

Flying Embedded: The Industrial Scene and Challenges for Embedded Systems in Aeronautics and Space

Keynote Address by Dr. Jean BOTTI, EADS, Chief Technical Officer

This keynote address, given by an executive representative of the European aeronautics and space industry, introduces the strategic stakes and the international competitive landscape, for further development and understanding of the sizing dimensions of technology transfer all along the special day.

Next to new materials and structures, the introduction of advanced electronics systems has a key impact on the performance, flight characteristics and operability of new air and space vehicles. Mechanical and hydraulic components and subsystems are increasingly being replaced or at least further supported by electrical and electronic components. All these elements rely on on-board controllers and computers, at the core of which is their embedded software. The impact of embedded elements will continue to increase steadily, while they are already allowing breaking through the performance limitations of traditional flight control and communication systems.

Compared to automotive or consumer applications, embedded systems in aeronautics and space have to meet more stringent requirements due to the different levels of criticality and safety. This is significantly reducing the speed of their implementation, since additional safety rules have to be respected and built in. Safety and certification issues are imposing severe limitations on the use of advanced components, which are emerging from other applications, even if they appear to offer unprecedented performance and comfort features. Specific aeronautic and space developments in hardware and software are lagging behind the commercial state-of-the-art by several years due to their specific and different demanding characteristics versus commuter electronics, but then they do guarantee the required levels of safety and reliability in operation. There is a clear similarity and thus synergy emerging here with the developments in the automotive sector. However, for various generations of semiconductor technologies, it is not yet sure whether they can be used in the more demanding environment of the aerospace industry. Longer and different kinds of lifecycles necessitate the consideration of other aspects: obsolescence after the typical commercial lifecycle of just a few years is not an option for aerospace and defence products, as their lifecycles can extend to more than 50 years.

In addition to addressing the differences and constraints, the presentation deals with the new applications, where embedded smart systems will have a decisive impact on the development of airplane and spacecraft structures, design, layout and configurations, man-machine interfaces, performance monitoring, engine operations, navigation and safety systems. They will enable more precise control of vehicles while reducing the size, mass and power requirements of operational and safety functions as well as energy efficiency. They will be decisive for diagnostics and predictive maintenance management of the engines and the vehicle's structure, enabling a more connected operation within the overall transportation and logistics system. Limitations of mechanical, electrical and hydraulic structures as well as manoeuvring behaviours will more and more be monitored and controlled by embedded systems. Smart systems will provide better services and more comfort to the users, allowing the air transportation system to be more time and cost efficient, more environmentally compatible and secure.