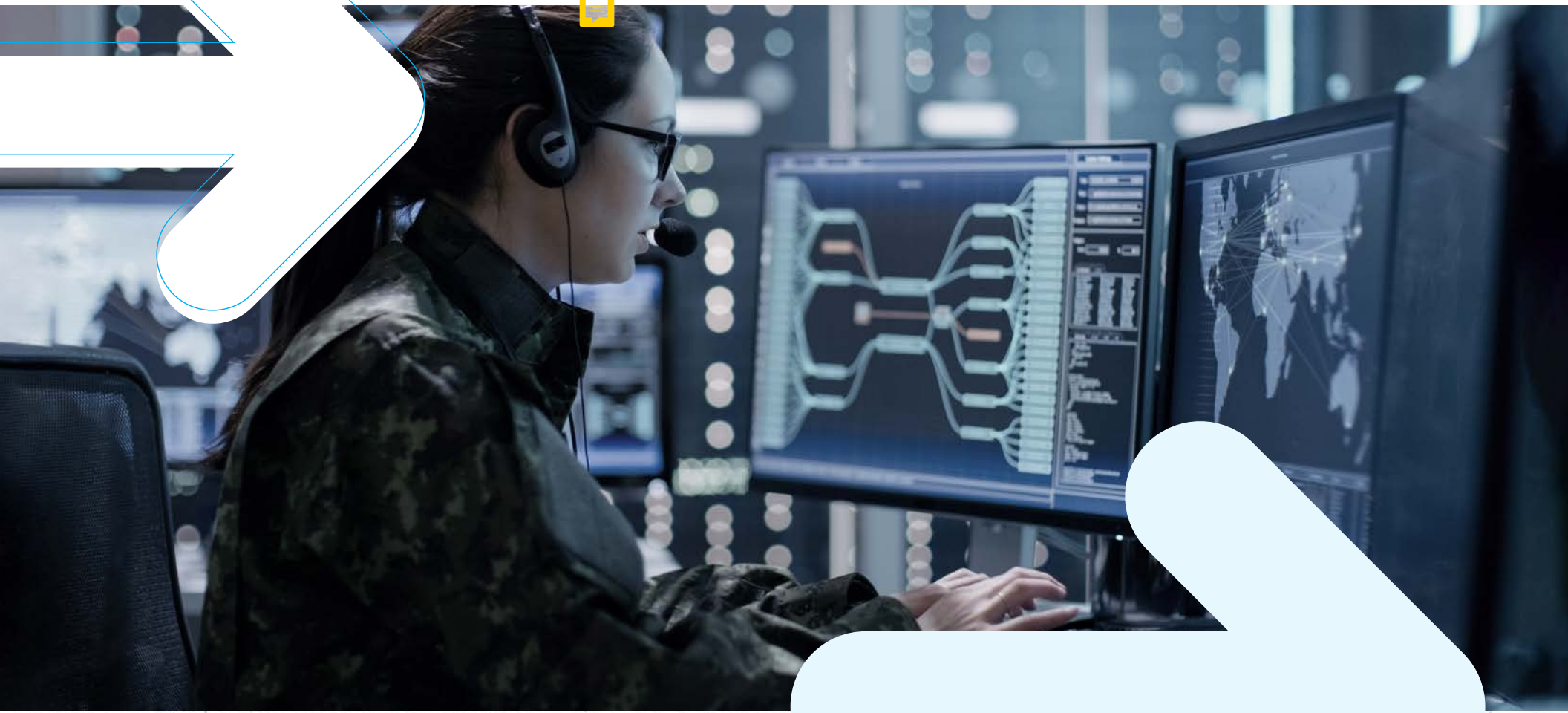
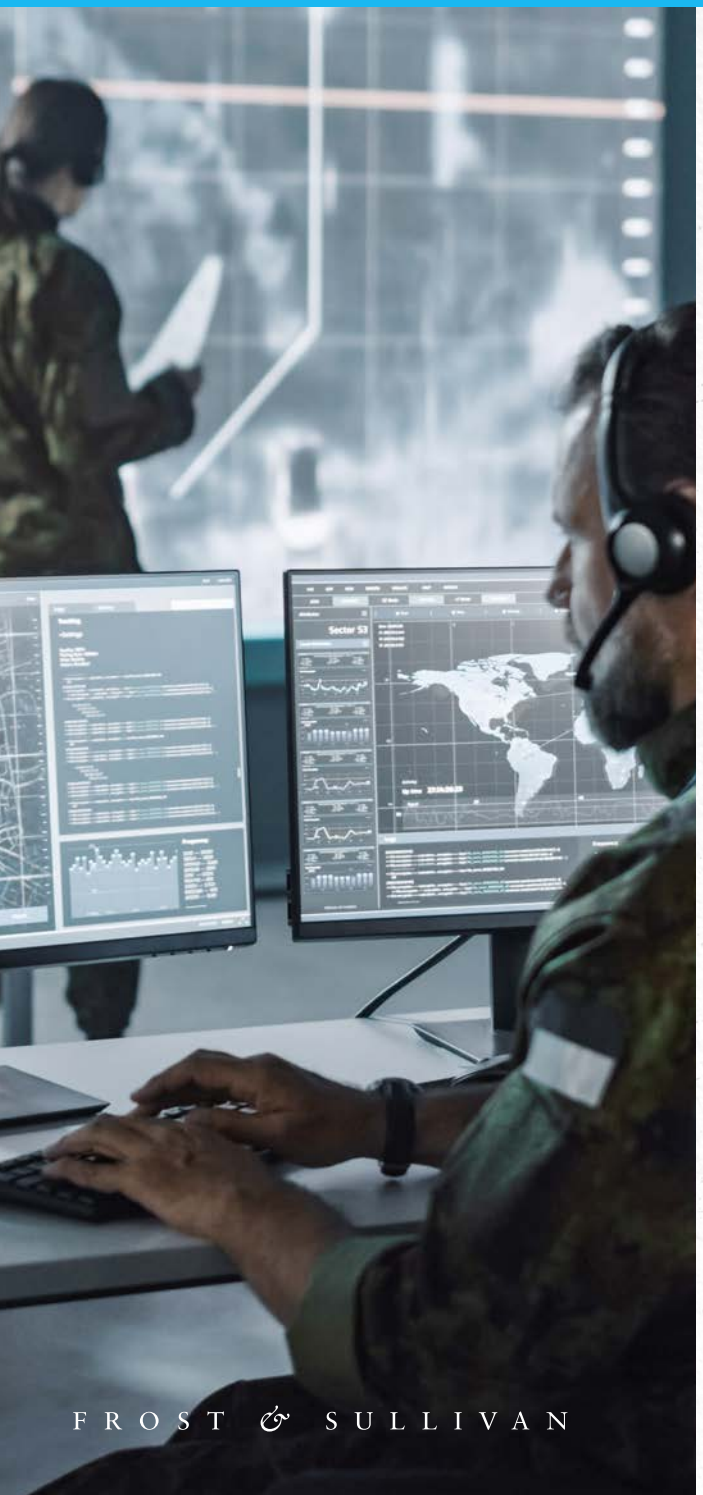


The Digitalization of Armed Forces

Harnessing the Power of Data for a Decision Advantage

FROST & SULLIVAN VISUAL WHITEPAPER

CONTENTS



INTRODUCTION

Andrew W. Marshall defines Revolution of Military Affairs (RMA) as "a major change brought about by the innovative application of new technologies which, combined with dramatic changes in military doctrine and operational and organizational concepts, fundamentally alters the character and conduct of military operations."[1]

Armies are rushing to embrace information-enhanced decision-making capabilities that offer advantages across the conflict spectrum. As Marshall argues, successful use of new technologies depends not only on technological breakthroughs but also on recognizing the most appropriate innovation and adopting the organizational structures to exploit it fully. Marshall suggests that it would be helpful to analyze not the informational, computational, and communication technologies themselves but the impact they have on industrial organizations and how they will fundamentally change society.

Militaries around the globe are racing to not only develop new technologies but to be the first to exploit the advantage these tools can render. One need not look hard to identify how those digital technologies Marshall referenced have impacted both the mode of armed conflict engagement and the nature of conflict itself. Retired US Army Colonel Steve Banach identifies four conditions necessary to gain a technological advantage in what he has named non-terrestrial warfare.[2] This paper will explore the three characteristics of non-terrestrial warfare (the changing nature of conflict, the challenge of data, and the four conditions necessary for success). It will highlight three current products that address Marshall's challenge of addressing RMA, and explain why they are fundamental to the future of warfare.

1 Andrew W. Marshall, 1993 (https://stacks.stanford.edu/file/druid:yx275qm3713/yx275qm3713.pdf)
2 Steve Banach, 2022 (https://community.apan.org/wg/tradoc-g2/mad-scientist/m/articles-of-interest/415777)

Changing Character of Conflict

The nature of conflict itself has changed.

People now live in an environment of global entanglement[3] where everyone is connected to everything and everyone else. The term global entanglement is borrowed from the study of quantum physics and refers to the interaction of particles. It is simply an analogy to describe how people and their devices interact. Yet the widespread utilization of interconnected devices increases the attack surface among industrial organizations and provides a wealth of sensitive, confidential, and actionable information.

Belligerents will fight to control the electromagnetic spectrum and use offensive cyber weapons once reserved for national strategic command authorities. Such operations include hacking an opponent's network and using it to cause destruction from within, perhaps by poisoning AI data streams to disrupt machine learning and decision-making. In all likelihood, the outcome of future conflict will be determined by who can leverage an advantage derived from information and data.

> Advanced disruptive technologies are changing our security landscape, with artificial intelligence and big data leading the way."
>
> —NATO Deputy Secretary General Mircea Geoană at the Cybersec Global 2022 event

3 Steve Banach, 2022 (https://community.apan.org/wg/tradoc-g2/mad-scientist/m/articles-of-interest/415777)

Challenges Militaries Face with Digitalization

Militaries face two challenges when embarking on the digitalization of defense.

The first is non-standard data across massive silos. The challenge of non-standard data is especially true for large nation-states. Because of the myriad of classification and handling requirements, data generated or collected is challenging to process outside approved systems and channels. No standard taxonomy for data processing exists. The data problem compounds further in multinational coalition environments. **The second challenge is the requirement to digitize across all aspects of the competition continuum.**

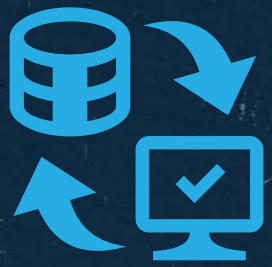
> Currently coalition forces do not share sensor data effectively, resulting in incomplete situational awareness, which unnecessarily exposes NATO personnel to threats."
>
> —NATO Sensors Electronics and Technology 256 Report (2021)

Four Necessary Elements That Must Be Maintained

(Banach 2022)

TECHNOLOGICAL STRUCTURES

TECHNOLOGICAL CAPABILITIES



THE FLOW OF BIG DATA

THE TIMING OF BIG DATA

Technological structures can be considered the **open systems interconnection model (OSI Model) physical layer**. It is the physical medium carrying raw data. Technological capabilities are the systems and processes that collect and process data. The flow of data is the requirement to identify the proper destination of big data for processing or refinement. Finally, the timing of data is the requirement to process it into understanding and awareness that enhance decision-making. Remove or disrupt any element, and decision-making either grinds to a halt or is severely degraded. As the complexity of the operational environment increases, time and space compress, and the range of available options for the military decision-maker shrinks.

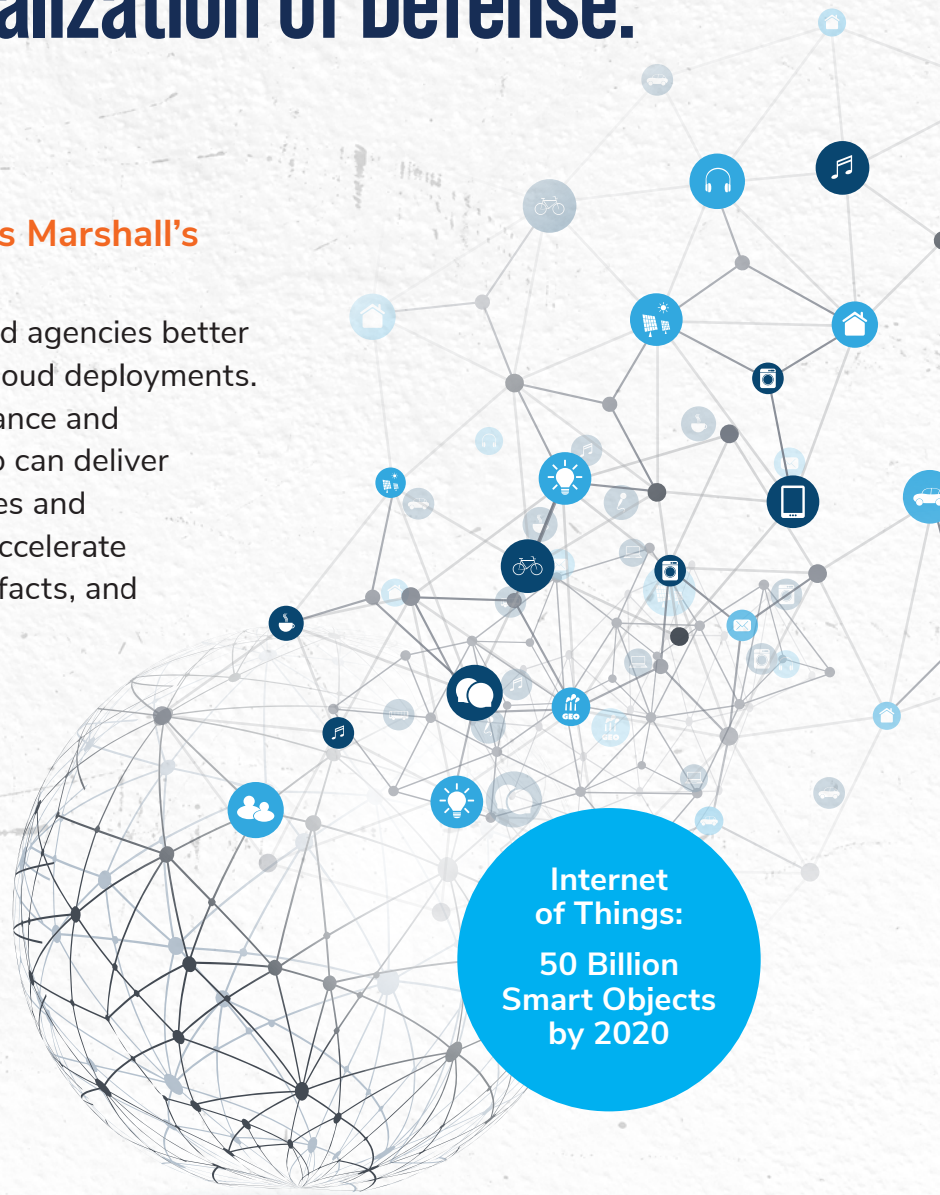
> The Pentagon collects 22 terabytes of data every day.
>
> —Lt. Gen Jack Shanahan briefing, 2017

Two Market Leaders in the Digitalization of Defense: Intel and VMware

Intel® and VMware have tools and capabilities that address Marshall's challenge, defined in RMA.

As an industry leader with a broad portfolio, Intel helps enterprises and agencies better understand how to integrate COTS solutions for successful edge-to-cloud deployments. Intel's network of solution providers benefit from exceptional performance and interoperability, along with select ruggedized equipment partners who can deliver Intel-based compute platforms that will meet/exceed mission objectives and operate within demanding environmental conditions. Intel also helps accelerate certification processes by providing evidence packages, processor artifacts, and long-life product availability to help minimize recertification efforts.

VMware's cloud computing products support large command centers to the tactical edge. In the current operating environment, military forces need simple, automated, cloud-first software technologies they can count on to deliver an advantage. VMware's rapid, secure, and proven software has transformed the delivery of warfighting capabilities. They are configurable for any app, on any device, or in any cloud environment. VMware technology allows allies to share data and context in real time, bilaterally. Whether the partner force is in the command center meters away or on the other side of the world, they will have the ability to coordinate activities. VMware's product offering enables decision-making dominance across the full spectrum of conflict.



Source: Defense Science Board, June 2016

CASE STUDIES

Intel® Situational Awareness at the Dynamic Edge (SADE)

The current operational environment is changing rapidly. Military operations encompass not just the land, sea, and air, but also the electromagnetic spectrum and the cyber domain. The requirement to rapidly build situational awareness and understanding is unparalleled. Long-range precision fires or cyberattacks can rapidly render operational units' combat ineffective. The need to coordinate activities and remain undetected or reduce the signature output applies equally from small teams to large operational headquarters.

In response to this operational need, **Intel® developed Situational Awareness at the Dynamic Edge (SADE)**. SADE provides a means for legacy and state-of-the-art applications to coexist and interoperate under demanding conditions. SADE uses deep learning techniques to isolate, identify, and prioritize objects relevant to the user and critical for tactical decision-making. For SADE to deliver on Banach's data flow and processing for understanding, it needs an architecture at the dynamic edge.

SADE is a reference software infrastructure that enables the deployment and management of modular scalable and resilient edge solutions for defense, aerospace, and emergency personnel. The infrastructure is powered by Intel technologies and maximizes the use of commercial off the shelf (COTS) technologies and open source software.

CASE STUDIES

Intel® SceneScape

Intel® SceneScape is a suite of systems that operate on a common framework for sensing, data processing, and compute components. The technology uses temporal and spatial understanding to contextualize data from many sensors. These sensors could be audio, vision, 3D cameras with depth, LIDAR, radio frequency, and almost any other sensor. Intel® SceneScape then applies compute, graphics, and AI to build a powerful scene using technologies like OpenVINO, vision accelerators, simultaneous location and mapping (SLAM), point cloud analytics, and other high-compute workloads. Intel® built the solution for next-generation applications; this four-dimensional digital fabric provides temporal and spatial understanding critical for IoT capabilities. Uses include targeting processes to assess battle damage. Instead of waiting for human analysts to dynamically task collection platforms, Intel® SceneScape can provide the assessment in real time.

CASE STUDIES

VMware Cloud Computing

VMware's cloud computing solutions represent a third capability that naturally complements the previous two. Operating at the tactical edge requires a modular architecture that minimizes space, weight, and power consumption. Rapid mobility is directly tied to survivability. VMware supports the modern warfighter by addressing these key survivability traits. As armed conflict is rarely conducted in a go-it-alone situation, VMware cloud capabilities allow for the unimpeded synchronous transfer of data and virtualized cloud-native applications between allies. VMware successfully tested this capability during the United States Central Command's multinational Command Post Exercise Regional Cooperation. The command post used VMware's Software Designed Datacenter (SDDC) to run multiple applications across several platforms. It provided a network for the staff to coordinate actions in the air, land, maritime, cyber, and space domains.

What Next Steps Should a Company Engage?

These are only **three examples of what Marshall envisioned back in 1993 when he coined the concept Revolution in Military Affairs**. All three case studies turn information into an advantage for enhanced decision-making. As mechanized land warfare and the aircraft carrier changed warfare in the 20th century, information will play a similar role in the 21st century.

> We declared cyberspace as a domain of operation to ensure unhindered access and freedom of maneuver in cyberspace during Allied Operations and Missions. In addition, as the cognitive domain, cognitive warfare and cognitive superiority have been identified in our NATO Warfighting Capstone Concept, cyberspace is considered the main vehicle for this."
>
> —NATO Allied Transformation Command Supreme Commander General Philippe Lavigne during closing remarks at the 2021 Cyber Coalition media day.*

Andrew W. Marshal's concept of RMA and the informational, computational, and communication technologies it comprises reverberate through General Lavigne's statement.

* As technology companies, VMWare and Intel are cyber-centric. NATO recognizes what happens in cyber impacts effectiveness in all other domains. They are especially interested in a cyber-derived cognitive advantage related to sensing, understanding, and deciding. For additional context, General Lavigne's speech can be found here: https://www.act.nato.int/speeches

Conclusion

The increasing complexity of the operational environment is altering the nature of competition and armed conflict. The technical structures and capabilities, along with the flow and timing of data, will progress. Each can work in tandem to provide an information advantage that leads to decision dominance. The question is, will you be able to press the advantage by making the proper investments?

For more information, please contact:

Michael Crowley
EMEA Public Sector Industry Director
VMware
mcrowley@vmware.com

John Brynildson
Intel Sales & Marketing Group
john.brynildson@intel.com

GROWTH IS A JOURNEY. WE ARE YOUR GUIDE.

For over six decades, Frost & Sullivan has provided actionable insights to corporations, governments and investors, resulting in a stream of innovative growth opportunities that allow them to maximize their economic potential, navigate emerging Mega Trends and shape a future based on sustainable growth.

Contact us: Start the discussion