



# SPACE SHUTTLE MISSIONS SUMMARY

	<b>PCN-3 Change ORBITER</b>	CREW (6+1 UP/6+1 DN)	LAUNCH SITE, LIFTOFF TIME,	LANDING SITE/ RUNWAY, CROSSRANGE	SSME-TL NOM-ABORT EMERG	SRB RSRM			FSW	PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS	MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)
NO.	<b>This Column Only</b>	TITLE, NAMES & EVA'S	LANDING SITES, ABORT TIMES	LANDING TIMES FLT DURATION, WINDS	THROTTLE PROFILE ENG. S.N.	AND ET	INC	HA/HP			

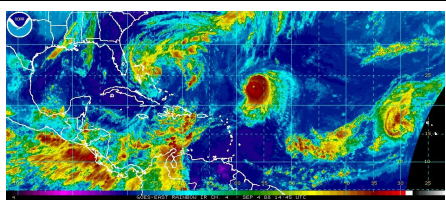
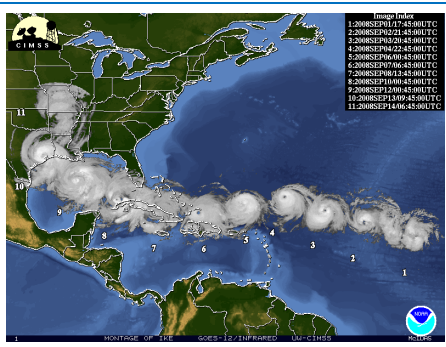
# SPACE SHUTTLE MISSIONS SUMMARY

<p><b>STS-126/ISS-ULF2</b>  SEQ FLT # 124  KSC-124  PAD 39A (47)  MLP- 3  27<sup>th</sup> SHUTTLE FLIGHT TO ISS</p>	<p>OV-105 (Flight 22) ENDEAVOUR  OMS PODS: LPO3-33 RPO4-29 FRC5-22  PLT Eric Boe P772/R331/M286  MS1 Donald Pettit Flt 2 (STS-113 Up - Soyuz TMA-1 Dn) P773/R289/V198/M253  MS2 Steve Bowen P774/R332/M287  MS3 Heidemarie Stefanyshyn-Piper Flt 2 (STS-115) P775/R301/V199/F40  MS4 Shane Kimbrough P776/R333/M288  MS5 UP Stay ISS EXP 18/FLT ENG Sandra Magnus Flt 2 (STS-112) P777/R284/V200/F36  MS5 DN EXP 17/Flt ENG Greg Chamitoff (UP ON STS-124, stay ISS) P778/R330/M285  SS EVA 125 DOCKED QUEST EVA 48 EMU/TETHERED EVA 118 SCHEDULED EVA 116 DURATION 6:52  Continued...</p>	<p>CDR: Chris Ferguson Flt 2 (STS-115) P771/R300/V197/M179  PLT Eric Boe P772/R331/M286  MS1 Donald Pettit Flt 2 (STS-113 Up - Soyuz TMA-1 Dn) P773/R289/V198/M253  MS2 Steve Bowen P774/R332/M287  MS3 Heidemarie Stefanyshyn-Piper Flt 2 (STS-115) P775/R301/V199/F40  MS4 Shane Kimbrough P776/R333/M288  MS5 UP Stay ISS EXP 18/FLT ENG Sandra Magnus Flt 2 (STS-112) P777/R284/V200/F36  MS5 DN EXP 17/Flt ENG Greg Chamitoff (UP ON STS-124, stay ISS) P778/R330/M285  SS EVA 125 DOCKED QUEST EVA 48 EMU/TETHERED EVA 118 SCHEDULED EVA 116 DURATION 6:52  Continued...</p>	<p>KSC 39A 320:00:55:39Z 7:55:39 PM EST (P) 7:55:39 PM EST (A) Friday (26) 11/14/08 (15)  <u>LAUNCH WINDOW:</u> 4M 39S (PLT in-plane)  EOM PLS: KSC TAL: ZZA TAL WX: FMI  <u>SELECTED:</u> RTLS: KSC15 CI/NOM TAL: ZZA30L N/N AOA: KSC15 CI/N 1<sup>ST</sup> DAY PLS: EDT22 N/SFD  Continued...</p>	<p>EDT04 CONC EDW 52 CONC 33 335:21:25:09Z 1:25:09 PM PST Sunday (15) 11/30/08 (13)  <u>DEORBIT BURN:</u> 335:20:19:29Z  <u>XRANGE:</u> 169.6 NM  <u>ORBIT DIR:</u> A/L (40)  <u>AIM PT:</u> Close-In  <u>MLGTD:</u> 2040 FT 5:09Z VEL: 219 KGS KEAS  Continued...</p>	<p>104/104/10 9%  <u>PREDICTED:</u> 100/104.5/1 04.5/ 72/104.5  <u>ACTUAL:</u> 100/104.5/1 04.5/ 72/104.5  1 = 2047 (12) 2 = 2052 (7) 3 = 2054 (8)  M 3 EOM: WEIGHT: 221787 LBS X CG: 1087.2 IN  <u>LANDING:</u> WEIGHT: 221712 LBS X CG: 1089.0 IN</p>	<p>BI-136 RSRM 104 ET-129  SLWT 32  ET IMPACT  MET 1:14:18  LAT: 36.202 S LONG: 158.21 SW  OMS-125.7</p>	<p>51.6 (27)  DIRECT INSERTION  POST OMS-2: 125.7x 84.6NM  DEORBIT: HA 193.1 NM HP 21.9 NM  ENTRY VELOCITY: 25863 FPS  ENTRY RANGE: 4400NM</p>	<p>OI-33 (1)  CARGO: 39471 LBS  <u>PAYLOAD CHARGEABLE:</u> 32403 LBS  <u>DEPLOYED:</u> 30432 LBS  <u>NON-DEPLOYED:</u> 1760 LBS  <u>MIDDECK:</u> 211 LBS  <u>SHUTTLE ACCUMULATED WEIGHTS:</u> <u>DEPLOYED:</u> 1487349 LBS  <u>NON-DEPLOYED:</u> 1603708 LBS  <u>CARGO TOTAL:</u> 3982716 LBS  <u>PERFORMANCE MARGINS (LBS):</u> FPR: 2651 FUEL BIAS: 1063 FINAL TDDP: 1682 RECON: 2329  <u>PAYLOADS:</u> PLB: ISS-ULF2 (MPLM, LMC),SSPL/PSSC  <u>MIDDECK:</u> ISS-ULF2, MAUI SEITE  5 CRYO TANK SETS  RMS (81) SRMS, ODS, OBSS, SSPTS</p>	<p><b>Brief Mission Summary: "Extreme Home Improvements" STS-126/ULF2 (27th ISS mission) outfitted the ISS to increase accommodations from a crew of three to six. Life support and habitability additions included: an advanced resistive exercise device, a second toilet, a galley, two sleep stations and an integrated water recycling system. The mission also included EVA's for lubricating the sluggish Solar Alpha Rotary Joints (SARJ) and installation of other external systems.</b></p> <p>Endeavour was originally rolled to Launch Pad 39B as the Launch on Need (LON) vehicle in support of STS-125 HST servicing mission. Last minute complications with HST caused an indefinite delay for STS-125. Endeavour was rolled to Launch Complex 39A and prepared for the STS-126 November launch date. (Shuttles have only moved from one spaceport launch pad to another twice before in the program's history, in 1990 and 1993.)</p> <p><b>KSC W/D</b> The Orbiter prep days are 162 workdays (W/D) + 3 holidays + 3 weather days in the OPF. VAB ops = 7 W/D + 1 weather day Pad B ops = 19 W/D + 15 contingency days Pad A ops = 18 W/D + 5 contingency days Total W/D = 206</p> <p><b>LAUNCH POSTPONEMENTS</b> - Added STS-126 to FDRD - launch date of 09/18/08 on 08/15/07. - Ppd. to 10/16/08 on 02/14/08. Slip due to ECO sensor problems experienced during December launch attempt of STS-122. - Ppd. to 11/10/08 on 05/27/08. Slip due to delays in delivery of ET-127 &amp; ET-129 for STS-125 &amp; STS-400, respectively. - Ppd. to 11/12/08 on 09/08/08. Slip due to Hurricane Faye impacts to HST payload readiness. - Ppd. to 11/16/08 on 09/24/08. Slip due to STS-125 slip to from 10/10/08 to 10/14/08 caused by Hurricane Ike. - Launch moved forward to 11/14/08 on 10/19/08. Move due to critical path adjustment. STS-126/ULF2 now "prime crew" as STS-125 postponed to NET Mid-Feb 2009 on 10/02/08.</p> <p><b>LAUNCH SCRUBS:</b> None.</p> <p>Continued...</p>
		 <p>STS-125 (HST Service) &amp; LON Vehicle on Pads 39A &amp; 39B. LON Vehicle became STS-126 when STS-125 was ppd to 2009. Picture courtesy of Rod Ostoski/KSC-USA.</p>		<p>Continued...</p>		<p>Continued...</p>			

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FLT	ORBITE R	CREW (7)	LAUNCH SITE, LIFTOFF TIME,	LANDING SITE/ RUNWAY, CROSSRANGE	SSME-TL NOM- ABORT EMERG	SRB RSRM	ORBIT		FSW	PAYLOAD WEIGHTS,	MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS,
NO.		TITLE, NAMES & EVA'S	LANDING SITES, ABORT TIMES	LANDING TIMES FLT DURATION, WINDS	THROTTLE PROFILE ENG. S.N.	AND ET	INC	HA/H P		PAYLOAD S/ EXP	TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)

# SPACE SHUTTLE MISSIONS SUMMARY

<p><b>STS-126/ISS-ULF2</b> Continued... ...</p>	<p>Continued... SS EVA 126 DOCKED QUEST EVA 49 EMU/TETHERED EVA 119 SCHEDULED EVA 117 DURATION 6:45  SS EVA 127 DOCKED QUEST EVA 50 EMU/TETHERED EVA 120 SCHEDULED EVA 118 DURATION 6:57  SS EVA 128 DOCKED QUEST EVA 51 EMU/TETHERED EVA 121 SCHEDULED EVA 119 DURATION 6:07  MCC WHITE FLIGHT FCR (54)  <u>FLIGHT DIRECTORS: SHUTTLE:</u> ASC- Bryan Lunney LD/O1- Mike Sarafin O2- Tony Ceccacci FD 1-12 - Paul Dye FD 13-EOM Planning- Paul Dye FD 1-3 - Kwatsi Alibarufo FD 4-EOM ENT- Bryan Lunney MOD - John McCullough Team 4- Richard Jones  ISS O1 - Holly Ridings LD/O2- Ginger Kerrick O3 - Brian Smith Team 4- Courtenary</p>	<p>Continued... <u>TDEL:</u> 0.000 (P) 0.192 (A)  <u>MAX Q NAV:</u> 757.6 (P) 750.2 (A )  <u>SRB STG:</u> 2:04.32(P) 2:06.24(A)  <u>PERF:</u> NOMINAL  <u>2 ENG TAL (MRN):</u> 2:38 (P) 2:39 (A)  <u>NEG RETURN:</u> 3:52 3:54  <u>PTA (U/S 157 FPS):</u> 5:08 5:14  <u>SE TAL (ZZA 104):</u> 6:01 6:04  <u>PTM (U/S 168 FPS):</u> 6:07 6:18  <u>SE PRESS 104</u> 6:54 6:59  <u>MECO CMD:</u> 8:22.1 8:23.0  <u>VI:</u> 25819.0 25818.8  <u>OMS-2:</u> 38:20 38:19.3 97.4 FPS 95.9 FPS</p>	<p>Continued... <u>DRAG CHUTE DEPLOY:</u> 193 KEAS 335:21:25:12Z  <u>NLGTD:</u> 6761 FT 335:21:25:20Z <u>VEL:</u> 154 KGS 146  KEAS HDOT: -6.2 FPS  <u>BRK INIT:</u> 124 KGS  <u>DRAG CHUTE JETTISON:</u> 53 KGS 335:21:25:42Z  <u>BRK DECEL FPS<sup>2</sup>:</u> : <u>AVE</u> 6.2 PK 9.3  <u>WHEELS STOP:</u> 335:21:26:02Z 11180 FT  <u>ROLLOUT:</u> 9140 FT 0:53 M:S  <u>WINDS:</u> 4H KT 0 KTS <u>OFFICIAL:</u> 04004P06 KTS 6H 0CROSS KTS  <u>DENS ALT:</u> 3234 FT  <u>FLT DURATION:</u> 15:20:29:30 <u>S/T:</u> 1183:15:39:46 <u>OV-105:</u> 250:22:48:03 <u>DISTANCE:</u> 6,615,109 sm <u>TOTAL SHUTTLE DISTANCE:</u> 480,274,259 sm</p>	 <p>Parade of storms during STS-125 &amp; STS-126 launch preps as seen on Sep. 04, 2008: Gustav (inland remnants, upper left)</p>  <p>IKE08-notrack.gif: Hurricane IKE tracking. Category 2 landfall at 2:10 a.m. CDT near Galveston Sep. 13, 2008. (From: JSC Roundup Nov. 2008) Damage from hurricanes east NASA</p>	<p>Continued... <b>LAUNCH WINDOW:</b> Total launch window was 9 minutes 26 seconds with window open at 320:00:50:52Z and close at 320:01:00:18Z. Preferred Launch Time was 320:00:55:39 (In-Plane Time) for a launch window of 4m39s.  <b>LAUNCH DELAYS:</b> None. Launch occurred on time at 320:00:55:39Z, 7:55:39 p.m. EST, Friday, November 14, 2008. Weather on launch day was acceptable. Isolated afternoon showers were observed at 60 miles south of KSC along the sea breeze late in the day. The showers diminished by sunset - not a threat for the evening launch time or RTLS.  <b>TAL WEATHER</b> Weather at the TAL sites was forecast/observed GO.  <b>PERFORMANCE ENHANCEMENTS:</b> Include the standard set plus: 1) PE Operational High Q TRN/NOV, 2) OMS Assist, 3) a 52 nautical mile MECO, and 4) Del Psi  <b>FLIGHT DURATION CHANGES/LANDING:</b> - FD 11 MMT decision made for a one-day extension for additional on-orbit time for the Urine Processing Assembly (UPA) troubleshooting &amp; processing or possible Distillate Assembly (DA) return. - Weather for landing was quite complex. Both KSC and EAFB were activated on Sunday, November 30, 2008, as possible landing sites. A large upper level low pressure system over the eastern US with a cold front moving across FL were concerns for landing at KSC on Sunday (EOM) &amp; Monday (EOM+1). Spaceflight Meteorology Group (SMG) weather forecasts were "NO GO" for KSC with crosswind, ceiling, precipitation, and thunderstorm flight rule violations. Also, two Tornado Watches were issued for central FL and a third Watch included KSC. A squall line moving east at 20 kts combined with an unstable air mass across south and central FL generated numerous thunderstorms and isolated tornadoes by mid day. The weather continued to deteriorate across central FL, prompting the MMT to assess the possibility of staying on orbit and attempting EOM+1 landing at KSC. The SMG forecasts for that day indicated marginal conditions for a safe return to KSC. After waving off the first opportunity to KSC and with weather conditions deteriorating through the day at KSC, the decision was made to land at EAFB. Weather conditions at EAFB were nearly ideal with light northeast surface winds and mostly clear skies. Endeavour touched down at 335:21:25:09Z (3:25 PM CST, November 30, 2008) on temporary runway 04. This runway was built due to construction and resurfacing of the primary runway.</p> <p>Continued...</p>
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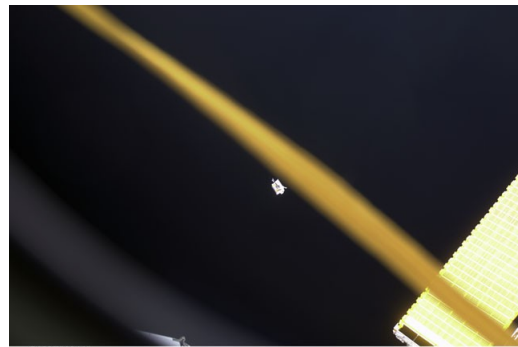
**STS-126/ISS-ULF2**  
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**CAPCOMS:**  
**SHUTTLE**  
A/E - Alan Poindexter  
- Greg (Box) Johnson (Wx)  
LD/01 - Steve Robinson  
O2 - Jim Dutton  
Planning - Shannon Lucid  
Team 4 - N/A

**ISS**  
O1- Terry Virts  
LD/O2- Mark Vande Hei  
O3 - Robert Hanley  
Team 4 - N/A



S126E-008178 (18 Nov. 2008) --- Pettit installs the Water Recovery System (WRS) rack in Destiny lab.



S126E-008143 (18 Nov. 2008) --- Tool bag drifts away from ISS during EVA1 SARJ lubrication. It would later burn up during re-entry into the earth's atmosphere in Aug. 2009.



S126E-008741 (20 Nov. 2008) --- Stefanyshyn-Piper (left) and Kimbrough during EVA2 continue removing debris and applying lubrication around starboard SARJ.

Continued...

**FIRSTS/SECONDS:**

- First water regeneration system to recycle urine into drinking water delivered and installed on ISS.
- First flight OI-33 Flight Software. Several minor changes made to improve Post MECO attitude control and reduce the risk of recontact with the ET.
- First flight of new SSME controller S/W to downlink Advanced Health Management System (AHMS) data on-orbit - provides backup to MADS data.
- First flight of redesigned EVA Prime Flight Glove TMG, a Turtleskin® reinforcement layer sandwiched between molded palm and RTV on thumb and index finger and new RTV-3145.
- First flight of ET redesigned LO2-to-Intertank Flange closeout per RTF B/L Plan
- First flight of ATK BSMs in both forward and aft positions.
- First Flight of BSM Forward Segment Grain Redesign - eliminated waiver.
- First flight of SRB Installed Enhanced Data Acquisition System (EDAS) Units and Instrumentation.
- First flight of SRB Redesigned Frangible Nut with Pyrotechnic Crossover Assembly to help prevent stud hang-up.
- A Second: "World Toilet Organization (WTO) is a global non-profit organization committed to improving toilet and sanitation conditions worldwide. World Toilet Day November 19<sup>th</sup> - During this mission the crew did their bit for WTD with installation of a new second toilet facility on ISS."

**NIGHT LAUNCH: # 31** NASA Test Director Charlene Blackwell-Thompson, "Endeavour is ready to go. And we're really excited to share our version of a sunrise with you ..."

**RENDEZVOUS: #71** Rendezvous and dock with ISS.

**EVENTS:**

- FD1: OMS2 ignition at 320:01:33:58.3Z resulted in a 125.7 by 84.6 NM orbit.
- FD2: RCC inspection found no areas of concern - focused inspection cancelled on FD4.
- T1 maneuver at 321:19:26:48.0Z resulted in a 192.4 by 184.3 NM orbit
- FD3: R-Bar Pitch Maneuver was performed. No issues.
- Docking Contact occurred at 321:22:01:17Z
- Hard Dock occurred at 321:22:44:35Z
- ISS Hatch opened at 321:24:16:00Z (6:16PM CST, Nov 16, 2008) welcomed by ISS crew.
- IELK Seat Liner Transfer at 322:02:50:00Z (8:50 PM CST, Nov 16, 2008). At that time Greg Chamitoff became a member of STS-126 and Sandra Magnus joined the ISS Expedition 18 as Flight Engineer.

Continued...

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STS-126/  
ISS-  
ULF2  
Continued ...

Pawel-Warchal-  
EndISS281108\_1227890243.jpg:  
Impressive photo taken by Polish



## SIGNIFICANT ANOMALIES:

### Orbiter:

- The Fuel Cell 1 S/N P760106 Hydrogen Flowmeter Measurement Began Drifting High And Erratic At 320/12:36 GMT.
- MER-02, LV57 E2 GH2 FCV, After Engine Throttle up E2 GH2 Line Shows a Drop of 200 Psi
- MPS Helium Bottle Lost 140 Psi During Ascent, OMRSD Allows 60 Psi Max. (MER-10)
- GNC Bypass of Ku-Band Radar Data
- Tile Damage on Edge .65l X .23w X .05d

### KSC:

- RDUnassigned - Column parity errors on all ME FEPs.
- IRAMS Failed at GMT Rollover.

### SRB:

- STS126/Bi136 Squawk 126-001: HDP 3 Blast Container Debris Containment Failure
- RSRM, SSME, & ET: None.

### MOD:

- Updating Minimum EPS Consumables
- Loss of Crewlock Bag during Eva #1
- Over Torque of Trundle Bearing Assembly Mount
- Middeck Return Item Weights Missing
- Debris Released Near the LH2 T-0 Plate

### Integration:

## EVENTS: Continued...

- FD5: Based on review of launch imagery, the MMT decided that the focused inspection of the Orbiter heat shield was not required.
- FD5: EVA 1: Piper & Bowen transferred the Nitrogen Tank Assembly (NTA) from the External Stowage Platform (ESP)-3 to Lightweight MPESS Carrier (LMC), followed by the Flex Hose Rotary Coupler (FHRC) transfer from LMC to ESP-3. JEM EFBM Multi-Layered Insulation (MLI) Cover was removed in prep for c/o of EFBM (to be installed on 2JA later in 2009). Stbd SARJ trundle bearing assembly (TBA) #10 and #6 were replaced, and the stbd race ring was partially cleaned and lubed. A crew equipment bag was inadvertently released during the EVA, but there was sufficient redundant cleaning and lube equipment to finish scheduled tasks. EVA 1 duration 6:52.

- FD6: Home improvements continued aboard ISS with installation of two new

bedrooms and preparations to activate the water recycling facility.

- FD7: EVA2: Piper & Kimbrough relocated the CETA carts in prep for 15A install of S6 solar array upcoming in Feb. 2009; SSRMS Latching End Effector (LEE) A snares were lubricated; all stbd SARJ cleaning and lube objectives were completed except for cleaning under covers 11 and 12; & 4 more trundle bearing assemblies were replaced. EVA was terminated slightly early due to high CO2 readings in Kimbrough's suit. EVA2 duration 6:45.

**[During this EVA the ISS marked the 10<sup>th</sup> Anniversary of launching its first element - the Russian-built Zarya control module. "It's hard to believe it's been 10 years," said Kirk Shireman, NASA's Deputy Manager for ISS, who remembers it being a cold day on the steppes of Kazakhstan.]**

- FD9: UPA anomalous shutdown due to centrifuge speed below limits & high motor current.
- FD9: EVA3: Piper & Bowen continued cleaning of ISS stbd SARJ; R&R'ed the remaining TBA; and cleaned area around SARJ's drive lock assemblies. EVA3 duration 6:57.
- FD11:EVA4: Bowen & Kimbrough completed stbd and port SARJ lube tasks; P1 lower inboard camera installed in camera port 7; external facility berthing mechanism latch bolt retracted via EVA override and cover reinstalled; JEM GPS A installed and heaters checked out ok, JEM GPS B deferred to stage or next flight; and, no get-ahead radiator imagery was taken. EVA4 duration 6:07.
- SARJ put back in autotrack at 330/00:35 GMT (post-EVA).
- FD12: UPA processing was completed for the docked mission.

## Transfers:

- 16,390 lbs of hardware transferred to ISS (Leonardo & middeck)
- 3,642 lbs of hardware returned from ISS to Endeavour (inside)
- 25 lbs O2 transferred to ISS
- FD15: Undocked at 333:14:47:26Z followed by Sep-1, Sep-2 and Sep-3; OBSS surveys on starboard, nose cap and port; and LDRI downlink.
- Communications blackout during Entry: "There [were] a few drop outs but nothing big around GMT 335:21:09 d:h:m."



296595main\_ED08-0306-131c\_946-710.jpg:  
STS-126 Ferry Flight in route to KSC

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