Erik M Mueller, Ph.D., P.E., FASM
ASM Trustee (2025-2028)

Erik Mueller is currently a Materials Research Engineer at the NTSB where he has performed over 100 failure investigations of aircraft, rail, pipeline, and marine transportation accidents. Erik has previously won the ASM Silver Medal award for his contributions to failure analysis and is a Fellow of ASM International, having twice won the *Journal of Failure Analysis and Prevention* Best Paper Award. He is a licensed professional engineer (PE) in Florida, Virginia, and the District of Columbia. Dr. Mueller previously graduated from the University of Florida in 2007, where he served as the official mascot (Albert the Alligator). Dr. Mueller also recently graduated with his Masters in Civil Engineering from the University of the District of Columbia. Erik chairs the FAS International Relations Committee, currently serves on the ASM Board of Trustees, and volunteers with the ASM Inclusion Diversity Equity & Awareness Committee. Erik teaches failure analysis to high school students at the Eisenman Materials Camp and Lycée Lafayette Materials Explorers camp each summer, while also teaching the PE test preparation course for TMS and instructs failure analysis classes as an adjunct assistant professor at Case-Western Reserve University. Erik has been an invited guest lecturer at Ohio State, Iowa State, Michigan, Campbell, and Youngstown State Universities, and has been the featured speaker at local ASM chapter meetings in Philadelphia, Washington, Chicago, and Cleveland. Erik is also a volunteer for Engineers Without Borders, having helped design and implement water and sewer projects near Nebaj, Guatemala, and currently designing and fundraising for a bridge project in southeastern Sierra Leone.

Abstract: The Investigation of a GEnx Engine Fan Midshaft Fracture

On July 28, 2012, a Boeing 787-8 airplane experienced a loss of thrust in the right GEnx turbofan engine during a pre-flight, low speed taxi test at Charleston International Airport in Charleston, South Carolina. Inspection of the engine revealed the forward end of the fan midshaft had separated, causing the low-pressure turbine rotor to shift aft, damaging that section of the engine.

A detailed investigation found the fan midshaft on the GEnx engine had separated from an environmentally assisted cracking mechanism under static load. Cracking was predicted by an intricate and previously undetected reaction between the fan midshaft ultra-high strength steel, the dry film lubricant, and the assembly aid. This investigation explored multiple and fundamental aspects of the fan midshaft, including manufacturing, assembly, design, and loading. From the investigation, a non-destructive inspection was developed and employed throughout the fleet with multiple changes to the assembly of the GEnx engine to prevent future recurrences.

Abstract: NTSB Materials Failure Analysis of Lithium-Ion Battery Incidents from the Boeing 787

Among the events investigated by the agency, the NTSB agency investigated multiple incidents of eight-cell lithium-ion batteries that powered various systems of the Boeing 787 in 2013. Specifically, a mechanic servicing a Japan Airlines 787-8 gate parked at Boston Logan International Airport found heavy smoke and fire from the front of the auxiliary power unit (APU) battery case. This battery consists of eight lithium-ion cells connected in series and assembled in two rows of four cells, each based on a lithium cobalt oxide compound chemistry with a flammable electrolyte liquid. The investigation found that the thermal runaway of several of these battery cells led to the failure of the battery, which affected safety of flight at the time. This presentation will review the novel failure analysis process performed by the NTSB materials laboratory, specifically focusing on examining fire signatures, thermal damage mapping, computed tomography, and chemical analytical data. Along with optical and electron microscopy, the data helped recreate the sequence of events leading to thermal runaway. Along with details of battery manufacturing processes, the investigation resulted in multiple recommendations to prevent thermal runaway from impacting flight safety again.

Investigation and Recommendations on Bottom-Dented Petroleum Pipelines

On September 21, 2015, the National Transportation Safety Board responded to a petroleum leak from a transmission pipeline in Centreville, VA. A small through crack was found leaking at a dent on the underside of the pipe, located away from any welds. The investigation found that corrosion fatigue could initiate at small dents, typically caused by impingement. While top-side dents from excavation and servicing have well-been documented and regulated, bottom-side dents, deemed

acceptable per regulations, were found to be susceptible to stress corrosion and fatigue cracking. This investigation explored multiple and fundamental aspects of cracking in steel pipe dents, including non-destructive inspection, electron microscopy, finite element modeling, and long term cyclic loading tests to characterize the cause of this pipeline accident.

A Review of Biocorrosion Issues and Mitigation Strategies in Concrete Sewers and Wastewater Collection Systems

The collection and treatment of wastewater are vital for human society, yet the public and even some engineering curricula often overlook it. As the Clean Water Act requires, all wastewater must be processed and decontaminated before being released into the environment. This collection and treatment of wastewater create environments that are not only highly corrosive but contain a myriad of microbial species that accelerate the corrosive attack of the materials they encounter. Failures occur in steel and iron alloys and, most commonly, concrete. While selected to withstand corrosive environments for long periods, these wastewater components typically fail from microbial, sulfur, and chloride attack. This presentation will detail the more common materials used in wastewater and sewage processes and their susceptibility to biocorrosion and inorganic corrosion. The presentation will highlight novel prevention methods such as coatings, concrete additives, and improved maintenance strategies to enhance the service lives of sewers.

Teaching Materials Science to High School Students Using Weeklong Camps

Named after William Hunt Eisenman, ASM International's first director, the Eisenman Materials Camp for students is the largest and most elaborate student camp sponsored by the ASM Materials Education Foundation each year. At this weeklong camp during the summer, high school students from the 11th and 12th grades work in groups to determine the root cause of a failure of an object or series of objects. These objects include household tools, industrial components, or evidence from transportation accidents. Supervised by volunteer mentors from industry, academia, and government laboratories, the students use metallography, electron microscopy, mechanical testing, and heat treating to find the root cause of their failure, which they present as recommendations to correct the problem to the leaders of ASM, even publishing results in peer-reviewed journals. The camp begins with pewter die casting and materials-focused post-mortem of household appliances,

and culminates with students creating keepsakes by sand casting tin and blacksmithing wrought iron. These physical experiences are interspersed with the weeklong failure projects, providing immediate, concrete associations of materials science concepts with tangible creations. Hundreds of students have attended the materials camp in the last 25 years, producing numerous leaders in the materials industry, including tenured professors, industry executives, and government researchers. Many camp graduates return to volunteer as mentors, perpetuating the enthusiasm and lifelong learning that the experience bestows. Further, these camps have been emulated in France and India. This presentation will demonstrate how materials camps are models for rapidly teaching material science to young students and cultivating candidates for university curricula in the discipline.