Space Mission Success in 2012

By LT. GEN. ELLEN PAWLIKOWSKI
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The United States space community enjoyed a wide array of accomplishments in 2012. The U.S. Air Force (USAF), National Reconnaissance Office (NRO), Missile Defense Agency (MDA), and U.S. Navy launched eight satellites that deliver critical capability to our national security customers. Additionally, the Advanced Extremely High Frequency Flight-1 Recovery Team rescued a satellite that suffered a critical anomaly in 2011, winning the 2012 Aviation Week Laureate Award for their efforts. And the National Aeronautics and Space Administration (NASA), after years of careful work and attention to every detail, successfully landed Curiosity Rover on Mars.

In 2012, we witnessed the end of an era as we embraced a new one in space enterprise. We bid farewell to the Space Shuttle. We also felt deep regret for the loss of two national heroes, Neil Armstrong and Sally Ride, who contributed so much to our rich history in space. Still, we welcomed a new generation of launch systems, which achieved an impressive milestone when Space X’s Dragon successfully docked with the Space Station for a resupply mission.

In contrast, two launch failures occurred this year on the international front, which should serve as a painful reminder of just how unforgiving the business of space can be. As we look forward to the immediate future, the U.S. space enterprise is faced with significant challenges. After successfully upgrading nearly every major communication, navigation, and Intelligence, Surveillance, and Reconnaissance (ISR) space system on orbit, the country’s leadership is looking for a return on its investment. As space systems transition from “development” to “production” and industry offers cost comparisons with commercial satellite developments, our country expects more efficiencies and cost savings.

In addition, threats are proliferating, most notably in the areas of cyber security and space protection. Our current architectures and space...
PERM Strives to Resolve Lead-Free Risk

By ANDREW D. KOSTIC
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The Aerospace Industries Association (AIA) established the Pb-Free Electronics Risk Management (PERM) Consortium to promote a common coordination of activities for the government-industry aerospace/defense community to deal with lead-free platings and solders. PERM is working to help develop reliability test methods for lead-free solders and tins whisker mitigations that could eventually allow their use in aerospace systems.

Lead-free electronics can impact system reliability in ways that are nonquantifiable right now. There are two basic reliability issues: solder joint reliability and tin whiskers.

The main focus of industry efforts has been to attempt to mitigate the risk of tin whiskers that grow spontaneously from lead-free tin platings and solders.

Tin whiskers are hairlike filaments up to 23 millimeters in length growing from lead-free tin. The cause(s) of their growth is unknown, so it has not been possible to quantify their reliability effect or prevent their growth other than by the addition of 3% lead by weight to the tin.

The current industry consensus for reducing the risk associated with tin whiskers is to use conformal coatings. PERM is working to develop and standardize effective conformal coating protocols. Parylene C and urethane (greater than 4 mils thick) conformal coatings have been shown to be effective at preventing tin whiskers from emerging from lead-free plating or lead-free solder. More importantly they are effective in preventing whiskers, from contacting electrically active areas and creating short circuits.

However, if the conformal coating is too thin and/or the wrong type, whiskers can poke through, as shown in the accompanying images.

The best guidance for space systems is to avoid lead-free tin finishes and lead-free solders on both individual components and assemblies whenever possible.

Use tin lead (Sn/Pb) solder attachment material, except where prohibited by contract or law or where a higher melting temperature material is required.

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systems are not necessarily optimized to defend against all potential emerging threats.

As an enterprise, we face a daunting systems engineering challenge to evolve our existing systems and architectures into architectures that are affordable, resilient, and sustainable. It will take some time to develop and implement these new architectures.

In the meantime, maintaining our record of mission success for the legacy systems will be a key element to the successful transition to these new architectures. As Gen. William L. Shelton, USAF Space Command Commander, stated at the National Space Symposium, “Clearly, mission success is our number one focus in this program (launch), so we will continue to ensure mission assurance corners are not cut. Let me say that again: We will continue to ensure mission assurance corners are not cut. With the expense of national security missions—not to mention the opportunity cost of lost capability—one launch failure can make the costs of mission assurance look awfully cheap. Finding the appropriate balance is our challenge.”

Editor’s Note: General Shelton’s statement frames the context and challenge for the fifth annual U.S. Space Program Mission Assurance (MA) Summit. Facilitated by The Aerospace Corporation, the Summit is held in support of the Air Force Space and Missile Systems Center (SMC), NRO, MDA, and NASA.

Taking place every December, the MA Summit strives to focus collaborative efforts among the four agencies in order to advance progress toward an environment that will deliver 100% mission success. The theme of this year’s MA Summit, “Tailoring Mission Assurance and Managing Risk in Different Environments,” addresses the active and conscious management of risk. The current environment places extraordinary pressure on government and industry program managers to “get it right” the first time, as government stakeholders seek to ensure mission success without unnecessary costs. The Summit aims to improve collaboration across government agencies and industry, as well as to develop actionable plans to achieve 100% mission success.

The 2012 MA Summit includes four small group discussions on areas that are critical to mission success in different environments:

- Risk and program success in cost-plus development vs. firm fixed price production vs. technology demonstration
- Design lessons learned and assuring design integrity
- Parts, materials, and processes risk posture
- Tailoring specifications and standards

Global space activity highly leverages modest investments in space vehicles and launch vehicles. The Space Foundation estimates the total expenditures on satellite manufacturing as $7.66B by government and $4.24B by commercial operators. This is only 4.1% of the revenue from the global space industry.

The enormous commercial space product infrastructure market depends on reliable space and launch vehicles from both the commercial and government sectors. Given the high stakes, mission assurance is cheap insurance against large market loss.

In addition to small group discussions, the Summit agenda includes a keynote address from a government executive leader and a two-part Executive Panel discussion. Part I of the Executive Panel discussion will consist of government leaders, and Part II will consist of industry leaders.

The MA Summit provides a venue to allow space leaders to reflect and develop a strategy to ensure continued success in our U.S. space endeavors.

For additional information on the Summit, contact Susan Hastings, 571.307.5866, susan.e.hastings@aero.org.
Mission Assurance Guide Updated and Released

By GAIL JOHNSON-ROTH
The Aerospace Corporation

The Mission Assurance Guide (MAG), TOR-2007(8546)-6018, was created in 2007 to document revitalizing disciplined systems engineering and mission assurance (MA) programmatic activities to provide practical guidance to personnel of The Aerospace Corporation and national security space (NSS).

The MAG defines the overarching MA framework and describes core processes, supporting disciplines, and associated executable tasks that are recommended for and applicable to all NSS programs.

This MA framework includes best practices guidance that program office, engineering, and laboratory personnel can apply in the context of real-life program constraints. The content is readily tailored to the specific needs of a program and can be applied to NASA and other civil and commercial programs supported by Aerospace when planning mission assurance activities.

The latest revision of the MAG (Rev B) includes updates to all existing chapters, the addition of two core process chapters ("Program Assurance" and "Operations & Sustainment"), and an additional supporting discipline chapter on "Information Assurance."

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work have been reviewed internally and published as ATR-2012(9010)-12, Evaluating Software Architectures in Space and Ground Systems. Aerospace has exercised this process eight times in the last two years, identifying significant issues and recommending specific mitigations.

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