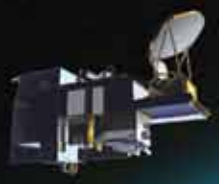
AEROSPACE NOW

Vol. 3, No. 4 April 2011

DWSS' Earth Day Is on the Horizon



NORTHROP GRUMMAN

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ISR Northrop Grumman's systems enable warfighters to respond with speed and confidence. Decades of multiple domain ISR leadership have given us the expertise and knowledge to anticipate operational needs. Which is why our ISR systems are the best choice in the quest for ground truth and the ability to read and react, quickly and accurately.

Aerospace Now

April 2011

Northrop Grumman Aerospace Systems

Vol. 3, No. 4

Published for employees by Aerospace Systems Communications, Aerospace Now archives are available on the intranet at https://as.myngc.com/Services/Comms/Pages/AerospaceNow.aspx

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NORTHROP GRUMMAN

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Gary's SPACE

Gary Ervin, Corporate Vice President and President, Northrop Grumman Aerospace Systems

Doing What's Best for Our Environment and Customers

Each April, the world celebrates the natural wonders of our planet on Earth Day. We all want to do what's best for the environment in the communities where we live and work. We also recognize that we are living in a period of more extreme weather and dramatic climate trends that affect our economy and create security issues that can impact all of us.

According to the National Oceanic and Atmospheric Administration, 2010 tied with 2005 for the warmest year on record. It was the 34th consecutive year with global temperatures above the 20th century average. In the United States, 12 states experienced record warm summers. Conversely, several U.S. locations, including Washington, D.C., experienced record snowfall. Last year, catastrophic floods ravaged Pakistan, China and Australia, as well as parts of the United States. Russia experienced record heat and drought, as did China. The resulting significant decline in wheat production and several other key food staples contributed to soaring food prices and civil unrest in many parts of the developing world.

Different phenomena influenced the extreme weather of the past year and longer-term global change trends. Our customers, including the U.S. Department of Defense, have recognized that varying environmental conditions may significantly impact national security and military operations.

In this issue, we look at a program that will be central to helping our customers maintain effectiveness in a world of varying environmental conditions. We are working with the U.S. Air Force to explore how to transition work done for the former National Polar-orbiting Operational Environmental Satellite System program into the future Defense Weather Satellite System (DWSS). Our company's expertise designing and developing spacecraft and sensors, as well as integrating large, complex satellite and ground systems, has the potential to be essential to this program that will succeed the current Defense Meteorological Satellite Program. Across the armed forces, our warfighters operating on land, sea and in the air will depend upon accurate, timely information provided by DWSS once it comes online after its scheduled 2018 launch.

Also in this issue, we explore what we are doing as a company and through the initiative of our colleagues to reduce our environmental footprint. Part of our corporate vision prioritizes reducing greenhouse gas emissions, solid waste and water use. Such efforts allow us to be proactive in addressing the planet's larger climate problems while reducing our operating costs and improving bottom-line performance. As we find ways to conserve resources and develop technology that allows us to adapt in a world marked by changing climate, there's payoff for shareholders, customers and employees alike.

Gary

news briefs

Landmark Flight Brings Program One Step Closer to Demonstrating Autonomous Aerial Refueling Between Two Unmanned Aircraft

Earlier this year, Northrop Grumman, the Defense Advanced Research Projects Agency and NASA Dryden Flight Research Center took a major step toward demonstrating autonomous aerial refueling between two unmanned, high-altitude aircraft, an

operation never before performed. In a key risk-reduction flight test, Northrop Grumman's Proteus test aircraft and a NASA Global Hawk flew as close as 40 feet apart at an altitude of 45,000 feet, an industry-setting record. The flight test was conducted in the challenging high-altitude environment required for refueling of high-altitude, long-endurance unmanned aircraft systems. Wake turbulence between the two aircraft and engine performance and flight control responsiveness in the stratosphere were evaluated. Simulated breakaway maneuvers also were conducted. The flight was key to reducing risks as the program prepares for autonomous aerial refueling of two Global Hawks in the spring of 2012. "Demonstrating close formation flight of two high-altitude aircraft, whether manned or unmanned, is a notable accomplishment," said Geoffrey Sommer, KQ-X program manager at Aerospace Systems. "When you add autonomous flight of both aircraft into the mix, as we will do later in the KQ-X program, you gain a capability that has mission applications far beyond just aerial refueling."

Fire Scout Completes First Unmanned Test Flights on Littoral Combat Ship

The Northrop Grumman-built MQ-8B Fire Scout vertical takeoff and landing tactical unmanned aerial vehicle achieved a significant development milestone late in 2010 when it flew its first test flights from the U.S. Navy's littoral combat ship *USS Freedom* (LCS-1). The Navy conducted the activity, known as dynamic interface testing, off the coast of Southern California to verify Fire Scout control systems have been integrated on the ship properly. "This was a great opportunity to witness the pairing of the LCS with Fire Scout because it represents what the Navy will use for future littoral security missions," said George Vardoulakis, vice president for Tactical Unmanned Systems for Aerospace Systems. "We used the opportunity to demonstrate system performance capabilities with the ship, maintenance crew and other key logistical support functions." Northrop Grumman is the Navy's Fire Scout prime contractor.

Legendary Physicist and Aerospace Pioneer Simon Ramo Receives Goddard Memorial Trophy

Dr. Simon Ramo, an engineering pioneer who enabled the United States to become a world leader in space technology and its applications, on April 1 received the Dr. Robert H. Goddard Memorial Trophy, the National Space Club's pre-eminent award.

Ramo co-founded TRW, one of the country's premier defense electronics corporations, which was acquired by Northrop Grumman Corp. in 2002 and is now part of Aerospace Systems. The Goddard Memorial Trophy recognizes significant contributions to U.S. leadership in the fields of rocketry and astronautics. According to the National Space Club, Ramo was chosen for his "lifetime of engineering and scientific leadership and achievement that has made an unparalleled impact on our nation's space programs. Among his many accomplishments are many critical early space programs including intercontinental ballistic missiles, the Thor, Atlas and Titan rockets, Project Mercury, Pioneer 1, Viking 1 and 2, and the Lunar Excursion Model Descent Engine."

Broad Area Maritime Surveillance Program Holds System Critical Design Review

Northrop Grumman's MQ-4C Broad Area Maritime Surveillance Unmanned Aircraft System (BAMS UAS) program conducted system Critical Design Review (CDR) with the U.S. Navy in February. "It is gratifying to see the design mature from the Preliminary Design Review to the Critical Design Review over the past 12 months," said Steve Enewold, vice president and program manager for BAMS. The MQ-4C system CDR, which was preceded by 10 subsystem and segment CDRs, sets the initial product baseline for the MQ-4C system. The government and Northrop Grumman teams will work to close out action items that were generated at the review to officially close CDR. The MQ-4C BAMS UAS air vehicle is a marinized version of the U.S. Air Force RQ-4B Global Hawk. Changes to the RQ-4B include a stronger wing, an ice protection system and a sensor suite based upon components of (or entire systems) already fielded in the Department of Defense inventory.

F-35 Team Wins Logistics Award

The F-35 Joint Strike Fighter Team (Team JSF) won the 2010 Defense Logistics Award for "Best Logistics Strategy" for a military-contractor partnership achieving logistics excellence. The Defense Logistics Awards were established to honor and recognize the

defense industry for its significant contributions to military logistics in support of the Department of Defense and the ultimate end user, the warfighter. Team JSF comprises the JSF Program Office, Lockheed-Martin Aeronautics, Northrop Grumman, BAE Systems, Pratt & Whitney and the Fighter Engine Team (GE/Rolls Royce). Congratulations to the F-35 Northrop Grumman Autonomic Logistics Global Sustainment team for its contributions toward the successful implementation of the Team JSF Support Program.

CELEBRATING 100 YEARS

The Grumman TBM Avenger takes its well-deserved place among vintage aircraft displayed to commemorate the 100th anniversary of naval aviation. Used as a torpedo bomber during World War II, the Avenger was famously piloted by former President George H.W. Bush to attack Japanese installations in 1944.

Northrop Grumman's MQ-8B Fire Scout faces a luminous sunrise hours before 70,000 spectators arrive for the Centennial of Naval Aviation festivities. The Fire Scout unmanned aerial vehicle system provides unprecedented support to the U.S. Navy and currently is being used onboard the *USS Halyburton*.

Northrop Grumman's E-2C Hawkeye appeared at the Open House Feb. 12. The latest variant of the Grumman E-2 Hawkeye, the E-2D Advanced Hawkeye is the Navy's newest airborne early warning and command and control aircraft. On Jan. 31, it landed on the *USS Harry S. Truman* to begin carrier suitability testing.

The legendary Blue Angels lead more than 180 military aircraft in the Parade of Flight, celebrating the start of a yearlong tribute to aircraft, ships, individuals and milestones that contributed to a spectacular 100 years in naval aviation achievement. The Blue Angels performed their first flight demonstration in June 1946, flying the Grumman F6F Hellcat.

A new era dawns on a full-scale model of the Northrop Grumman-built Navy Unmanned Combat Air System Demonstration (UCAS-D) aircraft displayed at the Centennial of Naval Aviation Media Day Feb. 11. The first tailless, fighter-sized aircraft to autonomously take off from and land on a carrier deck, the UCAS-D completed its historic first flight a week earlier at Edwards Air Force Base, Calif., pioneering the next 100 years of naval aviation.

One hundred years after the original 1911 A-1 Curtiss Triad flew over San Diego Bay, the replica briefly takes flight over the same waters. The first amphibious seaplane to fly in the United States and the first U.S. naval aircraft, the A-1 Curtis Triad officially bestowed aviation pioneer Glenn Curtiss the title "Father of Naval Aviation" and declared San Diego the birthplace of naval aviation.

Two Grumman C-2A Greyhounds rumble along to pay tribute to the 100th anniversary of naval aviation. Developed from the Grumman E-2 Hawkeye, the C-2A Greyhound is a twin-engine cargo aircraft designed in 1966 to shuttle mail and supplies between U.S. Navy aircraft carriers.

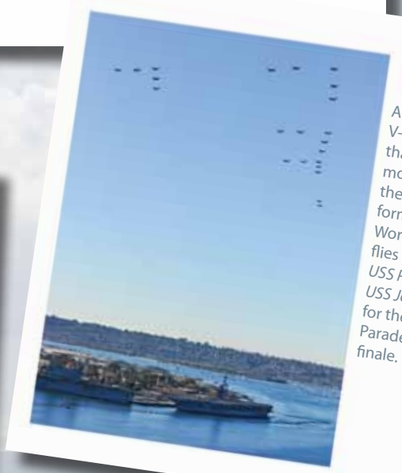
Whizzing by in the aerial parade are four single-seat, twin-engine Northrop F-5N Tiger IIs painted in *faux* Soviet markings. The aircraft is used to train the U.S. Navy's top fighter pilots.

Four F/A-18 Hornets in tight formation roar through crystal clear blue skies over San Diego during the Parade of Flight Feb. 12.

Photos by Alan Radecki

Throngs of naval aviation enthusiasts enjoy food, music and an impressive array of 75 old warbirds and modern-day jets and helicopters during the Centennial of Naval Aviation Open House at the Naval Air Station North Island, Calif.

The *USS Midway* is decked out for the evening kickoff gala on Feb. 12, which was attended by the secretary of the Navy, chief naval officer, commandant of the Marine Corps and a plethora of admirals, captains and corporate executives.



A stately, mile-wide V-formation of more than 30 vintage and modern aircraft, the largest military formation since World War II, flies over the *USS Peleliu* and *USS John C. Stennis* for the magnificent Parade of Flight finale.

"The 100th Anniversary of Naval Aviation is a special celebration for our company. We have been supplying the Navy with aircraft and technology for nearly as long as the naval aviation programs have been in existence. We are proud of this partnership and proud of the role we have played in supporting the men and women who serve our nation and defend our freedoms."

—Jim Zortman, Sector Vice President, Life Cycle Logistics & Support, Site Executive, San Diego, Aerospace Systems

Centennial of Naval Aviation Catapults into the Next Century

AMY AKMAL AND ALAN RADECKI

Northrop Grumman kicked off the yearlong celebration of the Centennial of Naval Aviation in a two-day event beginning Friday, Feb. 11 at Naval Air Station North Island, Coronado, Calif. Northrop Grumman joined the U.S. Navy, Marine Corps, Coast Guard and Naval Aviation Foundation in an open house and parade of flight that highlighted the finest vintage and current naval aircraft.

The event was a milestone for Northrop Grumman as it bookended its 100-year heritage of contributing to naval aviation with the historic first flight of the Northrop Grumman-built Navy Unmanned Combat Air System Demonstration aircraft, developed to be the first unmanned tactical aircraft to take off and land aboard a carrier, just a week earlier on Feb. 4. The Northrop Grumman team is already charging full speed ahead into the next century of naval aviation. Bravo Zulu.

—Susan Wetzel contributed to this article

Navy League Long Island Honors Centennial

DIANNE BAUMERT-MOYIK

Pictured (l-r) during the awards presentation are Navy League National President Daniel Branch, Sector Vice President and General Manager for Battle Management and Engagement Systems Pat McMahon and U.S. Cmdr. Vice Adm. David Architzel, Naval Air Systems Command.

U.S. Cmdr. Vice Adm. David Architzel, Naval Air Systems Command, gave the keynote address before the Long Island Council of the Navy League of the United States' annual gala Thursday, March 3 at the Melville Marriott in Melville, N.Y.

The Long Island Council honored U.S. Congressman Steve Israel (New York), Col. Michael F. Canders (retired), commanding officer, 106th Rescue Wing, Air National Guard, and Lt. David Barnes, supervisor, Marine Safety Office (Coram), U.S. Coast Guard, as well as industry leaders, Northrop Grumman and Curtiss Wright for their contributions to naval aviation.

"We were honored that Vice Adm. Architzel, who grew up on Long Island, could attend our annual gala and share his perspectives, especially as our nation celebrates the Centennial of Naval Aviation," said Tom Matteo, council president. "It's a fitting time for us to honor the contributions that hundreds of thousands of Long Islanders, including all of the employees at Northrop Grumman, have made and continue to make to the success of naval aviation. It's also vital that we as an organization and community demonstrate our continuing commitment to naval aviation and its impact on our national and allied security."

Visit the Long Island Council online at www.nluslongisland.com.

For more information about Northrop Grumman's contribution to naval aviation, please visit www.northropgrumman.com/naval100.

Fire Scout Deploys on *USS Halyburton*, Preps for Afghanistan Mission

WARREN COMER


Photo by Northrop Grumman

Earlier this year, the U.S. Navy deployed the MQ-8B Fire Scout onboard the *USS Halyburton* and began preparing the vertical takeoff and landing tactical unmanned aerial vehicle for a land-based deployment in Afghanistan to support U.S. Central Command.

A three-vehicle deployment to Afghanistan is a first, as Fire Scout will be used to support ground forces in their fight against insurgent groups and the Taliban.

"Fire Scout's ISR (intelligence, surveillance and reconnaissance) capabilities were assessed during a deployment on the *USS McInerney*, where the Navy used the system to capture illicit drug traffickers along with about 250 kilos of drugs last year," said George Vardoulakis, vice president for Tactical Unmanned Systems. "We're working with the Navy to apply these capabilities to help warfighters succeed on the battlefield."

As part of the Afghanistan deployment, Northrop Grumman engineers, maintainers, air vehicle and payload operators are accompanying their military counterparts to help meet critical ISR and targeting needs.

A team of Northrop Grumman employees will operate the Fire Scout system under military leadership to support a Department of Defense ISR Task Force requirement of gathering 300 hours of full-motion video a month.

The video captured by Fire Scout will help identify potential threats over greater areas without detection. Battlefield commanders then can use this intelligence to direct forces in neutralizing threats more efficiently — ultimately saving lives.

"Operating Fire Scout in the field is really exciting because we'll be using it on the front lines, exactly where it's supposed to be," said Michael Sheek, who is a member of the Northrop Grumman support team. "The philosophy of everyone deploying is that we're supporting the warfighter directly and that we will be happy to call ourselves a part of the mission."

"While I've trained to operate payloads on the Fire Scout for the deployment, I'll also be able to use the knowledge I have in working as an engineer with the program over the last six years," Sheek said.

Joint STARS

Eyes in the Sky over Land and Sea

GREGORY B. HARLAND

The E-8C Joint Surveillance Target Attack Radar System (STARS) aircraft has completed a series of successful demonstrations and test flights highlighting its ability to rapidly integrate new technology into its state-of-the-art intelligence, surveillance and reconnaissance and battle management command and control platform.

The Melbourne, Fla., program office recently fit the E-8C Joint STARS test-bed aircraft, known as T-3, with the MS-177 long-range multispectral sensor. The MS-177 is tucked into a new keel beam accessory bay beneath the main fuselage.

This imaging sensor augments the E-8C's radar, giving Joint STARS aircrews the ability to identify targets to aid ground commanders in making decisions in real time, according to Dave Nagy, vice president of Business Development for Battle Management and Engagement Systems.

"Today, Joint STARS covers a broad area," Nagy said. "Since the radar looks at literally tens of thousands of square miles, it picks up lots of moving objects. If you want to go take a look at something, you need to go fly in … a Predator, Reaper or even a Global Hawk, and that can take time."

To date, Congress has added funding to defense bills to cover a sensor demonstration to inform a Joint STARS Military Utility Assessment.

Joint STARS Shines in Joint Surface Warfare Flights

Off the California coast, an E-8C Joint STARS aircraft completed a series of flights to see how well it could help guide anti-ship weapons against surface combatants at standoff distances.

These activities were part of the Navy-led demonstration called Joint Surface Warfare (JSuW).

To support the demo, members of the Joint STARS modernization branch at Hanscom Air Force Base, Mass., developed prototype software, called Link 16 network-enabled weapon, for the Joint STARS T-3 test-bed aircraft.

With it, the aircraft served as the command-and-control node and a node for Navy joint standoff weapons during the three days of tests in September off the coast.

"From the Joint STARS perspective, the demonstration was completely successful," said Brittany Ridings, program manager for the JSuW Joint Capability Technology Demonstration who oversaw the JSuW effort.

—Arie Church contributed to this article

A Northrop Grumman E-8C Joint Surveillance Target Attack Radar System test-bed aircraft, with its new JT8D engine propulsion pod system, performs a multi-sensor demonstration with the APY-7 radar system and the multispectral sensor, MS-177, located immediately aft of the radar in the new keel beam accessory bay.

Photo by U.S. Air Force

A NEW WEATHER SYSTEM IS APPROACHING

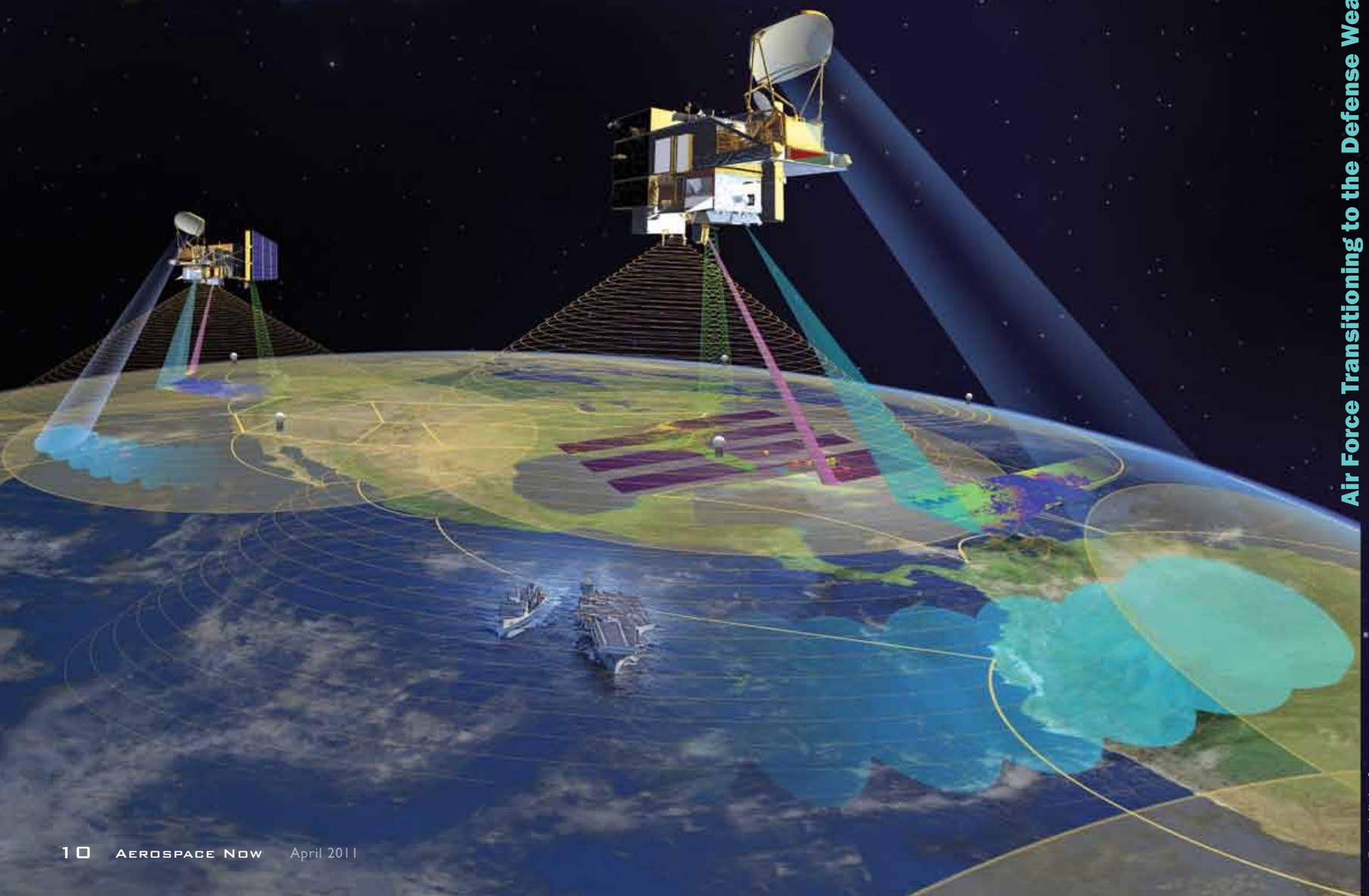


Illustration by Northrop Grumman

Air Force Transitioning to the Defense Weather Satellite System

MARY BLAKE

The U.S. Air Force Space and Missile Systems Center (SMC) at Los Angeles Air Force Base, Calif., is coordinating closely with an Aerospace Systems team to move forward on the Department of Defense's new Defense Weather Satellite System (DWSS).

Transitioning work done for the National Polar-orbiting Operational Environmental Satellite System (NPOESS) program, the DWSS team will leverage NPOESS' accomplishments, which have been tailored for the DWSS spacecraft size and power requirements.

Aerospace Systems has worked very closely with SMC to establish the plan for the way forward. "My thanks go to all our NPOESS/DWSS team members who have applied their talents and dedication this last year to the needs of our customer," said Linnie Haynesworth, vice president and DWSS program director. "Their efforts made it possible to transfer the considerable progress we've made on NPOESS to the DWSS program in a way that will significantly benefit SMC."

DWSS will provide enhanced weather information critical to battlefield operations and deliver it more quickly to the warfighter than current systems.

The Defense Meteorological Satellite Program (DMSP) has delivered weather data for military use since the mid-1960s, and DWSS, projected for launch in 2018, is its successor. It is important that DWSS be launched on time to maintain continuity with the current DMSP satellites and establish a backup in the event of a launch or satellite failure on orbit for the remaining two DMSP satellites. Time-sensitive weather data delivered promptly is essential to military operations planning and warfighter and weapons deployment.

Haynesworth explained how our work on NPOESS will benefit the DWSS program. "For DWSS, we are leveraging the high level of maturity and risk reduction achieved on the NPOESS spacecraft and sensors, which have progressed from development into production," she said. "All of the spacecraft subsystems are functionally unchanged, with 95 percent of the configured items being continued from the NPOESS configuration. Ninety percent of our space vehicle tier one suppliers have remained unchanged. We have worked closely with the U.S. Air Force to optimize the program by tailoring the spacecraft size and power to match the smaller payload manifest of the dedicated defense weather mission, while maintaining production momentum."

As a result of modest modifications to the spacecraft for the Air Force requirements, the DWSS authorization allows the program to proceed directly to the delta Systems Requirement Review milestone (an updated validation of system requirements against the overall mission requirements) and initiate time-critical manufacturing in 2012.

In modern warfare, Gen. Dwight D. Eisenhower clearly recognized the importance of weather in battle planning. In the days and hours leading up to D-Day, his "go" or "no-go" decision depended heavily on a critical "weather window." In one of their most important roles ever, Allied weather forecasters predicted that the weather would clear sufficiently on June 6, 1944. However, the German meteorological services were unaware of this temporary break in the weather. The German Navy canceled its usual patrol of the English Channel on the eve of the attack. Eisenhower gave the order for D-Day and set in motion the largest amphibious invasion in world history.

With the far-ranging capabilities of DWSS, our modern military forces will be even better able to minimize risk to ground troops and exploit ever-changing weather conditions to support the success of land, sea and air missions.

Advanced Coating Technology: It All Rolls Off

SUSAN WETZEL

Splat! Whose car windshield hasn't been graced by bird droppings? As the offender flies overhead, you're quickly reminded that driving a car with a dirty windshield is more than just a simple annoyance. Depending on the size of the droppings, it's potentially dangerous. And so are the contaminants that are floating in the Earth's atmosphere and around other terrestrial bodies like Mars. They, too, can pose dangerous safety risks for our air and space missions.

Lunar dust, dirt and gases are just some of the contaminants found in space, and they can cause serious risks due to their abrasive and penetrating nature. They can cause skin and lung damage to our astronauts, and they can scratch and damage the devices our space crews rely on. That's why Dr. Ron Pirich, technical fellow, Technology and Development (TD), is leading a joint effort between Aerospace Systems and Electronic Systems to develop advanced coating technology that would minimize adherence of contaminants to structural surfaces. His team, consisting of Aerospace Systems colleagues John Weir, associate technical fellow, and engineers Dennis Leyble and Steven Chu — both from TD — as well as Electronic Systems colleagues Len Chorosinski, consulting engineer, and Senior Manager Dennis Fortner, is developing a family of coatings that will protect air and space vehicles against both biological and natural contaminants.

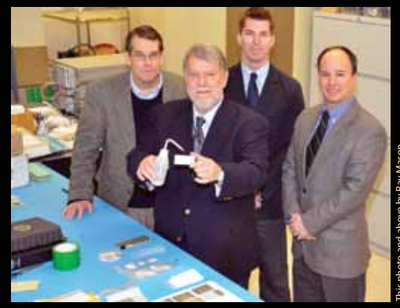
"The constant exposure to harsh elements and conditions in space has left our space crews and equipment extremely vulnerable," Pirich said. "To reverse this, our team is developing a transparent coating that will allow any contaminant to hit it and just roll off."

The advanced coating technology, which has been in development for the past five years, is highly elastic, can mitigate abrasive Martian and lunar dust, neutralize contaminants that attach to structural surfaces, de-ice and withstand extreme temperatures that range from at least 100 degrees below zero Celsius to 100 degrees Celsius. It is also highly resistant to radiation, as proven by Pirich and his team when they conducted experiments at the Berkeley Lawrence National Laboratory in Berkeley, Calif., and at the University of California at Davis. In tests that simulated what would happen if vehicle surfaces were consistently attacked by high densities of protons and gamma rays during an eight-year period in space, the coatings emerged with their self-cleaning and self-decontaminating qualities in check.

"This kind of durability is critical to ensure the safety of our astronauts and the functionality of the equipment they depend on," Pirich said.

Aerospace Systems is under contract with NASA and is partnering with major coatings companies. The team is currently working with our sector's Intellectual Properties team on the West Coast to investigate a spinoff of commercial applications of the new technology.

The advanced coating on the article surface protects it from becoming wet when water is poured on it. Here, water is seen dripping off the article.



This photo and above by Ray Mason

From l-r, John Weir, associate technical fellow, Dr. Ron Pirich, technical fellow, and engineers Dennis Leyble and Steven Chu demonstrate the ability of their advanced coating technology to prevent contaminants from adhering to structural surfaces. Team members not pictured: Len Chorosinski, consulting engineer, and Senior Manager Dennis Fortner.

Photo by Richard Fiedler

Electronic Systems team members (l-r) Dennis Fortner, senior manager, and Len Chorosinski, consulting engineer.

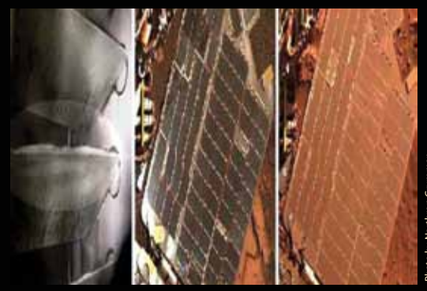


Photo by Northrop Grumman

Contaminants include icing on aircraft (far left) and dust; an array of solar cells prior to effects of dust contamination (center) and an array after being affected by dust contamination (far right).

GREEN Ideas in Motion

Cross-functional Collaboration Credited for Securing Funding

EDWARD LEVY

Going green has just been put into overdrive at Aerospace Systems following the addition of 13 new hybrid and low-emission vehicles for use at several of its Southern California facilities. The purchase not only supports the company's goal of reducing greenhouse gas (GHG) emissions 25 percent by 2014 (normalized by sales) but provides another example of the sector's ongoing efforts to invest in more environmentally friendly technology.

"With this initial purchase and our desire to upgrade our fleet with hybrid, compressed natural gas and electric vehicles as opportunities arise, we've taken an incredible step forward to demonstrate our commitment to environmental stewardship," said Ron Babers, administrative generalist and greeNG team lead for Global Supply Chain. In addition to the purchase of 10 Ford Fusion hybrids and three Ford Escape hybrids, which will replace older, less eco-friendly models, several new electric forklifts also were added to the fleet.

By comparison, the Fusion hybrid averages 41 mpg while the Escape hybrid averages 32, replacing vehicles that averaged 14 and 15 mpg, respectively. Most notably, both are certified as Advanced Technology Partial Zero Emission Vehicles, receiving an environmental performance score of nine (10 being the cleanest and most efficient). Overall, the 13 new hybrid vehicles will reduce the fleet GHG emissions by more than 76 metric tonnes of carbon dioxide.

The Security organization took delivery of its 2011 Ford Fusion hybrids in late 2010, ushering in the sector's newest additions of cleaner-burning and more reliable vehicles.

Along with the recordable impact this purchase will have on the environment and the sector's bottom line, the value of promoting cleaner and more fuel-efficient vehicles served as the influence for San Diego's site security services contractor to purchase a new Ford Escape hybrid vehicle. "We applaud their efforts and hope we can continue to encourage similar participation from many of the companies we do business with," Babers added.

Although credit for securing the funding goes to the Global Supply Chain Transport organization, Logistics, Security, Transportation and members of greeNG played a significant role in helping prepare the ambitious plan that will eventually replace all of the sector's vehicles with cleaner-burning alternatives. The collaboration between these cross-functional organizations is being viewed as a testament to the company's overall success in soliciting support for its goal to reduce its carbon footprint.

"This represents the type of cultural shift beginning to take hold across the disciplines," said Jonathan Rawitz, budget manager, Global Supply Chain. "While bottom-line performance and top-line growth will continue to be our focus, we're proving that you can incorporate affordable, eco-friendly alternatives into your decision-making."

Funding also was made available to complete work on retrofitting the emissions on diesel tractors that will exceed California Air Resources Board requirements through 2015, and on large-spark ignited propane-fueled forklifts. The retrofits not only add a cleaner-burning energy source but also require less maintenance and provide improved performance.

Northrop Grumman established its five-year goal in 2010 to reduce GHG emissions by 25 percent (normalized by sales). The GHG goal was defined through benchmarks of other companies in the aerospace industry and a rigorous and detailed assessment of the company's operations.

SECTOR SHOWS IT KNOWS THE THREE R's

SUSAN WETZEL

Reduce. Reuse. Recycle.

Aerospace Systems takes these three words seriously. With a longstanding reputation as environmental stewards, sector employees work hard to preserve our environment. This year, Aerospace Systems announced two new environmental goals — reduce solid waste and reduce water consumption — demonstrating a commitment to sustaining our natural world.

Solid waste management programs exist sectorwide. The St. Augustine Manufacturing Center (SAMC) in Florida has employed a comprehensive strategy for years and always strives to expand it. "Everyone is interested in sustaining the planet, and recycling items that would otherwise fill up a landfill is one way of doing that," said Rick Matthews, vice president, Production Operations, and SAMC site manager. "For us, it's a continuous improvement process."

Currently, SAMC recycles everything from antifreeze to bottles and cans, and the site is redoubling its efforts to recycle more. SAMC recently established a "Soles for Souls" program to recycle used shoes and is participating in the sectorwide recycling program that donates old greeting cards to St. Jude's Ranch for Children, where they are made into new cards.

The El Segundo, Calif., facility recycles more than 800,000 pounds of metal and 100,000 pounds of cardboard annually, which led to its winning the Waste Reduction Award Program statewide recognition for 13 consecutive years.

Water conservation, another new environmental goal at Aerospace Systems, is already being implemented at facilities across the sector. SAMC established a water-recycling program in 2010 that has saved 270,000 gallons. Using a treatment system at its on-site water conservation plant, contaminated groundwater (polluted by a previous site owner) is pumped and treated to better-than-drinking-water levels. From there, it's delivered to a facility to wash aircraft prior to their being painted or delivered to the customer.

"Normally, this water would be released into the public wastewater system without a beneficial use, and we would use potable water from the public's supply to wash aircraft," said Rick Doria, manager, Facilities and Environmental Safety, Health and Medical, Battle Management and Engagement Systems. According to Doria, the new system yields a savings of approximately $2,500 annually.

Several sites have started conserving water by changing their landscaping. They've replaced existing plants and shrubs with those requiring less irrigation. When SAMC implemented this strategy recently, employees found that the new "Florida-friendly" bushes were also more pest-resistant. The result was a savings of 230,000 gallons of water annually, in addition to a reduction in pesticide and fertilizer costs.

Other sector water-conservation strategies include upgrading bathroom and kitchen fixtures at Space Park (Redondo Beach, Calif.), El Segundo and Palmdale, Calif., to include low-flow faucet aerators and toilets, as well as the Space Park Facilities pilot test of a zero blow down (ZBD) system. Installed last December, the system eliminates water drained (blow down) from two of the site's cooling towers — water that's usually dumped into the public wastewater system at an additional charge. The ZBD system could realize a 20 to 40 percent reduction in water usage and a reduction in the amount of chemicals used to treat the water.

Ron Holliday, director of Environmental, Safety, Health and Medical, is proud that Aerospace Systems is a responsible partner in the community. "We've made a lot of progress in our greeNG efforts at both the local and sector level, and that is due to the combined efforts of all of our team members," he said. "Together, our efforts are making a tremendous contribution to our environment."

Photo by Jack Anderson

Members of the St. Augustine Green Team with the various recycling containers used at the facility (l-r): Scott Graf, Raina Smithley, Russ Carter, Bob Johnson, Brian Clanton and Mark Fontana.

Photo by Christina Kull

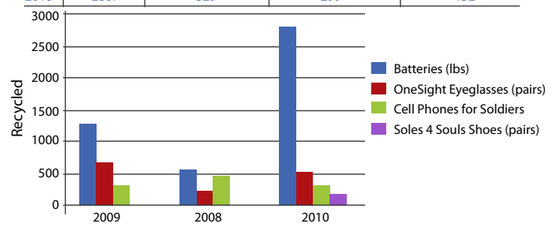
Newly upgraded restrooms in the El Segundo Continental Building include features that save water and energy as well as reduce solid waste. The sink (above) features a faucet with a low-flow aerator to conserve water and an automatic soap dispenser to reduce waste.

Recycling Every Day Keeps the Trash Away

CHRISTINA KULL

Since 2008, sites with greeNG teams across the sector have joined together to participate in a common recycling program for the month of April. The three common elements are batteries, cell phones for soldiers (www.cellphonesforsoldiers.com) and glasses for the OneSight Program (http://www.lenscrafters.com/eyeglasses/7/about/onesight-charitable-giving). In 2010, the St. Augustine, Fla., and Bethpage, N.Y., sites added Soles 4 Souls (http://www.soles4souls.org), a shoe-collection program for Third World countries. Among the then seven greeNG teams in 2010, more than 2,800 pounds of batteries, 299 cell phones, 529 pairs of glasses and 152 pairs of shoes were recycled by employees. The best news? Most of these sites will repeat the collection this month. Check out the Aerospace Systems greeNG wiki (http://wiki.northgrum.com/wiki/AS_greeNG) to see what your greeNG team is doing for Earth Day on April 22.

Year	Batteries (lbs)	OneSight Eye Glasses	Cell Phone for Soldiers	Soles 4 Souls Shoes
2009	1291	674	296	—
2008	551	205	457	—
2010	2807	529	299	152



Get 'Click-y' with the greeNG Wiki!

CHRISTINA KULL

Now joining the ranks of the greeNG website (http://greeNG.as.northgrum.com), there's a new green wiki in town. Check out the Aerospace Systems greeNG wiki at http://wiki.northgrum.com/wiki/AS_greeNG. You'll find information about the sector's sustainability goals (greenhouse gas, water and waste reduction), surplus office supply programs, sites with greeNG Employee Resource Groups, partnerships with environmental nonprofits and even environmental awards won by Northrop Grumman. You can update and add green items that you find at your own site. So go ahead, take a moment to browse the greeNG wiki page, and even document your own favorite "green things" about the sector.

students receive awards for environmental innovation

SUSAN WETZEL

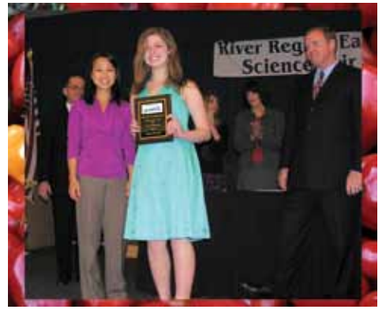
In its ongoing commitment to local communities, education and the environment, Battle Management and Engagement Systems (BMES) awarded two high school students from St. Johns County, Fla. (home to Aerospace Systems' St. Augustine Manufacturing Center), with greeNG awards in recognition of their environmentally innovative projects in the River Region East Science Fair.

Both Hannah Schaffer, representing Liberty Pines Academy, and Maya Goldman, representing Ponte Vedra High School, were selected from a pool of 124 sixth- to 12th-grade students to receive the award at the two-day event, which took place Wednesday and Thursday, Feb. 2-3. Raina Smithley, engineer, Environment, Safety, Health and Medical (ESHM), presented the awards that recognized the students' projects for their focus on local environmental concerns.

The BMES greeNG award, which included a plaque and small cash prize, was developed to encourage green awareness in our local schools and communities. ESHM worked with the school district to develop the award criteria, and school officials selected the individual award recipients — one each from the middle and high school levels.

Hannah's project — focusing on the effect of aeroponics compared with hydroponics in the growth of capsicum chinense chili peppers — and Maya's project — which described a self-sufficient, sustainable irrigation system — were selected from a total of 110 projects submitted to the event.

With this first-time presentation of its greeNG award, BMES hopes to extend award opportunities to schools near the Bethpage, N.Y., and Melbourne, Fla., facilities in the future.



Pictured (l-r) are Raina Smithley, engineer, Environment, Safety, Health and Medical, junior division winner Hannah Schaffer of Liberty Pines Academy and St. Johns County Superintendent of Schools Dr. Joseph Joyner.

Photos courtesy of Jack Anderson

Shown here (l-r) are Raina Smithley, engineer, Environment, Safety, Health and Medical, senior division winner Maya Goldman of Ponte Vedra High School and St. Johns County Superintendent of Schools Dr. Joseph Joyner.

Rain or shine, the St. Augustine Manufacturing Center's golf cart pilot program keeps employees on the move — no matter the weather. The program, which converts existing carts to 100 percent solar-powered, has been a fantastic success story for promoting the use of environmentally friendly energy sources.

Photo by Jack Anderson

EDWARD LEVY

If there's one thing you can count on in St. Augustine, Fla., it's plenty of sun. In fact, this part of the country can boast more than 220 days of sunshine annually.

Looking to take advantage of this region's most renewable resource, St. Augustine Manufacturing Center (SAMC) Site Manager and Vice President Rick Matthews and a team of representatives from the Facilities and greeNG organizations helped lay the foundation for the sector's first solar-powered golf cart pilot program.

"As the sector continues to promote the use of a more sustainable means of energy, it's become incumbent on all of us to consider creative and innovative ways to accomplish this goal," Matthews said. "Throughout the Southeast, converting solar energy into electricity is an extremely popular alternative that not only provides a cleaner energy source but also a significant cost savings over time."

The program's initial plan called for retrofitting two of the site's existing electric carts and converting them to 100 percent solar powered. Switching to the much cleaner and environmentally friendly solar energy was a relatively simple and easy installation. After reconfiguring the wiring system, the next step was the installation of a powerful 205-watt photovoltaic panel that sits atop the cart's roof, producing electricity directly from sunlight — working on sunny and cloudy days.

At a cost of about $3,000 per panel, this option is significantly cheaper than purchasing a brand-new solar-powered cart, which can cost $9,000 or more. The result has been a 70 percent savings in energy compared to regular golf carts and a complete reduction in carbon dioxide emissions, which directly supports the sector's initiative to reduce its greenhouse gas emissions. The program's short-term goal calls for the SAMC to retrofit all the carts in its operations.

"Because the carts continue to charge while driving, they are not just more efficient than their battery-powered counterpart but more cost-effective and always ready to go," Matthews added.

Thanks to Matthews and his team, converting energy from this planet's most plentiful and environmentally benign sources has become just one of the many bright ideas to rise in the East.

Photo by Christina Kull

CAUGHT GREEN HANDED

CHRISTINA KULL

Joseph L. Behen, who has 29 years of experience as an environmental engineer in El Segundo, Calif., is the force behind that site's 13 consecutive years of Waste Reduction Awards Program recognitions. These awards from CalRecycle recognize organizations that "… prevent waste through sustainable business practices that reduce greenhouse gas emissions, protect the environment and preserve valuable resources." This includes reusing materials, recycling, environmentally friendly purchases and educating employees. Behen's favorite "green" activity is waste reduction and material recycling. "Working with the greeNG team, you can't help but share the members' enthusiasm and energy for green systems. With top management participation, Northrop Grumman energy conservation and recycling programs will lead the industry," he said. Behen's green tip to other employees is to keep in mind, "With effort and participation, great things can happen."

Nominate your green employee for recognition at http://greeNG.as.northgrum.com.

Joseph Behen has been the force behind 13 consecutive years of recycling awards at the El Segundo, Calif., and other local sites.

CLAYTON KAU

Receives Engineers' Council Award

Photo by Northrop Grumman

Clayton Kau, honored with the Jack Northrop Spirit of Innovation Award by the Engineers' Council, San Fernando Valley, Calif.

'Spirit of Innovation' Honor Recognizes Achievements during 34-Year Career

Check out next month's issue of *Aerospace Now* for a wrap-up of activities that took place during National Engineers Week at Aerospace Systems sites across the country.

BOB BISHOP

Clayton Kau, who led programs and engineering initiatives critical to anti-jam military satellite communications during his 34-year career with TRW and Northrop Grumman, received the Jack Northrop Spirit of Innovation Award from the Engineers' Council Feb. 26 as part of the group's observance of National Engineers Week.

Kau received the honor that commemorates the vision, perseverance and engineering prowess reminiscent of Jack Northrop, whose achievements and techniques broke the barriers of traditional aircraft design. Council members presented the award to Kau for his lifetime role as a leading defense industry engineer. The council is a regional organization based in the San Fernando Valley, Los Angeles.

"As a leading defense industry engineer, Clayton successfully tackled many of the tough problems of national importance," said Gabe Watson, vice president, Aerospace Engineering, Space Systems Division, who nominated Kau for the award. "The solutions he spearheaded led to better understanding of how things work and to finding new and better ways to get things done. The programs he worked on made a difference, including saving lives and advancing understanding of the world we live in or could live on in the future, or the past history of the universe."

Kau retired in 2010. His leadership positions included the Advanced Extremely High Frequency military satellite communications payload (vice president and program manager) and its predecessor, Milstar medium data rate payloads (program manager); the Very High Speed Integrated Circuit program (assistant program manager for systems engineering); the Digital Development Laboratory (manager); and Communications Systems Engineering (department manager).

He was named Asian-American Engineer of the Year in 2007, and at TRW received the CEO Leadership Award and the Chairman's Award for Innovation.

Almond, Teams Honored

Also honored by the Engineers' Council Feb. 26 was Aerospace Systems' Jonathon Almond, a lead engineer. Almond received an Engineering Merit Award for "meeting the challenges of the highly technical and complicated guidance, navigation and control (GNC) concepts of unmanned rotor aircraft systems. He is receiving this award in recognition for outstanding contribution in the area of GNC to the Fire Scout system."

In addition, 15 Northrop Grumman-led teams were honored with Distinguished Project awards for exemplary work:

- Global Hawk Block 10 service life assessment
- Global Hawk air vehicle modifications for communications payload
- Global Hawk sloped runway flight
- Tier One material inspection system
- Euro Hawk unmanned air vehicle first flight
- Aerodynamic efficiency improvement — Swept Wing Laminar Flow Control TRL=6 Flight Test
- Broad Area Maritime Surveillance ice protection system
- B-2 Extremely High Frequency Increment 1 successful first flight of new high-speed fiber optic network
- Fire Scout universal control station United Arab Emirates demonstration support
- RQ-4B Global Hawk Block 30/30+ airworthiness stress report
- Global Hawk communication payload integration and flight test
- LR-240 Inertial Based Northfinder
- H-1 weapons systems support activity
- F-22 GPS/inertial navigation system flight safety software
- Wiki browser and interface to enhance the efficiency of reliability engineering

Northrop Grumman Highlights ISR Capabilities at Aero India 2011

KIRSTI DUNN

As an industry leader in intelligence, surveillance and reconnaissance capabilities, Northrop Grumman is well positioned to provide near- and long-term solutions to effectively meet the new, challenging threat environment facing the United States and our allies. Advanced Systems programs showcased in Northrop Grumman's exhibit at Aero India 2011, held in Bangalore in early February, included the E-2D Advanced Hawkeye, Broad Area Maritime Surveillance Unmanned Aircraft System, Long Endurance Multi-Intelligence Vehicle and MQ-8B Fire Scout vertical unmanned aircraft system multi-role unmanned aerial vehicle.

Venues such as Aero India provide an opportunity for Northrop Grumman to demonstrate its key capabilities, strengthen relationships with current customers and build relationships with potential customers. Northrop Grumman has a strong relationship with India that dates back more than 25 years and is built on a legacy of trust and performance. India represents one of the largest potential growth markets for defense products in Asia, and Aerospace Systems is committed to continue providing India with the most advanced technology and capabilities to ensure the protection of India's national security.

Photo by Anne Adams

Northrop Grumman's exhibit at Aero India 2011 provided the opportunity to discuss Aerospace Systems' leading intelligence, surveillance and reconnaissance platforms with U.S. and Indian Navy representatives. Pictured at far left is Rear Adm. Joseph W. Rixey, director, Navy International Programs Office, U.S. Navy, who met with Indian naval officials.

Corporate Responsibility Report Available to All Employees

BRIAN SCHOENING

In mid-May, Northrop Grumman will release its 2010 Corporate Responsibility (CR) report, a description of the last year's activities surrounding ethics, diversity, the environment and community involvement. The CR report has become an important supplement to the company's annual report. While the annual report is focused on providing financial performance information for shareholders, the CR report is the key mechanism through which a company reports its non-financial, corporate responsibility performance to its stakeholders (those whom its activities impact: the community, employees, investors, suppliers, etc.).

"Here at Northrop Grumman, we are reminded daily of our commitments to maintaining the highest ethical standards, embracing diversity and being an outstanding corporate citizen, all of which are key components of our corporate responsibility program," said Roberta Currier, director, Sector Staff, Ethics and Community/Employee Services. "Each employee has the ability to shape and promote corporate responsibility through participation in Aerospace Systems' organizations and sponsored programs such as the High School Involvement Partnership (HIP) program, Employees Charity Organization, greeNG Employee Resource Groups and many others."

Northrop Grumman's 2009 report describes four primary areas of responsibility:

1) Responsible partner — stakeholders
   Corporate governance, ethics and supply chain responsibility
2) Responsible employer — people
   Employee work practices, commitment to diversity and maintaining a safe workplace
3) Responsible steward — environment
   greeNG, sustainability and compliance with environmental regulations
4) Responsible leader — society
   Community investment and military and veterans' support programs

External stakeholders look to the CR report to learn about and validate Northrop Grumman's progression toward sustainability. The environmental stewardship section details our greeNG program and the progress made as the company works to meet our greenhouse gas reduction goals. It also describes specific initiatives that are helping to reduce electricity consumption, control hazardous waste, minimize solid waste and conserve water. The description of Aerospace Systems' technologies and our contributions to global climate-monitoring platforms is a unique success story for the company. This component will continue to expand and showcase the growth of the greeNG programs, our sustainability accomplishments and the additional steps we need to take to reduce our environmental impact.

Take an opportunity to familiarize yourself with the CR report, and see how our employees' activities and contributions fit into our corporate responsibility program. Discover the many successes of the first few years of the greeNG program and learn more about the program's future direction. You may surprise yourself and find a new opportunity in 2011 to get involved.

The Corporate Responsibility programs, as well as all CR reports, can be found on the Northrop Grumman Office for Corporate Responsibility website at http://home.northgrum.com/corporateresponsibility/index.html

CENTENNIAL OF NAVAL AVIATION For more than a century, Northrop Grumman has had the distinct honor of designing, building, and maintaining many of the ships – and for more than 80 years the aircraft and technologies – that support the vital missions of the United States Navy, Marine Corps, and Coast Guard in protecting Americans at home and abroad. As the longest-running provider of aircraft and ships to our naval aviators, we take great pride in honoring the past, celebrating the present and advancing the future for the next 100 years. Congratulations!