

EMERGING TECHNOLOGIES IN DEFENCE

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“The most stressing threat is a complex, integrated attack incorporating multiple threat capabilities in a well-coordinated and synchronized attack.”

U.S. Army's Air and Missile Defense 2028 strategy



ARMENIA

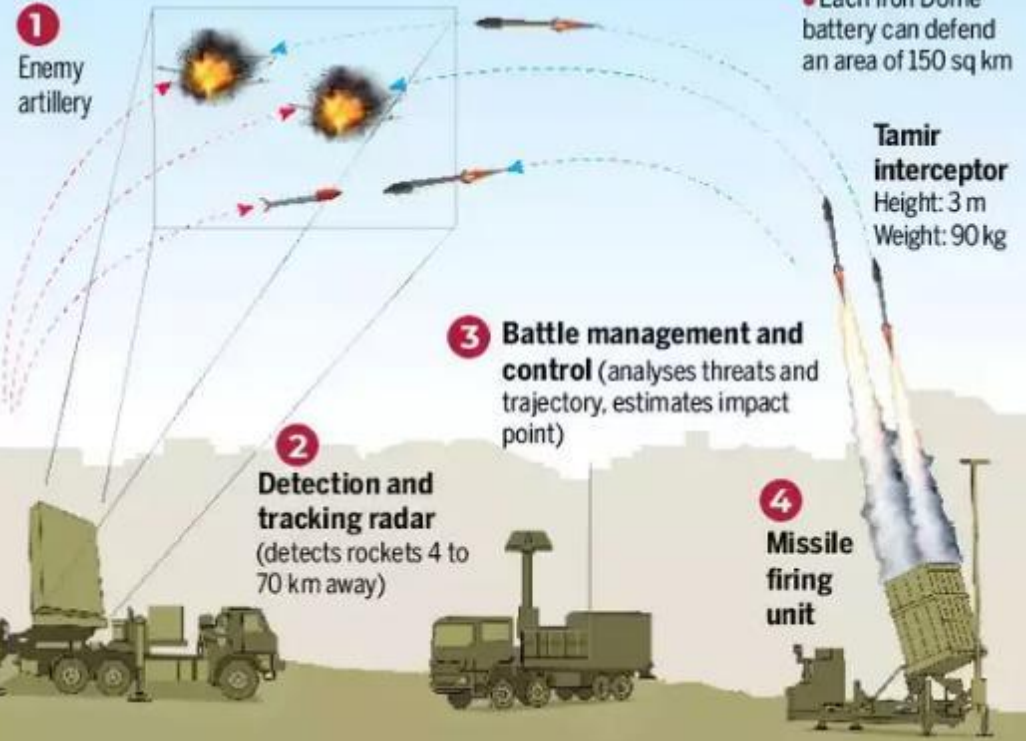
NAGORNO - KARABAKH

AZERBAIJAN

Israel's Iron Dome defence system

In service since 2011, intercepts around 90% of rockets fired into Israel

- Interceptor is fired if enemy artillery threatens populated areas
- Incoming targets are detonated in mid-flight and within seconds
- Each Iron Dome battery can defend an area of 150 sq km



Samsung SGR-A1 Robot Sentry



The AI War

Israel's operation against Hamas was the world's first AI war

The IDF used artificial intelligence and supercomputing during the last conflict with Hamas in the Gaza Strip.

Collecting data using signal intelligence (SIGINT), visual intelligence (VISINT), human intelligence (HUMINT), geographical intelligence (GEOINT) and more, Israel had mountains of raw data that had to be combed through to find the key pieces necessary to carry out a strike.

They used AI to generate recommendations for, which used them to produce quality targets and then passed them on to the forces to strike.

By the middle of the 21st century warfare will be affected by:

- More advanced, sophisticated capabilities, take advantage of artificial intelligence to improve decision-making.
- Increased speed in terms of integration, decision-making and operational imperatives, occur at even longer ranges.
- Deliver a range of effects whose impact and destructiveness are both broader and more precisely delivered.
- Unmanned systems, including advanced battlefield robotic systems acting both autonomously and as part of a wider trend in man-machine teaming means, will become increasingly common.

By the middle of the 21st century warfare will be affected by:

- Swarms of small, cheap unmanned systems, will be used in novel ways, both offensively and defensively, creating targeting dilemmas for sophisticated, expensive defensive systems.
- Laser and radiofrequency weapons drawing upon small, lighter, and much more portable sources of power, will become more practical, and will further increase the ranges and lethality of direct fire weapons, particularly defensive weapons designed to counter aircraft, unmanned aerial vehicles, and ground systems.
- Communications will be critical, and advances in quantum computing, networking, and the Internet of Things will make the need to communicate both easier, and more difficult in the face of the same technologies used to counter an enemy's communications capabilities.



Scale



Speed



Detecting patterns



Informed decision
making

Key Focus Areas



Cyber
Defence



Information
Management
and decision
making



Advanced
Analytics
-Deep
learning
-Machine
Learning



Modelling
Simulation
and Training



Autonomy
-Vehicles
(air,sea,land)
-Ammunition



Robotics
Support
(search and
rescue)
Logistic
Support
(carry
equipment)
Operate
(patrol,
destroy)

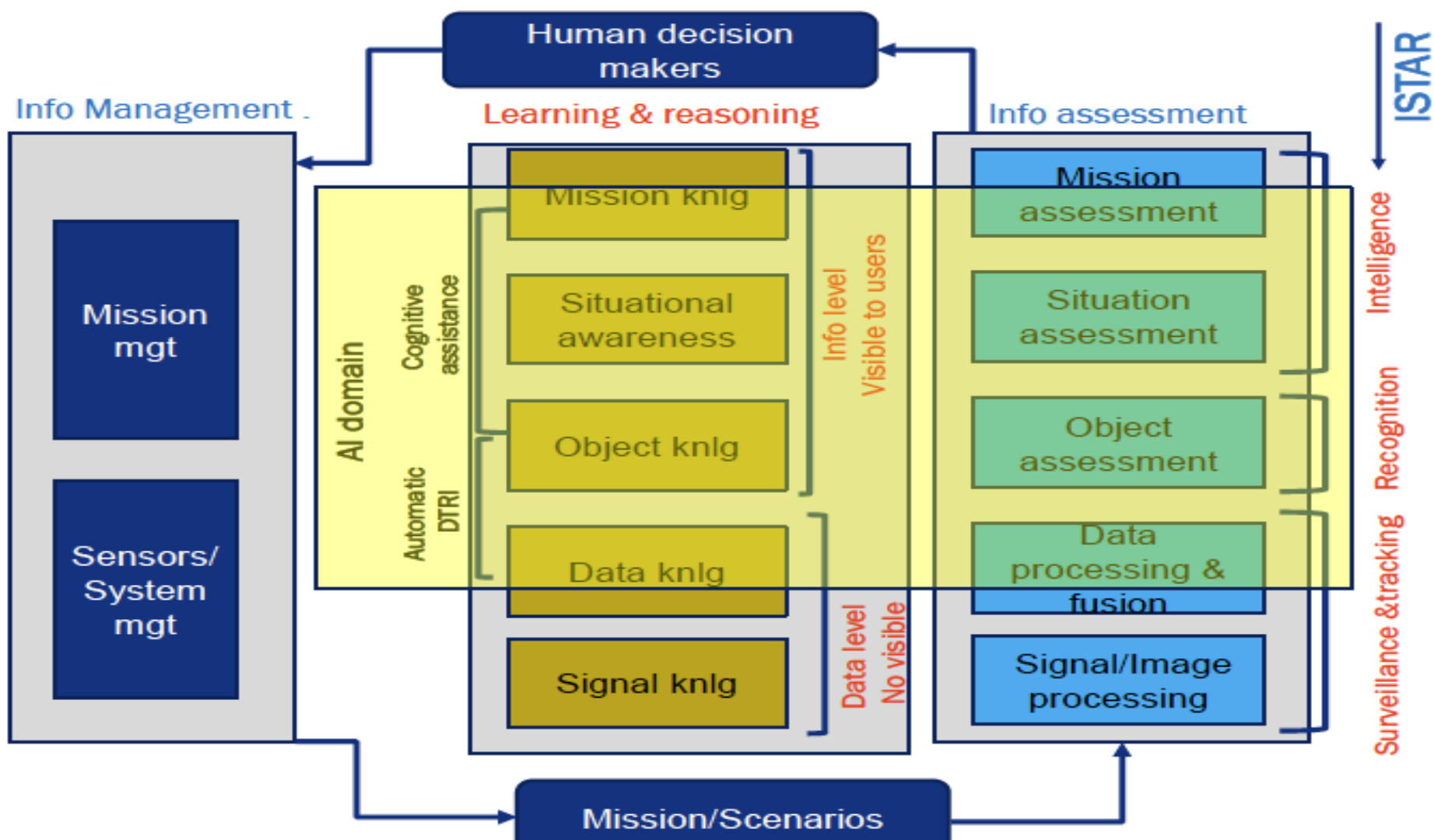


Image Recognition

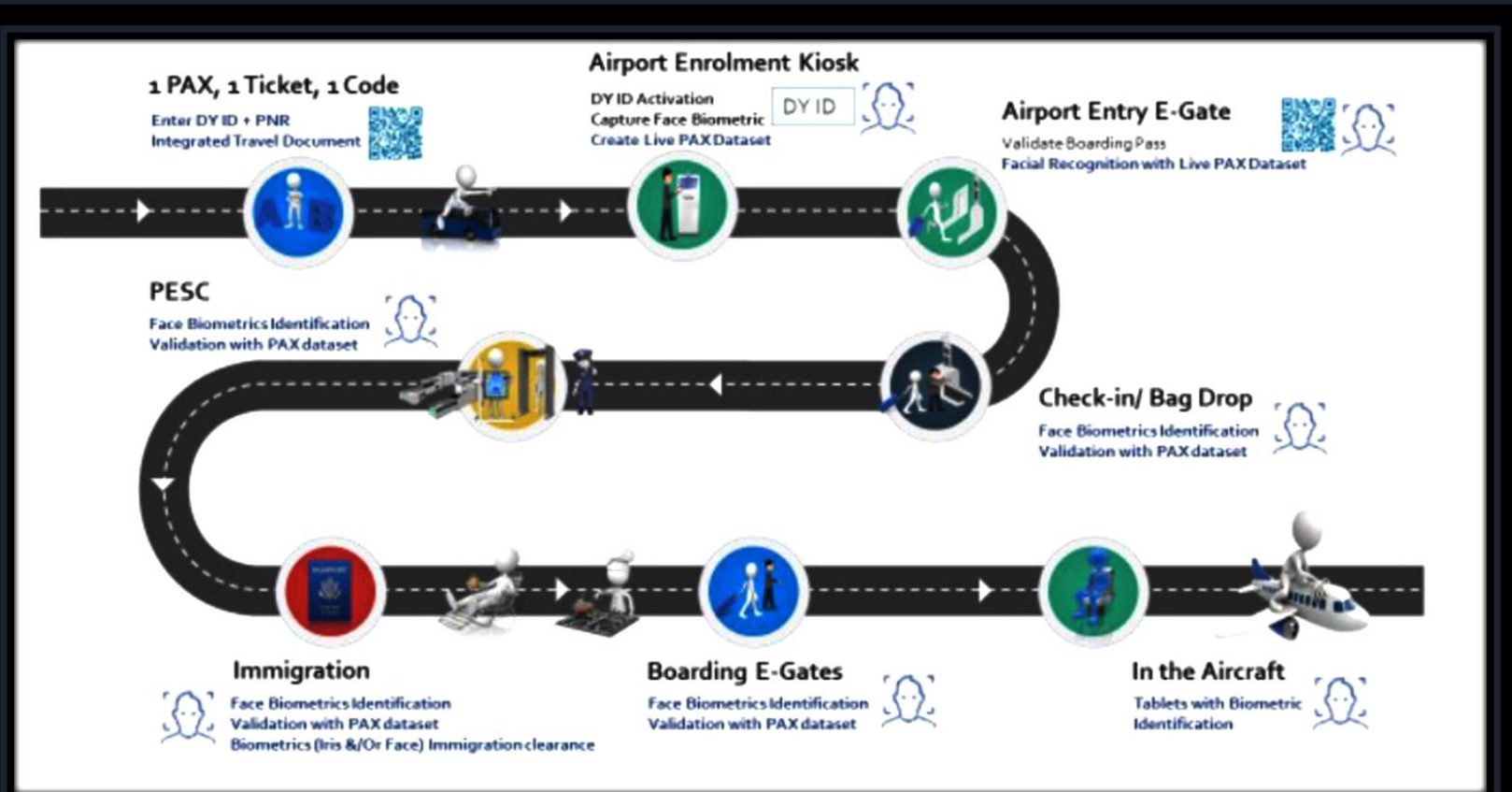
Driver Fatigue Monitoring System



Face Recognition under Disguise



Digiyatra



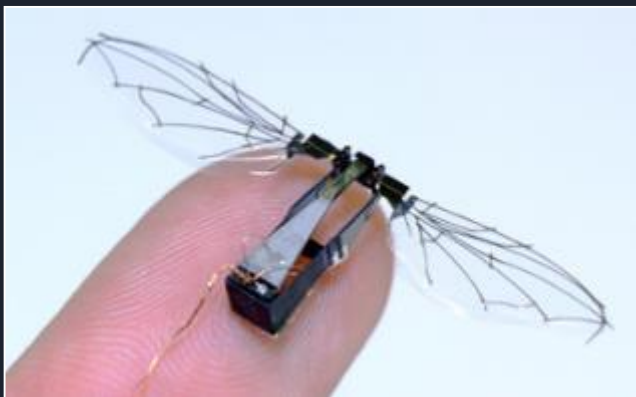
Robotics & Autonomous Systems (RAS) in Defense



- Improved performance and reduced risk to soldiers
- New force designs freeing up personnel for redeployment
- Better institutional support at military warehouses and depot functions to combat forces
- New operational concepts- employing autonomous air, ground and naval systems
- New models for recruiting and retaining soldiers

Military Robots

Robots play a constantly increasing role in warfare – they are unmanned aerial reconnaissance and combat vehicles, demining robots, universal military robots capable of substituting soldiers, robots making corridors in mine fields etc.



Drones

Swarm Drones

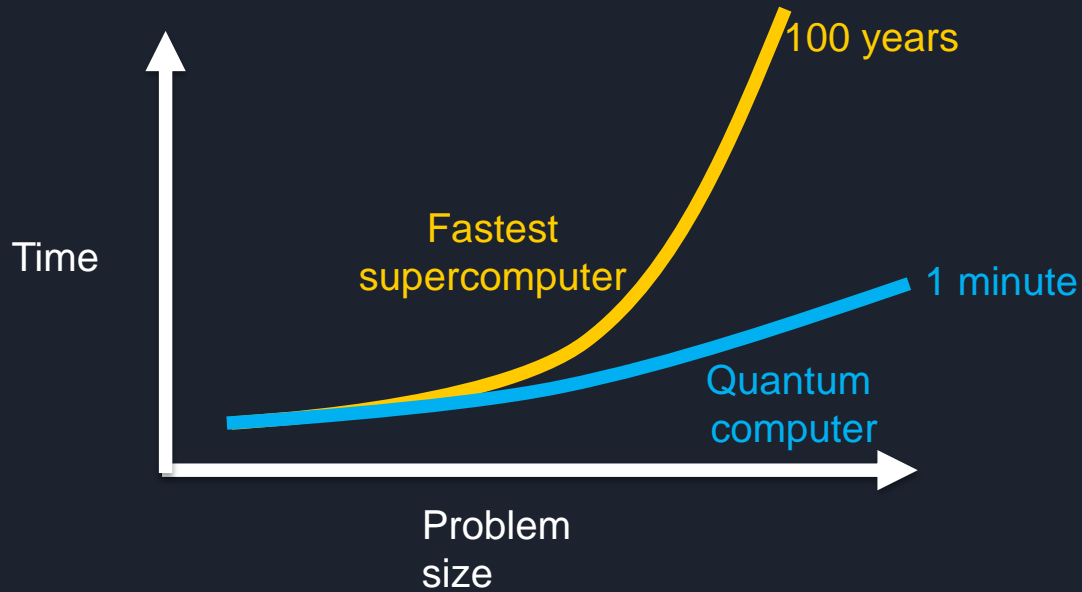


Automated Room Intervention Drones





Why quantum computers?



Not **10x** speedup but possibly **10^x**

Why is there a problem with classical computers?

Travelling Salesman Problem



Find the shortest route to visit 60
US landmarks

$\sim 10^{81}$ possible routes to check!

(10^{78} is the number of atoms in the universe)

The potential of quantum computers

Travelling Salesman Problem



Only **270 qubits** will be needed to encode the problem **on a quantum computer**

Find the shortest route to visit 60 US landmarks

Blockchain



- Confidentiality
- Integrity
- Availability and Resiliency

Blockchain in Defense – Improving Supply Chain



- Blockchain Validates data amongst participants in a way that is simultaneous, encrypted and safe. No unauthorised changes can be made to the data. As a result, everyone has access to the same permissioned information, and they can trust that the information is current and correct.
- The most intuitive application of blockchain is to increase the transparency of the supply chain, not only during manufacturing but once an asset is in operational use. By using the technology, each part can be tracked from raw materials through assembly to finished component, to its installation in an operational asset and then throughout its service life.

Internet of Military Things



Internet of Military Things - Application

- Gathering Battlefield Data
- Monitoring Soldier Health
- Equipment and Vehicle Fleet Management
- Smart Bases
- Data Processing & Analytics
- Remote Training
- Predictive Asset Maintenance



Big Data in Defense

- Satellite Imaging
 - Geo-Spatial Analytics for detection of alien object.
 - Detailed threat analysis of hostile terrain/environment
 - Selection and prioritization of targets
 - Post-strike damage assessment
- Military logistics and human resource management
- Running modelling and simulation exercises for training and planning



Challenges and Areas of Concern

Technical Infrastructure

- Data collection and acquisition
- Compatibility issues with existing systems and technologies

Network Infrastructure

- Closed network at military bases
- Challenges of accessing information
- Adaptive real-time learning with constrained resources

Ethical

- Vulnerability of models to manipulation
- Hacking, enemy behavioral manipulation

Military history is filled with the record of military improvements that have been resisted. Between the development of new weapons or new tactics and their adoption there has always been a time-lag, often of generations. And that time-lag has often decided the fate of nations.

Sir Basil Liddell Hart, British military writer, 1944

Thank you



EXAMPLES

- [Nagorno-Karabakh War](#)
- [Israel's operation against Hamas was the world's first AI war](#)

AWS BLOGS

- [AWS and Project Kuiper to support the US military's Hybrid Space Architecture project](#)
- [Readying the warfighter: U.S. Navy ERP migrates to AWS](#)
- [US Navy deploys DevSecOps environment in AWS Secret Region to deliver new capabilities to its sailors](#)
- [AWS launches first Defence Accelerator for startups](#)
- [Increase military readiness with AWS IoT for Defense and National Security](#)
- [The Navy Turns to AWS GovCloud \(US\) for Standardization and Security](#)

Nagorno-Karabakh War

Azerbaijan

- Azerbaijan used diverse arsenal of missiles rocket and drones. Had Tochka missiles of Soviet Union vintage, Israeli [LORA](#) ballistic missile and EXTRA (EXTended Range Artillery) guided rocket.
- Azerbaijan had an impressive drone arsenal composed of Turkish and Israeli UAVs. It acquired the Turkish purchased numerous Israeli loitering munitions, known as “suicide” or “kamikaze” drones, including the Harop, Orbiter, and SkyStriker UAVs. Modified its Soviet-era An-2 Colt biplanes with remote-control systems, flying them to the front lines to draw out Armenian air defences.
- Invested heavily in rocket artillery. The Turkish TRG-300 and Belarusian Polonez MLRS had the ability to range targets up to 120 and 200 km away. The [BM-30 Smerch](#) was Azerbaijan’s rocket of choice.
- UAVs were operationally integrated with fires from manned aircraft and land-based artillery. Frequently used their own ordinance to destroy high-value military assets.
- Turkish-made Bayraktar TB2
 - Demonstrated the versatility of UAV platforms.
 - TB2 drones cost as little as \$1m to \$2m each.
 - TB2 carries four Smart Micro Munition laser-guided missiles,
 - has a flight time of 24 hours and a communication range of almost 100 miles,
 - can carry a maximum payload of more than 55kg.
 - Create a disturbing sound when approaching their targets, which can be psychologically unsettling.
- **Information Operations.** The Azerbaijani Ministry of Defence has released daily updates utilizing drone footage on its YouTube and Twitter accounts.

Nagorno-Karabakh War

Armenia

Bulk of Armenia's air defences consisted of obsolete Soviet-era systems.

Armenia's larger air defences like the S-300 are not designed for counter-UAV missions and were targeted early in the conflict by Azerbaijani loitering munitions.

Armenia lost 224 tanks compared with 36 from Azerbaijan.

Armenia's passive defence was poor. Operated out in the open, static or moving slowly, poorly camouflaged and clumped in tight, massed formations.

Nagorno-Karabakh War

Lesson Learnt

Without adequate sensors, electronic warfare cover and counter-drone weaponry traditional ground units are in trouble.

Integration of land-based fire-support and drones inevitable in modern warfare. Azerbaijani artillery and rocket systems fought in close coordination with drone warfare assets. Turkey and Russia developed 'drone – artillery complexes' during their Syria expeditions. Russia now integrates Orlan-10 drones to the 152mm-class artillery.

Intra-war deterrence gain importance.

Drones make good SEAD assets against low-to-mid-range air defences.

Israeli loitering munitions Harop has anti-radiation capabilities, can detect and autonomously home onto radar emissions. This has been sensationally manifested in Azerbaijan's targeting of the Armenian air defense forces' Russian-manufactured S-300 strategic SAM (surface-to-air missile) system.

Despite the drone age, military geostrategic calculus still matters. As the Azerbaijani push developed, its military planning transformed from a drone-driven, overwhelming war of attrition into a more combined arms warfare effort, pursuing a more balanced approach. Conventional warfighting capabilities to clear, hold and deny territory remains crucial.