DIFFERENT BY DESIGN™

CASE STUDY:

Mobile and expeditionary C3N operations powered by 5G

OVERVIEW

Mobile resilient communication systems

Expeditionary Command, Control, Communications, and Network Operations (C3N) refer to mobile, agile, and resilient communication systems that support military units in remote or hostile environments. Designed to facilitate mission command across dispersed locations, these operations prioritize quick deployment, adaptability, and secure communication in contested spaces. The aim is to enable forces to maintain situational awareness and execute operations despite limited infrastructure or potential electronic warfare.

In an expeditionary context, C3N operations are typically designed to be rapidly deployable, resilient to environmental challenges, and adaptable to various mission needs, from humanitarian assistance to direct combat support.

Therefore, expeditionary C3N require reliable, secure, high-capacity data, low latency and in specific cases, instantaneous connectivity. There are different methods for delivering such connectivity. For example, Satellite Communications (SATCOM) is very suitable to provide high-capacity data, especially between remote units at the front and rear echelons. Beyond Line of Sight (BLOS) high-capacity SATCOM is in general, more suited as a “data pipe” as it’s limited to users with larger and static SATCOM terminals to receive that higher data throughput. High-Capacity Line of Sight (HCLOS) radios or high-capacity Troposcatter systems have similar benefits and shortcomings as high-capacity SATCOM, whilst Mobile Ad Hoc Networking (MANET) radios systems or tactical SATCOM (TACSAT) can provide Point to Point (PTP), Point To Multipoint (PTMP) and mesh networking communications both At The Halt (ATH) and On The Move (OTM), but are limited in bandwidth and data throughput. Wi-Fi offers efficient and easy-to-set-up multi-user network access but is limited in terms of throughput, range and frequency versatility.

SITUATION

Mobile and expeditionary units face a unique set of challenges with Command, Control, Communications, and Network (C3N) operations during deployment of both OTM and ATH:

Limited infrastructure and resources: Expeditionary units typically operate in remote or contested areas where they lack established infrastructure for communications or power. This necessitates lightweight, portable, and self-sustaining systems, which are constrained in terms of range, capacity, and durability.

Complex coordination: During critical events like embarkation, disembarkation, insertion and extraction, the amount of people and assets that need to be organized and matched up in very a short period overwhelmed traditional coordination systems and methods.

Complexity of setup and maintenance: Expeditionary communication systems require technical setup and ongoing maintenance by skilled personnel. With limited communication staff, the units faced difficulties in establishing and sustaining networks under demanding conditions.

Bandwidth and data management: Bandwidth is severely limited, especially in remote locations with high terrain or electromagnetic interference. This affected the units' ability to share real-time intelligence and video feeds, or run advanced applications.

Reliability and resilience in contested environments: Adversaries attempted to disrupt or intercept communications through electronic warfare, jamming, or cyber-attacks. This puts pressure on the units to maintain redundant, resilient communications channels that can quickly adapt to interference or outages.

CONTEXT

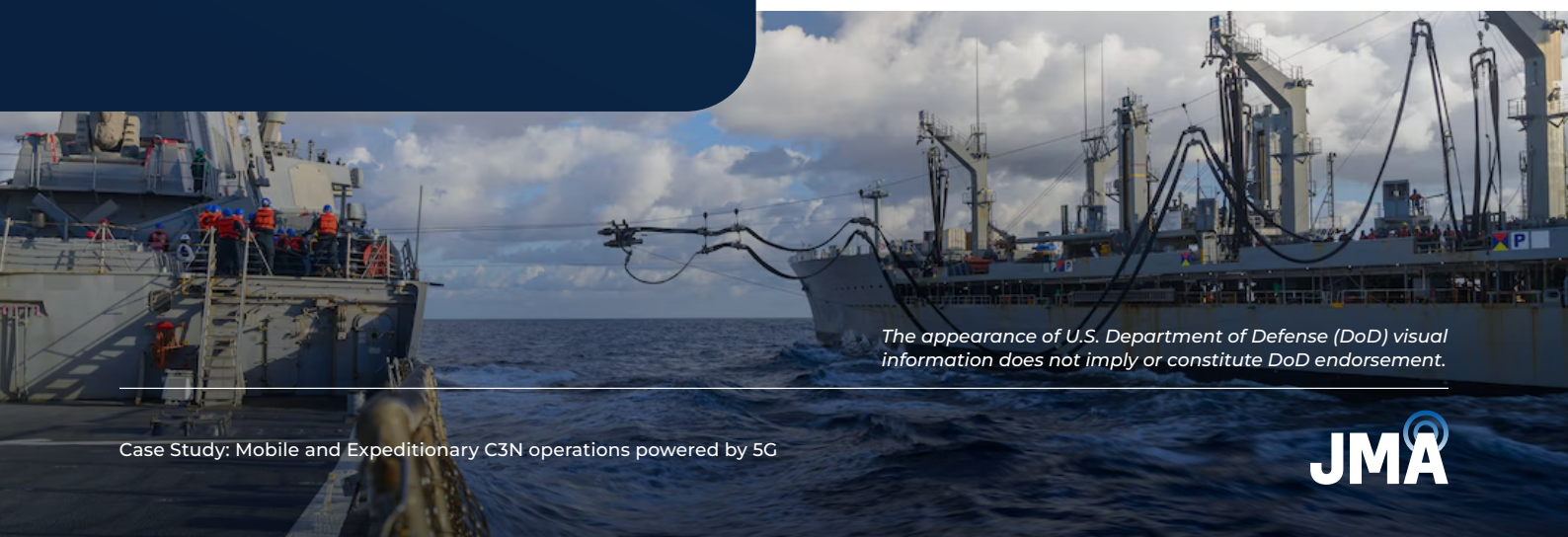
5G mobile network technology

5G is the fifth generation of mobile network technology, designed to offer faster data speeds, lower latency, and more reliable connectivity than previous generations like 4G LTE. It operates on higher frequency bands, allowing for much faster data transfer—potentially up to 100 times faster than 4G—enabling downloads, streaming, and communication in near real-time.

5G supports a higher number of connected devices, essential for IoT, UXVs, robotic systems, uncrewed systems and drones. It reduces network congestion, benefitting Command-and-Control networks, and enhances performance for VR and AR applications. With its low latency and high speed, 5G drives innovations across government and defense, from base modernization to edge mobility.

O-RAN: Open Radio Access Network refers to an open and interoperable approach to building and operating cellular networks, where network functions are decoupled from proprietary hardware and software provided by a single vendor. This enables different contractors to supply hardware and software components, promoting innovation, flexibility, and cost savings to the advantage of the government customer.

Private Wireless Network (PWN): A private 5G wireless network is a dedicated, high-speed cellular network that operates within a specific organization or location, such as a factory, campus, military installation or Mobile Command Post (MCP). Unlike public 5G networks that are provided by telecom carriers and serve the public, private 5G networks are owned or managed by the organization using them, offering more control over data, security, frequency band and network configurations. Military organizations, for example, can tailor private 5G networks to meet their specific needs, such as prioritizing certain types of traffic, controlling device access, network and cyber security and integrating the network with other internal systems. Additionally, private 5G can be scaled up or down to support a growing number of devices as needs evolve.



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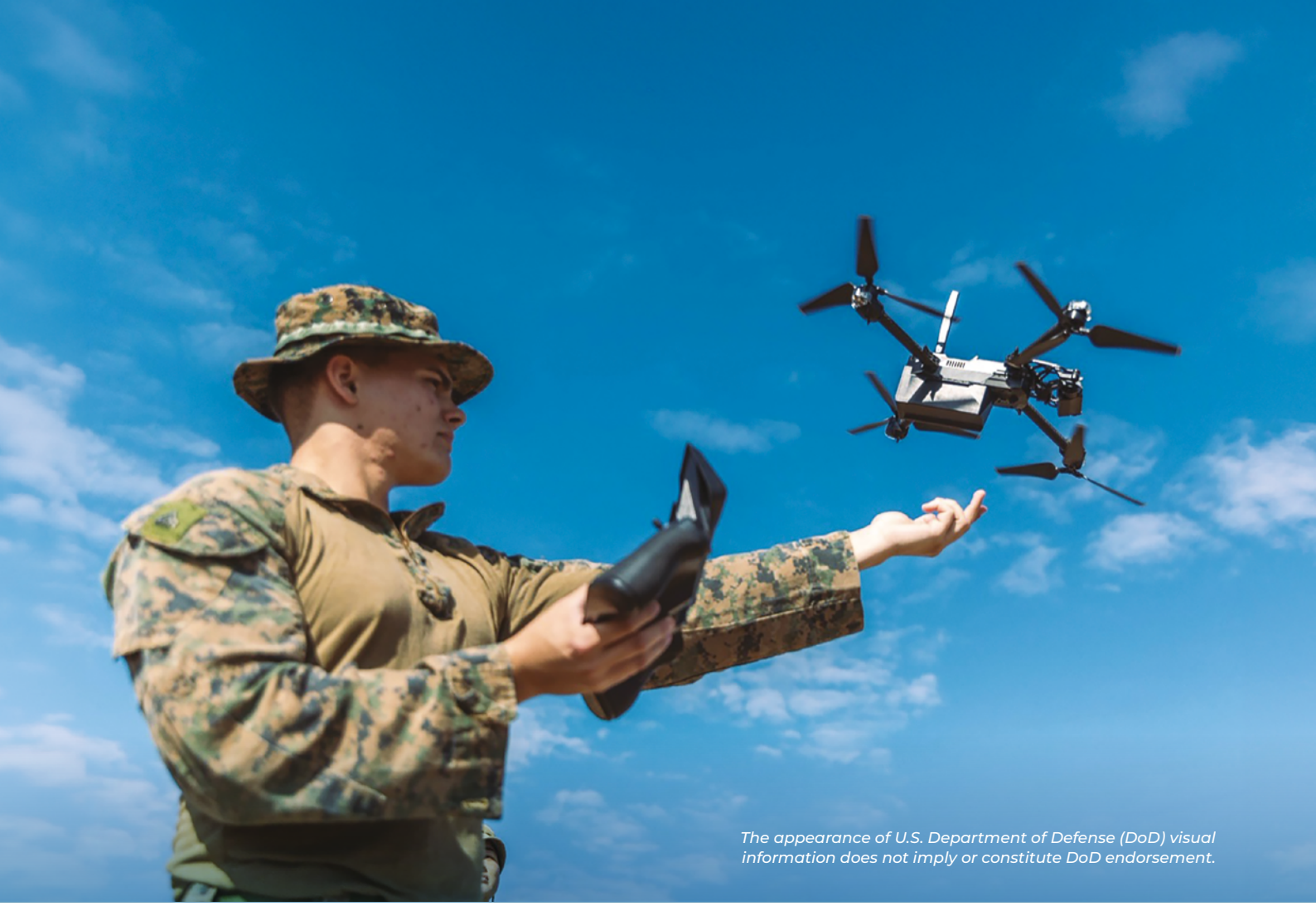

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SOLUTION

Private wireless network

JMA, in collaboration with Prime Sherpa-6, provided a ruggedized and OTM-capable expeditionary 5G system with network connectivity for various headquarters elements in austere environments. This supported an integrated tactical network enabling effective combined arms maneuver and increasing the lethality and survivability of the expeditionary warfighting unit.

The core of the 5G system is built around the JMA XRAN Private Wireless Network solution. XRAN is a fully virtualized O-RAN distributed system built on an software-based architecture over standard or ruggedized commercial-off-the-shelf (COTS) IT Equipment and networks. XRAN can work across multiple bands, supporting both 4G and 5G technologies.

The solution's critical components include a 5G core, virtual baseband, centralized unit (CU), distributed unit (DU), multiple radios heads / radio units (RU), across licensed and unlicensed bands, combined with an LPI/LPD antenna system, and rugged edge computing UE supporting key customer military applications.

The entire solution is interoperable with the existing communications infrastructure, including the ability to connect or backhaul through available SATCOM BLOS or optional LEO/MEO connectivity for OTM use.

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RESULTS

Instant high-capacity communication infrastucture

Expeditionary 5G military private wireless networks using unlicensed, licensed or shared spectrum, offer fiber-like speed, capacity and reliability, enabling low-latency applications, offer efficiencies, and deliver frequency band flexibility, often not feasible with wired or other wireless network solutions for expeditionary ATH and OTM operations. In addition, 5G PWN can efficiently distribute high-capacity SATCOM data/connectivity to forward locations, covering extensive areas with numerous users and UEs, both ATH and OTM, within line of sight. It can also be used to connect multiple 5G networks, remote units, or for backhaul purposes.

Specifically:

The expeditionary 5G network provided instant “communications infrastructure” without the need for laborious and time-consuming cabling and set up, connecting multiple user groups from the first foot on the ground.

The expeditionary 5G network enabled instant, high-capacity communications to large numbers of mobile users and equipment, enabling fast and efficient coordination between units. It also facilitated tracking of equipment and personnel during critical events like embarkation and debarkation.

The expeditionary 5G network provided instant connections for all UE with minimal setup, drastically simplifying the need for training or technical support.

The expeditionary 5G network enabled the required and existing applications while also providing the flexibility to quickly expand to new ones. With instant network connectivity and high data rates, it enabled capabilities such as video feeds from UXVs and asset tracking for situational awareness.

The expeditionary 5G network allowed a diverse set of robots, autonomous vehicles, video systems, and user devices to leverage “One Network” instead of a multitude of separate networks each with their own management and technical support.

The LPI/LPD antenna solutions combined with the flexibility of RU’s and frequency bands, provided resilient communication options within a contested environment.

About JMA Wireless

JMA Wireless is restoring U.S. leadership in wireless technology at a critical time in the transition to 5G. JMA makes the world's most advanced software-based 5G platform, which it designs and manufactures in the United States. JMA's Open RAN platform is ushering in a new era of innovation and connectivity with leading government organizations.

The JMA Federal team is enabling modernization at scale and helping the DoD make wireless history by deploying the most advanced private 5G networks at the U.S. Army, Navy, Air Force, and Marine Corps, enabling modernization at scale for frontline military operations, smart warehouse logistics, and flightlines of the future.

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