



NORTH ATLANTIC TREATY ORGANIZATION
SCIENCE & TECHNOLOGY ORGANIZATION

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EDT's and Their Effects to Military Strategy

Defensive Systems

SAS-174 "Are the major weapon platforms obsolete?"

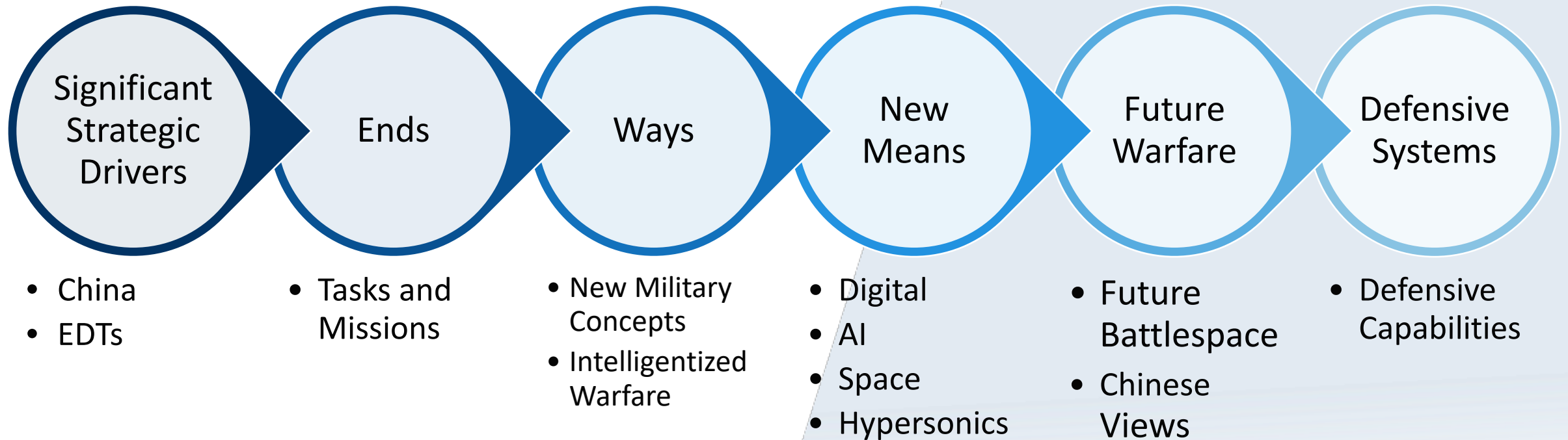
Empowering NATO's Technological Edge

Name: M. Cem Okyay

Title: Rear Admiral (LH) (Ret.)



Methodology (Outline)



“There is least one thing worse than fighting with allies, and that’s fighting without them.” Winston Churchill, 1945.

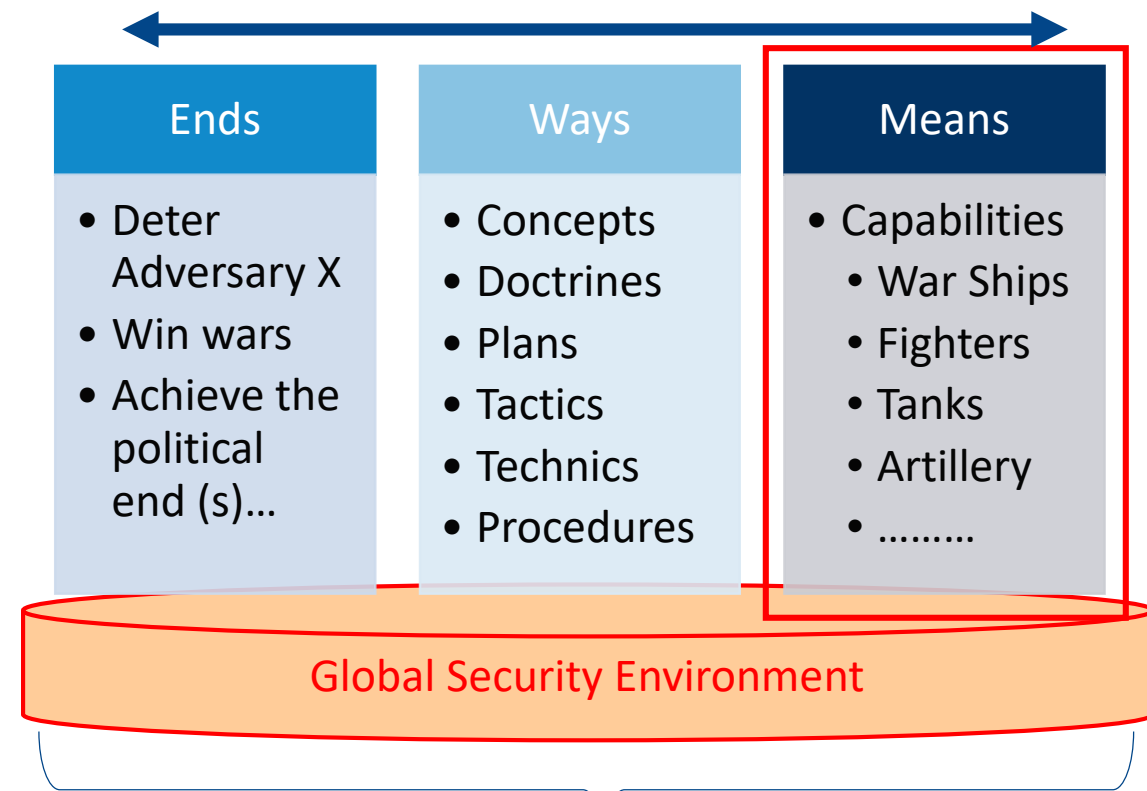
Military Strategy and Major Weapon Platforms



- Military strategy is fundamentally about choices. It uses ends, ways and means to create a roadmap between the present and a desired future state or condition...

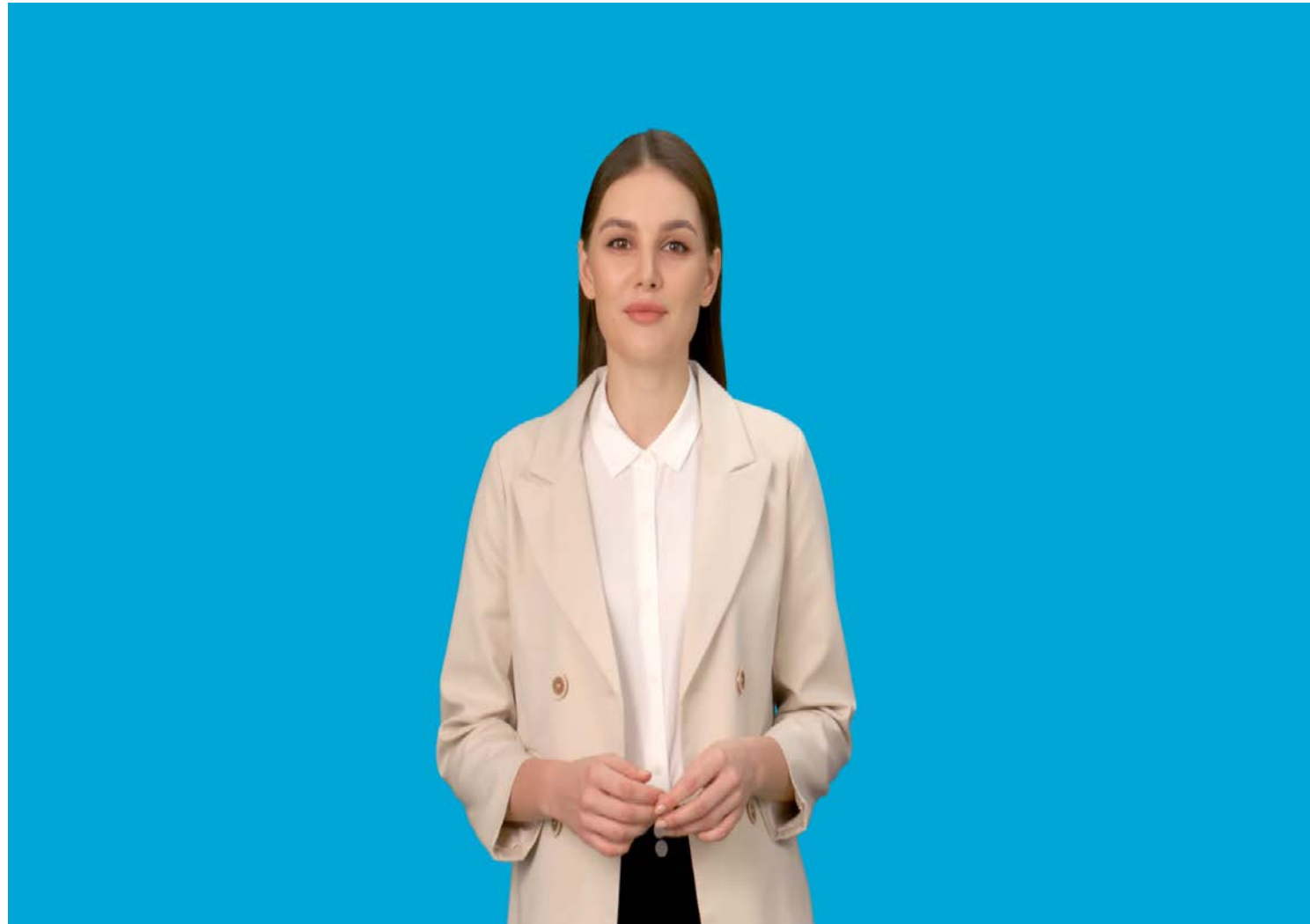
AJP-01, Edition F)

Defence Planning vs. Operational Planning perspectives may change the order...



«Are Major Weapon Platforms obsolete?» is a strategy question!

Spoiler: Are major platforms obsolete due to EDTs? *Thus spake AI!*



The significant driver #1 : China

«China's National Defence in the New Era (2016)» and 2021 revision...

The strategic goals for the development of China's national defence and military in the new era are:

- by 2020, mechanisation of PLA army forces and progress in 'informationisation' – the integration of information and communications technology (ICT);
- by 2027, army building and professionalisation;
- by 2035, full modernisation and 'intelligentisation' – integration of artificial intelligence (AI) and autonomy into the PLA's command and control, weapons systems and platforms, and decision-making – through reform of theory, organisational structure, service personnel and weaponry;
- by the mid-21st century, the ability to fight and win wars.

Emerging and Disruptive Technologies

NATO STO Future of Warfare, April 2022; Science Technology Trends 2023-2043	NATO's Coherent Implementation Strategy on EDTs, 2021; NATO DIANA, 2023	European Defence Agency, 2022	US National Defence Strategy, 2022	China's National Defence in the New Era, July 2019	China's Innovation Driven Development Strategy, 2016
Data (BDAA)	Big data	Big data analytics		Big data	Informatization
Artificial intelligence	Artificial intelligence	Artificial intelligence	Artificial intelligence	Artificial intelligence	Artificial intelligence
Robotics and Autonomous Systems (RAS)	Autonomy	Robotics and autonomous weapons systems	Lethal autonomous weapon systems	Autonomous weapon systems	Autonomous Weapon Systems
Quantum technology	Quantum	Quantum-based technologies	Quantum technology	Quantum technology	Quantum technology
Space technologies	Space technologies	Space technologies		Space technologies	Space technologies
Hypersonics	Hypersonics	Hypersonic weapons systems	Hypersonic weapons		
Biotechnology and human enhancement	Biotechnologies and human enhancement,		Biotechnology		Genomics, stem cells, synthetic organisms, bio-engineering
Novel materials and manufacturing	Novel materials and advanced manufacturing	New advanced materials			Advanced manufacturing
Energy and propulsion Electronics and Electromagnetics	Energy and propulsion		Directed Energy Weapons	IOT	IOT and many others... 😊

NATO EDT Policies and Initiatives

- NATO EDT Roadmap, 2019
- NATO's Overarching Space Policy, 2019
- NATO 2030, 2021
- NATO Artificial Intelligence Strategy, 2021
- NATO's new Strategic Concept, 2022
- Data Exploitation Framework Policy, 2022
- Data Exploitation Framework Strategic Plan 2022
- NATO's Autonomy Implementation Plan
- NATO STO Initiatives
- Centre for Maritime Research and Experimentation (CMRE).
- NATO Space Centre (Ramstein), 2020
- Strategic Space Situational Awareness System (3SAS)
- DIANA (Defence Innovation Accelerator North Atlantic)
- NATO Innovation Fund (NIF)
- NATO Innovation Challenge
- NATO's Data and Artificial Intelligence Review Board
- Alliance Persistent Surveillance from Space (APSS), 2023
- NATO Warfighting Capstone Concept (NWCC)
- Military Medicine COE

Hypersonic Missile Defence?

Military Instrument Of Power

✓ Use the Force

✓ Ready the Force

✓ Develop the Force

- Deterrence and defence
- Crisis prevention and management;
- Cooperative security



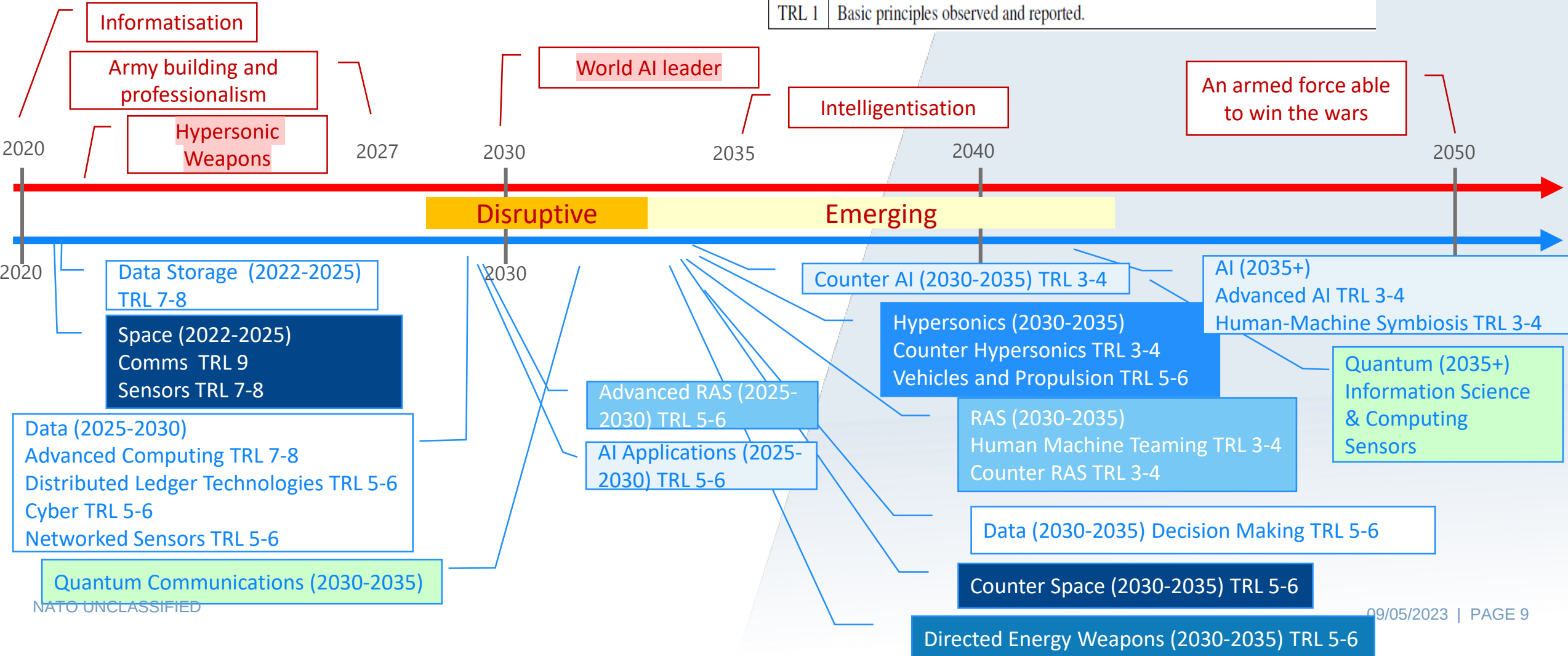
Assure, Contain, Deter, Defeat, Defend,
Deny, Stabilise and Transform



These themes and related mission sets are not going anywhere soon...

TRL 9	Actual system proven through successful mission operations.
TRL 8	Actual system completed and qualified through test and demonstration.
TRL 7	System prototype demonstration in a space environment.
TRL 6	System/subsystem model or prototype demonstration in a relevant environment.
TRL 5	Component and/or breadboard validation in relevant environment.
TRL 4	Component and/or breadboard validation in laboratory environment.
TRL 3	Analytical and experimental critical function and/or characteristic proof-of-concept.
TRL 2	Technology concept and/or application formulated.
TRL 1	Basic principles observed and reported.

Timeline Benchmarking



Digitisation, Digitalisation and Digital Transformation

- ✓ Digitization is the conversion of analogue data and processes into a machine-readable format.
- ✓ Digitalization is the use of digital technologies and data as well as their interconnection which results in new or changes to existing activities.”
- ✓ Digital transformation refers to the economic and societal effects of digitization and digitalization.
(Culture, Organisation, Business Models and Processes)

- ✓ The progress on EDT related interoperable capabilities require digitalised defence structures. NATO DPP must urge and encourage Allied Nations to develop their Digital Capabilities IAW NAF and Data Exploitation Framework.

AI Use Cases - NATO

NATO Cooperative Cyber Defence COE

Artificial Intelligence and Autonomy in the Military: An Overview of NATO Member States' Strategies and Deployment

- Autonomous Vehicles
- Autonomous Air and Missile Defence Systems, Autonomous Missiles, and AI-Enabled Aircraft
- Data Analytics
- Logistics and Personnel Management.

NATO STO Science and Technology Trends 2020-2040

- C4ISR
- Weapons and Effects
- Autonomous Vehicles
- Capability Planning
- CBRN
- Medical
- Enterprise Management
- Logistics
- Cyber and Information Space
- Training

The use of AI in Operational Planning, Execution and Battle Rhythm (C2) is inevitable....

AI Use Cases – China

Chinese Perspectives on AI and Future Military Capabilities, CSET Policy Brief, 2020

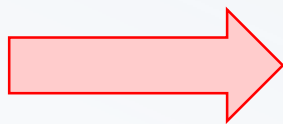
- UAVs, USVs, UUVs, UGVs,
- Intelligent munitions,
- Intelligent satellites,
- ISR software,
- Automated cyber defence software,
- Automated cyberattack software,
- Decision support software,
- Automated missile launch software,
- Cognitive electronic warfare software.



AI would increase or reduce one of seven features of wartime operations:

- (1) attack response time;
- (2) the cost of signalling or expending force;
- (3) the capability to find and track strategic forces;
- (4) the capability of air defence systems;
- (5) the vulnerability of command and control systems;
- (6) the capability to strike at enemy forces; or
- (7) the probability of technical failure.

Active Defence



AI-Enabled Offence

Hypersonic Weapons: Operationally Ready Examples

Russia reports use of hypersonic missile

Kinzhal missile (Kh-47M2)

Highly manoeuvrable, air-launched ballistic missile fired from MiG-31 - hypersonic means can fly 5x speed of sound (Mach 5)



Type: Conventional or nuclear-capable

Range: 2000km approx

Missile length: 8m

Speed: Possibly to Mach 10
(12,350 kmh or 7,674 mph)

Source: CSIS, BBC research Image: Planetpix/Alamy Live News



China's DF-17 hypersonic boost-glide missile



<https://www.scmp.com/news/china/military/article/3037972/will-hypersonic-df-17-missile-transform-beijings-taiwan>

Hyperersonic Weapons: Operationally Ready Examples Циркон

The Zircon hypersonic cruise missile successfully hit a sea target located at a distance of about 1000 km. , 28 May 2022

По данным объективного контроля гиперзвуковая крылатая ракета «Циркон» успешно поразила морскую мишень, расположенную на расстоянии около 1000 км. Полёт гиперзвуковой ракеты соответствовал заданным параметрам.

#Минобороны #Россия



Стрельба ракетой «Циркон» в Баренцевом море

127,461 seyredici

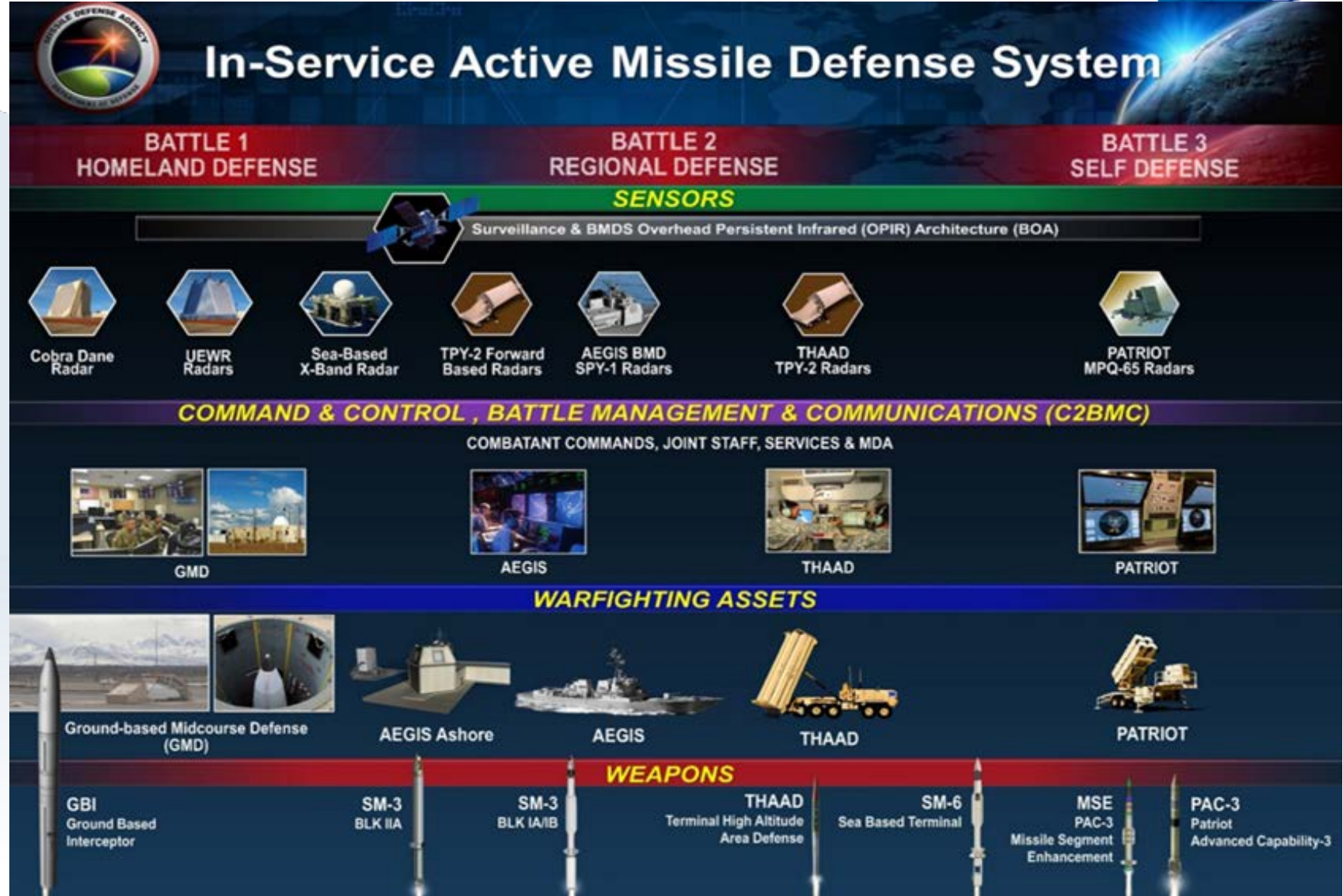
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Hypersonic Missile Defence

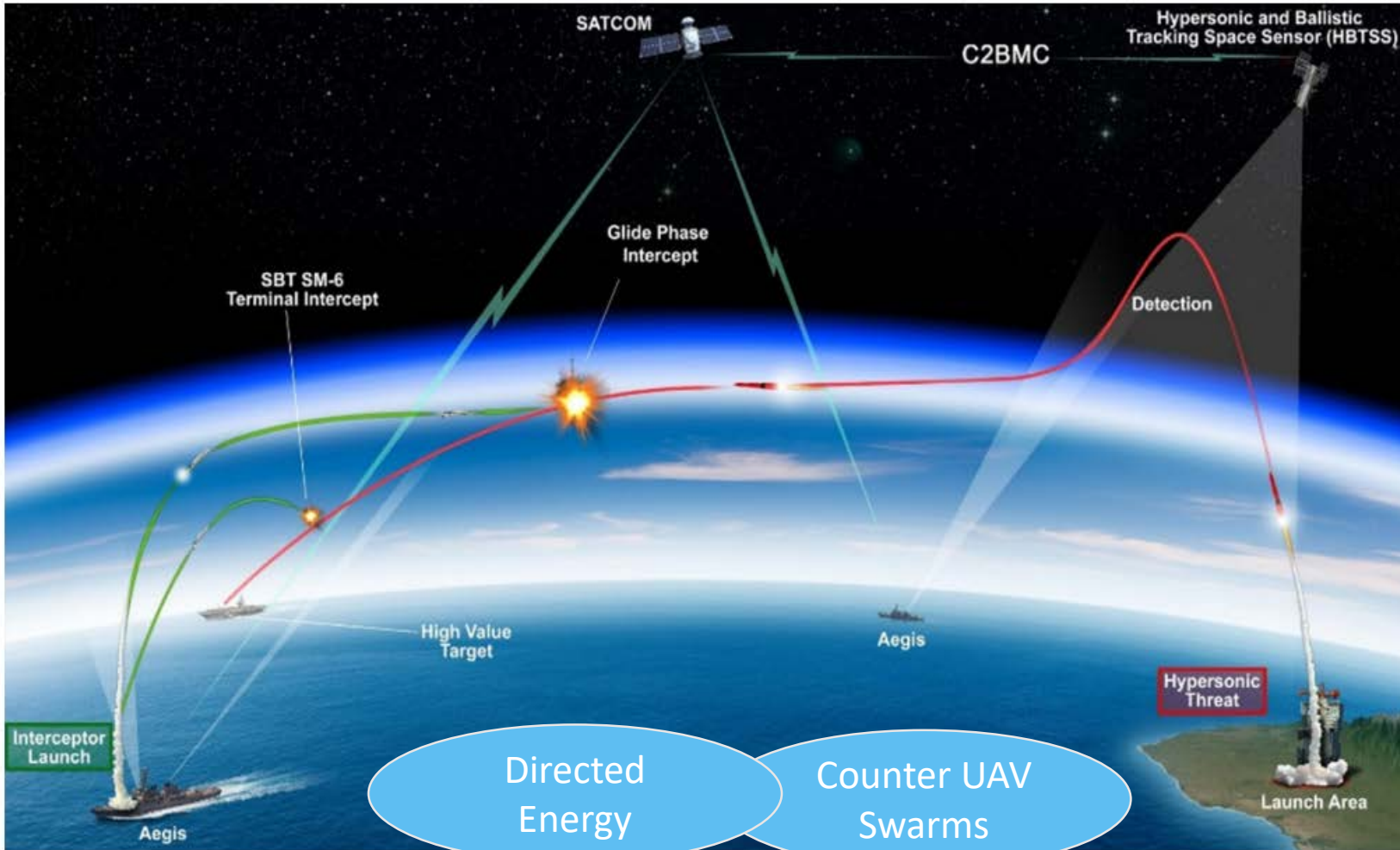
- ✓ Networked
- ✓ Distributed
- ✓ Multi-Dimensional
- ✓ Expensive

A capability that no NATO Nation can alone achieve...



Hypersonic Missile Defence

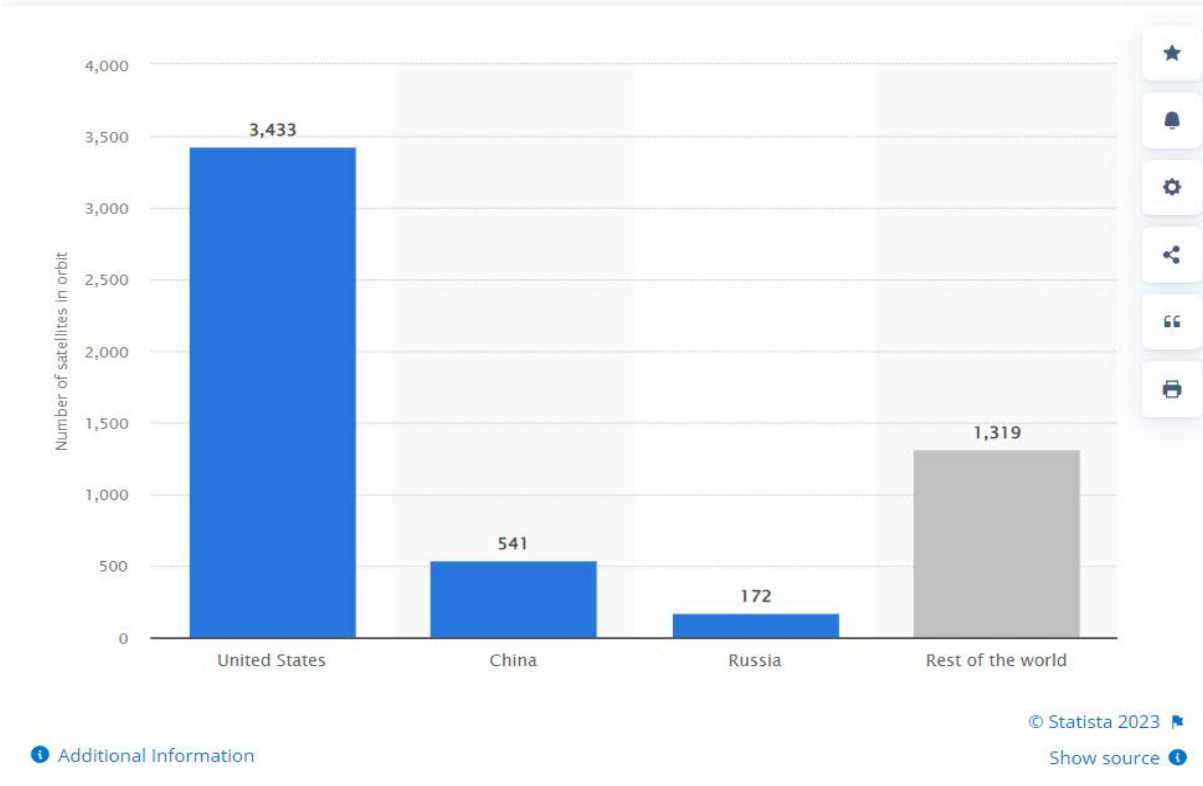
Self defence at operational and tactical scene...



- ✓ This is an idealistic depiction. There will be submarine, UUV, mine, smart torpedo threats or amphibious operations will be conducted where units will be in proximity in shallow waters.
- ✓ No OTC can handle this threat
- ✓ No time for verbal AAW communications...
- ✓ AJP and ATP doctrines need to be revised.
- ✓ Integrated, Layered, Automatic and autonomous capability is essential.

Satellites Around The Globe

Number of satellites in orbit by major country as of April 30, 2022



- 90 countries operate in space.
- While over 5,400 satellites are in-orbit today, more than 24,500 satellites are anticipated to be launched in the next 10 years (2022–2031), over 70 percent of which will be commercial.
- In 2022, China conducted 64 space launches, including two space launch failures. The successful launches resulted in over 150 satellites successfully placed into orbit and the launch of one orbital and one suborbital spaceplane

▪ Space Situational Awareness is inextricable dimension of C2.

Counter Space Capabilities

- Kinetic Physical
 - Direct Ascent Anti Satellite Weapons
 - Co-orbital ASAT Weapons
 - Ground Stations Attacks
- Non-Kinetic Physical
 - Lasers
 - High Powered Microwave
 - Nuclear Weapons (Banned but...)
- Electronic Countermeasures
- Cyber Countermeasures
- **Decoys and material for camouflage and deception**

https://csis-website-prod.s3.amazonaws.com/s3fs-public/2023-04/230414_Bingen_Space_Assessment.pdf?VersionId=oMsUS8MupLbZi3BI SPrgPCKd5jDejZnJcs/264472/number-of-satellites-in-orbit-by-operating-country/

Russia's anti-satellite test should lead to a multilateral ban



Space debris in orbit around planet earth. Photo: Adobe Stock

7 December 2021

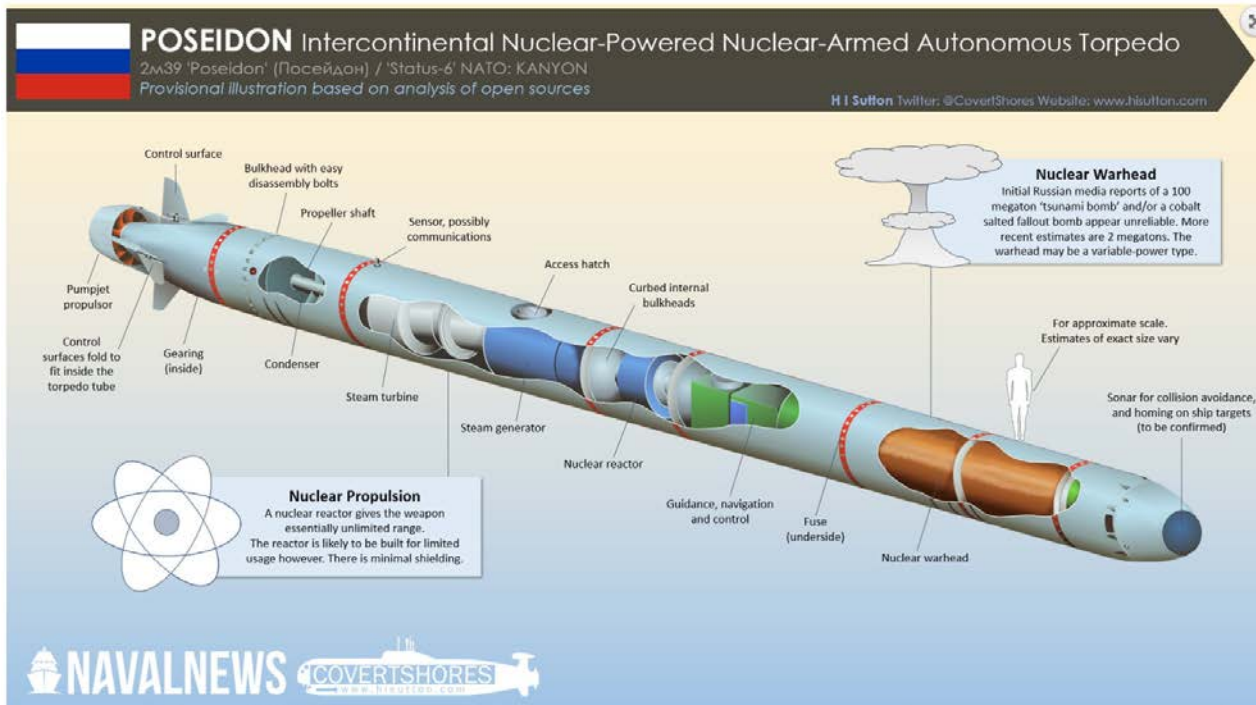
Nivedita Raju

On 15 November, Russia conducted a direct-ascent anti-satellite (DA-ASAT) test, destroying one of its own space objects, a defunct satellite, in low-earth orbit. The test captured international attention and was quickly and widely condemned as threatening and irresponsible—not least for the cloud of lethal, uncontrollable debris it created, which will endanger both space assets and human spaceflight for years to come.

<https://www.sipri.org/commentary/essay/2021/russias-anti-satellite-test-should-lead-multilateral-ban>

05/09/2023 | PAGE 18

Mines and Torpidos



- Autonomous, nuclear powered torpedo, <100kts



- Supercavitating Torpedoes, >200 kts, 9-10 miles range

New Military Concepts (New Ways)

To comprehend future defence environment....

- **Intelligentized Warfare**
- **Mosaic Warfare**
- **Algorithmic Warfare**
- **Software-enabled Warfare**
- **Memetic Warfare**
- **Cognitive Warfare**
- **Multi Domain Operations**
- **Joint Multi Domain Operations**
- **Hybrid War**
- **Hyper War**
- **Next Generation Conflict**

New Warfighting Concepts (Ways)- China`s Intelligentized Warfare

- China`s “information revolution” has been progressing through three stages: first “digitalization” (数字化), then “networkization” (网络化), and now “intelligentization.
- Integrated warfare waged in land, sea, air, space, electromagnetic, cyber, and cognitive domains using intelligent weaponry and equipment and their associated operation methods, underpinned by the IoT information system (China National Defence University).

New Warfighting Concepts (Ways)- China`s Intelligentized Warfare

- “on the future battlefield, with the continuous advancement of AI and human-machine fusion technologies, the rhythm of combat will become faster and faster, until it reaches a ‘singularity’ (奇点): the human brain can no longer cope with the ever-changing battlefield situation, unavoidably a great part of decision-making power will have to be given to highly intelligent machines.”

Future Warfare: Chinese Views

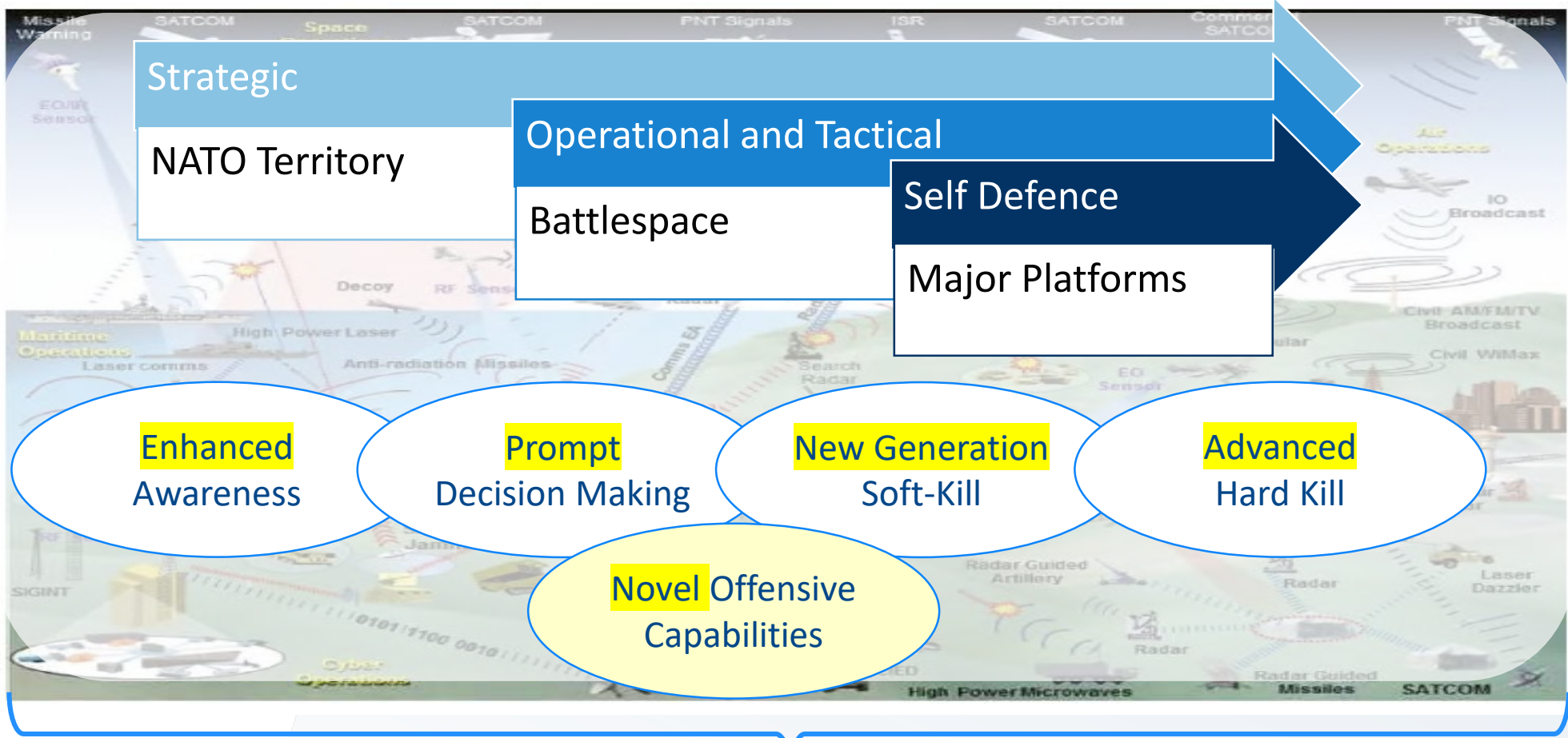
- In the future, a system for intelligentised operations might be composed of intelligent weapons and equipment, enabled by pervasive sensing, guided by real-time coordinated mission-planning systems to enable autonomous combat formation and swarm, human-machine integration, and autonomous operations across multiple domains (Liu, 2018).
- Potentially, the new combat methods that will arise as a result could include “latent warfare” (潜伏战), in which unmanned systems are deployed to critical targets or locations in advance to be activated when needed and “global rapid assault combat,” involving the employment of unmanned hypersonic space platforms that may enable new approaches to deterrence (Pang, 2017).

Future Engagement Space



- Global
- Multi Domain
- Congested
- Contested
- Dynamic
- Overwhelming for humans alone

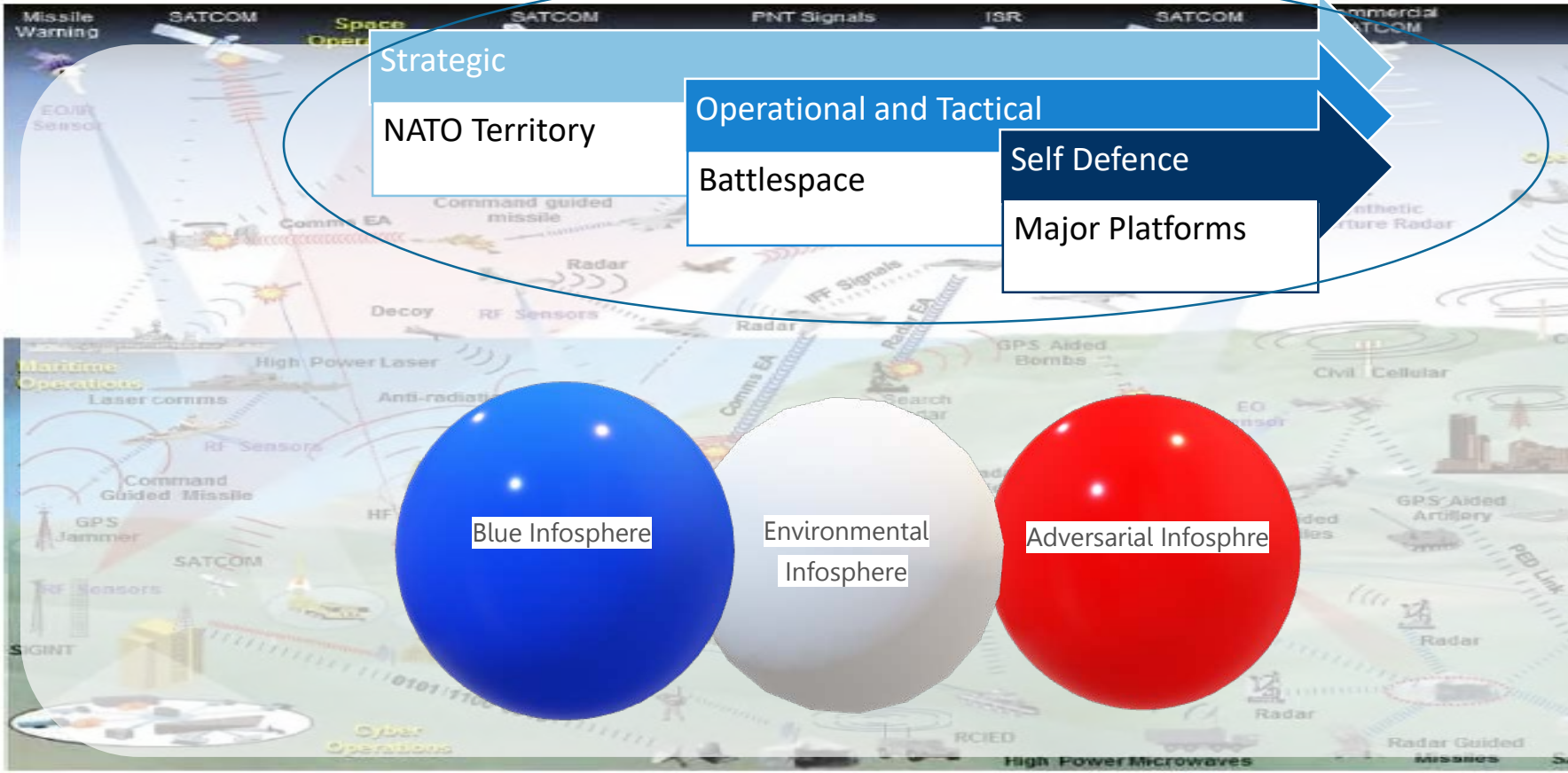
Defence



D O T M L P F I

Defence

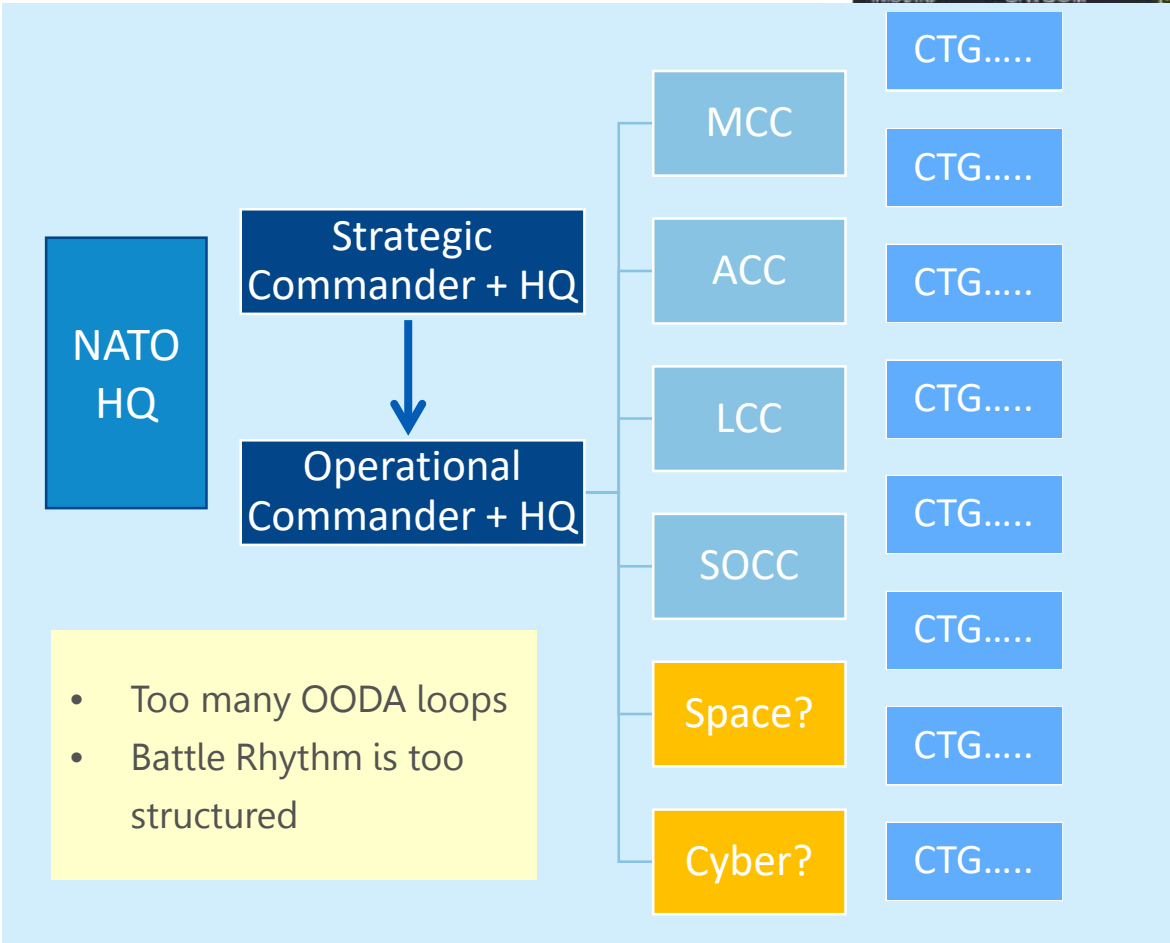
Enhanced Awareness



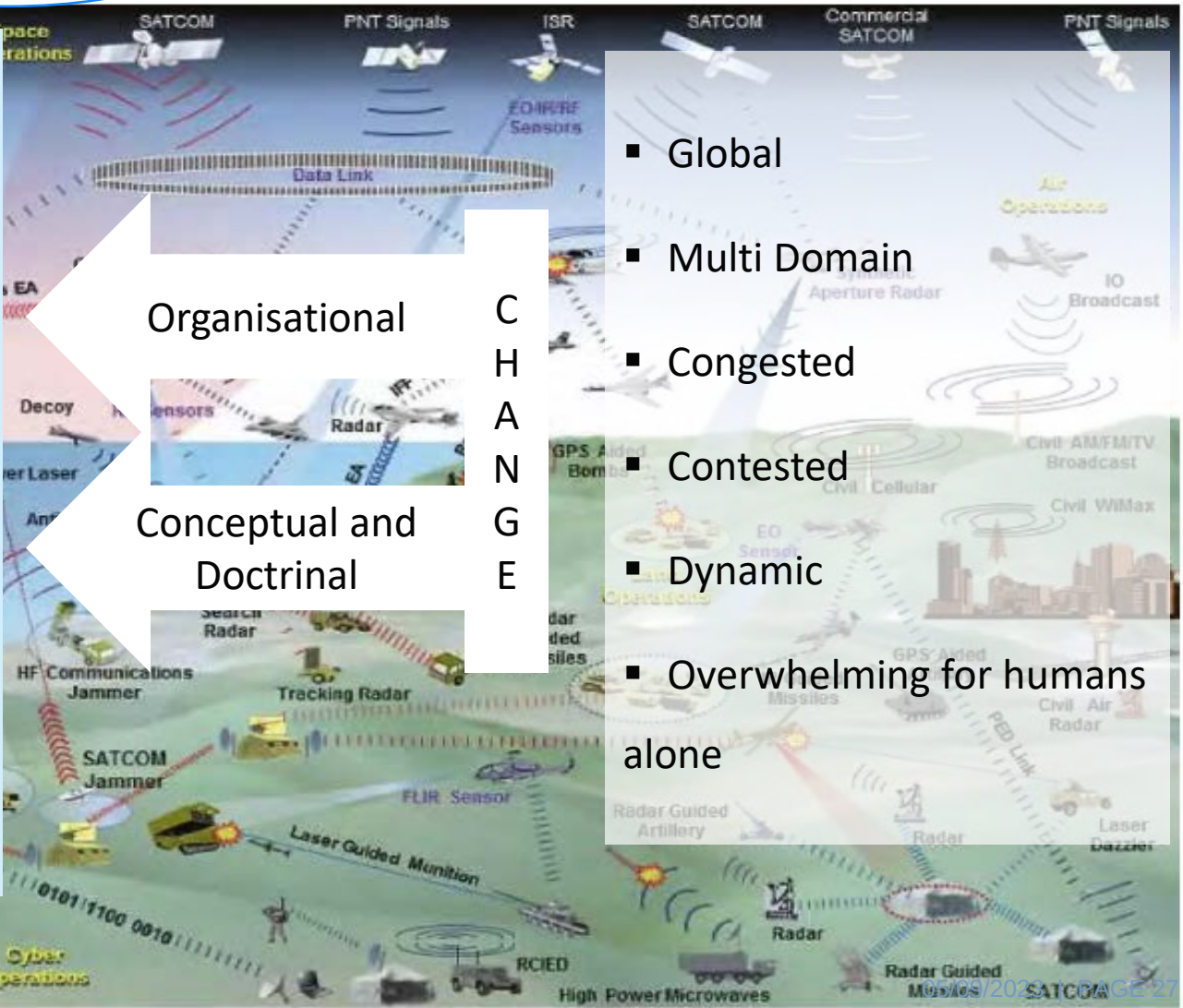
- Data Collection
 - Space Sensors
 - Distributed & Networked Sensors
 - Passive Sensors
 - Advanced Sensors such as OTHRs
 - UxVs
 - Quantum Sensors
- Comms
 - Space Comms
 - Distributed Ledger Technologies
 - Digital
- Digital Transformation
 - Architectures (NAF)
 - Digitalisation of processes
 - Data Storage and Exploitation
- Advanced Computing
- AI Applications
- System Security & Cyber Defence

Defence

Prompt
Decision Making



- Too many OODA loops
- Battle Rhythm is too structured

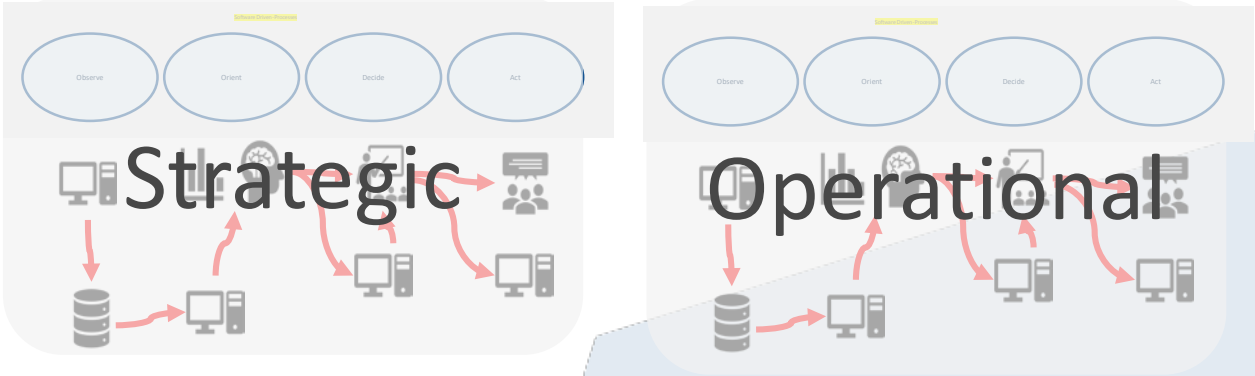


Organisational
Conceptual and
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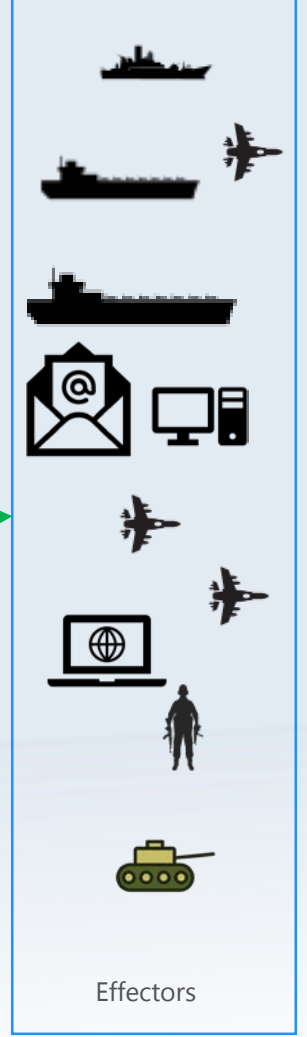
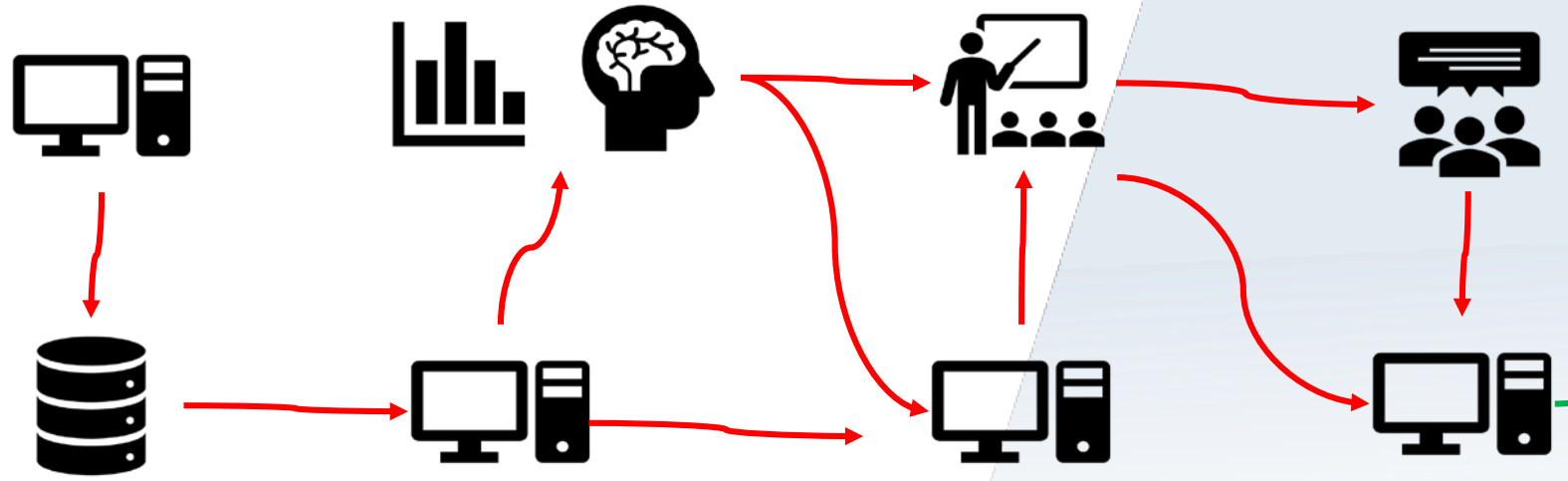
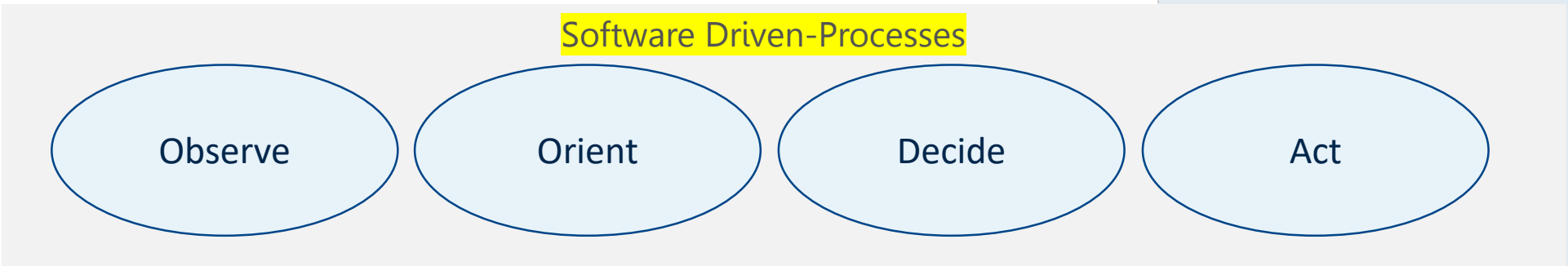
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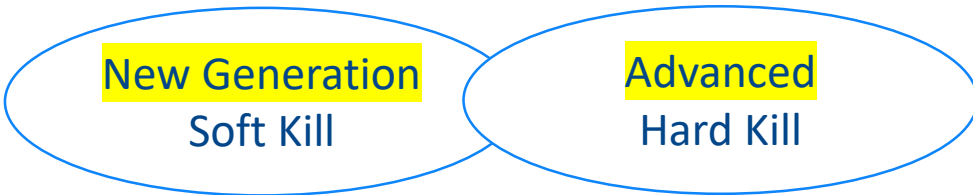
- Global
- Multi Domain
- Congested
- Contested
- Dynamic
- Overwhelming for humans alone

Prompt
Decision Making



Defence





Defence

Strategic

NATO Territory

- Cyber Defence
- Hypersonic Defence
- CBRN
- Instability Situations
- Counter Space
- Counter AI

Operational and Tactical

Battlespace

- Counter space
- Cyber Defence
- Counter UAV
- Force EW assets
- Force Hypersonic Defence
- Hybrid Force Composition and Formations (UxVs).

Self Defence

Major Platforms

- Automated and autonomous defence systems
- Networked Defence Systems
- Cyber Defence
- EW capabilities
- Directed Energy Weapons
- SAMs Missiles with higher speed and manoeuvrability
- Decoys present visual, heat and radar signatures
- Organic UxVs (MCM, ASW, ISR, Decoys, Counter UAV)
- Robotic exoskeletons, smart textiles, human enhancement





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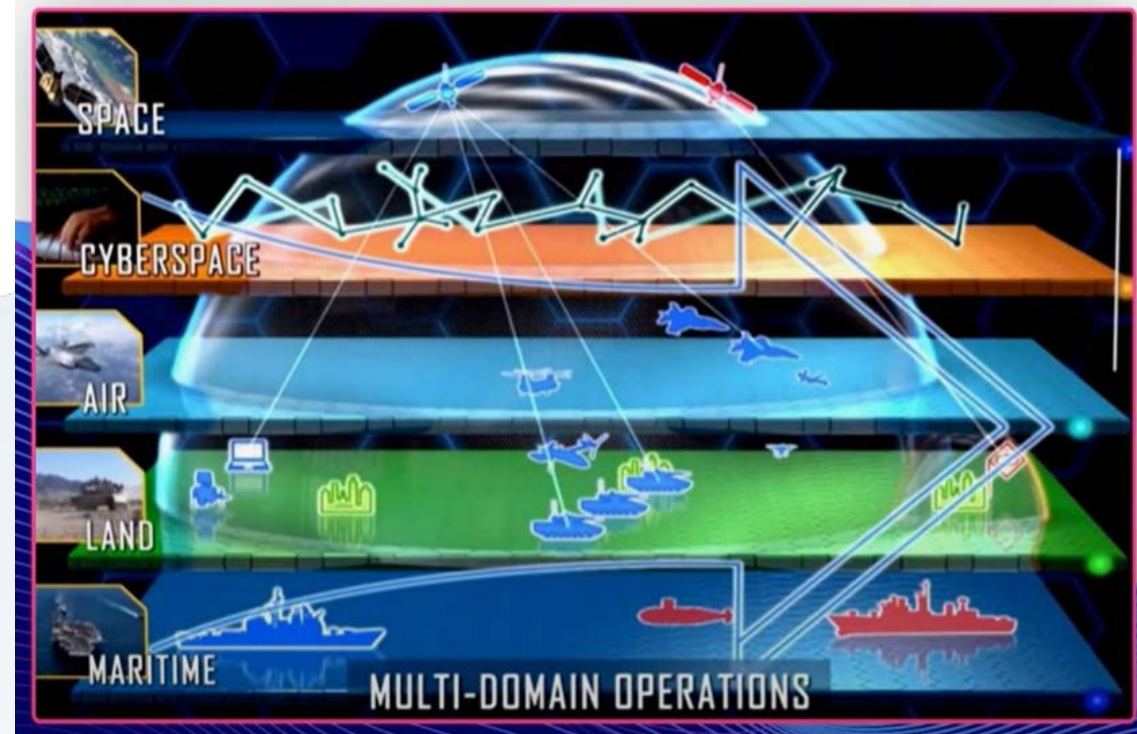
PHONE 0090 533 3611269

www.sto.nato.int



New Warfighting Concepts (Ways) – Multi Domain Operations

- ***“The orchestration of military activities, across all domains and environments, synchronized with non-military activities, to enable the Alliance to deliver converging effects at the speed of relevance”.*** (Working Definition)





New Warfighting Concepts (Ways) – DARPA's Mosaic Warfare

- The concept is called “Mosaic Warfare.” Like the ceramic tiles in mosaics, these individual warfighting platforms are put together to make a larger picture, or in this case, a force package.

