By JIM SHULTZ
Director, Boeing Network and Space Systems Satellite Development Center

As the director of quality at Boeing’s Network and Space Systems Satellite Development Center, I have had the opportunity to collaborate with aerospace industry leaders through the Space Quality Improvement Council (SQIC). For the past decade, this forum has addressed, through collaboration and an open sharing of ideas, some of the most challenging problems facing our industry, from tin whiskers to the integration of best practices, and I am wondering where our next challenge lies.

I believe next-generation quality will present the next challenge. Based on how space and launch systems have evolved over the last 20 years, and the mounting challenges of sequestration, Better Buying Power 2.0, ITAR controls, and consolidation, the way we look at quality in the 21st century will determine our collective success or failure.

Gone are the days of the slide rule, the scientific calculator, the eraser, the view foil, the white-collared shirt, and the pocket protector. These have been replaced by the tablet, slide shows, model-based design, and virtual manufacturing and inspection. We are at a critical time with a workforce that demands instant access to information, visual work instruction, robotic assembly,
NASA SLS LEVERAGES EXISTING SYSTEMS FOR AFFORDABILITY AND LOW RISK

By JON HOLLADAY
Evolvability Group Manager,
NASA SLS Payload Integration and Evolvability Office

Currently under development, NASA’s Space Launch System (SLS) represents a new national heavy lift capability, enabling a wide variety of missions, including human exploration of deep space. Managed at the Marshall Space Flight Center in Huntsville, Alabama, SLS will provide an initial near-term 70-metric-ton launch capability and is expandable to 130+ metric tons. The vehicle’s primary purpose is to provide transportation for the Orion Multipurpose Crew Vehicle and related human exploration systems on a series of missions that will eventually lead to human landings on Mars.

On track for launch readiness in FY18, the SLS, Orion spacecraft, and associated ground infrastructure will enable the U.S. to demonstrate new human spaceflight capabilities in cis-lunar space as a proving ground for missions farther into deep space and then to Mars.

Designed from inception to meet the requirements for these missions in a manner that honors the three driving objectives of safety, affordability, and sustainability, SLS development leverages existing NASA spaceflight assets, infrastructure, and workforce, and a commonality-based approach for evolution. Using proven legacy hardware and infrastructure with a heritage of success helps keep NASA’s exploration launch vehicle program safe and affordable while also expediting delivery of a near-term capability. By planning for enhancements based on commonalities, SLS will evolve into the most powerful launch vehicle ever flown in a manner that is affordable and sustainable for the nation.

While the primary purpose of SLS is enabling human exploration missions, the vehicle’s unmatched mass, volume, and departure energy capabilities enable a wide variety of other missions, making it a valuable addition to the nation’s launch infrastructure. In order to maximize the vehicle’s utilization potential, SLS payload environments are being developed to comply with Evolved Expendable Launch Vehicle standard interface specifications. The interim cryogenic propulsion stage has common payload accommodation interfaces with the Delta cryogenic second stage flown on Delta IV launch vehicles. Additionally, it is compatible with standard interface plane and standard electrical interface panel interfaces, existing 4394 and 1575 adapter configurations, and 5-meter composite and metal fairing configurations. In addition to enabling unique science missions, the SLS upper stage design can also support the future stretch needs of existing national security missions.

Substantial progress has been made toward launch readiness of the vehicle’s initial configuration. SLS has completed Key Decision Point C (KDP-C), which is equivalent to DOD Milestone C, and is progressing toward a critical design review in 2015; meanwhile, hardware now exists for every major element of the vehicle. While the program is now strongly focused on delivering the first vehicle on schedule, early development work is already underway for the future evolution of the vehicle (see figure), including risk reduction investments for advanced boosters, systems requirements work for an exploration upper stage, and studies into future payload accommodations.

For more information, contact Jon Holladay, SLS Evolvability Group Manager, jon.holladay@nasa.gov

SLS Evolving Capability

Evolutionary Path to Future Capabilities
- Minimizes unique configurations
- Allows incremental development

Commonality of Payload Interfaces
- Mechanical
- Avionics
- Software

Launch vehicle/stage adapter (LVSA) (TBE)

Upper Stage and Core Stage Commonality
- Same diameter (27.5 ft.) and basic design and processes/practices
- Workforce
- Supply chain/industry base
- Transporation logistics
- Ground systems/launch infrastructure
- Propellants

Commonality of Core Stage

Commonality of Engines

Illustration courtesy NASA, used with permission

Volume 5, Issue 3 / February 2, 2015
DID YOU KNOW?

Supply Chain Resilient Framework Makes Matters Clearer

A resilient supply chain balances risk and costs to prevent or recover quickly from a multitude of dynamic and simultaneous risk-related disruptions. Resilient supply chains are characterized by four pillars: visibility, flexibility, collaboration, and control. In building and maintaining resilience, organizations must also develop and implement effective governance structures and key enablers.

For more information, contact Patrick Joyce, Deloitte Consulting LLC, 206.979.0025, patjoyce@deloitte.com

CALENDAR OF EVENTS

SPRING 2015

Feb 23–24
22nd Annual Conference on Quality in the Space and Defense Industries, Cape Canaveral, FL

March 2–4
30th Annual National Test & Evaluation Conference, Springfield, VA

March 2–5
Ground Systems Architecture Workshop, Los Angeles, CA

March 7–14
IEEE Aerospace Conference, Big Sky, MT

March 24–26
Space Thermal Control Workshop, El Segundo, CA

April 13
Space Quality Improvement Council, Colorado Springs, CO

April 13–16
Space Symposium, Colorado Springs, CO

May 4–6
ASQ World Conference on Quality and Improvement, Nashville, TN

May 5–7
Mission Assurance Improvement Workshop, Sunnyvale, CA

May 11–14
Space Power Workshop, Manhattan Beach, CA

May 19–21
Space Tech Expo, Long Beach, CA

SUMMER 2015

June 2–4
Spacecraft and Launch Vehicle Dynamic Environments Workshop, El Segundo, CA

June 21–24
GEOINT 2015, Washington, DC

FALL 2015

Sept 22
Space Supplier Council, Colorado Springs, CO

Oct 20–22
NSISC Space INFOSEC Technical Workshop, El Segundo, CA

Oct 27–29
Aerospace Testing Seminar, Los Angeles, CA

Nov 19
Joint SQIC/SSC

Nov 19–20
Mission Assurance Summit
MISSION ASSURANCE SUMMIT
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Supply Chain Risk to Improve Quality.” Members from MDA, SMC, Lockheed Martin, Space X, and Ball Aerospace shared their perspectives on the topic. The panelists also commented on what their organizations are doing to help develop the workforce of the future. Austin closed the panel session by summarizing the discussed approaches to supply chain management.

The second executive panel was facilitated by Rand Fisher, Aerospace Senior Vice President, Systems Planning, Engineering, and Quality. Panelists included representatives from NASA, NRO, Orbital Sciences, Northrop Grumman, and United Launch Alliance. Each panelist was asked to share their thoughts on what innovative approaches are required to achieve mission success in 2020.

Following the panel discussion, Harold Bell, Deputy Chief, Safety and Mission Assurance Office of NASA, provided a summary of the Joint Mission Assurance Council (JMAC).

The JMAC is a government collaborative forum that convenes, about three times a year to advance best engineering and program management practices across the U.S. space programs.

The summit concluded with a summary outbrief on the Joint SQIC/SSC meeting held the day before. Full meeting details are available in TOR-2015-00695.

For more information, contact Terita Norton, 571.304.7840, terita.r.norton@aero.org.

RECENT GUIDANCE AND RELATED MEDIA

SPECIAL REPORTS

GPS User Equipment Prototypes to Illustrate the Common GPS Module (CGM) Concept by J. Lee; TOR-2014-01672; OK’d for public release

Space Supplier Council Meeting 23 September 2014 by T. Norton; TOR-2014-00223; OK’d for USGC

Space Is Still a “One Strike and You’re Out” Business by B. Ballhaus; TOR-2014-03061; OK’d for USGC

Mission Assurance Improvement Workshop 2014 Product List by J. Wyritzke; TOR-2014-03065; OK’d for USGC

Trusted Foundry Program by J. Cheng, et al.; TOR-2014-02847; OK’d for USG

Questions Used in the Benchmarking of Commercial and Other Government Agencies’ Satellite Operations by A. Campbell et al.; TOR-2014-03194; OK’d for public release

Joint Mission Assurance Council Minutes – November 2014 by C. Stevens; TOR-2015-00544; OK’d for USG

U.S. Space Program Mission Assurance Summit November 12-13, 2014 by T. Norton; TOR-2015-00695; OK’d for USGC

Joint Space Quality Improvement Council (SQIC) / Space Supplier Council (SSC) November 12, 2014 by T. Norton; TOR-2015-00766; OK’d for USGC

Assurance Policy Evaluation – Spacecraft and Strategic Systems by R. Stone; DODIG-2014-116; OK’d for public release

Spacecraft Components & Manufacturers Survey by W. Mckelthern; TOR-2015-00076; OK’d for USGC

Design and Test Requirements for Space Flight Pressurized Systems by M. Mueller; TR-RS-2015-00005; OK’d for public release


TECHNICAL ASSESSMENTS

Downward Trending of Tensile Properties for Ti-Al-4V Forgings by M. Kwan; TOR-2014-02971; OK’d for USGC

Construction Analysis of Base Metal Electrode Multilayer Ceramic Capacitors by T. Ayvazian et al.; TOR-2014-03663; OK’d for USG

Requirements Engineering Process Guidelines – Use of TBXs by M. Gura et al.; TOR-2014-01671; OK’d for USG

Design Advisory DA-2014-02: Anticipate Circuit Disruption Caused by Subtle Behavior of Metal Oxide Semiconductor Field-Effect Transistors (MOSFETS) by P. Cheng; TOR-2014-02790; OK’d for USGC

DDDC = Dept. of Defense and DOD contractors

USG = U.S. gov’t agencies

USGC = U.S. gov’t agencies and their contractors

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

Getting It Right
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and additive manufacturing.

The processes and tools that made our industry great and led to mission success remain the foundation, but as an industry we must continue to adapt to keep pace with the next-generation workforce. It is critical that we remain vigilant in our pursuit of first-time quality in a digital age, that we draw on the brilliant minds of the next generation, who are beginning their careers without the luxury of spending time in the lab or at the workbench building products, experimenting with buttons and dials, or physically touching hardware before moving it into production.

We must adapt our processes to account for this transformation and understand the interaction between the virtual world and the world of physical reality. Accessing the lessons of the past and ensuring that we remain diligent in our design, manufacturing, and test readiness practices will be critical to continued mission success; however, we must not cast aside the concepts and principles of incremental review and mission assurance, but embrace them and embed them in the virtual world.

So as an industry, we will continue to push the boundaries of innovation to secure freedom and provide the most advanced capabilities to the warfighter. We must continue to work collaboratively and ensure that we are developing new habits, capitalizing on new technologies, and adapting to the pace of the next generation. As with SQIC, this is our mission and our responsibility.

First-time quality is our legacy and the key to our collective future.