



Mission Success Bulletin

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on-line

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STS-121 launch hugely successful

“Extraordinary improvement” says Sigur

The spectacular July Fourth launch of STS-121 continues to shine brightly as all data to date indicates that External Tank-119 performed as expected and that the Orbiter *Discovery* is in outstanding shape.

The four major ET systems – electrical, propulsion, structural and thermal protection – all worked well. As part of the electrical system, the low level engine cut-off sensors performed nominally and within expected limits following their replacement prior to launch.

The bipod and bellows heaters worked well, with no ice/frost noted. One bipod heater temperature sensor approached Launch Commit Criteria limits on the first launch attempt (July 1), but was switched to a manual control mode without issue. Operational hardware such as the ullage pressure sensors performed nominally. The liquid hydrogen (LH2) 5% loading sensor did not respond to a “dry” command during a planned checkout for the first launch attempt and

was bypassed for subsequent loadings.

In order to evaluate vehicle performance following removal of the Proturbance Airloads ramps, instrumentation data were successfully gathered from three of four Enhanced Data Acquisition System boxes on the Solid Rocket Boosters. Available data are currently in review.

The propulsion system, including pre-launch purges, liquid oxygen (LO2) and LH2 performance was nominal, while loading system performance was within requirements. Structural systems performed as expected as well, and ET disposal in the Pacific Ocean, south of the Cook Islands, occurred as forecasted.

Performance of the Thermal Protection Systems (TPS) received considerable attention and preliminary reviews suggest ET performance was good.

Pre-launch TPS performance was nominal, and all ice conditions fell within required levels. The two weekend launch attempts



STS-121

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scrubbed due to weather conditions resulted in minor instances of crushed foam, cracks and minor erosion.

What was expected to be a quiet Monday after two launch attempts changed suddenly with the discovery of a crack and subsequent small foam loss in the TPS on the inboard strut of the LO2 feedline. After a day of examination and analysis, NASA accepted a use-as-is disposition.

Following the launch on July 4, NASA used the resources of 117 cameras on the ground and in the air to evaluate foam performance. The LO2 ice frost ramps (IFR) saw popcorning and typically minor erosion on about one-half of the ramps. No divots were observed.

The Intertank IFRs experienced typical popcorning on two ramps and light to moderate erosion on most. As on the LO2, no divots were noted on the Intertank IFRs.

On the 16 LH2 IFRs, foam loss was typically isolated to

minor popcorning on a majority of the ramps and light to moderate erosion on about one-half. Divots appeared in five areas, but all were within the allowable debris size. Probable causes include delta pressure, secondary impacts or void in PDL foam.

Several areas of LH2 tank acreage foam also saw losses, but these too were of a size within debris allowables and – when possible to determine – at a time during ascent that posed a reduced risk to the Orbiter. Data review and analysis will

continue beyond Orbiter landing, currently scheduled for the morning of July 17.

“The performance of ET-119 during ascent showed extraordinary improvement and is a direct result of tireless efforts of the entire ET team,” said **Wanda Sigur**, vice president of the ET Project.

“My thanks and appreciation go to everyone involved in supporting the STS-121 mission. It’s great to have a tangible sign that our hard work is paying off. STS-121 and the performance of ET-119 is that sign.”



ET-119 shown with relatively minor foam loss after separation from Discovery.

Improvement initiative addresses tank flow concerns

This past month the late delivery of ET-118 pointed out the need to improve External Tank critical path processing. As a result, ET Project Vice President **Wanda Sigur** is sponsoring a variety of improvement initiatives - one of which is the LM21 Critical Path Hardware Transformation Process Review.

The initiative's purpose is to review and improve critical path processes to assure successful on-time delivery of tanks to support NASA's flight manifest.

Six 2-person teams consisting of LM21 Blackbelt and Greenbelt resources are studying day-to-day processes in the Vertical Assembly

Building, Final Assembly and the mock-up panel areas. A Greenbelt, knowledgeable in process observation and mapping, is assisted by a Blackbelt who has more training and experience.

One team is studying the Liquid Hydrogen/Intertank flange Thermal Protection Systems (TPS) closeout

processes in Cell A. These processes are required on all retrofitted and future in-line tanks.

Teams also are reviewing processes in Final Assembly. Two are looking at TPS, and electrical and mechanical processes. The other two are evaluating quality inspection

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Crews finish ET-118 early at Kennedy Space Center; tank ready for August 28th launch

When ET-118 shipped to Kennedy Space Center last month five days behind its ship date, it still had outstanding work to be finished.

Michoud work crews greeted the tank at KSC and immediately set about venting the Intertank foam, finishing external shakedown activities, completing Non-Conformance Documents deferred to KSC, and removing and replacing engine cut-off (ECO) sensors.

The crews posted July 9 as their deadline to be off the tank and beat that mark by six days, finishing ET-118 on July 3.

Business planner **Bill Gilbert**, who coordinated the KSC effort with production manager **Mike Holcomb**, said the key to getting ahead of schedule and returning the tank to its original processing date was having all the support resources - thermal, aerodynamic and stress - in place this time.

"When we were down before, we had to send all the data and photos back to Michoud where they crunched the numbers and sent it back to us at KSC. So we were losing a lot of schedule time getting dispositions. This time we said why not bring all of our people with us up front, let's attack all these areas, get all our dispositions and do our repairs. It's on the spot, real-time processing."

This way, Gilbert said the team was able to concentrate on high traffic PAL ramp removal and bipod areas to finish the tank shakedown

three days quicker. Likewise with the ECO sensors, the team saved schedule time by getting all the mechanical and quality engineers to KSC early to review the paper with United Space Alliance and NASA, to decide the exact scope of work and to assign who was responsible for each task.

When ET-118 was moved to the horizontal position on the transporter after ECO sensor removal, the team made up more time by combining three hand packs of super light ablator into one on the bolts, the leakport and the attach points after the manhole cover had been

reattached. This plan saved several cure times of 24 hours, Gilbert explained.

The crews averaged 70 workers from Michoud each day. In all, approximately 100 employees cycled through KSC to do their part, working two 12-hour shifts, seven days a week.

"Not a lot of beach time," quipped Holcomb of the KSC experience.

More serious, Holcomb called it "a miraculous effort by everybody - TPS, ME's, QE's, QC's and technicians. They all pulled together and worked in an out-of-position environment, having to go up and down 20 to 30-foot scaf-

folding. It was a real challenge."

Both said all the prep work and 22 straight work days were worth it because ET-118 mated with the Solid Rocket Boosters just a few days after the Michoud crew finished up. Next up is the Orbiter mate with *Atlantis* scheduled for July 25 with launch on August 28.

As a parting gift, 30 crew members watched the STS-121/ET-119 launch on July 4 from a great vantage point next to KSC's Vehicle Assembly Building before returning home to Michoud.



Technicians Troy Smith (left) and Joe Johnson trim foam on the manhole cover of ET-118 at Kennedy Space Center.

Michoud hosts Congressional hearing on levee system and coastal restoration



U.S. Rep. Charlie Melancon (D-La), a member of the House Committee on Science, organized a public briefing on levee re-construction and coastal restoration at Michoud on July 7. The briefing covered a report from the U.S. Army Corps of Engineers on a recent American Society of Civil Engineers' (ASCE) evaluation, which was part of the pre-Katrina levee system and the Corps' subsequent implementation of their recommendations. In attendance were several Congressional members and other elected officials from coastal parishes affected by Katrina and Rita. Those presenting included Dr. Ivor van Heerden, head of the LSU Hurricane Center tasked with leading the investigation of Katrina levee failures and responsible for leading a team of engineers and coastal scientists conducting analysis of storm surges, levee construction and levee failure mechanisms. Additionally, Dr. Gordon Boutwell of the ASCE Levee Assessment Team, one of the co-authors of the ASCE/National Science Foundation report on the levee investigation, presented findings.



Experts reported on the condition of coastal restoration and levee planning to several Congressional members and Louisiana elected officials including from left: U.S. Rep. Sheila Jackson-Lee (D-Tex), Melancon and U.S. Rep. William Jefferson (D-La).

Col. Richard Wagenaar, Commander & District Engineer of the U.S. Army Corps of Engineers in New Orleans, provides expert testimony on the ASCE report and Corps' implementation at the briefing. Responsible for rebuilding much of the damaged levee system, the Corps has developed a long-range plan for re-construction and management of the levee systems. The N.O. jurisdiction includes 2,800 miles of waterways, 1,300 miles of levees and floodwalls, 12 navigation locks, six major flood control structures and other projects to create and protect coastal wetlands.



Tank study

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processes. A team also is observing mock-up panel refurbishment.

The team holds daily status meetings with Industrial Engineering manager **Brian Magendie** and Lean/Six Sigma lead **Tim Livingston** who are coordinating the strategic effort. The initial phase of this assessment is scheduled to be completed in late July.

“Number one, we're all change agents; and number two, we selected employees

from across several directorates, so we have a diverse group of experienced and knowledgeable teammates,” says Livingston.

Using a LM21 tool, called a Structured Improvement Activity (SIA), Magendie, Livingston, and their team will analyze all the process data to see if there are common elements that are process inhibitors to hardware transformation.

“We're assuming that we've got common inhibitors across all elements, and that they stand out once we gather all the data together,” explains

Magendie. “Then we'll address a series of additional Structured Improvement Activities to try to minimize/eliminate the process disruptions that we may be observing.”

Livingston says the SIAs will follow an 8-step path to excellence in the LM21 methodology. He and Magendie will make recommendations to senior management, get their feedback and then changes will be implemented.

Responding to a question, Magendie describes the critical path as “Cell A, Final

Assembly and 420, with Cell A currently the rate/pace driver. So it's inhibiting our rate delivery capability in terms of tanks per year, and in essence would be considered the bottleneck.”

But Livingston adds that they're reviewing all the processes that take place during this slice of time.

“The key objective of this effort is to complete tanks earlier with the same level of quality and safety that we exhibit and require today,” Magendie sums up.

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