Embracing Digitalization is the Future of the Aerospace Industry.

By Slaheddine Frikha,
Aerospace Industry Director, ESI Group.

get it right.

We recently sat down with our Aerospace Industry Director, Slaheddine Frikha, to get his views on the current status of the industry.

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You were at the most recent Paris Air Show, which is one of the biggest events in the aviation calendar. What were your main takeaways from the event?

It was the first session after four years, and after a period where the aviation industry was very impacted and had to see a lot of adaptation in terms of making the industry survive and so on. This year was clearly tuned towords the future, and everything was set to say the industry is recovering and looking ahead.

I was really impressed to see the new Open Rotor prototype engine exhibited on the SAFRAN prototype booth next to the Leap, their flagship engine which is already a great technological feat that has enabled substantial savings in fuel consumption, and therefore in pollutant emissions. The Open Rotor aims to go even further, and seeing it exhibited on SAFRAN's booth is proof that this is coming in the very near future.

Urban Air mobility vehicles were the superstars of the airshow with their own dedicated hall. Four years ago, they were just presented as new concepts, nothing was flying, but this year there were several OEM's exhibiting full-scale eVTOL aircraft and offering visitors the possibility to get inside and experience it. The progress made in four years is absolutely incredible.

Another fact that shows the spirit of an industry moving forward was the very high interest in recruiting new talent, which shows another dimension of an industry that needs to create a new future based on new technology. Hall Concorde, which was usually dedicated to research and innovation, was this time dedicated to attracting talent and to promoting jobs and skills needed to achieve next year's challenges.

So, the general message of the show was: "change is for now", and the industry is more ready than ever to embrace technological breakthroughs resulting from decades of research and innovation.

While it's positive that everybody is trying to look to the future, innovate, and move things forward, there must be some challenges still facing the aerospace industry?

The aviation industry is caught between two very strong trends. They must reduce environmental impact, while there is a huge increase in travel demand. We saw that this summer- it was very difficult to find a flight in comparison to previous years. So there is no choice but to implement very fundamental changes in the way they are designing, manufacturing, and operating aircrafts.

This needs to happen in the next 10 years, which is not a long time in aviation. Not only are new and more sustainable aircraft needed, but it is a whole ecosystem that needs to transform to be able to reach ambitious carbon neutrality targets. For example, new engines with sustainable fuel will induce a deep change in aircraft architecture and design, and beyond that, a whole ecosystem must adapt, like airports, ground facilities and safety appliances.

This can only happen with the integration of several breakthrough technologies that have to operate smoothly together.

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You mentioned a change in architecture and design is needed. Are there any specific challenges you see from the design and production perspective?

Let's focus on Aircraft OEM's and their supply chain. They are at the leading edge of a change that must happen and must happen fast. And as a result, they will be facing two challenges.

The first challenge is to succeed in designing more sustainable aircrafts and accelerating new programs to get new aircrafts ready for the sky.

The second challenge is to produce enough new aircrafts to replace the many old ones and achieve a massive emission reduction on time. Therefore, the target in terms of sustainability can only be achieved if production rate allows for a quick replacement of current fleets at affordable cost.

The combination of both challenges adds to the complexity of the whole equation. Aircraft OEM's and suppliers must rethink their design and engineering process to consider manufacturing efficiency early in the design phase to shorten time to market, and secure cost-effective technology for production.

We have already seen that ramp-up with the first phase of fuel consumption reduction achieved in the last decade, with the move from the CFM56 engine (and similar) to the LEAP engine that drastically reduced the operating cost of single aisle aircraft.

That created a huge demand on this aircraft segment, leading to an unprecedented increase in production rate, and causing production facilities for the OEM duopoly of Airbus and Boeing, and their supply chain, to struggle.

In the last decade, breakthroughs in engines, and aircraft technologies overall, to reduce fuel consumption were developed to fulfill a business-critical objective that was mostly motivated by the reduction of operating costs. However, as of today, more than half of in-operation aircrafts are still flying with old technologies due to overall economic balance.

Toady's new challenges related to climate neutrality have to be addressed as a mission-critical target. It is not optional anymore; it is an obligation to survive.

The adoption of these new enabling technologies and new processes that are designed to help ramp up production can often be quite slow for OEMs. Why do you think that is?

The aviation industry is very driven by certification. The design of an aircraft cannot tolerate any risk, accident, or serious incidents happening during a flight.

What is new today is that the certification is not only impacting the design itself, but also the production.

This basically avoids the additional design margins that create additional costs and increase lead times due to manufacturing uncertainties and production variabilities in the design phase.

The main enabler here is to move to the cross-process, digitalization bridging, model-based-engineering workflow for the whole development cycle.

Now, from the beginning, we can optimize the design, but we can also optimize manufacturing and assembly processes to be sure that what we produce is consistent with what has been designed, and to predict more accurately the effects of different scenarios and variation.

The certification of production capabilities and processes can then rely on such predictive capabilities, including both physical modelling assets and operational data intelligence.

Are there any digital technologies that you see more companies are open to adopting - for example virtual reality, the use of digital twins or AI?

One of the main drivers is understanding the need to integrate. Aggregating various new technologies leads to a higher number of new situations where knowledge based on previous aircrafts may become obsolete and a trial-and-error approach is no longer an option. This is pretty new to the aircraft industry which is used to evolving incrementally.

Our role in the digitalization value chain is to position virtual prototyping as a key enabler, to test and validate such aggregation in a comprehensive way, allowing teams to work in a natural way - agility and collaboration is very, very important.

Bringing in immersive metaverse technology to be understood, and to a level of readiness that can be used by industry, is a very good example for talking about digitalization. It is building the foundation. You have a real scale model that you can operate with your own hand and create an incredible number of experiences for very low cost, and through that you can get more knowledge, more insight, and even more data.

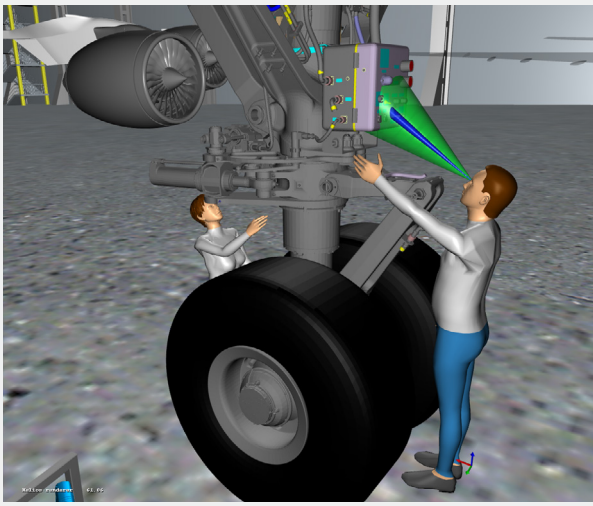
> **It is a whole ecosystem that needs to transform…this can only happen with the integration of several breakthrough technologies that have to operate smoothly together.**

Can you give any examples of ESI solutions that are enabling innovation in any of these areas?

What are ESI doing today?

One - we are bringing an industrial metaverse to life with a robust virtual reality solution addressing real-world challenges. Our solution allows people to work together in a virtual world, without need for physical prototypes, gathering people together without needing to be in the same place to interact, evaluate and decide. Teams meet around a full-scale model and experience it like they would around a physical mockup. This is something that closes a big gap in terms of agility and collaborative engineering. Our IC.IDO software is tailored to define and validate assembly and maintenance operations, smoothly leading to a concurrent “product and process” test and validation. We are proud to be pioneers of this kind of technology, which will expand into several other engineering domains. The starting blocks we are building will unleash many possibilities and leverage digital capabilities to accelerate innovation.

The second area where we have a very important role to play is to support the aircraft industry reaching new heights in terms of material performance. This is a very critical objective to reach sustainability targets set for the industry. The Aeronautic industry must increase the propulsion system performance and, at the same time, decrease aircraft’s overall weight, while also securing safe and durable structures and systems.

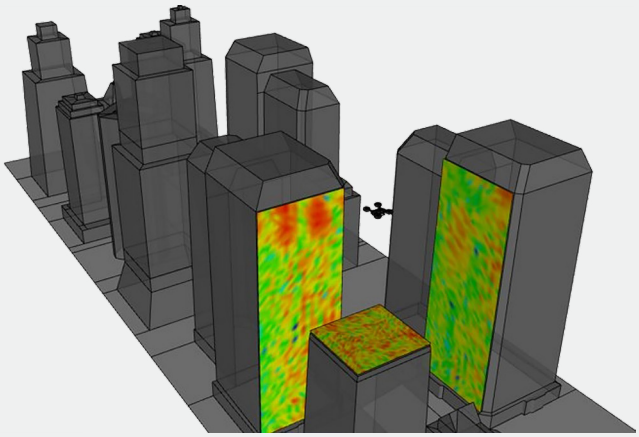


An emblematic example is the high-pressure turbine of turbojet engine - a key stage system that has drastically contributed to the increase in energy efficiency of modern aircraft engines through key breakthroughs in aerodynamics, structures, and high-performance materials.

ESI is the preferred partner of engine OEM’s and their part suppliers around the world, providing tailored solutions for manufacturing process simulation, based on our high skills in material physical modelling. ESI’s ProCAST enables Investment Casting process simulation that leads to new heights in terms of high-strength and high-temperature capability of single crystal materials. Going beyond such performance is a critical objective for future energy efficient gas-turbine engines.

Thirdly, ESI is helping the emerging eVTOL industry to face critical challenges, from energy efficiency to secure an affordable range, to safety requirements and social acceptance. Noise level is a key criterion for social acceptance for both passenger comfort and community impact. Adoption of new urban air mobility will ultimately require an innovative acoustic design. Here also, ESI plays a key role providing flagship players with advanced solutions for full frequency acoustic simulation.

ESI VA-One enables our customers to predict noise propagation through and across complex systems, like interior lining and sophisticated noise control treatment, fitting tailored composite structure. By relying on such predictive modelling, our customers can shift left the acoustic design in the overall product development lifecycle, unleashing key possibilities combining noise source reduction and aircraft structure acoustic performance. This is a critical target to optimize the design of ad-hoc noise control treatment with a minimum of additional weight.



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About Slaheddine Frikha

Slaheddine Frikha is Industry and Partnership Senior Director at ESI Group. He is a Mechanical Engineer graduated from École Nationale Supérieure des Arts et Métiers and holds a PhD in Applied Mechanics. He conducted several research projects as a professor at Paris University. He joined ESI Group in 2002 to lead the newly acquired Vibroacoustic Business Unit and has held several Business Development positions. Over the past decade, he is leading the Aerospace industry business by developing new opportunities and nurturing deep relationships with the ecosystem. He holds the ESI membership in several innovation and professional organizations, working closely with industry leaders to engage in digital transformation, leveraging IoT, digitalization and Data Intelligence enablers for safe, productive and sustainable operations.

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