MODERNISATION PRIORITIES

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IN MILITARY APPLICATIONS
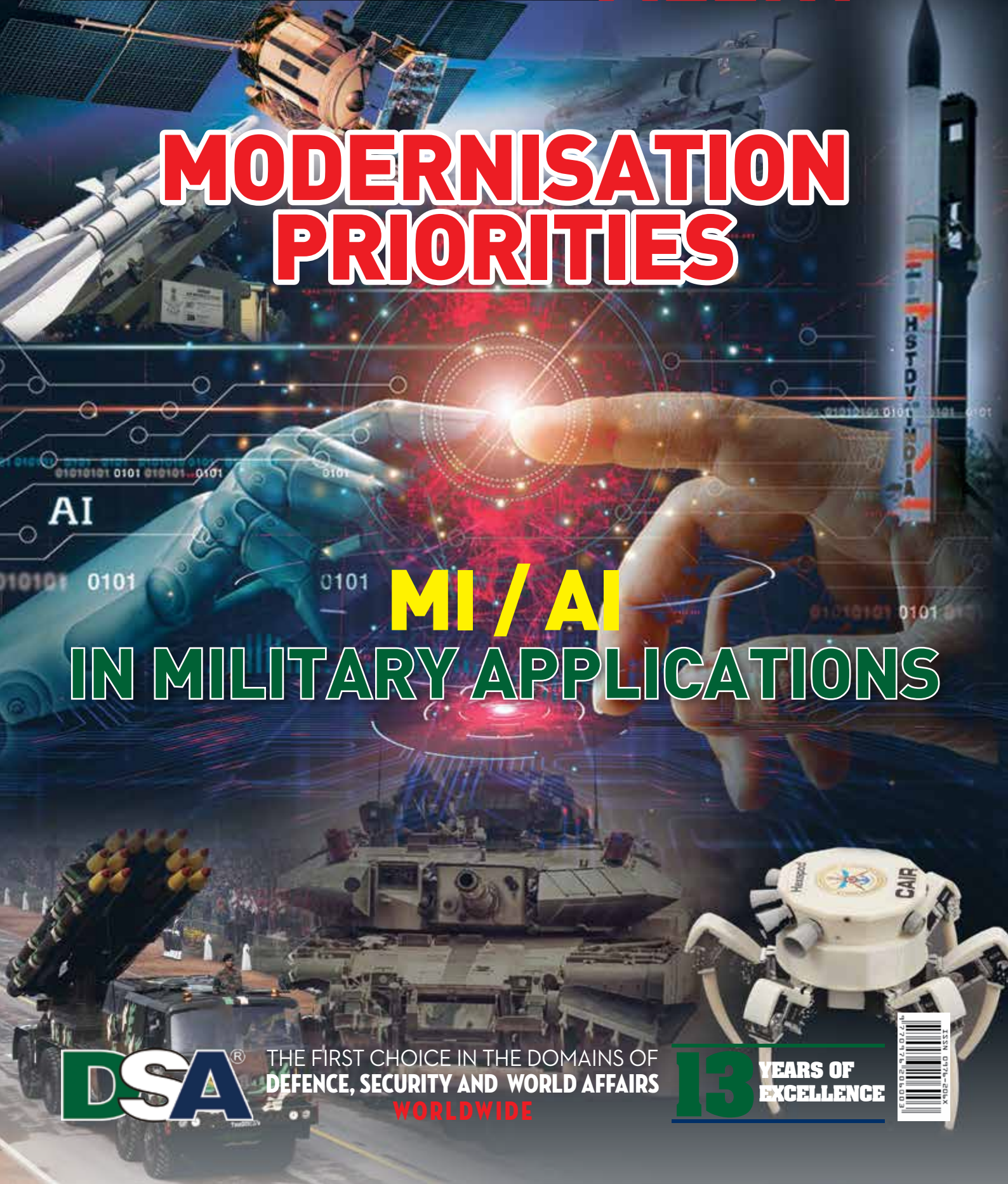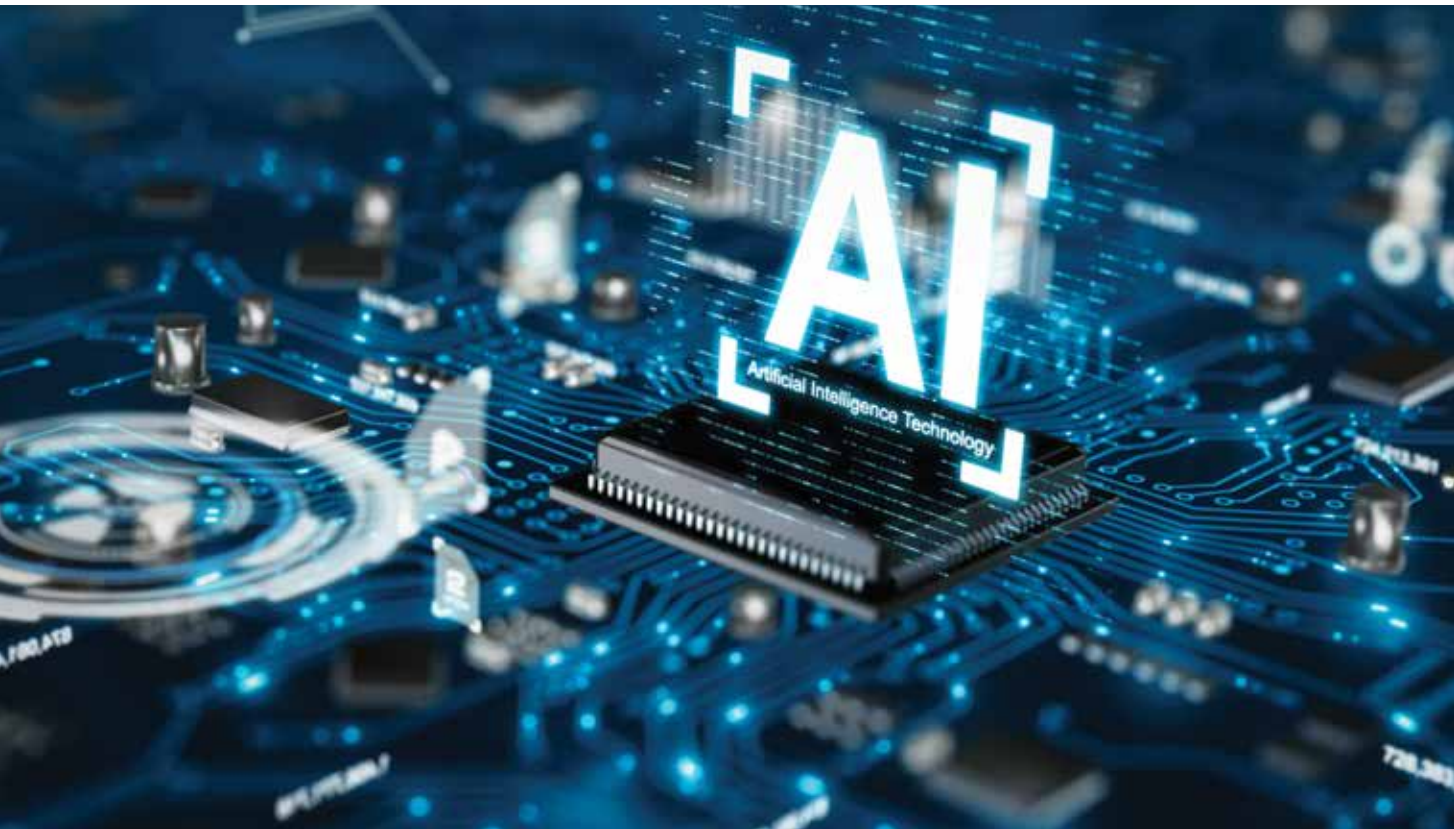
AI

MILITARY APPLICATIONS OF ARTIFICIAL INTELLIGENCE

> AI-based weapon systems have great advantages. AI has already brought a major disruption into the existing military technology domain. There is a possibility of the AI emerging as a 'new nuclear power' revamping the existing global order.

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The idea of artificial intelligence (AI) is not new. However, the technology remains as an evolving technology and there is a necessity for much revolution in the technology sphere to obtain the apparent benefits of this technology for humanity in general and the defence forces. Specifically, in the field of military research, various defence-related scientific

establishments are working with zeal towards developing various defence applications of this technology. At the same time, there is a realisation with the military leadership that since much research is also undergoing in the civilian field towards enhancing the competence of AI-based application, the militaries gain some useful insights from such research.

AI normally gets identified as the imitation of human intelligence processes by machines. The overall AI system involves specific hardware, software and algorithms and few view AI as an extension of existing information technology (IT) architecture, nonetheless in a limited sense. One reason for this is that IT systems are good data stores and data analysers and it is the data which is the heart of any AI system. AI systems labour by nursing large amounts of data and undertaking pattern analysis. Quantity as well as the quality of data are equally important. Currently, AI is impacting practically every sector of society. It is changing the business processes fundamentally. Various AI-enabled devices are bringing in a silent revolution in various fields from science research including climate research, industry, agriculture, education, medicine, critical infrastructure management and defence. Several military applications of this technology are becoming obvious. The defence industry is looking at this technology as a major game-changer for the future.

John McCarthy, a professor emeritus of computer science at Stanford, is created to have coined the term 'artificial intelligence'. McCarthy was a giant in the field of computer science and a seminal figure in the field of artificial intelligence. While at Dartmouth in 1955, McCarthy authored a proposal for a two-month, 10-person summer research conference on 'artificial intelligence' – the first use of the term in publication. He defined AI as the science and engineering of making intelligent machines like intelligent computer programmes. In spite of AI being there for more than six decades, this technology began evolving in the military domain mainly after the 1990s, after the initiation of deep learning and neural networks. Today, in this era of Industry 4.0, AI is getting recognised as one of the most important technologies with the potential to dictate the future of the industry, including the

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John McCarthy, professor of computer science in the Artificial Intelligence lab at Stanford in 1974.

A model of HAL AMCA.

defence industry. Particularly, post-2000, AI has sprung various surprises for the industry.

Post 1991 Gulf War that showcased the importance of technologies for the armed forces, many states in the world are found increasing their technology dependence to remain ready for warfighting. In fact, the ongoing Ukraine-Russia conflict is also found much depending on technologies and Russia has even used this war as an opportunity to demonstrate new state-of-art technologies like hypersonic missiles. Today, apart from modern fighting systems like the fourth / fifth generation fighter aircraft, new battle tanks and ships and submarines, states are found looking at technologies in drone technologies and modern sensor technologies as force multipliers. AI has major significance for various new weapon systems.

AI technology has the potential to bring **comprehensive changes** to the military–industrial complex **(MIC)**

AI technology has the potential to bring comprehensive changes to the military–industrial complex (MIC). AI is viewed as a technology which alone cannot be of much use to the armed forces. What is important is to use AI algorithms to make (modify) the existing military systems more intelligent and autonomous. Broadly, AI also should be viewed as a 'force multiplier.' It is also important to note that AI not as a standalone technology has much utility for future military systems but when AI is used in unison with machine learning (ML), its capability for the defence forces increases much.

Following are the few central arenas, where AI applicability is becoming perceptible:

Combat Systems

AI reduces the dependency on human inputs that this becomes an advantage for various combat systems like weapons, sensors and surveillance equipment. AI is still viewed in its infancy. Hence, armed forces are found not directly using AI-powered systems for the purposes of combat, but more in the domains of training and logistical systems. There is a major utility of AI for simulation systems. AI-enabled land combat systems are getting researched. Presently, the major focus is happening in the arena of drone technologies.

Unmanned Aerial Vehicles (UAV) or Unmanned Combat Aerial Vehicles (UCAV) have

Swarm of combat drones and command systems.

proven their battlefield utility (Azerbaijan- Armenia in 2020, over the disputed enclave of Nagorno-Karabakh) as remotely operated or autonomous systems. These systems have now become a part of the defence inventory for various states and are fast becoming a significant part of the combat forces apart from being used for intelligence, surveillance and reconnaissance (ISR). Today, AI can help fly warplanes. However, at present, the aim is not to remove the pilot from the cockpit but to have a system where AI will fly the plane in partnership with the human pilot. Could be in future we may have air forces using a pilotless combat aircraft.

The navy can use AI for the conduct of underwater warfare, surface warfare and aerial warfare. Unmanned surface vehicles are one of several new proficiencies the navy is pursuing that readily uses

AI. Also, AI and machine learning are critical to the navy's various maintenance initiatives.

Many predict that Drone Swarms are the future for various militaries. There could be huge cost savings towards using such systems. When operational, such swarms are in commutation with each and perform pre-programmed functions. In case of any drone from the swarm getting unserviceable, the other units take over its functions. Here each platform (an individual drone in the swarm) is controlled jointly with others. All drones operating in a swarm are all interlinked and in continuous communication with each other. Such systems are entirely AI-driven.

C4ISR
Command, Control, Communications, Computers, Intelligence, Surveillance and

Reconnaissance (C4ISR) is at the heart of any military architecture. Due to the presence of IT-based tools; various land, water and air-based sensors providing continuous real-time data coverage; availability of satellites for reconnaissance and communications, the concept of net-centric warfare (NCW) has become a reality. Obviously, there is much dependence on C4ISR systems. Navigational feedback based on global positioning satellites (GPS), and inputs from various radar / telescopic systems make C4ISR systems more proficient. Here, mainly AI-based tools assist soldiers to access and share information throughout the entire network almost in real-time. In near future, such and other AI-based technologies are likely to become embedded in various other technologies and help provide autonomous decision-making on behalf of military commanders.

Terminal High Altitude Area Defense (THAAD).

AI also allows formulating Intelligent Decision Support Systems, which actually leads to the transformation of human decision-making to machine-based decision-making. C4ISR structures are known to work with some systems like the blockchain technologies and the Internet of Military things (IoMT).

Lethal Autonomous Weapon Systems (LAWS)

For long, there is much ethical debate happening in regard to the efficacy of LAWS as a usable system. This is because such systems operate without any human intervention and are known as "fire-and-forget" systems which, once activated, select and engage targets on their own without any guidance from humans. At present, the only deployed fully autonomous systems belong in the defensive category like missile defence systems: S-400, THAAD and Iron Dome.

Today, with the increasing **number of cyber threats** and attacks, **AI security** services are becoming very **crucial**

Cyber Security

AI could take corrective measures against any cyber-attack in the shortest possible time. AI is already being employed to verify code and identify bugs and vulnerabilities. Modern-day armed forces are already facing major cyber threats. With increasing military dependence on IT tools, the challenges from cyber threats are going to be more severe in the coming years. Today, with the increasing number of cyber threats and attacks, AI security services are becoming very crucial.

In general, increasing instances are found happening in military-related AI technologies. Various weapon systems are getting designed with some achieving operational status, while some are still in the initial level of development. Broadly, AI allows the military leadership to get suggestions based on the systematic assessment of vast data. It is found to make the process of decision-making from the early stages of planning to actual operations easier and more logical. AI-based weapon systems have great advantages. AI has already brought a major disruption into the existing military technology domain. There is a possibility of the AI emerging as a 'new nuclear power' revamping the existing global order.

Note: The article is based on various internet-based sources DSA