



TMS2019 PLENARY LOOKS TO THE FUTURE OF AVIATION

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This year marks 100 years of flight for GE Aviation. In honor of that milestone, Luana Iorio, who is general manager, Engineering Material Systems, at GE Aviation, looked at the “Next Materials Frontier for Flight” at the TMS 2019 Annual Meeting & Exhibition (TMS2019) all-conference plenary session on Monday, March 11.

Iorio discussed how additive technologies, digital data, and integrated computational materials engineering can help to accelerate materials and process development, using examples from her own company.

“All major accomplishments have a story,” Iorio told the audience at the plenary session, which brought together a total of 1,072 conference attendees. Iorio shared with them the story of the GE9X jet engine. “It’s the largest engine in the world,” she said, “but it makes extensive use of composites, which takes 1,000 pounds of weight out of the engine.” The 9X, which is expected to enter service in 2020, represents a step-change in application, according to Iorio.

The engine uses 19 3D-printed fuel nozzles, initially developed for GE’s LEAP engine, to help reduce weight, and stiffer carbon fan blades meant that only 16 fan blades were needed, compared to 22. The engine also made use of silicon carbide-silicon carbide (SiC-SiC) ceramic matrix composites for additional weight savings.



More than 1,000 TMS2019 attendees gathered in the Lila Cockrell Theatre at the Henry B. González Convention Center in San Antonio, Texas, for the plenary session.

“SiC-SiC is our most capable material, and it is one third the density of the alloy it replaces,” Iorio noted. “It also has metal-like damage tolerance, which is an extremely important attribute.”

Bringing the material into widespread use, however, required creating a new supply chain and the development of new facilities. “Maturing a material takes commitment, persistence, and resolve,” said Iorio.

Gathering data on previous ceramic matrix composite parts that GE produced was also key. According to Iorio, GE has the ability to interrogate all the LEAP engines it produces for instantaneous traceability.

“By having all of this data, we gain a sense of the health of our processes,” she explained. “It is difficult to overstate the value we have realized from this.”

Similarly, while creating digital infrastructure for additive manufacturing wasn’t an enormous challenge (because it’s natively digital), it does result in a *lot* of data, Iorio pointed out, and the volume grows quickly.

Having this data available, though, can lead to accelerated material and process development. Iorio suggested that a robust digital infrastructure could lead the



Luana E. Iorio, General Manager, Engineering Material Systems, GE Aviation, delivers the TMS2019 all-conference plenary presentation, “The Next Materials Frontier for Flight.”



Members of TMS leadership met with Iorio after her talk. Pictured are (from left to right): James C. Foley, 2019 TMS President; Kevin J. Hemker, 2018 TMS President; Iorio; David H. DeYoung, 2017 TMS President; and James J. Robinson, TMS Executive Director.

way through the so-called Valley of Death of intermediate technology readiness levels by providing insights into key process variables that affect product quality and performance.

“We’re changing the paradigm,” said Iorio, from the number of years it takes to produce a new material to the

number of new materials that can be produced in a year. “There’s an unrelenting push for introducing new materials.” The future of materials engineering, she added, is faster development cycles.

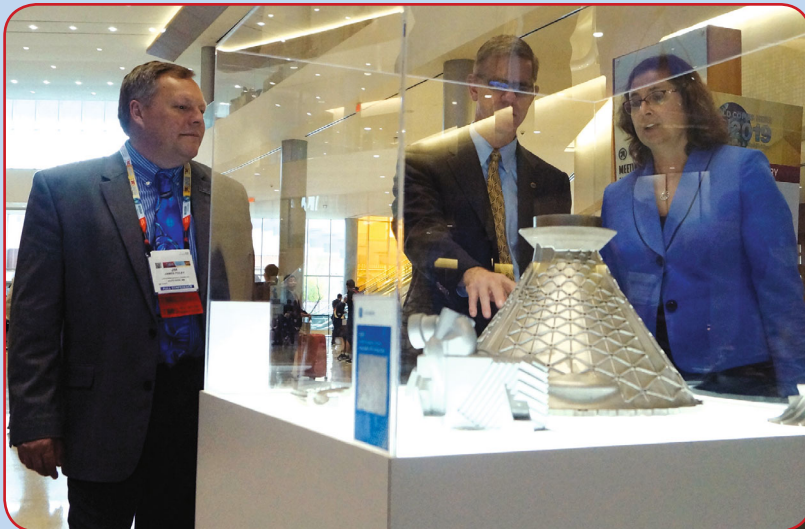
Given the increased focus on data and technologies, Iorio offered the following advice to students in the audience. “Build digital skill sets, along with a deep understanding of materials fundamentals. It will serve you well.”

She ended her presentation by sharing a short video from GE Additive, “The Anything Factory.” In the film, a young girl rides her bike past a factory whose name changes each day. One day, it’s the Unbreakable Bone Factory, then the Everlasting Satellite Factory, then the Supersonic Racecar Factory. Finally, she goes inside to find scientists who, the narrator tells us, are “3D printing magical parts to help the whole world.”

At the end, the message of the film—and the promise of additive manufacturing—are summarized in these brief but hopeful words: “When a factory can make anything, anything is possible.”

A Look at the Technology

Attendees were able to view GE Additive technologies related to Iorio’s talk at a display located outside of the TMS2019 Exhibit Hall. Throughout the week, representatives from GE Additive Materials groups were on hand to answer questions.



Luana Iorio (right) discusses some of the items at the GE Additive Manufacturing display with TMS presidents Kevin Hemker (center) and James Foley (left).

