LOCKHEED MARTIN MICHOUD SPACE SYSTEMS

MISSION SUCCESS® BULLETIN

July 30, 1999

X-33 Structural Test Article - one tank, many uses

NASA and Lockheed Martin personnel are currently preparing the X-33 Structural Test Article (STA) for a series of pioneering tests in propellant densification. The tank, built by Michoud Space Systems, arrived on June 29 at the NASA John Glenn Research Center at Lewis Field in Cleveland, Ohio.

"Propellant densification is the latest advance for cryogenic propellant conditioning and has great potential for improving launch vehicle performance," said Michoud Space Systems researcher **Timothy Knowles**.

Densifying cryogenic propellants, explained Knowles, is a process of chilling down these liquified gases to a point even lower than their usual very low temperatures. At these lower temperatures, the propellants are denser so given amounts of cryogenic liquid take up less space. This makes it possible to use smaller, lighter propellant tanks and vehicle structures.

"The resulting vehicle weight savings mean that propellant densification is a major enabling technology for single stage to orbit (SSTO) launch vehicles," he said. "We project the weight savings for VentureStar™ from propellant densification to be approximately 8,000 pounds."

The 6,000-lb. aluminum STA is the second of two Al 2219 tanks manufactured at Michoud Assembly Facility by Michoud Space Systems. The first of the two tanks to be built

Continued on Page 4

BSI auditer Cynthia Lopez examines documentation with Timothy Murphey and James Garnett, both of Technical Operations.

ISO pre-assessment goes well

A team of auditors from British Standards Institute (BSI) spent three days at Michoud Space Systems recently in what was billed as a "no-fault pre-assessment."

"In other words, if something's not right, find it now and get it corrected before we undergo the final ISO audit in September," said **Mike Schaefer**, ISO Team lead. "The auditors are actually on your side this trip. They're here to help you spot discrepancies."

BSI is the organization that certifies companies as compliant with ISO 9001 standards. Michoud Space Systems' goal is to achieve ISO 9001 certification by September 30.

During the three-day assessment, BSI auditors walked the factory floor and offices in Buildings 101 and 102 talking to employees and checking hardware and paperwork.

In the course of the pre-assessment, auditor **Ky White** noted that Michoud technicians had opened non-conformance documents (NCDs) on ET-105, which was nearing the date of its delivery to NASA. One had already been corrected, and he was satisfied that the second one would be closed out by the end of the same day.

On the way from checking ET-105, White noticed an orange discrepancy tag on a dome. Stopping, he checked the part number, the serial number and the NCD number. Then he checked a computer in the area to find out who had control of the NCD document.

"I want to see what's wrong with the dome and what's being done to resolve it," said White.

Continued on Page 5

LM NEWS

Lockheed Martin reports second quarter net loss

Lockheed Martin Corporation reported a second quarter 1999 loss per share of 11¢ on a diluted basis, compared to second quarter 1998 diluted earnings per share of 76¢. Net loss for the second quarter 1999 totaled $41 million. In the second quarter of 1998, net earnings were $289 million.

As disclosed by the Corporation earlier, results for the second quarter of 1999 reflect the impact of increased cost growth and reduced production rates related to the C-130J program, and the effects of problems in the Corporation's commercial satellite and space launch businesses.

Net sales for second quarter 1999 were $6.2 billion, compared with second quarter 1998 sales of $6.5 billion.

The Corporation's backlog totaled $45.0 billion at quarter's end compared with $45.3 billion at year-end 1998.

"These results are consistent with the revised performance outlook we released June 9," stated **Vance Coffman**, Lockheed Martin Chairman and Chief Executive Officer. "We are focused on our core aerospace and defense businesses to deliver strong performance. As part of our previously announced detailed review of the Corporation's business operations, our entire management team is directing its full energies to improving organizational effectiveness, performance and strategic alignment.

"We will build on our inherent strengths and competencies, delivering better quality, cost performance and mission success for our customers. Achieving these goals will translate into increased value for our shareholders and a more rewarding environment for our employees," Coffman said.

A shining example

The ongoing project of resurfacing the floor in Michoud's manufacturing building continues with the recent completion of the Major Weld area and adjacent aisles.

External Tank Progress Report

Selected Highlights as of July 26, 1999

HARDWARE	STATUS
ET-103	
Tank	In Building 420, Position 1. DD250 completed on 6/22. Staged for shipment to KSC on 8/26.
ET-105	
Tank	In Building 420, Position 2. Completed DD250 on 7/16. Tank is staged for planned shipment to KSC on 8/5.
ET-106	
LO2/ Intertank	In Cell G. Completed LO2 acreage spray. Plug pull values are good. TPS trims are under way.
LH2 Tank	In Cell C. Completed removal of Apex TPS closeouts. Replacement activities are under way.
ET-107	
LO2 /Intertank	In Cell H. Shakedown activities continue. Plan to move to Cell A next for ET final splice.
LH2 Tank	Cell A. Preps are under way for ET final splice.
ET-108	
LO2 Tank	In Cell E. First TRIC rinse failed particulate count. Will rinse again, then start Harness installation.
LH2 Tank	On 7077 Tool. Post-proof NDE continues. X-ray on repair of the HAG-4 is acceptable. Planishing is next.
ET-109	
LO2 Tank	On 5347 Tool. Completed proof test, and started post-proof test NDE activities. A .350 inch Crack PI (porosity indication) has been identified and is in Engineering for disposition.
LH2 Tank	On 5069 Tool. H-3 repair is complete less planishing. Mechanical installations will follow. Plan to move to 5068 Tool for Dome weld next.

Instilling Safety Awareness — an attitude of attention

Michael Javery

*This issue's article on safety is by **Michael Javery**, Director of Manufacture and Test.*

The importance of attitude and common sense is pivotal for safety in the workplace.

Safety requires, and receives, a lot of attention here. The government has numerous safety programs and regulations that the company follows. We make an effort to purchase equipment and design processes that reduce risk and improve safety. The company also provides us with training and protective clothing and equipment, all with the goal of preventing accidents and keeping us safe and healthy to return from work here to our families and loved ones.

I would like to take this opportunity to share my thoughts on "Safety Awareness in the Work Place."

I truly recognize and hope that you will agree that we must look out for ourselves first, to allow the training, regulations and equipment to provide us protection.

The most important safety tool we can bring to work is our attitude. It's what describes us and our actions in the workplace. After all, safety is the single most important element of our jobs.

General hazards

We can be the biggest hazards on our job. When we get careless, we get hurt and maybe injure an innocent bystander. The concept of no-fault doesn't really apply to on-the-job-safety.

Most careless accidents can be pinned down to one of these causes:

- Complacency
- Emotions
- Tiredness
- Lack of knowledge

When working with complex machinery, hazardous chemicals and electrical power, we must provide full precision and attention to detail.

We are not expected to remember every single thing so don't be afraid to ask questions.

- If you're not sure what to do, **ask**
- If you're not sure how to do it, **ask**
- If you're not sure how it works, **ask**

Our work is serious business that involves a lot of equipment and substances that can be dangerous if not treated with care, respect and knowledge.

One of the most important safety responsibilities is simply to be aware of the need for safety. That means applying what we know to what happens on the job. It means thinking ahead to what hazards you could encounter, and thinking ahead about what could go wrong, on everything you do.

Computer training opportunities multiply

The Microsoft Accelerated Learning Program is underway. The Human Resources Computer Training department kicked off the program in June to provide participants with training in technical Microsoft programs such as Visual Basic, SQL, Windows NT Server, Internet Information Server and many more.

More than a dozen employees from several different departments including Facilities and Environmental Operations, Product Assurance, Business Operations, M.I.S. and Human Resources have applied. Applications are still being accepted. Any employee with a job requirement and management approval is welcome to participate.

The program includes study groups, lab practice sessions, a book lending library, computer-based training and it features Knowledge Pool. Knowledge Pool is a web site that allows participants to take courses and correspond with product specialists for that course.

Training Specialist **Kevin Kolb**, the program's point of contact, says, "I've been pleasantly surprised to see that we are adapting to new technology on the facility faster and faster. I've met several people who already have a good understanding of Microsoft products and they're clamoring for more. This program is designed to give them all the resources we can and then it's up to them to do something with it. So far, so good."

For more information and an application to the Microsoft Accelerated Learning Program visit http://gumbo/train/tech on the Michoud Space Systems Intranet.

Self service blood pressure testing

The Lockheed Martin Health Services Department has installed a free-standing blood pressure monitoring station for the convenience of employees. The machine is located in the Building 103, Column M-1 vending area.

"Our fully automated Health Monitor Center will make regular blood pressure monitoring easy," said Dr. **Lawrence McManus**, Health Services.

The machine is similar to those found in many drugstores.

X-33 test tank

Continued from Page 1

was the liquid oxygen (LO2) flight tank for the X-33. This tank was the first major hardware item to be completed for the vehicle, which is currently under construction at the Lockheed Martin Skunk Works in Palmdale, California.

The second of the twin tanks, the STA, was planned to be used for several ground tests. In May it completed a series of rigorous structural tests at Marshall Space Flight Center (MSFC).

"The STA structural testing program is an excellent example of NASA and Michoud Space Systems working together to achieve great results," said **Richard Harris**, Lockheed Martin STA Tank Team lead.

"The test program was started and completed within 14 weeks," said Harris. "The test stand, Building 4699, used for structural testing on the SLWT Aluminum-Lithium Test Article was not available due to scheduling conflicts, so we teamed with NASA/MSFC to build an alternate test facility at Building 4719 from scratch and use it to successfully complete the testing.

"This is a good example of a fast track program to minimize program cost while meeting all test objectives," Harris said.

The tests simulated conditions the X-33 will experience during the pre-take-off, take-off, ascent, return and landing phases of the X-33 flight tests. **Gene Austin**, NASA's X-33 program manager, said the completed test series "adds to our overall confidence in the vehicle as we keep pushing toward final assembly and its first flight next year."

With the structural testing completed, the versatile STA is now to be used in propellant densification testing at GRC.

The program will test Michoud Space Systems' proprietary predictive model for densification. This mathematical model relates propellant temperature to quantity within the STA, as well as predicting the behavior of subcooled cryogenic liquid as it is cycled through the tank and test fixture.

The STA will be used to test the densification of both LO2 and liquid hydrogen (LH2). Liquid oxygen is nominally maintained at –297°F. Densifying LO2 brings it down to an average temperature of –338°F, and this yields a 9% reduction in the volume of the liquid. LH2 is kept at –423°F. Densified LH2 achieves a temperature of –429.7°F and provides a reduction in volume of 6%. These volume decreases are key to the weight savings required for future launch vehicles.

The STA has been transported from MSFC to GRC. Michoud Space Systems technicians will install test instrumentation and structure inside the STA, including 40 silicon diodes to monitor propellant temperatures.

The STA is scheduled to be installed in the test facility in August, with LO2 testing planned to start in the October time frame. LH2 testing is projected for Spring 2000.

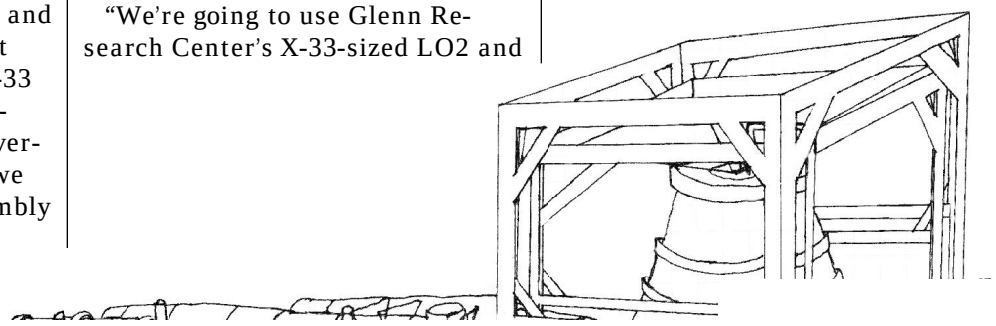
"We're going to use Glenn Research Center's X-33-sized LO2 and LH2 densifiers and their test facility," said Knowles. "The densifiers were built by NASA for a potential opportunity to fly densified propellants on the X-33 program."

The test will consist of cooling the cryogenic liquid to the target temperature by cycling it continuously through the test tank and back to the heat exchanger in the densifier. Each time propellant travels through the heat exchanger, it is further cooled. As the liquid is progressively cooled, so are the tank and the test fixture piping containing the liquid.

The sensors in the test tank will gather the temperature data the researchers will use to validate the math model.

Michoud had very good results from earlier LH2 densification tests using a 10-foot dual-lobed composite tank. "Data gathered during these tests strongly confirmed our predictive model," Knowles asserted. "We expect that the STA testing at Glenn Research Center will further support the high degree of accuracy of the model.

"Our knowledge of propellant densification, its benefits and requirements along with our proprietary modeling tools give us a competitive advantage for cryogenic main propulsion systems and launch vehicle propellant tank design and manufacture," Knowles said.



Artist's conception of the test setup at Glenn Research Center. At right is the STA mounted in the test fixture. To the left is the densification equipment.

Employee photo contest now open

Employees at Michoud Space Systems are invited to enter the third annual Lockheed Martin Photo Contest. This year's theme is "Excellence," selected from the Corporation's six core values of ethics, excellence, "can-do," integrity, people and teamwork.

The entries will be judged on adherence to the theme of "Excellence," as well as technical and aesthetic merit. Professionals and amateurs alike are encouraged to enter.

The objective is to expand the Corporation's database of images representing themes such as competition, achievement and teamwork portrayed as examples of excellence in business, explains **Eric Schulzinger**, the Corporation's director of photography and archives.

The winning entries will be included in the "stock category" of the Corporation's Digital Photo Collection, which is an Intranet site featuring a comprehensive collection of Lockheed Martin images.

The photographs — credited to the employees — will be available for use around the Corporation for business development presentations, employee communications, management briefings and other products calling for descriptive images.

Prizes to be awarded to this year's top three winners are:

- Gold: Canon A-2 camera with 28-105 mm zoom lens

- Silver: Canon Elan II camera with 28-80 mm zoom lens

- Third Place: Canon Rebel 2000 camera with 28-80 mm zoom lens.

Employees may enter up to 10 photographs. Prints, original transparencies and slides will be accepted. Color or black and white prints should be submitted no larger than 8.5 x 11 inches.

The deadline for entries is Oct. 1. Contest submissions will not be returned.

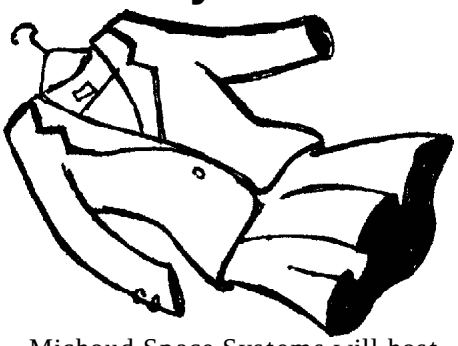
The contest will be judged by a panel of photographers, editors and writers selected by Corporate Communications, which is sponsoring the contest.

Entry forms and contest rules can be found by visiting the Digital Photo Collection at: http://imagebank.orl.lmco.com/photo

Michoud Work Status

To find out the status of work at MAF, call 257-1MAF or 1-800-611-3116; check the EWS; listen to WWL-870 radio or WWL-TV; or access the MAF Site Status web site at www.mafstatus.com

Now's a good time to clean your closet



Michoud Space Systems will host a clothing drive supporting *Dress for Success New Orleans* from August 16 through 20.

This service provides interview suits and clothing to low-income women seeking employment.

How does it work? Each Dress for Success client receives one suit when she has an interview, and a second suit when she gets the job.

The clients are job-ready women referred by numerous non-profit organizations such as homeless shelters, job training programs, literacy programs, adult education programs and domestic violence shelters.

You can help by making a tax-deductible donation of clean women's interview suits and accessories, including suits, blazers, skirts, dresses, pants, belts, blouses, jewelry or purses.

Please bring items to the Cost Management Conference Room, Building 350, 2nd Floor, Column V-7.

ISO audit

Continued from Page 1

Next, White wanted to see the paperwork for the discrepancy and walked to another department to find that. "Sometimes I check the hardware first and then the paperwork, and sometimes vice-versa," he said.

White wanted to know the dome's disposition — if Michoud planned "to scrap it, fix it, rework it or use it as is."

Later, in the final de-briefing after the pre-assessment tours and interviews were completed, the auditors were complimentary.

Auditor **Cynthia Lopez** said she could see that employees at the operator-practitioner level were very committed to quality. "They all had their training certificates. It's a very good work system — a good foundation for the system that's been built around them.

"What you're doing is taking your core quality and wrapping ISO around it," Lopez said.

Lead auditor **John Rogers** said the team had found only a small number of non-conformances. "I take one or two samples off the floor and see how far I can take them and how many elements I can touch," Rogers said in describing his own investigative process. He termed the pre-assessment as "certainly beneficial," showing that Michoud Space Systems has "a mature quality system."

Feltus Kennedy, who is leading Michoud's ISO certification effort, summed up the three days of the pre-assessment. "We were given some good recommendations and suggestions for improvements. The non-conformances that we did have are minor and can be corrected in short order."

Kennedy thanked everyone who participated in the audit and helped the auditors during their examinations.

MILESTONES

Employees celebrating milestone anniversaries with Lockheed Martin in June include:

25 years
Jerry Mattio
Thomas Mobley
Louis Palermo
Patricia Wittorf
Wayne Wright

20 years
Faye Baillif
Thomas Dirksen
Joseph Miller
Guridat Rupnarain
Terry Steudlein
Chi Chi Williams

15 years
Anthony Bondio
William Bouchereau
Maria Bzik
Kenneth Eddlestone
Angelo Greconia
Larry Groves
William Hall
Gary Harris
Patti Jones
Cindy Melton
Barry Morgan
Jonathan Sharpe

10 years
Terri Murphy
Terry Sheeley

5 years
Alan Arbourgh
Mark Bacon
Ronald Bozant
Larry Dickson
James Dileo
Todd Duhon
Jesse Hawkins
Bret Holt
Hannah Ladner
Guillermo Ladut
Richard Michel
Clayton Newbill
Aaron Pearson
David Saunders

Questions on ethics?

To obtain clarification on ethical matters or to report possible wrongdoing, contact the Michoud Space Systems ethics officer, **Stuart Stine**, at 7-3842, or call the Corporate Office of Ethics and Business Conduct, 1-800-563-8442.

See you at Fall Fest on October 16! Mark your calendar now.

BITS & PIECES

Employee discounts for coming events

The ever-popular Sesame Street characters plan to romp in the Big Easy again this year.

The live Sesame Street Players production "When I Grow Up" will be showing at the UNO Lakefront Arena November 5-7.

For pricing information and to order discount tickets, phone (504) 455-6285.

Please order soon. Payments must be made by October 21 for orders to be processed.

Up, Up and Away

The New Orleans Balloon Extravaganza is coming to the New Orleans Fairgrounds August 27, 28 and 29.

Come on out to the Fairgrounds for great food, live entertainment, crafts and giant hot air balloons!

There will be lots of fun for the kids in Children's Village along with hot air balloon shows, tether rides, and more!

To obtain the discount for available Lockheed Martin employees call (504) 455–6285.

Free parking. Kids under 12 attend free.

MISSION SUCCESS® BULLETIN

Volume 18, Number 7
July 30, 1999

Editor/Writer: Arthur Nead
Graphics, Photography:
L. Songy, A. Nead
Contributors:
M. Javery, K. Kolb, H. Wadsworth

Lockheed Martin
Michoud Space Systems

Telephone: (504) 257-1308
Mission Success Bulletin is published by the Public Affairs Department.