

GETTING IT RIGHT

COLLABORATING FOR MISSION SUCCESS

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REVOLUTIONIZING LAUNCH ACCESS FOR SMALLSATS

By **CARRIE O'QUINN**
The Aerospace Corporation

How do you most efficiently launch small satellites?

To answer that question, a consortium of industry, academia, and government has developed a new standard called a Launch Unit (Launch-U) and released it during the Small Satellite Conference in Logan, Utah in August.

Launch-U, which came from a group including The Aerospace Corporation, Cal Poly San Luis Obispo, Moog CSA Engineering, Spaceflight Industries, SpaceX, Tyvak, United Launch Alliance, Virgin Orbit, and VOX Space, lays out launch specifications for satellites between the size of a toaster and a small refrigerator.

With the Launch Unit standard, the space industry will be able to maximize the efficiency of the launch vehicle fairing and fill it with more satellites, thereby increasing access to space for everyone.

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INCOSÉ MODEL-BASED ENTERPRISE CAPABILITIES MATRIX (MBECM)

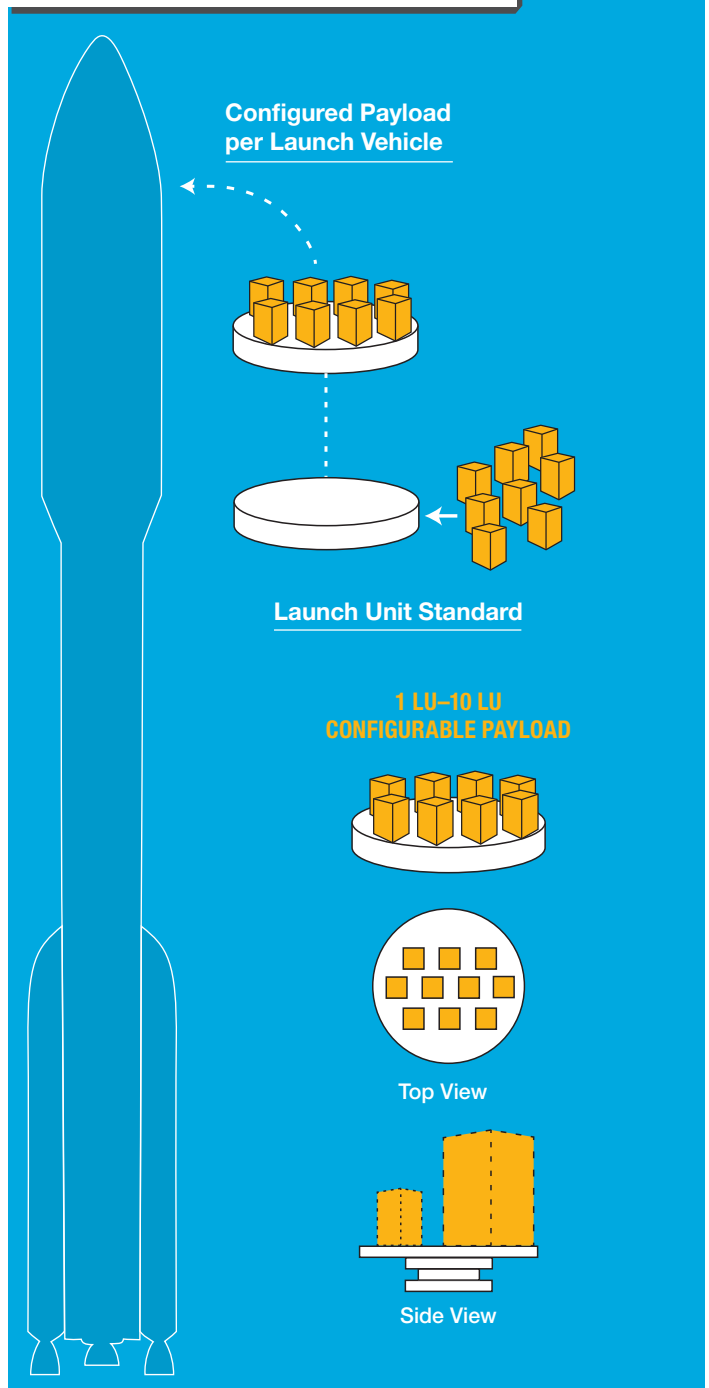
Engineering and program management are making increased use of models to handle complex problems. While models have always been part of key activities, they have been traditionally focused on specific problems and not necessarily developed in a coordinated manner where they can be shared across stakeholders, interfaced with one another, or provided flexible report types. The DOD Digital Engineering (DE) strategy, released in July, defines a comprehensive set of goals for implementing modeling across a project, program, and enterprise lifecycle. While the DE strategy is DOD-wide, a broad acceptance is being realized throughout the Intelligence Community and civil space as to the benefits of an overall strategy to implement modeling.

Projects, programs, and enterprise-level organizations have a need to assess the appropriate levels in term of description and specificity. An assessment tool would be useful to develop strategy, implementation plans, and/or assess specific implementations for systems engineering, project/program management, information technology enablement, or modeling development.

Joe Hale of NASA/Marshall Space Flight Center (MSFC) and Ryan Noguchi of The Aerospace Corporation independently came up with modeling assessment matrices that had comparable properties but identified different needed capabilities. Hale had briefed his approach across NASA, and

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CREATING A LAUNCH UNIT STANDARD



CHIEF ENGINEER'S CORNER

WELCOME TO THE NEW 'GETTING IT RIGHT'



By **TODD NYGREN**
Chief Engineer/
General Manager
The Aerospace
Corporation

Welcome to the fresh new face of *Getting It Right*, a quarterly newsletter that focuses on industry collaboration for mission success. *Getting It Right* was established eight years ago with an intent to widely inspire a culture of mission assurance across the space enterprise.

Since then, the national security space (NSS) climate has changed in response to the threat environment surrounding us, but the need for industry collaboration to face the nation's toughest challenges remains the same. Working together to share lessons learned, best practices, and advances in the field as they relate to mission success continues to remain the core of this newsletter.

We are happy to hear that these core attributes still resonate with our stakeholder community, and we will continue our efforts to provide quality content. We aim to keep incorporating topics that are relevant to the challenges facing the space community today, and we will adapt as requirements warrant.

But after eight years, we needed a fresh set of clothes. We hope the new look invigorates the newsletter so it continues to reach a wide audience and provide insightful takeaways for you and your colleagues. We are also now posting our individual articles online at www.aerospace.org (look for the *Getting It Right* link there), and we are generating an e-newsletter of the content, making it convenient to read via email on your phone, laptop, desktop computer, or tablet. Let us know what you think about these enhancements, and thank you for your continued support!

For more information, contact Todd Nygren,
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Among those attending the Space Collaboration Council meeting in June at The Aerospace Corporation in El Segundo, California, were, from left, Ajay Mehta (NOAA), David Pinkley (Ball), Aerospace Executive VP Dr. Wayne Goodman, Charles Lavine (Aerospace), and Beth Emery (Northrop Grumman).

COLLABORATING FOR FASTER ACQUISITION

By **GAIL JOHNSON-ROTH**
The Aerospace Corporation

Col. James Reynolds kicked off the June meeting of the Space Collaboration Council (SCC) with a discussion of SMC 2.0 Space Acquisition Transformation. Space acquisition is not broken, he said, and SMC is doing what it was tasked to do; however, the environment and threats have changed.

The driving question, he said, is: "How can we deliver the required warfighting capabilities faster?" SMC is implementing a "Go Fast" strategy that involves the use of new authorities and streamlined decisionmaking to bring about a new generation of segments that will work together in an emerging enterprise CONOPS. He signaled the new transformational approach will have achieved initial operational capability by this October.

Dr. Wayne Goodman, Executive Vice President of The Aerospace Corporation, carried the "Go Fast" theme further, citing several key attributes of a robust enterprise that dominates the threat. These include acquisition speed, production speed, and innovative capabilities and practices, along with a stable industrial workforce and supplier base.

In the ensuing roundtable discussion, industry and government participants offered a number of potential opportunities and approaches for faster acquisition. These included onsite decisionmaking authority, changes in verification requirements, and contracts restructured to reward speed while maximizing capacity.

The main part of the SCC meeting addressed a number of topics that were submitted in advance

by members. These focused on mission classes, space cyber, and additive manufacturing.

With regard to mission classes, participants felt that uniform application of requirements consistent with a single mission class can limit incremental efficiencies that might be appropriate to subsystems or lower-level components. Disaggregation of the mission-class requirements could enable acquisition efficiencies, with alignment of required deliverables to match the risk posture of the program.

Similarly, effective implementation of cybersecurity controls for space systems remains challenging. Ideally, a system, subsystem, or component design could be qualified so that a subsequent instance would be considered a trusted product. Identifying which parts could be considered as trusted products with the applicable security controls is worthy of further exploration.

Additive manufacturing is already being used to create primary flight structures and in the future will bring about a broad suite of designs that are entirely enabled by additives approaches. Given the fast pace of adoption, more insight is needed with regard to reliability, repeatability, and variability in materials and processing. Members wanted to further investigate implementation of additive manufacturing as a commodity.

The "Go Fast" theme reflects ongoing changes throughout the entire space customer base. The government acknowledges the need to partner with industry to find acceptable solutions that balance speed, agility, and performance to outpace the threat.

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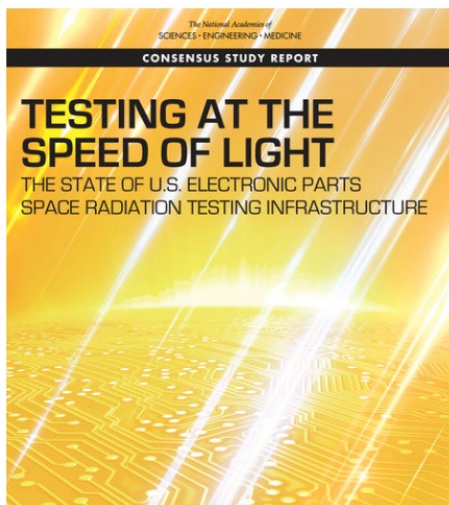


ENSURING A ROBUST INFRASTRUCTURE FOR RADIATION-EFFECTS TESTING

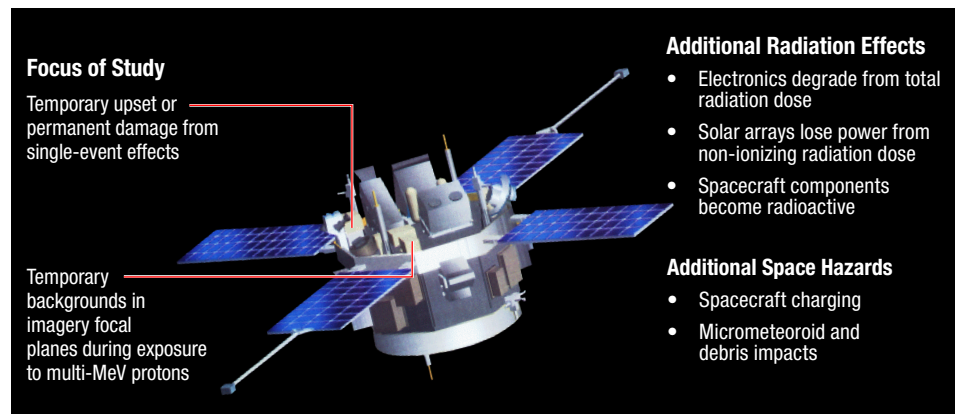
By JOSEPH MAZUR
The Aerospace Corporation

Scientists have long recognized the hazard posed by space radiation, which can lead to degradation, poor reliability, and potential failure in space systems. In mid-2017, three federal organizations—NASA, the Department of Energy, and the Air Force—asked the National Academy of Sciences to evaluate the current and future state of radiation-effects testing in microelectronics. The goal was to assess the adequacy of the infrastructure today and out to 2030, given the growing demands from civil, commercial, and national security space systems.

The study committee, which included members from industry, academia, and government, solicited input from across the radiation testing



A recent report proposes several steps to ensure the viability of the U.S. radiation-effects testing infrastructure.



community. Their final report¹, published in early 2018, made several key findings:

- The use of radiation testing facilities is growing while the supply is tightening
- The infrastructure is fragile and showing signs of strain
- The workforce is aging in a domain requiring specialized training and skills
- The fast rate of change in the electronics industry is making it increasingly difficult to test components and to develop testing standards

Based on those findings, the report provided a number of specific recommendations. For example, the space industry should establish an inclusive coordinating body to define infrastructure needs and ensure adequate resources out to 2030. This body would review the current testing landscape, develop a strategic forecast of new space systems, and create a test facilities plan.

It should also assess and support university capabilities for contributing to the testing infrastructure and engage with the commercial space sector to ensure that testing norms meet its needs as well as the needs of government customers.

The coordinating body should establish a mechanism to maintain existing modeling and simulation codes while supporting the basic research needed to develop new codes. The report also recommends that proton and heavy-ion test facilities receive stabilized funding to restore resilience in national testing capabilities. The report also suggests that the workforce should accommodate accelerated career development for younger testing and modeling personnel.

The committee found that the current system for radiation testing is working but is increasingly fragile. The recommendations laid out in the report should help restore stability and robustness to this critical aspect of space system development.

REFERENCE:

¹*Testing at the Speed of Light: The State of U.S. Electronic Parts Radiation Testing Infrastructure*, The National Academies Press, Washington, DC, 2018; doi: <https://doi.org/10.17226/24993>.

http://www.nap.edu/login.php?record_id=24993&page=http%3A%2F%2Fwww.nap.edu%2Fdownload%2F24993.

For more information, contact Dr. Joseph Mazur, 571.304.7587, joseph.e.mazur@aero.org.

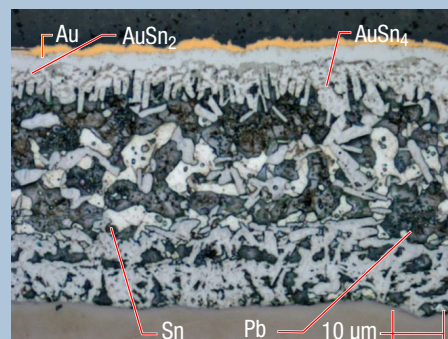


LESSONS LEARNED

THE PITFALLS OF TOO MUCH GOLD

By THANH T. TRAN
The Aerospace Corporation

Gold is a commonly utilized plating in electronic piece parts but requires proper precautions when soldering. Formation of gold/tin intermetallic compounds during soldering may result in an embrittlement of the tin/lead joint when less than 95 percent of the gold is removed from gold-plated components prior to soldering.



Gold embrittlement can result in solder joint loss of connectivity that may initially pass electrical testing but later fail during environmental testing or mission operations. It can also result in costly

unit rework, reduced mission life, reduced mission data, increased operational complexity, loss of redundancy, and mission failure.

As preventative actions, contractors should implement gold mitigation requirements in their PMP plan and IPC-J-STD-001 and flow the requirements to their suppliers that perform soldering of gold-plated parts. Suppliers should have sufficient capability to meet the tinning/gold mitigation requirements, and the receiving inspection process should verify incoming part compliance to these requirements.

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REVOLUTIONIZING LAUNCH ACCESS FOR SMALLSATS

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CubeSats are a standard size and can relatively easily find a slot for launch. Large satellites merit their own launch vehicles. But there are no standards for satellites between the size of a 12U CubeSat and an EELV Secondary Payload Adapter (ESPA) class satellite. This means each satellite generates its own launch integration requirements for each launch vehicle, which is inefficient.

The Launch-U tackles this issue, describing requirements for physical properties of midsized smallsats as well as their mechanical and electrical interfaces with the launch vehicle.

Just as the CubeSat definition standardized the launch interface, the Launch-U could have the same revolutionary impact on the industry, making better use of cargo space on launch vehicles and providing more flexibility with regard to launch opportunities.

Chad Foerster, Virgin Orbit's manager of Second Stage Structures and Mechanisms, observed, "The synergy between (Aerospace's) extensive history of providing comprehensive engineering support and mission assurance activities... along with the innovative and disruptive ideas of new space entrants, will help change the paradigm of delivery of small satellites into space."

For more information about Launch-U, please visit www.aerospace.org/launch-u or contact Carrie O'Quinn, senior project engineer for Aerospace's Research and Development Department and the Launch-U lead, at 703.808.4926 or carrie.l.oquinn@aero.org.



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FALL 2018 EVENTS

September 11–14 *The Advanced Maui Optical and Space Surveillance Technologies 2018 (AMOS) Conference, Maui, HI*

September 17–19 *AIAA SPACE 2018 Forum and Exposition, Orlando, FL*

September 25–27 *NASA Innovative Advanced Concepts (NIAC) Program's 2018 Symposium, Boston, MA*

October 9–11 *Satellite Innovation, Mountain View, CA*

October 22–25 *Aerospace Testing Seminar, Los Angeles, CA*

November 5 *Small Satellites and Disruptive Space Technologies Focus Day, London, UK*

November 6 *Manufacturing Problem Prevention Program (MP3), El Segundo, CA*

November 7 *NASA Additive Manufacturing Workshop, El Segundo, CA*

November 7 *Additive Manufacturing Guidelines Workshop, El Segundo, CA*

January 7–11 *2019 AIAA SciTech Forum, San Diego, CA*

February 25–28 *Ground System Architectures Workshop 2019, Los Angeles, CA*



RECENT GUIDANCE AND RELATED MEDIA

Software Development Standard Tailoring Guidance for Enterprise Service Based Environments by S. Rosemergy et al.; TOR-2017-02019; USGC

Interpretation of SMC-S-016 Thermal Testing Requirements for Spacecraft Units by J. Welch; TOR-2018-00317; PR

Introduction to Agile Development by T. McArthur et al.; TOR-2018-00561; USGC

Dimensional Measurements of an Additive Manufacturing Feature Demonstration Article by D. Witkin et al.; TOR-2018-01096; USGC

Launch Vehicle Mission and Process Reliability Estimation by S. Guarro;

TOR-2018-01912; USGC

2018 Emerging Small Launch Vehicle Systems by K. Chou et al.; TOR-2018-01391; USGC

Dead Bus Recovery Handbook for Earth Orbiting Spacecraft by D. Landis; TOR-2018-00319; USGC

PR = Approved for public release

USG = Approved for release to U.S. Gov't Agencies

USGC = Approved for release to U.S. Gov't Agencies and Their Contractors

For reprints of these documents, except as noted, please contact library.mailbox@aero.org.



INCOSE MODEL-BASED ENTERPRISE CAPABILITIES MATRIX

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Noguchi had briefed his at the November 2016 Aerospace System Engineering Forum focus day.

The Office of the Deputy Assistant Secretary of Defense (Systems Engineering) (ODASD(SE)) asked both of them to brief the Digital Engineering Working Group in November 2017 and at the January international workshop of the International Council on Systems Engineering (INCOSE). Al Hoheb, The Aerospace Corporation,

and Hale co-ran the January workshop that resulted in the INCOSE Challenge Team effort to produce a single INCOSE-endorsed matrix. The matrix has adopted the ISO/IEC/IEEE 15288 concepts for system engineering, reviews, and audits as well as many other concepts, such as digital model, digital twin, digital thread, and authoritative source of truth.

Hale and Hoheb continued the matrix development through additional workshops at May's Aerospace System Engineering Forum in Chantilly and online INCOSE Challenge Team meetings. Since January, the guide has gone from a framework to fully populated first draft with some name changes and concept changes. Their development roadmap includes more workshops at upcoming INCOSE, National Defense Industrial Association (NDIA), and Aerospace events along with online Challenge Team meetings.

If you'd like to be added to the Challenge Team, please contact either Al Hoheb at albert.c.hoheb@aero.org or Joe Hale at joe.hale@nasa.gov.



Joe Hale, NASA/MSFC, left, and Al Hoheb, The Aerospace Corporation