Orbiter
June 2018

Isakowitz Highlights Project Thor at June All Hands

by **Gail Kellner**
June 21, 2018

Steve Isakowitz and Dr. Wayne Goodman shared the stage for their signature format All Hands meeting on Thursday, June 21, addressing a packed house, complete with summer interns.

Isakowitz, president and CEO, showcased Project Thor, which he said improved corporate thinking and employee integration from across the corporation.

Isakowitz reminded employees that just three months ago, Deputy Secretary of Defense Patrick Shanahan asked the corporation for recommendations on plans to outpace the threat in space and how to align efforts to a new national defense strategy.

A diverse Aerospace research team was created to respond to the challenge, including: personnel who support national security agencies, NASA, and commercial companies. Teams also included personnel with experience working with the Pentagon and various branches of the Air Force. About 300 employees across the corporation were engaged in the project.

At the June All Hands meeting, CEO Steve Isakowitz asks the audience to raise their hands if they'd heard of Project Thor. (Photo: Elisa Haber)

Isakowitz said that the report, titled “Creating an Agile Space Enterprise,” was briefed to the deputy secretary of defense on June 6.

Project Thor Recommendations

Goodman, executive vice president, reported on the four recommendations in the report:

- A proposed change to the acquisition strategy for DOD space systems to one in which there is higher-volume production, called Continuous Production Agility (CPA).
- A recommendation of an integrated approach to management of the space architectural elements so that they function as an enterprise.
- A discussion on the importance of advancing the architecture through prototyping for rapid technology insertion and the benefits of developing partnerships with industry and allies.
- A discussion of the importance of streamlining the government’s decision-making process to achieve speed.

Isakowitz noted that the deputy secretary of defense was very interested in the CPA recommendation, and he asked for additional details in the next few weeks from Aerospace on how the DOD could implement this approach before he prepares a report for Congress in August.

Mission Success

Goodman reported another solid quarter of mission success. Among the most notable was the Air Force Space Command (AFSPC) -11 mission. Although there have been launches of EELV missions for well over a decade, there are still some first-of-a-kind missions, including the AFSPC-11 launched April 14 on an Atlas V. It was the first time an Atlas V rocket injected a satellite directly into geosynchronous orbit so that the satellite did not have use its fuel.

The launch included two missions: the Continuous Broadcast Augmenting SATCOM (CBAS) satellite – which augments existing military satellite communications capabilities and transfers military data with satellite communications relay links; and EAGLE, a geosynchronous laboratory experiment satellite built by the Air Force Research Laboratory.

New Appointments

In other news, Goodman announced that Kathi Chambers was appointed vice president of National Systems Group in May. She will lead geospatial intelligence and signal intelligence strategies in support of the government's intelligence space platforms. She has over 20 years of success in engineering, strategy, business, and acquisition for the DOD, as well as for civil, national security, and intelligence communities.

Changes within the ranks of Aerospace general managers were also announced:

- Andrew Dawdy has transitioned over to become general manager of the MILSATCOM Division.
- Debra Emmons has been promoted to general manager of Communication Technologies and Engineering Division.
- Phil Fawcett has been promoted to general manager of the new Electronic Programs Division.
- Susan Herbulock has been promoted to general manager of the new Enterprise Ground and Launch Division.
- Steve Leontis has been promoted to general manager of the Navigation Division.
- And, Dr. Randy Villahermosa has been promoted to general manager of iLab.

The Imperatives

Isakowitz re-emphasized the four imperatives – Shaping the Future, Innovation, Growth, and Velocity and he discussed how Project Thor has reinforced their importance and how they will fit into future goals and programs.

With new demands for its services increasing, the corporation is engaged in record hiring. Aerospace is also hosting a record number of interns this summer – 293. They are staffed in eight offices across the country, and they represent 124 schools from 32 states – and for the second year in a row, Scotland is represented.

Awards

Isakowitz presented the CEO 007 pin to Todd Nygren, general manager, Corporate Chief Engineer's Office, and Andrew Dawdy, general manager of the MILSATCOM Division, for outstanding contributions to Project Thor.

Todd Nygren hams it up after being awarded the CEO 007 Award for his work on Project Thor. (Photo: Elisa Haber)

Many Hero Award pins were presented throughout the quarter to various individuals, and Isakowitz highlighted a few of the recipients:

For Shaping the Future — Rachel Morford, for her role in developing the partnership with Space Norway for the launch of the Air Force's EPS-R communications payload on Norwegian satellite bus.

For Innovation — Andres Vila-Casado, Alon Krauthammer, and Esteban Valles for making the novel Sextant navigation project a reality.

For Growth — Adina Wadsworth, for her efforts with Congress to help get the STE increase pushed through.

For Velocity — John Fujita, Lubo Jocic, Mel Broder, and Megan Youngs, for their rapid support of architecture studies that evaluated space warfighting mission requirements on behalf of the major customer.

Isakowitz closed the All Hands meeting by thanking everyone for their excellent commitment to Aerospace for the quarter.

iLab and Starburst Accelerator Team on AI

by **Wendy O'Dea**
June 29, 2018

The Aerospace Corporation and Starburst Accelerator teamed up for the third time, this time in Chantilly, to introduce government stakeholders to emerging trends in artificial intelligence (AI).

The event, *Securing Our Future: Commercial AI Meets National Security*, took place on Wednesday, June 27, and featured commercial and government AI experts, start-up companies currently leveraging AI in various ways, and panel discussions.

Attendees from the Intelligence Community and Aerospace filled Gambit Auditorium for the morning's first keynote speaker, Dean Souleles, chief technology advisor for the Office of the Director of National Intelligence. Additional keynote speakers included Robbie Schingler, co-founder of Planet, William Brendel from Snap, Inc. (Snapchat), and Gary Landers, a methodologist for the National Air and Space Intelligence Center. These experts spoke primarily about current applications for AI, its limitations, and its potential for the future.

Robbie Schingler, co-founder of Planet, discuss AI at Chantilly event. (Photo: Carlina Johnson)

Start-up companies were also invited to attend the event to "pitch" and share with the audience how their organizations are using AI. During each presentation, audience members were given the opportunity to rate the company and submit questions, which were displayed in real time. Eight companies presented, including Descartes Labs, Slingshot Aerospace, Lucid Circuit and Spark Cognition.

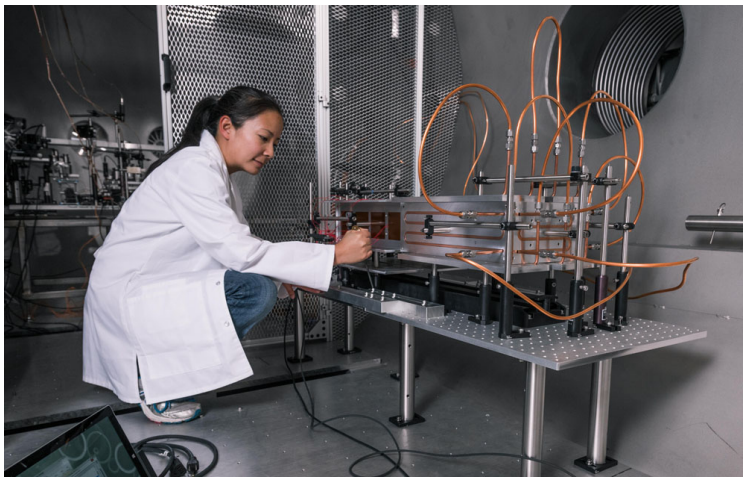
The chief technology officer from Ursa Space, Melanie Corcoran, gave an engaging presentation on the use of synthetic aperture radar—used to create two- or three-dimensional images of objects—and the company's ability to leverage it to collect and analyze geospatial data. Currently, Ursa Space is using this technology to monitor global oil storage.

The morning and afternoon sessions both concluded with panel discussions moderated by Van Espahbodi from Starburst Accelerator. The first panel focused on the current state of commercial AI, and the second focused on how to accelerate the acquisition and adoption of artificial intelligence. Panelists included Meagan Metzger from Dcode, Michael Colson from Amazon, Reggie Brothers from Peraton, and Aerospace's Randy Villahermosa, general manager of iLab.

Aerospace Leads in CubeSat Micropropulsion Testing

by **Wendy O'Dea**
June 25, 2018

A leader in micropropulsion testing and integration for CubeSats, Aerospace's micropropulsion facility has the unique capability to test cutting-edge microthruster technology that efficiently powers small satellites. As space technology evolves, one of the major goals in the advancement of space research and exploration will be to reduce the size and costs of launching satellites. The development and deployment of CubeSats and small satellites is an example of realizing this goal.



Dr. Andrea Hsu Schouten working in "The Snake Pit." (Photo: Erik Henderson)

CubeSats and Small Satellites Propulsion Challenges

Propulsion is important for all satellites. It enables a satellite to maneuver while in orbit, maintain an assigned orbit path and orientation, in addition to a host of other capabilities. Without it, satellites can't "go" anywhere. Historically, scaling down propulsion devices from large satellites to small satellites has been challenging and largely impractical due to power requirements and sheer size. However, this is changing in today's space environment.

The field of small satellite propulsion is growing, and growing *fast*—a cursory survey yields over a hundred propulsion device options, fueled largely by the rapid emergence of aerospace start-up companies.

Micropropulsion Testing Facility Services Aerospace Industry

In response to the growth of CubeSats and small satellites, The Aerospace Corporation's Propulsion Science Department has built a premier micropropulsion testing facility. Nicknamed "The Snake Pit," the facility possesses extremely precise instruments in order to

test miniature thrusters. With this facility, Aerospace can perform non-partisan, unbiased testing for small satellite propulsion customers including universities, aerospace start-up companies, and government agencies.

The Snake-Pit testing staff, led by research scientist Dr. Andrea Hsu, test micropropulsion in a vacuum chamber that is used to study how thrusters work in a space-like environment. The chamber uses precise, delicate instruments, designed and built in-house, to measure how much thrust (force) a miniature thruster can produce. Thrust is an important factor in gauging the performance of any propulsion device.

Prototype of a CubeSat that uses microthrusters. (Photo: Erik Henderson)

Snake Pit's Unique Capabilities

Typical amounts of force emitted from micropropulsion thrusters are on the order of hundreds of micronewtons, which is about the force of an eyelash falling on a hand. This may seem tiny, but in space where there is no gravity and no drag to overcome, only very small amounts of force are required for most missions. Testing these tiny amounts of force on Earth, however, poses some unique challenges like vibrational noise suppression, which are addressed in the micropropulsion testing facility.

Other tests include evaluating the performance of the thruster, such as how long it operates and if it experiences any type of failure. The entire testing process takes about a month's time and the data that is collected is reported to the customer along with any recommendations and feedback.

CubeSat Micropropulsion Technology Rises

Aerospace has an ongoing association with the Massachusetts Institute of Technology (MIT) to test its electrospray thrusters, and is also performing testing for commercial companies. "As CubeSats become increasingly capable and access to space becomes more readily available and inexpensive, small satellite propulsion research and development will really be going places," says Hsu.

All this means The Snake Pit will likely be very busy for the foreseeable future.

2018 Corporate Awards Presented in Gala Event

by **Eric Cheevers**
June 22, 2018

Thursday marked Aerospace's annual combined Corporate Awards presentation ceremony during which the corporation's highest honors, the Presidents and Trustees' Distinguished Achievement Awards, were presented in addition to other corporate awards.

The ceremony, which was held at 12 p.m. on Thursday, June 21, at Aerospace's corporate offices in El Segundo, California, was designed to pay tribute to the women and men who have made significant contributions to Aerospace, its customers, and the community.

The program began with a welcome by Steve Isakowitz, president and chief executive officer, who served as master of ceremonies along with Executive Vice President Dr. Wayne Goodman.

The Trustees' Distinguished Achievement Award winner Dr. Kasemsan Siri (right) shares a light moment with fellow award winner Michael Willhoff (left), CEO Steve Isakowitz, and board member Alan C. Wade. (Photo: Elisa Haber)

Alan Wade, a member of the Aerospace board of trustees, described the work done by recipients of the corporation's highest honor, the Trustees' Distinguished Achievement Award, commending honorees Dr. Kasemsan Siri and Michael Willhoff for their "unyielding resolve that affirmed Aerospace's core values." Wade then joined Isakowitz in presenting the award.

The individual and team honorees received trophies or plaques, depending on the category, as well as monetary awards of varying values. The honorees, along with a guest, were also invited to attend the Corporate Awards Dinner Program the same evening at Fort MacArthur in San Pedro where a celebratory evening was planned that included dinner, live music, and dancing.

Trustees' Distinguished Achievement Award

The Electrical Power System Team

Siri and Willhoff, both senior engineering specialists in Electronics and Power Systems, were cited for "outstanding contributions in identifying and resolving a wide-reaching electric power issue."

The duo had the complex role of providing independent assessments that consistently identified a critical contractor hardware design deficiency while maintaining a good rapport with the contractor, whose data was being scrutinized, to enable open data sharing and collaboration.

The team "identified and led the mitigation of a hardware design defect that impacted multiple national security space programs," the nomination stated. "The problem was initially associated with an operating mode discovered during ground test, however, the nominees hypothesized and modeled another possible way to activate this mode. As a result of the nominees' efforts, special testing of the design was completed which verified the Aerospace concern. Subsequently, the team established mitigation techniques tailored to individual programs. The exceptional analysis conducted by the nominees enabled the entire Aerospace, customer, and contractor community to better understand the overall operation of satellite electrical power systems."

The team's efforts and recommendations ultimately resulted in changes to major program milestones, and informed government decisions regarding hardware architecture and testing.

President's Achievement Award

Mark Nelson

The President's Achievement Award acknowledges specific outstanding achievements recognized by the professional community as being worthy of higher commendation. This year, two President's Achievement Awards were presented. The first recipient was Mark Nelson, senior project leader, Payload, GEOINT Development Office.

Nelson was recognized for "sustained superior technical and programmatic achievement for more than 30 years on National Systems Group missions."

"Mark Nelson has played an exceptionally influential role in the successful development and deployment of multiple national development programs over the course of his 30-plus year career, first as a contractor and subsequently as a consistently outstanding Aerospace employee," the nomination stated. "Mr. Nelson's achievements encompass the entire evolution of mission development, from formulation of mission requirements to identification of critical hardware technical readiness levels, to pragmatic, technical guidance on several large-scale hardware developments, to deep understanding of on-orbit hardware behavior and mission data providing unparalleled insights.

Over his career, Mr. Nelson's cumulative contributions have resulted in immeasurable cost savings/avoidance and years of schedule avoidance during space vehicle build and years of enhancement of mission duration."

Dr. Christopher Ranieri

Dr. Christopher Ranieri, engineering manager, Flight Design and Optimization, was also selected for the President's Achievement Award for "outstanding achievement in trajectory analysis for the Space Warfighting Construct."

According to his nomination, "Dr. Ranieri's technical insight and innovation, initiative, dedication, and communication skills have made him a recognized force in the emerging Space Warfighting Construct (SWC) community. These efforts have had direct impacts to multiple national programs of record, with the Air Force relying on his expertise to inform spacecraft upgrades to enable a stronger SWC posture in the near-term, for soon-to-be launched spacecraft, and for the next generation architectures."

Program Recognition Award

Civil Weather Systems Program Office

The Civil Weather Systems Program Office team was selected for the 2018 Program Recognition Award in recognition of program achievements and milestones. This award acknowledges the significant contributions of all categories of employees in the successful completion of a major program milestone that exceeded performance and reliability objectives.

The selection was based on the exceptional performance of the team, and for "critical performance and exceptional teamwork on the Civil Systems Program Operations' two successful satellite launches: GOES-16 and JPSS-1."

“Aerospace Civil Systems Program Operations (CSPO) division and its highly effective reach back team provided critical technical leadership to the interagency effort of NASA and the National Oceanic and Atmospheric Administration in its most successful year of satellite system engineering on record”, the nomination states. “CSPO’s team has been absolutely critical to the success of GOES-16 and JPSS-1 launches, each satellite the first of a new generation in two separate multi-billion dollar systems. GOES-16 is the first in a series of geostationary weather satellites essential for the nation’s public safety and JPSS is also the first in a series of global weather forecasting for planetary safety.”

Honorees from the 2018 Corporate Awards Program gather on the lawn in El Segundo. (Photo: Elisa Haber)

NOAA Satellite and Information Service Assistant Administrator Steve Volz said, “NOAA could not have been successful with GOES-R and JPSS without Aerospace support.” In addition, the nomination asserts that “GOES-R, now GOES-East, played a critical role during hurricane season, providing data to create unprecedented accuracy of hurricane tracks, saving countless lives, while JPSS has already been used for California firefighting and U.S. flood control even before operational acceptance. Fulfilling NASA and NOAA customer missions, CSPO has been critical to supporting these two failure-free launches that achieved mission success.”

JPSS/GOES-R Program Director Greg Mandt wrote, “The Aerospace team supporting NOAA satellite acquisition efforts have been absolutely vital to the successful development, launch and checkout of the nation’s next generation of operational weather satellites. The technical and management capabilities of the team members solved numerous problems and allowed government leadership to move forward confidently. The Aerospace team members deserve great credit and recognition for helping with the upgrade to this national critical infrastructure.”

Innovation Award

Watcher Team

The Innovation Award recognizes an individual or team that discovers, fashions, or develops a new or novel creation that has a noteworthy impact on Aerospace, its customers, or society at large. The innovation can be an outstanding singular act, a piece of work accomplished over a timely period of a few years, or a lengthy sustained effort with extensive positive impact in many areas.

The Innovation Award was presented to the Watcher Team of Daniel Balderston, senior engineering specialist, Applied Software Technologies, Michael Kaiser, senior project engineer, Systems Engineering and Development, Kenneth Lau, systems director, Systems Engineering and Development, and Aaron Myrick, project engineer, Systems Engineering and Development “for spearheading the development of The Watcher, which provides realtime monitoring and data analysis for warning and identification of cyber threats.”

The Watcher presents an entirely new innovation with no commercial analog, and can be uploaded to any spacecraft to provide on-orbit cyber threat detection and mitigation capabilities. The core of The Watcher is an artificial intelligence engine that learns the normal states of a given spacecraft and identifies even slight deviations to base states, while also possessing the ability to deploy quickly on legacy or existing hardware.

The Watcher can also detect malicious commands, malware, and software implants that may be inserted post-launch, and can intervene before malicious commands are executed by operating inside the flight software control loop, ensuring survivability.

Aerospace Team of the Year Award

Spectral Sensor Development

The Aerospace Team of Year Award acknowledges achievements that were made possible by the breadth and diversity of skills available at Aerospace and that have been recognized by the professional community as being worthy of higher commendation. The award's intent is to celebrate a true strength of Aerospace — the ability to synthesize exceptional products from a diverse and distributed workforce of specialists.

The 2018 Aerospace Team of the Year Award was presented to the Spectral Sensor Development team.

The team was recognized for "designing, building, and testing a new sensor capability and developing new processing and exploitation techniques."

Designed, built, integrated and flown within 24 months, the flight testing required the team to work off-hours and weekends to accomplish test objectives.

Excellence in Diversity Award

Peggy Tatum

The Excellence in Diversity Award encourages, recognizes, and rewards significant contributions and outstanding achievements that demonstrate excellence in advancing a diverse and inclusive work environment through outreach and recruitment, engaging diverse individuals and teams in the workforce, and creating an inclusive culture.

The 2018 Excellence in Diversity Award was presented to Peggy Tatum, application administrator specialist, United Communications Applications.

Tatum was recognized for "promoting diversity for 40 years at The Aerospace Corporation, in her community, and around the world."

In addition, Tatum has inspired the next generation of engineers and scientists in under-represented populations by establishing the Robert H. Herndon Memorial Science Competition on the East Coast, reaching out to students and teachers in Virgina, Maryland, and Washington, D.C., and increasing the number of students who participate. Her effort to inspire future STEM professionals also includes organizing the Brother's Fun Camp, introducing young African American boys to The Aerospace Corporation and future career opportunities.

Tatum has inspired and positively impacted people of diverse backgrounds by leading the Zeta Phi Beta Sorority Youth Organization programs that provide community services, social welfare, and academic scholarships, and by providing mentoring, counseling and support to teenage girls. Tatum has worked tirelessly to promote a diverse and inclusive work environment at Aerospace by assisting in the formation of Employee Resource Groups on the East Coast, holding leadership positions in the Aerospace Black Caucus and the Aerospace Women's Committee, and encouraging other employees to get involved.

Office Professional Recognition Award

Elaine Young

The Office Professional Recognition Award acknowledges outstanding achievements that have a very significant positive impact on the corporation's goals and/or objectives, demonstrate excellence exceeding normal expectations, and are recognized beyond the immediate peer group of the nominee(s). Applied effectively, this award will create a workplace climate of respect and opportunities for individuals with diverse backgrounds to grow personally and professionally.

This year's recipient of the Office Professional Recognition Award is Elaine Young, administrative specialist, Applied Software Technologies. She was nominated by the department director, Rick Johnson.

Young was recognized for "outstanding leadership in support of the Ground Systems Architecture Workshop (GSAW), while providing exceptional administrative support to the Applied Software Technologies Department."

Her nomination emphasized that her GSAW role is year round and noted that she showed leadership and initiative in that position.

Young, who came to Aerospace in 2015, worked in the Corporate Communications and Public Affairs Division before transferring to her current assignment.

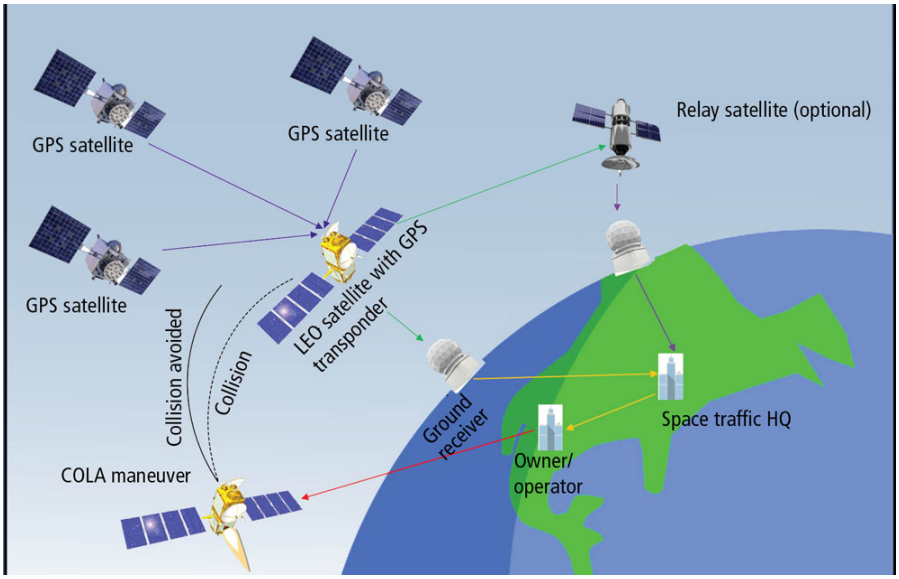
Nick Hirano also contributed to this story.

Dude, Where's My Satellite?

by **Gabriel A Spera**
June 04, 2018

When Aerospace scientists built the OPAL picosats nearly 20 years ago, they confronted a difficult challenge: how could they make such miniscule satellites visible to ground-based radar and optical telescopes? Ultimately, the problem was solved by tethering the two satellites together with a long cord that had gold wire dipoles woven into it, thereby increasing its radar cross-section.

The OPAL picosats were revolutionary at the time, but today, miniature satellites have become quite common. The problem of tracking them, however, has not gotten any easier. Moreover, the number of objects in space—both active hardware and inactive debris—has grown over time. This has made life increasingly difficult for spacecraft operators, who need to understand and manage the risk of a collision on orbit.

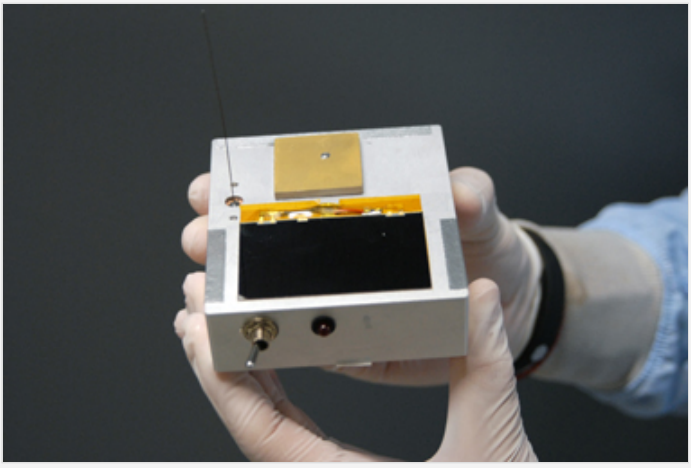


An overview of the GPS transponder system.

Researchers at Aerospace have been focused on the problem of space traffic management, and have derived a novel approach that draws upon another traditional area of expertise: GPS.

According to Andrew Abraham of the Mission Analysis and Operations Department, traditional passive tracking networks such as the Space Surveillance Network rely on the laws of physics to estimate where and when a tracked object will be. Still, various factors—intentional and otherwise—can alter a spacecraft's speed and trajectory. When that happens, the spacecraft can be lost, and tracking stations need to apply additional resources to locate it again.

A better solution would be for orbiting objects to actively communicate with tracking stations. That can be done, Abraham says, by means of an onboard GPS transponder.



The Aerospace Corporation's first working GPS-transponder prototype. (Photo: The Aerospace Corporation)

As envisioned, the device would transmit GPS data (position, velocity, and time) as well as a unique serial number. The encrypted signal would be received by ground- or space-based receivers and forwarded to a central coordinator for orbit determination and collision-risk assessment. The increased speed and accuracy would vastly improve calculations of collision probability and reduce the number of costly false alarms.

Such a system, Abraham says, would have ancillary benefits, as well. For example, the onboard GPS transponder could function independently, or provide input for a satellite's navigation system. This, in turn, could facilitate proximity operations on orbit and provide insight into risky maneuvers. Most importantly, the transponders would not be restricted to active assets, but could operate on dead rocket bodies and other inactive components that contribute to the growth in hazardous space debris.

Satellite identification, also called "Identify Friend or Foe," would be another benefit, said Abraham. "Unique, immediate, and unambiguous identification of space objects increases transparency and acts as a trust- and confidence-building measure with the potential to lower tensions in a contested space environment, should this technology become widely adopted," he said.

Aerospace is building these transponders by leveraging flight heritage of component parts from the highly successful AeroCube CubeSat program. Current efforts are focused on reducing the size of the transponder to roughly half the size of a pack of playing cards. That should make the technology feasible for a wide range of applications.

Abraham recently published a paper on the subject, "GPS Transponders for Space Traffic Management," in collaboration with the Center for Space Policy and Strategy. A brief overview can also be found on the corporation's YouTube channel.

A Model of Innovation

by **Gabriel A Spera**
June 18, 2018

Nearly 250 government-team attendees from more than 30 organizations converged on Aerospace in May for the third annual Systems Engineering Forum. With a focus on "Government Transformation to Digital Engineering," the event brought together members of civilian and military agencies, research centers, and direct support contractors.

Sponsored by the Corporate Chief Engineer's Office, the forum was organized by program chair Al Hoheb and deputy program chair Marilee Wheaton with sponsorship from Gail Johnson-Roth and Russ Kennedy. Additional support and engagement came from members of the Model-Based Systems Engineering (MBSE) Community of Interest. The event was planned in collaboration with the Office of the Secretary of Defense (OSD) and the SMC/AFSPC/NRO Enterprise Summit group.

According to Hoheb, MBSE is "the application of engineering models across the systems engineering and program life cycle." Such models can portray complex phenomena in a manner that is accessible and understandable to all stakeholders. OSD has expressed an interest in applying an MBSE approach beyond project implementation to enhance decision-making throughout the enterprise.

"Our customers are determining whether they want to use MBSE, how it fits into the OSD digital engineering strategy, and how to implement it with their mission partners," Hoheb said. "The Systems Engineering Forum technical workshops—along with the MBSE Community of Interest and support to programs—have provided needed leadership."

Robert Gold, director of Engineering Enterprise in the Office of the Deputy Assistant Secretary of Defense, delivered the keynote address, "Transforming DOD to Digital Engineering." Gold noted that MBSE will help outpace threats, minimize risk of unnecessary human interaction, drive additive manufacturing to reduce part count, and generally "drive the engineering practice towards improved agility, quality, and efficiency, resulting in improvements in acquisition."

Marilee Wheaton (Aerospace), left, poses a question to Chi Lin (JPL) during the government panel discussion.

The government panel, which included representatives from the DOD, civil space, and intelligence communities, provided insights on how to achieve the model-based enterprise vision. Panelists cited MBSE benefits, including the potential for better linkage between capabilities and cost/schedule implementation.

The panel also touted the prospects for better definition of implementation alternatives and faster technology adoption across the increasingly complex enterprise interactions needed to address emerging threats.

Through a series of interactive tutorials and workshops, Aerospace presented MBSE and problem-framing approaches that set the stage for technical presentations from different government organizations. Examples of successful implementations were demonstrated in classified and unclassified settings.

Discussions of enterprise and program MBSE tools underscored the importance of senior leadership follow-through for implementation success. "The space community has come to realize that a lot of work remains to be done to unlock the potential of MBSE to achieve the enterprise-wide digital engineering vision," Hoheb said.

The forum proceedings will be published as ATR-2018-01565.

The next Systems Engineering Forum, "Leveraging MBSE Across the Enterprise," will take place at Aerospace in mid-February, 2019. Registration will be open to all enterprise stakeholders from government, industry, and the research community.

Aerospace GPS Pioneers Added to Schriever Wall of Honor

by **Lindsay Chaney**
June 14, 2018

Two former Aerospace employees were inducted onto the Schriever Wall of Honor on Thursday, June 14. (Photo: Erik Henderson)

Two former Aerospace employees, whose work led to the development of the Global Positioning System, were posthumously inducted onto the Schriever Wall of Honor on Thursday, June 14, at a ceremony at the Los Angeles Air Force Base.

Hideyoshi Nakamura and Dr. James B. Woodford, Jr. were among six honorees recognized for their lasting contributions to national security space and the Space and Missile Systems Center (SMC).

Woodford and Nakamura made significant technical contributions to the development of GPS while working at Aerospace in the 1960s. The two carried out an extensive study on new satellite navigation systems that culminated in the 1966 Woodford-Nakamura report, which outlined 12 different options for system configurations. The twelfth option became the blueprint for the modern GPS.

SMC Commander Lt. Gen. John F. Thompson, who presided over the ceremony, hailed Woodford and Nakamura for "setting the gold standard of positioning, timing, and navigation that enables the American way of life."

Along with Woodford and Nakamura, the 2018 class of honorees consisted of James R. Dempsey, Maj. Gen. John E. Kulpa, Jr., Lt. Gen. Forrest S. McCartney, and Col. Albert John Wetzel.

Aerospace leaders in attendance at the unveiling included former Aerospace president and CEO Dr. Wanda Austin, former Executive Vice President George Paulikas, and Vice President Randy Kendall.

The Schriever Wall of Honor was named after Gen. Bernard A. Schriever, the architect of the Air Force's ballistic missile and military space program. The wall, which includes Aerospace founding president Ivan Getting, recognizes space and missile pioneers from the military, civilian government, and private industry.

Retired Maj. Gen. Thomas D. Taverney commended past and current honorees as "agents of change who never felt tied down and never settled for the status quo."

Press Release: Aerospace Selects Teri Spoutz as Chief of Government Relations

EL SEGUNDO, Calif., June 19, 2018 –The Aerospace Corporation announced today that Teri Spoutz has joined the company as the new chief of government relations. In this role, she will lead the organization's outreach to Congress, the executive branch, and state and local government officials. She will also conduct outreach activities for Aerospace's Center for Space Policy and Strategy (CSPS), which provides objective analysis and comprehensive research to ensure well-informed, technically defensible, and forward-looking space policy.

"We are delighted to have Teri joining the Aerospace team," said Jamie Morin, vice president and executive director of CSPS. "Her deep credibility and integrity will be great assets as Aerospace continues to work to shape the future in space."

Prior to joining Aerospace, Spoutz held positions at Pinnacle Engineering, as a professional member of the United States Senate Defense Appropriations Subcommittee, and as the director of the Air Force Budget Investment office. While working on the Defense

Appropriations Subcommittee, Spoutz performed oversight of Army, Navy, Air Force, and Marine Corps acquisition appropriations, and also recommended funding levels in annual defense appropriations legislation.

During her 20-year career with the Air Force, Spoutz acquired extensive financial and program analysis experience in all phases of weapon system acquisition, and, in her final Air Force assignment, was responsible for the budget formulation, financial execution, and accounting of Air Force procurement, research, development, test and evaluation, military construction, family housing, and base realignment and closure appropriations, which totaled more than $40 billion annually.

Teri Spoutz, chief of Government Relations

"Teri is a proven leader who brings a keen understanding of both DoD and Air Force financial management regulations and the congressional appropriation and authorization process to Aerospace," said Steve Isakowitz, Aerospace president and CEO.

Spoutz received her bachelor's degree from California State University Fullerton and her master's in business administration from Webster University. She earned the Secretary of the Air Force's Decoration for Exceptional Civilian Service in 2011.

About the Center for Space Policy and Strategy

The Center for Space Policy and Strategy is dedicated to shaping the future by providing nonpartisan research and strategic analysis to decisionmakers. The Center is part of The Aerospace Corporation, a nonprofit that provides objective advice to the government on omplex space enterprise and systems engineering problems. To read the latest publications related to space policy matters, visit www.aerospace.org/policy.

Press Release: Aerospace Awards STEM Scholarship to Future Engineer

EL SEGUNDO, Calif., June 14, 2018 –The Aerospace Corporation announced today the selection of Odinakachukwu "Aka" Amobi as the third recipient of the Dr. Wanda M. Austin Science, Technology, Engineering, and Math (STEM) Endowment scholarship award. Amobi will receive a $10,000 scholarship, which is potentially renewable for up to four years, along with a summer internship opportunity at Aerospace. Amobi is a senior at St. Bernard High School, a co-ed Catholic institution in the Los Angeles community of Playa del Rey. He will be attending California State University, Northridge in the fall to start his undergraduate studies in computer engineering.

Odinakachukwu "Aka" Amobi as the third recipient of the 2018 Dr. Wanda M. Austin Science, Technology, Engineering, and Math (STEM) Endowment scholarship award. (Photo: Elisa Haber)

"Ensuring mission success for generations drives our commitment to supporting the leaders of tomorrow," said Steve Isakowitz, Aerospace president and CEO. "Through this scholarship, we will help him soar to greater heights in engineering, and we can't wait to see what his promising future brings."

Amobi was born in Torrance, California, and moved back and forth between Nigeria and California during his elementary years. As a young child, Amobi's mother would take him on weekly trips to The Proud Bird, an airplane-themed restaurant near Los Angeles International Airport. Instead of eating, he remembers gazing in awe at these bird-like contraptions. Science continued to command his attention, and an eighth-grade science class eventually ignited his passion.

"St. Bernard is so proud of Aka," said Dr. Patrick Lynch, principal of St. Bernard High School. "He has tapped into the best of our STEM program and our co-curricular offerings to prepare himself for a promising future. In doing so, he has achieved academic success at the highest level and enhanced the program with his positive and enthusiastic approach to learning and especially to robotics."

Amobi played a lead role on the St. Bernard's robotics team at a regional competition in 2017. His robotics team attended a national robotics tournament, finishing fifth, narrowly missing out on participating in the worldwide robotics tournament. Amobi also served as captain of St. Bernard's varsity soccer team for two years, receiving numerous accolades for outstanding performances.

Amobi has played a vital role in the St. Bernard High School STEM Summit for all four years of his high school experience by leading diverse teams through several creativity-focused and engineering-related tasks.

Aerospace established the Dr. Wanda M. Austin STEM Endowment fund in 2015. The fund provides financial assistance to underrepresented and underprivileged high school students who demonstrate academic excellence, strong leadership skills, and intend to pursue undergraduate study in a STEM field at a four-year college or university. The fund is sustained through employee donations, charitable organizations, and estate gifts. More information about the STEM Endowment program can be found at: www.aerospace.org/education/stem-outreach.

Aerospace has also participated in the St. Bernard High School STEM Summit for the past four years. The idea for the summit comes from former Aerospace board of trustees member, NASA astronaut, and retired Air Force Gen. Kevin Chilton, who is also an alumnus of the high school. Chilton has routinely served as master of ceremonies for the competition.

Press Release: Aerospace's Policy Paper proposes Launch Unit Standards for SmallSats

EL SEGUNDO, Calif., June 8, 2018 – The Aerospace Corporation's Center for Space Policy and Strategy (CSPS) released a new policy paper today that explores the benefits of Launch Unit standards for smallsats during its Emerging Issues in Space Technology and Policy event at the Rayburn House Office Building in Washington, D.C.

In recent years, smallsats have proven to be invaluable in the space domain. Currently, most smallsats are launched as secondary payloads when there is excess space in a launch vehicle, and every deployment must be specifically designed for each smallsat. CSPS's new Setting the Standard: Launch Units for the SmallSat Era paper discusses the implementation of a launch standard for medium-class (25-200 kilogram) smallsats and the benefits those standards would provide to smallsat manufacturers, launch providers, government satellite acquisition programs, and other key stakeholders.

"More than 6,000 smallsats are expected to launch in the next 10 years, which is six times more than in the previous decade," said Carrie O'Quinn, senior project engineer for Aerospace's Research and Development Department. "As smallsats have increased in popularity, many stakeholders continue to advocate for cost-effective solutions in order to reduce cost and time-to-launch."

Just as smallsats have increased in popularity, so have rideshares. The authors' proposed standard configurations, like the Launch Unit, would enable straightforward access to launch vehicles, cargo, and satellites, leading to standard schedules and known pricing.

"The development of a standard smallsat Launch Unit is critical for high-launch availability and flexibility, integral aspects of achieving low-cost access to space," said co-author Danielle Piskorz, member of the technical staff in Aerospace's Visual and Infrared Sensor Systems Department. "The ability to swap out launchers and payloads on short notice is key for resiliency and addresses some of the shortcomings of modern launchers."

Aerospace is currently leading a coalition of industry leaders working to select a smallsat standard, called a Launch Unit, by the end of 2018. The group's recommendation will be announced at the Small Satellite Conference in Ogden, Utah in August 2018. At the same conference, CSPS will also host a panel discussion on the policy and economic implications of current trends in smallsats and launch.

"Aerospace has taken on a key role in the development of a standard smallsat form factor, or Launch Unit," said Jamie Morin, vice president and executive director of CSPS. "The Launch Unit pushes the smallsat community toward an ecosystem where one could build a satellite without knowing its launch vehicle, or where one could swap out launch vehicles or payloads on launch day. The implementation of the Launch Unit would significantly impact the development and success of the smallsat industry."

June 2018 Obituaries

by **Jessie Ding**
June 01, 2018

Sincere sympathy is extended to the families of:

Howard M. Cartwright Jr., member of administrative staff, hired May 8, 1961, retired Nov. 1, 1992, died Apr. 12, 2018
Jack D. Elias, member of technical staff, hired Mar. 22, 1968, retired Nov. 1, 1991, died Apr. 26, 2018
William Feess, member of technical staff, hired Aug. 5, 1963, retired Sep. 1, 2017, died May 17, 2018
E. Nason Field Jr., member of administrative staff, hired Jan. 29, 1962, retired July 1, 1997, died May 13, 2018
Angela Forman, office of technical staff, hired Dec. 20, 1960, retired Apr. 1, 1987, died Apr. 13, 2018

R.C. Hansen, member of technical staff, hired Dec. 5, 1960, retired Sep. 1, 1991, died Feb. 9, 2018
Ian MacDonald, member of technical staff, hired Oct. 17, 1960, retired July 1, 1993, died May 20, 2018
Helen M. Martin, office of technical support staff, hired Oct. 6, 1980, retired Feb. 1, 1988, died May 13, 2018
Charlotte McDaniel, office of technical staff, hired Aug. 26, 1985, retired Jan. 1, 2013, died May 2, 2018
Ali M. Naqvi, member of technical staff, hired Apr. 6, 1964, retired Apr. 1, 1998, died May 11, 2018
June Wohgethan, member of technical staff, hired June 23, 1980, retired Sep. 1, 1994, died Mar. 16, 2018
Robert White, member of technical staff, hired May 1, 1961, retired Jan. 1, 1986, died Apr. 8, 2018

To notify Aerospace of a death and have it included in the Orbiter, please contact People Operations at (310) 336-5107

These articles are reprinted from The Orbiter, a publication of
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