



INTEGRA
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Alternate Grade Panel

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- Dr. Ryan Rairigh is an Associate Lockheed Martin Fellow and a Mission Success Lead within National Security Space (NSS) at Lockheed Martin Space (LMS). He leads a multi-disciplinary team at LMS targeting the broader implementation of alternate-grade and commercial-off-the shelf (COTS) EEE components for space design. He is a member of the COTS Mission Success Improvement Workshop (MSIW) led by Aerospace Corp. and was team co-lead for the development of “Expanding Space Design Options Using COTs” (ATR-2023-01935), a joint industry, government and Aerospace Corporation effort to provide guidance for inserting COTs components into space programs. He has been at LMS since 2006 and worked on many different missions for customers including NASA, DoD and multiple NTK efforts. He received his Ph.D. in Physics from the University of Florida where his research focused on experimental thin film devices.
- Peter Majewicz received a B.S. in: Computer Engineering from Old Dominion University, Norfolk, VA, in 1999, a M.S. in Electrical Engineer from the Naval Postgraduate School in Monterey, CA in 2005, and a Ph.D. in Systems Engineering from George Washington University, Washington D.C. in 2017. He has been with NASA since 2009, and currently is the Manager of the NASA Electronic Parts and Packaging (NEPP) Program. Prior to NASA, he retired from active duty, ending a 22-year career in the U.S. Navy.

- **Larry Harzstark has over 35 years of experience in parts and component management related engineering areas. He has been involved in all aspects of component engineering from the design of custom radiation-hardened devices to meet strategic missile requirements, to failure analysis, parts selection, design reviews, supplier audits, technology reviews and parts control boards. Recently, Larry has been involved in aspects of Commercial Off the Shelf (COTS), as well as Plastic Encapsulated Microcircuits (PEMs) and their utilization in military systems. He developed the guidelines for use of PEMs in an Army missile system and in space applications. His extensive expertise and knowledge in the field of microelectronics has earned him a reputation as a problem solver. Larry currently is an Aerospace Fellow responsible for technical aspects of new technology insertion, PMP management, evaluations of alternative technologies and problem resolution for programs. He earned his BSEE from the Polytechnic Institute of Brooklyn in 1969, and his MSEE from Clarkson College of Technology in 1970.**
- **Mark Porter is the Chief Engineer for the Component Engineering and Assurance Office at NASA's Jet Propulsion Laboratory. He has 38 years of experience working parts, materials, and processes on boxes, payloads, and spacecraft across a variety of missions and applications. Mark is currently the SAE CE12 Chairman for the Alternate Grade Parts for Space Task Group as well as the Why We Test Task Group.**

Various Definitions of AG Parts



- Automotive grade (AEC)
- Automotive grade like parts (non-AEC fully compliant)
- EP (Extended Plastic)
- VID parts
- Reduced flow MIL PRF / QML parts
- Reduced flow MIL STD 883 M1004/5 passing parts
- Three temperature tested parts
- Parts that have some level of burn-in
- Commercial PEMs

TWO KEY TAKE AWAYS



- **There is no standard definition of AG parts – There are no standards or third part certifications for AG parts. However;**
 - Automotive parts are governed by AEC standards
 - PEMs have some guidance from Mil Std, SAE or JEDEC
 - Users need to define their own mission / application specific requirements
- **It is more than COTS**

TYPICAL MOTIVATORS FOR USAGE OF AG PARTS



- **Short duration missions with shorter lifetime / Alternate Space**
- **But we also see periodic usage of AG parts for long duration projects**
- **Typically lower risk applications**
- **Risks already mitigated by redundancy or Quality / Reliability built into design of EEE parts**
- **Cost of Space or military grade parts**
- **Availability and lead time**
- **Obsolescence**

Common Concerns



- **Manufacturers do not test 100% of listed parameters**
 - Guaranteed by design or stability validated during characterization
 - EEE devices are not completely tested to data sheet – Outliers exist
- **Reliability and Infant Mortality Concerns**
- **Lot to Lot Variability**
- **Derating and Acceleration Factors of New Technologies (GaAs and GaN Devices) Typically Not Available – Difficult to Predict Life**



THANK YOU

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