WHITE PAPER

Considering the Make vs. Buy Decision for Flight-Certifiable Embedded Electronics

abaco SYSTEMS

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Introduction

Introducing a new aircraft comes with considerable challenges. It can certainly seem like a jigsaw puzzle getting piloted, remotely piloted, or unpiloted, fixed or rotary wing, aircraft certified for uses including government, cargo, urban air mobility or passenger service.

Many questions must be addressed before a commercial or military aircraft design/upgrade process begins. Deciding which engineering steps to conduct in house, rather than contracting with an outside company, is usually at the top of the list.

Consider aircraft computers. How much money and engineering talent are justified to create new, embedded electronics? Will the electronics development occur before, during or after the structural design stages? Once designed and installed, will the embedded electronics pass rigid certification requirements?

Some aircraft designers and systems integrators already design computers in-house. For these companies, the question must be asked, just because you can, should you? Anything that distracts an aircraft designer from its core competencies could result in project overruns, delays or design failure.

Working with a partner with a long history of providing widely applicable, general purpose computing platforms is a viable alternative. This allows aircraft designers a myriad of options to add their own value on top of either a line replaceable unit (LRU) full box level or modules for companies doing their own system design and integration.

Open architecture computing and electronic system suppliers do the design and processes required to generate all the safety artifacts. However, the platform is delivered as a blank canvas with processor, communications interfaces, I/O, video and graphics and avionics bus support.

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This allows the aircraft designer to create its own fixed functionality on top of the platform—its own primary flight display—for example.

Companies undecided about developing their own embedded electronics, or instead working with a partner, must consider intertwined cost, risk and time to market ramifications at the beginning of the design process to ensure success.

Cost Top Priority

Reliability and safety are prerequisites for any certified aircraft design project, and aviation has long mandated certification. The FAA issued AC 20-115 in 1982 to call attention to DO-178 as a means of achieving approval for software and AC 20-152 in 2005 to call attention to DO-254 as a means of achieving flight certification approval for electronics hardware.

That leaves project cost and resource allocation as primary decisions for any new aviation design. Companies choosing to build certifiable aircraft systems, focusing on the function of the system rather than re-inventing the computer, can achieve significant cost advantages.

For example, the certification process itself is a considerable incremental cost delta when compared to a standard AS9100 development. It is not unusual for a company to invest millions of dollars in engineering time developing their own certifiable computer blocks.

However, significant cost savings can be achieved by working with a company that supplies already-certified embedded electronics commercially available off the shelf. The investment in the technology has already been amortized over many projects and customers. As a result, the cost to a company is considerably lower than if they designed the computer platform themselves.

On average, a typical savings can amount to millions of dollars and thousands of developmental hours when working with a partner when compared to designing from scratch.

Reduce Risk

Those choosing to design their own embedded electronics assume considerable risks. However, buying pre-qualified, general-purpose computing platforms greatly diminishes these risks. Cost overrun is probably the most common risk a company takes on when designing their own computer platform. Schedule overruns, delay getting to market, potential financial penalties from customers and missed opportunities for profits are significant gambles as well.

However, when suppliers partner with leaders in the silicon chip supply chain, these risks are greatly reduced. The best general purpose computing platform suppliers keep on top of the latest chip advancements, computer lifecycles and other supply chain considerations. These include counterfeit component avoidance, obsolescence management and long-term support. As a result, countering risks become forethoughts rather than afterthoughts. These suppliers have built their businesses working closely with NXP, Intel, NVIDIA, and others and bring that advanced edge technology to their customers.

Another big risk is design failure. Aircraft designers and systems integrators may have completed their computer design processes and are now working toward certification. However, during the process, auditors may look primarily at processes, not the design itself.

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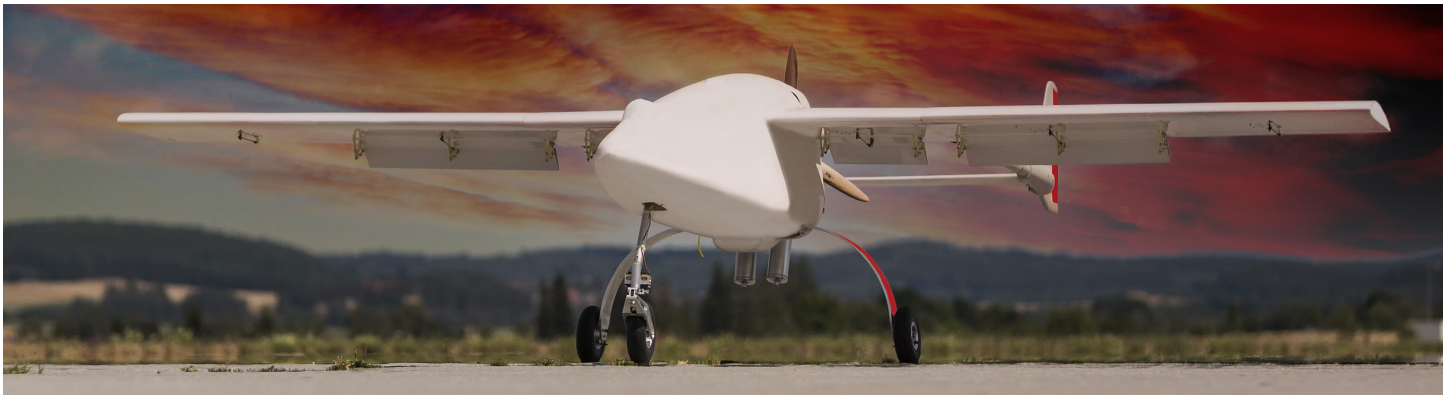

Also, modern processors demand extremely technical and precise printed circuit board (PCB) design techniques. This expertise is essential to handle the signal speeds and the transition from a correct schematic to a working PCB. Without this technical oversight, there is no guarantee that the design will pass the functional verification and validation testing phase at the end of the project. Companies that routinely develop non-certifiable state-of-the-art technology products benefit from this accumulated expertise when applied to certifiable programs.

The most efficient way to pass testing and ensure design certification is to work with a company that provides off-the-shelf platforms, ensuring that the proper design is available when needed. Retaining a consultant designated engineering representative (DER) to audit the process throughout the development can greatly reduce the risk by identifying and correcting issues in a timely manner.

Time-to-Market Mistakes

It generally takes years to bring a certified, general purpose computer platform to market in the aviation space. In the time it takes to design and certify an aircraft's general purpose computer platform, the design may become outdated.

However, because of the aforementioned chip maker partnerships, leading general purpose and embedded computing platform suppliers are aware of silicon roadmaps as they are being developed and are incorporating these into a stream of technology-insertion products. These partnerships ensure the latest chip technology is included in the circuit board design. The succession of production-ready hardware means there is always a modern product available, allowing companies to prototype on one variant but move to a newly released generation before going to production This delivers a significant time to market competitive advantage for aircraft designers.

Further, a company may perform its due diligence producing all the embedded computer documentation and meeting all objectives; only to find, because it has worked in isolation it ultimately fails the final tests. At that point, the company must reengineer the platform at the low-level board or system level and iterate through the certification process. This significantly impacts the time to market and the ability to certify the aircraft — not to mention the millions wasted on the effort.

Working with a company that has access to cost-effective and latest general-purpose platforms helps ensure the certified product is relevant in the market. However, if an aircraft designer performs its own embedded computer design, it will take several years before it can deploy it. By purchasing the embedded computer off the shelf, the company can go to market without delay.

Pulling it All Together

Working with a general computer platform vendor with a broad portfolio and a wide view of the aircraft market and its segments reduces cost, risk and time to market. These vendors can save aircraft design companies millions in costs as well as significantly reduce developmental time. Because the computer boards have already been developed with the latest chip technology, the costs have been amortized over time.

Look for an open architecture computing and electronic system supplier that works with independent auditors in parallel with the structural design process, rather than an inefficient and linear review that can ultimately lead to failed verification and validation testing. These companies have existing partnerships with leading chip manufacturers, ensuring the latest chip technology is included in the design project.

Abaco Systems takes a wholistic view of the market and understands the different needs of its customers, bringing all these needs together. This view allows Abaco Systems to better plan for emerging trends, ultimately keeping costs down, reliability up and the supply chain going.

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