



Photo courtesy of Lockheed Martin.

The need for interoperability

The clarity of communication between a commander and his troops is of the utmost importance. Without clear instruction and clear information flowing between both, wrong decisions may be made and commands misunderstood. Helen Jameson assesses the developments that have been made in command and control systems and what the future brings.

“The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of a mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, co-ordinating and controlling forces and operations in the accomplishment of the mission. Also called C2.” states the Field

Manual 3-0 Operations, 2001, United States Army

The statement defines Command and Control. Going back into history, messages sent from the top to the bottom echelon could take days, even weeks to arrive on horseback or on foot, yet these commands were vital and could mean victory or defeat. Obviously, nowadays, we have systems that do this job for us and, in many cases, provide instant results and combine other disciplines in order



to make difficult decisions such as surveillance, reconnaissance and target acquisition. Obviously, the more information available to a commanding officer, the more complete picture he has, and the more informed his decision. Knowledge is power – especially in the battlespace.

The network centric dream

Network centricity is the hot issue in military communications circles at present. The quest to connect every soldier, every commander and everyone else in between is what militaries all over the world are aiming for.

The doctrine of Network Centric Warfare (NCW) or Network Centric Operations (NCO) is changing the way that wars are fought today. This new kind of strategic thinking involves the linking of 'platforms' through high speed networks to ensure the rapid passing of information amongst different military entities thus enabling rapid response to threats.

The theory behind this concept is based on information sharing. This sharing of information increases situational awareness through a common operating picture. When the 'big picture' can be viewed by everyone from commanding officers right down to the soldiers on the front line, the ability to speed up strategic planning and make more informed and accurate decisions is much more easily facilitated.

A commander is able to assess a situation in the battlefield with extreme accuracy. He can see where his troops are, what resources are available to them, he even knows the type of terrain they are party to. But he also knows where the enemy is, what he is doing and he can then make a very informed and considered decision on what should happen next. It's quite an ability to have. Now we have discovered this ability it is vitally important that we move forward and develop.

Interoperability

An interoperable exchange of information is an absolute must. With-

out it, information cannot be shared effectively and, as a result, the decision-making process is hindered and a full picture of a situation is not built up. The information that is passed from unit to unit and person to person has to be accessible. There is no point in a soldier using a certain device or terminal that cannot receive the data necessary to fulfil a mission. Interoperability will ensure that no matter what the device, the information will still get through. The requirement for secure, jam-resistant communications is consistent across all armed forces. Protocols must be established to ensure that high standards of interoperability are supported and, so that the relevant information may be shared by all who sign up to a certain standard.

Lockheed Martin has created TULIP (Through Life Interoperability Planning). This is the only process that supports Tactical Data Link interoperability throughout a platform's lifecycle. TULIP presents standards and tools along with processes and procedures to ensure that interoperability is implemented from the very start. In the wake of TULIP, a further programme has been introduced by Lockheed Martin called iSMART that embraces all communications media. It is through standards such as these that interoperability will work. TULIP is already recognised and is implemented by the UK Ministry of Defence and the US Air Force. Australia, Germany, Switzerland, Spain and NATO all recognise the benefits of the system. It is inexpensive to implement and maintain and its raising of the initial level of interoperability helps focus on the areas that require further investigation.

The MIP

The Multinational Interoperability Programme or MIP was initiated in 2001 with the purpose of achieving international interoperability of command and control systems (C2IS) at all levels. This resulted from the merging of two previous separate programmes (the Army Tactical Command and Control Information System – ATCCIS and the former MIP).

The former MIP was established in 1998 by the Project Managers of the Army Command and Control Systems of Canada, France, Germany, Italy, the United Kingdom and the United States, to replace the Battlefield Interoperability Programme (BIP) and the Quadrilateral Interoperability Programme (QIP).

The decision was made to merge the ATCCIS and MIP by the Member Nations in order to prevent divergences, to save resources and to foster C3 interoperability in a broader arena. The ATCCIS ethos was passed to the merged programme and the MIP name was retained. The MIP has taken responsibility for keeping and further developing the specifications that had been produced by ATCCIS.

The MIP specification is a managed interface between C2 information systems. When incorporated into a system it enables interoperability of the information between any other system that also incorporates the specification. Battle-space data is transferred as information. The meaning and context of information is preserved across national boundaries precisely and without any ambiguity.

The information exchange requirements that MIP inherited from ATCCIS encompasses the spectrum of joint and combined land operations. Thus MIP meets the requirements of the land component Commander of Allied Joint Combined Operations. Systems may be wholly different from each other and need not necessarily conform to any hardware or software standard. Typically, systems will be acquired through national or NATO policy prevailing at the time.

In a community of MIP enabled C2 systems, Nations, command levels and organisations can share:

- Situational awareness;
- Orders, plans and intentions; and
- Capabilities and status of friendly and enemy forces.

GCCS

The United States Military, and other administrations across the world

Lockheed Martin and Sanmina-SCI to compete for US Army programme

Lockheed Martin and Sanmina-SCI have signed a teaming agreement to compete for the US Army programme to upgrade thousands of existing tanks, trucks and tactical wheeled vehicles with a next-generation digital intercommunications system.

Lockheed Martin Systems Integration in Owego, NY, will be prime contractor and systems integrator with principal subcontractor Sanmina-SCI's Defense and Aerospace Systems Division, Huntsville, AL. Together, the two companies will offer an enhanced tactical vehicle version of Sanmina-SCI's proven TOCNET™ intercommunication system for the Army's Vehicular Intercommunication System – Extended (VIS-X) competition.

Winner of the \$3.5 billion VIS-X contract will integrate and support intercom systems in 54,000 vehicles worldwide, among them Abrams tanks, Bradley Fighting Vehicles, up-armored HMMWVs and Army-operated commercial trucks. The VIS-X solution will provide vehicle crews with significant improvements in speech intelligibility and hearing protection, and will enable true on-the-move, command-and-control, over-the-horizon data and voice communications. The US Army's Communications-Electronics Command (CECOM), Ft. Monmouth, NJ, is expected to award a five-year indefinite-delivery/indefinite-quantity contract by mid 2008.

"The Lockheed Martin/Sanmina-SCI team will offer the US Army a low risk, off-the-shelf digital system designed for the battlefield environment, along with the testing, fielding, training and maintenance, and logistics to ensure global supportability," said Michele Evans, Vice President of Aircraft Systems at Lockheed Martin Systems Integration – Owego.

"We are extremely excited to team with Lockheed Martin and to have the opportunity to continue to provide the US Army with the proven and extremely capable TOCNET™ intercommunications system," remarked Jim Cocke, Senior Vice President, Sanmina-SCI's Defense and Aerospace Systems Division.

Sanmina-SCI's digital TOCNET™ system is already successfully integrated on multiple US Army vehicular and Tactical Operations Centres (TOCs) platforms, including Command Post Platform, Division, Brigade and Battalion TOCs. TOCNET™ is deployed on US Marine Corps light armed command and control vehicles integrated by Lockheed Martin, and on Marine Corps Mine Resistant Ambush Protected (MRAP) vehicles in Iraq, and has been selected as the Joint Intercommunications System for the MRAP vehicle. The system also is operating on a host of command and control air platforms, including VIP Blackhawk helicopters in Iraq.

have been working towards the goal of the ultimate command and control system

The Global Command and Control System or GCCS is an automated information system that will support deliberate and crisis planning with use of an integrated set of analytic tools and flexible data transfer capabilities. This system will be the C4I (Command, Control, Communications, Computers and Intelligence) system of the future.

The GCCS is the principal foundation for dominant battlespace awareness providing an integrated, near real time picture of the battlespace necessary to conduct joint and multinational operations. It fuses select C2 capabilities into a comprehensive, interoperable system by exchanging imagery, intelligence, status of forces and planning information. GCCS offers vital connectivity to the systems the joint warfighter users to plan, execute and manage military operations.

The system is a command, control, communications, computer and intelligence (C4I) system consisting of hardware, software, procedures, standards and interfaces that provide a robust, seamless C2 capacity. The system uses the tactical Defense Information Systems Network (DISN) and must work over tactical communications systems to ensure connectivity with deployed forces in the tactical environments.

Companies in command

Raytheon demonstrated its leading edge Joint Battlefield Integration capability in 2007 with a real-time hardware in-the-loop demonstration of Joint Command, Control, Communications and Intelligence (Joint C3I). The Joint C3I demonstration pushed required battlefield situational awareness to a new level by using existing and future communications infrastructures to enable real-time warfighter response at both strategic and tactical command levels. Using Raytheon's Joint Fires (JFires) tool, which brings its own unique warfighting capability, commanders will now be able to view a single integrated picture by integrating tactical command and control with intelligence systems using satellite communications links. Open architecture and net-enabled products were key contributors bringing this capability forward.

"The challenge is to provide accurate, fused, real-time information from multiple sources that enable both theatre and field commanders to respond in a timely and effective manner," said Dan Smith, President, Raytheon Integrated Defense Systems (IDS). "With threats around the globe — from terror to tactical — that require widely distributed response assets, Raytheon's Joint C3I capability provides a rapid and affordable capability that integrates and connects the 'now' global intelligence community with the warfighter."

The backbone technology that enables this capability is Raytheon's TCN(R) (Tactical Component Network) software. Systems integrated for the demonstration included the US Navy's Zumwalt Total Ship Computing Environment, Raytheon's JFires sensor networking environment, a satellite communications link, the US Air Force's Distributed Common Ground System, and Deep Siren, a submarine tactical paging system. Raytheon officials conducting the demonstration said that other sensor systems will also be integrated into Joint C3I.

Global connectivity is achieved using advanced extremely high frequency satellite communications with bandwidth to support video streaming, still images and intelligence, surveillance and reconnaissance data among geographically dispersed terminals.

"The critical enablers for this successful demonstration were an understanding of the warfighter's needs and a commitment to field open architecture and netted products that can be quickly and efficiently integrated," said Bill Kiczuk, Technical Director for Raytheon Integrated Defense Systems. "Joint C3I has shown that the tools to affect the integration are designed into our systems today and are ready to exploit more advanced capabilities as they are fielded."

Raytheon IDS, collaborating with Raytheon Network Centric Systems and Intelligence and Information Systems, led the integration of government and industry Joint C3I systems.

In addition, Raytheon has demonstrated the latest enhancement to its revolutionary AESA radar. By teaming with L-3 Communications, experts in advanced data transfer technology, Raytheon's AESA radars will be able to transmit large volumes of data and imagery — such as detailed synthetic aperture radar maps of potential targets — back to other airborne platforms or command and control centres faster than the speed of sending an e-mail. This emerging capability

will provide battle commanders with more rapid and real-time information, allowing them to make time-critical decisions that continue to be a challenge in theatre today.

“The ability of our AESA radar to act as a high-speed communications node, while continuing to perform its primary mission, provides optimal mission flexibility for both tactical and surveillance aircraft,” said Mike Henchey, Director of Strategy and Business Development for the Tactical Airborne Systems mission area of Raytheon’s Space and Airborne Systems business. “The ability of warfighters to rapidly share information across multiple platforms and assets — UAVs, satellites, command stations, and other air, ground and sea assets — is a game-changing technology we believe will have a dramatic impact on tactical operations in the future.”

The AESA radar’s ability to act as a high-speed communications node moving voluminous data at extremely high rates to meet time-critical needs was also proven during a series of flight tests performed by Raytheon. The test team demonstrated the radar’s ability to create a map, pass it to a ground station where annotations were made, and resend it back to the airborne test bed. The entire process was done very rapidly and was designed to prove the validity and effectiveness of the technology.

The emerging capability of Raytheon’s AESA technology is also poised to become a key element in the Global Information Grid (GIG), adding potential secure communications links that will increase the

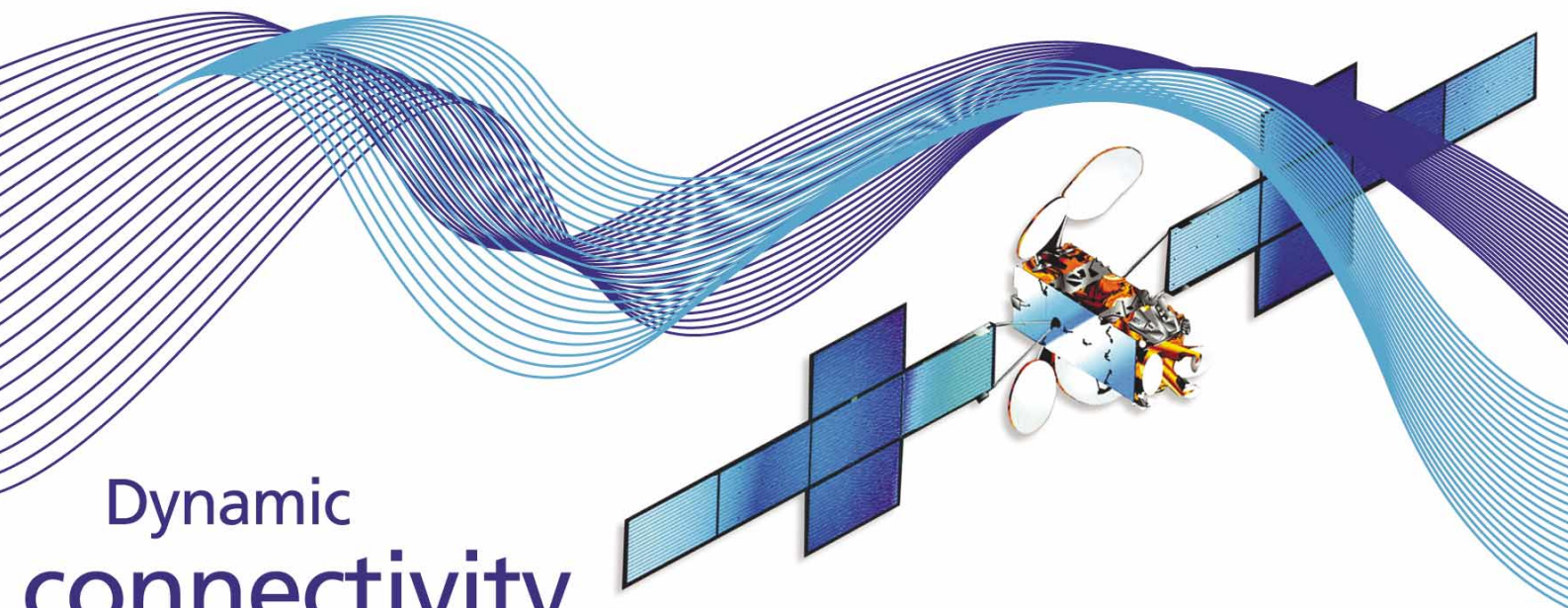
GIG’s information gathering and decision-making utility for military and business users.

Thales – Command and Control for NATO

NATO, through its Consultation, Command and Control Agency (NC3A) has chosen to outsource intra-theatre communication capabilities to Thales. Under the contract, Thales will provide and operate secure voice and data communication services for the International Security Assistance Force (ISAF) as it expands operations in Afghanistan.

Key challenges - From the Thales hub in Kabul, NATO will relay the intra-theatre capability to its infrastructure network and command centres in Europe. The local area networks (LANs) deployed under the Thales service contract will be authorised to handle voice and data at both classified and unclassified levels to provincial reconstruction teams (PRTs) in the field. Thanks to the Thales solution, ISAF units will have access to the full range of NATO secure and non-secure voice and fax communication services as well as information systems (e-mail, Internet, etc.) at various levels of classification. The contract also calls for integration of the functional applications used by forces in the theatre.

Solution - Thales is responsible for the provision, operation and maintenance of a complete network that will be progressively deployed to ISAF points of presence (POPs) in the country (ISAF HQ,



Dynamic connectivity across the Pacific

SAT-GE provides capacity on GE-23 Satellite, at 172° East (former name AMC 23), across the Pacific basin, encompassing 6 individual beams, 5 Ku-band and 1 C-band that give almost total coverage of both land mass and ocean from Perth in Australia to Los Angeles in the USA and from Alaska to South New Zealand.

GE-23 offers Ku-band cross connectivity capability between multiple beams and in C-band, a single Trans Pacific beam allows simultaneous uplink and downlink from anywhere within the beam.

GE-23 is ideal for the following applications:

- Broadcasting and Multicasting
- Aeronautical Networks
- Maritime Networks
- Broadband Data Networks
- Intranet and Internet Connectivity
- Point-to-Point VSAT services

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regional centres, provincial reconstructions teams, etc.) in 2007. The POPs will be interconnected via terrestrial link (direct line-of-sight or fibre optic) or via X-band satellite link using the NATO Satcom Post 2000 (NSP2K) capability. They will be distributed across Afghanistan.

Thales will deploy a COTS-based technical solution that is proven, robust and makes optimum use of bandwidth. It will be operated and maintained by highly qualified Thales personnel with solid experience in military theatres of operations. Thales will remain the owner of all deployed equipment and will operate and maintain the network and security for a minimum period of three years. A 24/7 help desk in Kabul combined with on-site user support will guarantee service availability of more than 98 percent at all times. Penalties may be applied if the agreed level of availability is not met. Thales will also assume responsibility for shipping the equipment and shelters from France to the various sites in Afghanistan.

SELEX Sistemi Integrati: Command and Control at Sea

Rome-based SELEX Sistemi Integrati have recently introduced the IPN-S Combat Management System for use on ships which integrates combat system sensors, weapons, EW (eSM/ECM) systems, tactical data links and navigation systems into a main system providing the command team with the facilities to operate the combat system to fulfil the ship operational tasks and missions. Its scalar architecture means that the IPN-S is a solution for any type of vessel starting from patrol vessels to aircraft carriers. It can be customised to meet naval operational requirements.

SAAB - ODIN

Odin is a state-of-the-art C3IS system for command, decision support and communication. Its technology supports land, air and sea-based units, and it builds on the NATO standards MIP, C2IEDM APP6A and JC3IEDM. The system supports the entire command process: the collection and distribution of information, the preparation of plans and calculations, follow-up and control of ongoing operations and monitoring of the communication channels from HQ to the individual units.

Odin is based on a range of fundamental concepts which ensure that the system is usable for all the types of tasks that it will be required to solve:

- Interoperability Combined and Joint - Odin is targeted at international tasks, and the system is compatible with other command systems building on NATO standards. Odins basic datamodels provide a platform for future joint land, sea and air operations.
- Modularity - Odin consists of a number of components that may be put together as required – for instance the Data Engine and Joint Replicator, the C3 Toolkit and branch-specific extensions such as Intelligence, Artillery, Engineering etc. This means that Odin can be tailored to the unit that is to use the system.
- Scalability - Odin is scalable and will thus work as a command and decision support system for all types of units. The units can themselves define how deeply Odin is to be anchored in the organisation.
- Flexibility - Odin is designed to handle many different tasks – covering the spectrum from specific military operations to peace-enforcing and peace-keeping tasks, humanitarian crises, etc.

Odin is a component-based, C3IS solution that can be customised to the tasks and requirements of the individual units. Thus, Odin ensures that individual needs are covered without jeopardising NATO standards. The user interface is intuitive and very easy to work with, very much because of the cooperation with the Danish customer during large parts of the development process.

Today, the Danish army uses Odin under the name DACCIS; it is implemented at division and brigade levels, and soon, the associ-

ated battalions will also be connected to the system.

The Danish army and Saab Danmark A/S continue the cooperation for the ongoing development that includes an improvement of platforms and fulfilment of international requirements.

L3 - Project LISTENER

In October, L-3 Communications was awarded a contract for the Assessment Phase of Project LISTENER for the UK's Ministry of Defence (MOD).

Project LISTENER integrates sensor products in order to provide actionable intelligence against selected targets and to achieve interoperability between UK ISTAR assets and US and Coalition systems and networks. LISTENER leverages the experience of L-3's Network Centric Collaborative Targeting (NCCT) programme, which networks Command and Control and Intelligence, Surveillance and Reconnaissance (ISR) assets to dramatically improve target location accuracy, timeliness and combat identification for the war fighter.

The Assessment Phase is a \$2 million, 10-month engineering effort focused on risk reduction and solution definition. L-3 was one of two preferred bidders for this phase of the programme. Main Gate approval is expected in 2009 for follow-on demonstration and manufacturing through 2015. The LISTENER capability is expected to remain in service until approximately 2035.

"Project LISTENER is blazing the trail for UK network-enabled capability," said Bob Drewes, President of L-3's Integrated Systems Group. "It takes advantage of our success in fielding the Network Centric Collaborative Targeting capability, modified for UK collection, processing, dissemination, and security context."

L-3 will be prime contractor for the effort, providing programme management, airborne platform integration, and systems engineering for requirements development and test and evaluation. The company leads the KAIROS Consortium, a team which includes UK partner companies QinetiQ (land and sea platform integration, system architecture, technology development, training and human factors) and LogicaCMG (integrated logistics support, security and communications). L-3 has committed to perform at least 60 percent of the LISTENER effort in the UK, and has set up a LISTENER project office in Tewkesbury, near the MOD customer.

Ron Cook, Vice President of L-3's London Operations, added, "L-3 has assembled a top-flight team with QinetiQ and LogicaCMG, two of the UK's leading firms in Intelligence, Surveillance, Target Acquisition, and Reconnaissance (ISTAR). The L-3 solution combines proven performance and a sovereign solution."

The issue of interoperability is sure to continue to be a theme as command and control systems advance. An open architecture holds so many benefits and also allows the military to integrate COTS equipment easily, so reducing cost and complications. Command and control is now so much more. C4IS is now introducing many more facets to command and control that help to deliver as much information as is possible to those who need it. Obviously, these systems cannot ultimately make any decisions for a commander as there are a plethora of other considerations to be taken into account but they are an essential part of the decision-making process.

These command and control systems also will play a large part in government services and will be extremely important in disaster situations where mission critical data must be moved around as quickly and efficiently as possible. There are many roles for these types of system.

The amount of research, development and time that is being put into creating innovative, interoperable and cost effective solutions to the challenges that command and control will see advancements made very quickly. Over the past fifty years, the huge steps forward that have been made are incredible. Ask the people in the know and they are all of the same opinion – that advanced command and control systems will form the bedrock of modern warfare and that the concept of network centrality and a completely connected battlefield is becoming reality. ■