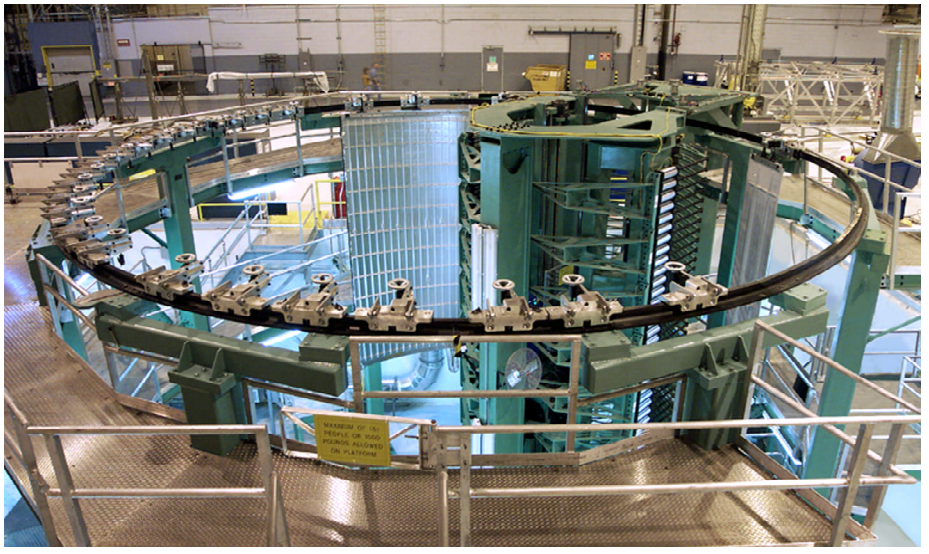
LOCKHEED MARTIN SPACE SYSTEMS COMPANY

MISSION SUCCESS® BULLETIN

December 11, 2002 MICHOUD OPERATIONS



The Friction Stir Welding tool has completed tool certification and will begin External Tank barrel production in mid-December.

Friction Stir Welding tool ready for External Tank production

Almost two years from the date that engineers began conceptual design reviews, Lockheed Martin activated the first of two production Friction Stir Welding tools in Building 103 on October 30.

"I'm very excited that we met our tool activation date and are able to implement friction stir welding into External Tank production," said **Dave Hartley**, shuttle upgrades manager.

"After years of development, we finally brought this technology to the state where it can be applied to human-rated launch vehicles."

Friction stir welding has proved to be a reliable welding process used to produce components for unmanned rockets as well as components in shipbuilding, automotive assembly and other construction and manufacturing-related industries.

The new tool can weld all five barrel sections of the External Tank and has the capacity to weld two barrels at a time.

The next important milestone is the tool's first use on ET-132 scheduled for mid-December.

"We were originally scheduled to begin our first production weld on ET-134 in April 2003," remarked Hartley. "However, because we did so well validating the tool and the weld process, our customer asked us to begin welding barrels three and four earlier for ET-132."

The implementation of friction stir welding into ET production

Continued on Page 2

ET Award Fee rated "Excellent"

In the wake of receiving the NASA Marshall Space Flight Center Contractor Excellence Award in the large-business product category, Michoud Operations has received more good news – this time on Award Fee scores.

The Performance Evaluation Board assessed Lockheed Martin's ratings as "Excellent" in all categories, with a composite score of 93.5 percent for the six-month period ending September 30 *(see table, Page 2)*.

"I am very pleased with NASA's evaluation of our performance," said **Ron Wetmore**, vice president, ET Project. "Our employees responded to major challenges, and I want to congratulate each of them for this success."

For 6th Buy Production, significant strengths consisted of returning to 2219 material in domes and forward ogives that resulted in improved producibility; delivery of the first 2219 Intertank thrust panels from a new supplier; and achieving Small Business, Small Disadvantaged and Woman-Owned Small Business goals.

On 6th Buy Operations and Maintenance, the report noted Lockheed Martin's passage of several environmental inspections and the facility's fine- and penalty-free performance.

Other strengths included installing uninterruptible power in the Mission Support Room,

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Award Fee

implementing a state of readiness during Hurricane Isidore and successfully transitioning to a new cafeteria contractor.

For 6th Buy Friction Stir Welding, the report stated that Michoud "has done an outstanding job in managing the implementation of a very technically challenging project."

Other significant strengths included work with the tooling subcontractor and successfully activating the trainer and production tools.

Under 5th Buy, the report noted a significant strength in delivering four tanks ahead of schedule to complete the 5th Buy contract. The report also acknowledged innovative rework on the ET-117 LH2 tank rib crack that became ET-121 – resulting in substantial savings to the program – during the Award Fee period.

Other significant strengths included Michoud's excellent safety record and technical expertise that overcame difficulties of mounting and testing an ET camera on STS-112.

Award Fee Scores

April 1 – September 30, 2002

Composite Score		**93.5 %**
6th Buy - Production	**Excellent**	**91.9 %**
6th Buy - MAF Oper. & Maintenance	**Excellent**	**94.2 %**
6th Buy - Friction Stir Weld	**Excellent**	**99.0 %**
5th Buy	**Excellent**	**97.3 %**

Employee Recognition Plan

The sustained 2002 Award Fee scores mean that employees will share in the success of the ET project. The ET employee recognition program will reward 15 percent of the hourly and 10 percent of the salaried workforce with cash amounts ranging from several hundred to over $2,000 each.

"It is appropriate that significant individual contributors be rewarded for their work," said Wetmore.

Continued from Page 1

Friction Stir

stemmed from a Space Shuttle Upgrades program initiative to enhance safety and reliability of shuttle components.

Currently, Michoud welds the ET aluminum sections together using a fusion welding process.

Unfortunately, the material melting caused by the fusion weld process reduces the strength of the weld joint. As a result, the alloys in the aluminum segregate during re-solidification of the weld pool. This makes a joint that is weaker than the base metal and prone to a higher rate of defects.

"After years of development, we finally brought this technology to the state where it can be applied to human-rated launch vehicles."

– Dave Hartley

On the other hand, friction stir welding is a solid-state welding process.

Invented and developed by The Welding Institute in Cambridge, England, friction stir welding uses a rotating pin tool under high pressure *(see illustration below right)*. This produces frictional heat to plasticize the aluminum alloy into a "taffy-like" state and "stirs" the metal together, creating a seamless joint.

Since the process never goes into a molten state, like fusion welding, the property in the aluminum alloy never changes phase and therefore maintains its strength, reducing the likelihood of weld defects.

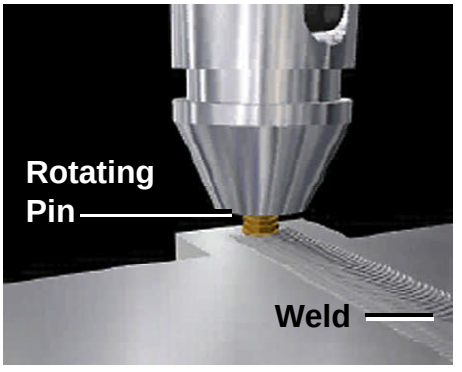
"We are predicting defect rates of less than one per barrel," Hartley said. "This in turn will minimize rework to fix weld joints and improve work flow."

Friction stir welding will also reduce the weight of the tank, because the use of weld wire during welding operations is not needed.

In related activities, NASA and Lockheed Martin have developed a solid-state repair process that can repair fusion or friction stir weld defects. This process uses an aluminum plug as a consumable pin tool, which becomes part of the repair.

In an effort to incorporate friction stir welding on the entire tank, NASA and Lockheed Martin again are working together on the next generation weld process referred to as Self Reacting Friction Stir Welding. In this method, loads are applied to two rotating shoulders that sandwich the aluminum joint to perform the weld.

This new process will greatly reduce tooling costs and allow technicians to perform circumferential welds. This process is scheduled to go into External Tank production by 2005.



Space Seekers kids explore Space Center Houston
Twenty-five fourth and fifth graders from the New Orleans area recently visited Space Center Houston as their prize for winning the Space Seekers educational contest. Approximately 1,200 students entered the contest sponsored by Lockheed Martin, the Audubon Nature Institute and Southwest Airlines. Here, three students size up the various components of an astronaut's spacesuit.

Ethics rules abide during yuletide

Tis the season to give and receive gifts. The Ethics Office advises employees to make sure their gifts do not give the appearance of receiving or seeking favorable treatment when dealing with customers and suppliers.

Lockheed Martin employees may not accept gifts or business courtesies valued at $100 or more from anyone who does or seeks to do business with the corporation. Those responsible for procuring goods and services cannot accept any gift from a supplier or vendor.

Advertising or promotional items with company logo from vendors are acceptable, as they aren't considered gifts.

So before offering gifts to or receiving gifts from customers, be aware of restrictions. For more information contact Ethics Officer **Feltus Kennedy** at 257-3842 or **Tom Fierke** in Legal at 257-4112.

Astronaut presents award for Build Process Team of Quarter
Team Lead Augie Panks (left) accepts the Build Process Team of the Quarter award for the Mechanical Assembly Intertank & Stringer team from astronaut Steve Smith. The winning team improved its performance in critical areas such as schedule, quality and cost. Production Operations will present the Build Process Team of the Year award in January 2003.

Behavior - a reflection of our values and beliefs

In previous Diversity Council updates I discussed the first three key attributes – *knowledge*, *understanding* and *acceptance* – of four that influence how we respond to workforce diversity. The fourth attribute is *behavior*.

Pat Powell, Diversity Council Chairperson

For successful social interactions, you must be attuned to how your values and beliefs shape your behavior and be willing to accept that the behaviors of others are rooted in their values and beliefs.

A common value and behavior across most cultures is to respect authority figures (bosses, teachers, leaders). Yet something as simple as misinterpreting body language can have an unexpected outcome. For example, avoiding eye contact with authority figures is an expression of respect in many Asian and Latino cultures.

However to Americans, particularly in a boss-subordinate relationship, this response may be interpreted as being disrespectful. A boss or teacher may reprimand an employee or student for looking away when in fact the message the subordinate was sending was one of respect and admiration.

Strength in Differences

Brilliance in Unity

We are a multi-cultural nation. According to a Census report, one in five Americans was born in another country or has at least one parent who was. The number of first- and second-generation Americans with roots outside the U.S. is the highest in our history.

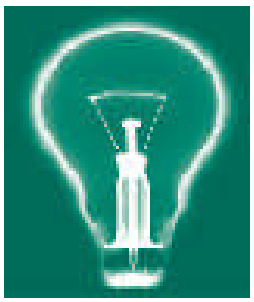
It is human nature to feel more comfortable with "people like me" or "Birds of a feather..." as the saying goes. Our differences, values and beliefs are our link to our roots; they make us who we are.

Take the initiative to understand the customs and values of other cultures so that you are more relaxed in cross-cultural settings. By expanding your horizons you will better appreciate the cultural styles and values of different groups and understand how others view your own ethnic, racial, and cultural differences.

When people understand how culture influences workplace behaviors and communications, there tends to be fewer conflicts and misunderstandings.

Patenting process available online

Does the gravity of paperwork pull all of you budding Einstein's down? Losing your patience completing forms for potential patents? Relax, with **Inventit™**, your manual days are over.



The new electronic version makes it a snap for employees to fill out patent applications. As an added bonus, the New Technology Disclosure and Idea Report B forms are history. Whether it's External Tank-related or not, all submittals are referred to as "Intellectual Property Disclosures."

It doesn't take a rocket scientist to get to the Inventit™ website. Go to Gumbo. Under "Lockheed Martin" select Corporate, choose the Inventit™ option and login with your userid and password.

Those endowed with photographic memories can go directly to the URL (web address) **http://www.man.fs.lmco.com/inventit/.** Curious minds can even track their ideas and inventions using this application.

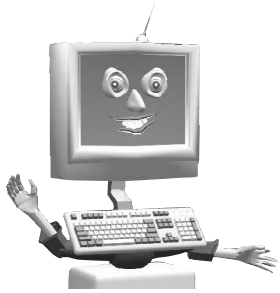
Still have questions? Contact **Gary Willett** at 7-4786 or **Judy Bilich** at 7-1314 for their intellectual advice.

Now that the paperwork's a little easier, go back to work and invent something.

Performance Enhancement manager on the receiving end
Associate Administrator for Space Flight Bill Readdy (left) presents Ralph Tortorich with a NASA Space Flight Awareness Leadership Award for his exceptional management in support of the SFA program. For 22 years, Tortorich provided the leadership and vision for employee motivational programs at Michoud.

Michoud and Fall Fest funds benefit Children's Hospital
Roger Gorman (left) and Kelli Tedesco of Children's Hospital accept a check for $7,817.95 from Marion LaNasa, director, Communications. This year Michoud Operations added a $2,500 contribution to the funds raised by employees from game revenues at Fall Fest.

Paperless Manufacturing Status



* Completed 1st pilot on 11/21 in Tooling Inventory and Tool Fabrication Departments

Space Shuttle missions in 2003

Date	Flight / ET	Orbiter	Payload
January 16	STS-107 (ET-93)	*Columbia*	Research Mission, Freestar
March 6	STS-114 (ET-117)	*Atlantis*	International Space Station (ISS) Raffaello Multi-Purpose Logistics Module, Crew Rotation
May 23	STS-115 (ET-118)	*Endeavour*	ISS P3/P4 (port truss) arrays
July 24	STS-116 (ET-119)	*Atlantis*	ISS SPACEHAB, Crew Rotation
October 2	STS-117 (ET-120)	*Endeavour*	ISS S3/S4 arrays
November 13	STS-118 (ET-121)	*Columbia*	ISS ITS S5, SPACEHAB, Crew Rotation

Michoud-built composite wingboxes delivered

The Michoud Operations composites team reached a major milestone recently by delivering two composite wingboxes for the RAH-66 Comanche helicopter – fiber-placed entirely at Michoud.

The Comanche, a stealth helicopter created for the U.S. Army, is the product of a Sikorsky/ Boeing joint venture. As part of the Rotary Wing Structures Technology Demonstration (RWSTD) Program, Sikorsky selected Michoud to fabricate the two composite wingboxes using the new fiber placement machine.

The wingboxes, affixed to the underside of the wings, will service the Comanche helicopter on special missions by carrying armor or extra fuel tanks.

"The wingboxes made a favorable impression on Sikorsky during a Michoud site visit," said **Gregg Ferrell**, manager, Business Development. Soon afterward, the company contracted Michoud engineers to help complete the design of its wingboxes in order to meet critical Comanche program milestones.

"This was a great opportunity to test our skills and technologies on the new fiber placement machine," explained **Eric Enright**, Program Management and Technical Operations (PM&TO). "We were able for the first time to use Lockheed Martin's proprietary 'in-situ' fiber placement process, which produces high quality thick composite laminates."

The RWSTD program not only challenged the skills of fiber placement machine operators but also proved to Sikorsky and the Army that the wingboxes could be fiber-placed in a cost and time effective manner using laminates of varying thickness.

The wingboxes will now undergo a series of tests by Sikorsky and the Army to verify design, fit, structural integrity and other mission essential requirements.

Upon completion of the verification process, the wingboxes are expected to move to production and will support approximately 650 aircraft beginning in 2007 and extending through 2025.

The U.S. Army is testing Michoud's prototype wingboxes that carry fuel tanks or weapons on Comanche RAH-66 helicopter special missions.

The success of the Comanche wingboxes serves as a major step for placing Michoud into the highly competitive composite structures marketplace.

Michoud's technical performance on the program to date does not automatically guarantee participation in the production phase. Michoud must compete for the production work by providing a successful bid consisting of demonstrated technical expertise and competitive pricing.

Due to our performance on the wingboxes, Sikorsky has asked Michoud to participate in a trade study for the Black Hawk tailcone assembly.

"This project served as our entry point into the composites industry and has given us the chance to hone in on our unique technical skills and talents," said **Gary Willett**, manager, PM&TO.

The Army touted the success of the wingboxes by showcasing them earlier this month at a Department of Defense manufacturing conference in Dallas.

Two complete ELDP course

Michoud Operations recognized **Andrew Clouatre** and **Kevin Davis** for successfully completing the Engineering Leadership Development Program (ELDP).

Recognized as an LM21 Best Practice, the ELDP initiative is a two-year program designed to provide a pipeline of talent to meet higher level technical and leadership requirements.

Clouatre

Davis

Participants must commit to an aggressive graduate study program while completing corporate leadership conferences, a technical project assignment and job rotations within varied technical disciplines.

Michoud recently expanded the LDP to include Operations and Finance, as well as the Engineering discipline. Participants are selected based on assessed leadership potential, academic achievement and job performance.

Nineteen receive Silver Snoopy awards at Michoud

Astronauts recently presented Silver Snoopy awards to deserving employees for their contributions to the success of Space Shuttle missions. In photo above, Mission Specialist Steve Smith presents Silver Snoopies to Kevin Barré and Suzette Archie. In photo at right other employees receiving Snoopies included (front row from left) Danny Owens, George Huber, Don Ricouard, Mike Cinquigranno and Carol McCall. Middle row: Vickie Schmersahl, Kenis Tobias, Steve Oxner, Elliot Perret, astronauts Pam Melroy and Sandy Magnus, Laurie Rando, Michelle Worden and Melanie Jennings. Back row: Mike Howard, Larry Decuir, Mike Gerken, John Carcamo and Jerry Pax.

MILESTONES

Employees celebrating anniversaries with Lockheed Martin in November and December

30 years
Philip Therrien

25 years
Lawrence Allen
Olympe Augustin
Eric Bennett
Gerard Burke
Brad Cartwright
Richard Evans
Jerry Graves
O'Neal Peters

20 years
Edward Augustus
Thomas Barrett
Isolde Dagg
Neil Duncan
Steven Hanberg
Richard Holekamp
Oba Ladnier
Marion LaNasa
Robert Michel
Carolyn Monteith
Jeffrey Norris
Lionel Roché
James Spray
Lonna Surla
Robert Thorner
Graf Weller

15 years
Marie Barré
Darren Bergeron
Dennis Collier
Susan Foozer
Ronnie Fortenberry
Richard Hake
Russell Harris
Merle Kirch
Linda Laborde
Martha O'Brien
John Padgett
Roger Reinmuller
Chi Tran

5 years
Ronald Bell
Joseph Butler
Marc Church
Edward Colgan
Clarence Creggett
Marcus Cuillier
Guy Dazzo
Craig Hill
Leonard Holifield
Syed Huda
Jules Hunt
Thomas James
Eddie Johnson
Keith Lord
Bryand McIntosh
Russell Mitchell
Gregory Monroe
Mark Moore
Mark Muscente
Allen Narcisse
Alfred Olivier
Randy Prisco
Nathaniel Rainey
Efrain Rivera
Robin Roberts
Matthew Robertson
Elliot Romain
John Shaw
Beatrice St. Amant
Charles Thomas
Clement Torregano

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