Interoperability: Today’s key word in C4ISR network trends

Command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) networks are a real game changer for defence forces, both in times of peace and war. Covering everything from battlefield sensors to night vision goggles, C4ISR systems are used extensively by just about every military group around the world. With these systems, commanders can gain great insight into enemy movements and their surroundings, and devise actions based on real-time information. However, as this technology has been developed in fits and bursts over decades, many devices are incompatible with others, and systems for efficient analysis of all the data are few and far between, leading to a deluge of information that can be nigh on impossible to fully-analyse and action.

In previous years, battlefield commanders would eagerly grasp any piece of information coming their way in the hopes that it might include insight about their enemy or environment. However, the last couple of decades have seen serious investment in sensor and tactical equipment which today produce overwhelming volumes of data. Without a unifying system for analysing and disseminating that data, the volume of information is staggering.

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The land segment currently holds the largest share in the C4ISR market, including weapon systems, tools and force protection systems. Communication between land, naval and airborne segments is the major focus of growth today, and is expected to be the highest growing area during the forecast period. Advances in cyber security, wired and wireless technologies are creating a driving force for that growth. By region, the largest growing C4ISR market is in the Asia-Pacific, where defence spending has increased significantly in recent years. The rise in conflicts between neighbouring countries and terrorist threats have been highlighted as significant market drivers.

While C4ISR has always played a vital role in the battlefield, in the last couple of decades, with political tensions driving demand and technological advancements increasing capabilities, the market has grown significantly. Indeed, Markets and Markets’ ‘C4ISR Market by Platform (Land, Naval, Airborne), Application (Command & Control, Communications, Computers, ISR, EW), Component (Networking Technologies, Communications Networks, Display Consoles, Software, EW Hardware) and Region – Forecast to 2021’ report valued the C4ISR market at US$93.8 billion in 2016. This is projected to grow at a CAGR of 3.36 percent between 2016 and 2021 to reach US$110.78 billion.

Growth is primarily being driven by the increasing amount of data generated across the C4ISR industry, in addition to rising demand for market and competitive intelligence.
Integration in the Air Force Office of Information Dominance, commented: “Literally, we have more than a billion hours a year in the production of full-motion video just in the Air Force. If you add in the other services, it’s probably well over two or three billion. How do we mine that so it’s tactically and operationally important?”

The sheer number of information sources has become a major challenge in modern warfare. Tasking, collection, processing, exploitation and dissemination (TCPED), and optimising C4ISR assets to improve cybersecurity and maximise efficiencies is now a major priority, particularly for the US Government.

“Right now, we’re doing the bubblegum and the paperclip and trying to jam things altogether. We need some cleaner ways to bring these things together,” said Major General Jody Daniels, USA, Assistant Deputy Chief of Staff, G-2, for the US Army. “There are so many gaps. We’re all trying to modernize, trying to bring our networks together, reduce the footprint we have. Network convergence and cross domain solutions are still a big challenge for us, but we’re getting there.”

Heavy C4ISR investments from the US Army

When it comes to investments in C4ISR networks, the US Army is one of the most active defence forces in the world. Today, it has several initiatives ongoing to enhance its systems, with the goal of grasping new operational advantages in the field.

The US Army’s plan to integrate its sensors, weapons, communications equipment, display screens and computers into its tactical and combat vehicles was announced several years ago, and directly addresses the need for a more unified system. The Vehicular Integration for C4ISR/EW Interoperability (VICTORY) initiative was launched to correct the problems created by the ‘bolt-on’ approach to field equipment on US Army vehicles.

The programme intends to streamline disconnected technologies and enhance its ability to launch electronic attacks, recover lost space while reducing size and weight and saving power, and provide an open architecture platform that will accept future technologies without the need for a significant re-design. VICTORY will also make combat vehicles more resistant to electronic attacks and jamming.

“Having a common architecture will let us share PNT (positioning navigation and timing) with all the boxes on a platform, so we only need to buy one or two receivers for that platform,” said Major General David Bassett, Programme Officer for Ground Combat Vehicles.

Under VICTORY, a framework for the integration of C4ISR/EW and other electronic mission equipment on ground platforms is being developed as follows:

- An architecture which defines common terminology, systems, components and interfaces;
- A set of standard specifications that provide technical specifications for the items identified in the architecture; and
- A set of reference designs.

The VICTORY programme’s technical approach includes:

- A data bus-centric design;
- Sharable hardware components so that software additions can be made without the addition of new hardware;
- Open standard physical and logical interfaces between the system and C4ISR/EW components;
- A set of shared data bus services; and
- Shared hardware and software IA components to enable systems integrators to build security designs that protect and control access to information.

A government-industry standards body is developing the VICTORY standards, following an in-depth adopt-adapt-author methodology to move towards establishing a set of common open standards for use within vehicle and mission system communities, which are independent of hardware and software solutions. The US Army intends to implement the new VICTORY architecture in a wide range of military vehicles in 2017, including Strykers, Abrams tanks, Joint Light Tactical Vehicles, and Bradley Fighting Vehicles.

Another investment from the US Army came in December 2016, when IT solutions provider CSRA was awarded a US$744 million contract to develop the Integrated Air and Missile Defense Battle Command System (IBCS). The US Department of Defense chose IBCS as the winner of a competition to develop a ‘single, unambiguous view of the battlespace’ for air and missile defence. IBCS is expected to deliver enhanced aircraft and missile tracking, improved situational awareness, decision support, and the ability to monitor and control multiple missiles and aircraft at the same time.

The Integrated Air and Missile Defense Battle Command System (IBCS) is a revolutionary command-and-control (C2) system developed to deliver a single, unambiguous view of the battlespace. This significantly enhanced aircraft and missile tracking improves the ability of combatant commanders and air defenders to make critical decisions within seconds. Picture: Northrop Grumman
According to programme officials, the AF DCGS's closed systems supporting C4ISR systems used by US Army coalition forces around the world. The single-award task order, administered by the Federal Systems Integration and Management Center (FEDSIM) under the OASIS Pool 3 contract has a one-year base period, with four one-year options. 

Under the contract, CSRA will deliver a range of mission-essential logistics, maintenance and sustainment work for current and future C4ISR systems, equipment and ancillary operational requirements for the warfighter and US coalition forces in all Army Field Support Brigade regions spread across the globe. The contract requires work consolidation across multiple vendors, which will significantly increase CSRA's scope of work.

"CSRA is meeting the challenge of delivering worldwide C4ISR systems maintenance and logistics support by investing in the people, technology and tools required to efficiently and effectively support FSSD's sustainment mission," said Ken Deutsch, CSRA’s Executive Vice President, Defense Group. “Leveraging a decade of experience collecting and analysing C4ISR performance data, and through close collaboration with CECOM, we will deliver a highly-effective enterprise approach, incorporating the ISO 9001:2008 quality management standard to increase operational availability and readiness at a reduced cost."

US Air Force tests open architecture

The US Army isn't alone in exploring open architectures. The benefits they are set to provide have also been taken note of by other US defence forces, with the US Air Force enacting new programmes.

The US Air Force Distributed Common Ground System (AF DCGS) is the Air Force's primary system for ISR information; there are many such sites based around the world, with thousands of US Air Force personnel working around the clock. According to programme officials, the AF DCGS's closed architecture was hindering analysis and leading to personnel performing tasks not related to their primary analytical duties. In addition, the closed system resulted in lengthy deployment cycles, non-agile processes, and isolated designs. As such, a new angle was needed.

"In order to support CFACC (Combined Forces Air Combat Commander) intelligence needs, AF DCGS must be able to conduct time-dominant and decision-quality analysis to optimise ISR operations, produce timely assessments and enhance battlespace awareness and threat warnings," said Lieutenant Colonel Joshua P. Williams, AF DCGS Branch Materiel Leader. 

"To ensure rapid response to changing threats and intelligence, our team worked to develop an open and agile architecture, enabling a plug-and-play-type environment."

Battle Management partnered with Air Combat Command and Air Force Research Lab to improve the AF DCGS capabilities and transition to the new system. The solution, with open hardware and software processes and specifications, was created and implemented in 42 weeks. Analyst evaluation and decision time was reduced by more than 60 percent as a result. According to Williams, the new architecture does not require the system to include hardware and software for each operational capability, since it has been standardised to support quick capability integration. The new system enables single consolidation of disparate operator workflow, allowing the gathering and storing of intelligence in one location, from where it can later be quickly queried, increasing target identification time and execution.

"Using live data with certified operators in two geographically separated locations, we were able to demonstrate the improved abilities of the open architecture by reducing analyst processing, evaluation and decision time," said Williams.

The project was the initial phase of a three-phase plan. Currently, the programme is deploying pilots that incorporate the new structure in three locations with three varying mission threads. This pilot phase will be complete in the summer of 2017 with a development and operational test.

“This effort changes every aspect of the AF DCGS programme. We have streamlined processes to support agile development and capability development, allowing for incorporation of new applications in weeks, instead of months or even years. The open architecture is truly a force multiplier for AF DCGS,” said Williams.

Restoring C4ISR networks

Despite the heavy investments in C4ISR networks from defence groups around the world, no system is 100 percent reliable. Tactical networks can be disrupted in any number of ways, including through enemy attack, equipment failure, or natural disaster. Whatever the cause, when a disruption occurs, the effect on military forces in the area is severe, and the network must be restored, even if only temporarily, as soon as possible. While satellite can provide a temporary or back-up solution to network disruption to airborne and land-based forces, when it comes to sub-sea communications, it is not a viable option.

In December 2016, the Defense Advanced Research Projects Agency (DARPA) commenced the first phase of a project that aims to build a deployable undersea network that will serve as a means to restore disrupted data links, C4ISR and networks.

The Tactical Undersea Network Architectures (TUNA) programme will demonstrate novel optical fibre-based technology options and designs to temporarily restore tactical network connectivity in a contested environment. During the current phase, concept and technology development is being focused on three areas:

- System design: Performers are aiming to develop novel system architecture designs that integrate a military tactical data network into a rapidly deployable temporary undersea network;
With defence forces and governments the world over investing more and more to update their networks, where there is a significant amount of pressure not felt at sea level, in addition to hazards from marine life and other vessels.

According to local media, several companies and vendors have provided highly promising ideas for the project, and solicitations were expected to be completed in January 2017. Participants included Raytheon BBN Technologies, Northrop Grumman Systems Corporation Information Sector, LGS Innovations, Harris Corporation, and Lawrence Livermore National Laboratory.

DARPA envisions a second phase to implement an integrated end-to-end system, and to test and evaluate this system in a laboratory setting, simulations and at-sea demonstrations.

**Entering the C4ISR market**

With defence forces and governments the world over investing more and more to update their networks with a heavy focus on interoperability, commercial companies are increasing their market presence in the C4ISR sector and related fields. Companies that can provide system-agnostic devices, or bundled solutions, will gain an edge as defence groups move towards open architecture designs.

Cubic Global Defense is one such company that is looking to build its global C4ISR presence in the wake of the growing market. Already well known in the Middle East for its training solutions, in May 2016, Cubic announced plans to expand its C4ISR activities after acquiring three key businesses which would help it reach this goal.

DTECH, GATR Technologies and TeraLogic are all niche C4ISR providers that provide products key to US military programmes, with a heavy involvement with special operations forces. DTECH brings its modular and miniaturised Internet-on-the-move capability, GATR brings a highly portable, inflatable satellite antenna in various sizes, and TeraLogic is the industry standard in the US intelligence community and at the combatant commands with regard to cloud-based full-motion video or just video management solutions. Cubic plans to sell all three capabilities in a single package deal, although each of the technologies is fully operational with other systems.

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**Kelvin Hughes to supply radar systems for the Royal Navy’s latest River-class OPVs**

Kelvin Hughes announced in April 2015 that it had been selected to supply its SharpEye™ systems for the new Batch 2 River-class offshore patrol vessels (OPVs) - HMS Forth, HMS Medway and HMS Trent. The company is delighted to announce that it will also be supplying the same industry-leading radar equipment for the two latest Batch 2 ships – HMS Tamar and HMS Spey.

Each ship will be equipped with a SharpEye™ I-Band radar for helicopter control and navigation as well as an E/F-Band SharpEye™ radar for navigation and collision avoidance. In addition, Kelvin Hughes will be supplying its ARPA widescreen radar display for all of the Batch 2 OPVs. The radar sets will be interfaced with each ship’s Combat Management System and other third-party systems such as WECDIS and WAIS.

Fundamentally different in appearance and capabilities from the Batch 1 OPVs, the Batch 2 ships have been designed with a Merlin-capable flight deck and a greatly expanded capacity for accommodating troops. They will be available for deployment anywhere in the world to undertake a range of anti-piracy, counter-terrorism and anti-smuggling roles currently conducted by Royal Navy frigates and destroyers.

With its solid-state technology, SharpEye™ radar systems deliver an advanced pulse-compressed Doppler navigation and situational awareness capability that can provide early warning not only of the presence of larger vessels but also small targets and asymmetric threats with a low Radar Cross Section such as RHIBs, small wooden boats, USVs and jet skis. Operating in the I-band, the new radar will enable the ships to distinguish between genuine targets and environmental clutter even in the most adverse weather conditions.

More than 25 of the world’s navies now use SharpEye™ radar and displays. Most recently, Kelvin Hughes was contracted to supply the Irish Naval Service with SharpEye™ systems for its new fleet of OPVs which are currently under construction.

Barry Jones, Kelvin Hughes Regional Sales Manager, said: “SharpEye™ is an ideal choice for these OPV projects. The system provides a 3-in-1 approach with a type approved navigation radar using advanced small target detection, a 2D surface surveillance capability and a helo detection mode to aid rotary aircraft recovery in bad weather; all in one compact radar package. Its scalable architecture allows it to satisfy the requirements of the smaller patrol boat as a primary radar or as a navigation radar and secondary surveillance radar on a larger warship”.

Rohan Dearlove, Kelvin Hughes’ Maritime Sales Director UK & France, commented: “The selection of two more ships sets of SharpEye™ radar under this latest contract is further evidence of the MOD’s commitment to a technological convergence strategy. Similar SharpEye™ radars are already in service with the fleet and significantly more have been ordered for other RN and RFA programmes, such as the fleet wide Navigation Radar Programme and the Tide class tankers. A convergence strategy based on the SharpEye™ navigation radar will deliver significant operational and support related benefits for the MOD.”

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