ANSYS

Application Brief

ANSYS Solutions for Future Airborne Capability Environment (FACE)

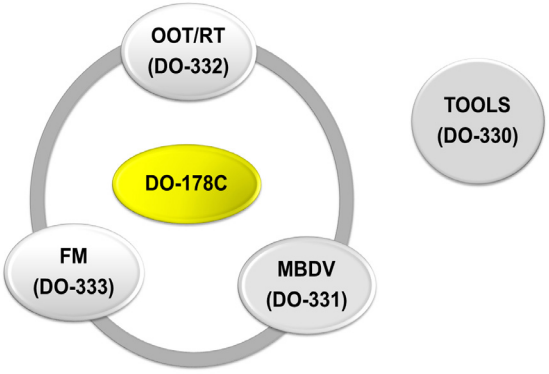
*By **Robert Harwood**, Aerospace and Defense Industry Director, ANSYS, Inc.*
***Tony Karam**, Vice President, Americas Operations, Esterel Technologies (part of ANSYS)*

Historically, U.S. Department of Defense (DoD) avionics hardware and software systems were developed for a unique set of requirements by a single vendor. This was not a major concern while electronic systems were a relatively low percentage of the flyaway cost of a platform. However, two major trends have begun to change this situation.

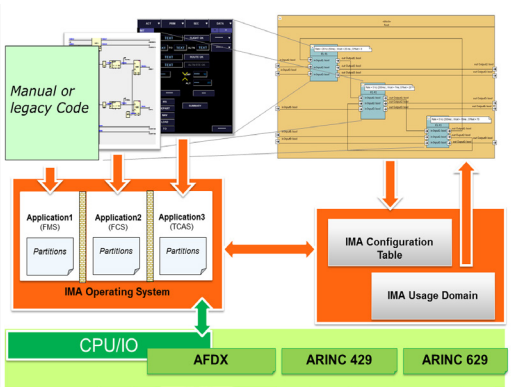
- The complexity of avionics systems and the number of embedded software lines of code have grown dramatically in recent years. It is no longer cost effective to develop complex systems customized for specific applications that are not re-usable across aircraft platforms.
- There is a continued DoD push to reduce development time/cost and introduce design improvements that support the concept of "design for affordability." The current climate of fiscal constraint has brought the concept into sharper focus.

As a result, the Future Airborne Capability Environment (FACE) Consortium's standard was designed as a response to the U.S. DoD aviation community's challenges. The FACE approach involves developing a standard for a software computing environment designed to promote software product lines that are re-usable across different air platforms.

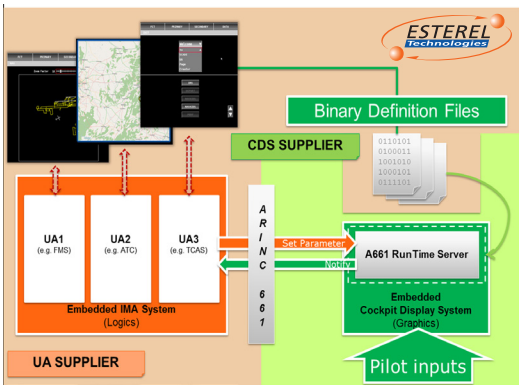
Several components comprise the FACE approach to software re-use. The concept allows software-based "capabilities" to be developed as components that are compatible with other software components through defined open-standards interfaces. It also provides for the re-use of software across different hardware computing environments that contain differing platform devices. This includes the use of avionics functional standards such as ARINC 653 for Integrated Modular Avionics and ARINC 661 for the design of Cockpit Display Systems (CDSs) and User Applications (UAs). For the future, FACE will support airworthiness qualification of airborne systems such as DO-178C Levels A through E as well as the Common Criteria Evaluation Assurance Level 4 (EAL 4) through Level 7 (EAL 7). Ultimately, the goal of FACE is to reduce development and integration costs and reduce time to field new avionics capabilities.



FACE Do-178C documents structure.
The FACE consortium is hosted by the Open Group, and it comprises U.S. military industry suppliers, customers and users. It meets regularly to define a reference architecture, set of guidelines and business model.



ARINC 653 use model and model-based technology



ARINC 661 use model and model-based technology

Embedded Software Challenge for Military Aviation

The cost, time and risk involved in manually producing, testing and verifying tens of millions of lines of code is increasing at an astronomical pace. In the long run, FACE will ease the embedded software challenge by making it possible to redeploy applications from one platform to another without having to do much more than recompile the application. Over the short term, FACE will increase the embedded software engineering workload by requiring that existing applications be rewritten and new applications be written to comply with FACE interfaces. But ultimately, manual generation of safety- or mission-critical embedded code is not cost scalable or aligned with the design for affordability initiative when compared with more automated approaches.

The ANSYS Solution

Esterel Technologies, a wholly owned subsidiary of ANSYS, Inc., addresses these challenges by providing engineers with the capability to quickly build a graphical model of aviation software and systems using prebuilt components without requiring manual code-writing, although hand-written code can be incorporated when required. Engineers can simulate the behavior of the model and immediately view the results, making it possible to gain critical insights early in the systems design process and to rapidly improve the model's performance. Engineers also can link the predicted behavior to specific customer requirements. Later in the design cycle, the model can be used to automatically generate embedded software (compliant with FACE and other DoD standards) that can be downloaded to an embedded hardware system to evaluate the prototype in real time.

Esterel's SCADE Suite® is a model-based development environment that includes requirements management, model-based design, simulation, verification, and certified code generation. SCADE System™ is a systems design tool suite for critical system modeling. SCADE users have achieved substantial reductions in development and verification cost. Users report that they have doubled the average number of executable lines of code developed per person per day, from five for manual coding to 10 with model-based design, while also reducing execution time. Software certification cost is reduced by an average of 50 percent. Coding, review and testing cost are reduced by 70 percent to 90 percent. The software update cycle time is shortened by 65 percent to 75 percent. SCADE tools provide additional savings by eliminating manual coding errors and eliminating the need for low-level testing. The cost of design changes and associated testing throughout project lifecycle and testing cost is reduced by 70 percent to 90 percent.

SCADE Suite is ideally suited for development of embedded software for FACE-compliant military aviation platforms. The tool provides a long and industry-leading track record of providing certified model-based auto-code generation solutions for the development of portable components and applications that support many open standards folded into the FACE standard, such as ARINC 653 operating system standard, ARINC 661 cockpit display system (CDS) and OpenGL graphics standard. The solution is a direct implementation of the principles at the foundation of DO-178B; it has shaped the discussion on tool qualification, model-based design and formal methods in the committee developing the new DO-178C standard.

Reasons to Select ANSYS as Your FACE Partner

Through Esterel Technologies, ANSYS model-based software development solutions dramatically reduce the cost, risk and time to certification of the embedded systems and software at the heart of military aviation systems. Our solutions offer the unique capability to graphically design, verify and automatically generate embedded software that complies with FACE and related DoD standards. We provide a partner ecosystem and global support that helpsto ensure a seamless transition into model-based design and automatic code generation.

ANSYS, Inc.
Southpointe
275 Technology Drive
Canonsburg, PA 15317
U.S.A.

724.746.3304
ansysinfo@ansys.com

ANSYS, Inc. is one of the world's leading engineering simulation software providers. Its technology has enabled customers to predict with accuracy that their product designs will thrive in the real world. The company offers a common platform of fully integrated multiphysics software tools designed to optimize product development processes for a wide range of industries, including aerospace, automotive, civil engineering, consumer products, chemical process, electronics, environmental, healthcare, marine, power, sports and others. Applied to design concept, final-stage testing, validation and trouble-shooting existing designs, software from ANSYS can significantly speed design and development times, reduce costs, and provide insight and understanding into product and process performance. Visit **www.ansys.com** for more information.