CoreAVI's Vulkan and COTS-D Technologies Enable HENSOLDT's Next Gen Safety Critical Airborne Computer

CHALLENGE:

Modern airborne systems require more processing power, performance, and functionality than ever before. Safety criticality is integral to new and refreshed legacy designs alike, and development for safety critical systems that meet the highest Design Assurance Levels (DALs) is not only time consuming, but complex and expensive. Previously, military platforms did not always require safety certifiable systems, whereas now many integrators are moving towards implementing not only safety critical systems, but ones that can attain the highest design assurance levels. These new requirements call for greater flexibility and ability to modify existing applications to meet higher standards as needed.

Legacy systems often consist of multiple chassis within one platform, resulting in increased size, weight, and power (SWaP). Platform manufacturers who manage many different platforms in very small numbers have an added challenge of maintaining various systems within each platform, with little to no standardization. Older proprietary systems have designs that are not only labour intensive to maintain or upgrade, but are configured to a specific platform, adding to the time, cost, and risk of tech refresh for several platforms at once. Legacy systems often rely on OpenCL® or CUDA® for compute capabilities, neither of which is safety critical. If safety criticality is required, integrators previously had to rely on more difficult and expensive options for computation using either FPGAs (Field Programmable Gate Arrays), or many CPUs at once, which increased the SWaP challenges. With rapidly evolving requirements and the speed of software updates, current safety critical systems cannot keep up with the pace of change. How can modern avionics platforms attain both the safety criticality levels required while keeping up with modern technology?

MODERN SAFETY CRITICAL AIRBORNE COMPUTERS:

Integrated Modular Avionics (IMA) has seen all disparate systems on aircraft platforms being merged into single or dual redundant IMA computer systems with full mission capabilities including primary pilot displays. Eliminating the need for multiple systems and instead combining many required functions into one consolidated module enables a greater level of flexibility, standardization, and ease for both integrators and pilots. HENSOLDT's next generation of safety critical COTS Airborne Computers solves the headaches inherent in legacy systems by offering the scalable power and high performance to meet the needs of a wide range of safety critical avionics applications.

A greater level of flexibility is introduced into airborne platforms with the Airborne Computer's hardware segregation's Safe Area and (non-safe) App Area. Strict Segregation is ensured by hardware and software mechanisms. Safety critical functions live in the Safe Area of the computer, while functions not requiring safety criticality live in the App Area. Apps from the commercial world can be hosted in the App Area and run on commercial operating systems, allowing them to be quickly and seamlessly updated to the latest technology while keeping the Safe Area's functions aligned to their prescribed DAL levels. With the ease and flexibility of this unique architecture, end users can find an app for almost any functionality they need. Airborne computing integrators can greatly benefit from this type of accessibility and adaptability, all during their aircrafts' in-service lifecycle. In this way, they can advance their capabilities while avoiding greater changes to their airborne systems.

To address hardware advances, the Certified Airborne Computer enables modern, high performance graphics processing with CoreAVI's COTS-D GPMX002 XMC graphics module featuring AMD's Embedded Radeon E9171 GPU. CoreAVI's VkCore® SC Vulkan®-based graphics and compute drivers enable the integrator access to state-of-the-art graphics and compute capabilities all in one API (Application Programming Interface), a luxury previously unattainable in safety critical systems. To make life easy on integrators who use OpenGL®, CoreAVI's VkCoreGL™ SC2 OpenGL application libraries allow programmers to continue to reuse legacy software and create new safe graphics applications with OpenGL, while benefitting from the more modern Vulkan capabilities. Vulkan enables HPC (High Performance Compute), which achieves up to a 35x improvement over the same type of HPC running on Intel i7 CPUs. The flexibility of Vulkan allows it to be used for HPC applications, processing data streams such as sensor data, radar data, ESM (Electronic Support Measures) and other signal processing data while simultaneously running high resolution graphic displays. Critically, Vulkan and its compute functionality is safety certifiable, eliminating the need for more expensive, SWaP-challenged FPGAs or multiple CPUs. The hardware and software combination in HENSOLDT's Airborne Computer is available with its associated DO-254/ED-80 and DO-178C/ED-12C certification packages, saving integrators time and money.

RESULT:

The flexibility and adaptability of HENSOLDT's Certified Airborne Computer means integrators avoid many of the traditional challenges associated with legacy systems. Having one supplier provide a pre-integrated, ITAR-free full system solution in one package—from the GPU, to safety critical software, segregated architecture, and certification artefacts—is key to reducing risk and speeding and easing integration efforts.

This Certified Airborne Computer is designed to offer customers the highest levels of safety and security without sacrificing features and performance. Keeping up with modern technology and new system requirements in a safety critical space is challenging at the best of times, and the Mission Computer aims not only to facilitate the integrator's job, but also to augment the pilot's capabilities and ease his/her workload.