Space Systems Company – Michoud Operations

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Mission Success Bulletin

September 27, 2007

on-line

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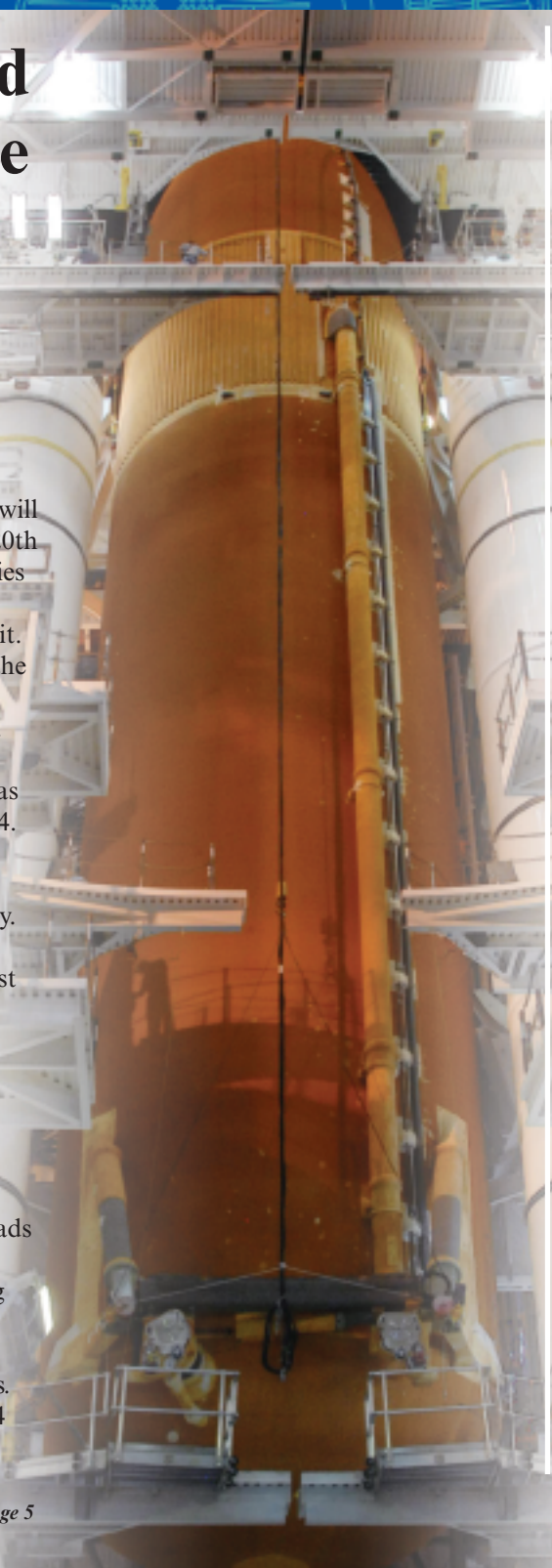
Discovery and ET-120 prepare for October flight to ISS



It doesn't happen often – the last time being the STS-80 mission in November 1996 – when the flight number, the mission number, and the ET number were all identical. But it will happen again in October when the 120th Space Shuttle mission takes to the skies on the STS-120 mission with ET-120 providing the propellant to reach orbit.

Discovery is scheduled to roll to the pad at the end of September or early October for the October 23rd launch. At press time, the Orbiter mate with ET-120 and Solid Rocket Boosters was planned for the week of September 24. The ET-120/SRB mate took place September 5 (photo at right).

ET-120 has a well-traveled history. Originally, the first Return to Flight tank, ET-120 underwent a tanking test and a launch attempt at KSC in the spring of 2005 before NASA decided to delay the launch and switch tanks due to issues relating to debris, ET diffuser, and Engine Cut-Off sensor anomalies.

After the RTF launch incurred foam loss from a Protuberance Airloads (PAL) Ramp in July 2005, ET-120 returned to Michoud for more testing and retrofitting. Technicians found cracks in a PAL ramp and also underneath adjacent Ice Frost Ramps. The PAL ramps were removed and 14 of the 16 Ice Frost Ramps replaced with a new design beneath the ramps.

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Michoud Ops pursues new business opportunities

With NASA encouragement, Michoud Operations is on the fast track to find and bring in new business to the Michoud facility.

Currently, **Dan Ferrari**, director of Business Development, and **Larry Knauer**, director of Enterprise Retention & Growth, are actively seeking near- and far-term opportunities that utilize the skills and resources that will be available as the Michoud Operations & Maintenance (MOM) work transitions to a new contractor in December 2008, and External Tank (ET) project employees become available in 2009 and 2010.

"Michoud Operations' vision is to be the preeminent provider of propulsion and structures solutions to NASA," states Ferrari. "With *Ares V* being the next major NASA activity in New Orleans, Michoud Operations is focusing our activities now to prepare for bid activity in 2010 or 2011."

The main elements of *Ares V* include a 33-foot diameter by 215-foot long Core Stage, a 27.5-foot diameter by 90-foot long Earth Departure Stage and the 27.5-foot diameter payload shroud. Other potential opportunities include the Lunar Surface access module that will require structural assembly and propellant tanks.

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New business opportunities

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Dan Ferrari
Director
Business Development

Retaining critical skills from the ET project and MOM are keys to Lockheed Martin's plan to bid on the *Ares V* work and – following a win – initiate start-up activities. In order to maintain those required job skills, Michoud Operations is pursuing a number of varied opportunities that will keep the workforce engaged until that time.

Despite the Team *Ares* loss on the Upper Stage, additional opportunities remain on the *Ares I* launch vehicle. Michoud Operations is currently providing input into Honeywell's Final Proposal revisions for the Upper Stage avionics unit, and preparing a response to NASA's Request for Information in support of development of Thermal Protection Systems (TPS) for the *Ares 1* vehicle. We are also pursuing opportunities to assist Boeing and NASA on *Ares I* development work.

The *Ares I* First Stage forward structure is another potential business opportunity. NASA and ATK are currently conducting trade studies on these structures for flight vehicles, and Friction Stir Welded components from Michoud Operations remain in the running. ATK expects to make a decision on the structures later this year.

Michoud Operations is also pursuing early development work for *Ares V* that would reduce the programmatic risk on the future launch vehicle.

Michoud Operations acquired a new customer with the recent award on the FAST program to build a ground test composite LO2 and CH4 propellant tank with integrated TPS and wing structure for the U.S. Air Force Research Laboratories.

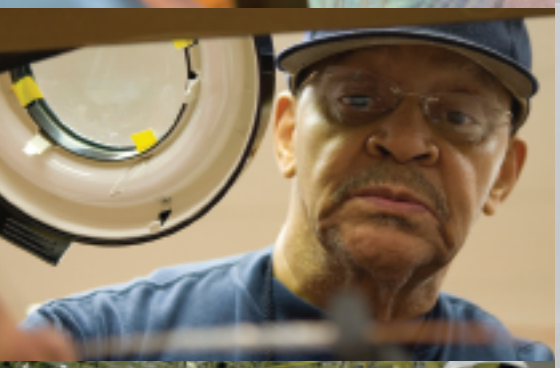
"This multiple-year program will lead to a downstream flight demonstrator vehicle and – if successful – an operational reusable launch vehicle fleet for future Air Force missions," notes Ferrari.

The Air Force continues to look at small launch vehicles and cost-effective Missile Defense targets, and hybrid propulsion technology is a candidate for both. Michoud Operations recently conducted a successful test of a force deflection nozzle, a key component for the hybrid small launch vehicle. A hybrid rocket launch is also planned for December from New Mexico.

Other opportunities include the assembly of composite structural components for the Joint Strike Fighter program, private business jets, 747 engine nacelle components, new military cargo aircraft, and payload carriers for the Evolved Extended Launch Vehicle program.

To support that potential volume of work, **Manny Zulueta**, Michoud Operations vice president & site executive, recently met with **Joanne Maguire**, Space Systems executive vice president, to discuss establishing a composite production facility at Michoud. Additional work will be necessary before that activity can proceed.

The Commercial Orbital Transportation Services (COTS) program, despite the failure of Rocketplane Kistler (RpK) to satisfy NASA's investment rules, still remains a



potential opportunity. Several companies may receive the NASA funding originally planned for RpK, and Michoud Operations will market our capabilities to these other companies. At the time of the COTS award in 2006, Michoud Operations was a member of three different teams.

In his role as director of Enterprise Retention & Growth, Knauer has developed a multi-level approach of employing the workforce that focuses on four areas of opportunity.

"The first goal would be to find work that could be done at the Michoud facility," notes Knauer. "The second would provide Lockheed Martin employees to build products at others' worksites. Another would provide loaned labor; and the final approach involves format retention programs."

Knauer is pursuing opportunities to participate in government work such as supporting the A-3 test stand construction at the Stennis Space Center. The test stand requires large cryogenic tanks.

Other Lockheed Martin companies are also prime candidates to provide work and within the past several weeks, Knauer has met with representatives from a number of LM companies to discuss Michoud support to a variety of programs from light military vehicles to remote minesweepers to detect and defeat systems for improvised explosive devices. The activities under consideration typically involve metal structural assembly and/or electronic integration.

Aerospace and related local industries are generating overwhelming interest. Louisiana business entities are winning or continuing major program work but lack the skilled workforce to meet their milestones. Knauer is in discussion with shipbuilders to container port operators who have requirements from advanced aluminum and composites manufacturing to facilities operation and maintenance.

"We are pursuing $200 million in specific shipbuilding opportunities that demand advanced aluminum and composites manufacturing skills," he reports. "These are not casual inquiries. We have received and are currently working formal requests for proposals."

A final area of opportunity is working with universities and technical schools to train tomorrow's workforce to meet the needs of the estimated $68 billion in new work and programs slated for the New Orleans area over the next five years.

"Our efforts today are the culmination of years of work," notes Knauer. "Until recently, our focus was on Return to Flight, and certainly safe, successful Space Shuttle flights are our number one priority. But now we are re-addressing opportunities from the past. Everywhere we go, we have received a very positive reception." ■

"The first goal would be to find work that could be done at the Michoud facility. The second would provide Lockheed Martin employees to build products at others' worksites."

Larry Knauer
Director
Enterprise Retention & Growth

NASA chooses Boeing for *Ares I* Upper Stage work

On August 28, NASA selected the Boeing team to build the *Ares I* Upper Stage at Michoud over the ATK-led team, which included key partners Lockheed Martin and Pratt & Whitney Rocketdyne (PWR).

"It is always disappointing when a high-visibility opportunity such as *Ares I* Upper Stage is awarded to a competitor, but I want to reassure the entire Team *Ares* proposal team that their hard work is not unrecognized," said **Ron Dittemore**, president, ATK Launch Systems.

"Our three companies are still highly involved with the Constellation Program. ATK is responsible for the *Ares I* first stage and the launch abort motor, PWR is building the J-2X engine, and Lockheed Martin is developing the *Orion* capsule. We are committed to supporting NASA and the nation's Vision for Space Exploration, and we will continue to partner with NASA on numerous future projects in the years and decades to come."

Regardless of who won the competition, NASA had previously announced that the Upper Stage work would take place at Michoud – a project that will continue to help the New Orleans area recover economically. The scope of work consists of structural assembly of cryogenic tanks, final assembly, integration, and check-out.

"The loss was certainly disappointing," said **Ron Wetmore**, vice president, Shuttle Derived Launch Vehicles. "I want to thank all the team members for their devotion to the proposal we submitted and to all the employees here at Michoud who had our backs. Now, we must stay engaged on the Constellation Program. We're competing for the avionics package on the *Ares I* Upper Stage to be awarded in December.

"In the future NASA has also indicated it wants to build key stages of the *Ares V* heavy lift vehicle here at Michoud. So we have to be prepared to win projects like the core stage, the Earth Departure Stage, and the Lunar Lander." ■

Employees receive Silver Snoopy awards

STS-118 Commander **Scott Kelly** and Mission Specialist **Tracy Caldwell** presented three Snoopy awards to employees for outstanding performance on September 19. They include the following:

- **Dale Mahnke** (2nd from left in photo), environmental engineer, Lockheed Martin, for sustained environmental engineering performance, resulting in operational and process improvements ensuring External Tank and Michoud program environmental compliance
- **Marilee Bourg**, lead quality assurance specialist with DCMA, for being instrumental in identifying cracks in the Thermal Protection Systems surfaces of the Ice Frost Ramps on ET-120 and contributing to the decision to redesign the closeouts
- **Vincent Morales**, staff quality engineer, Lockheed Martin, for leading the Safety & Product Assurance support at Kennedy Space Center during the investigation and repair of hail damaged ET-124 while ensuring flight safety of the STS-117 mission in June ■

STS-120

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ET Program Manager **Wanda Sigur** called ET-120 "a fundamental redesign of the manually-sprayed TPS (Thermal Protection Systems)."

Fast forward to the STS-118/ET-117 launch August 8 when two pieces of debris came off the Liquid Oxygen (LO2) feedline support brackets. One piece hit a thrust strut at the bottom of the tank and bounced up into *Endeavour's* heat shield, creating a small divot/damage site.

To resolve the debris issue at these bracket locations, a 16-person Michoud team traveled to KSC August 26 and hooked up with KSC Operations to work a bracket retrofit in one week on ET-120, the next tank to fly.

United Space Alliance technicians completed the rough trims by removing foam and super light ablator (SLA) around a 5-inch area at the top of the four forward LO2 feedline brackets on ET-120. NASA and Lockheed Martin decided the fifth feedline bracket, the lowest one on the tank, didn't require modification because it had a different TPS design and was not in a position to affect the Orbiter.

Eugene Sweet, lead engineer on the retrofit, said the team first cleaned up the substrate, primed and then prepared for the first foam sprays on brackets at Stations 1871 and 1623. (For reference, Bracket 1871 is 1,871 inches from the top of the tank.)

Ablative material did not have to be re-applied to the brackets because NASA Shuttle Program Manager **Wayne Hale** said recent shuttle flights and engineering analysis showed that the bracket areas did not get as hot as first thought during ascent.

After completing the first two sprays, the team let those sprays cure while prepping the final two brackets on Stations 1377 and 1129 for spray. After the cure, technicians started trimming the sprayed foam on the first two brackets.

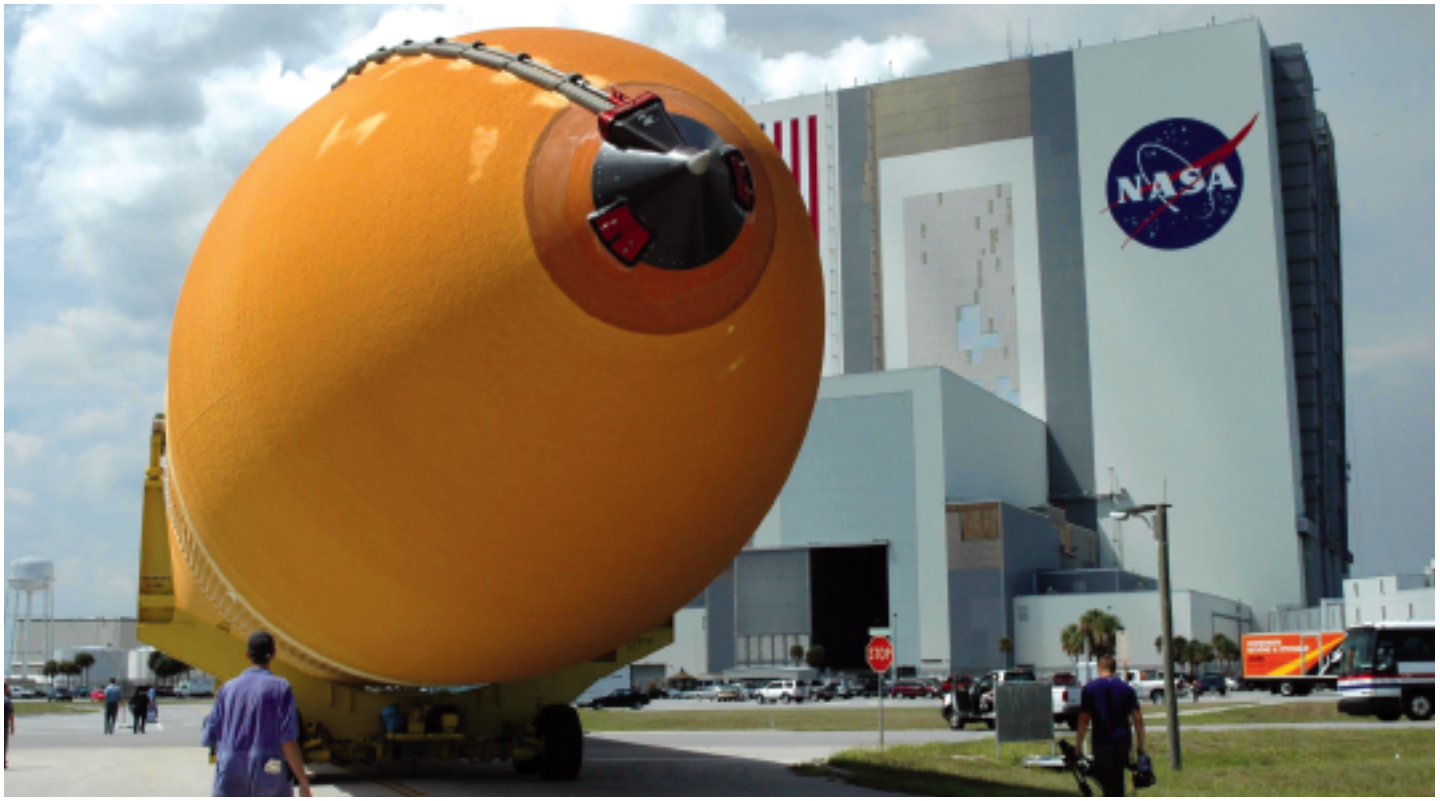
Then the team sprayed the final two feedline brackets. "We sprayed the brackets back to their overall configuration so we could stay within our drawing requirements," Sweet said.

Working in the five-inch area at the upper outboard monoball location of the feedline support bracket, Sweet explained that the team accomplished two important goals: re-applying the TPS design with the elimination of a potentially high density debris material (SLA), and installing rain diverters that possibly will lessen ice in bracket gaps.

"This small dedicated team did an awesome job implementing this retrofit within time constraints, and particular thanks goes to Materials Science and our Tech Lab team members," Sweet said.

NASA is also considering reducing the period between ET-120 tanking and launch by one hour to decrease the time that ice can form in the bracket gaps. ■

ET-125 arrives at Kennedy Space Center



Off- loaded on September 14 after a five-day, 905-mile trip from Michoud, ET-125 will serve as the launch-on-need tank for the STS-120 / ET-120 lift off scheduled for October 23. Subsequently, ET-125 is targeted for launch with the STS-122 mission in December.

Health and wellness programs promote fitness

In the hustle and bustle of our busy lives while juggling work and family among other things, who has the time to work out and eat right? Compounding the situation, today's technology of laptop computers and Blackberries makes it easier to bring work home. All of this affects the amount of time employees can devote to their health and wellness.

Dr. Winston Levy

Lockheed Martin's health & wellness mission is to engage employees in behaviors and lifestyle choices that will help improve their health and decrease the amount of time and money spent going to the doctor. *LM HealthWorks* is our on-line gateway for health and wellness information. Some of the top health concerns for employees include stress, fitness, nutrition, and smoking.

Several things can cause stress – your job, financial problems, relationships, family, daily hassles. Some people are naturally susceptible to stress. However, stress can lead to depression, high blood pressure, and other negative health conditions. Having high blood cholesterol can greatly increase your risk for heart disease.

Lockheed Martin's new on-site physician, **Dr. Winston Levy**, was amazed at the percentage of employees who have high cholesterol. "If they back off the starches and go on the 'no-white' diet, that will then lead them to eat healthier foods."

Eating healthier as well as exercising will in general bring the cholesterol levels down. Dr. Levy supports the Fitness Reimbursement program offered by the corporation as well as Michoud's fully-equipped fitness center here on-site.

The biggest obstacle is time – when to find the time to exercise and eat right. Many employees commute an hour or more just to get to and from work. The on-site gym can be a convenient alternative. Instead of sitting in heavy traffic, exercise 30 minutes in the gym and let the traffic die down. Yoga classes are also offered on Tuesday and Thursday, and Weight Watchers meets Thursday at lunch. If none of the above is convenient, take a break to eat a piece of fruit or walk for 15 minutes around the building, or do both.

Quality wellness programs in the workplace can go a long way in helping employees lead a better life in and out of the office. Many benefits accompany these wellness programs such as increased productivity, lower health care costs, fewer physical injuries, and reduced job turnover. ■

Troy Ohlsen works out using the stair climber while Frank Conrad (left), Medical Services, and Dr. Winston Levy monitor his progress.

United Way Kickoff

10:30 a.m. Thursday, October 18

On the apron outside the factory near Bldg 303

Hot dogs, chili, chips, soft drinks & water

Musical entertainment

Special guest — Margaret Orr of WDSU-TV

18 United Way agencies will be on hand to explain their role

Lockheed Martin's campaign runs from October 22 through November 9

Elfer named Lockheed Martin Fellow

Dr. Norm Elfer

Dr. Norm Elfer, a principal materials engineer at Michoud, has been selected as a Lockheed Martin Fellow – a corporate-wide program to recognize and reward world-class engineers and technologists in their individual contributor career paths.

The corporation selected Elfer for superb technical achievement in the areas of fracture mechanics and space debris protection. The program's challenge is to leverage the expertise of LM Fellows across the corporation.

Elfer joined Lockheed Martin in 1983 in the Metals, Welds and Parts group, where he worked metallurgy, damage tolerance and failure analysis. He chairs the Technical Sub-Committee of the Fracture Control Board and earlier served as senior manager of Materials Science.

His accomplishments include the following:

- application of fracture mechanics technology to TPS foam
- technical lead for Friction Stir Welding implementation on the ET
- development of 2195 aluminum-lithium fracture allowables for the Super Lightweight Tank
- author of "Handbook: Structural Damage Prediction and Analysis for Hypervelocity Impact" and "Space Debris Surfaces Users Manual" for NASA

Prior to joining Lockheed Martin, he was a guest scientist at the German Aerospace Research Establishment in Cologne, Germany; an assistant professor in Mechanical Engineering at LSU; and a summer faculty fellow at NASA Glenn Research Center in Cleveland.

Elfer was recognized at Space Systems Awards Night as lead of the Return to Flight TPS Test Team. He also has received a Silver Snoopy Award and was named a Launch Honoree for the Super Lightweight Tank's first flight. ■

Emergency Information

To find out work status during hurricane season at Michoud, go to www.mafstatus.com or call 257-1MAF or 1-800-611-3116, check ETV or listen to WWL-870 radio or visit wwl.com or watch WWL-TV, Channel 4 or go to wwltv.com

Seeing it for the first time

STS-118 Mission Specialist Tracy Caldwell who flew in August on* Endeavour *narrates the beginning video of her mission at a September 19th General Assembly. Caldwell had not seen the 25-minute video before she and Commander Scott Kelly narrated it unrehearsed before employees. Both astronauts thanked employees for their role in the Mission Success of ET-117 that successfully placed their crew into orbit.

Michoud volunteers collect bags of trash

Altogether, over 1,600 volunteers from various organizations covered nearly 100 miles of shoreline at this year's Lake Pontchartrain Basin Foundation Beach Sweep on September 15. Based on an average of 17 lbs. per bag, volunteers prevented 27,948 lbs of debris from washing into the waterways and dirtying up the Lake. Lockheed Martin volunteers included back row, from left: Robert England and daughter Jolie, Danny Radykowski, Tyler Spalding, John McDonald, and Joe Saputo. Kneeling: Tracie England and Carolyn Baringer. Not pictured is Netsy Wheeler.

Milestones

Employees celebrating anniversaries with Lockheed Martin in October 2007

30 Years
Lillian Baham-Gosin
Michael Cinquigranno
John O'Neal
Sheila Pedesclaux
Joseph Pleasant

25 Years
Toni Alvarez
Michael Gnau
Blanche Holding
Scot Marshall
Roger Meunier
Scott Spiehler

20 Years
Nelda Bellinger
Dilip Dudgaonkar
Stuart Layton
Paul Lorio
Ray Palmer

15 Years
Patrick Connolly

10 Years
Christopher Alfred
Janice Allen
Derrick Archie
John Arseneaux
Jon Arterburn
John Brawley
Lori Chandler
Shelia Cheneau
Trevor Converse
Michael Gioia
Daren Hubbard
Sylvester Keebler
Jessie Lee
Greg Menesses
Clifton Mitchell
Phat Nguyen
Brad Ricouard
Carl Saunders
John Singelmann
Alan Snyder
Reginald Williams

5 Years
Robert DuPont
Scott Gerace

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Director of Communications: Marion LaNasa

Editor: Harry Wadsworth

Graphics, Photography: Troy Cryder, Chip Howat, Jon Irving, Shannon Jurado, Ryan Martin, Brian Peterson, George Shelton

Contributors: Marion LaNasa, Michelle Morlier

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