Extreme machines

Neil Tyler talks to Paul Hart, CTO, Curtiss Wright Controls Avionics and Electronics about the challenges confronting suppliers to the military

Few companies have the historical pedigree of Curtiss Wright, formed in 1929 out of the merger of companies founded by Glen Curtiss, a leading innovator in naval aviation, and the Wright Brothers.

Over the past 90 years the company has changed immeasurably and today can claim leadership in advanced technologies for high performance platforms and critical applications, in sectors including industrial, power and defence.

When it comes defence the company supports a wide range of different programmes across naval, aerospace and ground defence markets linked by a host of sophisticated embedded computing products and electronics – it's a market that, like most others, is facing massive challenges and, according to Paul Hart, the company's Chief Technology Officer for Controls Avionics and Electronics, "The pace of change has been truly astounding and the challenges are certainly significant. Today's supply chain has been set up to address the needs of consumer electronics and not the military. It's not been designed to address the problem of obsolescence, which is a critical issue for the military.

"It's the overarching shadow that looms across almost everything we do," he concedes. "We need to be able to mitigate the component-level risk of obsolescence and that can only be done by designing with open architectures that will enable easier part replacement.

"It requires better and more proactive planning when it comes to inserting new technology into a programme that, in many cases, will have a long active life."

All of this requires extensive support for programmes and sourcing off-the-shelf (COTS) parts.

"Curtiss Wright looks to work with open architectures. We have to ensure that programmes are able to run continuously, and should a new component be required, a processor for example, that it can be run in a mode that will emulate a previous generation," Hart explains.

Open architectures are critical because long service military equipment may need to be deployed in a manner that's completely at odds with its original specification.

"The nature of warfare and the threats countries face continue to evolve, so the ability to upgrade equipment and adapt it to address new threats is critical.

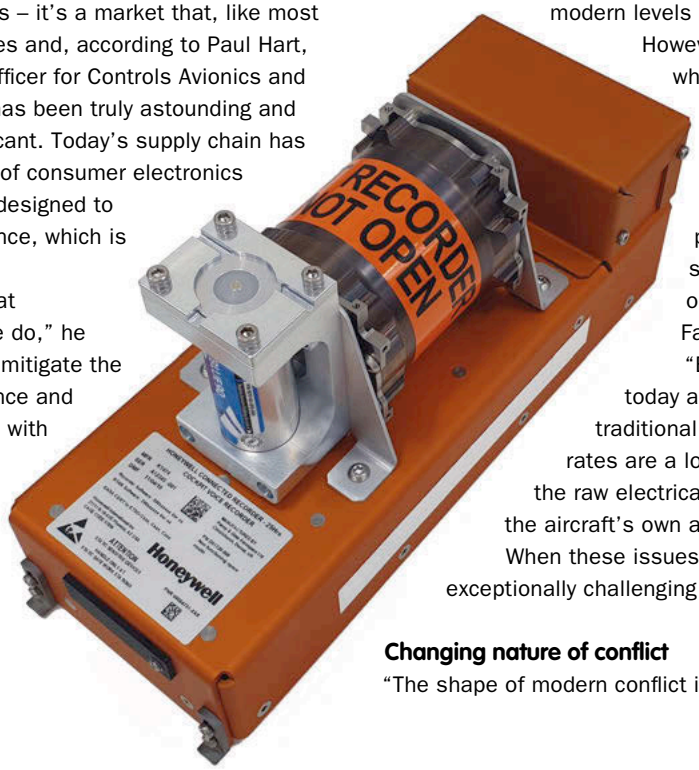
"We need to be able to install new avionics hardware and software, so we need to avoid proprietary systems.

"When you're looking to upgrade the capabilities of an aircraft that may have been designed and manufactured in the 1980s or 1990s, it's a challenge – but not an insurmountable one.

"These aircraft will not be able to meet today's military requirements and need to be upgraded. They have to be able to support electronic support measures, synthetic vision capabilities, have the ability to operate night and day and to operate safely in commercial airspace," explains Hart.

"If you want to upgrade the avionics – and the existing system is likely to have been as finally tuned as a Swiss watch – one solution is to overlay the legacy system with a new network that not only boosts capabilities but is able to pull data from the legacy system itself," according to Hart.

"Your aim is to enable that network to support and provide modern levels of performance."



However, there are just as many challenges when you are designing a modern aircraft.

"Today's designs use composite materials so that the avionics now have to be able to deal with EMC protection and possible lightning strikes, which were less of an issue in older designs – which were essentially Faraday cages.

"EMC/EMI protection is more stringent today and fibre optics have replaced traditional forms of wiring. Data and processing rates are a lot faster too, and in today's aircraft the raw electrical power supply has to be managed by the aircraft's own avionics," says Hart.

When these issues are combined it makes for an exceptionally challenging design environment.

Changing nature of conflict

"The shape of modern conflict is changing too, so the military needs

to be able to easily adapt its weapons and systems," says Hart.

In today's battlefield connectivity and interoperability are necessary requirements.

"Data collection and dissemination are critical and there's a requirement to relay information in real-time to other assets, both in the air and on the ground," and Hart makes the point that, "we are in a world that is now largely about asymmetric warfare, so systems designed 10-15 years ago need to be upgraded to meet new requirements."

Hart also makes the point that today's conflicts tend to involve multiple nations.

Paul Hart

With a long history in avionics - and spells at Thales, Smiths and Cobham, Hart joined Curtiss-Wright in 2011 as Director of Avionics Engineering. He was promoted in 2013 to Chief Technology Officer for the Avionics & Electronics Group, and then appointed as a Curtiss-Wright Technical Fellow in 2015.

"In those situations, communications systems must be able to interact with one another so that they can relay tactical data and communications."

According to Hart, "The growing use and deployment of autonomous vehicles means that communications will be critical and networks will need to be capable of processing vast amounts of data."

Military planners are always looking to improve and enhance force capabilities, giving their military the tactical edge over adversaries, and the pressure is on design engineers to square specifications with a workable and capable solution.

When it comes to drones, for example, while they are nothing new when it comes to their use by the military, they are evolving at pace and according to Hart, will see the growing use of artificial intelligence and robotic platforms.

"One of their main uses will be in surveillance and they can be deployed for reconnaissance, gathering intelligence from the battlefield before soldiers are deployed. Likewise, the use of autonomous vehicles in the field – in terms of delivering supplies – will be extended, but that will depend on developments in battery technology."

Curtiss Wright has a close working relationship with defence and research organisations, like DSTL and Innovate in the UK, and is involved in looking at how technology is likely to evolve and how it might be deployed.

"The use of augmented reality and how data and intelligence is made available to the end user is going to be critical," according to Hart. "Much of this is actually being driven by innovation in the gaming industry. Interestingly, the growing use of technology is raising issues around weight as more technology is deployed."

The use of open systems and COTS also raises concerns for military planners in terms of security, according to Hart.

"While avionics architectures have tended to be locked down, the evolution of more connected aircraft will introduce risks if the security levels of wireless networks are able to be breached – most manufacturers, operators are fully aware of this.

"Beyond avionics though, there are certainly high risks, especially as the military looks at edge processing and at addressing growing bandwidth issues.

"If a device is brought down or lost – a UAV, for example - it's quite possible that detailed tactical and security data could be lost. How do we control that – it's a huge risk going forward."

According to Hart, when it comes to obsolescence, it's critical that industry looks at upgrading legacy equipment with the necessary cybersecurity features that are capable of meeting evolving protocols and standards.

"It's not just weapons that are vulnerable but position, navigation and timings systems and, if your security is compromised, there's a real risk that all platform linked systems will be made vulnerable."