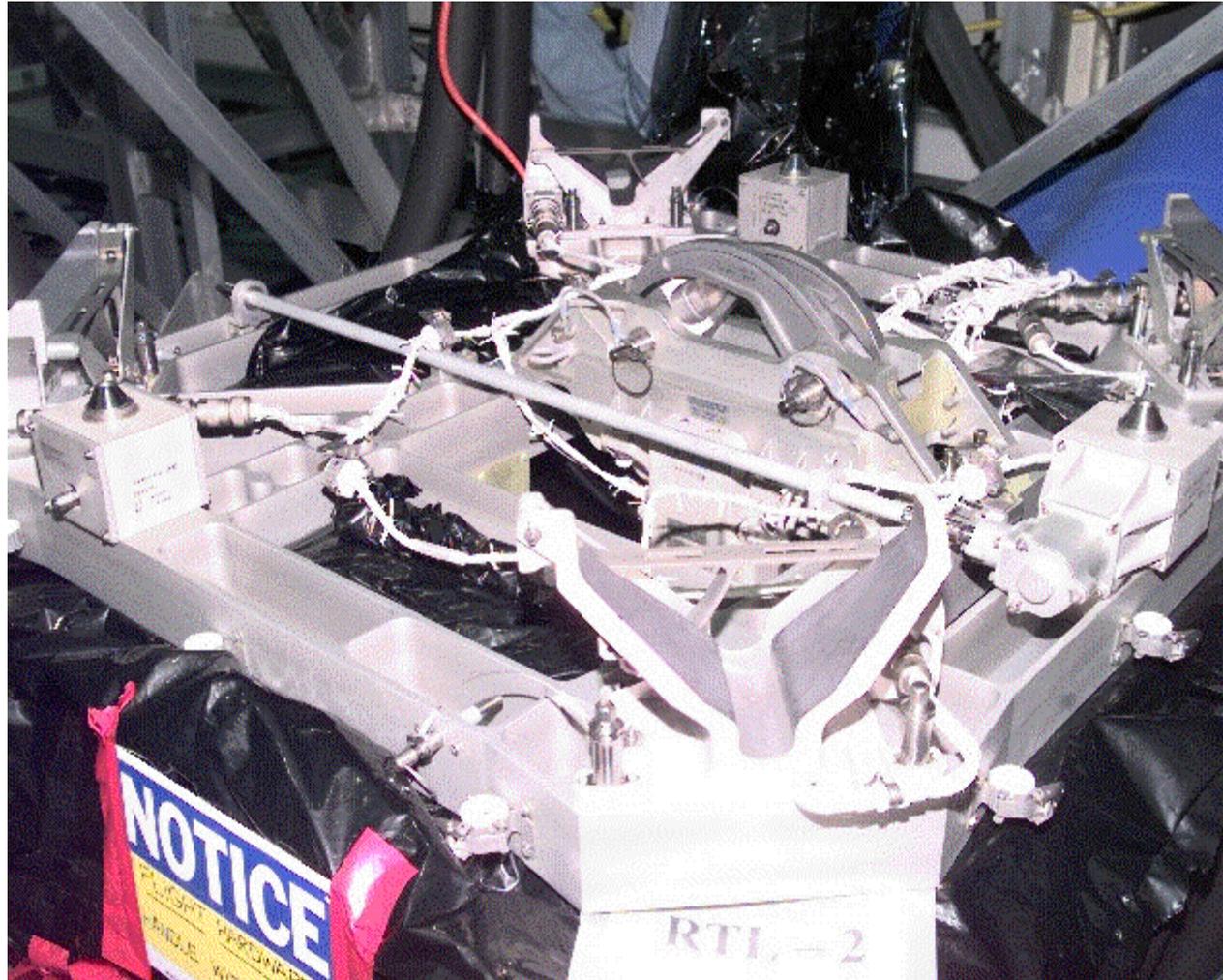
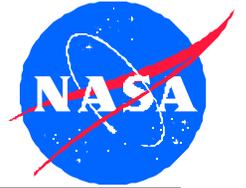
ICC in Launch Configuration Underside





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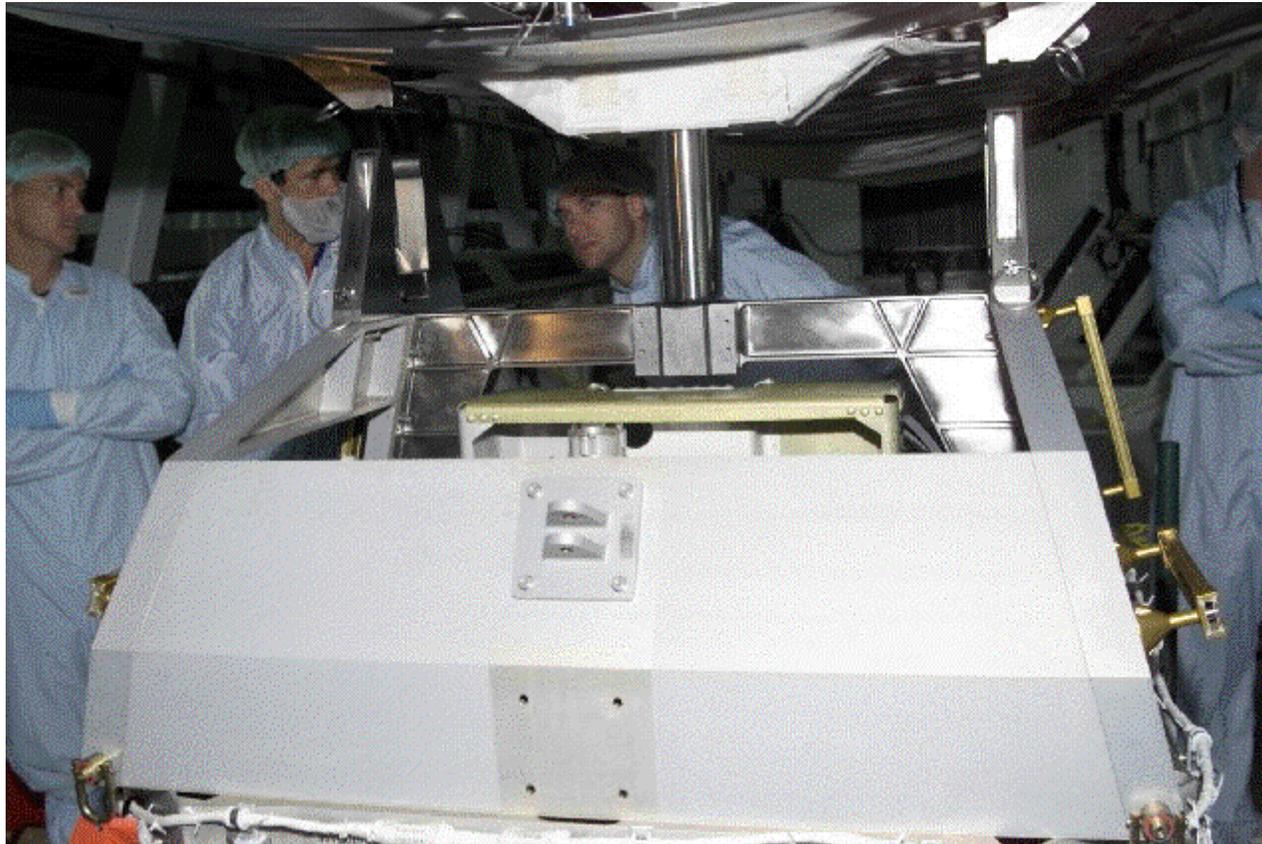
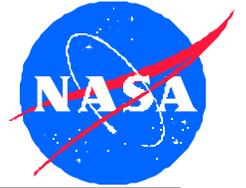
Overview of MTSAS





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LCA to Lab Interface





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RU- Aft Looking Forward- No MMOD Shields on the Lab

