THE VIEW FROM 30,000 FEET

Aerospace and defense companies share many commonalities in the type of products they produce, the harsh environments these products operate in, and their overriding focus on safety and reliability. However, the commercial aircraft, space and defense sectors each face unique market trends. In this aerospace and defense-focused magazine, we explore how these trends drive technology innovation and the way leading companies leverage simulation-driven product development to deliver tangible business impact.

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Commercial Aerospace

Volatile and rising fuel cost coupled with green initiatives drive the development of technologies that reduce the cost and environmental impact of flight. Pratt and Whitney, known for game-changing product innovations, deployed simulation to design an engine that delivered over 15 percent improvement in fuel burn while reducing its noise footprint and carbon emissions. (See article on page 7).

Competition to capture the growing number of air travelers means an increased focus on passenger comfort. Aircraft climate control experts at Tianjin and Purdue universities employed systems-level simulation and detailed thermal analysis to meet industry standards for environmental control system design (page 13).

Innovation must be achieved in an evolving, highly regulated safety framework — all while controlling development costs. To certify braking systems for safety, software developers must test for each possible input to the brake control software, as well as for a broad range of operating events. Crane Aerospace & Electronics, which performed these tests virtually, has been able to meet government guidelines, tight budgets and even tighter schedules (page 3).

Defense

While striving to deliver a technological edge in the least amount of time, many defense organizations and their suppliers operate on the principle of design for affordability. By using simulation, Piaggio Aero Industries converted an executive jet into an unmanned aerial vehicle (UAV) in one-third the time that would have been required using traditional design methods (page 31).

As the nature of military engagements evolves, the importance of intelligence, surveillance and reconnaissance (ISR) has never been higher. Lighter-than-air blimps can replace or complement drones on ISR missions. Worldwide Aeros Corp. used multiphysics analysis to design new airships 40 percent faster than for the previous generation. The savings arose from the ability to share data between simulation types and run automated processes. Virtual testing provided far more accurate estimates of performance than traditional methods (page 24).

Engineering for sustainability and optimizing operational availability of assets is critical for the defense community. By leveraging the power of multiphysics simulation, Raytheon Corporation achieved robust electronics design for high-power antennas and microwave components. The simulations helped engineers understand how failure could occur and how to correct the design to prevent it (page 27).

Space

With the emergence of commercial space entrepreneurs and new spacefaring nations, product development processes in the space industry are changing rapidly. Firefly Space Systems, one of the leaders in the "new space" industry, explains how the company changed its culture to include a diverse group of engineers and flatten the engineering function (page 38).

New space or old, products must perform first time, every time in one of the most extreme operating environments. Because conditions change quickly during atmospheric flight, space vehicles require thermal insulation to protect the payload and sensitive internal equipment from generated heat. Coupled multiphysics simulation saved SpaceX hundreds of thousands of payload-equivalent dollars per launch by calculating the exact amount of insulation required to safeguard the launch vehicle — approximately 50 pounds less than the amount used in the first demonstration flight (page 42).

It wouldn't be a space race without the goal of delivering products in the shortest possible time. This means reducing reliance on physical testing by building confidence in simulation. Virtual analysis provided NPO Energomash designers with confidence that their force measurement system could test rocket engines with up to 800 metric tons-force of thrust (page 34).

In addition to relying on advanced simulation technologies and performing virtual prototypes, aerospace and defense industry leaders focus on design process compression. While investigating heat flux prediction points for improved engine efficiency, Rolls-Royce Germany reduced its coupled simulation time by 80 percent using a cloud approach — and without building prototypes (page 17).

For the near future, aerospace and defense is leading the way in realizing the digital twin concept, which couples simulation with the operation of the physical product. Whether embarking on simulation for the first time and investigating the power of advanced simulation technologies or spearheading a digital twin initiative, companies across the aerospace and defense spectrum are leveraging the power of ANSYS simulation-driven product development solutions.