Orbiter
August 2014

Good Citizen Erik Baer Honored

by Matthew Kivel
August 28, 2014

Erik Baer, security director, Physical Security Department, was honored at a luncheon on Aug. 26, hosted by the El Segundo Police Department and the El Segundo Kiwanis club. He was presented with the Kiwanis and El Segundo Police Department Good Citizen Award by ESPD Chief Mitch Tavera for his timely and helpful response to a serious traffic accident that occurred in front of Aerospace's main gate on Tuesday, July 8.

Erik Baer, center, received the El Segundo "Good Citizen" award from police chief Mitch Tavera, left. On right is Kiwanis president Jerry Katzman. (Photo: Laurie Risk / El Segundo PD)

At approximately noon on July 8, Baer heard a loud collision near the Aerospace main gate on El Segundo Boulevard. He quickly discovered that two cars had engaged in a head-on accident and immediately radioed the Aerospace Security Control Center and instructed them to call 911. He then tended to one of the drivers, who was seriously injured in the accident, treating his wounds until the El Segundo Fire Department arrived. The victim was then transported by the ESFD to the Harbor-UCLA Medical Center trauma unit; he is currently recovering from his injuries.

In addition to Baer's efforts, Aerospace's security cameras recorded the accident, and the resulting video footage has aided the El Segundo Police Department in its investigation of the crash.

Three Honored with Woman of the Year Awards

by Kimberly Locke
August 27, 2014

The tradition of recognizing outstanding Aerospace women continued as the Aerospace Women's Committee (AWC) sponsored its 42nd annual Woman of the Year (WOTY) awards ceremony Monday, Aug. 25, at the corporate headquarters in El Segundo. The awards are part of AWC's Women's Week, featuring a variety of events for all employees.

This year, three award recipients were selected. They are Dr. Anita Polite-Wilson, manager, Leadership and Business Skills Development Office, The Aerospace Institute (TAI); Nish Fuchs, director, Business Intelligence and Reporting, Business Operations and Systems Services, Enterprise Information Services (EIS); and Jackie Wyrwitzke, principal director, Mission Assurance Subdivision, Systems Engineering Division, Engineering and Technology Group (ETG).

The award recognizes women at Aerospace who have made significant contributions in the areas of job performance; company activities; community involvement; professional/career/and educational achievements; and leadership and initiative that contribute to the advancement of the corporation.

In her opening remarks, Carmelita Johnson, AWC national president and project administrator specialist, Computers and Software Division, ETG, explained the theme of this year's Women's Week, "Celebrating Achievements and Pioneering the Future."

“This theme was chosen because AWC continues to celebrate the achievements of women and act as a pioneer to others,” she said.

After thanking all those who assisted with the award selection and ceremony presentations, Johnson introduced Dr. Wanda Austin, Aerospace president and chief executive officer, and a Woman of the Year award recipient in 1983.

“The WOTY ceremony inspires everyone at Aerospace because it reveals the wealth of talent and expertise that exists within the corporation,” said Austin. “By recognizing the achievements of these exceptional women, we show that our investment in talent development and our encouragement of employees to be involved in their community delivers tremendous benefit to Aerospace and to our customers.”

She then elaborated on this year’s Women’s Week theme and how “we continue to blaze new trails as we strive to improve for the future.” The examples set forth by the trio of major defense firms — Marillyn Hewson of Lockheed Martin, Phebe Novakovic of General Dynamics, and Linda Hudson of B.A.E. — are testimony to the achievements of women today, Austin said.

She added a few more to the list of today’s women pioneers with a brief mention of Mo’ne Davis, the first Little League baseball player to grace the cover of Sports Illustrated magazine, and Becky Hammon, new assistant coach to the San Antonio Spurs.

The 2014 Woman of the Year honorees, left to right: Dr. Anita Polite-Wilson, Nish Fuchs, and Jackie Wyrwitzke. (Photo: Eric Hamburg)

Austin continued with another first for a female, U.S. Navy Adm. Michelle Howard, who recently became the first woman to achieve the rank of four-star admiral in the history of the U.S. Navy.

“These four leaders, and countless others, have set a remarkable precedent for future generations of young women. Their stories serve to inspire and motivate Boomers, Gen X, Gen Y, and Millenials,” said Austin.

She underscored the need for celebrating individuals’ achievements “to show others what is possible, and with that possibility comes the confidence to pursue individual goals and dreams — whatever they might be.”

Austin concluded her remarks by returning to this year’s theme, “Pioneering the Future.”

“We must always strive to improve. Our industry isn’t static. It is always changing and evolving, as is our employee base. Sure, we’ve made improvements in promoting STEM professions to women, but we are not done. Women are still underrepresented in the STEM fields,” she said.

In reflecting on her many years at Aerospace, Austin added: “I’ve seen how far we’ve come, but more importantly, I’ve seen that this company has the will to evolve and improve. As Aerospace employees, we are all part of something bigger than ourselves — something great. This ceremony, and the women we are celebrating today, are evidence of that greatness.”

Susan Adams, senior business director, Operations and Support Group, and a WOTY award recipient in 1995, presented Fuchs’ accomplishments.

Nish Fuchs

The first award recipient, Nish Fuchs, was selected for her contributions to Aerospace’s systems and the insight she provides into “information systems and reporting in increasing the effectiveness and efficiency of business operations and mission success.”

With a bachelor’s degree in economics, with honors, from the University of California, San Diego, she continues to pursue educational opportunities while at Aerospace and completed a three-year program in business studies with a concentration in accounting at UCLA. Fuchs is also a certified Project Management Professional by the Project Management Institute. She has received numerous performance recognitions, Spot Awards, and commendation letters and has been promoted four times since joining the corporation some 12 years ago.

Most recently Fuchs served as a member of the Aerospace Leadership Today team that examined the current employee merit system and served as the presenter at Linking Leaders, a forum attended by most of Aerospace’s leadership. She is the EIS representative for the 2014 President’s and Trustees’ Awards Selection Committee and is a member of the Business Systems

Subcouncil to help prioritize business system needs, has served as a chairperson for EIS management meetings, and on the capital software selection committee.

She most recently led teams to “go live” with two new web application: Manager Web Reports, which is designed to provide managers with easily accessible business reports, and Labor Hours Review, a process for Space Systems Group management to execute job order tracking responsibilities with greater insight.

Fuchs has been active in Aerospace-sponsored events and has assisted with and participated in the Aerospace Toastmasters, AWC, and the Aerospace Asian Pacific American Association. She was a member of the Aerospace team for the Make-A-Wish walkathon and has been an active member of the Aerospace Employees’ Association’s Golf Club.

Her community involvement has included serving as a volunteer for such organizations as the Make-A-Wish Foundation, Hospice, and Children’s Hospital. She is a certified yoga instructor for both adults and children and donates yoga instruction to many charity organizations, including a shelter for battered women and children.

Anita Polite-Wilson

Marie Smith, director, Civil and Commercial Contracts, Finance and Business Operations, served to narrate Polite-Wilson’s accomplishments.

Polite-Wilson joined Aerospace in 2008 after breaking ground in the defense industry at the Space and Missile Systems Center (SMC) as a contractor supporting SMC’s Chief Engineer’s Office where she led a team to establish SMC University. For her efforts, Polite-Wilson received multiple commendations and cemented her reputation as a skilled facilitator.

She was then invited to conduct a leadership offsite for Dr. Sumner Matsunaga, general manager, Engineering and Integration, Space Systems Group, and shortly afterwards accepted a position as project leader with his division. Polite-Wilson led the re-invigoration of the Chief Engineers’ Council and several joint SMC/Aerospace efforts.

Polite-Wilson has made significant contributions in support of mission success to, among others, the Chief Engineers’ Office, SMC’s Personnel Office, and the SMC Strategic Planning Office.

Polite-Wilson was promoted to her current position as manager of the Leadership and Business Skills Development Office in 2013.

Her corporate activities have included supporting AWC and launch of its first annual Connections High Tea and Speed Mentoring Event in 2010 as well as contributing to the Aerospace Mentoring Initiative (AMI).

As a member of the AMI, Polite-Wilson led a subcommittee to design an orientation that explores the relationship between mentors and mentees. She most recently joined the AMI Steering Committee.

Through the Aerospace Rotation Program, Polite-Wilson was invited to join TAI in 2010 and was given the responsibility for the Program Office Personnel Enhanced Learning initiative, otherwise known as PROPEL.

Her community involvement has included serving as the monthly guest host of the Profiles in Passion series for Fantabulous Entertainment Radio Magazine. She is also the co-founder of Fruition Circle, Inc., which is based on the concept of women pursuing personal and professional growth within a like-minded mentoring community.

Polite-Wilson was among those who represented Aerospace at the Young Emerging Professionals Council, which included after-hours activities such as a series of cross-generational talks between the council and executives throughout the industry.

She is currently pursuing her coaching credential, having already earned her bachelor’s degree from Pepperdine University, one master’s degree from Biola University, and a second master’s and a doctorate from Fielding Graduate University, the latter two in Human and Organizational Systems. She joined the Rady School of Management at U.C. San Diego as an adjunct professor for the Elevate Certificate Program, which focuses on refining the soft skills that facilitate both professional and personal growth.

Jackie Wyrwitzke

Leading the presentation for Wyrwitzke was Dr. Allyson Yarbrough, principal engineer, Electronics and Sensors Division, ETG.

Wyrwitzke earned her B.S. and M.S. in aeronautical and astronautical engineering at the Massachusetts Institute of Technology. While at MIT, she was active in Air Force ROTC and worked as a research assistant at the Artificial Intelligence Lab, applying learning algorithms and classical multivariate control algorithms to unmanned aerial vehicles.

In the Air Force, Wyrwitzke was stationed at SMC where she worked in Developmental Planning and on the Milstar Program. Also while she was in the Air Force, she participated in the Education With Aerospace program where she worked in the Control Analysis Department in ETG for a year. After separating from the Air Force, she joined the new products group at Palomar Technologies and developed automated wire bond and fiber attach equipment.

In 2002, Wyrwitzke joined Aerospace in the MILSATCOM Division. She was a major contributor to the many challenges faced in the development of Advanced Extremely High Frequency spacecraft. She led "outstanding teams" from Aerospace to work challenges like the Hall Current Thruster risk reduction and integration and the solar array qualification, which were negatively impacted by commercial anomalies, according to her nomination packet. Wyrwitzke challenged and mentored team members in an effort to improve their capabilities and take on more responsibility, thereby strengthening the team.

She joined the Corporate Chief Engineer's Office in 2010 where she applied her skills as a proven change agent, working with teams to establish technical instructions to improve consistency of the corporation's critical technical processes. Wyrwitzke also managed key collaborative mission assurance activities such as the Space Quality Improvement Council and Space Supplier Council. In 2013 she joined ETG's Mission Assurance Subdivision and is also serving as the Mission Assurance Improvement Workshop's Program Committee chair.

Wyrwitzke was an early adopter of the AMI and participates in AWC's speed mentoring events. She has served as a management representative on the Aerospace Diversity Action Committee and worked closely with the Aerospace Totally Adaptable Group to help them achieve their goals.

Women's Week Events

The AWC Women's Week Planning Committee, led by Dr. Juliett Davitian, senior member of the technical staff, Propulsion Department, Vehicle Systems Division, ETG, is offering the following additional events:

• A luncheon, by invitation only, Tuesday, Aug. 26, for this year's award recipients and all other former WOTY honorees.

• Speed mentoring event with executive mentors, Wednesday, Aug. 27, 11:30 a.m. PT in A1 Titan IVA and IVB. Limited tickets remain. The ticket cost is $10 per person. To purchase tickets, contact Catherine Phan, 310-336-3090, or Karen Sharp, 310-336-0771.

• Speaker event with Dr. Bonnie Dunbar, member, Aerospace Board of Trustees and a former NASA astronaut; cosponsored with TAI as a Corporate Colloquium. Thursday, Aug. 28, 11:30 a.m. PT in A1 Titan IVA with VTC to various locations.

• Clothing drive, Monday, Aug. 25, through Friday, Aug. 29. There will be collection bins in El Segundo, A8 and D8 lobbies; Colorado Springs, front lobby; and Chantilly, A101 garage employee entrance, Greens 1 and Greens 3 lobbies.

The above events are open to all Aerospace employees except for the Aug. 26 invitation-only luncheon.

Student Team RIPS a New Tool

by Heather Golden
August 26, 2014


RIPS program members, left to right: James Gidney, Aerospace mentor; Victor Lin, Aerospace mentor; Kathleen Yanit; Tim Wu; Peter Morfe; Elizabeth Spencer; Flavio Lorenzelli, Aerospace mentor; and Stephen DeSalvo, UCLA academic mentor. (Photo: Heather Golden)

Four college students with this year's Research in Industrial Projects for Students, or RIPS, spent their summer working with a group of Aerospace mentors, breaking scientific ground and creating a new tool for company engineers.

The RIPS program is coordinated through UCLA's Institute for Pure and Applied Mathematics.

The students, all undergraduate mathematics majors – Peter Morfe, Cooper Union for the Advancement of Science and Art; Elizabeth Spencer, University of Maryland; Tim Wu, Massachusetts Institute of Technology; and Kathleen Yanit, University of Guam – collaborated with members of the Systems Engineering Division and the Communications and Cyber Division to study and calculate the communications channel capacity of satellite communication systems, specifically the Mobile User Objective System (MUOS). The theoretical capacity for this system had never before been calculated.

They worked primarily with four industry mentors from Aerospace — Victor Lin, associate director for the Modeling and Simulation Department; Flavio Lorenzelli, senior engineering specialist, Communication Systems Engineering Department; James Gidney, department director, Navigation and Geopositioning Systems Department; and Fletcher Wicker, retired casual, Communication and Network Architectures Subdivision — and one academic mentor provided by UCLA, Stephen DeSalvo.

"We hoped to provide engineers at Aerospace a tool with which to understand the performance of a system," Spencer said during a final seminar where the team presented their results and demonstrated their new tool.

To do this, the students first researched the various factors that affect how information travels to and from communications satellites — scintillation, terrestrial multipath, and shadowing. These factors have to do with combinations of physical obstacles, like buildings, geographical features and weather patterns, that interfere with the data.

The team's next step was to create mathematical formulas to be used to calculate and predict the new capacity levels given any number of the combinations of these interfering factors, called fading effects. This was their stated goal at the beginning of the nine-week program. But, they went a step further and created a user-friendly calculator in MATLAB, available for use by the Aerospace team.

"These tools developed will help us understand how well we are doing in meeting the capacity of the MUOS communication system," said Lin, the principal investigator for the RIPS project. "It provides us with a benchmark to see if we can further improve communication performance of SATCOM systems."

All four of the students said they did not know what to expect when coming to work with Aerospace at the beginning of the summer, only that their assigned project would somehow relate to mathematics. They ended up needing the separate skills each individual brought to the plate, like Yanit's knowledge of probabilities and Spencer's in-depth working knowledge of physics.

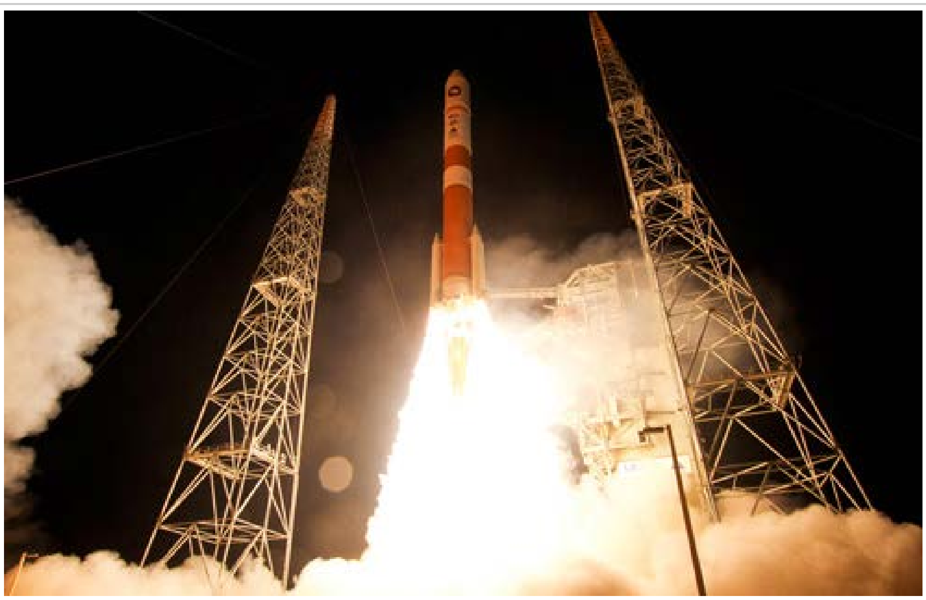
When asked their thoughts on the program, now that is it concluded, the students all replied that the level of independence they were given during this project is what set this program apart from other similar programs they had previously participated in. They were given their own office space to share and complete control over the direction they took with the project.

"What's also different about this program is it is the first time we're doing something that's quite applied, and the important thing I learned is with applied research, you really have to change your mindset," Wu said.

RIPS is an annual, nationwide program that attracts the top mathematics students in the country. The program receives upwards of 600 applications each year, from which only 36 students are chosen. These 36 are split into nine teams of four and are placed with different industry leaders to complete projects outlined by those companies.

Zero to 60: What's Faster, an Atlas V, a Delta IV, or Your Car?

by Lindsay Chaney
August 19, 2014



The Delta IV with four strap-on solid rocket motors is the fastest EELV launch vehicle. (Photo: United Launch Alliance LLC)

If you read automotive magazines, you know that zero to 60 – that is, the time in seconds it takes a car to accelerate from a standstill to a speed of 60 miles per hour – is a commonly cited performance metric.

For cars, it's a useful bit of information to have when shopping for a new vehicle or deciding whether to pass the truck in front of you. The zero to 60 time for a car correlates closely with how quickly you can pass other vehicles on country roads, change lanes on a freeway, and get up to freeway speeds from an onramp.

It's more difficult to find zero to 60 times for rockets. There's a simple reason for that, according to Jon Binkley, director of the Aerospace Spacelift Telemetry Acquisition and Reporting System (STARS) lab.

“It’s not that hard to record zero to 60 times for a car. You just need a big, empty parking lot and a stopwatch,” said Binkley. “But very few people are in a position to get that data for a rocket launch.”

Data From STARS

Fortunately, Binkley is in charge of one of the few facilities in the world that is capable of finding zero to 60 times using telemetry taken during the launch of a rocket carrying a spacecraft into orbit.

The Aerospace STARS facility gives engineers the ability to review, display, and analyze real-time launch vehicle telemetry; to inspect live video feeds of critical launch vehicle and ground support components; and to promptly communicate findings to the multi-agency, multi-located launch decision team.

Jon Binkley, left, and Jason Anderson study data from the FlightVis tool in the El Segundo STARS lab. (Photo: Eric Hamburg)

In the early days of the space age, the practice was to send a team of analysts to a launch site to review the data collected during the launch – a process that involved engineers being away from home for days or weeks at a time while they reviewed data on strip chart recorders. As technology improved, it became obvious that rather than sending the analysts to the data, it was better to bring the data to the analysts, and the concept of the STARS laboratory was conceived.

During a launch, real-time telemetry is displayed to analysts using a proprietary Aerospace program referred to as FlightVis, short for 3-D Flight Visualization Tool, which depicts, relative to the Earth, the position, attitude, and orbit of a rocket from liftoff to spacecraft separation. The tool can also calculate engine burn times and staging events based on the incoming telemetry.

Jason Anderson, a senior project engineer in STARS, developed most of the code for the current version of FlightVis and is responsible for running the FlightVis program during launches. Using telemetry archived at STARS from previous launches, Anderson was able to calculate zero to 60 times for a variety of recent launches.

Delta IV and Atlas V rockets — both built by United Launch Alliance, a venture owned by Boeing and Lockheed Martin — are in a class of launch vehicle called Evolved Expendable Launch Vehicles (EELVs). Both are available in a variety of configurations and are used for national security space launches. Each comes in two basic sizes, based on the diameter of the payload fairing – either four or five meters in diameter. The main engines of the Deltas and Atlases are the same for both sizes. The Atlas main engine is an RD-180 engine that produces about 860,000 pounds of thrust on liftoff. The Deltas are powered by an Aerojet Rocketdyne RS-68A engine with an advertised 702,000 pounds of thrust.

Each rocket also can be equipped with strap-on solid rocket engines that provide additional boost at liftoff. The four-meter Atlas series can have up to three solid rocket boosters (SRBs), while the five-meter will take up to five. The smaller Delta comes with a two-SRB option and the larger one can be ordered with two or four SRBs. In addition, the Delta comes in a Heavy version, which consists of three liquid engines strapped together. The Delta IV Heavy is the most powerful launch vehicle currently built by the United States.

Zero to 60 for Rockets

A rocket’s zero to 60 time is loosely related to its “performance,” which is a measure of how much mass a given launch vehicle can get to a specific orbit. All else being equal, a rocket’s speed off the launch pad will reflect its performance, since the faster the launch vehicle can climb out of the atmosphere and start building a horizontal velocity component, the smaller will be its velocity losses caused by gravity and aerodynamic drag.

But that is not the whole story.

For example, both Delta IV and the Atlas V rockets with no solid rocket boosters have been used to launch Defense Meteorological Satellite Program (DMSP) missions. The most recent DMSP mission, DMSP-19, launched April 3 aboard an Atlas V, went from zero to 60 mph in 14.96 seconds. The DMSP-17 launched in November, 2006, aboard a Delta IV took 13.14 seconds to go zero to 60. But the Atlas carries more fuel than the Delta, allowing its main engine to burn longer, so although it is slower off the pad, it actually has better performance and can lift more weight to a given orbit.

This performance difference between the Delta and Atlas rockets is also seen in GPS IIF missions, for which the Atlas uses no SRBs while the Deltas are outfitted with two SRBs. The Atlas — carrying GPS IIF-4 — took 15.3 seconds to go zero to 60. The other five GPS IIF missions on Deltas have all gone zero to 60 in under five seconds — demonstrating better performance provided by the SRBs.

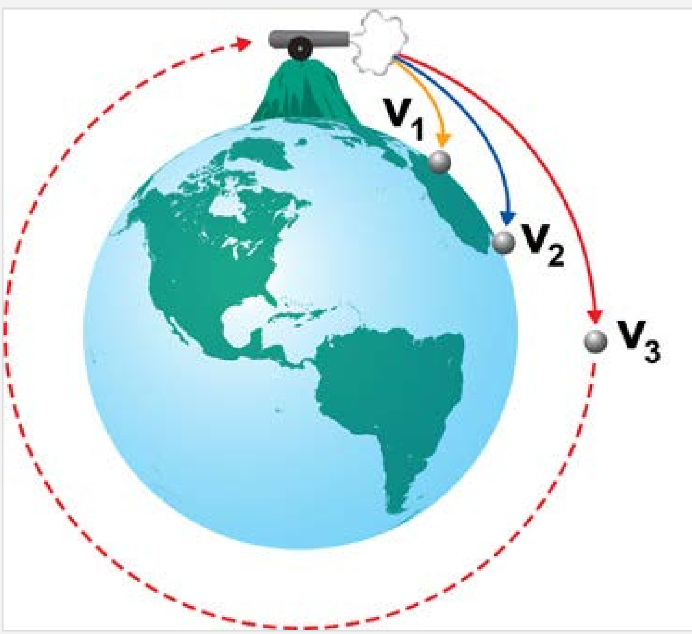
The Navy's second Mobile User Objective System (MUOS) communications satellite was launched in July 2013 aboard the most powerful and fastest version of the Atlas V, equipped with five solid rocket boosters. (Photo: United Launch Alliance LLC)

Interestingly, the topic of whether a Delta IV without any SRBs could get a GPS IIF satellite to its proper orbit has been the subject of discussion among the Air Force and defense contractors, going back more than 10 years. Aerospace contributed to the debate, doing a study that concluded a Delta IV without SRBs could get a GPS IIF to orbit if the rocket launched in a different direction than GPS satellites were usually launched. However, the decision was made to keep the two SRBs to provide an extra margin of performance.

Getting to Orbit, and Staying There

Getting a spacecraft to the proper orbit for the job it needs to do is what the space launch business is all about. The flight profile — such things as the direction of the rocket launch, length of main engine burn, and number of second stage engine burns — for every launch is different, even with similar or identical spacecraft. That is because the flight profile is adjusted for things such as the upper atmosphere winds and the amount of solar radiation on the day of launch, the launch day temperature, as well as other conditions that can affect the rocket being launched. In addition, each launch vehicle has a unique liftoff weight, even if it is carrying the same payload on the same configuration to the same orbit as another rocket. The reason may involve design changes on components, making them heavier or lighter than previous versions. There also could be additional instruments or secondary payloads.

In general, rockets launch straight up for about eight seconds, then pitch over and race toward the horizon. Rockets launched from Cape Canaveral go in an eastward direction to take advantage of the extra boost in speed provided by the Earth's rotation. Rockets launched from Vandenberg generally head south to reach a polar orbit.



Issac Newton proposed this "thought experiment" showing how a cannonball fired from a mountaintop would go into orbit if its velocity was high enough. (Illustration: Stuart Araki)

Being in orbit essentially means that an object is falling toward the earth, being pulled by gravity, but is traveling at a fast enough horizontal speed that the path of the object exactly matches the curvature of the Earth. In effect, an object in orbit is in freefall, but falls over the horizon and never hits the ground.

The trick to getting a spacecraft into orbit is getting the speed high enough that when the engines cut off, the spacecraft is traveling at an orbital speed.

Orbital speed varies depending on how far a spacecraft is from the Earth's surface. Somewhat counterintuitively, the further away from the ground a spacecraft is, the slower the orbital velocity.

For example, an object in a circular low earth orbit 100 nautical miles (115 statute miles) above the surface travels at 17,430 mph. It circles the Earth about every 90 minutes. An object in geosynchronous stationary Earth orbit over the equator, 19,323 nautical miles up (22,235 statute miles), travels at only 6,880 mph. A satellite at that height orbits the Earth once every 24 hours, thus appearing to stay motionless in the sky.

How Does Your Car Compare?

Now, back to the question posed by the headline to this story, can your car go zero to 60 faster than an Atlas V rocket? And how about a Delta IV?

Among other things, that depends on what kind of car you drive. According to the website zeroto60times.com, a 2014 Toyota Corolla L, for example, will go zero to 60 in 9.1 seconds. The 2014 Honda Accord Hybrid will do it in 7.2 seconds. And the 2014 Porsche 911 Turbo only takes 3.2 seconds.

How fast a rocket will go zero to 60 depends to a large extent on how many strap-on solid rocket boosters it has. As noted above, an Atlas V with no SRBs has launched both DMSP and GPS IIF satellites and has taken about 15 seconds to reach 60 mph. That makes it slower than virtually every new vehicle on the road today, including minivans and pickup trucks. The Delta IV with no SRBs took a DMSP to 60 mph in 13.14 seconds, which makes it slightly faster than a 2014 Toyota Aygo, which has a zero to 60 time of 13.9 seconds and isn't sold in the U.S.

Although it is the most powerful launch vehicle used by the United States, the Delta IV Heavy is not the fastest. (Photo: United Launch Alliance LLC)

But adding a few SRBs makes a considerable difference. The Delta IVs that have launched GPS IIF satellites used two SRBs and reached 60 mph in times ranging from 4.66 to 4.83 seconds. That makes the Delta IV almost as fast as a 2013 Mustang GT 5.0 (manual gearshift), which goes zero to 60 in 4.5 seconds.

Adding two more SRBs to the Delta IV, for a total of four — the configuration used for Wideband Global SATCOM missions — results in times to 60 mph of 3.6 seconds, the same as a 2015 Ferrari California T, and the fastest time for any Delta or Atlas launch vehicle.

That is the most powerful version of the Delta IV, aside from the Delta IV Heavy. Because the Heavy is so heavy, it is slower off the pad — the last Delta IV Heavy launch from Vandenberg took about 11 seconds to reach 60 mph, although a Delta IV Heavy launch in June 2012 did zero to 60 in 9.06 seconds, a tad faster than the Toyota Corolla.

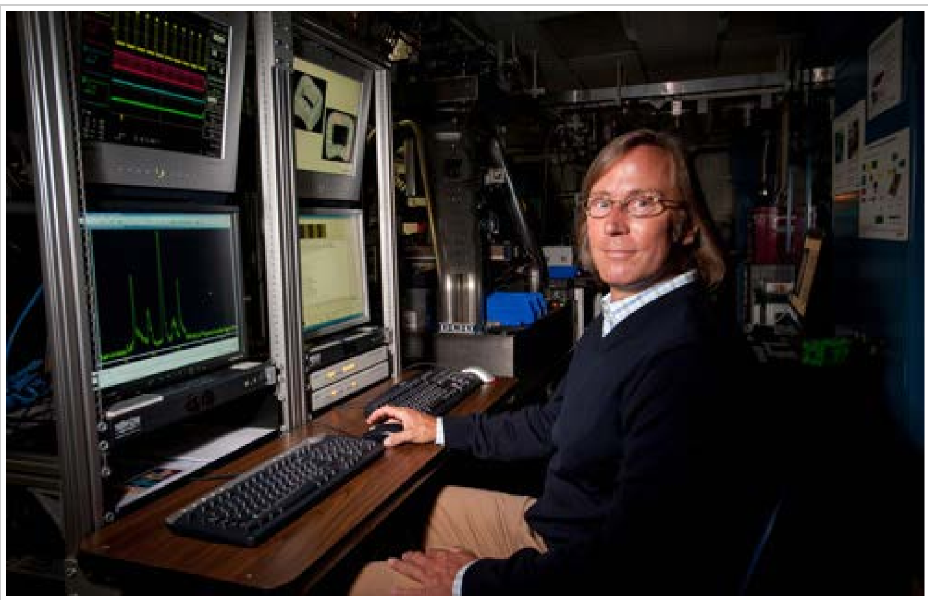
The fastest Atlas V rocket is the 551 version, the one with five solid rocket boosters. It has been flown four times, the most recent in July 2013 in 4.49 seconds, and the fastest in August, 2011, when NASA launched its JUNO mission to Jupiter. The zero to 60 time was 4.39 seconds, edging out the aforementioned Mustang GT 5.0.

No matter how fast your car accelerates to 60 mph, the one thing it can't do is keep accelerating to more than 17,000 mph, the speed a spacecraft needs to be traveling to get to orbit. That is faster than any other object on Earth can move. The fastest jet plane ever flown was the SR-71 Blackbird, once clocked at 2,193 mph. A high-power rifle bullet can reach about 3,100 mph, still nowhere close to the orbital speed of a launch vehicle.

Although space launches can seem routine these days, it still takes tremendous engineering skill to get launch vehicles to the correct speed and their payloads safely to orbit — a job The Aerospace Corporation has been doing for more than 50 years.

An Aerospace Technology Moves From Sensors to Medical Implants

by Matthew Kivel
August 14, 2014



Dr. Frank Livingston in his laboratory. (Photo: Elisa Haber)

Some of our most useful human inventions are, in reality, anything but human. Velcro, Japanese bullet trains, waterproof fabrics, swim suits and countless others were all, in some way, inspired by the natural world and its spectrum of intricately evolved organisms. Since the beginning of human existence, we have looked to the world around us for ideas in order to enhance our environment and contribute to the evolution of our species.

In recent years, the concept of mining nature for technological innovation has only intensified. Why develop a new concept from scratch when plants, animals, and microorganisms have had millions of years to perfect their finely tuned processes? Scientists have been asking that question a lot recently and, in turn, are increasingly using nature's evolutionary head start to their advantage. Nowhere is that more apparent than in the surging biomedical field, where innovative technologies are being developed to grapple with many of humanity's most challenging health-related issues.

Tucked away in Aerospace's El Segundo campus is Frank Livingston's lab. A sprawling collection of computers and parts, it is centered around a labyrinthine, laser scripted processing machine that is so precisely constructed that attempts to develop a fully functioning duplicate in other facilities have been largely unsuccessful. Livingston is a senior scientist for the Center for Laser Materials Processing at Aerospace and he is also the sole member of Aerospace's fledgling biomedical department. "It's just me right now," laughs Livingston, whose recently co-patented design for laser processed medical implants presents a potentially game-changing solution to a problem doctors have been dealing with for decades: how to get medical implants to participate in the physiology of the human body as a safe, interactive component instead of as an inert support system.

The notion that Aerospace's investment in laser technology would one day lead to advances in the biomedical field may seem surprising, but not to Livingston and Aerospace's Tim Taylor, senior projects engineer, Business Development, who saw vast cross-industrial potential in Livingston's research. Over the past few years, Livingston, Taylor, and John Skratt, principal director, Civil and Commercial Development Directorate, helped to assemble much-needed support and funding for research and development from Amendia – an implant technology firm based in Marietta, Georgia.


Close-up view of an implant. (Photo: Elisa Haber)

Livingston's long, strange trip into the biomedical world began in 2008 with an Army research grant that had him working with bio-inspired materials for surveillance and communications technologies. In collaboration with Aerospace, the U.S. Army Research Laboratory, MIT, Caltech, and the Institute for Collaborative Biotechnologies at UC Santa Barbara, Livingston worked to develop passive uncooled infrared sensors for target tracking, surveillance, and driver vision enhancement, the latter being the primary application of the technology.

Using laser scripted processing, Livingston was able to create novel infrared-active focal-plane arrays comprising highly sensitive nanoparticles – barium titanate and barium strontium titanate developed by UCSB and ICB researchers. The nanoparticles, initially synthesized in an IR-inactive phase, were spincast as ultra thin films directly onto prefabricated infrared sensor circuitry. Following laser scripted pixelation and site-selective pyroelectric activation, the prototype arrays could observe infrared photons at various wavelengths and time scales. The low-cost, high-efficiency nature of these new sensors makes them incredibly useful in a host of military settings, especially since they require no power and, thus, can operate in nearly any context. Currently, the Army is in the process of field testing the sensors.

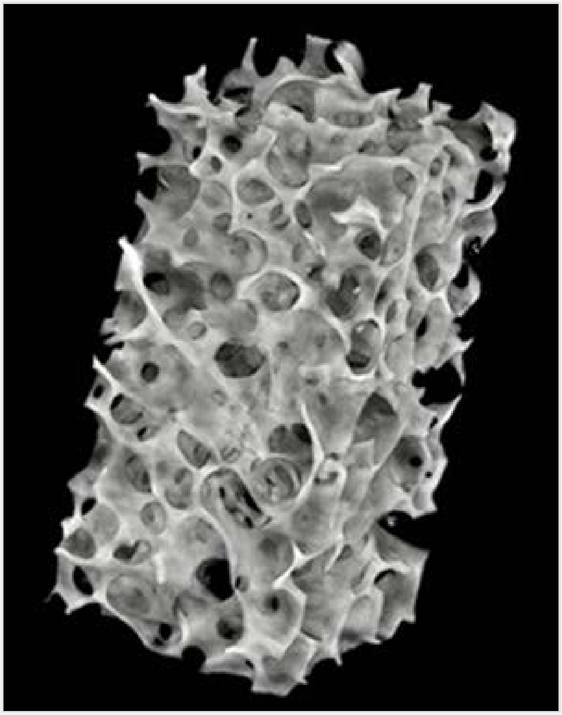
In 2012, based on the success of the infrared sensor design, Tim Taylor tasked Livingston with developing a biomimetic implant for Amendia that could interact with the human body in a way that promoted effective healing while remaining safe to the patient.

"The whole premise for this came from Dr. Tim Ganey from the Department of Orthopaedic Surgery at the Atlanta Medical Center and a scientific medical advisor to Amendia," says Livingston. "Cells respond to pattern, structure, and topography, and they also respond to a lot of other physics and chemistry taking place on the surface of inner body devices and biological systems. Dr. Ganey's premise was that certain biogeometric patterns, particularly those derived from marine mammals, could be translated to create bio-architectures that promote cell recognition and regulate vital cell functions. Following pattern recognition, the cells would then communicate – not only with themselves, but with the surface – to create a bone-specific morphology that would mimic nature and have an isotropic cancellous or trabecular structure, so you could promote better fusion and better tissue regeneration, while reducing complications related to poor fixation, fibrosis, and inflammation."

With Ganey's research as a foundation, Livingston set out to inscribe cervical and spinal implants with a specific set of physical instructions for cells to react to while inside of the human body. Instead of accepting the limitations of human bone structure, he and his collaborators developed an implant that was better-suited to the task of healing by looking to the skeletal makeup of sea mammals that support enormous bone structures while living in the tremendously buoyant confines of the ocean. As a consequence of their under-loaded conditions, marine mammal tissues develop in a manner significantly different from human tissues. Marine mammal skeletons are unique in their structure and molecular organization, comprising a predominantly isotropic cancellous bone structure, which is spongier in consistency, more uniform, and lighter than human bone.

"When implemented under normal gravitational conditions, the marine-derived architectures – with their exceptional structural and mechanical properties – provide enhanced tensile loading and the ability to stimulate bone cell activity with tissue-specific composition," says Livingston. "The marine mammal patterns encourage cell adhesion and differentiation, and enhance bone matrix deposition, metabolic efficiency, and vascularization – all critical factors that may support faster and higher quality bone regeneration and reduced healing times for humans."

When Livingston designs an implant, he is updating the code of the human body in a truly revolutionary way, by essentially customizing the implant – via laser scripting, which embeds genetic and other medical information into a laser etching – to maximize efficiency in the processes of healing and regeneration. These cervical and spinal implants are geared towards patients dealing with a wide variety of ailments, from cancer and disease to athletic injury and general wear and tear. In a lot of ways, Livingston's implant is better than the bone that his patients are born with.



Computerized tomography (CT) scan of the implant structure. (Image: Neil Ives)

The implant is made of a biocompatible plastic polymer (polyether ether ketone), a prominent implant material that is chemically and biologically inert, thermally stable and exhibits mechanical properties well aligned with human bone. By precisely etching a modified proprietary version of the marine mammal's naturally-occurring pattern into the plastic implant, a strong, rapidly-regenerating implant is born. "Our collaborative approaches do not rely on chemical or pharmacology-based methodologies, but instead leverage physics and energy-based transduction mechanisms to control and accentuate surface-cell interfaces," says Livingston. "So we're utilizing structure, surface charge and conductivity effects, electrochemical changes and electromechanical changes within the otherwise inactive implant to communicate with the cells and to tell those cells what to do; how to attach, how to proliferate, and how to differentiate. So you're controlling cell-cell and cell-surface interactions."

Current bone growth implant technologies are lacking in a number of areas, but the primary drawbacks are that they either do not react to cells — essentially serving as glorified structural supports — or they are blended with biogenic morphic proteins to spur rapid, but out of control, bone growth. In some instances, implant patients have suffered terrible complications from the overgrowth of bone, stimulated by their implants.

So far, Livingston's cervical implants have produced promising results in their first round of sheep trials. Over the course of six months, the implants consistently outperformed traditional implants in the areas of bone growth, bone fixation, and bone remodeling within the trial sheep. As a result, the team is moving forward with clinical trials, which are scheduled to begin in the coming months.

Livingston's groundbreaking work has introduced Aerospace to a new industrial niche, hinting at the breadth of untapped potential for innovative applications lying within the Aerospace labs. Livingston is ambitious, and rightfully so. With a single project, he's placed Aerospace at the cutting-edge of one of the most cutting-edge industries in the medical profession. "I would like to see our lab here become the epicenter of biomaterials development," says Livingston. Perhaps someday that will be the case, and Livingston will fondly recall the modest years when he comprised the entirety of the Aerospace biomedical staff.

Green Propellant Could Increase Worker Safety, Save Money

by Heather Golden
August 05, 2014

Aerospace recently had the opportunity to work with an emerging class of liquid rocket propellants that could save the space industry millions of dollars and keep its workers safer.

The company was contacted by the Federal Aviation Administration to work with Innovative Space Propulsion Systems (ISPS), one of the companies working with greener in-space propellants. The new fuel class is called NOFBX, or nitrous oxide fuel blend. The propellant uses nitrous oxide, the same substance used as a dental anesthetic, as an oxidizer and proprietary fuels, combined into one substance known as a monopropellant. Aerospace helped test two different blends for the ISPS.

"Within a couple years, we should have at least three viable nontoxic propellant sources," said Dr. Brian Brady, senior scientist, Propulsion Science Department.

The benefit of NOFBX propellants is the lower cost in launch processing and the lowered risk to worker health. The current standard for in-space propellant is hydrazine, a high-performance storable fuel that is also highly toxic and carcinogenic in certain forms. Hydrazine has a lengthy list of safety handling requirements, including full HAZMAT suits for workers fueling the rocket, which they can only wear for upwards of four hours at a time without the risk of overheating. Certain rocket systems cannot be adjusted once the fuel is loaded, which means the hydrazine has to be drained first if any changes need to be made.

"Fueling can take days," Brady said.

Conversely, NOFBX expels a mix of hydrogen and water and is 100 percent breathable, Brady said. NOFBX has the lowest toxicity of the three nontoxic fuels being developed. Workers do not need HAZMAT suits, and the NOFBX would not have to be drained before making adjustments to systems.

“Really, the only way you’d be injured from inhaling NOFBX is if you used it to completely replace the oxygen in the room,” Brady said. “But that’s the same for any gas that isn’t oxygen.”

With NOFBX ready to ship to the International Space Station, the FAA hired Aerospace as a neutral third party to monitor final safety testing to make sure the tests met NATO standards.

Innovative Space Propulsion Systems conducted two tests, the drop and the fast cook-off. Drop testing involves dropping a container of the propellant from a height of at least 12 meters to observe its reaction upon impact. Ideally, the container should not explode. A fast cook-off simulates a shipboard fire to see how the propellant reacts to a rapid increase in heat. Monitors watch for sooty burn-off.

John Desain (left), research scientist, and Brian Brady, senior scientist, both with the Chemical Propulsion and Environmental Sciences Section of the Propulsion Science Department in the Space Materials Laboratory, were the leads on work Aerospace has done with NOFBX, a new greener option for in-space propellant. (Photo: Elisa Haber)

The FAA then hired Aerospace again to complete a secondary phase of testing to find a material from which to construct fuel tank valves.

“Some substances are not compatible with rocket fuel,” Brady said. “ISPS sent us two materials they thought might work. It was a good test. We found one that worked and one that didn’t.”

The one that failed expanded once exposed to the propellant and permanently sealed the valve.

Aerospace’s role with NOFBX is complete, for now. But Brady hopes Aerospace will be asked to work with NOFBX again.

“I think that if this will be flying to ISS, and potentially for the Air Force, there will be even more questions for us to answer,” Brady said. “There might be new challenges that hydrazine didn’t have.”

Atlas V Carries GPS Satellite to Orbit

August 04, 2014

GPS IIF-7 was launched on an Atlas V late Aug. 1 from Cape Canaveral.

According to Ray Johnson, vice president of Space Launch Operations, it was "a very busy week of launch activity at Cape Canaveral! Just four days after Monday night's launch of the Delta IV/ AFSPC-4 mission, we have successfully completed a launch of Atlas V/GPS IIF-7 from Space Launch Complex 41. The vehicle lifted off Friday night right at the opening of the launch window at 11:23 p.m. EDT.

"There were no significant technical issues during the mission, and the GPS spacecraft was successfully deployed at 2:47 a.m. EDT on Saturday morning. Congratulations to the Atlas launch team for this outstanding success."

An Atlas V launches into the night sky carrying GPS IIF-7. (Photo: United Launch Alliance, LLC)

August 2014 Anniversaries

by Carolyn Weyant
August 01, 2014

40 YEARS

Civil and Commercial Operations: Ada Rochester

35 YEARS

Engineering and Technology Group: Nina Younger

Operations and Support Group: Patricia Mack

Space Systems Group: David Gorney

Systems Planning, Engineering, and Quality: Joanne Ostroy

30 YEARS

Engineering and Technology Group: Michael Gorlick, Andrew Moulthrop, Richard Rudy

25 YEARS

Engineering and Technology Group: Myun Kim, Cheryl Sakaizawa

Operations and Support Group: Georgetta Solomon

Space Systems Group: Alan Clarke, Patrick Riley, Susan Ruth

20 YEARS

Operations and Support Group: Arturo Ortiz

15 YEARS

Civil and Commercial Operations: Matthew Begert, James Grover

Engineering and Technology Group: Eric Campbell, Anil Gupta, Robert Holbrook, Michael McMullen

National Systems Group: Daniel Allred, James Blohm, James Young

Operations and Support Group: Margaret Maher

Systems Planning, Engineering, and Quality: Steven Weis

10 YEARS

Civil and Commercial Operations: Stephanie Barr

Engineering and Technology Group: Jason Andryuk, Francisca Fuentes, Christine Rink, Andrew Walston, Dave Wells

Engineering and Technology Group: Bryan Howard

National Systems Group: Jolynn Thagard

5 YEARS

Engineering and Technology Group: David Wang

Operations and Support Group: Rod Butterfield, Yvonne Crane

August 2014 Obituaries

by Carolyn Weyant
August 01, 2014

Sincere sympathy is extended to the families of:

John Aseltine, member of the technical staff, hired Aug. 11, 1960, retired May 1, 1990, died March 24.
Jay Baetz, member of the technical staff, hired Jan. 3, 1972, retired Oct. 1, 1996, died July 14.
Sandra Burchell, space arc assistant, hired Aug. 16, 2004, retired June 1, 2012, died July 28.
John Colwell, member of the technical staff, hired July 24, 1961, retired Sept. 1, 1993, died June 25.
Henry Feldmann, staff group VP administrator, hired Sept. 10, 1979, retired July 1, 1992, died May 10.
Ronald Lopes, project engineer, hired July 5, 1977, retired Oct. 1, 1999, died July 5.
Beatrice Matsumura, office technical support, hired Jan. 20, 1969, retired Jan. 1, 1991, died March 4.
Michael Trauring, member of the technical staff, hired May 20, 1963, retired April 1, 1987, died June 6.

To notify Aerospace of a death and have it included in the Orbiter, please contact Cynthia Johnson in Human Resources at 310-336-5806.

August 2014 Notes

by Carolyn Weyant
August 01, 2014

Notes of appreciation to fellow employees and Aerospace for thoughtfulness and sympathy have been received from:

Charles Donahue, for the recent passing of his father, Charles Donahue, Sr.
Myriam Easton, for the recent passing of her mother, Isabel Perdices.
Cassandra Lakey, for the recent passing of her mother-in-law, Dorothy Allen.
Linda Nakashima, for the recent passing of her father, Fred Masukawa.

Ivory and Paulette Porter, for the recent passing of their mother and mother-in-law, Irene Porter.
Paul Stanton, for the recent passing of his father-in-law, Ray Smelcer.

To submit a note of appreciation to Aerospace, please contact Valerie Jackson in Human Resources at 310-336-0891.