Active and Productive Year in National Security Space Launch

OCT

4 Oct Delta IV
8 Oct Falcon 9
11 Dec Atlas V
26 Jan Delta IV
31 Jan Atlas V
11 Feb Atlas V
1 Mar Falcon 9
19 Mar Atlas V
21 Apr Antares

APR

Corporate Values
The corporation’s commitment to its core values has made it the leading architect and principal technical resource for space programs of national significance.

Dedication to Mission Success  Committed to assuring 100-percent space mission success.

Technical Excellence  As the technical conscience of national security space, Aerospace tackles the tough questions and delivers the candid answers.

Commitment to Our People  A rare collection of the smartest people in the field, fully empowered to do their best thinking and work.

Integrity  A truly independent and unbiased nonprofit organization, with no competing agendas or incentives.

Objectivity  Always delivering the technical truth, no matter what.

Contents
2  Letter from our Chairman of the Board and President-CEO
4  Value Vignettes
6  Space Systems Group
22  National Systems Group
48  Corporate Social Responsibility
54  2013 Achievement Awards
58  Board of Trustees
60  Executive Council

Corporate Headquarters
2310 East El Segundo Blvd.
El Segundo, CA 90245-4691
310-336-5000

Washington D.C. area
Chantilly, VA
Crystal City, VA
Falls Church, VA
Silent Spring, MD
Suitland, MD

Colorado Springs area
Boulder, CO
Buckley Air Force Base, CO
Colorado Springs, CO
Peterson Air Force Base, CO
Schriever Air Force Base, CO

Albuquerque, NM
Cape Canaveral Air Force Station, FL
Columbia, MD
Hill Air Force Base, UT
Houston and Johnson Space Center, TX
Huntsville, AL
Kirtland Air Force Base, NM
Offutt Air Force Base, NE
Onizuka Air Force Station, CA
Pasadena, CA
San Diego, CA
Vandenberg Air Force Base, CA
Wright-Patterson Air Force Base, OH

The use of Department of Defense images within this publication does not imply or constitute DOD endorsement of this organization, its products, or services.

The Aerospace Corporation Locations

The trademarks, service marks, and trade names contained herein are the property of their respective owners.

Photographs and artwork contained in this document courtesy of Air Force Association; Ball Aerospace; Boeing; Defense Advanced Research Projects Agency; European Space Agency; Lockheed Martin; Missile Defense Agency; MIT Lincoln Laboratory; National Aeronautics and Space Administration (NASA); NASA Ames Research Center; NASA Goddard Space Flight Center; NASA JPL-Caltech; National Science Foundation; National Oceanic & Atmospheric Administration; RUSH Construction, Inc.; Sebastian Saarloos; Space Exploration Technologies Group (SpaceX); The Washington Post/Getty Images; United Launch Alliance; United States Air Force; United States Antarctic Program; United States Geological Survey; and De Luca, T., Gendeyer, S., & Juniper, E. (2013). In-flight aero-optics of turrets. Optical Engineering, 52 (7), 071405.
May 15, 2013  GPS IIF-4 launched from Cape Canaveral atop an Atlas V rocket. Its mission was to ferry the GPS IIF-4 satellite into MEO, more than 11,000 miles above Earth.

May 25, 2013  A Delta IV blasted off from Cape Canaveral and successfully delivered a Wideband Global SATCOM satellite (WGS-5) to its desired supersynchronous transfer orbit.

June 28, 2013  NASA launched a Pegasus XL from Vandenberg, carrying an interface region imaging spectrograph (IRIS) that will provide high-resolution photos and spectral imaging data from a narrow layer of the Sun’s atmosphere.

July 19, 2013  An Atlas V successfully deployed the Mobile User Objective System (MUOS-2) satellite from Cape Canaveral, the second in a series of sophisticated spacecraft to expand the U.S. Navy’s new mobile communications network that will span the globe.

August 8, 2013  A Delta IV successfully delivered the WGS-6 satellite to supersynchronous transfer orbit from Cape Canaveral.

August 28, 2013  A Delta IV launched from Vandenberg, carrying a classified payload for the National Reconnaissance Office.


September 18, 2013  The U.S. military’s Advanced Extremely High Frequency communications satellite (AEHF-3) was released into orbit to complete the AV-041 launch from Cape Canaveral.

September 29, 2013  Canada’s CASSIOPE satellite was launched on the first flight of SpaceX’s upgraded Falcon 9 vehicle and carried a commercial communications system called Cascade, as well as a scientific experiment package called the Enhanced Polar Outflow Probe.

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 definition, design, acquisition, development, deployment, and operation 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 other organizations. 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.
Our accomplishments in FY13 contributed significantly to the unprecedented launch and on-orbit mission success experienced by our customers. Our commitment to mission assurance has become increasingly important in these times of tight budgets and limited resources.

In FY13, Aerospace helped our customers maintain a high operational tempo to successfully deploy the enhanced capabilities developed in recent years. The theme for this year’s annual report — delivering value and innovation — is the focus we used to align with our customers.

**Delivering Value – Major Events in 2013**

- In FY13, the Evolved Expendable Launch Vehicle (EELV) program successfully launched eight national security space payloads, all of which benefitted from the disciplined Aerospace launch verification process. During a 90-day period, the EELV program executed five launches, the most aggressive launch rate in program history.

- The Air Force and NRO continued to show significant interest in launching small scientific and experimental payloads at a low cost. By applying innovative simulation tools, Aerospace provided key technical data to support Air Force Space Command Headquarters cost-trade decisions in offloading satellite contact supports from the Air Force Satellite Control Network to commercial providers.

- Aerospace worked extensively with the Air Force New Entrant team and SpaceX representatives over a 15-month period to develop the comprehensive certification plan for the Falcon 9 v1.1 launch system. Our support to monitor the three certification flights is well underway.

- Aerospace provided essential onsite support for the final Wideband Global SATCOM (WGS) program WGS Block II satellites, WGS-5 and -6, successfully launched in May and August 2013, respectively. Processing was conducted in record time, and the government industry team launched both satellites within 75 days.
• The highest levels of government requested Aerospace work on a variety of studies on new architectures and strategies to address the pressing problem of avoiding costs while meeting new threats to our space systems. Topics included hosting additional sensors and payloads on satellites, recommending bulk buys where appropriate, and supporting multiple satellite launches on single launch vehicles.

• Aerospace received the 2013 Theodore von Karman Award for outstanding contribution to national defense in the field of aerospace science and engineering.

Innovation
Delivering innovation is defined by our efforts to help architect future systems within the budget constraints that are most likely to exist. We partnered with our customers in the development of highly efficient space systems and the technologies that support them to meet the continually evolving needs of the nation for supremely capable systems at lower cost. Creating an environment where innovation can flourish is a critical part of developing our workforce. Our employees are exposed on a regular basis to opportunities to solve difficult problems, take smart risks, experiment, and share their results across the enterprise. This approach to innovation ultimately benefits our customers and end users alike. An example of this type of innovation is the Global Positioning System (GPS), where we continuously retrofit a constellation of satellites so that it functions in a new way, while the system remains in operation. The Aerospace PicoSat team has continuously built innovative spacecraft while meeting immensely restrictive budget and scheduling requirements. The team has designed, built, and flown 20 spacecraft that have changed the face of the aerospace industry and have created a multitude of new opportunities by challenging convention and boldly pushing technology forward.

Our ability to attract world-class talent and our commitment to invest in our employees with continuous learning opportunities has enabled our success. Our investment in technical tools and capabilities in the area of national security space has provided great dividends. In addition, we expanded our knowledge and expertise across the civil and commercial space enterprise to include our work with NASA, NOAA, and other agencies. This allowed us to expand our expertise to help solve problems in the national interest and promote a stronger industrial base. An example of this type of engagement was the role Aerospace played with the NASA Ames Research Center in the successful Lunar Atmosphere and Dust Environment Explorer (LADEE) mission.

Looking Forward
We anticipate that federal budget pressures will persist in FY14, and we are committed to working closely with our customers to find cost-effective ways to deliver efficient and affordable capabilities. We will continue to work to reduce costs by leveraging our partnerships with government, commercial, and civil space customers to propose new approaches to the problem. The real challenge, which will persist well into the future, is to help our customers increase resiliency and lower lifecycle cost at the same time.

Our work this past year has been both challenging and rewarding for our company and the entire national security space community. In all of our efforts, we will continue to adhere to our corporate values—Dedication to Mission Success, Technical Excellence, Commitment to Our People, Integrity, and Objectivity—to ensure we deliver the highest possible value and innovation to our customers.

Peter B. Teets
Chairman of the Board

Dr. Wanda M. Austin
President and CEO
Delivering Value and Innovation

The engineering expertise of the company is applied across the national security space community and helps address a wide variety of crucial and time-sensitive problems, including new investment strategies; new tools and methods in design, test, and manufacturing; and reduced risk to programs.

GRIPS Improves Performance of a National Security Space System

A National Reconnaissance Office (NRO) space-based asset was discovered to be exhibiting degraded performance in one of its mission areas. Under the normal constellation replenishment plan, the problem could not be addressed satisfactorily for several years, an unacceptable situation. Aerospace was asked to examine the problem and create a solution that would restore capability more quickly.

Aerospace engineers used the company’s Genetic Resources for Innovation and Problem Solving (GRIPS) tool suite to develop a new replenishment approach, a significant challenge due to the myriad factors that had to be considered, analyzed, and implemented in the new approach. Using GRIPS, Aerospace engineers developed a solution that restored the asset’s performance to baseline levels several years earlier than had been anticipated. Further, the solution allowed performance to be improved by approximately 20 percent over baseline, once the plan was fully completed. These changes were implemented with no additional development costs to our customer.

Prototype Receiver Delivers Weather Alerts to a Larger Population

The Geostationary Operational Environmental Satellite (GOES) constellation provides timely and highly accurate weather information to users. To reduce costs, the latest series (GOES-R) combines two critical signals and transmits them on a single transponder; past GOES series used a separate transponder for each signal.

The signals carry emergency weather alert information — for example, tsunami and hurricane warnings — for users where telephone and Internet access is not available. These users expressed concern that their ground-based decoders could not handle the increased bandwidth from the combined signals. Aerospace developed a prototype system for GOES-R that is backward-compatible with legacy GOES systems. The prototype allows users with limited resources to construct and operate a complete receiver in remote parts of the world, and incorporates a new RF front end that allows a significant cost reduction.

Aerospace Analysis Leads to Improved GPS IIF Battery Charging Circuit Design

During the testing of two GPS satellites prior to launch, an intermittent problem was discovered in the battery chargers of the power conditioning units. The battery chargers ensure battery recharge after the satellites exit an eclipse. Loss of this function would result in payload outages and eventual mission loss. Preliminary analysis suggested the problem might be unique to those two satellites. Subsequent modeling and simulation analysis by Aerospace engineers, however, revealed a generic design flaw common to all the power conditioning units in the GPS IIF fleet. An Aerospace-recommended hardware design modification was implemented for units not yet flown, along with a flight software upgrade to alleviate charger stress for on-orbit assets. The Aerospace-identified design flaw and subsequent solutions saved the government, at minimum, $300M due to potential early mission failure.
The analysis and characterization of on-orbit satellite anomalies is exceptionally difficult to accomplish; anomaly triage is too complex and the data too sparse for human operators to complete on operational timescales without the aid of automated tools. Since the inception of the DOD space program, Aerospace laboratories have led the way in the measurement of space hazards and the development of models to predict satellite performance. The Spacecraft Environmental Anomalies Expert System – Geostationary Earth Orbit, or SEAES-GEO, an Aerospace-developed set of algorithms, characterizes the hazards posed to geostationary weather satellites. SEAES-GEO was derived from actual on-orbit anomalies caused by the space environment: single event effects, internal charging, surface charging, and total radiation dose. SEAES-GEO is simple to implement and so superior to alternative approaches in anomaly prediction and characterization that it is under consideration for use in the Joint Space Operations Center Mission System.

Aerospace Aids National Research Council in Determining Realistic Science Goals

Determining the priorities and necessary resource allocation for future space science missions is a difficult task. The National Research Council provides the government advice in this area; key NRC products in this area are their decadal surveys in earth science, astrophysics, and planetary and heliophysics. Aerospace provides support to the surveys in the areas of programmatic and technical risks associated with the implementation of various mission concepts. In collaboration with the NRC, Aerospace has developed the Cost and Technical Evaluation (CATE) process, which assesses cost, schedule, technical, and programmatic risks associated with mission concepts at the earliest stages of development. Aerospace’s CATE process has significantly improved the understanding of cost and risk associated with decadal survey missions, allowing the government to more accurately plan the future space science portfolio.

Aerospace Analysis Leads to Improved Atlas V Redesign

During the ascent phase of Atlas V missions, radar assets are used to track the vehicles. Aerospace analyzes the radar data to characterize separation and debris events. Aerospace strongly urged the Air Force to take advantage of more-capable radar assets, resulting in the funding and use of the Mid-Course Radar (MCR) to track launches. Following the first such use, Aerospace analysts identified debris ejected forward of the Atlas V being tracked; this debris posed a distinct and significant threat to the payload. MCR data from subsequent launches confirmed and characterized this debris. Aerospace recommended an Atlas V design change to eliminate the debris and, using Aerospace-developed tools and capabilities, the change was accomplished without impacting launch schedules and potentially saving billions of dollars by avoiding mission or capability loss.
Space Systems Group (SSG) assists and advises the Air Force Space and Missile Systems Center (SMC) in all phases of space system development, including conception, design, acquisition, and operation. SSG provides the essential skills necessary to assure 100-percent mission success through mission assurance focus, technical reviews, and systems engineering processes as space programs are architected, acquired, and deployed. SSG’s emphasis for all phases of system lifecycles is on effectiveness for the operational end user.

**Strategic Intent**

*SSG supports its customers by applying innovative approaches to developing and deploying next-generation military and civil space capabilities. Additionally, SSG is the Aerospace technical lead organization in certifying launch capabilities of New Entrants.*
Space Launch Operations (SLO)

Evolved Expendable Launch Vehicle (EELV)

As provider to the EELV program, United Launch Alliance (ULA) successfully launched eight national security space (NSS) payloads during this fiscal year, each having received full mission assurance support using the rigorous Aerospace launch verification process. The manifest included one Navy, one National Reconnaissance Office (NRO), and six Air Force missions. Two NASA and one commercially acquired DOD mission, launched by ULA, were closely monitored by Aerospace for potential impacts to the EELV fleet. Seven of the eight NSS missions were launched in a six-month period. The EELV program executed four launches in a 90-day period, making for the most aggressive launch rate in program history. The schedule for FY14 will be equally challenging, with a total of eight NSS launches, along with four civil and commercial missions.

The Delta IV GPS IIF-3 mission was the first launch this fiscal year, successfully placing the spacecraft in its desired orbit. However, during the second-stage flight, the Delta IV upper-stage engine exhibited lower than expected chamber pressure and thrust. The guidance system compensated by extending burn durations and adjusted the trajectory to deliver the spacecraft to the intended orbit. A comprehensive investigation was initiated, with Aerospace working closely with ULA and Aerojet Rocketdyne to determine the direct cause of the anomalous performance: a high-pressure fuel leak into the combustion chamber. Multiple potentially problematic scenarios were identified and evaluated through an extensive set of analyses and tests. After eliminating the majority of the scenarios, those remaining were mitigated through a combination of hardware manufacturing reviews, process controls, and inspections. In addition, hardware modifications and operational changes were implemented for the Delta IV launch vehicle to mitigate risks for future launches. The testing also demonstrated the robustness of the RL10 engine, providing greater confidence in future EELV missions.

The Delta IV NROL-49 launch from Vandenberg Air Force Base (VAFB) in January 2011 highlighted differences between East and West Coast launch pads that exacerbated the significant heat load associated with the hydrogen ignition plume of the Delta IV Heavy launch vehicle (HLV).
The staggered start sequence (SES) concept was successfully implemented for the next Vandenberg HLV launch, NROL-65. A multidiscipline, cross-organizational team of Aerospace technical experts evaluated the implementation and effectiveness of SES as well as the implications of SES on the launch vehicle and spacecraft environments. The team also evaluated the operation of the ground system and the interactions of the ground system and launch vehicle in light of the modified start sequence. An experimental study was conducted to look at the flammability of the white paint applied to the launch vehicle. An alternate paint that is able to withstand the high heat loads of the ignition plume was identified. The independent analyses and tests provided confidence in SES effectiveness in reducing heat load and contamination, and did not create any unintended consequences that would create additional risks to the mission, clearing the way for its implementation.

To address the demand for an increased launch rate, ULA has been implementing a number of launch site span-time and production cycle-time reduction efforts. Aerospace has taken a proactive and methodical approach to evaluating each of the proposed changes, with experts from across the company assessing each proposal and identifying potential technical risks. The most significant changes have been the elimination of wet dress rehearsals for Atlas V missions launched from the East Coast, reducing the vehicle processing time by six days per mission.

The Air Force and NRO continue their significant interest in launching small scientific and experimental payloads at low cost. Aerospace worked closely with these customers to plan and implement various rideshare missions using both the EELV Secondary Payload Adapter (ESPA) and Atlas Aft Bulkhead Carrier (ABC). The Atlas V NROL-36 mission, launched at the end of FY12, was the first to utilize the ABC, deploying 11 CubeSats from eight poly-picosatellite orbital deployer canisters held within the Operational Unique Technologies Satellite auxiliary payload. Near-term rideshare missions include Atlas ABC/GEMSat on Atlas V NROL-39 and EELV ESPA/ANGELS on Delta IV Air Force Space Command (AFSPC)-4. In addition, early integration efforts on other rideshare missions are in progress.

ULA launched their Atlas V rocket on March 19, which carried the SBIRS GEO-2 infrared missile detection satellite into orbit. Liftoff from SLC-41 at Cape Canaveral was on schedule at 21:21 UTC (16:21 EST), followed by the successful deployment of the spacecraft. ULA processed this Atlas faster by eliminating the standard wet dress rehearsal process.
Due to the increasing emphasis on national orbital debris mitigation policy, Aerospace is collaborating with the customers to address orbital disposal concerns, with debris mitigation considerations incorporated early in rideshare mission identification and launch vehicle assignment processes.

**EELV Common Avionics (CA)**
The CA program achieved several key milestones in the past year, including the inertial navigation control assembly (INCA) preliminary design review (PDR), mission integration/flight software PDR, and integrated structures critical design review (CDR). In support of the CA program entering the CDR phase, Aerospace stepped up its independent verification and validation efforts, completing an independent requirements trace from heritage avionics systems, developing peer-reviewed thermal models of the INCA, and conducting audits of the field programmable gate array/application-specific integrated circuit development process.

Outstanding progress has also been made in the buildup of the CA hardware-in-the-loop platform for flight software validation. Aerospace also initiated a new milestone readiness review (MRR) prior to the integrated structures CDR. An MRR will be held before each major program milestone to identify the major risks on the program, review independent assessments intended to mitigate the risks, and assign critical launch verification matrix responsibilities. As a result, the Aerospace team was especially well-prepared for the integrated structures CDR, which was recognized by both ULA and the Air Force.

**EELV Dual-Launch Capability**
ULA is developing, under Independent Research and Development (IR&D) funding, a generic dual-launch capability for the five-meter Atlas V and Delta IV launch vehicles. Several key milestones were completed this year, including a PDR update for the Dual Launch System, including the common dual spacecraft system (DSS-5) composite canister. ULA entered into a long-term strategic partnership with RUAG Space on DSS-5 development, signaling their commitment to dual-launch capability by 2017. The Air Force GPS Directorate also conducted its final review with ULA and Lockheed Martin on GPS III specific dual-launch requirements. At this closeout review, Aerospace played a key role in orbital disposal analysis, presenting independent hazard analyses showing that the DSS-5 canister would sufficiently demise upon reentry and meet casualty expectations. Aerospace also formed a multidisciplinary dual-launch team to identify risks early and plan and execute the critical nonrecurring development verification tasks in preparation for the August 2014 CDR.

**Phase 1 Launch Services**
Aerospace worked closely with the Air Force Program Executive Officer for Space Launch, providing technical and programmatic support for the development of the procurement strategy for the ULA Phase 1 launch services contract, as well as the follow-on competitive
procurement. Aerospace helped develop a multilayer plan to ensure a stable, cost-effective launch capability in the near term and a transition plan for competitive procurement once a New Entrant is certified. Aerospace provided leadership in drafting the request for proposal, performance work statement, and evaluation criteria for the competition and procurement of up to 14 cores identified as being in the competitive trade space. Aerospace also conducted a Red Team Review of the EELV system performance requirements document and the standard interface specification to ensure that program requirements are updated appropriately and do not introduce undue cost or requirements creep in the launch service acquisitions.

**Alternative Launch Vehicles (ALV)**

**Falcon 9 (v1.1) Cooperative Research and Development Agreement (CRADA)**

Aerospace assisted with the technical coordination and successful signing of the Air Force CRADA between the Space and Missile Systems Center Launch Systems Directorate (SMC/LR) and Space Exploration Technologies Corporation (SpaceX). Aerospace worked extensively with the Air Force New Entrant team and SpaceX in developing a comprehensive certification plan for the Falcon 9 v1.1 launch system, a first-of-a-kind effort for SMC and Aerospace. This certification process will enable the government team to perform a flightworthiness evaluation of the SpaceX Falcon 9 (v1.1) launch system against category 3 (low-risk) EELV certification requirements. The ALV team held more than 100 reviews with SpaceX in several programmatic and technical areas during this period to develop and refine the CRADA/Certification Plan, which contains more than 2,000 tasks. Several meetings were held with internal and external government stakeholders to finalize the CRADA/Certification Plan and ensure that government requirements would be met in accordance with the New Entrant Certification Guide.

**Systems Requirements Review (SRR)**

Aerospace supported SpaceX’s SRR in July 2013. A primary objective of the SRR, as derived from the Falcon 9 v1.1 CRADA/Certification Plan, was for SpaceX to explain how their processes provide the equivalent assurance of meeting requirements as that of a traditional process, including requirements allocation, decomposition, and traceability. The government-Aerospace New Entrant Certification Team successfully closed the SRR milestone as well as the separate Launch Site Design Methodology Review, added as a result of the SRR activity.

**Falcon 9 v1.1 Launch Support and Certification**

During this period, Aerospace continued its support of the SpaceX Falcon 9 v1.1 certification. Key activities included monitoring and processing telemetry for independent verification and validation (IV&V) for the F9-006 CASSIOPE mission, the first launch of the new v1.1 configuration. For the Falcon 9 IV&V, Aerospace interacted with SpaceX in a variety of technical disciplines through regular working groups and independently developed models, simulations, and analytical tools. Aerospace also developed preliminary assessments for the initial set of engineering review board data packages critical toward completion of certification.
Aerospace enables continued, responsive, and effective support to the warfighter, provided by the Launch and Test Range System (LTRS) and the Air Force Satellite Control Network (AFSCN). The LTRS supports NSS launch and test missions, providing assured access to space. The AFSCN provides highly reliable command, control, communications, telemetry, and tracking for more than 170 DOD, civil, and allied satellites. The corporation is critical to managing architectures, assuring modernization program success, and sustaining the LTRS and AFSCN infrastructures.

**Architectural Management**

Aerospace provides objective technical input to a variety of architecture-related activities focused on top-level requirements assessments. Aerospace participated on the Headquarters Air Force Space Command (HQ/AFSPC) team chartered to translate AFSCN operational requirements into new production capabilities documents reflective of the current acquisition phase of the program. Aerospace assisted the Air Force in the timely assessment and critical analysis of spectrum management issues that have the potential to affect national space operations.

Aerospace provided expert advice to the LTRS capabilities-based assessment, charged by HQ/AFSPC to achieve an affordable, effective, and efficient range for assured access to space. Aerospace helped shape options and provided critical advice on the affordability analysis of proposed options. Aerospace enabled the collection of a comprehensive reporting of range costs, a critical foundation of the Aerospace Economic and Market Analysis Center affordability analysis of all material and nonmaterial solutions. Aerospace identified currently unachievable requirements and proposed operational performance requirements that enable straightforward architectural trades between system reliability, operational risk, and cost.

By applying innovative simulation tools, Aerospace provided key technical data to support HQ/AFSPC cost-trade decisions in offloading satellite contact supports from the AFSCN to commercial providers. Aerospace quantified antenna loading reductions and assessed potential divestitures, should commercial service options for satellite operations be pursued.

**Acquisition Planning and Support**

Aerospace played a critical role in the several Spacelift Range and Network Systems Division acquisition activities on the AFSCN and LTRS programs. This included development of acquisition artifacts and technical evaluations for the LTRS integrated systems contract, which is designed to achieve cost savings by consolidating multiple contracts. Aerospace is a key contributor to Eastern and Western Range acquisitions to modernize communications, command, and control systems.

**Design and Development Mission Assurance Activities**

Aerospace is integral in fielding modernized capabilities to the Eastern and Western Ranges, as well as to the worldwide AFSCN locations. Aerospace’s critical oversight and engineering led to operational acceptance of the Western Range Pillar Point Command transmitter site. Aerospace ensured that the Oak Mountain Telemetry Receiving Station at VAFB met its requirements to handle high telemetry rates and to achieve faster system configurations, while lowering operating costs. Aerospace’s innovative analysis ensured that the AFSCN’s new internet protocol communications system delivered performance equivalent to the legacy system it replaced.

Aerospace supported the fielding of modernized remote tracking station block change (RBC) antenna systems at several sites worldwide. Aerospace technical leadership was key to the successful completion of a combined integrated systems test (IST)/Force Development Evaluation with the 17th Test Squadron at the Guam Tracking Station (GTS); an IST at the Hawaii Tracking Station that resulted in a transfer of the RBC system to the operator; and a completed pre-IST at the New Hampshire Station, with a contact success rate of 96 percent.

Aerospace technical surveillance of the Electronic Scheduling Dissemination (ESD) program was critical to the contractor’s completion and functional demonstration of the last major software build, completing the development of approximately 1.5 million lines of source code. Aerospace provided crucial technical input to the government’s decision to accept the ESD 3.0 functionality demonstrated on a subset of the AFSCN operational system. Aerospace supported all testing on the operational system conducted at GTS; Vandenberg Tracking Station; MESA Support Ops Center, Kirtland AFB, New Mexico; and the two AFSCN control nodes at Schriever and Vandenberg Air Force Bases.
Advanced Extremely High Frequency (AEHF) Program

Aerospace is integrally involved in all aspects of the AEHF program, the successor to Milstar as this nation’s core, protected communications system for strategic and tactical missions. AEHF is capable of mitigating a broad spectrum of natural and manmade threats, and represents a tenfold improvement in communications capacity as well as significant improvements to coverage and access.

AEHF space vehicle-1 (SV-1) was successfully launched in August 2010 from Cape Canaveral. Aerospace provided critical support to ensure the success of this mission by developing and optimizing the orbit transfer strategy. The satellite reached its test location in October 2011, followed by successful payload deployment, on-orbit test campaign, integration with the Milstar constellation, and turnover of satellite control authority to the Air Force. The satellite completed movement to its operational location in June 2013. In May 2012 AEHF SV-2 was launched from Cape Canaveral Air Force Station and successfully reached its test location in August 2012. On-orbit satellite testing was completed successfully, and the Air Force has deployed the vehicle in preparation for early access by U.S. and international partner users. The third AEHF satellite launched in September 2013. Satellites 4, 5, and 6 are in production. Unit production for AEHF SV-4 is approximately 50-percent complete and is scheduled to start vehicle integration in 2014. The contract for SV-5 and -6 production is expected to be finalized before the end of FY13.
Wideband Global SATCOM (WGS) Program
Aerospace serves as “first responder” when WGS satellite anomalies occur and provides technical expertise and independent assessment during anomaly resolution. Aerospace is integrated into the Air Force acquisition and operations teams, and provides critical daily support during spacecraft assembly, integration, and test, and for on-orbit spacecraft health and safety. The WGS-1 through -4 satellites are currently on orbit and in operation, providing full mission support to U.S. and allied warfighters and other strategic and diplomatic users.

Aerospace provided essential onsite support for the final WGS Block II satellites, WGS-5 and -6, successfully launched in May and August 2013, respectively. Processing was conducted in record time, and the team was able to launch both satellites within 75 days. Aerospace’s active engagement with the combined mission operations team ensured disciplined configuration control and prevented cross-commanding of the satellites.

The WGS-7 through -10 program is structured to procure four additional satellites. The WGS-7 bus and payload modules are currently in subsystem test. The telemetry and command transponder is being substantially redesigned, and the WGS-7 flight unit is in protoqualification testing. The digital channelizer, the heart of the payload, is being significantly redesigned to increase its communications capacity, starting with WGS-8. Components for both the engineering model and flight hardware are being delivered, and full proof-of-design is anticipated for June 2014, with delivery of the WGS-8 wideband channelizer unit four months later.

Milstar Program
Aerospace has provided systems engineering and integration support for Milstar since the program’s initiation, including a strong emphasis on ensuring Milstar and AEHF intersystem terminals. Milstar serves as the nation’s core, protected communications system for strategic and tactical missions, capable of 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. All five satellites have exceeded their design lives, and longevity and performance of the Milstar constellation are critical, given the time required for the follow-on AEHF system to reach operational acceptance.

Emerging Systems Directorate
The Air Force formed the Advanced Concept Division (SMC/MCX) to formulate an evolutionary path for MILSATCOM programs and execute risk-reduction and demonstration programs to advance new programs along that path. Aerospace supports MCX on technology, acquisition strategies, and systems engineering to incubate the emerging future MILSATCOM programs. The Aerospace Emerging Systems Directorate conducted a Protected MILSATCOM Design for Affordability Risk Reduction study during FY13, for which Aerospace provided the primary study acquisition guidance and organization. Aerospace also created an initial interface control document for a new government-owned waveform to be finalized. Phase I was accomplished during FY13, resulting in a standardized government waveform, three contractor space modem designs, and three contractor terminal modem designs to be built in Phase II and tested in Phase III.
**Enhanced Polar System (EPS)**
Aerospace helped the Air Force develop the overall program requirements, architecture, and acquisition strategy for the EPS program, a follow-on to the Interim Polar System, which will provide EHF-protected satellite communications capability to forces operating in the North Polar region. This year, the program initiated development of the control and planning segment and matured the system design through multiple design reviews, including the EPS preliminary design review, completed in August 2013. The program also completed key documentation required for Milestone B, scheduled for February 2014.

**Command and Control System – Consolidated (CCS-C) Program**
The CCS-C program develops and sustains an integrated S-band control system for MILSATCOM satellite programs. It provides telemetry, command, control, and mission planning capability for four satellite systems: Defense Satellite Communications System (DSCS) III, WGS, Milstar, and AEHF.

CCS-C has reached full operational capability and supports operations for all constellations. CCS-C developed software, databases, and command procedures to support planned satellite control authority handover of WGS-5 in October 2013 and WGS-6 in December 2013. CCS-C developed software, databases, and command procedures to support the AEHF SV-3 launch in September 2013. CCS-C supports 20 operational satellites among the DSCS, Milstar, WGS, and AEHF constellations.
Cross-Program Engineering and Operations (CPEO)

MILSATCOM CPEO directly supports the MILSATCOM Directorate Enterprise Chief Engineer (SMC/MCE), Joint Terminal Engineering Office (JTEO), and Family of Advanced Beyond Line-of-Sight Terminals (FAB-T) program. CPEO also provides cross-program satellite operations, mission assurance, information assurance, mission effectiveness, and international partner expertise directly to MILSATCOM. Aerospace now leads the National Security SATCOM Systems Synchronization Roadmap (NS4R) analysis activities after successful transition from the JTEO contractor. Analyses included the NS4R President’s Budget Executive Briefing and Report and support to studies such as the Presidential and National Voice Conferencing and Executive Agent for Space Narrowband working group.

Space Based Surveillance Division

The Space Based Infrared System (SBIRS) program, consisting of highly elliptical orbit (HEO) and geosynchronous (GEO) space elements, is the follow-on program to the Defense Support Program (DSP). The HEO element continues to deliver a wide array of game-changing persistent surveillance capabilities to the military and intelligence communities. The SBIRS GEO-1 satellite, launched in May 2011, was accepted into operation by Air Force Space Command (AFSPC) and the National Geospatial-Intelligence Agency in May 2013; it was subsequently certified for Integrated Tactical Warring and Attack Assessments by U.S. Strategic Command in August 2013. The GEO-1 space and associated ground elements add a wide array of strategic and theater missile warning, battlespace awareness, and technical intelligence capabilities to the enduring global DSP capabilities. The GEO-2 space vehicle (SV) was successfully launched from Cape Canaveral in March 2013. On-orbit tuning and calibration efforts were completed in August 2013 and included laser beacon line-of-sight calibration testing, conducted by Aerospace. The GEO-2 operational capability will provide additional dramatic improvements to military and intelligence community users across the breadth of SBIRS mission areas. Operational acceptance of GEO-2 is expected in late 2013.

In parallel, the SBIRS program is working to complete the Increment 2 ground system that will consolidate the separate and distinct DSP, HEO, and GEO ground stations into a single mission control station. Aerospace is currently finalizing an enterprise mission assurance plan that documents the process for developing comprehensive risk assessments and headline metrics for Increment 2, which is expected to be operational in 2015. The SBIRS Follow-on Production program, consisting of the HEO-3 and HEO-4 payloads and GEO-3 and GEO-4 SVs, is continuing to make steady progress. The HEO-3 payload completed environmental testing and was delivered to the host for integration in June 2013. The GEO-3 spacecraft core and communications subsystem panel were delivered to Lockheed Martin in February and July 2013, respectively.

Aerospace provided significant contributions to the GEO-5/6 Non-Recurring Engineering (NRE) Proposal, Advance Procurement Proposal, Advance Procurement Engineering Change Proposal, and the requests for proposal documentation, and provided comprehensive support to respective source selection efforts. After contract award, Aerospace has been active on GEO-5/6 NRE contract activities and has made similar contributions to the pending GEO-5/6 production contract, expected to be finalized in FY14.

Aerospace provided system and sensor performance analysis for a number of potential future architectures in support of DOD architecture studies. In particular, Aerospace was engaged with the Overhead Persistent Infrared (OPIR) community to implement improvements for the Joint OPIR Ground enterprise that enable greater access to OPIR data and advance data exploitation efforts. Aerospace continues to support the Space Awareness and Global Exploitation system at Falcon Shield, Schriever Air Force Base.

Aerospace regularly analyzed data at Falcon Shield from the Commercially Hosted Infrared Payload (CHIRP) and generated event reports that were provided to SMC and the Commander, Air Force Space Command. Aerospace generated data packages for evaluation by potential new data users that included the Air Force Weather Agency, National Weather Service, National Air and Space Intelligence Center, and other civil agencies. At Aerospace’s recommendation, a realtime, onboard CHIRP tracking test using uploaded flight software modifications was successfully conducted.

Aerospace continued to support multiple Space Modernization Initiative (SMI) acquisitions, including the wide field of view (WFOV) testbed small satellite demonstrator. The testbed will include a small satellite that will host a separately procured, six-degree WFOV payload. The satellite bus contract with Millennium Space Systems was defined and executed through PDR, and Aerospace generated all the technical requirements documents and assisted the Air Force with the contract awards. The planned launch date for the SMI testbed is in December 2016.
Global Positioning System (GPS)
Aerospace continues its technical stewardship across the GPS IIF and III satellite programs, GPS control system programs, GPS user equipment programs, and the space-based navigation enterprise. 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. Since reaching full operational capability in 1995, GPS has become an essential part of the global civil infrastructure and military operations.

GPS Satellite Programs
The GPS IIF program started FY13 with the successful launch of GPS IIF-3 in October 2012. Prior to that launch, Aerospace identified a design flaw in the GPS IIF satellite power conditioning unit (PCU), a major element of the electrical power system that regulates the flow of power from the solar arrays to recharge the satellite’s batteries, and conditions electrical power out to the various satellite electronic units. Aerospace’s independent review of the flight software mitigation gave the government confidence to proceed in launching the GPS IIF-4 satellite in May 2013 while the IIF contractor completed the PCU redesign. The IIF-4 satellite is now on orbit and operating nominally with the flight software mitigation. Aerospace also worked closely with the contractor on the design and testing of the new PCU, which will be launched on GPS IIF-5 in early 2014.

GPS III
The GPS III program accepted for flight many components that were successfully tested, delivered, and integrated onto GPS III-1, which enabled the first set of initial powered GPS III satellite tests to be completed. Aerospace assistance in executing the software development effort resulted in successful completion
of the software item qualification test of the GPS III bus flight software. Aerospace reviewed critical areas of the payload and satellite bus, and provided assessments and recommendations for resolving unit and subsystem issues.

The GPS III Non-Flight Satellite Testbed (GNST), a full-scale physical and electrical GPS III simulator, was delivered to Cape Canaveral in July 2013 for launch-base pathfinding risk-reduction testing. Earlier in the year, the GPS III satellite simulator, which will be used for integration testing by the Next Generation Operational Control System (OCX), was successfully tested and delivered to the government at Cape Canaveral. A launch and checkout capability (LCC), using OCX’s Launch and Checkout System (LCS) software, was successfully established at Lockheed Martin’s Newtown, PA facility. GPS III early-orbit operations will take place at that location, and by the end of FY13, the contractor/AF/Aerospace team had conducted three successful early orbit operational exercises and had successfully demonstrated command and control of the GNST at Cape Canaveral from the LCC/LCS node.

Defense Meteorological Satellite Program (DMSP)
DMSP provides timely and accurate worldwide terrestrial and space environmental data to DOD and national program users. Satellites are currently deployed in two low Earth, sun-synchronous orbits to support both strategic and theater users. The current DMSP constellation is healthy and is meeting all mission requirements for the warfighter. Following successful consent-to-ship reviews assisted by Aerospace, the satellite was shipped to Vandenberg in August 2013 to commence launch processing. DMSP F-19 is on schedule to support an April 2014 launch date. F-20 satellite testing has begun, but will be deferred until after the F-19 launch campaign. Once testing is completed, F-20 will be placed into storage.
DMSP Flight 19 (F-19) Local Time Ascending Node (LTAN) Selection

Aerospace completed a space system analysis to determine the optimal orbit LTAN for the DMSP F-19 spacecraft scheduled for launch in April 2014. The Air Force’s decision to reduce the DMSP constellation from two morning satellites, with different LTANs, down to one was a complicating factor. An earlier Aerospace analysis showed there was no single orbit selection optimal for all mission sensors. Aerospace conducted an analysis of DMSP operations, McMurdo antenna use, mission data collection, ingest at the Air Force Weather Agency (AFWA), data processing metrics, and cloud mission timelines necessary to build Cloud Depiction and Forecast System-II (CDFSII) products for the warfighter and intelligence community. Aerospace assembled Satellite Orbital Analysis Program simulations for several potential F-19 LTANs and characterized the selection impact on CDFSII mission success rates. The later LTAN selection will significantly benefit the warfighter, tactical users, and forecasters by increasing daytime visual descending coverage, and likely increasing cloud forecast accuracy by 10 to 15 percent.

Environmental Satellite Systems Division Develops New Cloud Database

Since 2003, Aerospace and the AFWA have been archiving hourly cloud analyses derived from the Defense Meteorological Satellite Program, the Polar Orbiting Environmental Satellite, geostationary constellations, and AFWA’s World Wide Merged Cloud Analysis system. Aerospace’s Satellite Orbit Analysis Program has been extended to support the display, analysis, and playback of historical weather data, which will be used for modeling and evaluation of remote sensing scenarios for a number of government programs. Such data can be also used in setting up near-realtime weather displays for space and ground situational awareness. The archive has been identified as a source of data to use in military utility analyses and to assess mission operational environments.
Space Situational Awareness Environmental Monitoring (SSAEM)

The SSAEM program is a space weather sensor procurement effort designed to meet requirements for ionospheric density and scintillation sensing. The Constellation Observing System for Meteorology, Ionosphere, and Climate 2 (COSMIC-2) is managed by a tri-agency partnership that includes SMC, the National Oceanic and Atmospheric Administration (NOAA), and Taiwan. The SSAEM program is developing the primary and secondary sensors that will be hosted on six COSMIC-2 satellites and flown in a low Earth equatorial orbit. In FY13, all SSAEM sensors advanced from the critical design review phase into the manufacturing phase. Aerospace has been leading the effort to define the spacecraft-sensor-launch vehicle interface, providing mission assurance for the sensor and significantly contributing to the COSMIC-2 systems engineering processes.

Weather Satellite System Follow-on (WSF)

The WSF program, replacing the Defense Meteorological Satellite Program satellites currently on orbit, will provide a timely and reliable space-based remote sensing capability that will provide global and regional environmental observations to military and civilian users. In October 2012, the Milestone Decision Authority designated WSF as a Pre-Major Defense Acquisition Program and authorized the initiation of a space-based environmental monitoring analysis of alternatives (AoA). Aerospace developed viable future weather satellite system architectures and assessed their effectiveness in satisfying capability gaps, and was instrumental in identifying innovative and affordable architecture concepts that were ultimately folded into the AoA.

Specifications and Standards Development and Application

Aerospace provides leadership in developing and improving specifications and standards and their application to national security space programs. Aerospace serves as secretariat for two joint DOD-Institute of Electrical and Electronics Engineers teams to develop systems engineering and technical review standards suitable for use by DOD, and coordinates with similar joint DOD-industry efforts for configuration management and manufacturing management standards. Aerospace developed new standards for spacecraft safe mode and ground systems test, and requirements for test-like-you-fly and human systems integration. Aerospace released a revised software standard, Software Development Standard for Mission Critical Systems. This standard, along with the associated Aerospace-developed Software Measurement Standard, clearly define software development processes as well as a methodology for national security space customers to quantitatively manage a program’s software development and perform valid cross-program analysis. Aerospace also worked with industry partners and SMC to develop revisions of systems engineering and environmental test standards. Lastly, Aerospace supports a key Air Force objective to develop an Air Force-wide process for development, maintenance, and implementation of standards.

Streamlined Acquisition Process

Aerospace provided early strategy formulation and execution planning for an upsurge in SMC programs. During FY13, the number of programs in the early acquisition phase requiring key decisions doubled from the historical nominal acquisition battle rhythm. To address this new rhythm, Aerospace and the SMC Acquisition Center of Excellence defined a streamlined acquisition planning process, including clear lines of decision authority. In the streamlined process, Aerospace-led workshops were highlighted as value-added activities that help program offices collect and integrate information necessary to support the milestone authorities in making program decisions. Aerospace was also designated as the core of the SMC Cadre, a multidisciplinary expert team with the mission of providing direct and consistent staff assistance to program teams. The results of Aerospace’s efforts have been the generation and subsequent approval of program strategies, solicitations, and the successful planning and conduct of source selections.

SMC Affordability Initiative

Aerospace developed an innovative, integrated methodology and leveraged lessons learned across SMC programs to analyze the basis of estimate associated with contractors’ cost proposals for AEHF 5/6 production, GPS III 5-12 production, SBIRS GEO 5/6 advanced procurement, SBIRS GEO 5/6 production, and SBIRS system support. Aerospace identified total cost avoidance opportunities of approximately $300-400M as a result of this activity. Aerospace generated actionable recommendations and supporting rationale for program offices in preparation for negotiations with contractors, supported with specific data to defend government counterproposals and positions on both program costs and performance-based payment plans.
Rapid Attack Identification and Detection Reporting System (RAIDRS)

RAIDRS, a defensive counterspace system capability for the warfighter, completed site development and delivery of all integrated radio frequency satellite communications interference detection and geolocation capabilities, consisting of five remote worldwide detection sites and a central command and control center. Aerospace was responsible for troubleshooting and resolving multiple communications circuit issues. Aerospace also participated in the first day-in-the-life exercise of the RAIDRS system, which successfully demonstrated system capabilities and provided confidence to enter independent operational testing. Aerospace was instrumental in supporting the independent SMC audit team inquiries and mission assurance readiness reviews, and ensured that software corrective actions for the ground system were validated. Formal operational testing was conducted in July 2013, and activities are progressing toward an initial operating capability.
Joint Space Operations Center (JSpOC) Mission System (JMS)

The JSpOC JMS program replaces the legacy Space Defense Operations Center (SPADOC) system and lays the groundwork for a predictive battle management command and control system for the commander, Joint Functional Component Command for Space (JFCC SPACE) and other users. JMS is being acquired incrementally, using an agile software development approach. Increment 1 is comprised of the foundational service-oriented architecture, the user-defined operational picture, and basic user applications. The user-defined operational picture and netcentricity key performance parameters were satisfied, and Increment 1 was fielded in November 2012. After successful operational test and trial, the Increment 1 intelligence operational capability was declared in April 2013.

Increment 2, which will be delivered in the first quarter of FY16, fully replaces SPADOC and other legacy JSpOC systems. Aerospace has provided mission assurance support to the JMS program at every step. Prior to the Increment 1 operational utility evaluation, Aerospace prepared an independent assessment of the readiness to enter operational testing. In rapid succession, several major JMS Increment 2 program reviews were held: the system functional review, PDR, and build review for the first of four “service packs.” Aerospace delivered presentations during each of these reviews on key topics, including: requirements development, data modeling and interoperability, an exercise and test approach, and sensor calibration. Aerospace also completed work on the Increment 2 application requirements document and led the development of the software requirements specification (SRS) for service pack 7. The SRS will be the ultimate basis for verifying that service pack 7 is feature-complete.

Navy Space Systems – Navy Ultra-High Frequency (UHF) Satellite Communications

Aerospace supports two Navy satellite communications programs: operational support to the legacy UHF Follow-On (UFO) constellation and acquisition of the Mobile User Objective System (MUOS). MUOS is the Navy’s transformational narrowband communications system that will provide substantially increased communications capabilities by implementing Wideband Code Division Multiple Access (W-CDMA) third-generation cellular technology. Connectivity by tactical terminals to the Global Information Grid will enable worldwide communications.

MUOS-2, the second of five MUOS satellites, was successfully launched on at Atlas V from Cape Canaveral in July 2013. All deployments were completed, which included unfurling both the 5-meter and 14-meter antenna reflectors. Bus testing was completed, with all systems performing nominally. Payload testing is underway, with legacy operations planned to commence in January 2014.

In preparation for operations with the new W-CDMA capability, the MUOS mission ground system completed site acceptance testing across three site locations: Virginia, Hawaii, and Australia. The final secure communications waveform successfully completed qualification testing and integration onto the Handheld Manpack System terminal platform. Aerospace is providing technical leadership for the on-orbit system validation in the first quarter of FY14, which will culminate in W-CDMA initial operations in the third quarter of FY14.

The second satellite of the Mobile User Objective System will enable mobile users to communicate securely using smartphone-like features.
A Delta IV Heavy rocket, carrying a payload for the National Reconnaissance Office and designated mission NROL-65, lifted off from Space Launch Complex-6 at Vandenberg Air Force Base on August 28, 2013.

As the key systems engineering arm for the National Reconnaissance Office (NRO) and the Intelligence Community (IC), National System Group’s (NSG’s) focus is to leverage the corporation’s cutting-edge technologies and core competencies in support of the acquisition and operation of the IC’s programs designed to collect and disseminate national and tactical intelligence products.

**Strategic Intent**

*With an eye toward future customer needs, NSG is bringing new and innovative performance analysis tools to bear, ensuring our customers’ architectures are affordable, while providing resiliency and superlative capability.*
National Intelligence Operations

The National Intelligence Operations (NIO) organization was formed within the National Systems Group (NSG) in 2013 to increase executive-level management focus of Aerospace support to IC agencies beyond the NRO, such as the National Geospatial-Intelligence Agency (NGA). The NSG vice president manages NIO operations and reports to the NSG senior vice president.

ODNI Space Protection Initiatives
Aerospace provided support to the Office of the Director of National Intelligence (ODNI) for two space protection initiatives in 2013.

Space Protection Major Issue Study
Aerospace supported ODNI Systems, Resources, and Analysis as they led a community-wide Space Protection Major Issue Study. The corporation provided analytical expertise to assess IC resources, risks, and alternatives to meeting future threats.

Space Threat Assessment Cell (STAC)
Aerospace provided technical and analytic support in establishing the Office of the Director of National Intelligence STAC. The STAC was established to address the technical intelligence and evaluation needs of the IC and the recently chartered Space Security and Defense Program.

Securing the Government Cloud
Aerospace provided critical technical support for utilization of the IC government cloud. In support of the ODNI, Aerospace conducted a technical review of the NSA government-proposed baseline cloud concept and architecture. Aerospace also applied its extensive cloud and cyber computing expertise to a number of technical challenges for NSA’s cloud-hardening effort. Aerospace provided specific recommendations on the composition of service-level agreements (SLAs) for critical mission applications. Implementation of SLA admission controls is one facet of ensuring secure operations for the IC government cloud. Aerospace also conducted a compliance analysis that resulted in specific recommendations to reduce or eliminate vulnerabilities.
Training the Intelligence Community

Aerospace adapted its internally developed Aerospace Systems Architecting Program into an IC resource. This program was originally tailored for a single agency, but was expanded to address the needs of the broader IC. Customers are taught techniques to identify and select high-value problems, work iteratively in finding efficient solutions, and create executable program plans. In a capstone exercise, students use actual challenges/problems from their home offices and work in teams to generate program concepts. This program has received significant accolades and recognition by senior executives from across the IC.

Systems Engineering and Launch Division

Eastern Processing Facility (EPF)

Aerospace provided vital leadership and technical resources to the Office of Space Launch of the NRO for the Eastern Processing Facility (EPF) design, development, and test activities at Cape Canaveral Air Force Station over the past four years. With the EPF construction phase coming to an end in April 2013, Aerospace provided vital technical support for acceptance of all EPF systems. In addition, Aerospace provided technical oversight of the development of two Payload Access and Encapsulation Stands (PA&ES) to be used in the EPF, and has recently completed the coordination of installation planning post-EPF acceptance for the PA&ES.

Space Cargo Transportation System – Functional Equivalent (SCTS FE)

Over the last three years, Aerospace has supported the design, manufacture, and testing of a second space cargo transportation system (SCTS) that is functionally replicating the original SCTS container. Aerospace supported critical structural acceptance testing, performing an analysis to determine whether the new container was the dynamic equivalent of the original container. Aerospace technical staff developed a static test methodology that was implemented to show that the existing dynamic model was valid for coupled load evaluation for SCTS environments.
Aerospace provided an assessment and final structural report to demonstrate the SCTS was functionally equivalent to the original container.

**Examination of Common and Modular Bus Designs**

Aerospace investigated the efficacy of adopting common and modular spacecraft buses for certain national security space missions. The investigation pursued and examined several design approaches for planned missions. For each of the design approaches, Aerospace subject matter experts employed the Concept Design Center to develop and refine initial designs. Aerospace delivered the designs to the government for cost estimation. Aerospace worked closely with the government to resolve issues and improve understanding of the model and its implications as the comparative costs were developed. The results indicated little to no overall savings due to low purchase volume and the “over-design” penalty incurred when common parts and subsystems are designed and tested to meet the stressing yet essential mission requirements.

**Ground and Communications Division**

**Ground Frontiers**

Aerospace has been supporting the migration of intelligence community mission applications software to the government cloud. The corporation designed and tested a prototype system to support the migration of high-performance software applications. Our unique configuration allocates, utilizes, and releases virtual machines with high-performance hardware components to leverage resource sharing in the cloud while meeting realtime latency requirements. Aerospace’s hybrid approach to cloud computing is not currently available through commercial vendors.

**Leveraging Commercial Scheduling Algorithms and Practices**

Aerospace delivered a study examining how the commercial market successfully develops and employs software for complex schedule planning and execution. Aerospace compiled algorithms and development practices from successful scheduling systems, including United Parcel Service partial load delivery scheduling; Nike, Inc. shoe order and delivery systems; and airline flight scheduling. These algorithms and practices are being examined for applicability to complex scheduling missions.

**Mission Transport Service Architecture**

Aerospace helped produce acquisition strategies and documents for the development of core technologies by industry to support the NRO Mission Transport Service (MTS). The goal of MTS is to provide standardized cost-efficient communications for the NRO by recapitalizing and improving data transport services. The NRO is investing in various technology subsystems and components to reduce the MTS architecture’s programmatic and technical risk, and to ensure multivendor competition. Aerospace’s communications test bed has proven to be a vital component to the success of MTS by verifying the performance and the physical and logical interfaces of these subsystems and components.

**Aerospace Support to the NRO Infrastructure Service Provider (NISP)**

Aerospace has been assisting the NRO with a transformational change in how they acquire, operate, and maintain information technology (IT) systems for business and mission applications. The corporation provided acquisition support to several key elements of the IT infrastructure. In FY13, the NRO made sweeping organizational alignment changes by giving its Communications Directorate sole authority to acquire, operate, and maintain IT systems for both business and mission purposes. Aerospace developed acquisition strategies and documents for the NRO’s Common Mission Environment, a compute and storage environment intended to meet some of the unique NRO needs; the Common Service Layer 1 (CSL-1), an intermission network; and a new operations and maintenance (O&M) contracting approach that consolidates many IT-related O&M contracts within the NRO.
Electronic Programs Division

Support to Low Earth Orbit (LEO) SPO
Aerospace has been fully engaged in the pre-acquisition phase of the future LEO capability. Our engineers helped the program successfully complete system and segment requirements reviews. Aerospace program office staff, with support from Engineering and Technology Group subject matter experts, reviewed more than 30 contractor-developed artifacts and independently evaluated risks related to requirements uncertainty, technology development, program processes, cost, and schedule. The corporation also played a significant role in tailoring mission assurance standards, developing requirements for new payloads, resolving requirements disconnects between the system and segments, reviewing the bus architecture, and assessing critical and new technologies. Aerospace continues to perform independent evaluation while contributing to the development of the program’s baseline “point of departure” vehicle design.

Imagery Programs Division

New Capability Fielded
Aerospace’s Processing and Image Quality (P&IQ) group within the Imagery Programs Division was instrumental in establishing new capabilities for existing customer missions. P&IQ worked closely with the customer and other contractors to devise a series of data collections that provided the information necessary to determine the feasibility of the new capability. Once data were collected, the staff devised innovative methodologies to analyze the information and produce accurate results in an efficient manner. Many of the new models and algorithms have been adopted for use by the customer, and established Aerospace as a strong contributor in this emerging area.

Major Milestones Achieved
Aerospace was a key contributor in the preparation for, and execution of, a major milestone for a critical national program.
The milestone drove the review of thousands of pages of design documentation for accuracy and completeness. In addition, Aerospace completed independent analysis in several areas to ensure proposed designs would meet user expectations. As a result of the extensive preparatory work, the actual event was successful and allowed the program to progress into the next phase of development.

**Successful Test Completion**
Aerospace personnel were on site for the successful integrated testing of a major program. The successful testing was the result of a long engagement among Aerospace, customer, and contractor staff, and resulted in a new test baseline. The new baseline reduced test time by several weeks without resulting in a loss of perceptivity or effectiveness. Aerospace provided realtime analysis of issues, which led to minimal downtime and enabled the contractor to effectively apply their resources. This support was critical in ensuring the test article was delivered well ahead of the need date and at a lower cost.

**Advanced Technology Division**

**Program Executability**
Aerospace produced conceptual designs and performance analyses to help the customer reduce cost, schedule, and technology risk on a new NRO program. Aerospace analysis provided the customer with critical data necessary to make a significant design change during early program initiation and ensure program executability within cost and schedule. This decision was validated by another independent team with membership from across the national security space community.

**Mass Trends Assessment**
Aerospace performed an independent assessment of technology options and mass trends for a critical subsystem of a major system acquisition. The assessment was part of a broader effort to examine the existing program approach and determine whether a significant change was warranted. On an extremely aggressive timeline, Aerospace gathered and normalized mass data on the current program as well as numerous other relevant programs, and used this data to develop a predictive mass comparison of various technology approaches. In addition, Aerospace made an assessment of cost, manufacturability, program risk, and architecture performance. These results were incorporated directly into senior government briefings and used in part to support a major program redirection.
Containing almost half of the company’s technical workforce, Engineering and Technology Group (ETG) comprises five specialty organizations equipped with state-of-the-art computing, testing, diagnostic, research, and simulation facilities, along with unique Aerospace databases that have evolved since the beginning of the space era.

**Strategic Intent**

From space architecture development to multisource data exploitation, to new propulsion technologies and improved techniques for remote sensing, ETG is taking aggressive strides to assure its workforce and technical capabilities are ready to ensure mission success in an environment of new challenges and budget constraints.
Aerospace Instruments Carried on VISIONS Rocket Launch

Aerospace designed and built six instruments that were recently launched on a NASA sounding rocket from the Poker Flat Research Range outside Fairbanks, Alaska. The mission, called VISIONS (Visualizing Ion Outflow via Neutral atom imaging during a Substorm), is a collaboration between the NASA Goddard Space Flight Center and Aerospace, and its purpose is to study the escape of ions from the upper atmosphere during a substorm. A substorm is a space weather phenomenon that drives magnetic activity and beautiful auroral displays at high latitudes. During substorms, ionospheric ions are heated and some become further energized at high altitudes and are ejected to the magnetosphere. The suite of instruments designed to measure the relevant processes consist of the Miniaturized Imager for Low Energy Neutral Atoms, the Rocket-borne Auroral Imager, the Fields and Thermal Plasma suite, electron and ion electrostatic analyzers, an energetic electron electrostatic analyzer, and an ion mass spectrometer. The rocket was launched into active aurora and successfully collected a large amount of data over a range of altitudes, which Aerospace is analyzing to understand the processes that drive auroral ion outflow.

VISIONS launched on February 6, 2013, as a green aurora appeared in the Alaskan night sky.
Capability to Measure Radome Effectiveness Developed

Aerospace recently developed a capability to characterize and quantify the electromagnetic performances of the materials used in radomes and frequency selective surfaces (FSS). Most terrestrial antennas for satellite ground terminals, which are scattered across the country and the globe, have radomes to protect the antennas from the environment. Often, these same antennas are Cassegrain reflector antennas with FSS. While the radomes are designed to be electromagnetically transparent at all frequencies of operation, an FSS is often intended to be transparent in one frequency band and reflective in another band. In a ground terminal, an FSS can enable dual band operation for the terminal, sending different frequencies in different directions. Introducing an FSS can effectively double the cost-effectiveness of the antenna system. The Aerospace tests enable evaluation of beginning-of-life and end-of-life radio frequency (RF) performance, and RF measurement of aged radomes can be performed to evaluate whether their replacement can be postponed, potentially deferring million-dollar expenses per installation. This capability allows Aerospace to assure mission operation for communications systems with maximum cost efficiency in mind.
**Staggered Engine Start (SES) Condition for Delta IV Heavy**

To mitigate the effects of plume heating during liftoff of the Delta IV Heavy, an SES of the three RS-68 engines was implemented for the National Reconnaissance Office 65 (NROL-65) Delta IV Heavy mission. Aerospace performed unique, state-of-the-art computational fluid dynamics simulations with multispecies reacting flow to assess the benefits of an SES on reducing the heating environment. In a conventional engine start, all three booster engines ignite simultaneously. With an SES, in order to aspirate the launch duct, the starboard engine is ignited before the simultaneous ignition of the core and port engines. Aerospace also analyzed the effects of the combined low frequency pressure waves, as well as the acoustic environment for both the conventional engine start and SES scenarios. As a result of the independent evaluations, the design change was implemented with high confidence, and NROL-65 was successfully launched in August 2013.

![Diagram showing conventional and staggered engine start conditions](image)

These five photos show the ignition plume during the NROL-49 CES launch.
Aerospace Sensors on NASA Van Allen Probe Spacecraft Highlight New Discoveries

Aerospace provided two instruments, the Relativistic Proton Spectrometer (RPS) and the Magnetic Electron Ion Spectrometer (MagEIS), for the NASA Van Allen Probes mission, which has been returning scientific data from the near-Earth radiation environment since September 2012. The innovative measurement techniques employed by MagEIS and RPS have revealed Earth’s radiation belt in a new light, with unprecedented spatial, temporal, and energy resolution. Several remarkable features have been observed, including a transient radiation belt that lasted for more than one month in a region of space typically devoid of energetic particles. Aerospace is also using MagEIS and RPS data to validate the next generation of radiation environment specification models used in spacecraft design. Current environmental specification models suffer from a number of shortcomings, which lead to unknown margin in spacecraft design. Uncertain margin can result in excess cost due to overdesign, or unanticipated performance degradation of parts during the mission due to underdesign. Valid models of the near-Earth radiation environment are thus critical for designing reliable, cost-effective space systems.
Debris Risk Analysis Capability to Medium Earth Orbit (MEO) and Geosynchronous Earth Orbit (GEO) Extended

Following the Chinese antisatellite test that destroyed a defunct weather satellite in 2007, Aerospace formed the Debris Analysis Response Team (DART) to analyze the risk posed by breakup debris to other active satellites. Aerospace has since provided the government with operational risk assessments for several breakup events in low Earth orbit. The extension of DART analysis to MEO and GEO, which had long been a priority since a collision or explosion could happen there at any time, was accomplished this year. The DART team and software models are now ready to support major breakup and debris events at all operational altitudes.

The photo, taken at the Hypervelocity Ballistic Range at NASA’s Ames Research Center, shows the “energy flash” that occurs when a projectile launched at speeds up to 17,000 miles per hour impacts a solid surface. This test is used to simulate what happens when a piece of orbital debris hits a spacecraft in orbit.
Systems Planning, Engineering, and Quality (SPEQ) works with strategic government organizations to positively impact the lifecycle mission assurance of critical military space programs. In support of the national security space enterprise, SPEQ assists and advises customers such as Air Force Space Command, Missile Defense Agency, Air Force Materiel Command, Space and Missile Systems Center, National Reconnaissance Office, and Operationally Responsive Space. SPEQ also works closely with industry counterparts to document technical best practices to strengthen early acquisition development and systems engineering practices.

**Strategic Intent**

*SPEQ is working to shape future national security space missions by providing superior analysis-based decision support to our customers in response to the need to strictly control costs while meeting ever-increasing requests for capability.*
Strategic Space Operations (SSO)

Aero-Effects Flight Program.
Aerospace played a key technical role in response to Air Force Research Laboratory (AFRL) strategic guidance to reduce risk and mature the technology associated with integrating laser weapon turrets on airborne platforms. A cornerstone of the Aero-Effects Flight Program Execution Plan is the development and flight test of an intermediate-scale turret based on technology matured under DARPA’s Aero-Adaptive/Aero-Optic Beam Control (ABC) program. The ABC turret will be flown on the next generation of the University of Notre Dame’s Airborne Aero-Optic Laboratory (AAOL), the AAOL-Transonic, a modified Falcon 10 capable of speeds exceeding Mach 0.8. Aerospace established and led an interface working group consisting of participants from AFRL, Lockheed Martin, and the University of Notre Dame, and coordinated requirements and interface development for integration of the ABC turret on the AAOL-Transonic aircraft. Aerospace performed initial systems engineering efforts leading to a successful ABC preliminary design review.

Air Force Nuclear Enterprise Mission Assurance (MA)
Aerospace conducted two key mission assurance reviews in support of the Air Force Nuclear Weapons Center (AFNWC) and Air Force PEO for Strategic Systems: an MA review of AFNWC’s Nuclear Capabilities Directorate, to assess management processes and accountabilities with respect to their weapon delivery systems; and a second MA review of the 576th Flight Test Squadron for Minuteman III Operational Test Launches, to assess their processes. These reviews are examples of how the Air Force is utilizing Aerospace’s MA expertise to ensure mission success for the nuclear enterprise.

Nontraditional Space Situational Awareness (SSA) Sensor Integration
Aerospace supported the development and integration of a nontraditional sensor system into the U.S. SSA architecture. Aerospace worked with engineers at various product centers to assess the performance of the nontraditional source for SSA tasking, collection, processing, and dissemination to the Joint Space Operations Center (JSpOC), and coordinated with Space and Missile Systems Center to ensure interoperability with the JSpOC mission system.
Tri-Layer Communications for Resiliency Development Planning (DP) Study

The study addressed a key initiative of the commander, Air Force Space Command, to identify the most affordable and operationally effective way to increase communications resiliency for the warfighter. Aerospace provided the technical leadership and rationale to HQ Air Force Space Command/ Directorate of Requirements to successfully advocate for this DP study, completed in FY13. Aerospace developed and evaluated cost data for 10 combinations of terrestrial, air, and space-based communications. Interoperability recommendations included investing in low-risk, air-to-space common data links; multiwaveform user terminals interoperable with both air and space layers; and a software-based radio waveform for ground terminals providing deployment and expansion flexibility. The results provide essential input for the Protected Satellite Communications Services analysis of alternatives (AoA), which is required to consider the contribution of an air layer.

Launch and Test Range System Capability Based Assessment (CBA)

Aerospace made key technical contributions to the commander, Air Force Space Command-directed Range CBA. The CBA assessed the billion-dollar annual launch and test range enterprise’s current capability and future needs, and made recommendations to streamline range activities with acceptable mission risk. Aerospace served as technical director of the multicontractor effort, performed overall systems engineering, and led inquiries into the commercial launch industry. Aerospace’s Economic Market Analysis Center led and developed the methodology for the CBA affordability analysis and developed an innovative approach to parametrically model lifecycle cost drivers.
Corporate Chief Engineering Office (CCEO)

**Collaborative Forums**
CCEO coordinated a number of collaborative forums with government and industry, including the Mission Assurance Summit, the Space Quality Improvement Council, and the Space Supplier Council, to foster greater transparency, communication, and cohesion within the national security space (NSS) community. The results are briefed to the Space and Missile Systems Center (SMC) commander, National Reconnaissance Office (NRO) director, Missile Defense Agency (MDA) director, and NASA associate administrator, and other senior leaders. The focus of the meetings involves transforming intent into action: tailoring MA and managing risk in different environments.

**Quality Management System (QMS)**
CCEO deployed a companywide QMS to formalize technical work performed at the corporation. The QMS is anchored in the newly published Business Operations and Quality Manual, which describes how QMS is implemented through corporate policies, practices, and processes. Numerous internal audits of functional areas and programs have been performed, and extensive employee training on quality has been conducted. In addition, 15 Technical Instructions and Procedures covering important technical accountabilities have been issued.

**Effective Mission Assurance Practices**
CCEO develops and promotes technical best practices, lessons, alerts, and major updates to the MA process. A configuration-controlled, tailorable, MA baseline and an integrated MA Tool (iMAT) are now in place to ensure program MA planning and verify accountability. CCEO incorporated ground segment and launch MA tasks to the baseline and is supporting iMAT transition to sustainment mode within Aerospace’s Systems Engineering Division.

---

National Space Systems Engineering (NSSE)

**Pentagon Decision Support**
Cross-company Aerospace teams provided technical leadership and detailed analysis for architecture and investment studies affecting the president’s FY14 and FY15 budget. Results from the Assessment of National Space Control Capabilities were presented to government officials at the highest levels in the Pentagon, the Office of Management and Budget, and the White House, resulting in significant resources to pursue a plan to protect NSS systems. The Future Long-Track Airborne Intelligence Surveillance and Reconnaissance Satellite Communications study identified investment strategies for satisfying future communications requirements for fixed and mobile platforms, resulting in a decision from the Office of the Secretary of Defense/ Acquisition, Technology, and Logistics (OSD/AT&L) to initiate a formal analysis of alternatives and influencing the FY15+ budget cycle. An Aerospace-led independent design assessment of the Precision Tracking Space System was presented to the Defense Management Action Group in the fall of 2012, influencing the FY14 president’s budget, and leading to a review of missile defense space layer requirements and options.

**Assuring Acquisition Success in the Pentagon**
Aerospace supported the Deputy Assistant Secretary of Defense for Systems Engineering to implement program protection planning across the space; missile defense; command,
control, and communications; and intelligence surveillance and reconnaissance mission areas. For programs like the JSpOC Mission System and the Evolved Expendable Launch Vehicle program, this effort helped shape program assessments for acquisition milestone decisions by the Defense Acquisition Board. Aerospace helped orchestrate a senior-level program review that helped build consensus for a transition plan from the current Milstar Secure Enterprise Conferencing Network capability to the Presidential National Voice Conferencing system.

**USSTRATCOM Space User Support**
Aerospace supported the Executive Agents for Space Staff, U.S. Strategic Command, NRO, and Air Force Space Command to execute a Defensive Space Control (DSC) CBA, providing a communications backplane critical for success. The CBA was used as the foundation for the nation’s first DSC initial capability document (ICD), of which Aerospace was the principal author. This ICD will drive significant changes in acquisition planning and future system development by increasing the importance of protection and enhancing current system procedures to defeat counterspace attacks. Aerospace also supported international cooperation maturation of the Combined Space Operations concept to deepen shared operations with current partners, and provided technical leadership in integrating NATO and U.S. efforts to combat purposeful GPS interference.

**Developmental Planning and Architectures Division**

**Hosted Payload Office (HPO)**
Aerospace support enabled the Space and Missile Systems Center Planning Directorate to establish and operate the HPO as the SMC focal point for planning and execution of commercial-hosted payload missions. The SMC Hosted Payload Solutions request for proposal will qualify a set of offerors who will then compete for mission-specific delivery orders to host, integrate, and support the on-orbit operation of government payloads on commercial satellite missions.

**Conventional Prompt Global Strike (CPGS)**
Aerospace provided independent technical support to the CPGS program (run from the OSD/AT&L) and to the DARPA Hypersonic Technology Vehicle (HTV-2) program.

DARPA’s HTV-2 third flight was cancelled, and Aerospace was chosen as the sole FFRDC to support remediation, which will extend through FY14. For OSD and the Air Force program office, Aerospace successfully led a navigation flight experiment and performed the postflight analyses that helped quantify key navigational aspects of future hypersonic strike systems. Aerospace completed Phase 1 of an analytical comparison of hypersonic glider shapes, which resulted in Aerospace’s inclusion in regular telecom discussions with the program director. Through extensive analyses, Aerospace also developed wind tunnel and arc jet test requirements for an Air Force CPGS concept vehicle. Additionally, to address the high costs of seagoing data collection assets, Aerospace designed a hypersonically jettisonable data pod, which collects flight test data, separates from the test vehicle in flight, and is recovered in the ocean. Ocean retrieval tests of the first prototype were conducted successfully in August 2013.

**Navigational Satellite (NavSat) Initiative**
NavSat is a proposed supplement to the GPS III constellation of approximately six less-expensive position, navigation, and timing (PNT) satellites that could enhance GPS affordability, resiliency, and availability of accuracy in urban/mountain canyons. Application of the Aerospace decision-support framework identified innovative concepts for more affordable, resilient, and capable operational architectures via PNT/Nuclear Detection System disaggregation, commercial competition, and payload second-sourcing. Aerospace analysis of high-efficiency power amplifiers, flexible signal power, and waveform implementation options enabled design, costing, and performance analysis of government reference NavSat concepts. The results support several future outcomes that include GPS III evolution, payload technology development, and potential operational augmentation.
Nanosatellites
Aerospace continues to be a leader in the small satellite community in advancing the technical capability and utility of nanosats. Aerocube 4 has been the most successful mission to date. The three-satellite constellation demonstrated formation flying using variable drag, “gyro-less” attitude control, and has acquired numerous images since launch in September 2012. Efforts are underway to develop Aerocube 6, to be launched in 2014. A design tool, database, and cost model have been developed to significantly enhance the capability and expertise to conduct nanosat mission concept design studies for Aerospace customers. Aerospace has played an integral role in the development of the USAF Space and Missile Center Development Planning Directorate’s Space Environment Nanosat Experiment pathfinder mission, which launched in November 2013 on Operationally Responsive Space-3 (ORS-3).

Missile Defense and Space Sensors Division (MDSSD)
Aerospace made key contributions in systems architecting and engineering, mission assurance, space system integration, and evaluation and insertion of advanced technology in support of the MDA. MDA manages an extensive program to develop, produce, and utilize target vehicles for major integrated tests of the Ballistic Missile Defense System (BMDS). Current space-based demonstration systems include the Space Tracking and Surveillance System (STSS) and the Near-Field Infrared Experiment.

STSS satellites carry first-of-a-kind electro-optic infrared sensor payloads designed to track missiles from launch to target impact. Aerospace was instrumental in assuring mission success on an MDA flight test that demonstrated the first successful realtime closure of the fire-control loop for a BMDS weapon system with a space sensor. Aerospace performed extensive pre-mission analyses and assessments to assist MDA in developing the test architecture, timeline, plans, and procedures. Aerospace leads the BMDS Capability Assessment team chartered by MDA to perform nonadvocate assessments of the fielded BMDS and its components. The team’s assessments, performed at element and system levels, inform both MDA leadership and the warfighter of BMDS capabilities and limitations. Additionally, Aerospace conducted analysis of STSS and the Space Based Infrared System to assess the expected performance of the BMDS.

Aerospace provided MA detailed pedigree reviews – a subset of the corporation’s launch verification matrix – for targets and interceptors destined for BMDS flight tests. In addition, Aerospace played a key role in resolving target and interceptor flight hardware issues, including issues that were pacing items in the execution of certain MDA flight tests.
Civil and Commercial Operations (CCO) works to apply the corporation’s considerable technical expertise, gained from decades-long experience in support of national security space, to the solving of problems for customers such as the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), and other federal agencies, along with states, nonprofit organizations, commercial companies, and international agencies. Additionally, CCO manages the Intellectual Property Programs Office, which works to put technologies developed by Aerospace researchers into the hands of commercial companies to create commercially viable products.

Strategic Intent
Leveraging the corporation’s expertise in support of national security, NASA, NOAA, and other civil space arenas, CCO is working to assist customers in areas of the public interest such as transportation, biomedical systems, energy, and the environment.
NASA Headquarters – In-Depth Programmatic Assessment for NASA Science, Technology, and Human Exploration Programs

Aerospace provides ongoing technical and programmatic analysis and monitoring of NASA projects and programs encompassing Earth science, climate and weather, planetary science, astrophysics, and heliophysics missions. Aerospace has conducted numerous programmatic assessments for NASA, including the Astrophysics Focused Telescope Assets mission and the Mars 2020 rover mission. Aerospace also provides program scenario planning for the NASA Headquarters Exploration Systems Development Division, which oversees development of the nation’s next generation of human exploration systems, including Orion, Space Launch System (SLS), and Ground Systems and Development Operations.
NASA Ames Research Center (ARC) – Lunar Atmosphere and Dust Environment Explorer (LADEE) Mission a Success

Aerospace played a significant role in the inaugural launch and mission of the Minotaur V rocket in September 2013 that carried the LADEE spacecraft. The LADEE mission was designed, built, and is being operated from NASA ARC in Northern California, with support at all phases from the local Aerospace office. LADEE is a small class-D mission that will orbit the moon to measure lunar atmosphere and dust. Scientists hope the mission will answer a question raised by an observation from Apollo astronauts in the 1960s and 1970s. Crew members of Apollo 8, 10, 15, and 17 saw pale, luminous streamers pop up over the moon’s gray horizon approximately 10 seconds before lunar sunrise or lunar sunset. On Earth, “twilight rays” can be frequently seen as shafts of sunlight penetrate evening clouds and haze. The airless moon should not have such rays, yet the Apollo astronauts clearly saw them. Aerospace will continue to play a key role in the LADEE mission, supporting operations through end of mission in April 2014.


Aerospace presented a CDC study on JPSS-1 and JPSS-2 space architecture to NOAA.
and NASA JPSS teams, as well as to the NOAA National Environmental Satellite, Data, and Information Service. An objective of the study was to examine an alternative JPSS architecture for JPSS-2 and beyond that would result in smaller vehicles and possibly lower total cost (while delivering the same capability as JPSS-1). Aerospace also presented a second CDC study on ground systems team capabilities to examine how they can be used to support future NOAA efforts.

Aerospace assisted the FBI in accessing and operating the Sentinel system to gather data and collect evidence, and provided critical leadership in ensuring FBI personnel were quickly integrated into their teams and able to perform their investigative and collection duties soon after arriving in Boston. Aerospace employed its significant evidence-management expertise to assist evidence technicians by fielding questions on Sentinel system process and workflow.

**U.S. Geological Survey (USGS) – Successful Landsat Data Continuity Mission (LDCM) Satellite Launch in February 2013**

The LDCM satellite, a joint NASA/USGS mission continuing a 40-year legacy of continuous coverage of the global land mass, was successfully launched in February 2013. Aerospace serves as one of two NASA mission managers leading around-the-clock activation and checkout of LDCM on orbit. Aerospace also played a key role in decommissioning Landsat 5, the longest operating low Earth orbit (LEO) mission ever launched.
In a spectacular nighttime event, the NASA Tracking and Data Relay Satellite (TDRS-K) was successfully launched from Cape Canaveral Air Force Station on an Atlas V in January 2013. The first new TDRS satellite to be launched in 10 years, TDRS-K joins seven other actively operating TDRS missions that provide vital communications for the International Space Station, Hubble Space Telescope, NASA science missions, and other LEO missions. Aerospace also had a major role in the acquisition and development of the third generation of TDRS satellites. Aerospace’s TDRS Resident Office at Boeing Satellite Systems has supported the program for the past five years, serving as the project’s “eyes and ears.”

Aerospace is conducting a commercial suborbital reusable launch vehicle (sRLV) market study for NASA’s Flight Opportunities Program. The study is analyzing sRLV’s market parameters based on many successful past transportation systems that were normalized for performance, technology, and capacity. Using a parametric approach, the study is assessing market expectations, economics, and physics to forecast sRLV technologies in various market scenarios. Analytics that consider speed, altitude, cargo capacity, range, and passenger count are employed to evaluate market capture rate and trip pricing relative to some of the most successful flight systems in the last century. Other parametric analyses and market estimates include vehicle safety, development, flight test programs, annual operational flight rates, maintenance, and other recurring costs.
National Science Foundation (NSF) / Division of Polar Programs

Aerospace established key relationships with DOD government stakeholders that resulted in approval for the NSF to be an authorized user of the Defense Satellite Communications System (DSCS) in order to provide high bandwidth communication to the South Pole base. In July 2013, Aerospace, acting on behalf of the NSF, led a continental U.S. (CONUS) shakedown test of equipment and procedures for the subsequent January 2014 test at the South Pole with equipment vendors, support contractors, and the Defense Information Systems Agency. Aerospace supported the January South Pole test, which achieved all goals. Further testing of CONUS and South Pole antennas are planned, with DSCS operational support to the South Pole base beginning in 2017.
Department of Energy (DOE)/National Nuclear Safety Administration (NNSA) Independent Assessment of Defense Programs and Nonproliferation Research and Development

Aerospace actively supports systems engineering and integration functions in nuclear weapons stockpile management and nonproliferation for the DOE. Aerospace provides embedded senior systems engineering support to the Weapons Systems Life Extension Programs for the B61 nuclear bomb, and also provides ongoing independent studies and analyses on technical and programmatic issues addressed by the Nuclear Security Enterprise. Aerospace, working with Lawrence Livermore National Laboratory and Los Alamos National Laboratory, also supports the development and accreditation of a new system architecture performance assessment capability for evaluation of current and future nuclear detonation detection system architectures.

MIT/NASA GSFC – Aerospace Supports the Transiting Exoplanet Survey Satellite (TESS) Program Selected for Flight

Aerospace provided assistance to the Massachusetts Institute of Technology (MIT)–led TESS program, which NASA selected for flight as the next astrophysics mission under the recent 2011 Explorer Mission Opportunity. The TESS mission, the next step after the Kepler mission, is a two-year, all-sky survey that will focus on the discovery of extrasolar “Earths” and “Super-Earths” around bright and nearby stars. Like Kepler, TESS will use the transiting method — dips in brightness of the host star — to discover new rocky and water worlds. Aerospace will continue to provide assistance to TESS during the execution of the flight program.

Intellectual Property Programs – NASA Requested Technology Transfer of Aerospace’s Small Satellite Launch Portal

NASA requested a technology transfer of the Aerospace-developed Small Satellite Launch Portal, a web-based searchable database for satellite developers to find candidate launch vehicle opportunities. The initial capability was intended to only include cubesat satellites, with the intent to expand to ride share for small satellites. NASA has expressed interest in expanding the capabilities to all classes of satellites. The plan is to transition the web-based system onto a NASA Ames Research Center server, update the system with current datasets for cubesats and launch opportunities, and then perform sufficient testing to release for initial operating capability.
U.S. Geological Survey (USGS) – Transferral of Landsat-8 Satellite from NASA to the USGS

Aerospace played a critical role in preparation for the launch of Landsat-8 and its transference of operational control from NASA to USGS in May 2013. The event marked the beginning of the satellite’s mission to extend an unparalleled four-decade record of continuous monitoring of Earth’s landscape from space. Landsat-8 is the latest in the Landsat series of remote-sensing satellites, which have provided global coverage of landscape changes on Earth since 1972.
**HERNDON SCIENCE COMPETITION**

Middle and high school students demonstrated their science experiments at the 36th Annual Robert H. Herndon Memorial Science Competition in Chantilly on April 7. A Herndon competition was also conducted in El Segundo on April 18.

Enthusiastic students demonstrated experiments covering vertical aquaponics, rotating greenhouses, ultrasonic sensors, salt-water conductors, and robotic prosthetic hands, among numerous other experiments.

The award is named for the late Robert H. Herndon, an Aerospace engineer and manager who served as a mentor for many at the corporation. The competition events are designed to stimulate interest among minority students in science, engineering, and technology, and increase diversity across the aerospace industry.

**STARS FIELD TRIP**

Aerospace’s state-of-the-art Spacelift Telemetry Acquisition and Reporting System (STARS) laboratory welcomed fourth-grade students from Star View Elementary School in Midway City, CA. STARS staff answered students’ questions on rockets, satellites, and space, while alien inquiries were addressed by Aerospace in-house extraterrestrial expert Dr. Ed Ruth.

Aerospace intends for these field trips to serve as a template on which a capability to visit schools and foster students’ excitement about learning science, mathematics, and engineering can be spearheaded. STARS personnel are working to build a “virtual STARS” capability as a training tool to get students excited about the space program.
ADAC

The Aerospace Diversity Action Committee (ADAC) is focused on capitalizing on the strengths and capabilities of a diverse workforce. By understanding the needs of our stakeholders, ADAC enables the attraction, management, and retention of a diverse employee population to support a dynamic and global business environment. A key part of this strategy is to design outreach and recruitment initiatives and activities centered around maintaining our position as an employer of choice. Inclusion and diversity are also part of our leadership development and continual learning programs.

Aerospace held its third Affinity Group Leadership Conference on July 9. Chaired by vice president Bernard Chau, the leadership orientation included more than 30 participants and presenters.

The conference offered participants a unique opportunity to have a direct impact on the creation of Aerospace’s inaugural ADAC-level strategy for inclusion and diversity (I&D), which encompasses attracting, managing, and retaining a diverse employee population and customer base. Diversity strategy discussions focused on participants’ experience with I&D at Aerospace, their vision for I&D, and the Aerospace I&D business case. In a separate session, affinity group leaders attended a capstone workshop focused on strategic planning and leadership.

The objective of ADAC is to assist Aerospace in meeting its equal employment opportunity (EEO) and affirmative action programs (AAP) commitment by providing an open forum for the discussion and development of EEO and AAP policies and diversity programs by representatives of Aerospace’s diverse population.

Leadership Lifestyle Event

Aerospace led a dynamic event titled “Leadership Lifestyle: In Work, Life, and the Community,” which offered a unique opportunity to learn about the individual traits of successful leaders by exploring their personal stories on their quest to succeed at work, in their personal lives, and in the community. These esteemed leaders openly and frankly discussed negotiating through barriers, overcoming adversity, embracing opportunities, and establishing a healthy balance between their responsibilities, goals, and personal life.

Leadership Lifestyle Café

A diverse group of Aerospace employees came together August 15 for the first Leadership Lifestyle Café — a career development initiative focused on work-life balance.

The café, a term used to denote the more informal collaborative discussion format, allowed participants to actively engage in collaborative conversations in small groups and then share the collected knowledge within a larger group. It served as a venue for employees to learn from other employees’ achievements and gain insight on how to best attain a work-life balance to be successful — as each individual defines success — at work, home, and in the community.
Youth Internships
For the fourth consecutive year, Aerospace participated in an internship program for inner-city youth sponsored by the Constitutional Rights Foundation. This year, two high school juniors completed an internship in the Corporate Communications Directorate. High school students are afforded the opportunity for hands-on experience and mentoring that can help them realize the wide variety of career possibilities ahead. Aerospace interns have emerged from the program energized, motivated, confident, determined, and prepared to make a better life for themselves.

Green Initiative
Aerospace’s new Chantilly campus achieves a high degree of energy efficiency and integrates with natural surroundings in an environmentally responsible way. Green materials for windows and roofing, and designs that achieve green certification, further illustrate how Aerospace is committed to minimizing its impact on the local environment and protecting the surrounding natural preserve.

Part of the Chantilly campus is an open-space system designed to link and preserve natural resource areas and provide space for passive recreation. The system includes stream valleys, wildlife habitats, and wetlands. Aerospace has designated 50 percent of the site (21.87 acres) as a private conservation area. Additionally, workers relocated 17 large trees to the National Reconnaissance Office site, adjacent to the Chantilly campus, and saved additional trees in the construction and stream restoration areas.

Albuquerque STEM Initiative
The Aerospace American-Indian and Alaskan-Native Council and the Aerospace Women’s Committee sponsored an event as part of the science, technology, engineering, and mathematics (STEM) initiative and outreach objectives. Aerospace employees visited with students at Pueblo of Laguna Middle School in Albuquerque, NM, and Aerospace volunteers spoke with students about the space and missile industry as well as local career opportunities available to students as they progress through their college curriculum and beyond. More than 120 students listened to discussions and watched videos of the Kodiak Launch Complex Space Test Program’s S-26 mission.
OUR WORKFORCE

Mentoring

A fundamental part of Aerospace culture is our commitment to assisting one another and encouraging growth in our professional environment. This practice is enhanced with numerous supporting efforts.

Aerospace Mentoring Initiative (AMI)

The AMI has grown tremendously in its third year of matching mentors with other staff to preserve and expand corporate expertise and personal development.

Aerospace Rotation Program

A number of employees participate in the rotation program to enhance perspectives and knowledge of the company and customers via temporary assignments throughout the corporation.

Diversity

A focus on supporting and strengthening diversity in our workforce is paramount in our corporate strategy, resulting in diverse teams that create innovative solutions faster and more effectively. We have a variety of events and programs that promote cultural awareness and inclusion among all employees.

Recruitment

Aerospace has aggressively sought to diversify its workforce through recruitment in academia, at science fairs, and via affinity groups.

COMMITMENT TO OUR PEOPLE

Our dedication to mission success, technical excellence, integrity, and objectivity is dependent on our commitment to Aerospace’s greatest asset: our people. We bring the same commitment and enthusiasm to workforce development and diversity that we do to the arenas of space systems engineering.

The Aerospace Institute

The Aerospace Institute offered more than 350 classes and seminars in FY13 to keep our workforce on the cutting edge in their fields. The Institute also operates the Charles E. Lauritsen Library, its suite of electronic resources, and The Aerospace Press.

Independent Research & Development

IR&D supports innovative research on issues crucial to national security space but reaches beyond the boundaries of traditional FFRDC funding.

Aerospace Corporate Study Assistance Program

Nineteen employees received fellowships in FY13 worth up to $15,000 annually per person. Another 60 received an academic reimbursement of $5,250, payable each calendar year.

Maintaining & Improving Our Workforce

To remain a leader in the application of engineering and science for advanced space systems, we recognize the importance of recruiting top talent while nurturing and retaining our world-class workforce.

Workforce Profile

More than 3,450 people work for Aerospace, at more than 20 locations across the country. Our employees are diverse in work experience, academic training, and demographics, enhancing the corporation’s reputation for career advancement opportunities and its ability to promote from within.

70% Percentage of our workforce who are members of the technical staff (MTS).

7 out of 10

Approximate proportion of MTS who hold advanced degrees in a broad range of disciplines. About 1 in 4 holds a Ph.D.

Charles Meigs, Jr. shared his personal experiences researching his African-American and American-Indian heritage with employees March 21 at the El Segundo offices. From left: Kimberly Locke, Aerospace American-Indian & Alaskan-Native Council president, Charles Meigs Jr. and Craig Robertson, Aerospace Black Caucus president.

Dr. Alexander C. Liang Asian Pacific Achievement Award luncheon, sponsored by the Aerospace Asian Pacific American Association (Aapaa) From left: Amy Peter, AAPAA president; keynote speaker Mike Gin; and Betty Liang, Kalyani Rengarajan, Sky Troyer, Lauren Kint, Vincent Kong, and Tung Lam.

Mike Drennan, senior vice president, Operations and Support Group, fields questions from mentees with The Aerospace Corporation’s East Coast mentoring and networking program Sept. 5 in Chantilly, Va.
HONORS & AWARDS

CORPORATE RECOGNITION

Theodore von Karman Award
Aerospace was presented with the Theodore von Karman Award, the Air Force Association’s highest honor in the field of science and engineering, for the corporation’s exceptional support to the Air Force and other government and civilian partners on a wide range of innovative projects.

2020 Women on Boards
Aerospace was recognized as “A 2020 Women on Boards Winning Company” for its commitment to board diversity.

Ethisphere Award
For the sixth consecutive year, the Ethisphere Institute—a leading research-based international think tank dedicated to the creation, advancement, and sharing of best practices in business ethics, corporate social responsibility, anticorruption, and sustainability—bestowed its Ethisphere Award on Aerospace, declaring the corporation to be one of the “World’s Most Ethical Companies.”

CORPORATE AWARDS

Team of the Year Award
The Commercially Hosted Infrared Payload (CHIRP) team was presented with the very first Aerospace Team of the Year Award. CHIRP was the first military payload hosted on a commercial satellite. It provided missile warning, technical intelligence, missile defense, battlespace awareness, and civil/environmental monitoring.

Excellence in Diversity Award
The Excellence in Diversity Award was presented to Sonia Henry for her leadership and promotion of diversity, inclusion, and excellence at Aerospace and in the community.

Office Professional Recognition Award
The Office Professional Recognition Award was presented to Corey Baer for her work extending far above and beyond what are considered normal duties for her position. While diligently maintaining access security, Baer helped design the security layout for the new corporate headquarters building and conducted the Annual Security Penetration Exercise, which tested Aerospace’s security measures.

The Herndon Black Image Award
Andrea Brangran, Karolyn Young, and Patricia Strong were presented with the Robert H. Hendon Black Image Award for their career and professional achievements, leadership and initiative, and community volunteer activities.

Howard Katzman Innovation Award
The Howard Katzman Innovation Award was presented to Dan Mabry, Norman Katz, William Crain, and Dr. Bernard Blake for their invention of a coin-sized dosimeter that monitors radiation in orbit.

Dr. Alexander C. Liang Asian Pacific American Achievement Award
Dr. Tung Lam was honored with the Dr. Alexander C. Liang Asian Pacific American Achievement Award for his outstanding contributions to the successful deployment of...
of the Enhanced Overhead System satellite system and to the GPS, NASA, and NRO programs, among numerous other professional and personal accomplishments.

**2013 Women of the Year**
The Aerospace Women’s Committee named Dr. Margaret Chen, Dr. Anne Gick, and Patricia Strong as the 2013 Women of the Year for their job performance, company activities, community involvement, professional/career/educational achievements, and leadership and initiatives that contribute to the advancement of the Aerospace mission.

**EXTERNAL AWARDS**

**Service to the Flag Award**
Dr. Wanda Austin and Lt. Gen. Ellen Pawlikowski, commander of Space and Missile Systems Center, received the inaugural Service to the Flag Award, given by the Women in Defense Greater Los Angeles Chapter.

**Women in Aerospace Leadership Award**
Catherine Steele, Vice President, Strategic Space Operations was recognized as an “exceptional role model and unparalleled leader, having made significant contributions to the aerospace field” and received the Women in Aerospace Leadership Award.

**2013 NDIA Peter B. Teets Industry Award**
The 2013 NDIA Peter B. Teets Industry Award was presented to Dr. Wanda Austin and Lt. Gen. Ellen Pawlikowski. This award recognizes exemplary government service and contribution to the development and support of space systems.

**David C. Schilling Award**
The Air Force Association presented the David C. Schilling Award to the Advanced Extremely High Frequency Satellite Rescue Team for “the most outstanding contribution in the field of flight.”

**Johannes Kepler Award**
The Institute of Navigation (ION) presented the Johannes Kepler Award, the organization’s highest honor, to Karl Kovach for his “sustained and significant contributions to the development of satellite navigation,” and his “contributions to the development of the Navstar Global Positioning System satellites, operations, signals, receivers, and standards.”

**Top 10 Breakaway CIO Leader**
The Evanta Global CIO executive summit honored Dr. William C. Krenz as a 2013 Top 10 Breakaway Leader. Dr. Krenz’s dynamic and influential leadership resulted in Aerospace becoming more efficient and effective in a high-consequence national security business, while maintaining a secure and reliable environment.
The Aerospace Corporation’s contributions to assuring space mission success are made possible through the efforts of many dedicated men and women. 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. The following people have been selected for their exceptional contributions in 2013.

**Trustees’ Distinguished Achievement Award**

Dr. Donald A. Lewis, principal director, Strategic Awareness and Policy, Systems Planning, Engineering, and Quality, was selected as the 2013 Trustees’ Distinguished Achievement Award winner “for outstanding personal contribution and leadership of Project West Wing (PWW) into its 56th year of premier space-related technical intelligence service to the nation.”

For more than two decades, Dr. Lewis has provided the leadership, personal technical contributions, and intellectual focus to make Project West Wing (PWW) synonymous with excellence in space intelligence. Dr. Lewis brought a new vision to the organization that traded its narrow Cold War focus for a broader strategy that supported the full spectrum of space technical intelligence research studies, as requested by various elements of the acquisition and intelligence communities.

During a time of great uncertainty and financial instability, Dr. Lewis built PWW into a flourishing enterprise that accounted for dynamic changes in a rapidly evolving global security environment. In many ways, he went above and beyond the typical duties of an Aerospace principal director, creating an innovative business model and adding relevancy and prestige to the PWW brand.
President’s Distinguished Achievement Award

The team of Ronald S. Clifton, director, Performance Modeling and Analysis Department; Marc D. DiPrinzio, senior engineering specialist, Mission Analysis and Operations Department; Dr. Matthew P. Ferringer, project leader, Architecture and Design Subdivision; and Timothy G. Thompson, senior engineering specialist, Performance Modeling and Analysis Department, all of the Engineering and Technology Group, was awarded a President’s Distinguished Achievement Award “for execution of a revolutionary constellation replenishment technique, allowing for performance recovery and optimization for a critical national system.”

Due to a system anomaly, an NRO asset was exhibiting degraded performance in one of its mission areas. Using the baseline constellation replenishment plan, it would have taken several years before this situation was rectified by the replacement of the degraded spacecraft. The team of Clifton, DiPrinzio, Ferringer, and Thompson was enlisted to provide support.

The team was tasked with developing simulation capabilities that were not previously available within Aerospace or elsewhere. In fact, such a difficult replenishment scheme had never been executed on any other program. Nonetheless, the team developed a revolutionary constellation replenishment technique that allowed for the recovery of system performance many years ahead of the anticipated date. The new constellation design significantly improved performance and was accepted by the NRO Director and intelligence community partners and has been implemented by the system program office, thus establishing a new constellation configuration plan.

Left to right, Marc D. DiPrinzio, Ronald S. Clifton, Dr. Matthew P. Ferringer, and Timothy G. Thompson
James W. Ford, principal director, Finance Planning, Analysis, and Reporting, Operations and Support Group, was awarded a President’s Distinguished Achievement Award “for outstanding sustained contributions to Aerospace financial management and corporate operations.”

Ford has devoted decades of extraordinary and exemplary service to Aerospace, having played a pivotal role in the unique field of Aerospace financial management for 25 years. His exceptional leadership and solid expertise have been instrumental in championing long-term management and operational initiatives that have vastly improved Aerospace and government operations, making them more streamlined, efficient, and effective. Through his efforts, Aerospace’s critical technical support to the Air Force, NRO, and other customers has never been jeopardized due to financial issues.

Ford’s ability to understand the financial and contractual implications of virtually any situation that arises at Aerospace, along with his understanding of the customer perspective, have allowed him to develop innovative and resourceful solutions to a variety of issues that have confronted Aerospace management over the past 25 years.

Kenneth H. Goussak, systems director, System Security Engineering, Space Systems Group, was awarded a President’s Distinguished Achievement Award “for developing an elegant and quickly deployable solution to mitigate a fatal design flaw uncovered in some GPS receivers during SAASM capability deployment, and for avoiding a major disruption in military operations of GPS-enabled platforms.”
Goussak made a significant, positive impact on the GPS program and several military platforms when deployment of the new version of the GPS Control Segment software revealed a fatal flaw in some SAASM-based GPS receivers. Working around the clock, Goussak was able to establish that the outages were caused by a flawed implementation of SAASM functions in the affected receivers. Very quickly, Goussak developed the iKey solution—a workaround that caused the flawed receivers to bypass the SAASM functions, while allowing all other receivers to exercise those same functions.

By October 2010, the flawed receivers had all been inoculated with iKey. Since then, a permanent fix has been developed by the receiver manufacturer, and has been partially fielded. While a number of operational units don’t yet have a permanent fix, Goussak’s iKey solution continues to protect those receivers from flaw-induced outages.

With timely decision-making and tireless effort, Goussak greatly minimized downtime for critical military systems and avoided hardware fixes that would have cost an estimated $30M.

Dr. Patrick H. Mak, principal director, Defense Meteorological Satellite Program (DMSP), Space Systems Group, was awarded a President’s Distinguished Achievement Award “for ensuring the continuity of critical environmental weather data for deployed warfighters.”

Mak championed a successful service life extension program for DMSP that extended the mission life of numerous satellites in the constellation, thus avoiding critical weather coverage gaps for deployed military users. Mak singlehandedly spearheaded the design and critical incorporation of a backup ring laser gyro miniature inertial measurement unit to address observed premature on-orbit failures. This important modification allowed DMSP F-17 and F-18 satellites to operate and meet mission requirements far in excess of design life.

Mak vigorously advocated for and implemented an innovative on-orbit, single-gyro spacecraft attitude control capability that extends DMSP F-15 and F-16 well beyond design life. He also developed and managed a service life extension initiative for key aging components, prolonging the life of the DMSP F-19 and F-20 satellites to be launched in the future. The impact of Dr. Mak’s efforts must be viewed not only in the extended life of these vital operational assets, but also in achieving cost-savings of greater than $500M while avoiding key mission outages for both the warfighter and civilian communities.
Corporate Leadership Board Of Trustees

(from left to right) Robert S. Walker, Bonnie J. Dunbar, Keith R. Hall, Tina W. Jonas, Kevin P. Chilton, Barbara M. Barrett, Wanda M. Austin, Peter B. Teets, George K. Muellner

Hon. Peter B. Teets
Chairman
Former Under Secretary of the Air Force and Director of the National Reconnaissance Office; former President and Chief Operating Officer, Lockheed Martin Corporation

Dr. Wanda M. Austin
President and CEO
Former Senior Vice President, National Systems Group, and former Senior Vice President, Engineering and Technology Group, The Aerospace Corporation

Amb. Barbara M. Barrett
Vice Chairman
Former U.S. Ambassador to Finland; former Deputy Administrator, Federal Aviation Administration; former President, Thunderbird School of Global Management; former CEO, American Management Association

Gen. Kevin P. Chilton (USAF, Ret.)
Former Commander, U.S. Strategic Command and Air Force Space Command; former member of the Joint Staff and the Air Staff; former NASA astronaut

Dr. David M. DiCarlo
Retired Vice President and General Manager of the Space Systems Division, Aerospace Systems Sector, Northrop Grumman

Hon. Michael B. Donley
Retired Secretary of the Air Force; former Director of Administration and Management, Office of the Secretary of Defense; former Assistant Secretary of the Air Force for Financial Management, and Comptroller

Dr. Bonnie J. Dunbar
M.D. Anderson Professor of Mechanical and Biomedical Engineering and Director of the STEM Center, University of Houston; former NASA astronaut

Hon. Keith R. Hall
Former Director of the National Reconnaissance Office; former Assistant Secretary of the Air Force for Space; former Deputy Assistant Secretary of Defense for Intelligence and Security; retired Senior Vice President, Booz Allen Hamilton

Dr. Daniel E. Hastings
Cecil and Ida Green Education Professor of Aeronautics and Astronautics and Engineering Systems, Massachusetts Institute of Technology; former Chief Scientist of the Air Force
Hon. Tina W. Jonas
President of UnitedHealthcare Military and Veterans; former Under Secretary of Defense (Comptroller) and Chief Financial Officer, Department of Defense; former Assistant Director and Chief Financial Officer, FBI

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

Hon. Michael Montelongo
Senior Vice President, Public Policy and Corporate Affairs, Sodexo, Inc; former Assistant Secretary of the Air Force for Financial Management, and Comptroller

Lt. Gen. George K. Muellner (USAF, Ret.)
Retired President of Advanced Systems, The Boeing Company; former Principal Deputy, Office of the Assistant Secretary of the Air Force for Acquisition

Dr. M. Elisabeth Paté-Cornell
Burt and Deedee McMurtry Professor of Engineering and past Chair, Department of Management Science and Engineering, Stanford University; Senior Fellow, Stanford Institute for International Studies

Mr. Jeffrey H. Smith
Senior Partner, law firm of Arnold & Porter; former General Counsel, Central Intelligence Agency; former General Counsel, Senate Armed Services Committee

Ms. K. Anne Street
President, Riverside Consulting Group, Inc.; former President and Chief Operating Officer, Geo-Centers, Inc.; former Vice President, Battelle Memorial Institute

Mr. Vincent Vitto
Private consultant; retired President and CEO, The Charles Stark Draper Laboratory

Mr. Alan C. Wade
President, Wade Associates, Inc.; retired Chief Information Officer, Central Intelligence Agency

Hon. Robert S. Walker
Executive Chairman, Wexler & Walker Public Policy Associates; former member of the House of Representatives from Pennsylvania

(from left to right) K. Anne Street, David M. DiCarlo, Michael Montelongo, John E. McLaughlin, Michael B. Donley, Daniel E. Hastings, Jeffrey H. Smith, Alan C. Wade, M. Elisabeth Paté-Cornell, Vincent Vitto
Corporate Leadership Executive Council


Dr. Wanda M. Austin  President and CEO
Ellen M. Beatty  Vice President, Chief Financial Officer, and Treasurer
Bernard W. Chau  Vice President, National Systems Group
Malissia R. Clinton  Senior Vice President, General Counsel, and Secretary

Dr. Manuel De Ponte  Senior Vice President, National Systems Group
Jerry M. “Mike” Drennan  Senior Vice President, Operations and Support Group
Rand H. Fisher  Senior Vice President, Systems Planning, Engineering, and Quality
Dr. Wayne H. Goodman  Vice President, Space Program Operations
Dr. David J. Gorney  
Senior Vice President,  
Space Systems Group

Ray F. Johnson  
Vice President,  
Space Launch Operations

Randolph L. “Randy” Kendall  
Vice President,  
Civil and Commercial Operations

Dr. William C. “Willie” Krenz  
Vice President,  
Chief Information Officer

Howard J. “Mitch” Mitchell  
Vice President,  
Program Assessments

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

Catherine J. Steele  
Vice President,  
Strategic Space Operations

Dr. Sherrie L. Zacharius  
Vice President,  
Technology and Laboratory Operations
Aerospace's revenue from contracts decreased in 2013 as compared with 2012 due to decreases in deliveries and related costs. The company signed a new five-year contract with the Air Force that expires at the end of fiscal year 2018.

Net cash provided by operating activities is used for capital expenditures and debt service. Net cash provided by borrowing activities is used to develop land and construct buildings. 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.
Active and Productive Year in National Security Space Launch

October 4, 2012 A Delta IV launched from Cape Canaveral Air Force Station delivered the Global Positioning System IIF-3 satellite to medium Earth orbit (MEO).

October 8, 2012 In NASA’s first operational commercial cargo resupply mission (CRS-1), SpaceX’s Falcon 9 rocket launched the Dragon spacecraft to the International Space Station (ISS) for NASA.

December 11, 2012 The X-37B Orbital Test Vehicle (OTV)-3 mission, involving the first X-37B to be reused, launched atop an Atlas V from Cape Canaveral. The payload is classified.

January 26, 2013 The Missile Defense Agency conducted the Control Test Vehicle (CTV-1) launch from Vandenberg Air Force Base.

January 31, 2013 An Atlas V lifted off from Cape Canaveral to deliver NASA’s Tracking and Data Relay Satellite System satellite (TDRS-K) to orbit.

February 11, 2013 The Landsat Data Continuity Mission (LDCM), carrying a payload of two Earth-observing sensors, was launched from Vandenberg. The LDCM will obtain valuable data and imagery to be used in agriculture, education, business, science, and government.

March 1, 2013 A SpaceX Falcon 9 rocket lifted off from Cape Canaveral and orbited a Dragon spacecraft on the CRS-2 mission to the ISS for NASA.

March 19, 2013 An Atlas V carrying the second Space Based Infrared System (SBIRS) satellite (GEO-2) for the U.S. Air Force blasted off from Cape Canaveral.

April 21, 2013 An Antares vehicle launched from NASA’s Wallops Flight Facility in eastern Virginia, under the commercial-off-the-shelf phase 1 demonstration program.

Corporate Values

Dedication to Mission Success Committed to assuring 100-percent space mission success.

Technical Excellence As the technical conscience of national security space, Aerospace tackles the tough questions and delivers the candid answers.

Commitment to Our People A rare collection of the smartest people in the field, fully empowered to do their best thinking and work.

Integrity A truly independent and unbiased nonprofit organization, with no competing agendas or incentives.

Objectivity Always delivering the technical truth, no matter what.