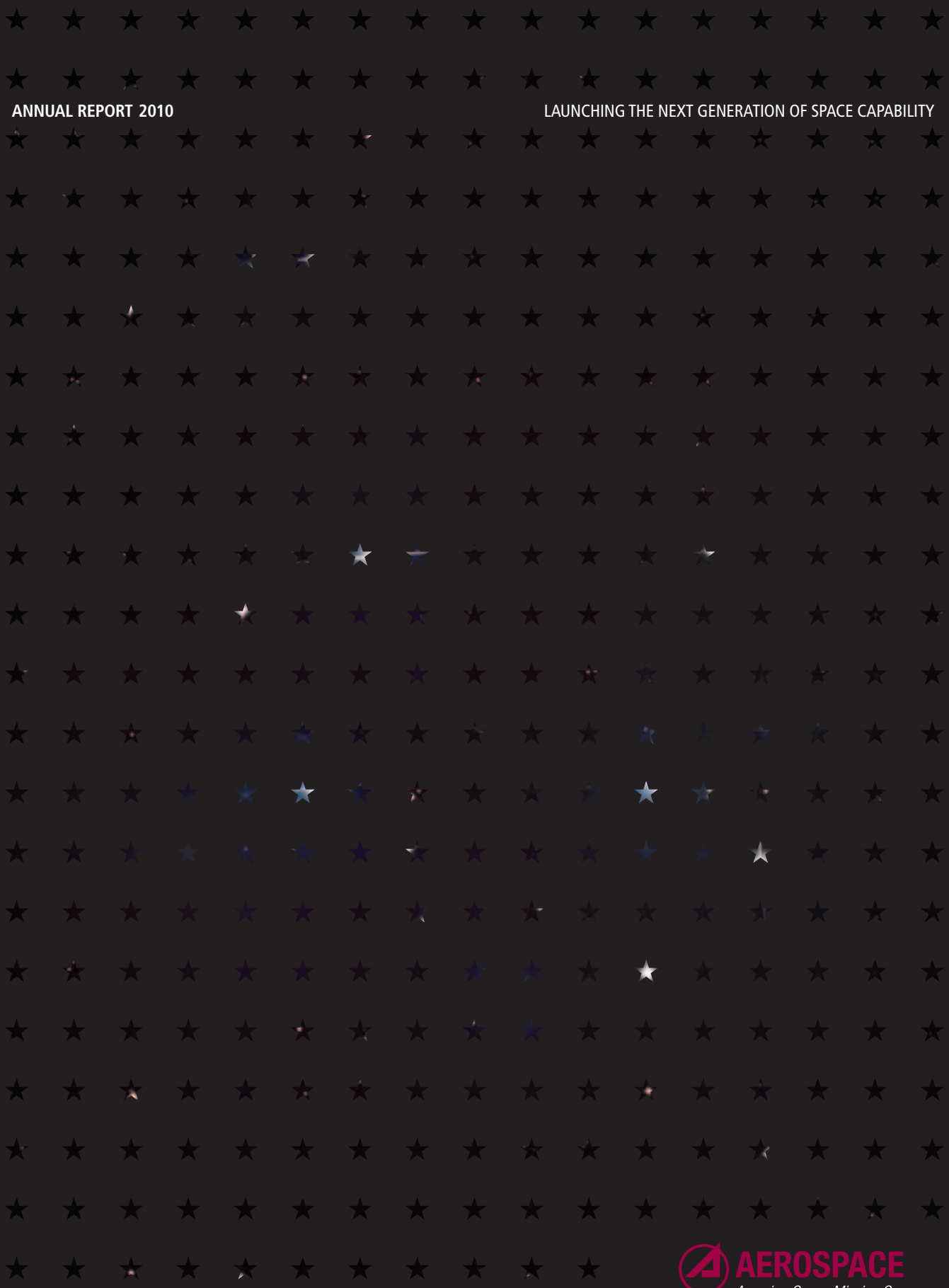

ANNUAL REPORT 2010

LAUNCHING THE NEXT GENERATION OF SPACE CAPABILITY

AEROSPACE

Assuring Space Mission Success

ANNUAL REPORT 2010

LAUNCHING THE NEXT GENERATION OF SPACE CAPABILITY

AEROSPACE

Assuring Space Mission Success

El Segundo, California • Albuquerque, New Mexico • Denver, Colorado (area) • Cape Canaveral Air Force Station, Florida • Chantilly, Virginia • Colorado Springs, Colorado • Columbia, Maryland • Falls Church, Virginia • Houston, Texas • Huntsville, Alabama • Kirtland Air Force Base, New Mexico • Offutt Air Force Base, Nebraska • Onizuka Air Force Station, California • Pasadena, California • Patrick Air Force Base, Florida • Peterson Air Force Base, Colorado • Rosslyn, Virginia • San Antonio, Texas • San Diego, California • Schriever Air Force Base, Colorado • Vandenberg Air Force Base, California • Washington, D.C. (area) • Wright-Patterson Air Force Base, Ohio

Every day, 3,926 people in 23 locations demonstrate the technical leadership to promote the spirit of innovation and assure 100-percent mission success for the next generation of space capabilities.

Dedication to mission success, technical excellence, commitment to our people, objectivity, integrity;

this is The Aerospace Corporation.

2. **Corporate Profile** • The Aerospace Corporation is a private, nonprofit corporation that has operated a federally funded research and development center (FFRDC)* for the United States Air Force since 1960, providing objective technical analyses and assessments for space programs that serve the national interest • As the FFRDC for national security space, Aerospace supports long-term planning as well as the immediate needs of the nation's military and intelligence space programs • Aerospace's involvement in concept, design, acquisition, development, deployment, and operations reduces costs and risks, and increases the probability of mission success.

* FFRDCs are unique nonprofit entities sponsored and funded by the government to meet specific long-term needs that cannot be met by any single government organization • FFRDCs typically assist government agencies with scientific research and analysis, systems development, and systems acquisition • They bring together the expertise and outlook of government, industry, and academia to solve complex technical problems • FFRDCs operate as strategic partners with their sponsoring government agencies to ensure the highest levels of objectivity and technical excellence.

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Letter

Letter from the President – Chief Executive Officer and the Chairman of the Board

Launching the Next Generation of Space Capability

As we look to the corporation's future work in support of the nation's vital military space assets, we need to keep in mind that, above all, The Aerospace Corporation must always remain forward-looking and continue to emphasize our dedication to mission success.

On June 4, 2010, The Aerospace Corporation reached its 50th anniversary. The company's many achievements over the past five decades were noted at events held at all of our locations across the country. During the course of our commemorations, we recognized the corporation's past innovations and successes and touted the contributions of our stellar workforce in helping to ensure the progress and stability of our national security space endeavors.

It was also a good time to focus on who we are as a company and where we are planning to go in the future. The Aerospace Corporation has always been forward-looking as a result of the very nature of our work. Even as we celebrated our past, our efforts and emphases in FY 2010 have been concentrated on making certain that The Aerospace Corporation is just as relevant 50 years from now as it is today. With that goal in mind, the theme of this Annual Report is "Launching the Next Generation of Space Capability." This theme is consistent with our efforts to set the pace for the next 50 years, and coincides with what has been a remarkable year of launch successes in delivering new space capability with several first-of-a-kind satellites.

During FY10, some of our ongoing program work that considerably enhanced our national security space capability included:

- The Global Positioning System (GPS)-IIF satellite, launched in May 2010, will enable new capabilities to civilian and military users. The GPS IIF will also provide a more robust signal.
- The Advanced Extremely High Frequency (AEHF) system will eventually replace the Milstar constellation. Milstar provides secure communications to the military and national authorities; AEHF will substantially improve services available to them.
- Each Wideband Global SATCOM (WGS) spacecraft will provide more than twice the military communications capacity as the entire primary constellation of Defense Satellite Communications System (DSCS) spacecraft it is replacing. The constellation of six WGS satellites will provide more than 12 times the military communications capacity of the DSCS constellation.
- The Space Based Infrared System (SBIRS) will replace the Defense Support Program (DSP) system that has been in place since 1960, and provide significantly improved missile-warning capabilities.

- The Space Based Space Surveillance (SBSS) system will provide a new capability to monitor what is going on in space to help avoid spacecraft collisions and provide better situational awareness for the military.
- New GPS and AEHF program ground systems were transitioned and certified.

In the future, Aerospace will be focused on our customers' hard problems through our efforts in support of national security space. Decades from now, there will still be a need for independent analyses when dealing with complex systems.

These improved systems will significantly enhance space system operations that have been in place for decades and will be the ones that the United States uses through the next 20 years.

In the future, Aerospace will be focused on our customers' hard problems through our efforts in support of national security space. We will continue to provide a laser focus on each launch, one at a time. Decades from now, there will still be a need for our independent analyses when dealing with complex systems. There will also be a need for our efforts to ensure that our space systems and their related ground components operate effectively and securely in a cyber threat environment. This means that in the future a need will remain for the expertise provided by systems engineers, who will be able to innovate and integrate their knowledge into new capabilities. Our customers will continue to need the assistance of someone who can, from an objective viewpoint, ask if everything has been considered when attempting to solve problems.

Our work in civil and commercial operations during FY10 included continued support to the Review of U.S. Human Space Flight Plans Committee. We answered questions submitted by the House Science and Technology Committee's Space and Aeronautics Subcommittee regarding technical, cost, schedule, and affordability analyses that were conducted by Aerospace. We also continued our efforts in support of other NASA and NOAA programs, as well as commercial, international, and homeland security programs critical to national security. Aerospace contributions to civil and commercial programs will be of enormous benefit as we look toward our corporate future, as the industrial base is globalized, and as we continually work to make our operations more efficient.

In addition, environmental awareness will play a larger role in everyone's future, both inside and outside the corporation. We will need to be more mindful of the fuels and chemicals used by the aerospace industry. There must also be a major focus on the cleanup of space so that our critical space assets will not be hindered by collisions with space debris. The corporation's past and current work with environmentally oriented programs, such as the launch of NOAA's Geostationary Operational Environmental Satellite (GOES)-15, places Aerospace in an excellent position to make contributions to this growing endeavor as awareness and concern for our terrestrial environment expands to the space environment.

Our work during the past year has been challenging and productive, for both Aerospace and the entire national security space community. As we look to the corporation's future work in support of the nation's vital military space assets, we need to keep in mind that, above all, The Aerospace Corporation must always remain forward-looking and continue to emphasize our dedication to mission success.

Dr. Wanda Austin
President – Chief Executive Officer

Peter Teets
Chairman of the Board

6. Corporate Values

Dedication to Mission Success

COMMITTED TO ASSURING 100-PERCENT SPACE MISSION SUCCESS. THIS IS OUR PROMISE

Space enterprise is embedded in the fabric of our nation's economy and our national security. The failure of a launch vehicle or satellite jeopardizes our ability, as a nation, to leverage the advantages that space offers in an age when it has become the medium for providing essential and reliable global resources. The Aerospace Corporation's No. 1 role is assuring space mission success.

Operations Support Group (OSG) • Finance
Jacqueline Dorsey, Payroll Accountant

Technical Excellence

AS THE TECHNICAL CONSCIENCE OF NATIONAL SECURITY SPACE, AEROSPACE TACKLES THE TOUGH QUESTIONS AND DELIVERS THE TOUGH ANSWERS

The Aerospace Corporation is the principal engineering arm of the Space and Missile Systems Center and the National Reconnaissance Office for space, launch, and related ground systems. In addition to providing systems engineering and analysis, Aerospace supports customers in meeting quality, cost, and schedule. Aerospace is a recognized leader of innovative solutions to the most difficult problems in the national security space community. In this arena, Aerospace is focused on architecting; engineering, specifically capabilities engineering; large-scale ground systems; netcentricity; and innovative constellation architectures.

Commitment to Our People

A RARE COLLECTION OF THE SMARTEST PEOPLE IN THE FIELD, FULLY EMPOWERED TO DO THEIR BEST THINKING AND WORK

The people of The Aerospace Corporation make the difference in assuring 100-percent mission success for our customers. Our goal is to attract, retain, and develop the highest-quality workforce for the company and then organize it in ways that allow flexible response to customer needs. In addition to investing in first-class engineering tools and facilities to support the mission of our customers, we also provide corporate knowledge management and communication tools that support the work of an increasingly mobile, geographically distributed workforce.

OSG • Institute Operations Center
Robert Ho, Decision Support Analyst

Objectivity

A TRULY INDEPENDENT AND UNBIASED NONPROFIT ORGANIZATION, WITH NO COMPETING AGENDAS OR INCENTIVES

Aerospace was established to create a framework for a trusted-agent relationship on which the government could rely to be independent, objective, and free from conflicting interests and priorities. For 50 years, Aerospace has served as a valued national asset with insights into every national security space program launched over the course of those years. As a result, the Aerospace team offers a unique combination of innovation and institutional knowledge. With every assignment, Aerospace is committed not only to finding the truth, but also to working to eliminate any differences between perceived reality and the truth.

Integrity

ALWAYS DELIVERING THE TECHNICAL TRUTH, NO MATTER WHAT

In five decades as the federally funded research and development center for national security space, objectivity and integrity have been the prime deliverables of Aerospace. As such, the corporation is committed to the highest ethical standards in all of our dealings with customers, suppliers, contractors, and employees. In 2010, Ethisphere, a think-tank dedicated to the research and promotion of profitable best practices in global governance, business ethics, compliance, and corporate responsibility, declared Aerospace to be one of the "World's Most Ethical Companies" for the fourth consecutive year.

OSG • Procurement
Paul Murphy, Senior Administrator

8.

Our Future in Space Capability

We are preparing for change.

Space is a dynamic and complex arena that requires of us the ability to anticipate future needs, transition existing technologies, and develop new capabilities to ensure the nation's security and retain our leadership in space. In the wake of several recent first-of-a-kind launches, Aerospace is poised to transition its workforce and processes from supporting first-of-a-kind developments to leveraging mission assurance to support production of more efficient and affordable systems. Our future operations must maintain our current high levels of efficiency and cost-effectiveness, even as our innovation and productivity levels increase.

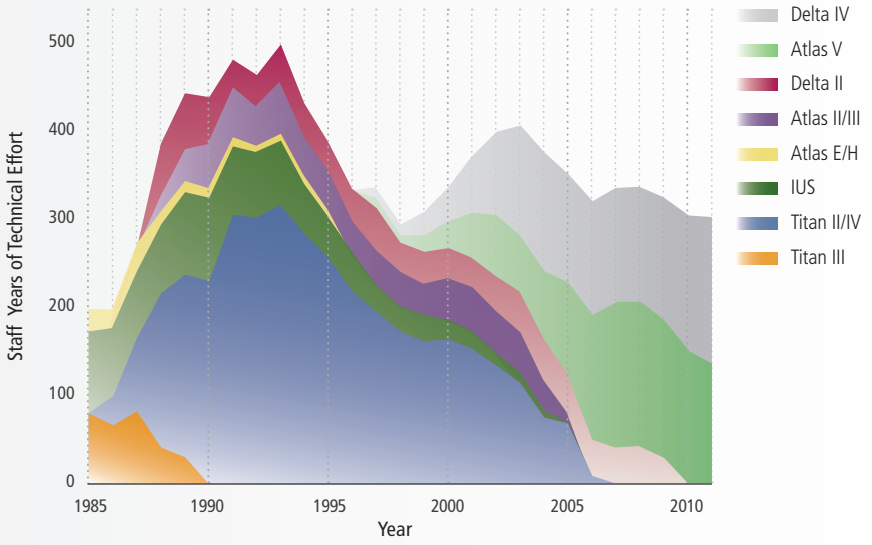
LOOKING AHEAD Aerospace is preparing for the future by continually improving our processes; developing new technologies; and growing a highly skilled, efficient, and effective workforce. The future promises to challenge our customers in unprecedented ways, and The Aerospace Corporation will be there to develop successful solutions to those challenges.

FROM THE BEGINNING Aerospace has earned its reputation for technical excellence and expertise in accurately assessing future national security space needs and systems. This has long enabled the corporation to achieve its goals both effectively and efficiently, and this skill will be even more critical to the future of Aerospace.

We are committed to assuring that every launch is successful and on-orbit performance is stellar.

Aerospace continues its longstanding focus on mission assurance by striving to ensure that every military space launch is an unqualified success. The corporation has the necessary launch-related skills, from technical assessment to mission assurance verification, to provide the necessary support to our national security space customers' increasingly complex planning and operational needs. With assistance from Aerospace, our customers have achieved an unprecedented record of launch successes, including delivery of several recent first-of-a-kind space capabilities. In order to maintain these levels of success, the company works to improve the effectiveness of mission assurance practices across both government and industry, and assists in the creation of an environment that will enable our customers to achieve 100-percent mission success.

AEROSPACE TECHNICAL SUPPORT FOR LAUNCH OVER TIME Ensuring success of first-of-a-kind launch vehicles requires more and different kinds of technical support than launch vehicles that have already transitioned into production.

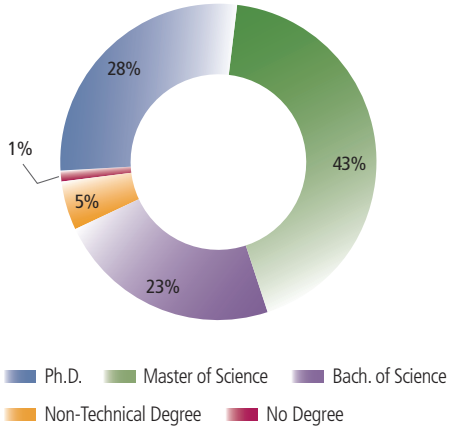


We are dedicated to maintaining and improving our world-class workforce.

The Aerospace Corporation has a well-established history of hiring many of the nation's best scientists and engineers. As the aerospace industry evolves and international industry contacts increase during the next few decades, the company must be able to attract, develop, and retain a world-class technical workforce.

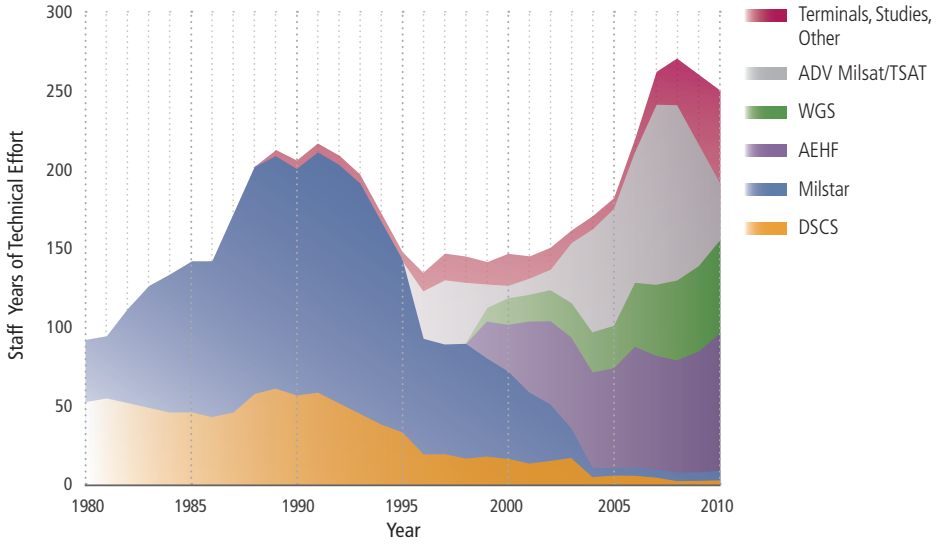
THE NEXT GENERATION In addition to current employee hiring efforts, Aerospace is involved with mentoring and educating the next generation of scientists and engineers. The decades-long decline in student enrollment in scientific, engineering, mathematics, and technical fields endangers the future of both the corporation's and the entire national security space community's workforces by placing potentially drastic limitations on the availability of technical talent.

AEROSPACE TECHNICAL STAFF Well-educated and experienced, our experts are empowered to do their best thinking and work to asssure space mission success.



Aerospace is committed to reducing this potential shortfall of skills in the nation's space industrial base by conducting a variety of educational outreach and mentoring programs in cooperation with our partners in the fields of education, industry, and government.

AEROSPACE TECHNICAL SUPPORT TO MILITARY SATELLITE CAPABILITY As the support to this single critical capability (shown notionally below) has grown more complex, the amount of Aerospace technical support has remained stable, providing an example of how Aerospace technical leadership is both effective and efficient.



We are improving the value of our services.

PRIMARY CHANGES One of the primary changes that must take place in the very near future is already well known:

The Aerospace Corporation, as well as every other member of the national security space community, must work to ensure that productivity increases, while simultaneously utilizing the same level of resources.

This adaptation to producing more and improving customer support without increasing budgets and workforces is imperative to the future of the aerospace industry. Time and again, Aerospace has proven its value and has demonstrated leadership in this regard.

Aerospace has a well-deserved reputation for delivering assessments, advice, and innovative technical solutions to its customers, while at the same time controlling costs. All of these strengths are reflective of our commitment to ensuring mission success, now and in the future.

Space Systems Group

Space Systems Group (SSG) assists the Air Force Space and Missile Systems Center (SMC) in the conception, design, acquisition, launch, and operations of satellite, launch vehicle, ground control, and range systems • SMC utilizes Aerospace's extensive expertise in all of these areas as it pursues the goal of acquisition and mission success • Aerospace SSG provides the critical skills and processes to achieve mission success and effectiveness for the end-users through our mission assurance focus, technical reviews, and systems engineering processes as the SMC systems are architected, acquired, and fielded • SSG is responsible for conducting independent launch readiness verification processes for SMC launches • Our launch verification product is the industry benchmark for launch assurance.

- The first Advanced Extremely High Frequency (AEHF)-1 satellite was successfully launched aboard an Atlas V rocket on Aug. 14, 2010.

Space Launch Operations

Space Launch Operations (SLO) is dedicated to achieving 100-percent mission success on all space launches of our Air Force and National Reconnaissance Office customers. SLO is responsible for conducting the Aerospace independent launch readiness verification process for legacy and evolved expendable launch vehicle (EELV) launches. Our launch verification product is the industry benchmark for launch assurance and provides the primary input to the government's mission assurance process. The results are captured in the launch readiness letter specified for each mission.

SLO also focuses on lessons-learned, data, and best-practices shared among launch programs. SLO has expanded its role by utilizing its launch mission assurance expertise and launch processing experience to support Missile Defense Agency and Minuteman III activities. In addition, SLO provided independent risk assessments to NASA on their EELV missions, and technical expertise to the Launch and Test Range and Air Force Satellite Control Network programs.

SSG • Space Program Operations
Dr. David J. Gorney, Senior Vice President

"In military space, we have only seen the first wave of integration between systems, such as multisource intelligence and surveillance, communication, navigation, and space situational awareness. The results of this integration provide highly leveraged and high-value products to the warfighter, such as more accurate and timely target location and persistent global situational awareness. Over time, we will undoubtedly see even more levels of integration between space, air, and terrestrial capabilities, in all mission areas."

• LAUNCH SYSTEMS DIVISION

LAUNCH SYSTEMS ENGINEERING Launch Systems Engineering provides technical support to launch programs to provide mission analyses, data processing, and systems effectiveness with an emphasis on identifying critical areas and achieving mission success. The Spacelift Telemetry Acquisition and Reporting System (STARS) is a networked, distributed processing system used to acquire, process, analyze, display, and archive launch vehicle telemetry and other data for vehicle checkout and launch activities. Systems Effectiveness monitors and assesses program parts, materials, and processes with the goal of increased product reliability through early identification and assessment of risk. Mission analyses performed include mission planning and trajectory design, flight range safety, flight operations, environmental/safety policy, performance analysis, guidance, navigation, and flight control. Significant areas of support during FY10 are highlighted below.

OPERATIONS PLAN FINALIZED FOR INTERNATIONAL SPACE STATION (ISS) NODAL SEPARATION NOTIFICATION
Following spacecraft separation, spent upper stages are left in disposal orbits that could have conjunctions (i.e., potential physical impact) with the International Space Station (ISS) before evasive maneuvers can be planned and executed. The Joint Space Operations Center (JSpOC) typically requires about 24 hours to acquire a reliable orbital track of a spent upper stage, and NASA typically requires a minimum of 30 to 33 hours after receiving a JSpOC conjunction warning to plan and execute an evasive maneuver. The result is that the ISS is vulnerable from the end of launch-collision-avoidance protection until approximately 56 hours later. Vulnerability is dependent on the final upper-stage disposal orbit, launch date, and launch time.

Aerospace has been performing a preflight orbit nodal separation analysis of the disposal orbit with the ISS for Air Force and National Reconnaissance Office missions based on lessons learned from Delta II missions that experienced close conjunctions with the ISS. As a result of the lessons learned, an operations plan for protecting the ISS on future launches has been developed. Greater communication has evolved between Aerospace, the Air Force,

IMAGE COURTESY OF NASA

IMAGE COURTESY OF NASA

- The International Space Station (ISS) in orbit. Aerospace is assisting with the development of an operations plan that will help shield the ISS from possible impacts with spent upper stages remaining in disposal orbits.

- NASA's Lunar Reconnaissance Orbiter (LRO) and Lunar Crater Observation and Sensing Satellite (LCROSS) were launched into space by an Atlas V from Kennedy Space Center on June 18, 2009.

JSpOC, United Launch Alliance, and NASA relative to ISS protection. A process is in place for initial analysis at L-6 weeks, with updated analysis presented at Aerospace Readiness and Aerospace President's reviews. A final update is provided at L-7 days with the latest ISS orbit and final preflight trajectory information. With this enhanced awareness of ISS vulnerability and the development of an improved concept of operations, a valuable contribution to space safety has been achieved.

STUDY PERFORMED FOR DUAL MISSION CAPABILITY The Mission Analysis unit evaluated Atlas V and Delta IV launch vehicle capability for dual Earth science/planetary payloads launched from the Eastern and Western ranges. The first payload is an Earth-observing science payload, and the second payload is for a planetary mission. This study evaluated the performance capability to deliver an Earth science payload followed by a second payload delivered into an escape orbit. Performance capability was examined for the Atlas V 401 and 411, and the Delta IV Medium and M+(4,2) configurations. Each launch system was found capable of performing the specified missions.

OPENING OF THE AEROSPACE OFFICE AT THE UNITED LAUNCH ALLIANCE (ULA) DECATUR, ALA., FACILITY In order to provide a greater insight into the launch vehicle integrity and the daily work that takes place on the Delta and Atlas launch vehicles, Aerospace has opened an office at the ULA facility in Decatur, Ala. This office reviews the daily status of the various hardware elements in production and test. With the introduction of the Atlas and Centaur final assembly from Denver, the ongoing integration of the booster fabrication from Denver, and the Centaur fabrication from San Diego, the entire fleet of ULA hardware is visible in every aspect of fabrication and integration. This office has expertise in machining, welding, testing, avionics, propulsion, hydraulics, insulation, ordnance, vehicle assembly, and systems integration.

ARES I-X TEST VEHICLE The sole test flight of the Ares I vehicle, named Ares I-X, was intended to test the ascent conditions and controllability of a vehicle with an aspect ratio and outer mold line (OML) identical to the actual Ares I vehicle design. The Ares I-X test vehicle utilized a four-segment solid rocket motor (SRM) from the shuttle program in place of the five-segment version that was to fly on Ares I. It had mass simulators for the entire upper portion of the vehicle forward of the SRM. The avionics boxes and flight software were provided by Lockheed Martin Astronautics, and are of Atlas V heritage. By preserving the Ares I vehicle's outer dimensions and mass, while using existing propulsion and avionics systems, NASA was able to perform a useful, relatively simple test that provided valuable engineering data early in the Constellation program. Aerospace performed several general systems engineering and integration (and independent verification and validation) functions in support of the Ares I-X flight test.

IMAGE COURTESY OF NASA

- The Ares 1-X was launched for a flight test from NASA's Kennedy Space Center on Oct. 28, 2009.

These analyses were performed by several of the engineering departments within Engineering and Technology Group's Vehicle Systems Division. The disciplines included fluid mechanics, thermal, loads/dynamics, structures, mechanical systems, flight software, guidance, navigation, controls, and vibroacoustics. Approximately 100 Aerospace engineers have supported the program, at an average rate of over 10 STE, since participation began in July 2007. Aerospace was involved throughout the flightreadiness review process and supported the launch at Kennedy Space Center in October of 2009. Aerospace postflight analyses have continued throughout FY10 and are scheduled to be concluded by Sept. 30, 2010. The mission was almost perfectly executed, with only minor anomalies relative to preflight predictions.

SUPPORT TO FEDERAL AVIATION ADMINISTRATION/OFFICE OF COMMERCIAL SPACE TRANSPORTATION (FAA/AST) Final reports for six tasks under this Task Order Contract were completed and transmitted to the FAA customer. Under one task, assessments were made of the impacts of space weather on reusable and expendable launch vehicles (RLVs, ELVs) operating at suborbital altitudes from launch sites located at low, middle, and high latitudes. In another instance, Aerospace was tasked with assessing risks to RLVs from triggered lightning at four regional spaceports. Additional tasks involved analyses of noise and sonic boom models that may be applicable to the computation of environmental impacts for the commercial space industry, and analysis of a proposed change to the collective public risk limit for commercial space launch operations. Two other tasks addressed effects of winds on commercial launches of suborbital rockets from non-federal sites.

• LAUNCH AND SATELLITE CONTROL DIVISION

AIR FORCE SATELLITE CONTROL NETWORK (AFSCN) The mission of the AFSCN is to provide highly reliable command and control, communications, telemetry, and tracking for more than 170 DOD, National Reconnaissance Office, civil, and allied satellites. The AFSCN consists of eight worldwide remote tracking stations (RTSs) and secure communication links that enable satellites to be connected to Satellite Operations Centers (SOCs) at Schriever Air Force Base, Colo. Aerospace provides systems engineering and integration services to the Satellite Control and Network Group (SCNG) for the modernization and sustainment of the AFSCN, to ensure continued, responsive, and effective support to the warfighters.

Significant progress was made in the RTS Block Change (RBC) program over the past year. The modernized antenna systems were installed at the Diego Garcia Tracking Station and the Eastern Vehicle Checkout Facility. As with the system at the Vandenberg Tracking Station, Aerospace personnel were responsible for executing the system tests leading to operational acceptance at each site. Aerospace also played a key role in the verification of the 133 system requirements that were referred to the RBC implementation at the Colorado tracking station through test execution, data analysis, and coordination with the National Telecommunications and Information Administration.

In addition, the transportable RBC system, which is intended to augment the fixed antenna systems under a variety of conditions and configurations, successfully passed the preliminary design review. Aerospace worked

IMAGE COURTESY OF USAF

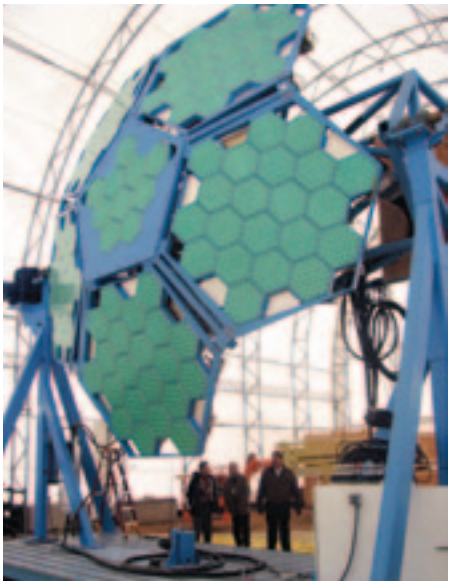


IMAGE COURTESY OF USAF

- A view inside the Vandenberg Air Force Base Tracking Station A-Side Antenna.
- Workers review the assembled Geodesic Dome Phased Array Antenna at Schriever Air Force Base, Colo. The system will eventually be connected to the Air Force Satellite Control Network.

- Emblems for the U.S. Air Force Wings working with Aerospace on Launch and Test Range Systems.

closely with the contractor to resolve a number of design deficiencies and issues associated with the configuration item and interface specifications. The next program milestone will be the activation of the RBC system at Royal Air Force Oakhanger, England, and the Colorado tracking station.

LAUNCH AND TEST RANGE SYSTEMS (LTRS) The LTRS mission is to modernize and sustain the ranges in support of the evolving launch mission and to replace obsolete and difficult-to-maintain equipment. The products are in all phases of the acquisition lifecycle. The Aerospace focus is on the systems engineering and integration, architectural management, and modernization efforts.

Systems engineering (SE) continues to play a major role in LTRS system program office deployment of modernized Eastern and Western range systems. Aerospace has been working with the contractor to develop mature system- and subsystem-level architecture baseline and requirements baseline documentation. This documentation needs to be in place to support the follow-on range contract, which will consolidate the sustainment and the operation and maintenance contracts currently managed independently by Launch and Range Systems Wing, 45th Space Wing, and 30th Space Wing. Aerospace also conducted a thorough analysis of LTRS SE effectiveness, identifying many critical systems engineering responsibilities needing further attention.

These improvement areas were presented to the LTRS systems engineering and integration team to be addressed. One outcome was the development of a risk management framework that focuses on the degree to which the condition being evaluated takes the LTRS down for a significant period of time; scrubs missions; forces unnecessary command destruct; keeps the LTRS from destructing an errant vehicle, thereby potentially causing harm to people or property; or denies mandatory LTRS capabilities from being used, such as denial of approval to operate due to information assurance considerations. This risk management framework facilitates a direct comparison that allows scarce resources to be applied to those areas that have the most impact.

• LAUNCH OPERATIONS DIVISION

ATLAS V Aerospace support to the Atlas V element of the evolved expendable launch vehicle (EELV) program was key to the successful launch of the twenty-second Atlas V, and the first ever Advanced Extremely High Frequency (AEHF-1) satellite aboard an Atlas V vehicle (AV-019) from Cape Canaveral Air Force Station. The launch on Aug. 14, 2010, was the first Atlas V DOD mission to utilize the Swiss-made five-meter payload fairing (PLF). In addition to Aerospace personnel at the launch site, the essentially nominal Atlas V mission was fully monitored from the Spacelift Telemetry Acquisition and Reporting System (STARS) facility.

Over the last several years, Aerospace worked closely with the government and the launch vehicle contractor to ensure that the PLF from RUAG Space in Switzerland, as well as the ordnance devices in its separation systems, were qualified and tested to standards equivalent to those of American-made hardware. In the case of the separation ordnance hardware, a comprehensive test program was devised. When one of the vertical separation system (VSS) devices performed anomalously in tests due to bellows leaks, Aerospace

supported the investigation to clear the Atlas V/AEHF-1 vehicle for flight. The recovery from the failure-to-function of another ordnance device in qualification testing was the most demanding. The noted ordnance device, a half-inch separation nut, must function properly to release the Centaur forward load reactor immediately after PLF separation, or loss of mission is possible.

The lack of a definitive explanation for why the qualification device failed demanded an innovative approach to confirm that hardware on the vehicle was acceptable. Aerospace supported the definition of a test plan for additional test units, and provided a nondestructive inspection technique that Aerospace experts performed on the units on the vehicle hardware. The separation system performed flawlessly in flight. Much of the experience gained prior to the AEHF-1 launch was applicable to the Atlas V (AV-025) that launched the NROL-41 satellite from Vandenberg Air Force Base (VAFB) on Sept. 20, 2010. The Aerospace separation nut inspections on the VAFB rocket ultimately convinced the contractor to remove and replace the hardware prior to proceeding with launch preparations.

DELTA IV The inaugural launch of the next-generation Global Positioning Satellite (GPS) IIF-1 was successfully accomplished by a Delta IV (4,2) vehicle launched from Cape Canaveral Air Force Station (CCAFS) on May 27, 2010. Initial attempts to launch GPS IIF-1 on May 21 were scrubbed when the satellite was unable to maintain an acceptable flow of telemetry on a landline between the satellite and its data processing facility. A second attempt, on May 23, was scrubbed when it was determined that cause and associated corrective actions for the satellite telemetry problems were not adequately defined. A third attempt the following day was aborted about 10 seconds before launch when the automated computer system detected an unacceptable parameter in one of the solid rocket motor's helium system. Because the countdown had proceeded to near completion, it was necessary to replace the radially outward firing initiators in the launch deck, which required a three-day recycle. During the post-abort period, Aerospace worked closely with the contractor to determine that the vehicle hardware was flightworthy and that the limits for the parameter in question were too constraining. The parameter limits were expanded and the essentially nominal Delta IV mission lifted off on its fourth attempt.

The Delta IV team is now engaged in preparations for their next two missions. The current activity to support the planned Heavy launch of NROL-32 from CCAFS and a Heavy launch of NROL-49 from Vandenberg, scheduled for January 2011, is unprecedented for the evolved expendable launch vehicle. Integral to Aerospace's launch certification efforts for these two Delta IV Heavy launches is the independent verification that the various modifications to centerbody tubing systems of the booster engine for the anti-geyser line, liquid hydrogen pressurization line, and Pogo line are acceptable. Because NROL-49 will be the first ever Heavy vehicle to launch from Space Launch Complex-6 at VAFB, a comprehensive set of tests has been devised to ensure that ground systems can effectively support the demands to fill eight cryogenic tanks on the launch vehicle as well as environmental control systems for both the launch vehicle and the spacecraft.

IMAGE COURTESY OF ULA

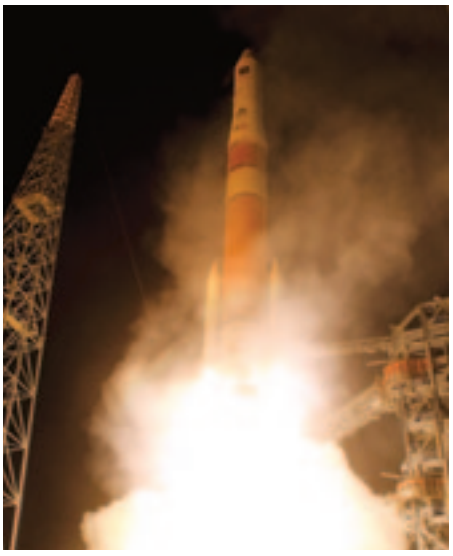


IMAGE COURTESY OF ULA

- The Air Force's first Advanced Extremely High Frequency satellite, encapsulated in its five-meter payload fairing, is shown being mated to its Atlas V booster.

- A United Launch Alliance Delta IV rocket launched the Air Force's GPS IIF SV-1 satellite from Cape Canaveral Air Force Station on May 27, 2010.

SSG • Space Program Operations
Ray F. Johnson, Vice President

"Aerospace is going to face many challenges in the next 30 years as it strives to maintain technical excellence in the development of launch systems. The most significant challenge will be promoting the spirit of innovation that leads to the development of the next generation of launch vehicles. This nation's launch enterprises need to take the next step to develop systems that are more reliable, operable, and affordable. Most likely these vehicles will be some sort of reusable launch system."

Space Program Operations

SPACE INNOVATION DIRECTORATE
Aerospace supports several organizations at Kirtland Air Force Base, New Mexico, including the Air Force Research Laboratory and the Space and Missile Systems Center's Space Development and Test Wing. Aerospace supports both the Space Development Group and Space Test Group (STG) within the wing. Aerospace supports the entire life cycle of these research and development missions, including mission design; systems engineering support for satellite design, integration, and test; and mission risk assessments. For STG, Aerospace provides oversight of the development of ground systems and mission-unique software for flight operations, development of flight plans, and technical support to mission operations.

SPACE TEST PROGRAM (STP)-S26 MISSION LAUNCH PREPARATIONS The 26th small-launch vehicle mission in the Department of Defense STP's more than 40-year history, designated STP-S26, is at the Kodiak Launch Complex preparing for final integration. The mission consists of four space vehicles and two Cubesats on a Minotaur IV launch vehicle. The mission is scheduled to launch in the fourth quarter of 2010.

Aerospace supported the Air Force program office in the integration of the multiple payloads onto the launch vehicle by providing both systems engineering support and mission assurance. Aerospace completed the mission risk assessment for the STP-S26 multiple payload integration mission in July 2010. Aerospace personnel support continues at the launch complex, where personnel are providing mission assurance oversight at the processing facilities. Once again, Aerospace is supporting a mission with a significant number of "firsts": the first Minotaur IV multiple payload mission, the first Minotaur IV dual-orbit mission, the first use of the Standard Interface Vehicle, and the first use of the new Multi-Mission Spacecraft Operations Center.

IMAGE COURTESY OF BALL AEROSPACE

- The STP-S26 spacecraft in preparation for shipment to the Kodiak Launch Complex in Alaska.

HYPERSPECTRAL IMAGER FOR THE COASTAL OCEANS (HICO) – REMOTE ATMOSPHERIC AND IONOSPHERIC DETECTION SYSTEM (RAIDS) EXPERIMENT PLATFORM (HREP) HREP was launched Sept. 11, 2009, on the first flight of the Japanese H2B rocket from Tanegashima, Japan. The RAIDS instrument makes global measurements of the thermosphere and ionosphere.

HICO is the first hyperspectral sensor specifically designed to investigate the coastal ocean and nearby land regions from space. Its imaging shows unique characteristics across the electromagnetic spectrum, including those ranges not visible to the human eye, such as ultraviolet and infrared light. Aerospace personnel were key members of the HREP team and played critical roles in accomplishing this very successful and continuing mission.

DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP) DMSP has been providing timely and accurate worldwide terrestrial and space environmental data to DOD and national program users for nearly five decades. Satellites are deployed in two low-Earth, sun-synchronous orbits to support both strategic and theater users. During fiscal year 2010, DMSP F18 was successfully launched from Vandenberg Air Force Base on Oct. 18, 2009, and placed into a near-perfect orbit by an Atlas V launch vehicle. Aerospace provided technical support to both the prelaunch countdown as well as the early-orbit test. All spacecraft subsystem performance was nominal. DMSP F18 was declared the primary satellite for the mid-morning orbit, and with DMSP F17 in the early-morning orbit, the DMSP constellation is healthy and meeting all requirements for the warfighter.

SPACE SUPERIORITY SYSTEMS (SYS) Aerospace provides support to the Air Force's SYS Wing in developing, delivering, and sustaining space control capabilities to ensure space superiority for the joint warfighter and the nation. These capabilities include systems that support space situational awareness, defensive counterspace, and offensive counterspace. Key programs nearing delivery to the warfighter include the Space Based Space Surveillance system and the Rapid Attack Identification Detection and Reporting System.

SPACE BASED SPACE SURVEILLANCE (SBSS) The SBSS program consists of an integrated space and ground system, which will provide the capability to track and characterize a large number of objects in space. SBSS will provide significantly improved timeliness and coverage over the ground-based elements of the Space Surveillance Network, which can be limited by geometry and weather constraints. The SBSS spacecraft was launched successfully on Sept. 25, 2010, and is undergoing initial system checkouts.

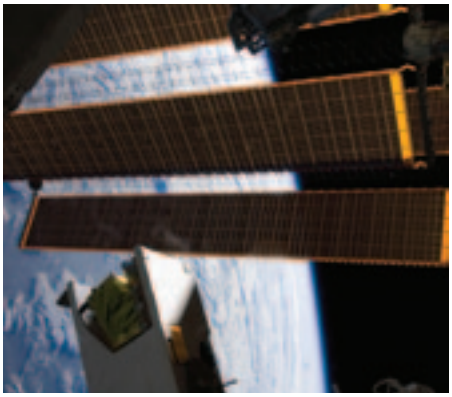


IMAGE COURTESY OF NASA

IMAGE COURTESY OF NASA

IMAGE COURTESY OF BALL AEROSPACE

- View of Hyperspectral Imager for the Coastal Oceans (HICO) and Remote Atmospheric and Ionospheric Detection System (RAIDS) Experiment Payload (HREP), which was launched aboard the first flight of the Japanese H2B rocket in September 2009. The payload is shown here installed on the Japanese Experiment Module.

- A HICO image taken over the mouth of Chesapeake Bay in October 2009.

- The Space Based Space Surveillance spacecraft is shown during final functional testing at Ball Aerospace.

IMAGE COURTESY OF USAF

IMAGE COURTESY OF BALL AEROSPACE

- Rapid Attack Identification and Detection Reporting System (RAIDRS) 5.4-m antennas undergoing checkout prior to factory acceptance testing.

- The NPOESS Preparatory Project spacecraft will monitor Earth's weather, oceans, atmosphere, land, and near-space environment.

RAPID ATTACK IDENTIFICATION AND DETECTION REPORTING SYSTEM (RAIDRS) RAIDRS will develop and deliver radio frequency satellite communications interference detection and geolocation systems and a command and control center called the common operating location (COL). The initial operational capability (IOC) system completed development test and evaluation in June 2009, completed factory acceptance test (FAT) in August 2010, and is planning for IOC at its first site in May 2012. The COL will be at Peterson Air Force Base in Colorado Springs, Colo. Accomplishments this fiscal year included the final operational capability (FOC) delta critical design review, preparation of the requests for proposals for the FOC development effort and the site development and build effort, contract award for the RAIDRS trainer, and a successful FAT.

NATIONAL POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITE SYSTEM (NPOESS) NPOESS was a presidentially directed tri-agency (Department of Defense (DOD), Department of Commerce, and NASA) program designed to converge existing polar operational environmental satellites and infuse new and emerging technologies. NPOESS consisted of eight different sensors measuring from ultraviolet to gamma rays, an observatory-class spacecraft, a ground system, and a data processing system.

In February 2010, the president announced that the National Oceanic and Atmospheric Administration (NOAA) and the Air Force would no longer continue to jointly procure NPOESS. The agencies will still share coverage responsibilities, but NOAA and the Air Force will pursue their own procurements for satellites. Agencies are making plans to accomplish this, but in the interim Aerospace continues to support the NPOESS program office in accordance with the president's FY10 budget, with its emphasis on the NPOESS Preparatory Project, the building and testing of the observatory for potential use by either or both agencies, and the transition of materials and contracts to the replacement programs, the Defense Weather Satellite System (DOD) and the Joint Polar Satellite System (NASA/NOAA).

NPOESS PREPARATORY PROJECT (NPP) The NPP spacecraft is completed and all sensors – Visible/Infrared Imaging Radiometer Suite, Ozone Mapping and Profile Suites, Cloud and Earth Radiant Energy System, Advanced Technology Microwave Sounder, and Cross-Track Infrared Sounder – have been successfully integrated on the NPP bus. Launch is currently planned for October 2011.

ADVANCED EXTREMELY HIGH FREQUENCY (AEHF) PROGRAM The AEHF program will succeed Milstar as this nation's core, protected communication system for strategic and tactical missions mitigating a broad spectrum of natural and manmade threats. AEHF represents a tenfold improvement in communication capacity, as well as significant improvements in coverage and access. Aerospace is integrally involved in all aspects of the program, working with the government and contractors to ensure the success of this critical mission area.

In May 2010, the legacy control system that had been in place for more than 16 years was successfully replaced by the AEHF mission control system for satellite command and control of the Milstar constellation. This was a significant milestone, demonstrating the phased capability to integrate the AEHF capabilities into the existing on-orbit constellation. This transition will enable planned activities over the next few years to integrate Milstar and AEHF satellites, as well as the extended data-rate capabilities planned for AEHF.

AEHF Space Vehicle-1 was successfully launched on Aug. 14, 2010, from Cape Canaveral Air Force Station. During early-orbit operations, the liquid apogee engine used to begin the transition to a geosynchronous orbit shut down prematurely. Aerospace is working with Lockheed Martin and the Air Force to devise orbit-raising strategies, using the other healthy chemical and electrical propulsion systems to achieve the mission orbit and subsequently achieve mission objectives. The effort is using the extensive modeling and simulation capabilities of the Engineering and Technology Group that are in place for just this type of contingency.

ENHANCED POLAR SYSTEM (EPS) The EPS program will provide extremely high frequency (EHF) protected satellite communications capability to forces operating in the north polar region. This system is a follow-on to the Interim Polar System, and will both replenish and upgrade the capabilities provided by the interim system by extending the waveform capabilities of advanced EHF capabilities northward. Aerospace is assisting the Air Force with the development of the overall program architecture throughout the system definition and development phase. The program is working toward a preliminary design review for the EPS, to be followed by Milestone B in FY12. The Aerospace team has played a significant role in responding to program affordability concerns by rescoping system and segment requirements, updating design baselines, and modifying the overall acquisition strategy.

MILSTAR PROGRAM The Milstar System serves as the nation's core, protected communication system for strategic and tactical missions mitigating a broad spectrum of natural and manmade threats. The five-satellite constellation consists of two Milstar Block I satellites (low data-rate) and three Milstar Block II satellites (low and medium data-rate). The constellation continues its excellent performance in meeting worldwide warfighter requirements. The two Milstar Block I satellites have exceeded their design lives. The longevity and performance of the Milstar constellation is critical, given the time required to phase-in the follow-on Advanced Extremely High Frequency system. Aerospace has provided general systems engineering and integration support for Milstar to the government since the program's initiation. Aerospace currently maintains a small but vigilant team in support of systems sustainment and mission operations.

IMAGE COURTESY OF ULA

IMAGE COURTESY OF ULA

- The inaugural Advanced Extremely High Frequency (AEHF)-1 satellite is encapsulated within the Atlas V rocket's nose cone at the Astrotech processing cleanroom.

- An Atlas V successfully launched the AEHF-1 satellite from Cape Canaveral Air Force Station on Aug. 14, 2010.

IMAGE COURTESY OF BOEING

IMAGE COURTESY OF ULA

- Boeing technicians examine the third Wideband Global SATCOM (WGS) satellite. The successful launch of the satellite in December 2009 completed the initial three-satellite WGS constellation.

- A United Launch Alliance Delta IV rocket with the Air Force's Wideband Global SATCOM-3 (WGS-3) satellite awaits a successful liftoff from Space Launch Complex-37 on Dec. 5, 2009.

WIDEBAND GLOBAL SATCOM (WGS) PROGRAM Aerospace provided extensive contributions to the ongoing activities of the WGS program, including the successful launch of the WGS-3 satellite in December 2009 and the beginning of operational communications support to the warfighter in June 2010. The launch of WGS-3 completes the Block I constellation. Aerospace provided technical oversight throughout the WGS-3 on-orbit testing, orbit relocation, and operational-transfer phases. Aerospace played a key role in the investigation of a significant on-orbit anomaly and provided subject matter expertise and independent assessments of operational contingency concepts.

The pace of the WGS Block II program is rapidly accelerating. Integration of the WGS-4 spacecraft bus and payload modules is complete, and system-level testing has begun. The WGS-5 payload and bus modules are nearly complete, and integration into a complete spacecraft is expected early in FY11. The bus and payload module components for WGS-6 are being assembled. Aerospace is actively monitoring the integration and testing of WGS-4 and WGS-5, and is fully engaged in reviewing the production of the remaining hardware for all three Block II satellites.

The Block II Follow-on program is structured to procure up to six additional satellites that are functional clones of the Block II WGS satellites. The contract for the initial non-recurring engineering effort and advanced parts for WGS-7 has been awarded. Source selection activities continue with the goal of awarding the WGS-7 production contract in FY11.

DEFENSE SATELLITE COMMUNICATIONS SYSTEM (DSCS) PROGRAM DSCS provides wideband communication capability for the National Command Authority; strategic forces; military forces deployed; and in garrison, diplomatic services, and long-haul, fixed, government communications services. The DSCS constellation consists of two prime satellites, six residual satellites, and one test satellite that is out of service but functional in a super-synchronous disposal orbit.

The program priorities continue to be mission-life extension and enhancement to maximize utility of on-orbit assets as the Wideband Global SATCOM constellation deploys. DSCS constellation optimization planning continues to be a major activity. With the launch of the WGS-3 satellite, analyses were conducted to readjust the DSCS constellation to optimize link availability.

ADVANCED CONCEPTS DIVISION (ACD) The ACD was formed by the Air Force to analyze future MILSATCOM architecture alternatives and formulate an evolutionary path for MILSATCOM programs following the cancellation of the Transformational Satellite Communications System (TSAT) program by the secretary of defense. Aerospace supports ACD for the purpose of harvesting intellectual capital, industry expertise, and technology from the investment in the TSAT program and applying it to current and future MILSATCOM programs. Aerospace is assisting the Air Force with the development of overall MILSATCOM architecture concepts, the evolution of current MILSATCOM programs of record, and the development of new communication systems. Specifically, Aerospace has provided technical support to ACD with the planning of the capability insertion programs to evolve the existing Advanced Extremely High Frequency and

Wideband Global SATCOM programs; the exploration of commercial satellite communications capabilities to meet military needs; and the definition of a potential airborne intelligence, surveillance, and reconnaissance demonstration program for the Air Force, showcasing rapid acquisition concepts. These capabilities will seek to meet some of the unsatisfied requirements caused by the cancellation of the TSAT program.

SPACE BASED INFRARED SYSTEM (SBIRS)

The SBIRS program, consisting of both highly elliptical orbit (HEO) and geostationary Earth orbit (GEO) elements, is the follow-on program to the Defense Support Program (DSP). The HEO system has been certified for both missile warning and technical intelligence. The HEO system is operational and delivering a wide array of persistent surveillance capabilities to military and intelligence communities. The overhead DSP constellation continues to provide global early warning of strategic and tactical ballistic-missile launches. As the SBIRS GEO space vehicles are deployed in the next few years, the overall system will provide improved missile warning, missile defense, battlespace characterization, and technical intelligence products to the military and the intelligence community users.

The GEO program is continuing efforts to deliver the first two space vehicles with both scanning and staring sensor capabilities. The GEO-1 space vehicle is undergoing final integrated systems testing before being readied for launch in April 2011. The GEO-1 flight software has completed development and is nearing completion of software item qualification testing. The GEO-2 space vehicle completed baseline integrated systems testing (BIST)-1 (expanded mode), and spacecraft panels are being integrated prior to BIST-2 testing planned for early FY11. The SBIRS follow-on production (SFP) program, consisting of the HEO-3 and HEO-4 payloads and GEO-3 and GEO-4 space vehicles, is underway. HEO payload long-lead part procurement and subsystem integration and testing are progressing. Long-lead part procurement and systems engineering for the GEO space vehicles is also under way. All subsystem and space vehicle critical design reviews have been successfully completed.

The principal focus areas of Aerospace personnel continue to be the assembly, integration, and test of the GEO space vehicles; flight software discrepancy report resolution and qualification; and supporting SFP procurement, assembly, and integration. In the area of ground operations, Aerospace has continued to improve the contractor's testing of GEO ground software, supported HEO operations and sustainment, assessed the impacts of continued modifications to the flight software on the ground system development, and assessed the ability of the ground system to support the GEO-1 launch. Aerospace has also supported replanning activities for the delivery of ground products required for launch, early on-orbit test, message certification, and technical intelligence certification.

Aerospace continues efforts to increase the on-orbit life of the DSP constellation. In particular, the corporation is developing algorithms for a backup ground capability to determine satellite attitude that closely approximates the primary system.

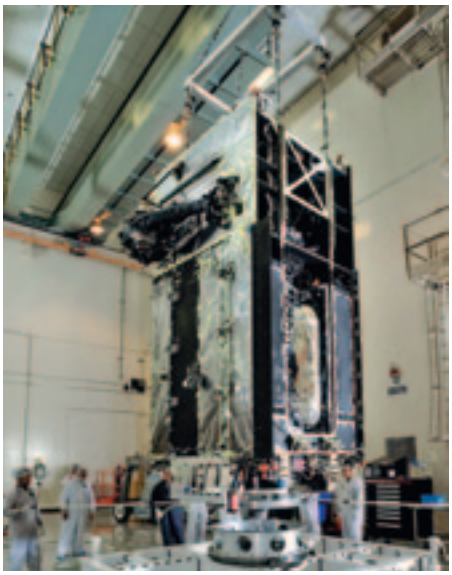


IMAGE COURTESY OF LOCKHEED MARTIN

IMAGE COURTESY OF LOCKHEED MARTIN

- Engineers inspect the Space Based Infrared System (SBIRS) geosynchronous (GEO)-1 spacecraft.
- A SBIRS highly elliptical orbit (HEO) payload is prepared for delivery.

IMAGE COURTESY OF NASA

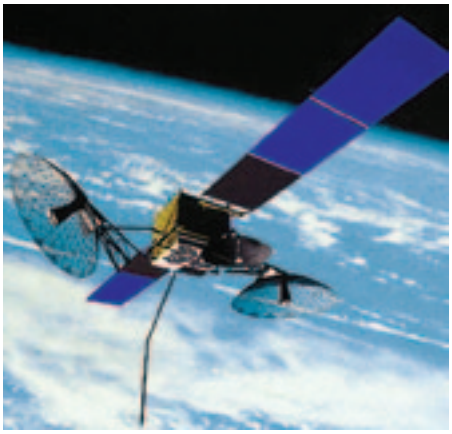


IMAGE COURTESY OF NASA

- Tracking and Data Relay Satellite (TDRS)-1 shown being deployed from the space shuttle *Challenger*. In June 2010, NASA completed the shutdown of the TDRS-1, which remained in operation from 1983 to 1998. Aerospace is cooperating wit the Space and Missile Systems Center to develop improved methods of mapping orbital debris, such as decommissioned satellites.

- Artist's rendering of the TDRS-1 satellite in orbit.

PROGRAM EXECUTION BEST PRACTICES
Several best practices developed and institutionalized by Aerospace and the Space and Missile Systems Center (SMC) were recognized by the Secretary of the Air Force/Acquisition (SAF/AQ); the Office of the Secretary of Defense/Acquisition, Technology, and Logistics; and Defense Acquisition University (DAU) for application across Air Force and DOD system acquisitions. These include the independent program assessment (IPA), early strategy and issues session (ESIS), and early lifecycle program mission assurance. SAF/AQ is incorporating descriptions of these best practices into updates to Air Force acquisition policies. DAU intends to include them in the Defense Acquisition Guidebook, a DOD-wide set of online instructions.

Aerospace continually assesses the findings from each IPA and ESIS into general trends to identify lessons learned. One such lesson led to the SMC best practice of starting lifecycle planning immediately in a program's early formative state and maintaining a focus on lifecycle throughout each phase of development. The lifecycle emphasizes a balanced solution across performance, cost, schedule, and risk, and is referred to as program assurance or program mission assurance.

ORBITAL DEBRIS MITIGATION AND MANAGEMENT Aerospace prepared 15 space vehicle and launch vehicle space debris assessment reports, end-of-life plans, debris mitigation waiver packages, and exception-to-policy documents for various SMC and National Reconnaissance Office programs as required by the 2010 National Space Policy (NSP) and the Orbital Debris Mitigation Standard Practices document. In response to the release of the NSP in June 2010, Aerospace developed a Space Debris Regulatory Interpretability Matrix (SDRIM) tool for efficient mapping of debris mitigation requirements to specific SMC program needs, from system design through end-of-life. Once finalized, the SDRIM will be released for use by SMC for allocation of resources and development of contract specifications early in the acquisition process.

CRITICAL TECHNOLOGIES INDUSTRIAL BASE
Aerospace is continuing to provide key support to Space Industrial Base Council member agencies by providing technical guidance and project definition for mitigation of critical technology industrial-base concerns. Aerospace led numerous deep-dive investigations to develop the way-forward plans. Funding profiles starting in FY11 have been identified for infrared sensors (detector, substrate, readout integrated circuits), star trackers (visible sensor and next-generation development), traveling wave tubes, and solar cell substrates.

SOFTWARE ACQUISITION MANAGEMENT
Aerospace provided technical products that advance the practices of software acquisition planning during the period. One major initiative was the development of software acquisition management plans for each of the major SMC wings. In addition, an SMC operating instruction was written to more clearly define the process of writing, approving, and executing the plan. Aerospace also significantly improved the Software Development Standard for Space Systems and released a new Software Measurement Standard.

PROGRAM MANAGEMENT ASSISTANCE GROUP (PMAG) INTEGRATED PROGRAM RISK ASSESSMENTS Aerospace continues to evolve and utilize its capabilities to assess the executability of space system development programs in support of PMAG. Aerospace provided key technical and integrated program risk assessment expertise to enhance executability over a program lifecycle. This covers comprehensive estimate at completion, schedule risks analysis, over-target-baseline basis-of-estimate evaluation, technical baseline reviews, critical baseline reviews, program measurement baseline evaluation, integrated master plan and integrated master schedule wall walk, integrated baseline review, critical design reviews, and functional and physical configuration audit sell-off reviews. In addition to supporting Space and Missile Systems Center (SMC) programs, the inaugural Aerospace PMAG Symposium was held in February 2010. Lessons learned from PMAG efforts over the past two years were shared with attendees from industry, government, and technical staff.

GLOBAL POSITIONING SYSTEM (GPS) GPS provides precision signals from a constellation of satellites, ensuring continuous high-accuracy global position, navigation, and timing services to military and civilian users worldwide. GPS has become an essential part of the global civil infrastructure and military operations. The value and utility of GPS have far exceeded the expectations of its system designers and have led to significant system upgrades to enhance both military and civil services. Modernization is required across spacecraft, control system, and user equipment programs. This year, Aerospace continued its technical stewardship across the GPS IIR-M, IIF, and IIIA satellite programs; the GPS control system programs; GPS user equipment programs; and the space-based navigation enterprise.

GPS SATELLITE PROGRAMS The first space vehicle of the GPS IIF program was launched in May 2010, tested, and placed into navigation service in August. Prior to launch, Aerospace conducted extensive reviews of the hardware and software, with special attention placed on areas of residual risk. These efforts culminated in an Aerospace President's Review and support to the SMC flightworthiness review processes. Aerospace also provided technical guidance for oversight of satellite preparation, launch vehicle integration, and day-of-launch anomaly resolution. Following launch, Aerospace worked with Boeing and the government satellite team to safely deploy the vehicle, initiate bus and payload operations, and conduct a thorough checkout of satellite functions and ground segment command and operations.

GPS III GPS IIIA conducted a very rigorous critical design review (CDR) campaign that resulted in the successful CDR for the IIIA satellite in August 2010. This was the culmination of more than 60 Mil-Std-1521B(T) lower-level reviews where the prime contractor, its subcontractors, and Aerospace experts worked for months through a progressive series of subsystem and element hardware and software CDRs. The IIIA CDR campaign was finished two months ahead of schedule without sacrificing any technical rigor. Throughout the year, Aerospace also worked closely with the contractor on the requirements and documentation needed for the almost 600 electronic parts that needed GPS III-specific source control drawings (SCDs). By the time the CDR had ended, 100-percent of these SCDs had been approved for GPS III, an unprecedented feat for a program at CDR. It is expected that

IMAGE COURTESY OF BOEING

IMAGE COURTESY OF LOCKHEED MARTIN

- Artist's rendering of a Global Positioning System (GPS) IIF satellite.
- Artist's rendering of a next-generation GPS III satellite.

this rigorous parts requirements approval process will significantly reduce the program's exposure to parts-related risks later in the build and test cycle of the GPS III satellites. In parallel to these activities, the program conducted a successful Mil-Std-1521B(T) systems requirements review on the follow-on GPS IIIB program in May 2010.

GPS CONTROL SYSTEM PROGRAMS The latest update to GPS's modernized control system Architecture Evolution Plan (AEP) 5.5, completed its test and transition activities and became operational in January 2010. AEP 5.5 enabled Selective Availability Anti-Spoofing Module capabilities to the warfighting community and supported the May 2010 IIF-1 launch. AEP 5.5 joined Launch, Anomaly Resolution, and Disposal Operations 2.8.3 as part of the Operational Control System (OCS) sustainment process.

In February 2010, the Air Force awarded the GPS Advanced Control Segment (OCX) contract to Raytheon Intelligence and Information Systems. Raytheon was placed under contract to develop, field, and sustain OCX. The new system will replace the current OCS and maintain backwards compatibility with the GPS IIR and GPS IIR-M constellation, provide command and control of the GPS IIF and GPS III families of satellites, and enable new modernized signal capabilities. In August 2010, the OCX program successfully completed the integrated baseline review (IBR) and the performance management baseline (PMB) was established for this ACAT-1D program. The OCX program is on schedule to hold the software specification review (SSR) at the end of September 2010. OCX is a software-intensive system and the SSR is a major milestone on the road to the preliminary design review (PDR), scheduled for April 2011.

IMAGE COURTESY OF USAF

- The GPS MUE receiver module is a demonstration unit intended for platforms such as the Raven unpiloted aerial vehicle, shown here in preparation for launch.

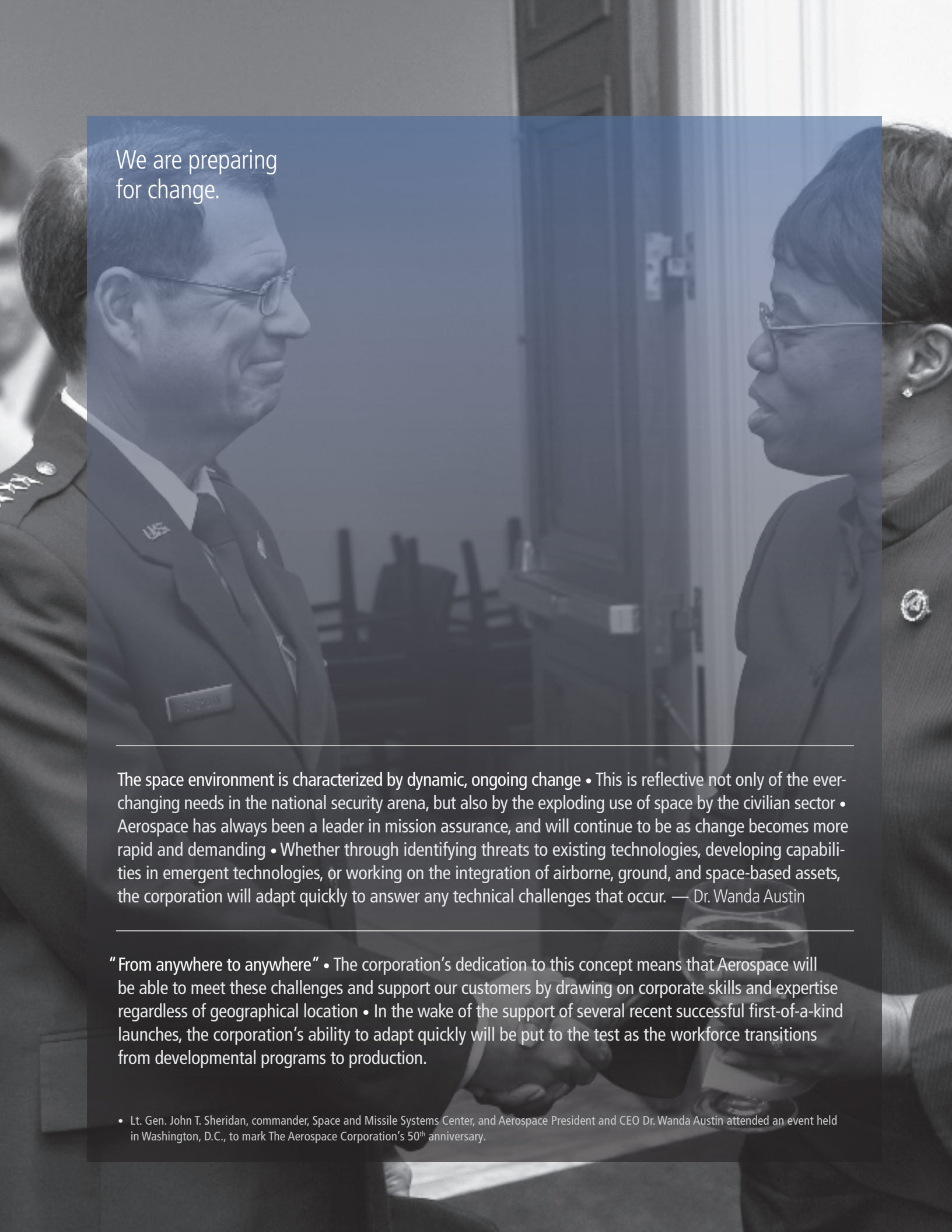
GPS USER EQUIPMENT PROGRAMS The GPS Modernized User Equipment (MUE) program is an Air Force pathfinding technical demonstration program for the new GPS military signal (M-Code) and a new information assurance-based security approach. Aerospace provides technical leadership and support in all aspects of the program, which awarded parallel contracts in June 2006. This year, as each contract moved into the testing phase, Aerospace participated in test readiness review (TRR) preparations, advising the government of the contractors' status to move forward. As a result, one contractor completed test ing and delivered technical demonstration units, which will now be subjected to a government testing regime. A second contractor passed TRR and is expected to complete testing in the fall of 2010. The third contractor is expected to hold TRR and complete testing shortly thereafter.

GPS ENTERPRISE The ability to flex power from one signal to another one on the same frequency was identified in early 2000 as mitigation to the GPS jamming risk. The capability was deployed on IIR-M and IIF satellites, and Aerospace has been involved in the testing that has taken place between 2003 and 2010. The last in a series of flex-power tests was successfully conducted this year. This "live" test involved the entire fleet of IIR-M satellites and consisted of switching all the power from the M-code signals to the P(Y) signals. Test results were obtained from a newly augmented test receiver suite, as well as from a large number of civil and military operational receivers. Aerospace analyzed the results to characterize the benefits of flex power. •

SSG • Meteorological Satellite Systems
Anthony Stier, Assoc. Member of the Technical Staff

"Within the Space Systems Group (SSG), my satisfaction comes from the fact that my efforts contribute directly to the mission assurance of our SSG customers.

I take pride in knowing that my work at Aerospace, and specifically within SSG, has the capability of benefitting end-users across the world."



We are preparing for change.

The space environment is characterized by dynamic, ongoing change • This is reflective not only of the ever-changing needs in the national security arena, but also by the exploding use of space by the civilian sector • Aerospace has always been a leader in mission assurance, and will continue to be as change becomes more rapid and demanding • Whether through identifying threats to existing technologies, developing capabilities in emergent technologies, or working on the integration of airborne, ground, and space-based assets, the corporation will adapt quickly to answer any technical challenges that occur. — Dr. Wanda Austin

"From anywhere to anywhere" • The corporation's dedication to this concept means that Aerospace will be able to meet these challenges and support our customers by drawing on corporate skills and expertise regardless of geographical location • In the wake of the support of several recent successful first-of-a-kind launches, the corporation's ability to adapt quickly will be put to the test as the workforce transitions from developmental programs to production.

- Lt. Gen. John T. Sheridan, commander, Space and Missile Systems Center, and Aerospace President and CEO Dr. Wanda Austin attended an event held in Washington, D.C., to mark The Aerospace Corporation's 50th anniversary.

Engineering and Technology Group

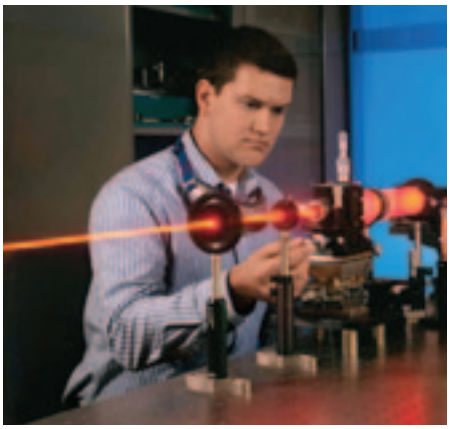
Engineering and Technology Group (ETG) is a matrix of nationally recognized space systems experts that supports both external customers and the other corporate groups in the pursuit of mission success • Containing nearly half of the company's technical talent, the group consists of six specialty organizations equipped with state-of-the-art computing, testing, diagnostic, research, and simulation facilities, as well as proprietary Aerospace databases that have evolved since the beginning of the space era • ETG's engineering activities support the corporation's strategic objective to be the principal engineering arm of the Air Force Space and Missile Systems Center and the National Reconnaissance Office for space, launch, and related ground systems • The research and development activities are conducted to support the corporate goal of being the leading contributor of innovative solutions to the most difficult problems in the national security space community.

- The A6 E-pod, the newest addition to the Engineering and Technology Group's Physical Sciences Laboratories, was dedicated in March 2010.

ETG • Engineering and Technology Group
Dr. Rami R. Razouk, Senior Vice President

"The biggest challenge in the future will be maintaining and enhancing the quality of our workforce in the face of an education system that is not producing enough engineers and scientists. This is a challenge to our nation, but is particularly difficult for those who work in support of national security space. As the hiring engine for the corporation, ETG will be increasingly challenged to bring in and retain the best and brightest employees."

FOCAL PLANE ARRAY (FPA) TESTING
Sophisticated FPAs are used for a variety of applications in space vehicles, most notably imaging, surveillance, remote sensing, and star tracking. The existence of several different broad manufacturing technologies enables a diverse set of applications to be served, from scanning to staring, varied wavelengths, and low-noise and high-speed collection. Because of their complexity, the technical advancements involve long lead activities with significant program risk. State-of-the-art test facilities allow Aerospace to perform independent tests, as well as to characterize them in ways that the manufacturer is often unable to do. These efforts play a crucial role in evaluating such devices at all stages of their life cycle. Aerospace has been instrumental in helping contractors validate or improve their manufacturing processes, confirming that devices meet performance specifications, and resolving late-stage anomalies or emulating on-orbit performance.



• Jonathan Bray, of the Electro-Optical Device Evaluation Lab, uses a tightly focused laser beam to test the point-source-response of a focal-plane array.

SPACE TRACKING AND SURVEILLANCE SYSTEM (STSS) DEMONSTRATION ON-ORBIT ATTITUDE DETERMINATION ANOMALY RESOLUTION The two STSS demonstration space vehicles were launched on Sept. 25, 2009, and immediately encountered attitude determination issues causing each vehicle to enter survival mode several times, threatening the mission. An anomaly investigation team was formed that included Northrop Grumman and Aerospace attitude-determination experts. Aerospace was instrumental in determining root cause of the attitude determination system anomalies. From limited on-orbit data the team identified several issues that led to a susceptibility to false star identifications by the Goodrich 1003 star tracker and associated flight software algorithms. Among these issues were star tracker alignment errors, star catalog problems, data latency, and numerical problems with the software algorithms. Through the concerted efforts of Northrop Grumman and Aerospace, the anomalies were resolved and the program was able to complete bus initialization and proceed to payload operations.

BUFFET ENVIRONMENT CHARACTERIZATION FOR ARES I Aerospace applied its unique expertise in the determination of aerodynamic buffet environments for the Ares I-X flight test, and the altitude abort (AA)-1 and AA-2 tests. For Ares I-X, Aerospace used lessons learned from historic launch vehicle programs to help NASA interpret anomalous wind-tunnel results, leading to a 30-percent reduction in predicted bending moment, and satisfying the allowable vehicle design level. Ares I-X successfully launched in October 2009. For AA-1, Aerospace developed methodologies to utilize Ares I-X wind-tunnel data in predicting buffet for the launch abort system and crew module during flight at maximum dynamic pressure. The

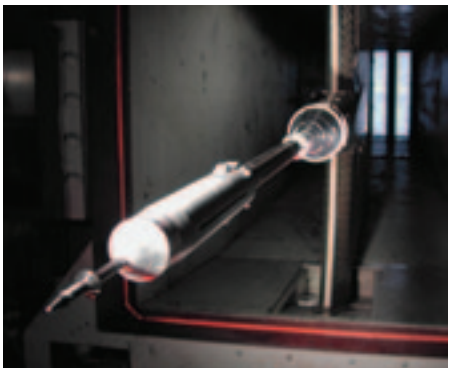


IMAGE COURTESY OF NASA/BOEING

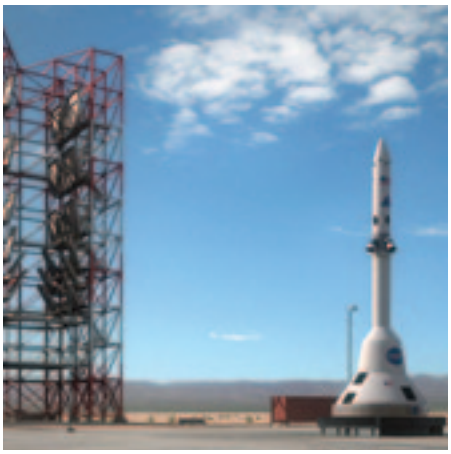


IMAGE COURTESY OF NASA

- A model of the Ares 1-X launch vehicle and integrated Orion crew module inside one of four wind tunnels used for testing by NASA. Aerospace supported the wind tunnel test for Ares 1-X and independently analyzed the wind tunnel test data.

- Artist's rendering of the Orion launch abort vehicle in preparation for launch in the Pad Abort 1 flight test at White Sands Missile Range, N. M. Aerospace developed methodologies for predicting buffet for the launch abort system.

Aerospace approach produced a 10-percent reduction in bending-moment predictions.

For AA-2, the objective is to test the launch-abort system and crew module during transonic flight. Aerospace was again tasked with predicting the buffet environment, but launch-abort motors were fired in flight, and the available wind-tunnel data used cold air as the simulant for the motor plumes. Utilizing both the wind-tunnel data and data from a single ground firing of the launch-abort motors, Aerospace used computational fluid dynamics simulations to determine maximum local dynamic pressure fluctuations for the flight configuration.

ALGORITHM DEVELOPMENT LAB (ADL) The ADL was opened in Aerospace's A8 Research Center (ARC) to provide a contractor-neutral facility for maturing and evaluating ground algorithms and processing sensor test data for future overhead persistent infrared sensor systems. The Space and Missile Systems Center (SMC) executive director officiated at the formal ceremony in May 2009, and the SMC commander designated the ADL as one of the top two nonspacecraft-related success stories of the year.

Since then, Aerospace has matured the capabilities of the ADL. The corporation participated with the development contractor in defining the software architecture that supports modular development and integration of ADL algorithms. Aerospace recently developed subspace projection algorithms for tracking and detection, and demonstrated superior performance in representative scenarios in terms of convergence on targets. Aerospace also recently demonstrated innovative algorithms to distinguish closely spaced targets and to suppress clutter in detection algorithms.

Hosting the ADL in the ARC, which is operated for the Space Based Infrared System program, allows the ADL to take advantage of the legacy ARC capabilities for integrating live data from operational OPIR spacecraft, directly through the ARC ground station antennas or near-realtime through connections with other DOD ground stations, and from a variety of archived operational or simulated data sources. While the ARC has already proven invaluable for legacy programs, the future sensor concepts under development bring with them even more stressing requirements for signal processing, and the ADL and Aerospace's expert algorithm analysts are providing the additional risk reduction capability needed to make these concepts executable.

SCHEDULE RISK ASSESSMENT OF SPACE SYSTEMS ACQUISITION Aerospace has developed the Quantitative Assessment of Space Systems Acquisition Risk (QASAR) process to assess the potential impacts of technical and programmatic risks to a project baseline schedule. In the QASAR methodology, subject matter expert technical assessments are translated into potential schedule impacts for key activities. A unique method for assessing the probability of occurrence and associated consequence expands on commercial scheduling tools and provides a systematic method for developing unique probability distributions. This methodology is especially suited for combining multiple technical disciplines into a single schedule baseline impact. The resultant probability distributions are combined using traditional Monte Carlo probabilistics.

The modeler can also incorporate historic program data and allow feedback from engineering disciplines that may result in further explanation and normalization. Some typical outputs from the QASAR model include a cumulative probability density function (S-curve), a schedule critical path, and the key contributors to schedule slip. Schedule impact results can be used to assess the probability of funding shortfalls, likelihood of meeting launch schedules, requirements for management reserves, and other programmatic factors affected by schedule fluctuations. Most recently, QASAR has provided program managers in the Space Based Infrared System and Global ositioning System Wings insight into the schedule impacts from various technical and programmatic risks.

LASER BEACON ACHIEVES MILESTONE For more than 30 years, the Aerospace laser beacon, used for infrared sensor calibration, has illuminated geosynchronous satellites. Since 2007, the laser beacon has also been used to illuminate highly elliptical orbit (HEO) satellites. In spring 2010, the Aerospace laser beacon achieved another milestone by illuminating a low Earth orbit (LEO) vehicle, at the request of the Space Tracking and Surveillance Systems program office in support of on-orbit requirement verifications.

Aerospace maintains and operates several mobile laser beacon systems. These systems were designed and developed internally with funding provided by several different program offices. The original objective for these systems was to provide a deployable, fully mobile infrared beacon that could illuminate on-orbit geosynchronous Defense Support Program satellites. The mobile systems capabilities were significantly expanded and upgraded under SBIRS funding and successfully used to illuminate the SBIRS-HEO satellites, allowing verification of numerous requirements. Before a mobile system could be used to illuminate a LEO vehicle, the system needed major modification of the software used to control the laser beacon director. This modification, plus testing and debugging, was accomplished over a tight, three-month period.

Testing of the software modifications was accomplished by visually tracking satellites that were sunlit in early evening and early morning skies. With testing and debugging completed, the mobile system was deployed to Edwards Air Force Base to perform illumination tests on the LEO satellite. The very first illumination test was fully successful, providing a laser signal to the LEO vehicle during the entire satellite pass. With this result, Aerospace provided the government a fully mobile, low-cost alternative for sensor calibration of LEO satellites.

IMAGE COURTESY OF LOCKHEED MARTIN

- Artist's depiction of the Space Based Infrared System (SBIRS) GEO-1 spacecraft.
- Laser beacon van deployed to Edwards Air Force Base in support of on-orbit calibration of infrared sensor.

30. **ROOT CAUSE OF FLIGHT TERMINATION SYSTEM (FTS) BATTERY CELL CASE CRAZING DETERMINED** Aerospace led a team consisting of Aerospace, Space and Missile Systems Center, Range Safety, NASA, United Launch Alliance, and Yardney Technical Products personnel in determining the root cause of cell crazing that occurred during qualification testing of a launch vehicle flight termination system (FTS) battery. The failure investigation led to implementation of corrective action that successfully resolved the issue.

Qualification testing for the FTS battery used on the Atlas V and Delta II/IV vehicles suffered a setback when severe crazing was found in about 55 percent of the vendor-provided cell cases prior to integration into the battery housing. A failure investigation team was formed to determine the cause and prescribe corrective action. The root cause of the crazing was identified as a combination of the presence of the methylene chloride solvent used to seal the cover to the cell case, stresses in the cell case caused by localized high temperatures during the soldering process, and an externally applied solder flux used to improve solder flow. This conclusion was reached after many experiments, materials characterization tests, and modeling. The corrective action called for removal of the external flux from the soldering process and replacement with a solder containing resin core flux. New cells have been successfully fabricated and built into batteries using the new process. Once the new FTS batteries are completed, they will be space-qualified and deployed.

IMAGE COURTESY OF NASA

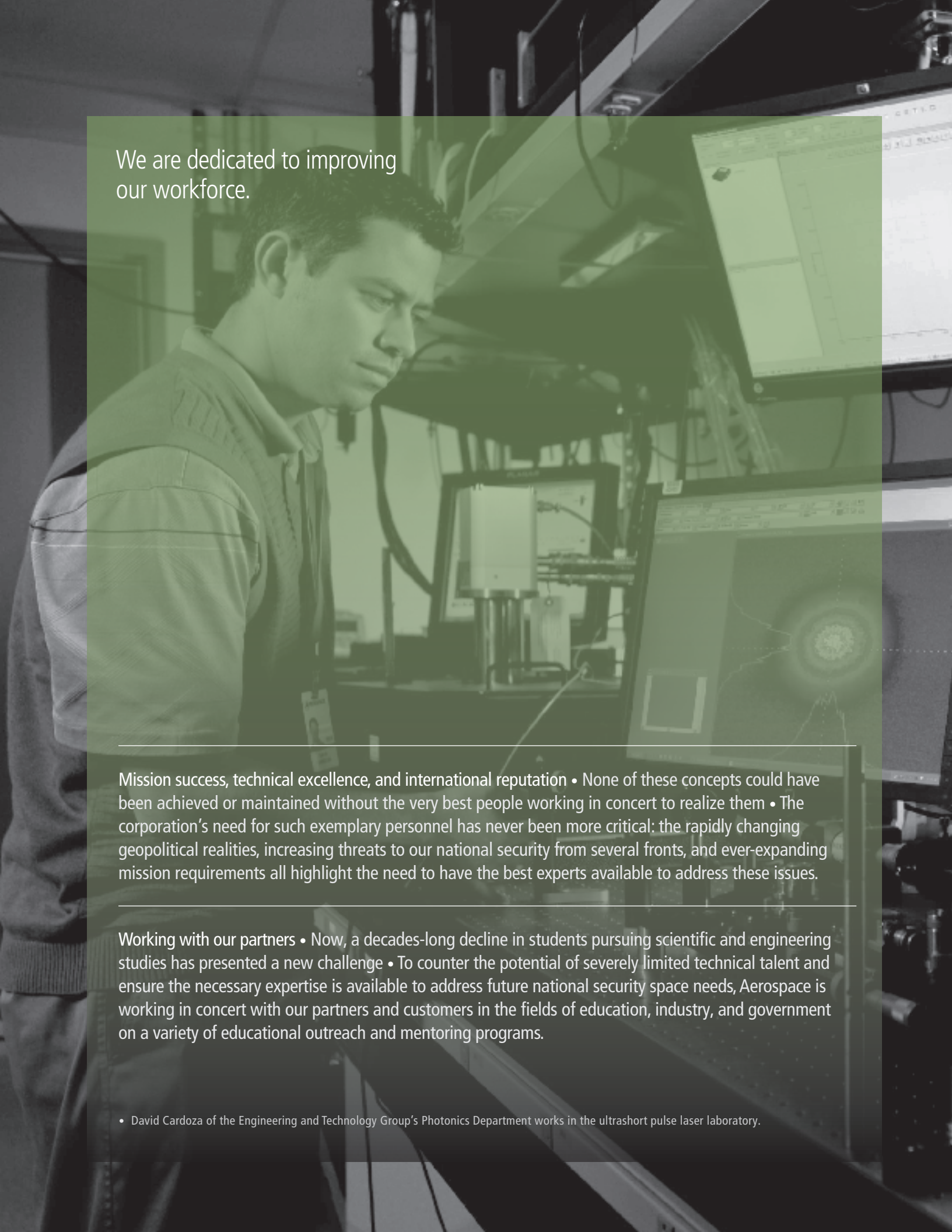
- A Delta II rocket launched from Cape Canaveral Air Station in March 2009 carried NASA's Kepler space observatory into orbit.

INCORRECT LUBRICANT IN MECHANICAL ASSEMBLY DISCOVERED Liquid lubricants are formulated with additives to ensure proper performance of space mechanisms under the expected operational conditions. Recently, a contractor was conducting a series of tests of a mechanical assembly for a classified program. The Aerospace laboratories had analyzed the lubricant for the previously completed tests of the series and received the lubricant from the final test. Aerospace discovered that the lubricant from the recent test did not contain any of the expected antiwear additives. After Aerospace issued a report, the contractor examined their records, and found that the wrong lubricant had been used in the test, and Aerospace confirmed the presence of the alternate additive in the lubricant that was received. In addition to the test article, the incorrect lubricant had infiltrated flight production; several articles were found that had incorporated this lubricant, but had been removed from the flight assembly due to other problems. Aerospace ultimately prevented further flight articles from being manufactured with the wrong lubricant, which ensured that the systems were not flown in an unqualified configuration. •

ETG • Architecture and Design Subdivision
Matthew Ferringer, Project Leader

"Aerospace has a culture of innovation, along with the resources necessary to transition research into practice.

My most rewarding experiences occur when I can bring research-to-practice full circle, resulting in high-value transformative change for our customers."



We are dedicated to improving our workforce.

Mission success, technical excellence, and international reputation • None of these concepts could have been achieved or maintained without the very best people working in concert to realize them • The corporation's need for such exemplary personnel has never been more critical: the rapidly changing geopolitical realities, increasing threats to our national security from several fronts, and ever-expanding mission requirements all highlight the need to have the best experts available to address these issues.

Working with our partners • Now, a decades-long decline in students pursuing scientific and engineering studies has presented a new challenge • To counter the potential of severely limited technical talent and ensure the necessary expertise is available to address future national security space needs, Aerospace is working in concert with our partners and customers in the fields of education, industry, and government on a variety of educational outreach and mentoring programs.

• David Cardoza of the Engineering and Technology Group's Photonics Department works in the ultrashort pulse laser laboratory.

National Systems Group

National Systems Group (NSG) serves as the technical "backbone" for the National Reconnaissance Office (NRO) and its mission partners involved in the collection and distribution of national and tactical intelligence • NSG utilizes Aerospace's core competencies and cutting-edge technologies to support the acquisition and operation of major programs • The strategic focus for NSG is to continue to apply strong systems engineering approaches to national intelligence programs in order to provide sound and objective technical recommendations and solutions • The following projects and programs highlight some of the efforts in which NSG has engaged and successfully applied those principles and procedures to support the intelligence community during fiscal year 2010.

- The United Launch Alliance launched a classified payload onboard an Atlas V for the National Reconnaissance Office on Sept. 20, 2010.

IMAGE COURTESY OF ULA

NSG • National Systems Group
Dr. Manuel De Ponte, Senior Vice President

NSG • National Systems Group
Dr. Bernard W. Chau, Vice President

"NSG will play a larger role in the acquisition process with more technical rigor in the requirements and feasibility process, along with advanced system engineering model and simulation capabilities.

NSG will strive toward enhancing interaction with the user base for end-to-end understanding in their requirements/needs, so they can take full advantage of space capabilities and influence acquisition to obtain the necessary capabilities."

• ELECTRONIC PROGRAMS DIVISION

INTERNAL MANPOWER ASSESSMENT (IMA)
An IMA of a large government program office was requested by the National Reconnaissance Office (NRO). Aerospace responded with an innovative approach that, for the first time, applied analytical techniques and engineering standards to a manpower assessment to include government personnel, Aerospace, and contractors. The IMA forecast ahead three years, so that the government could formulate its staffing plans accordingly. Beginning with the Aerospace Mission Assurance Standard Template, the Aerospace team constructed a detailed program statement of work (SOW) for the targeted program office.

The methodical, analytical approach of the Aerospace IMA was so successful that it was briefed to the NRO's principal deputy director, who subsequently took action to institutionalize the process within the NRO Human Resources Office.

• IMAGERY PROGRAMS DIVISION

NEXT GENERATION ELECTRO-OPTICAL (NGEO)
NSG worked closely with the NRO during the past fiscal year, furthering the progress of the NGEO program. The Aerospace technical team provided an in-depth analysis of requirements for the system requirements review, and was critical to the production of the many artifacts needed for the major milestone. Aerospace worked together with the contractors to ensure the review process would be successful and that the program could successfully enter the next phase of acquisition.

KEY TECHNOLOGY AREAS Aerospace continues to provide crucial technical and laboratory resources for imagery intelligence programs. At this time, there are several key technology areas where Aerospace labs are providing actionable data, including high-performance coatings, control moment gyro bearings, and energy generation and storage. The information, produced both analytically and through testing, will be used to ensure a high level of technical maturity for fielded designs.

• SYSTEM ENGINEERING AND GROUND DIVISION

GROUND ENTERPRISE MAJOR SYSTEM ACQUISITIONS The Ground Enterprise Program successfully completed an Acquisition Review Board, chaired by director of the NRO Bruce Carlson, and was approved to move forward with the FY10-12 acquisitions. This event concluded an 18-month effort to bring the customer's first nonsatellite major system acquisition to a milestone decision authority review board. The Aerospace Corporation used its strong systems engineering and acquisition experience and organization-wide collaboration to help the Ground Enterprise Division overcome many challenges of this pathfinder activity. The Aerospace Corporation's "backplane" was key to the collaborative efforts throughout this process and helped facilitate refining the acquisition strategies and products of the new integrated ground capability.

The Ground Enterprise Program consists of a total of more than 50 contracts and continuous orchestration of acquisition activities as the projects deliver capabilities to mission ground stations. The projects are grouped into four functional areas: command and control, mission management, mission applications, and frameworks and services. Aerospace provided key support to an overarching core team and the teams that supported each functional area. The core team managed the enterprise picture for the Ground Enterprise Directorate (GED) and served as the glue between the functional teams.

• Official seal of the National Reconnaissance Office (NRO). The National Systems Group provides important technical support to the NRO and the nation's intelligence community.

Aerospace provided vital support to developing acquisition strategies, project requirements, integrated schedules, and risk assessments to feed the development of cost data sheets and independent cost assessments. Aerospace also provided independent reviewers to assess the overall set of four functional programs. The result was a very successful acquisition review board, resulting in the decision for GED to codify its baseline and continue with the FY10-12 acquisitions.

PUSHING ANALYTICS TO THE DATA-UTILIZING CLOUDS FOR THE "DISADVANTAGED USER" As the ground enterprise moves to service-based architectures, large stores of data become accessible to an expanding community of diverse users. Challenges emerge in securing sufficient bandwidth to move ever larger data transfers over limited communication lines, and providing necessary processing for user-specific customization of Intelligence products. In order to deal with this increase of raw data and the need for customized intelligence products, several new areas of emphasis are under consideration. One area of current work involves positioning processing closer to the data sources, minimizing communication bandwidth requirements. The second area of emphasis is the production of on-demand customized intelligence products through automated analytics and associated workflows. Aerospace SEGD and CSD have collaborated on this dual problem set, developing some important pathfinder prototype technologies that leverage the use of cloud-based storage and computing with distributed Pypes- based workflow models.

Aerospace has designed and implemented a prototype service that demonstrates dynamic on-demand computing across a cloud with realtime results delivered to a user display. The demonstration "No Fly Zone Alert" correlates live CONUS air traffic flight paths against specified no-fly zones, such as nuclear power plants or military installations. Thousands of flights are processed every second, and the current location of every flight is compared against no-fly zone areas for the entire country. The processing functions are distributed over the cloud hardware and the results transferred to the end user, by only refreshing a screen with the set of results. This service in both application and architecture is of immediate interest to NRO's Mission Support Group.

NRO INTEGRATED ARCHITECTURE AND INVESTMENT PLANNING The Office of Chief Architect (OCA) at the NRO was established to provide an enterprise view across all the directorates to determine the best investments for the future of the NRO and to provide advice to NRO leadership. The detailed process for implementing these OCA responsibilities was developed and applied by The Aerospace Corporation, using its strong systems engineering and architecting expertise coupled with its substantial knowledge of the NRO architecture and ways of doing business. The first application of this integrated architecture and investment (IAIP) process was led by Aerospace with key support from several Aerospace technical staff, who provided both portfolio planning and domain subject matter expertise. A significant output of this process is the NRO Enterprise Plan (NEP).

The NEP is a key part of NRO's annual planning and programming cycle that defines the long-term NRO roadmap in terms of strategic thrusts and architecture vectors; communicates short-term and long-term investment opportunities consistent with the priorities of the NRO and the Intelligence Community; and outlines specific actions, decisions, and key financial changes to achieve the desired attributes of the future NRO Mission Architecture. The NEP also captures key decision points, offering the best enterprise-wide opportunities for

improved efficiency, integration, and innovation. The results of the IAIP process are used to inform the content of the annual technical planning guidance provided to all the acquisition directorates. IAIP process results include instructions for each program based on the specific actions needed to implement agreed-to architectural changes.

During the first implementation of this process, mission and enterprise capability gaps were identified. From this were derived the strategic thrusts and related architecture vectors. These vectors were used as the "ends objectives" in assessing and prioritizing the investment opportunities. The result of this assessment was an enterprise study plan laying out the business-case analysis activities for the highest priority opportunities over the course of the next two years. The IAIP process will be performed yearly to inform the annual budget formulation process.

• MISSION ENABLING OPERATIONS DIVISION

CLEAN ROOM TO CLEAN ROOM STUDY

Due to schedule concerns that could impact mission operations, NRO Director Bruce Carlson requested that Aerospace perform a detailed assessment of the clean room to clean room (C2C) concept of operations to include the spacecraft transportation processes, and provide him feedback prior to commencing with mission operations. The Aerospace Launch Directorate formed a team including launch base expertise and space vehicle program personnel to assess all facets of the C2C operations. Aerospace also defined clear objective risk assessment criteria as a tool in the review execution. Aerospace identified several issues associated with the C2C operations, and identified risk mitigation measures to lower the C2C risk posture to include additional trailblazer operations and/or alternative operations. These risk mitigation measures were accepted by the Office of Space Launch operations team and were implemented as part of the C2C mission operations. In the end, all transport operations incorporating the C2C concept of operations were performed without issue, leading to successful transport and maintaining mission schedule without compromising mission success.

NSG LAUNCH DIRECTORATE MISSION ASSURANCE SUPPORT FOR NROL-41

Several years of spacecraft integration efforts culminated in the successful launch of the NROL-41 mission aboard an Atlas-V (501), which lifted off from Vandenberg Air Force Base on Sept. 20, 2010. The launch placed its NRO spacecraft into a perfectly prescribed orbit.

The NROL-41 mission was the first Atlas-V five-meter-payload-fairing mission for the NRO. The mission presented several unique mission assurance challenges, and as the NRO works through its highest launch tempo in 25 years, the Launch Directorate continues to implement, improve, and hone prudent mission assurance practices and tools to provide the Office of Space Launch (OSL) with focused mission assurance support.

The Launch Directorate's Mission Assurance Team (MAT) is a key element of mission assurance for the OSL and consists of a multiorganizational, multidisciplinary team of technical experts with a focus on specific areas that could pose increased risk to mission success, including first flight items, systems with in-spec but out-of-family conditions or off-nominal data sets, Class I and II changes, and resolution of prior flight anomalies.

Key verification tools are implemented by the Launch Directorate to plan, document, and execute mission assurance work; those tools include the Integration Verification

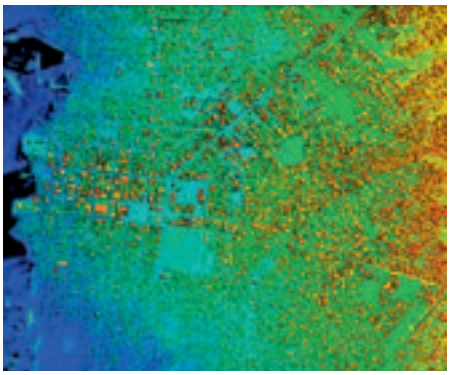


IMAGE COURTESY OF MIT LINCOLN LABORATORY AND NGA

• Elevation map of Gonaives, Haiti, derived from Airborne Ladar Imaging Research Testbed (ALIRT) airborne platform. Color scale represents elevation above sea level from low (blue) to high (red).

Matrix (IVM) and the Launch Site Verification Matrix (LSVM). The IVM tool focuses on planning and documenting the mission assurance efforts related to the verification of mission-critical launch vehicle to space vehicle interface control document requirements. The LSVM tool focuses on planning and documenting mission assurance efforts related to launch site facility and infrastructure readiness, integrated launch vehicle/spacecraft processing, launch base procedure reviews, and applicable system safety verifications. It is through the use of these tools that Aerospace documents and maintains an accurate accounting of all verification work planned and executed leading up to flight readiness and day-of-launch operations.

Aerospace focused on several technical challenges and issues throughout the processing of the NROL-41 mission, and leveraged expertise from the independent MAT and the Launch Directorate chief engineer to come to resolution on technical risks impacting the mission. NROL-41 technical challenges and issues included payload fairing separation system qualification, where the Launch Directorate played an integral role in defining revised test plans and executed independent tests in Aerospace laboratories to clear the system for flight. The directorate also examined Centaur forward-load reactor separation nut application issues, for which the Launch Directorate devised an ultrasound technique to inspect the torque of flight bolts, ultimately leading to removal and replacement of suspect critical flight hardware. These mission assurance efforts culminated in very successful missions for the NRO.

• ADVANCED TECHNOLOGY DIVISION (ATD)

TECHNOLOGY READINESS ASSESSMENTS As part of the corporation's systems analysis and evaluation role, ATD performed an independent evaluation on an advanced antenna technology development activity. The purpose of the independent evaluation was to validate the current progress of the program toward its goals and to provide objective judgment as to whether the current program plans will enable completion of the final goals within cost and schedule. The effort required Aerospace subject matter experts to work with the transition target satellite program office to clearly understand the project objectives, as well as with the executing technology development program office and its contractor to evaluate the technology and plans.

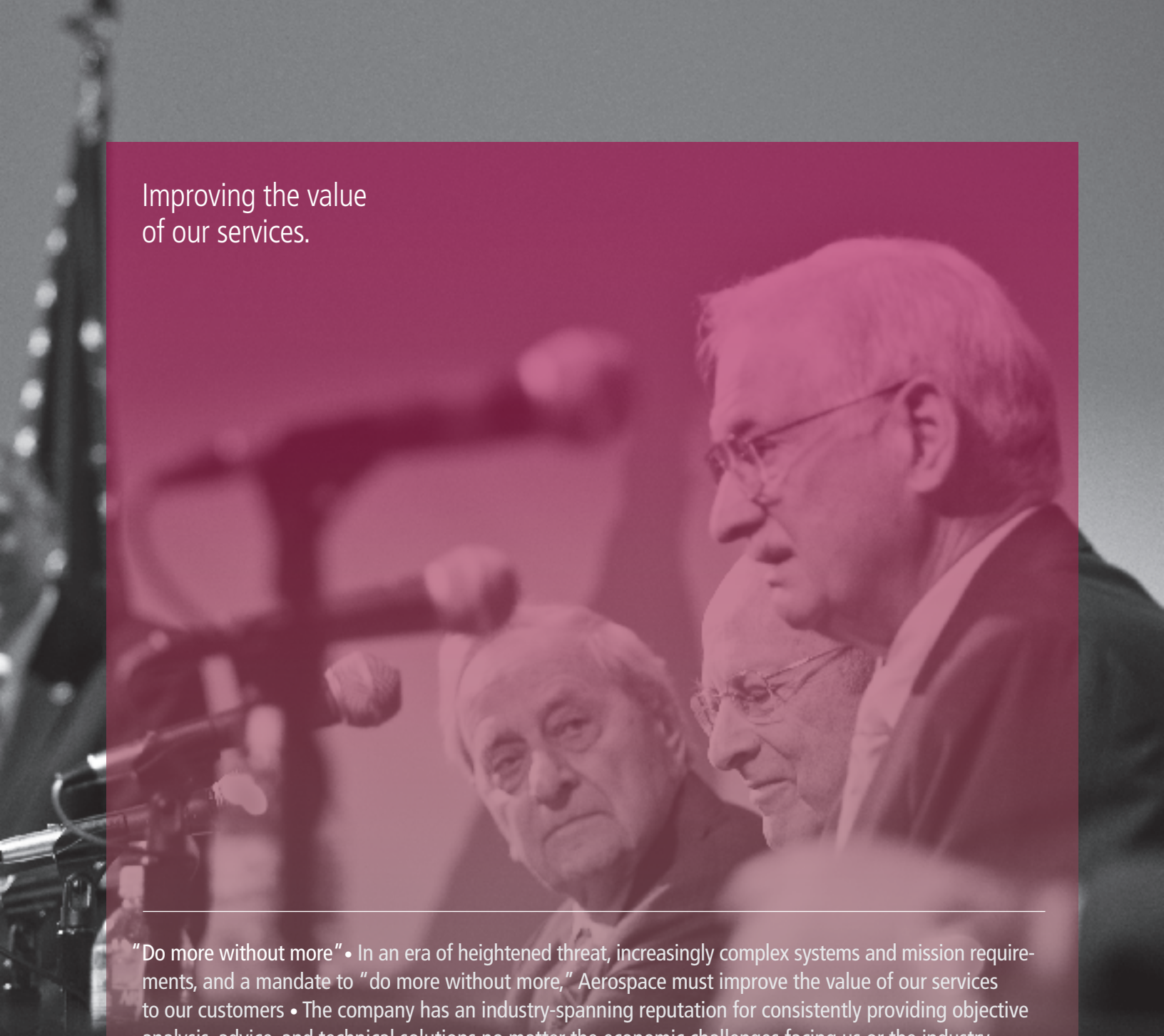
NATIONAL AIR AND SPACE INTELLIGENCE CENTER (NASIC) REVIEWS Aerospace conducted three reviews for the NASIC GEOINT/MASINT Innovation and Production Squadrons. The studies focused on defining and improving the squadrons' acquisition and development processes. Aerospace personnel from the Engineering and Technology Group and the local NASIC office reviewed the Cobra Brass F readiness, Integrated OPIR TPED System architecture, and squadron processes. The studies identified specific opportunities for both system and process improvements with suggested action plans. Several plans are being implemented with others still in consideration.

SUPPORT TO HAITI EARTHQUAKE Aerospace personnel performed processing and exploitation of data from the the Airborne Ladar Imaging Research Testbed (ALIRT) airborne platform – the first-ever insertion of Geiger-mode (photon-counting) into DOD operations. On Jan.15, 2010, U.S. Southern Command/J2 issued a Request For Forces for the ALIRT platform to deploy in support of Haiti earthquake relief efforts. In response, Aerospace personnel were on the ground in Miami the following day as part of a team of National Geospatial-Intelligence Agency, federally funded research and development center, contractor, and other government personnel, supporting data processing and product development over the ensuing four weeks. Of particular importance were the data products that identified the movements of internally displaced persons (IDPs), enabling commanders to direct aid distribution based on conditions on the ground. Other exploitation tools established lanes of trafficability, enabled selection of equipment and manpower for clearing debris, and influenced IDP camp resettlement location away from flood-prone areas. In all, over 7300 unique data products were produced and, based on the utility of the products, the ALIRT team was asked to extend the original two-week deployment to four weeks. •

NSG • Digital Electro and Electromagnetics Dept.
Catherine Zanetti, Member of the Technical Staff

"Aerospace is a great place to work, not only because of the wide variety of interesting and challenging projects, but also because of the true dedication of the people with whom I interact."

Improving the value of our services.



"Do more without more" • In an era of heightened threat, increasingly complex systems and mission requirements, and a mandate to "do more without more," Aerospace must improve the value of our services to our customers • The company has an industry-spanning reputation for consistently providing objective analysis, advice, and technical solutions no matter the economic challenges facing us or the industry.

Supporting our customers • As lean times come once again, the company will work to enhance our support to our customers in a number of areas, refocusing our efforts to improve the effectiveness of our mission assurance practices; support of program management processes that will lead to better acquisition strategies; our capabilities to support space systems that can withstand cyber attacks; and the effectiveness of ground systems and flight software for space systems • Aerospace's dedication to improving in these areas, among many others, will serve to revalidate the corporation as the premier technical resource for national security space.

- The Aerospace Corporation's National Reconnaissance Office program directors are shown during a panel discussion that provided a retrospective look at Aerospace's efforts in support of the intelligence community during the company's 50-year history.

Systems Planning and Engineering

Systems Planning and Engineering (SPE) provides analysis-based decision support to senior leaders on space architectures, developmental planning, system-of-systems engineering, threat reduction, and mission assurance that help shape future national security space (NSS) missions • SPE provides a broad range of services across the NSS enterprise, and supports two major NSS customers – the Missile Defense Agency and Air Force Space Command.

• Dr. Mal De Ponte (left) and Rand Fisher (top center) attended the 2009 Mission Assurance Summit, along with Bruce Carlson (right), the director of the National Reconnaissance Office.

SPE • Systems Planning and Engineering
Rand H. Fisher, Senior Vice President

"The next 30 years will see greater emphasis and dependence on space-based systems as they become increasingly embedded into the global economy and our national security.

SPE is working to develop improved tools, architectures, and processes to better inform decisionmakers, with the goal of increasing our contributions and impact across the space enterprise."

• MISSILE DEFENSE DIVISION

The mission of the Missile Defense Agency (MDA) is to develop and field an integrated Ballistic Missile Defense System capable of providing a layered defense for the homeland, deployed forces, friends, and allies against ballistic missiles of all ranges in all phases of flight. Aerospace has made key contributions in systems architecting and engineering, mission assurance, space system integration, and evaluation and insertion of advanced technology. The current operational system includes ground-based interceptors, Patriot Advanced Capability-3, Standard Missile Sea-Based Interceptors, Aegis Ballistic Missile Defense, Terminal High Altitude Area Defense, various ground- and sea-based radars, and Defense Support Program satellites. Current experimental systems that are operating include the Space Tracking and Surveillance System (STSS), the Near-Field Infrared Experiment (NFIRE), and the Airborne Laser Test Bed (ALTB).

Aerospace provided extensive mission-assurance and operations support to STSS, two demonstrator satellites launched in 2009, providing expertise during on-orbit checkout to resolve a number of anomalies and to assist in the calibration of the acquisition and track sensors. The corporation was also instrumental in the development of the STSS Data Analysis Center (SDAC) and has conducted an analysis of flight tests and real-world events on a daily basis. The SDAC results have anchored Aerospace simulation tools, benchmarked the contractor's models, and been used in flight-test reports to MDA.

Aerospace provided mission-planning activities for NFIRE, a ground segment and space vehicle that gathers thrusting-target plume phenomenology data and characterizes performance of high-data-rate information transfer. Experiments continue with the laser communication terminal (LCT) on NFIRE. In addition to the LCT experiments, measurements have been made by the track sensor payload and have included ground-site static motor firings and other targets of opportunity.

Aerospace contributes to development of the Precision Tracking Space System (PTSS) program by providing spacecraft, ground, and optical payload acquisition expertise. PTSS is a new, innovative acquisition program in which DOD laboratories are developing prototype satellites. Acquisition responsibilities for operational satellites and the ground segment will transition to industry. Aerospace is helping the government develop the PTSS acquisition strategy and program management plans by seeking ways to ensure that lessons learned from the STSS program are incorporated into the PTSS program.

The ALTB program achieved a major success this year, executing the first-ever shoot down of a threat-representative ballistic missile, known as foreign military asset (FMA). The FMA was launched from a mobile platform and engaged by the ALTB shortly thereafter. This marked the first time a FMA has been destroyed in boost phase by any missile defense system, and the first time any directed energy system has destroyed a FMA in any phase of flight. Aerospace's planning, development, integration, and test contributions were integral to this historic event.

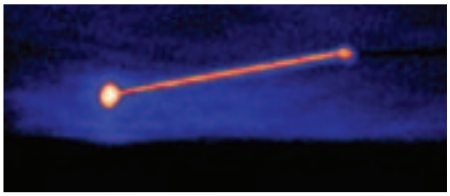


IMAGE COURTESY OF MDA

• An infrared image of the Missile Defense Agency's Airborne Laser Test Bed (right) destroying a threat-representative short-range ballistic missile target (left).

SPE • Strategic Space Operations
Catherine J. Steele, Vice President

"The need for Aerospace will only increase during the next 30 years. Aerospace participation in space control, space protection, and nuclear operations will grow as our government customers recognize our mission assurance and technical capabilities as well as the insight that we offer.

We will see improved capabilities and techniques to provide the government better space situational awareness. National security space partners will become much more aware of other team members' assets."

• STRATEGIC SPACE OPERATIONS

SUCCESSFUL FORCE DEVELOPMENT EVALUATION (FDE) LAUNCH Aerospace supports nuclear operations mission assurance through the Air Force Nuclear Weapons Center (AFNWC). The FDE program is comprised of three launches of Minuteman missiles each year, one from each operating base. Launch was originally scheduled for November 2009, but a combined Air Force, contractor, and Aerospace technical team convinced AFNWC to slip the launch due to the high risks of a stage-one flight controls battery and hydraulic system issues. The components questioned by the combined technical team were replaced, and the launch was successfully conducted in June 2010.

COMMERCIAL RADAR OPERATIONAL SUPPORT TO SOUTHCOM (CROSS) JOINT CAPABILITY TECHNOLOGY DEMONSTRATION (JCTD) Air Force Space Command (AFSPC) commander requested that the Space Innovation and Development Center and AFSPC Directorate of Requirements develop a combatant commander-responsive commercial overhead radar architecture. Aerospace was instrumental in the development of this architecture, leveraging years of previous space radar analysis, requirements, and operating concepts development. The CROSS JCTD will demonstrate the ability to task, on-demand, three commercial radar constellations and receive unclassified imagery to support U.S. Southern Command (USSOUTHCOM) operations and contingency-planning activities. This capability will provide USSOUTHCOM the ability to fulfill unmet lower-resolution imagery tasks (e.g., Haiti earthquake relief, Gulf oil spill, etc.) within its area of focus.

MILSATCOM WAY FORWARD Aerospace continued to provide technical leadership to AFSPC on the MILSATCOM Way Forward and the Joint Space Communications Layer Initial Capabilities Document, which will serve as the foundation for acquisition decisions for the next generation of military satellite communications systems.

DEFENSIVE SPACE CONTROL JOINT TEST AND EVALUATION Aerospace served as AFSPC's technical lead and interagency liaison for efforts supporting the development and execution of the Joint Jamming Assessment and Mitigation Joint Test (JJAM/JT). Due to the exceptional technical analysis supporting the proposal and the feasibility study, the secretary of defense's senior advisory council ranked it as the number-one proposal and chartered its execution as a formal, three-year JT. The JT enables satellite communications users to be better equipped to recognize, report, and operate through adversary interference tactics and capabilities.

IMAGE COURTESY OF MACDONALD, DETTWILER AND ASSOCIATES LTD.

• This image of the earthquake-stricken areas of Port-au-Prince, Haiti, was taken in January 2010 by the RADARSAT-2 satellite. Such images aid in assisting the U. S. Southern Command with fulfilling its lower-resolution imagery tasks.

DOD AND AIR FORCE WARGAMING SUPPORT Aerospace was instrumental in the development and organization of a Commercial Space Wargaming Seminar held March 31 – April 1, 2010, and played a major role in game design, analysis planning, development, and execution of Schriever Wargame 10 (SW10). Aerospace provided extensive technical support to both the Higher Level and Allied High special classification cells at SW10, and these special cells enabled senior leadership to witness first-hand the impact of classified space and cyber capabilities on future warfare.

- Aerospace assisted Air Force Space Command and the Unified Engagement Wargames with the development and organization of Schriever Wargame 10.

TACTICAL SURVEILLANCE TECHNOLOGY The Air Force Research Laboratory (AFRL) is executing a portfolio of rapid-reaction projects to apply emerging technology to tackle the challenges faced in military operations for force protection. One such project utilizes a small tactical, remotely piloted aircraft with a miniature, advanced day-night imager to support intelligence, surveillance, and reconnaissance missions. This system was developed and demonstrated during 2009 and deployed to theater for operational evaluations. Since November 2009, it has provided many hours of full-motion imagery for both day and night operations. Aerospace held central roles in the system engineering, providing project technical oversight and participating in daily teleconferences with operators to assess the system and plan for future upgrades. Based on the success of this program, two additional upgraded systems are under development for deployment in FY11.

RAPIDLY DEPLOYABLE SPACE CAPABILITIES BASED ASSESSMENT (RDS CBA) Aerospace provided significant support to the RDS CBA initial capabilities document (ICD) through the Joint Staff review process in FY10. USSTRATCOM submitted the ICD for Joint Requirements Oversight Council (JROC) approval. Upon JROC approval of the RDS ICD, the national security space (NSS) community will have a second key foundational document providing operationally responsive space infrastructure and capability needs.

IMAGES COURTESY OF USAF-AFRL

- Small surveillance aircraft just prior to launch by tactical launch mechanism.
- Small surveillance aircraft immediately after launch. Such aircraft provide protection for U.S. forces in the field.

IMAGE COURTESY OF ULA

- A Delta IV Heavy successfully launched the NROL-26 classified payload for the National Reconnaissance Office on Jan. 17, 2009.

• NATIONAL SPACE SYSTEMS ENGINEERING (NSSE)

NSSE provides technical analysis and decision support through staff assigned directly to senior Defense Department leadership within the Pentagon. This "Pentagon connection" also provides critical situational awareness for customers and the corporation.

KEY STUDIES FOR THE OFFICE OF THE SECRETARY OF DEFENSE At the request of Defense Research and Engineering, Aerospace led the system security engineering review of more than 20 program-protection plans, identifying significant program-protection issues. Aerospace also engaged with the services to develop action plans and is providing support to resolve the issues.

Aerospace's Communications Architecture Systems Assessor was used to evaluate multiple options for the satisfaction of growing airborne intelligence, surveillance, and reconnaissance requirements by various communication architectures. Study results were again used to inform Defense Department investment decisions for FY12 and beyond.

Aerospace's Center for Space Policy and Strategy also made significant contributions to the development and review of the Space Posture Review, the National Space Policy, and the National Space Strategy.

KEY STUDIES AND ACTIVITIES FOR THE SECRETARY OF THE AIR FORCE As part of the evolved expendable launch vehicle (EELV) tiger team chartered by Air Force Space Command and the National Reconnaissance Office, Aerospace helped create a new rate-based, block-buy acquisition strategy and business case for the EELV program. The new strategy has already been reflected in the FY12 budget, with a procurement rate of eight launch vehicle cores per year starting in FY13. The approach stabilizes the launch industrial base and promises to control future launch costs.

- Official seal of the Office of the Secretary of the U.S. Air Force. Aerospace assisted the secretary of the Air Force with the creation of a new rate-based, block-buy business strategy and business case for the evolved expendable launch vehicle program.

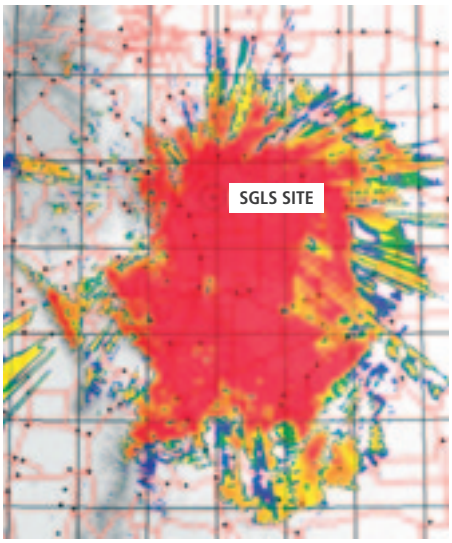
DEVELOPMENTAL PLANNING AND ARCHITECTURES

DEVELOPMENT PLANNING Aerospace supports the Space and Missile Systems Center's developmental planning directorate efforts to create developmental plans (DPs) for Air Force Space Command space mission modernization by developing tools to implement plans, and demonstrations to reduce program risk. Aerospace completed the next-generation spacelift DP that serves as a long-term architectural blueprint intended to improve affordability, responsiveness, and reliability via a reusable booster system (RBS). The RBS can be integrated into a family of expendable stages to support the full range of DOD payloads, from small operationally responsive payloads to heavy geosynchronous missions. Aerospace is also exploring responsive, affordable, and efficient means to augment space missions, including pico- and microsatellite capability, dedicated small-satellite launch vehicles, rideshare, and secondary mission hosting.

Aerospace was the technical lead for the Commercially Hosted Infrared Payload, which will demonstrate wide-field-of-view infrared space technology and the associated ground algorithms essential to effectively exploit this new capability, while also serving as the pathfinder for hosting military payloads on commercial space missions.

CYBER SECURITY AND MISSION ASSURANCE Emphasis by the current administration, U.S. Strategic Command, and Air Force Space Command on cyber security and mission assurance has increased awareness of both the National Reconnaissance Office and Space and Missile Systems Center customers of the Department of Defense Instruction 8581.01 requirements to certify and accredit both space vehicles, as well as their terrestrial and industrial-based support systems. This coincides with increased focus from the Office of the Secretary of Defense on program protection planning, supply-chain risk management with respect to information assurance/cyber vulnerabilities, and industrial-based cyber security related to space system development. Aerospace support includes information assurance assessments, risk assessments, and policy development.

OPTIONS FOR SPECTRUM REALLOCATION The president has requested that the National Telecommunications and Information Administration and Federal Communications Commission make available 500 MHz of radio frequency spectrum over the next 10 years for commercial wireless broadband use. The Space Ground Link System (SGLS) uplink band is only one of the bands being considered for reallocation. Department of Defense satellite systems use this frequency band for transmitting commands during launch, early orbit, and anomaly correction. Aerospace has identified options available to Space and Missile Systems Center that define conditions needed to mitigate harmful impact to SGLS operations in the event of any future spectrum reallocation.



- Typical interference levels from a typical Space Ground Link System (SGLS) antenna. These must be considered when identifying spectrum policy options.

- An issue of the Mission Assurance "Getting It Right" newsletter.

CORPORATE CHIEF ENGINEERING OFFICE (CCEO)

The CCEO completed its second year of operations and continues to elevate its visibility and expand the coordination and consistency of cross-program and mission assurance (MA) initiatives across our customer base. On pace with the urgency of national security space (NSS) "back-to-basics" tenets that will enable space program offices to build and field user space and ground capabilities more efficiently, the CCEO is focused on becoming a mission success communication hub for the govern-ment, contractors, suppliers, and other stakeholders. The office serves as a central resource for MA guidance and verification management tools, and delivers a cross-program, data-informed perspective on NSS acquisition issues. In FY10, CCEO:

- Developed an architectural framework for Aerospace technical instructions and procedures that form the beginnings of a formal quality management system that will be put into place in FY11. These technical documents are the core of corporate policies and practices and are under a formal governance and configuration management process.

- Continued to operationalize the mission assurance verification system and tool (Integrated Mission Assurance Tool – iMAT) in programs with a major focus on software enhancements, workforce development, and strategic planning. Formal configuration control boards are in place for both the software and the Mission Assurance Technical Baseline database.

- Developed and released a bimonthly MA newsletter, "Getting It Right," focused on collaborative forums such as the Space Quality Improvement Council (SQIC), Space Supplier Council, and others. The newsletter is widely disseminated throughout the industry, and several prime contractors publish the newsletter on their internal websites.

- Facilitated collaborative government and industry forums, including such as: the SQIC, the Space Suppliers Council, the Mission Assurance Improvement Workshop, monthly Chief Engineer Forums with contractors, and the NSS Mission Assurance Summit. The CCEO developed a formal action item tracking process across all of these forums.

- Initiated studies responding to customer requests for guidance as diverse as formal assessment criteria for test-like-you-fly, trends in satellite development practices, the value and cost impacts of mission assurance, late-cycle escape assessment process, hardware sell-off criteria, MA guidance, and firm fixed-price contracting lessons. •

SPE • Strategic Awareness and Policy
Karen Cuni, Assoc. Member of the Technical Staff

"Project West Wing has allowed me to develop a unique skill set in support of our national security space customers.

Though I am a relatively new employee, I am proud to have the opportunity to contribute original research that advances our technical intelligence mission."

We are committed to mission success.

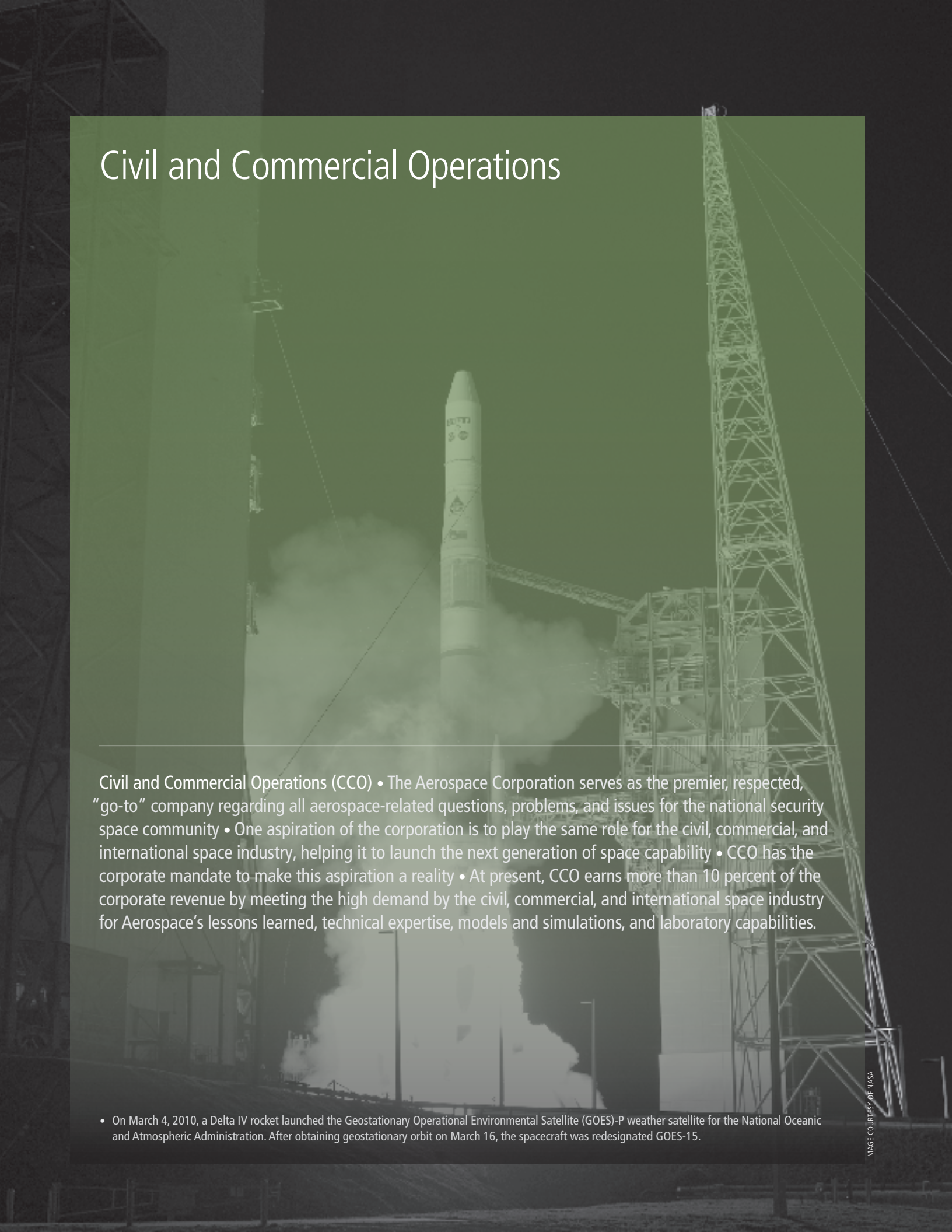
Nothing is constant but change • Rapid technology advancement, the ever-changing geopolitical environment, and the continual influx of new participants into the space arena requires experts in the field of space and space technology to adapt quickly in order to stay ahead • The ability to address such dynamic events – and indeed, to anticipate them well in advance – has been an Aerospace hallmark for more than 50 years • Our customers have long benefitted from the corporation's renowned ability to forecast future needs and developments.

The future will hold new challenges • cyberwarfare, mission assurance, space situational awareness, acquisition efficiency • To remain a world leader in space and space technology, Aerospace will adapt quickly, with redoubled effort and innovation, anticipating and addressing these challenges, and providing our customers now and in the future with the technical expertise and dedication to mission success that they have come to expect and depend upon from the corporation since the beginning of the space age.

- Mark Baldwin, the mission assurance director at Raytheon Co., and Dr. Malina Hills, of The Aerospace Corporation, attended the 2009 Mission Assurance Improvement Workshop.

Civil and Commercial Operations

Civil and Commercial Operations (CCO) • The Aerospace Corporation serves as the premier, respected, "go-to" company regarding all aerospace-related questions, problems, and issues for the national security space community • One aspiration of the corporation is to play the same role for the civil, commercial, and international space industry, helping it to launch the next generation of space capability • CCO has the corporate mandate to make this aspiration a reality • At present, CCO earns more than 10 percent of the corporate revenue by meeting the high demand by the civil, commercial, and international space industry for Aerospace's lessons learned, technical expertise, models and simulations, and laboratory capabilities.



- On March 4, 2010, a Delta IV rocket launched the Geostationary Operational Environmental Satellite (GOES)-P weather satellite for the National Oceanic and Atmospheric Administration. After obtaining geostationary orbit on March 16, the spacecraft was redesignated GOES-15.

IMAGE COURTESY OF NASA

CCO • Civil and Commercial Operations
Gary P. Pulliam, Vice President

"We will see pico-and nanosatellites being used in operational ways, and we will see the commercial sector taking over mission areas reserved today for the government. Aerospace's civil and commercial work will engage in all these areas, to serve our nation, our customers, and our company in the best way possible.

Over the next few decades, we will see dramatic developments in robotic capabilities. We will see continued miniaturization of parts to control size and weight of payloads to space."

Since CCO's inception in 1994, the largest portion of our work has been in support of NASA, followed by the National Oceanic and Atmospheric Administration's (NOAA's) civil weather and environmental satellite programs. CCO has also served national executive departments, states, nonprofit organizations, commercial, and international companies. The work performed by CCO for civil, commercial, and international customers directly supports and enhances the mission of the corporation. First, CCO work increases the corporate bottom line revenue. The revenue stream from civil, commercial, and international business contributes to the corporation's financial stability going forward. Second, CCO work provides diverse technical knowledge.

Third, and most importantly, CCO work enhances our mission assurance capabilities for national security space customers. The U.S. military depends on Aerospace to provide a full understanding of the diverse technologies and processes being used by civil, commercial, and especially international satellite and launch operators.

The technical expertise and lessons learned from assisting civil, commercial, and international programs help our national security customers become smarter consumers in acquiring new systems, and also helps them steer clear from the dangers of taking the wrong technical path.

CCO is organized to support customers in three primary areas: NASA programs; NOAA programs; and commercial, international, and Homeland Security programs. During the past fiscal year, NASA programs comprised over one-third of the work Aerospace performs that is not related to national security. NOAA programs comprised nearly one-third, and the remainder of CCO's efforts served commercial, international, and other civil customers. CCO manages the entire portfolio and performs one-third of the tasks across the customer base. The FY10 highlights in the three principal areas highlighted below have also drawn on Aerospace resources beyond CCO.

• NASA PROGRAMS SUPPORT

NASA HEADQUARTERS – CONGRESSIONAL QUESTIONS REGARDING SUPPORT TO THE AUGUSTINE COMMITTEE Aerospace submitted written answers to a dozen questions that the House Science and Technology Committee's Space and Aeronautics Subcommittee put forth regarding Aerospace technical, cost, schedule, and affordability analyses performed in support to the Review of U.S. Human Space Flight Plans Committee, also known as the Augustine Committee, during summer 2009. These answers were used during the subcommittee's hearing on March 24, 2010, that examined the president's FY11 budget and questioned the cancellation of the Constellation program.

IMAGE COURTESY OF NASA

- The Review of U.S. Human Space Flight Plans Committee's public meeting, held in Washington, D.C., is shown above. Aerospace performed technical, cost, schedule, and affordability analyses in support of the committee, sometimes known also as the Augustine Committee.

48.

IMAGE COURTESY OF THE NATIONAL ACADEMY OF SCIENCES

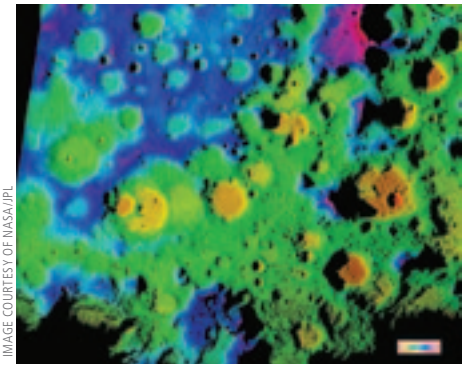


IMAGE COURTESY OF NASA/JPL

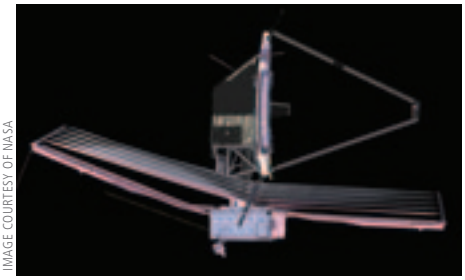


IMAGE COURTESY OF NASA

- The Astro2010 Decadal Survey Report, conducted and released by the National Research Council of the National Academy of Sciences, contained the findings of a survey of astronomy and astrophysics for the coming decade of the 2010s.
- High-resolution topography map of the moon's south pole, generated by scientists at the NASA Jet Propulsion Laboratory using data from the Goldstone Solar System Radar.
- Artist's conception of the James Webb Space Telescope spacecraft.

NATIONAL RESEARCH COUNCIL (NRC) RELEASE OF THE ASTRO2010 DECADAL SURVEY REPORT Aerospace made significant contributions to the latest NRC Decadal Survey. The task was led by CCO, but also involved support from the Engineering and Technology Group. This is the first NRC Decadal Survey that was required to obtain independent estimates of the cost and technical readiness of its proposed missions. For Astro2010, the NRC created a cost, risk, and technical evaluation process that involved hiring The Aerospace Corporation as an independent contractor. The Astro2010 report emphasizes that the contractor operated independently of the committee "so that their final analysis was free from undue influence by either the committee itself or by interests outside the [decadal] survey... Equally important to the independence of the contractor is the committee's responsibility for reviewing the contractor's work and exercising its judgment in accepting the contractor's results."

JET PROPULSION LABORATORY (JPL) LUNAR TOPOGRAPHIC MAPPING Aerospace-developed radar signal processing image-formation algorithms were used to process Earth-based Goldstone radar data to high resolution imagery of the lunar surface that were subsequently used to generate topographic maps as part of a joint project with JPL. The JPL-funded effort uses the high-power Goldstone radar for detailed investigations of the lunar south pole. In November 2009, Aerospace sent JPL updated and improved image-formation software that achieved 4m x 4m resolution. This efficient image formation software is much faster, and is able to process 100 x 100-km image tiles from 90-minute-long synthetic aperture data in a fraction of the time previously needed. The increased throughput is enabling JPL and Aerospace to generate a high-resolution topographic map covering an approximately 600 x 400-km region of the lunar south pole. The image-formation software, originally developed for Air Force customers, was enhanced to include improved autofocus algorithms, which are more accurate, much more efficient, and can vary the image focus based on variations in terrain elevation. In the future, NASA would like to achieve even higher resolution for the topographic radar maps. Aerospace is also continuing its work on improving the signal processing capability. This mapping project for JPL has provided Aerospace the opportunity to improve tools and image-processing algorithms that will benefit all users of this technology.

NASA HEADQUARTERS – INDEPENDENT COMPREHENSIVE REVIEW PANEL FOR JAMES WEBB SPACE TELESCOPE (JWST) In a June 2010 letter to NASA Administrator Charles Bolden, Sen. Barbara Mikulski (D-Maryland) expressed concern about JWST cost growth and schedule delays. Mikulski requested an independent and comprehensive review of JWST to examine the root causes of the cost growth and schedule delay, current plans for completion, cost-reduction measures, and the cost to complete the project. In response, the NASA associate administrator chartered the Independent Comprehensive Review Panel (ICRP) to address these four items. Aerospace supported the ICRP, acting as the executive secretary for the panel and performing cost-risk assessments. Aerospace examined historical cost-growth trends as a function of mission type and complexity in comparison with the JWST predicted cost at completion.

This analysis showed that the complexity of the mission may be underestimated,

resulting in an overly optimistic prediction of final cost. It was also determined that the project's reserve level is significantly below historical experience. Next, Aerospace developed a tool, based on the project's planned budget profile, to assist the ICRP in defining a realistic reserve posture. This tool was used by the ICRP as the primary means for developing its own internal top-level cost estimate for the project. Lastly, Aerospace performed a preliminary risk-based cost analysis. Through discussions with the contractor project team and internal expert review, Aerospace identified a number of higher-level strategic threats to the JWST program and estimated their likelihood and potential cost and schedule impacts.

• NOAA PROGRAMS SUPPORT

SUCCESSFUL LAUNCH OF GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE (GOES)-15 The GOES system provides a constant perspective of weather system movements, such as hurricanes, and other environmental parameters. The satellite built as GOES-P became GOES-15 on achieving orbit in March 2010. Aerospace engineers contributed to the successful launch by providing support to prelaunch activities as well as on-console support of the launch and postlaunch checkout phases. Specifically, Aerospace personnel served on-console, providing invaluable systems engineering support to all postlaunch testing (PLT) activities, including the trending and analysis of telemetry data during testing activities. Of particular importance was the technical expertise provided to the anomaly investigation and eventual recovery of the Solar X-Ray Imager. GOES-15 successfully completed PLT and was handed over to NOAA as an operations-capable satellite on September 1, 2010. Once placed into operations by NOAA, GOES-15 will provide a continuation of meteorological/environmental data products and services to the GOES data-user community. The GOES program began operations in 1974.

SUPPORT OF NOAA INTERNATIONAL ACTIVITIES NOAA has become increasingly active at the international level, and Aerospace has supported the agency in these activities. Europe's MetOp satellite flies in a polar orbit complementary to the Polar Operational Environmental Satellite (POES) system as part of a joint international polar system. Aerospace provided support to the operational planning for the upcoming launch of MetOp-B, and also provided support to several POES ground system upgrades including new receivers and frame synchronizers. JASON, another NOAA collaboration with Europe, uses NOAA ground stations to deliver sea surface height data. Aerospace played a key role in the development activities for the ground system upgrades necessary for the future launch of JASON-3. Technical support was also provided by the corporation to the Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC), a joint Taiwan-U.S. science mission for weather, climate, space weather, and geodetic research. NOAA collects the raw data and distributes data products from the COSMIC system.

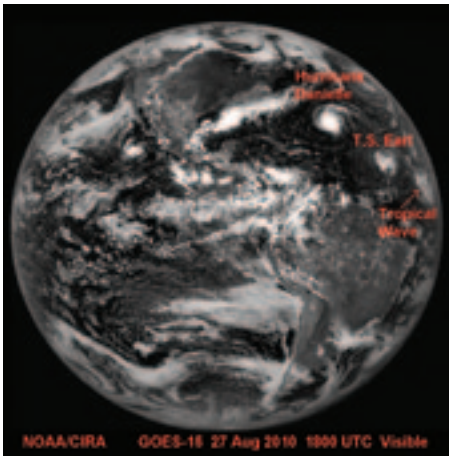


IMAGE COURTESY OF NOAA - CIRA

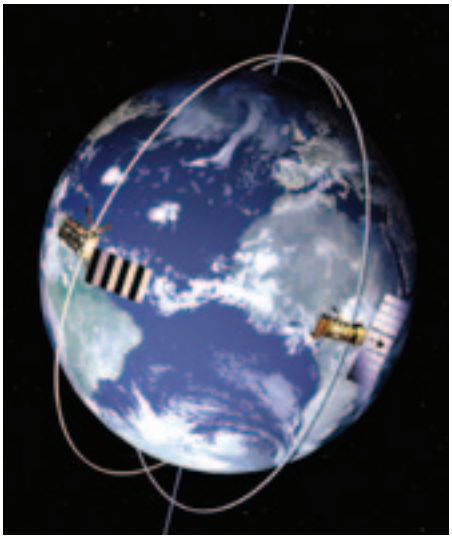


IMAGE COURTESY OF ESA - AOES MEDIALAB

- A visible-light full-disk image of Earth was captured by the NOAA GOES-15 satellite. At the time the image was taken, Hurricane Danielle, Tropical Storm Earl, and a tropical wave were all occurring simultaneously in the Atlantic Ocean basin.

- Artist's rendering of the European MetOp and American NOAA satellites, which both fly in low-Earth polar orbits. In conjunction, these two orbits maximize the coverage provided by the satellites.

• COMMERCIAL, INTERNATIONAL, AND HOMELAND SECURITY PROGRAMS

CONCLUSION OF NORTHROP GRUMMAN AND TRW COMPLIANCE PROGRAM WORK

During June 2010, The Aerospace Corporation concluded seven years of work supporting the compliance officer in verifying U.S. District Court Final Judgment regarding the merger between Northrop Grumman Corporation (NGC) and TRW, Inc. During that time, Aerospace developed and implemented specific processes to monitor and verify NGC compliance with Final Judgment restrictions. At the conclusion of the effort, the U.S. government compliance officer, Joseph Rouge, commended Aerospace efforts in "diligently working to foster an uncommon, but extremely necessary, high level of trust and cooperation to ensure fair competition regarding development, production, and sale of selected reconnaissance satellite systems. Throughout the seven-year period, Aerospace employees fully preserved all U.S. Government rights and equities."

ORBITAL SCIENCES CORPORATION GALAXY 15 ANOMALY INVESTIGATION The Orbital Sciences-built Galaxy 15 spacecraft was successfully launched five years ago and is now owned by Intelsat. On April 5, 2010, Galaxy 15 became unresponsive to telemetry commands, and no telemetry has been received since that date. Although telemetry was lost, the spacecraft's payload continued to operate normally, relying on autonomous onboard systems. Uplink signals captured by the Galaxy 15 are amplified and broadcast back to Earth. This has posed a serious interference problem with all other GEO spacecraft as Galaxy 15 drifts over the U.S. The corporation has assisted Orbital with the investigation and recovery effort for the Galaxy 15 spacecraft. Aerospace supported the development of a fault tree analysis early in the investigation, and assisted Orbital in its review of the space environment during the anomaly.

At Orbital's request, the corporation reviewed Orbital's electrostatic discharge protection procedure and specifications and made several recommendations. Aerospace performed an overall design review of the Orbital spacecraft telemetry front-end electronics and developed failure theories. Additionally, Aerospace assisted Orbital by reviewing its momentum build-up calculations and attitude control data from Galaxy 15 as part of the prediction for eventual reset.

IRIDIUM TECHNICAL DUE DILIGENCE In recent years, the operation of the original Iridium system has been profitable. Iridium Satellite Communications is now doing well, with nearly 80 percent of Iridium's current revenues now coming from the commercial market. Iridium offers both voice and data services, and is used by customers in remote areas. Business growth using small and cheap sensor/transmitter packages has been impressive. Iridium is being used to monitor everything from shipping containers to schools of fish. Iridium is in the process of purchasing a new satellite fleet, and Aerospace has led the technical due diligence effort for the investment banks supporting this new venture. Aerospace's effort was broken into two tasks, one supporting the U.S. Export Import Bank and Lockheed Martin, and the other supporting the French bank Société Générale and Thales Alenia Space. Aerospace reviewed the current performance of the Iridium network and compared this to other competitors in the market. Aerospace reviewed the health of the current constellation, and technical proposals were then reviewed to build and deploy the Iridium NEXT system. The launch segment of the program, in which Space X has been chosen as the primary launcher, was also reviewed. In addition, Aerospace reviewed the industrial base for Iridium user equipment. •

CCO • FBI Programs
Blake Kimbrough, Project Engineer

"After 22 years with Aerospace, it is exciting to be able to continually grow with new and diverse challenges.

As an example, I have recently been able to assist with improving our national security by modernizing investigative case management systems as part of the FBI's SENTINEL program."

We are preparing for change.

Evolving customer diversity • The rapidly changing space environment affects all those with planned or deployed assets, not just those involved with ensuring national security • Scientific endeavors and commercial interests also have a stake in the efficient application of adaptive processes and technologies to their programs • Aerospace is positioned for and dedicated to rapid response to these needs.

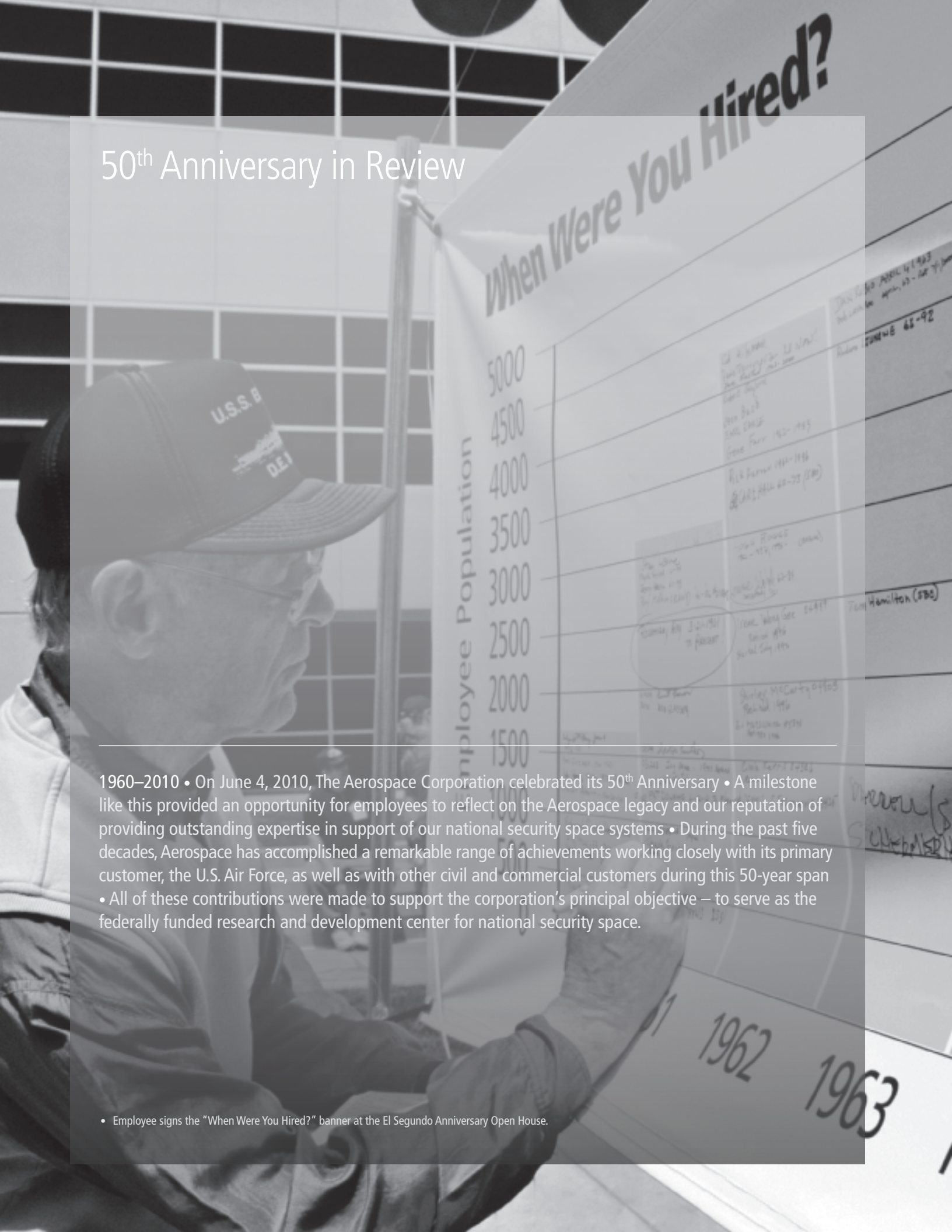
Commitment to our customers • To support these programs, Aerospace will pursue growth opportunities across the space community, to foster relationships and help control costs • The company's technical expertise, techniques, and broad program knowledge can thus be spread uniformly through the extended space community, improving efficiencies and avoiding unnecessary redundancy and lessons-learned "rediscovery" • In this fashion, Aerospace can work with other companies and FFRDCs who also support our customers to produce the best value for those customers and to reaffirm the corporation's role as a leader in space and space technology.

- Michael Moloney of the National Research Council (NRC) presents some of the findings of the NRC's Astro2010 Decadal Study, which anticipates the priorities for the space sciences during the next 10 years.

IMAGE COURTESY OF THE NATIONAL ACADEMY OF SCIENCES/PATRICIA POOLADI

50th Anniversary in Review

1960–2010 • On June 4, 2010, The Aerospace Corporation celebrated its 50th Anniversary • A milestone like this provided an opportunity for employees to reflect on the Aerospace legacy and our reputation of providing outstanding expertise in support of our national security space systems • During the past five decades, Aerospace has accomplished a remarkable range of achievements working closely with its primary customer, the U.S. Air Force, as well as with other civil and commercial customers during this 50-year span • All of these contributions were made to support the corporation's principal objective – to serve as the federally funded research and development center for national security space.



• Employee signs the "When Were You Hired?" banner at the El Segundo Anniversary Open House.

From early assistance on the Mercury and Gemini space programs; to major contributions toward the development of the Global Positioning System; to today's innovative work that will enable us to continue our nation's current superiority in space technology and exploration, the range of Aerospace accomplishments is nothing less than remarkable.

ANNIVERSARY EVENTS The unique role of our company, our people, and our contributions to national security space was commemorated at all of our locations.

ANNIVERSARY SPEAKERS As part of our anniversary celebrations, Aerospace hosted a series of lectures by distinguished speakers who discussed the company's history, programs, and projects. Some of the guest speakers included Gen. C. Robert Kehler, commander, Air Force Space Command; NASA Administrator Charles F. Bolden Jr.; author Jonna Doolittle Hoppes, granddaughter of famed aviator and former member of the Aerospace board of trustees Jimmy Doolittle; and the honorable Michael Donley, secretary of the Air Force.

Distinguished Guest Speaker
Michael Donley, U.S. Secretary of the Air Force

"You have certainly played a valuable role in the defense of our nation for 50 years, touching almost every aspect of military operations.

Throughout this history, you've sustained a strong base of technical talent that we will need going forward."

- Former Aerospace President Pete Aldridge addresses the Chantilly gathering.
- (left to right); Gen. C. Robert Kehler, Dr. Wanda Austin, U.S. Rep. Jane Harman, and Lt. Gen. John T. Sheridan at a 50th event held in Washington, D. C.
- Celebratory cake created with the 50th anniversary emblem for the Houston, Tex., anniversary luncheon.
- NASA Administrator Charles Bolden is presented a commemorative photo by Dr. Wanda Austin.
- At the SMC Commanders Panel, five former SMC commanders discussed their work with Aerospace during a panel discussion.
- NRO Director Bruce Carlson was an anniversary speaker in Chantilly, Va.

Corporate Social Responsibility

CORPORATE SOCIAL RESPONSIBILITY (CSR) CSR involves a merger of business interests and community interests that together help to create a better world for all of us. The Aerospace Corporation's leadership and employees have been committed to the goals of CSR since the company was founded in 1960.

For more than five decades, our employees have been heavily involved in volunteering their time, commitment, and money to educational, social, and environmental programs that help to make a positive impact on society.

This report reflects the variety of CSR efforts and participation of Aerospace employees during FY10.

Educational Outreach

SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH (STEM) Aerospace employees have been deeply involved with President Obama's STEM initiative and are also contributing to the work of STEM's nonprofit organization, Change the Equation. An Aerospace pilot program launched this year in the Washington, D.C., area that partners Aerospace employees with three schools in Maryland and Virginia. The program is designed to offer employees a variety of ways to support STEM in local schools, while at the same time complementing the education programs in the schools.

MENTORING ACTIVITIES Aerospace mentoring activities during FY10 included the sponsorship of two robotics teams at the FIRST Robotics Competition held in March in Long Beach, Calif.

SCIENCE FAIRS The Herndon Memorial Science Competition in El Segundo and the East Coast Robert H. Herndon Memorial Science Competition in Chantilly are held each year to increase interest among middle- and high-school minority students in science, engineering, and technology and to increase the diversity of the aerospace industry workforce. This year's Herndon Science Competition in El Segundo marked the 32nd time that the science fair was held at corporate headquarters.

- Each year, Aerospace engineers volunteer to support a team entered in the FIRST Robotics Competition.

- The 2010 East Coast Herndon Memorial Science Competition was held in Chantilly, Va.

- Student discusses his project at the 2010 Herndon Memorial Science Competition in El Segundo.

Community Programs

CLOTHING DRIVE For the past six years, The Aerospace Corporation has been the largest donor to the nonprofit organization Clothes the Deal. Each year in August during Women's Week, The Aerospace Women's Committee sponsors a clothing drive. The generosity of Aerospace employees was recognized in FY10 by Clothes the Deal.

EMPLOYEE GIVING One of many examples of employee giving was the 2009 United Way Campaign. Some 902 employees contributed $210,000.

ANNUAL FOOD AND GIFT DRIVE The annual Aerospace Christmas Holiday Food and Gift Drive was successfully conducted at the El Segundo, Chantilly, Albuquerque, Rosslyn, and Colorado Springs locations. The El Segundo drive is held jointly each year with the Air Force's Space and Missile Systems Center. In all, some 1,587 gifts were donated by Aerospace employees.

Environmental Stewardship

ENVIRONMENTAL RESEARCH Some of Aerospace's environmental research work in FY10 focused on the climate, in particular the effects of rocket emissions from launches of sub-orbital space vehicles on the atmosphere. Aerospace has contracted with the South Coast Air Quality Management District to use LIDAR (light detection and ranging) to measure particulates in the atmosphere to determine compliance with air quality regulations. Aerospace also supported the National Science Foundation in measuring the environmental effects of the Gulf oil spill using hyperspectral imaging on an airborne platform. Additional environmental research by Aerospace laboratories concentrated on the development of a "green" electric battery for cars. Research is being conducted into new solid rocket fuels called hybrid fuels based on paraffin wax. These are expected to reduce the solids in the exhaust known to affect the ozone layer.

CONSERVATION Aerospace was nominated for the Tree Preservation and Tree Planting Conservation Award by the Fairfax County Urban Forest Management Division. The nomination resulted from conservation efforts made during the site development of the new Aerospace site in Chantilly, Va.

- Annual holiday food and gift drive volunteers in El Segundo, Calif.

- The Aerospace Women's Committee assisted with loading Clothes the Deal vans with donated clothing.

- Trees were planted as part of the site development conservation effort in Chantilly, Va.

Achievement Awards

The 2010 President's and Trustees' Distinguished Achievement Awards

Each year, the corporation celebrates its commitment to excellence by recognizing individuals and teams who have demonstrated excellence exceeding expectations in the areas of science, technology, engineering, analysis, systems engineering, program and business management, and administration.

TRUSTEES' DISTINGUISHED ACHIEVEMENT AWARD RECIPIENTS Team members Dr. James LaPean Jr., associate systems director, and Dr. Bruce Nibbelink, senior project leader, both of Imagery Programs Division; and Peter Sowa and Carol Thompson, both senior project engineers, Advanced Technology Division, all of National Systems Group, were selected as the 2010 Trustees' Distinguished Achievement Award winners "for technical and programmatic contributions to the success of an innovative project that enhances national security."

This team of Aerospace engineers in the Advanced Materials Program, or AMP, worked on a highly classified advanced technology demonstration program focusing on supporting critical national imperatives to defeat current and emerging threats from terrorism and nuclear weapons proliferation.

Along with their government program office, the team developed this revolutionary new intelligence concept in late 2003 and guided the development, integration, and testing of this capability over the last five years, culminating in its deployment and transition to operations this year.

To ensure delivery of this new intelligence to the end users, the program has implemented a viable, low-cost, multiplatform, multi-level secure tactical dissemination architecture that will enable the timely delivery of this actionable, highly compartmented data

From left to right;
Peter Sowa, Dr. Bruce Nibbelink, Carol Thompson, and Dr. James LaPean Jr.

From left to right;
David Stodden and John Coggi

over existing intelligence community and Department of Defense networks.

Given their technical excellence and understanding of the operational utility of this new capacity, the team helped balance all segments of the program, allowing the development of this revolutionary capability in an unprecedented short period of time and well under the cost predicted by the National Reconnaissance Office Independent Cost Assessment.

The acquisition of this technically complex and operationally-oriented capability has been hailed as a model of procurement excellence throughout the intelligence community and Department of Defense, and is the template for future National Reconnaissance Office acquisition. •

PRESIDENT'S ACHIEVEMENT AWARD RECIPIENTS The team of John Coggi, senior engineering specialist, and David Stodden, senior project leader, both of Engineering Applications Department, Computers and Software Division, Engineering and Technology Group (ETG), was awarded a President's Achievement Award "for mission focus and innovation in developing and applying the flagship Aerospace software for satellite orbit visualization and analysis."

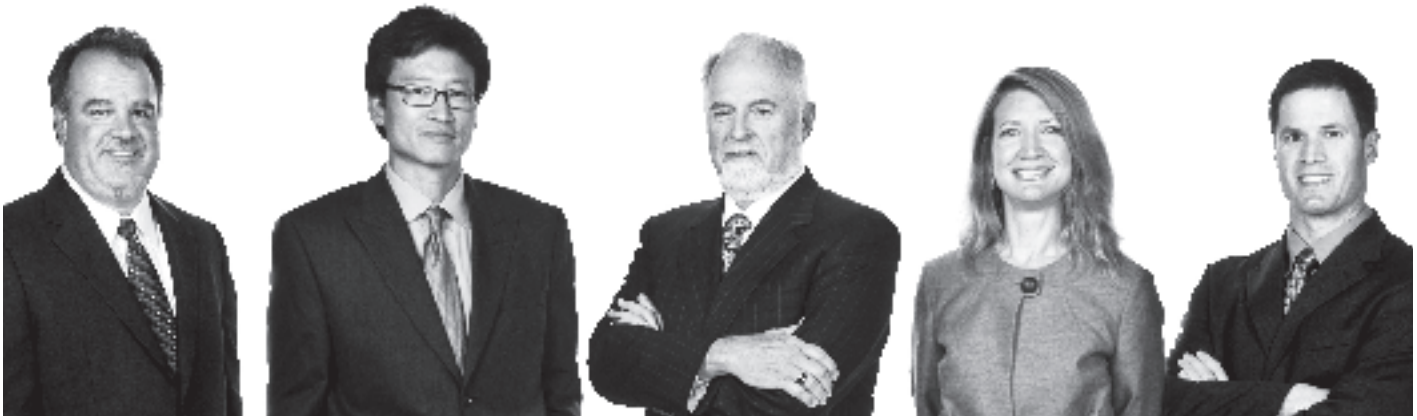
Through their creativity, technical excellence, and diligence, the team has evolved what was initially a simple workstation-based tool into a sophisticated, multiplatform software suite called the Satellite Orbit Analysis Program, or SOAP.

SOAP is a unique and critical corporate capability for orbit visualization and performance analysis and has been installed on over 2,000 desktops. It is used in an extremely cost-effective manner in a multitude of national security space and civil applications by Aerospace and dozens of external agencies.

When SOAP was initially developed circa 1980 to help with spacecraft thermal analyses, there were no other suitable programs available. Since then, commercial off-the-shelf tools have been developed that have many of the same capabilities as SOAP; however, over the decades the SOAP team has modified and extended SOAP in ways that would not be feasible with a commercial off-the-shelf product due to the customer timelines and classification issues.

Coggi and Stodden spent long hours, often uncompensated, to gain an understanding of customer needs, translate those into software modifications, and implement them. Their dedication and attitude is unparalleled. No job was beneath them. No customer's need was lower. No task was too small. The customer's urgency was their problem.

Their ability to represent Aerospace capability and exceed customer expectations time and time again was the purest form of business development, and Aerospace reaps the benefits of their efforts to this day. •



From left to right;
Matthew Hart, Dr. Inki Min, John Skratt, Debra Emmons, and Dr. Torrey Radcliffe

PRESIDENT'S ACHIEVEMENT AWARD RECIPIENTS The team of Debra Emmons, systems director, Independent Assessment, and Matthew Hart, systems director, Flight Project Engineering, both of NASA Advanced Programs, NASA Programs Division, Civil and Commercial Operations; Dr. Inki Min, director, and Dr. Torrey Radcliffe, engineering specialist, both of Space Architectures Department, Systems Engineering Division, ETG; and John Skratt, principal director, Space Launch Projects, Launch Systems Division, Space Launch Operations, was awarded a President's Achievement Award "for providing technical studies critical to the Augustine Committee's recommendations or future U.S. human spaceflight."

In May of 2009, the Obama administration announced the formation of a blue ribbon panel known as the Review of U.S. Human Space Flight Plans Committee, also known as the Augustine Committee. This committee was tasked with performing an independent review of planned U.S. human space flight activities to ensure that the nation is on a vigorous and sustainable path to achieving its boldest aspirations in space.

The Aerospace team's prominent presence on the national stage, while providing technical contributions to the president's blue ribbon panel tasked to address issues of the highest national importance, is a singular and exceptionally noteworthy accomplishment for the corporation.

The Augustine Committee's work has had a significant impact on NASA's future. Currently, the president and the NASA administrator have proposed a complete cancellation of the Constellation program, along with initiation of a new technology-driven emphasis that will include partnering with commercial companies. This is the most dramatic change in NASA policy in recent history. •

Dr. Jerry Michaelson

PRESIDENT'S ACHIEVEMENT AWARD RECIPIENT Dr. Jerry Michaelson, distinguished engineer, Communications and Networking Division, ETG, was recognized "for exceptional contributions in the field of radio frequency and communications engineering to numerous national security space programs."

For more than 30 years, Michaelson has made outstanding contributions to the mission success of national security space and civil space programs in the area of radio frequency electronics and communications.

He has led and participated on innumerable independent readiness reviews, tiger teams, and anomaly investigations. The breadth of the skills he applies is remarkable and unique at The Aerospace Corporation. The extent of his programmatic impact is exceptional as he applied his talents to classified and unclassified efforts.

His contributions have been recognized by generals, an admiral, representatives of civilian agencies, contractors, and through numerous internal Aerospace awards and commendation.

Michaelson's skill is beyond any reasonable expectation. An excellent example of this is his development of compact meteorological terminals. In his first effort in 2001, he developed a new receiver to replace the existing DMSP transportable receiver.

The main radio frequency electronics of the transportable receiver weighed 75 pounds and covered a large tabletop. He replaced this with a new receiver with greater functionality that was about the size of a small paperback book, and weighed less than one pound.

Michaelson designed the receiver using a field programmable gate array to provide flexibility and functionality. He programmed it himself and designed and populated the circuit boards, and to speed the process he milled the aluminum housing for the entire receiver. Once fabrication was complete, he demonstrated its performance.

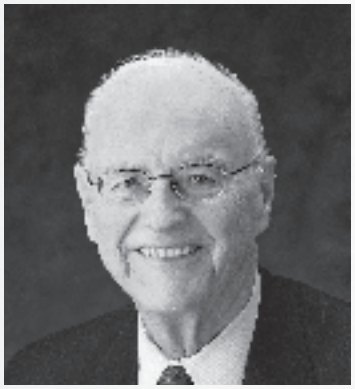
In essence, he served as an entire design and fabrication laboratory team. •

The Board of Trustees

Our Board of Trustees consists of eminent individuals from the business, scientific, academic, and public-service communities.

The board meets four times a year, and its members serve on a number of committees.

- Board members are elected to three-year terms. Reelection is possible, but no member (other than the president and chief executive officer, who is elected annually by the board and is an ex officio member) may serve more than three consecutive terms.
- The board elects corporate officers and sets policy for the Aerospace FFRDC while supervising and directing the general management of the corporation.
- From its inception, the board has established and maintained strict conflict-of-interest standards for its members and for the corporation's officers and employees.



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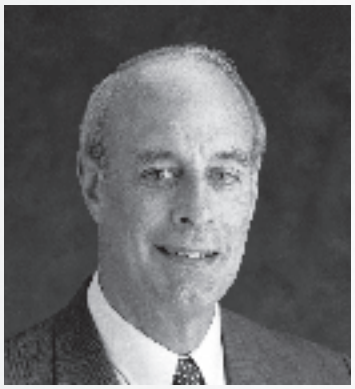

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Rufus A. Fulton Jr.

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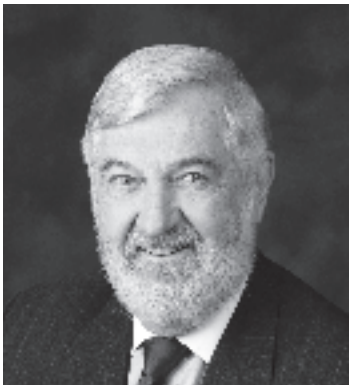

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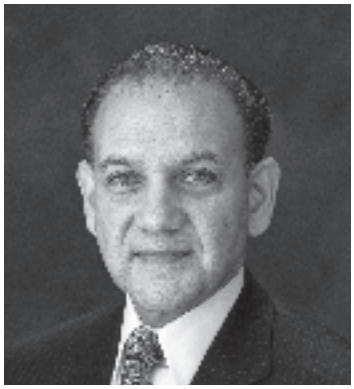
John E. McLaughlin

Distinguished Practitioner in Residence, Merrill Center for Strategic Studies, Paul H. Nitze School of Advanced International Studies, Johns Hopkins University; former Acting Director and Deputy Director, Central Intelligence Agency



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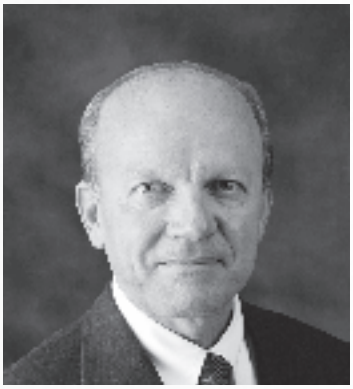
Corporate Leadership

The corporate officers are elected by the Board of Trustees and collectively represent our company's diverse range of skills and perspectives.

- In conjunction with the board, our executive officers oversee and are ultimately responsible for our economic, environmental, and social performance.
- Within compliance of the law and various codes of conduct, the executive officers focus on assuring 100-percent mission success.

Dr. Wanda M. Austin

President and CEO



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Senior Vice President,
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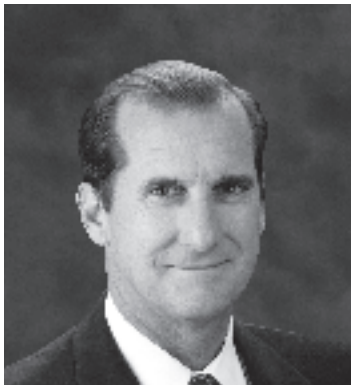

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Chief Financial Officer, and Treasurer

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Vice President,
Strategic Space Operations

Bernard W. Chau

Vice President,
National Systems Group

Dr. William C. "Willie" Krenz

Vice President,
Chief Information Officer

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Financials FY10

Aerospace's revenue from contracts has increased in each of the last three years. This was primarily due to increases in cost and deliveries in 2010, increases in cost in 2009, and increases in deliveries in 2008. The current five-year contract with the Air Force expires at the end of fiscal year 2013.

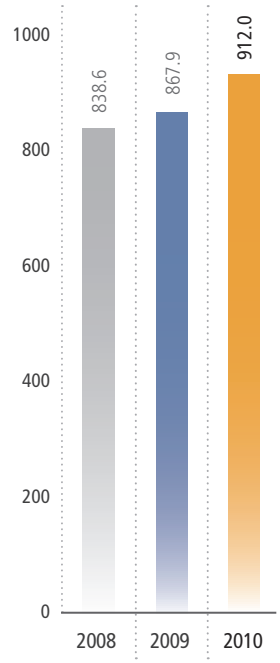
Net cash provided by operating activities is used to purchase equipment and for infrastructure needs. Net cash provided by borrowing activities was used to construct buildings in Colorado Springs, Colo., and in El Segundo, Calif., and to purchase and develop land for future expansion in Chantilly, Va. Long-term debt related to building construction is being repaid from depreciation and cost of money reimbursement from the related buildings over the life of the buildings and from fees from non-DOD contracts.

The corporation's independent auditors are Deloitte & Touche, LLP.

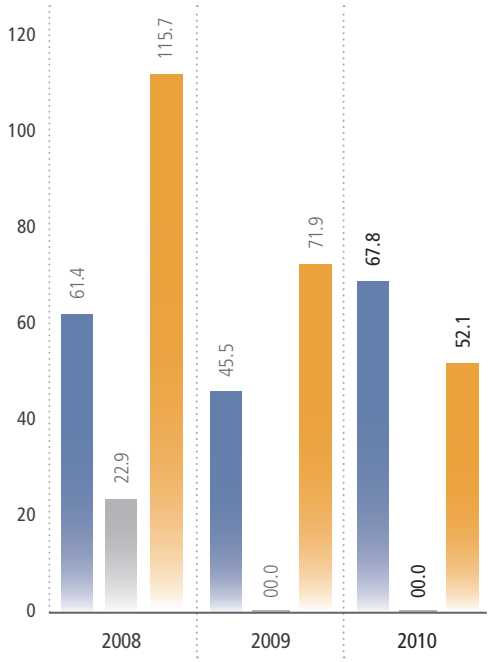
For a copy of the audited financial statements, please contact:

The Aerospace Corporation
P.O. Box 92957 - M1/064
Los Angeles, CA 90009-2957
310-336-1107, or CFO@aero.org

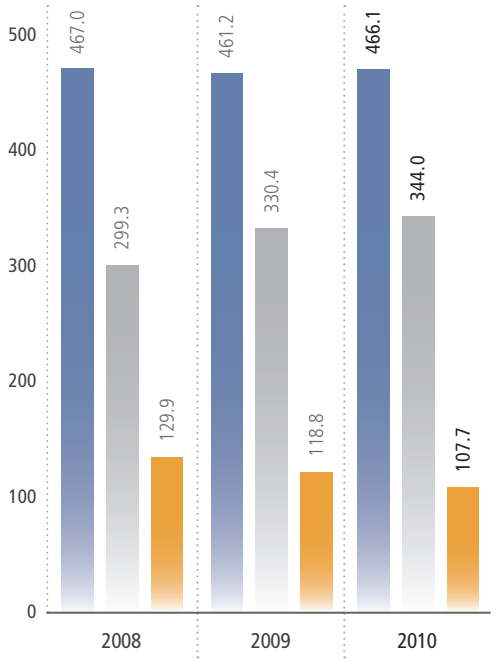
Revenue from Contracts
($ in Millions)



Cash Flows
($ in Millions)



Total Assets and Related Debt
($ in Millions)



Net cash provided by operating activities
Net cash provided by borrowing activities
Cash used to acquire property and equipment

Total assets
Net property and equipment
Long-term debt

AEROSPACE
Assuring Space Mission Success

FSC
100%

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