BENELEC
Innovative Radio Technology

MAKING THE RIGHT CHOICE – COMMAND AND CONTROL SYSTEMS FOR LAND AND MARINE PLATFORMS

Architecture · Battle Damage Resilience · Usability · Integrated Logistic Support · Through-life Costs

savox
You're never alone

Benelec Pty Ltd. 17 Byrnes St, Botany NSW 2019, Australia | +61-2-8397-3333 | reception@benelec.com.au | www.benelec.com.au

Ensuring optimum effectiveness on the battlefield and in peacetime

In today's military environment, reliable communications are a vital part of the Command, Control and Communications (C3) infrastructure and processes needed to maintain the operational and peacetime effectiveness of military forces on land and at sea. At an individual platform level, an effective C3 system will not only improve a military unit's efficiency, but it can be a force multiplier and help reduce combat stress in an operational environment.

WHAT KIND OF SYSTEM DO YOU NEED?

Procuring the right C3 system is, therefore, vitally important for any organization. Not only must it be highly capable of meeting specific needs, but it must also be robust and reliable, as well as easy to install, use and maintain. All of these factors will also result in a reduced training burden and cost savings. In addition, ensuring a new C3 system is scalable and can be upgraded, will help it to meet changing technological and operational scenarios, thereby extending its lifetime, accordingly.

With long in-service lifetime expectations for new equipment, coupled with low through-life costs being top priorities, this scalability is extremely important and makes a C3 system's upgrade capability vital, not only for its hardware but also, more importantly, for its software. Indeed, software upgradeability allows systems to be reconfigured to meet changes in such things as radio technology and user requirements, so that with a software-defined architecture, an organization can avoid the need for premature, complete-system replacement due simply to minor technological and threat scenario changes.

High value platforms can be rendered operationally impotent if C3 systems fail. A high degree of battle damage resilience, down to module level, is, therefore, another important aspect to be considered when purchasing new systems.

Battle damage resilience

Battle damage resilience is a system's ability to withstand technical malfunction and battle-inflicted damage. System architecture is one of the key defining factors of battle damage resilience, determining whether a platform can continue operating with minor damage to its C3 system, or becomes a non-operational casualty. Battle damage resilience has to be designed into a system and is not something that can be added as an afterthought.

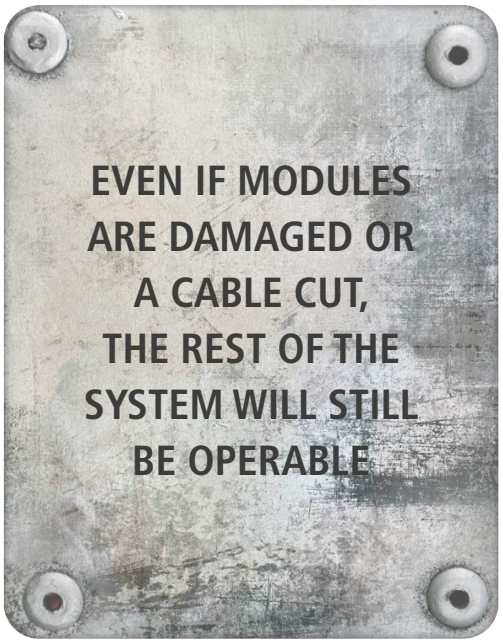
SYSTEMS WITH A MASTER CONTROL STATION

Traditional C3 systems, at individual platform level, typically have a Master Control Station of some form, where all the functionality is centralised. The system's communications data is then fed to various crew stations within the platform, each of which will have its own box with user controls to select radio access, VOX and other features. This type of configuration is a 'Star' architecture and, as the name implies, the master control is in the central unit and plays a major role in running the system. If the master control station is knocked out by a technical failure, or damage sustained in battle, the system will become inoperable and the C3 platform will fail and be rendered combat ineffective.

SYSTEMS WITHOUT A MASTER CONTROL STATION

In platform-based C3 systems without a master control station, or some form of centralised control, the crew will plug into their personal control modules that provide user-selectable functions to control access to the platform's radios and intercom.

Effectively, they become independent intercoms and radio units, although working co-operatively to form the platform's overall communications infrastructure. Even if individual modules are damaged, or a cable cut, the rest of the system will still operate ensuring a fighting platform can maintain its operational capability and will only suffer graceful degradation, rather than sudden, catastrophic failure.



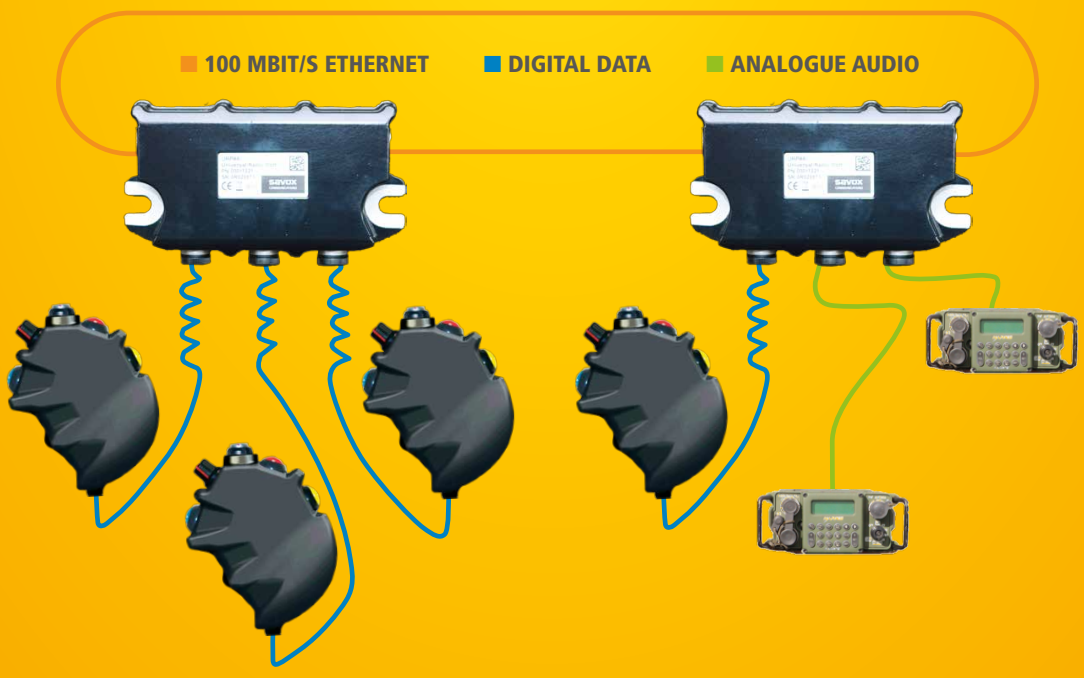
Multiple ring architecture can be utilized for example in large vessels: every deck has its own ring working together with other rings for added battle damage resilience.

Modularity

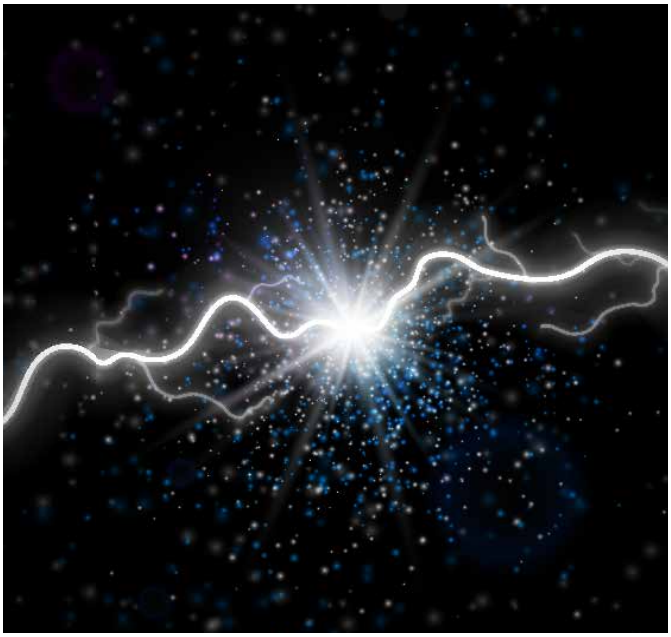
All modern command and control systems on the market are, to some extent, modular and two approaches to this modularity are clearly evident.

1. The first approach is adding modules with different features. For example a master control station module for system control and powering up the system, and a user module that provides all the functionality the crew needs and is allowed to use.
2. The second approach is building all functionality into a single module. This means that each module is a fully functioning C3 system, as long as it has power. Software-defined operation is a must and systems can be expanded easily by the simple addition of more independent modules. Normally, organisations can specify a greater number of users and radios on these systems in comparison to the older, centralised technologies.

Make sure that the system you choose supports a range of compatible accessories – such as headsets – for various use scenarios.



Software-defined systems



When a system is software defined, its functionality can be changed without changing the hardware. All that is needed is a simple software upgrade that can be done, either directly to individual modules or, in Ethernet-based systems, over the Ethernet to these modules.

As operational and technical requirements change, a software-defined architecture allows these changes to be quickly incorporated into the C3 system without the need for expensive hardware replacements.

Software-defined systems can be tailored to meet the needs of individual platform types, and can, therefore, be fitted to a wider range of equipment, from armoured vehicles to marine craft and inflatable ribs. Software-defined systems remove the threat of obsolescence from the hardware platform on which they run.

USER SOFTWARE DEFINED ITEMS

Microphone Levels

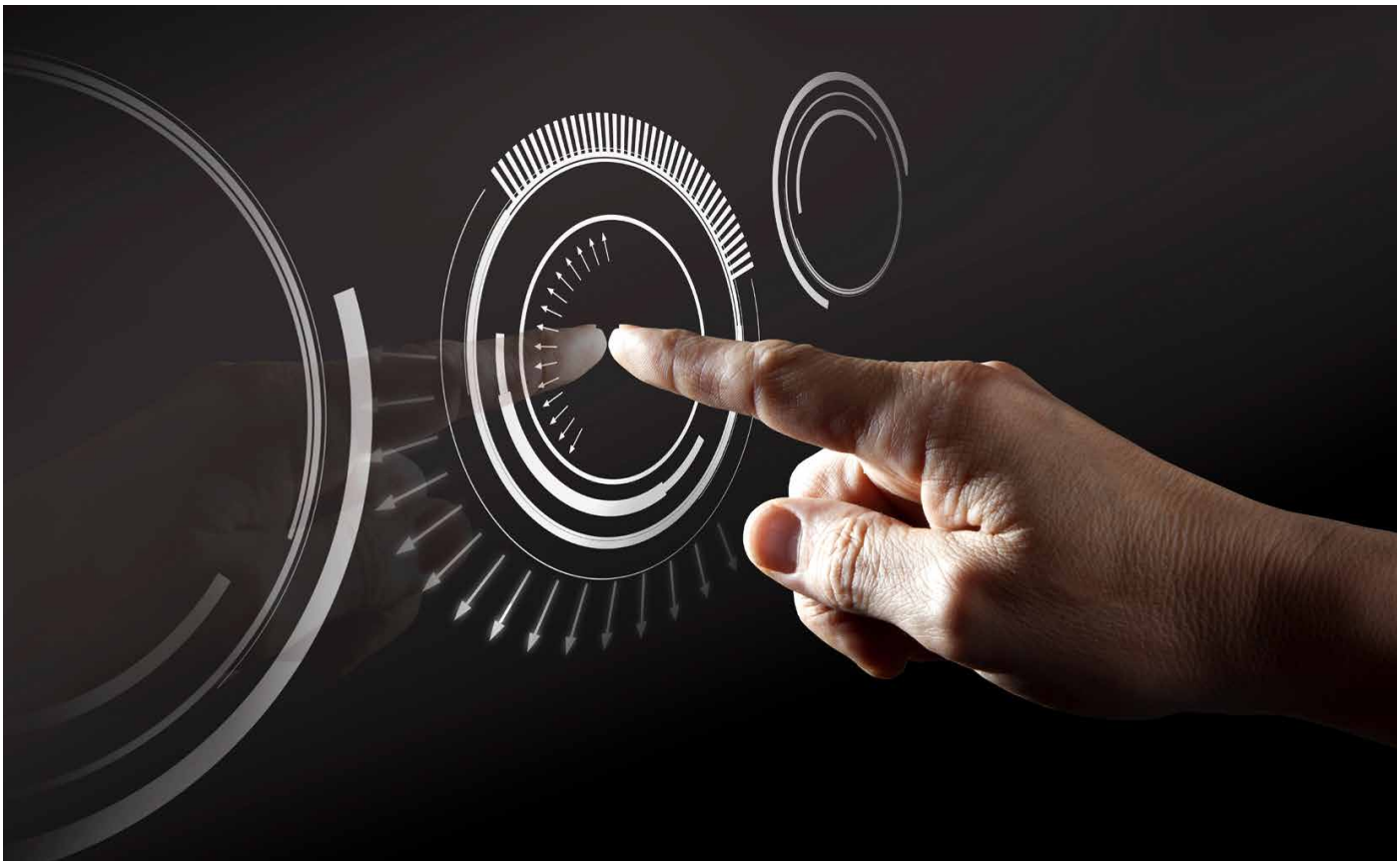
- Red PTT Radio Selection (including Off)
- Yellow PTT Radio Selection (including Off)
- Intercom Access (VOX, PTT Intercom Off)
- Monitor Radio Selection
- Side Tone Levels
- Status (provides all the user settings)
- Radio Silence On
- Break Radio Silence
- Intercom channel Selection

Radio Software Defined Items

- Audio Out Level
- Audio In Level
- Squelch Level
- Simplex or Duplex
- Dual Channel Radio (local and Higher level net)
- Radio Port OFF
- Ring Break Selection
- Local Radio Side Tone
  (for non-military radios without side tone)

User Interface Items:

- Customized and localized voice prompts.



Analogue or digital

Excluding a number of legacy C3 systems on older platforms, such as AN/VIC-1 and Soviet-designed intercoms, there are no modern analogue systems on the market.

Modern systems are, typically, of two kinds:

1. Digital, from the master control station to the user control Modules, with analogue to the user
2. Digital throughout the system, including to the user.

Power consumption

The power consumption of a C3 system can be many hundreds of watts. Modern fighting platforms have high demands placed on their power systems, especially with the need for Defensive Aid Suites (e.g. chaff systems and IR decoys). With power at a premium, low-power C3 systems offer a distinct advantage to platforms that will have other equipment added or changed over their in-service life and which will increase overall power consumption.

Size, mounting and user interface

Size, mounting and user interface are three mutually-inclusive factors when it comes to ease of use. In many cases, ease of use, or usability, is highly dependent on where a unit is mounted and what user controls are on it. In the cramped interior of a typical military vehicle/platform, mounting options are restricted and not necessarily ideal. The smaller a C3 system module is and the fewer controls it has, the better for the user. This has the additional benefit of making installation easier, especially if there are no user controls on the system at all.

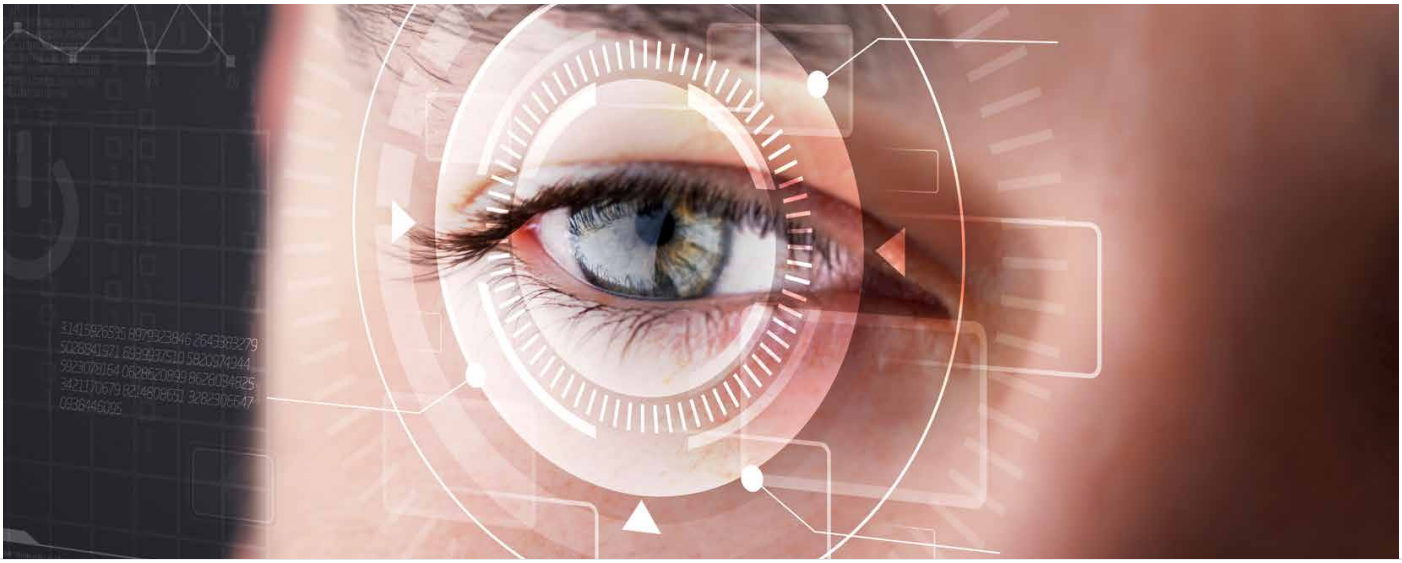
When mounting a C3 unit, there are two kind of scenario:

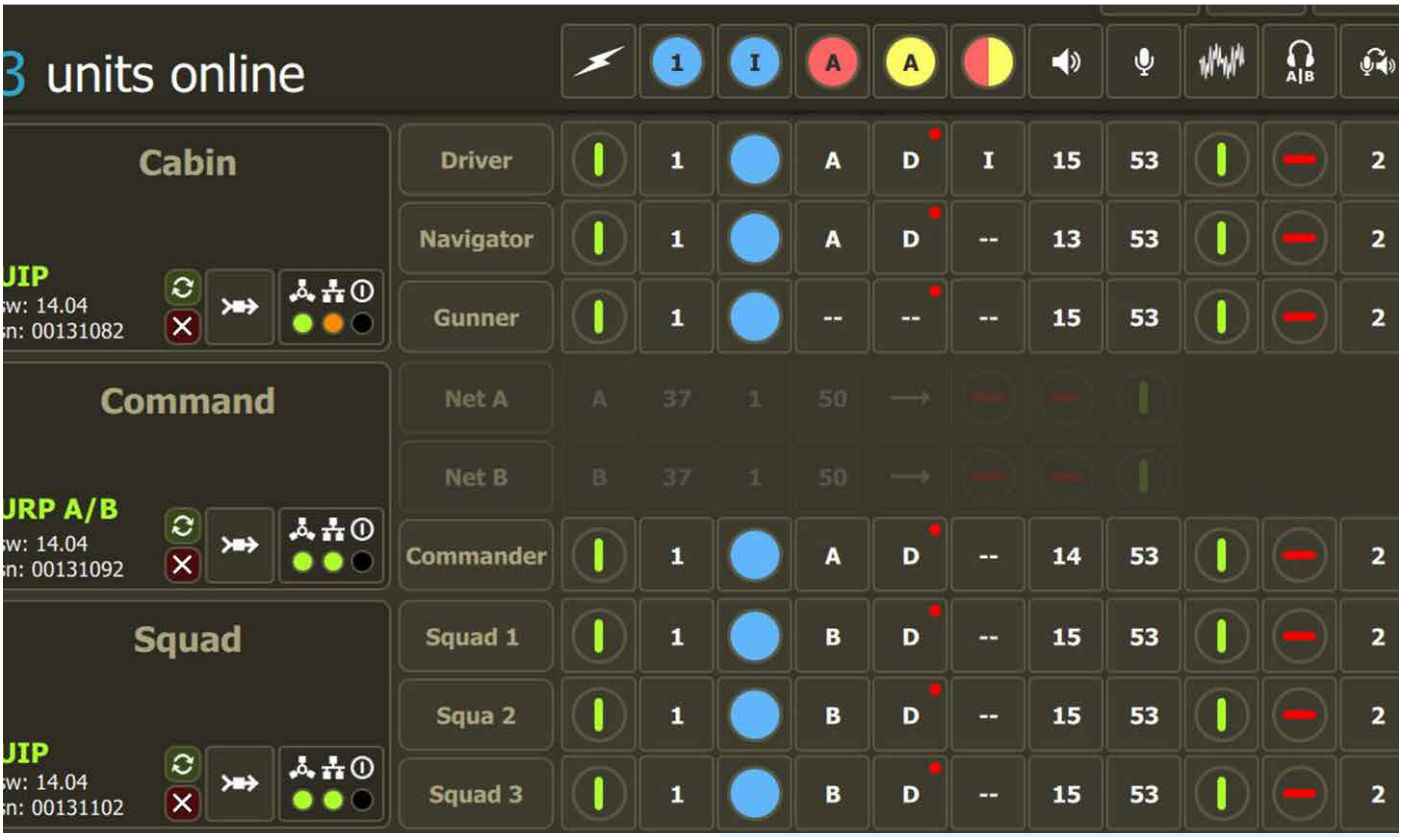
1. Systems with control switches and displays on the modules have very limited mounting options and often cannot be mounted in a suitable location for operations.
2. Systems with no displays, that don't require user access to the box and can, therefore, be mounted anywhere on the platform

When it comes to designing a system's user interface for use on military platforms and vehicles, nothing can replace practical experience -- what works on the drawing board, may not necessarily work in a reality.

Using a C3 system should be easy and intuitive. Its controls should be positioned so that they are convenient to reach and operate, especially under extreme conditions. From design and mounting perspectives, everything needs to be done to reduce stress and crew fatigue, which, in turn, will improve operational and combat efficiency.

For example, it makes little sense if a soldier has to operate switches on a C3 box that might be placed behind his/her head or under a seat, or perhaps, has a display that needs to be read but cannot be seen due to its positioning. Conversely, what a relief for the solider if they have a personal communica-





tions unit on their chest with all the controls they need readily accessible. Ergonomics really do make a huge difference when the heat is on.

Over the years, the average small military platform has grown in complexity with a two-radio complement as a minimum. Most systems allow the user direct access to one radio and if another is needed to relay a particular message, they might have to switch over using their control station. If design and ergonomics have not been thought through this may be more difficult than it sounds and dropped radios can be a consequence. Once this communication has been made they are likely, then, to need to switch back to the original radio – wherever it might be!

Newer systems should, therefore, offer two-radio access without the need for a user to switch over control units, and they should also de designed in such a way to avoid the 'dropped-radio' scenario when using a second or moving to a monitored radio.

Ensuring C3 system equipment is easy to use also reduces the continuous cost of ongoing training, as it will be quicker to train soldiers and easier for them to remember. And by keeping the user interface simple and intuitive will also reduce human errors when it matters most.

Through-life Costs of the system

Through-life costs play a major role in any defence-related system procurement and organisations need to ask the following questions to ensure that such costs are reasonable:

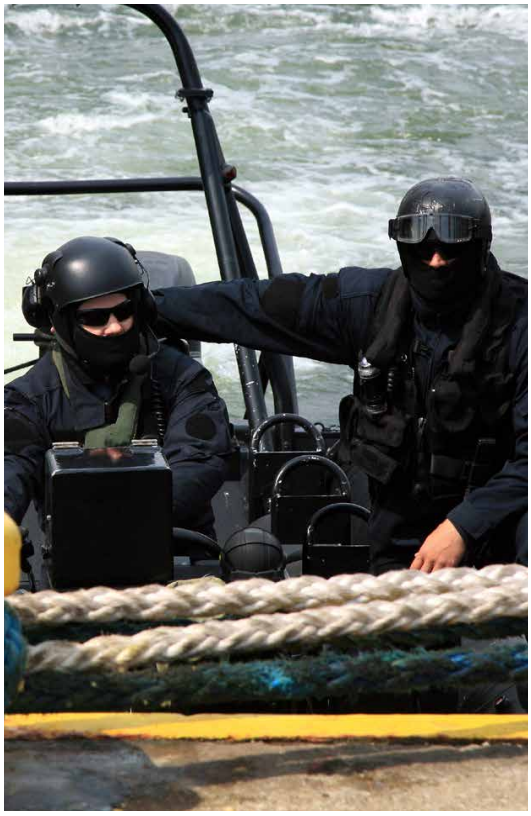
- Is the system hardware-specific, or software-defined?
- Can it be upgraded to allow technology insertions?
- Can it be adapted to changing operational scenarios?
- What is its obsolescence policy and how is it managed?

Suitability for different platforms

For economy of scale, organizations should look for a system that can be deployed across a wide range of platforms, and in the widest range of environments. If a country's armed forces can use the same technology on land and at sea, training and Integrated Logistics Support (ILS) can be streamlined to produce substantial cost savings.

The amount of users the system can support may also be a decisive factor. A system with an upper limit of 12 users will not be suitable, for example, on large platforms or within a headquarters setting.

An effective C3 system should be capable of supporting a very large number of users and radios, so that it provides flexibility well into the future and is capable of reliable operations in even the most unexpected of circumstances.



Data capability

In modern warfare, the data carrying capacity of a system often determines the outcome of a particular mission.

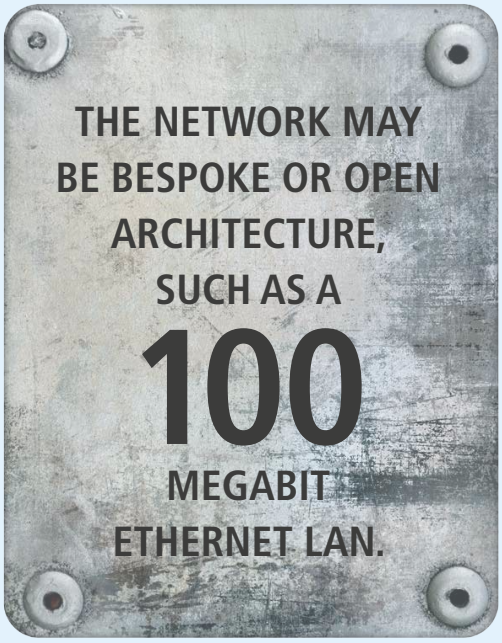
It is important, therefore, that organizations look carefully at the data carrying capability any C3 system has to offer. If the same cabling can be shared for all third-party applications such as video or other management systems, the data network within the platform can be simplified.

Such a network may be bespoke, or open architecture, such as a 100-megabit Ethernet LAN, and this will enable the deployment of third-party technology without the need for very expensive support from respective equipment manufacturers. There are a number of systems that claim data capability and even Ethernet/IP capability, however, many provide access without sufficient internal bandwidth to be functional and support future needs.

Compatibility and serviceability

When procuring a C3 system, check its full compatibility with different radios, including:

- Civilian radios
- Military radios
- Simplex radios
- Full duplex radios
- Multi-channel combat radios (Dual Net)
- IP-based radios
- Non-IP-based radios
- Legacy radios
- Unbalanced Audio
- Balanced Audio
- Radios with no local side tone



WHEN CHOOSING A COMMAND AND CONTROL SYSTEM MAKE SURE THAT:

- ✔ IT IS EASY TO USE
- ✔ IT WILL SUPPORT YOUR OPERATIONS NOW AND IN THE FUTURE
- ✔ IT IS BATTLE DAMAGE RESILIENT
- ✔ IT CAN BE USED ON A WIDE RANGE OF MILITARY VEHICLES AND PLATFORMS
- ✔ TROOPS CAN BE TRAINED EFFECTIVELY
- ✔ IT IS UNRESTRICTED IN THE NUMBER OF USERS/RADIOS IT CAN SUPPORT
- ✔ IT IS SOFTWARE DEFINED