Embedded Executives Talk Next Generation Military Avionics Systems

BY: KELSEY REICHMANN

The demand for embedded avionics systems is growing despite the COVID-19 pandemic. The need for advanced military aircraft communications, navigation, and surveillance capabilities is being met with technological innovations in emerging embedded systems configurations, designs, and standards.

Leaders in the embedded systems industry including Rodger Hosking, Vice-President of Pentek, Mike Pyne, Director of Strategic Accounts and Solutions Architect at CoreAVI, Benjamin Brosgol, senior technical staff at AdaCore, and Robert Tice, Lead Technical Account Manager at AdaCore spoke to *Avionics International* about how the pandemic effected their manufacturing environments, emerging trends in the industry, and new technological developments.

Avionics: **What was your development and design environment like before and after the impact of the COVID-19 pandemic started to force social distancing and other work restrictions in February? What has been the biggest change?**

Brosgol (AdaCore): AdaCore's software production infrastructure has always been based on a distributed development environment, so the work restrictions imposed by COVID-19 did not have a major impact. The company was founded in the mid-1990s with its staff geographically separated (mainly in New York and Paris, with additional personnel in satellite home offices in the U.S. and abroad). The distributed nature of our development process necessitated introducing effective measures for internal communication, including a ticket tracking mechanism to provide an audit trail of discussions underlying technical and business decisions, as well as automated procedures for conducting regression tests on our

products (currently millions of lines of test cases run on dozens of platforms daily).

Benjamin Brosgol is a senior member of the technical staff at AdaCore.

Over the 25+ years that we have been in business, our company and its infrastructure have evolved and grown significantly, but its engine has always been a geographically distributed workforce. We have therefore taken advantage of the many advances in communication and collaborative internet / cloud-based technologies.

Although the pandemic has proved detrimental and even catastrophic in many industries, we were well prepared to weather the disruption and to serve our customers. The biggest change was not on the technical or business side but rather on the social side: people need human interaction, and although Zoom (or in our case Google Meet) can bring people together virtually, we miss the social interactions that come with seeing our colleagues in person at the office, or meeting customers at a conference or an on-site visit.

Hosking (Pentek): As an essential business for national defense, we were fortunately allowed to stay open throughout the pandemic. We undertook major initiatives for hand sanitizers, cleaning, social distancing, and mask wearing, which have now become automatic behavior.

The biggest impact on our employees has been health fears, but fortunately not the uncertainty of unemployment or financial hardships, as with so many other businesses.

Pyne (CoreAVI): CoreAVI's engineering development environment is a mix of both hardware and software design. Because of the distributed nature of our worksites, a remote/work-from-home infrastructure was already in place. When the restrictions of the pandemic were enforced, CoreAVI was well equipped to handle the lockdown.

A few of our sites that required hardware testing were manned by skeleton crews, but for the most part all development objectives were properly addressed using a variety of remote access tools. The biggest change was knowing that we couldn't gather together, even if we wanted to.

Avionics: **One of the crucial activities for embedded systems development and manufacturing activities is collaboration among engineers, product managers and others. How has the collaboration process changed as a result of COVID-19?**

Brosgol (AdaCore): AdaCore has always maintained a collaborative process that supports development and management teams distributed geographically (including internationally) and across multiple time zones, and this process was well suited to meet the challenges raised by COVID-19.

Even before the pandemic we were making use of team-based tools such as Google Docs to share information in a controlled fashion and Google Calendar to coordinate remote team meetings, and we had migrated some intra-company communication to Slack channels in order to reduce the email burden. So again we were well poised to deal with the "new normal" imposed by the various restrictions.

The company's annual release cycle was conducted normally and completed on-schedule during 2020 (Q1 rollout of new major release of all products, Q3 minor release, Q4 preview release of next year's version). The main change was the increased usage of videoconferencing and webinars to keep staff (and customers) up to date.

Hosking (Pentek): During the weeks our engineers were working at home, product development efforts suffered from less collaboration and brainstorming, which are essential to solving problems and making decisions. After being isolated and working from home, engineers welcomed the opportunity to return to the workplace again. Now, we all fully appreciate that the interaction with others and a meaningful purpose is extremely important to mental and emotional well-being.

Rodger Hosking is the Vice-President of Pentek.

Pyne (CoreAVI): Fortunately, our collaboration tools were well in place well before the pandemic hit. During the lockdown, CoreAVI has relied heavily upon tools such as Microsoft Teams

for meetings, chats, scheduling, instant messaging and file sharing. A variety of other document management and customer management systems, which were in place well before the pandemic, made the collaboration process "transition" fairly easy. CoreAVI's IT group has been hailed as true heroes during the past year but by and large, there were very few new processes or tools incorporated by our company to deal with remote access and lockdown conditions.

Avionics: **COVID-19 has changed demand for some technologies and aircraft such as in the commercial market. How has it changed the demand for some of your technologies?**

Brosgol (AdaCore): AdaCore's main customers are from the aerospace and defense sector, and indeed we did see a temporary dip in demand from the commercial aerospace side. However, several factors mitigated this issue:

Demand from the defense industry was not adversely affected by the pandemic and in fact experienced an up-tick. This is perhaps due in part to the growing interest in the Future Airborne Capabilities Environment (FACE) effort, in which AdaCore is actively participating.

AdaCore's products are sold on a subscription basis, and several major customers had multi-year subscriptions that carried through 2020. Subscription start and end dates were staggered throughout the year, avoiding major perturbations in our revenue stream.

AdaCore's products are geared in general to customers who need to develop critical software, and tools that can help meet requirements for reliability, safety, and security see a continuing demand. Due to the nature of the industries we serve, project, product, and development lifecycles are often much longer than other markets. This allows us to create long-lasting relationships with our customers both at the commercial and product support level. This has allowed us to show the flexibility to help and support them through this continuing period of change.

Hosking (Pentek): We supply mostly to the MIL-AERO market so we have not been impacted by the drastic reductions in commercial air traffic.

Pyne (CoreAVI): The pandemic has substantially impacted several of the markets served by CoreAVI. Our commercial

aerospace customers were hit the hardest, followed by the automotive market. The US Defense market has remained strong. The foreign defense market saw some softening. Because CoreAVI products are in such high demand, our biggest challenge was developing a strategy on how to most effectively grow during the pandemic.

Mike Pyne is the Director of Strategic Accounts and Solutions Architect at CoreAVI.

Avionics: **Research and development investment in the creation of next generation technologies such as artificial intelligence was increasing prior to the impact of the pandemic. However, considering the unprecedented impact of COVID-19 on demand, has that changed your focus in terms of R&D? Are there still next generation architectures, processing or standards you're focused on developing despite COVID-19?**

Brosgol (AdaCore): AdaCore is pursuing several "next generation" technologies:

As noted above, we are actively involved in the FACE effort, both by contributing to the evolution of the FACE Technical Standard (in particular to ensure appropriate support for the Ada language) and by supplying tools and run-time libraries that help developers produce FACE conformant software that is reusable, reliable, and safe.

We are investigating technologies that can combine model-based engineering and formal methods, so that the developer can automatically verify critical assurance properties at each step of the software life cycle.

COVID-19 has not changed our focus and R&D investment; on the contrary we see these as increasingly important in 2021 and beyond.

Hosking (Pentek): The pandemic did not shift the focus on our product development efforts, which are mostly for military and government markets.

Pyne (CoreAVI): Like most companies with a focus on long term growth and market expansion, CoreAVI doubled its efforts in research and development during the pandemic. The opportunities for Artificial Intelligence (AI) and Machine Learning (ML) in the post-COVID-19 world will be unprecedented. Since CoreAVI has extensive experience with GPU architectures and their use to accelerate inferencing of convolutional neural networks for AI/ML, along with a proven track record for safety critical/deterministic software solutions, the market growth prospects are so compelling that the commitment of R&D funds in this area was an easy decision.

Avionics: **What areas of the embedded systems market do you see changes or new developments in demand in 2021?**

Tice (AdaCore): Embedded systems development, as we know it, has changed. Once upon a time, applications were developed to be deployed one-per-card in a large backplane or in separate federated boxes. But now, with faster silicon, systems on chips (SOC), and technologies like hypervisors, those applications can be consolidated onto a single board, saving space, time, and money in deployment.

Hypervisors give avionics application architects an interesting level of flexibility that previously was not available. For example,

using a DO-178C ready hypervisor technology, an architect can combine safety-critical and non-safety-critical applications on a single piece of silicon, allowing the hypervisor to handle separation.

This means that an architect can leverage a bare-metal (or safety-certified RTOS) solution to achieve safety-critical Level A certification for a component on one partition and utilize an OS for non-safety critical components at Level D on another partition, all on the same platform. Adding functionality to this system is as easy as adding guests to the hypervisor, which is a much more cost-effective methodology than adding boxes or cards to backplanes.

Robert Tice is the lead technical account manager for AdaCore.

Hosking (Pentek): We see increased demand for improving performance of military radars, SIGINT, and electronic warfare/countermeasures. The threat from China is driving strong interest in artificial intelligence and machine learning capabilities.

Pyne (CoreAVI): For 2021 we see a strong defense market with an increasing need for embedded systems for both retrofits/upgrades and for new platforms. We see a very strong automotive market where hundreds of distributed/federated microcontrollers will start to be consolidated into a few, more capable, embedded processors.

We see the beginnings of recovery for the commercial aerospace market with some intriguing possibilities for the urban air mobility segment.

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