

The future of defence technologies: 10 trends and predictions to watch

The future is not what it used to be. Past predictions of how life would be in the 21st century included flying cars, wireless telephones and living on other planets. These were all to become commonplace. And while some of those predictions have come true, others are still evolving. Flying cars are still a focus of entrepreneurs,

smartphones and devices have changed the frequency and ways of communication and humans do inhabit outer space – not on naturally occurring planets but on a space station orbiting the Earth.





Our research highlights many trends in the technology and the defence landscapes. As a technology company, it's paramount that Hexagon makes technological advancements for customers' benefit and reinvests a large portion of revenue in research and development. Not all innovation is new; it may be taking an existing capability and applying it to a different use case. Hexagon does this across its divisions and across customer industries.

What are the predictions for the defence industry? Its ever-changing landscape means looking forward to several variables, including:

- **Threats**

Addressing different threats from state and non-state actors, economic conditions, public sentiment and new and outdated technology

- **Opportunities**

Leveraging opportunities from civilian knowledge, advances in technology, collaborative workspaces and more

- **Directions**

Alternating among peacekeeping missions, defence domain changes, political will and national public feelings

- **Technologies**

Maintaining out-of-date equipment past its supported and intended life as well as benefitting from advancements in other industries

To create this list, Hexagon looked to its global network of system integrators and partners to better understand what future trends, opportunities and areas of change will impact defence organisations. From enhancements to intelligence, surveillance and reconnaissance (ISR) systems to cutting-edge 3D surveillance, the list presents various technologies at different stages of maturity and adoption.

Here is a look at 10 technology trends defence agencies and organisations need to be ready for.

1 More sensor integrations and better data analysis for ISR systems

Intelligence, surveillance and reconnaissance (ISR) systems are expected to react more quickly, with more sensors collecting data, provide a wider range of products to consumers and have greater analysis capabilities. Defence IoT capabilities and numbers of sensors will continue to increase, focusing down to the position location information of individual service personnel. This additional data will be used tactically; however, when viewed at a strategic level, it often needs to have already been analysed with the results ready to present. Hexagon provides capabilities that can streamline and automate the ISR task management process and allow rapid, cloud-based intelligence sharing.

2 Rapid route planning and radar avoidance for UAVs

Drones (UAVs) are well established in the battlefield toolkit tactically and deployed routinely for short and longer-term missions. The scope of missions means there is a need to maintain visibility of targets of interest. The best way to do this is rapidly planning routes while working around geographical and political limitations and avoiding obstacles like radar.

Conversely, the detection and notification of an adversary's drones, both in an air space or maritime zone, are paramount to maintaining defensive advantage. Once a drone has been spotted and identified, the potential sensor systems on board can reveal targets of interest. This helps maintain an advantage by learning the adversary's interests.



Real-time video draping using LuciadLightspeed.

3

Better ballistic missile detection and launch ranges

In PWC's The Defence Trends survey¹, launching and detecting ballistic missiles is mentioned as an area of growing interest. While some nations are reducing capacity of these weapons, others are expanding in reach and readiness. In many use cases, Hexagon's Luciad platform has been used within mission planning, detection solutions and real-time aviation C2 systems. The 2D and 3D air space monitors sensor feeds to trigger alarms when a UAV enters a predefined area. This is intended to inform the operator or the responsible authorities to take further action.

1 PWC <https://www.pwc.com/gx/en/ceo-survey/2020/trends/defence-trends-2020.pdf>

2 <https://3dsurveillance.hexagon.com/products/blk247>

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Improving border security and critical infrastructure protection with 3D surveillance

Because of migrants leaving their home countries due to food and job shortages, wars, natural disasters and other factors, border security has become a key issue over the last few years. Securing a nation's borders is nothing new; however, today a "soft wall" can be employed. Detecting change along borders can show undiscovered routes, such as paths through grassland, spoil heaps from tunnels or tent settlements at a staging post. Remote sensing technology such as LiDAR or radar sensors can help identify very small differences, even from a long stand-off position. Combining video, thermal imaging and LiDAR into a single sensor, such as the Leica BLK247, introduces 3D surveillance helping analysts discern between [notifiable change and expected change](#)².

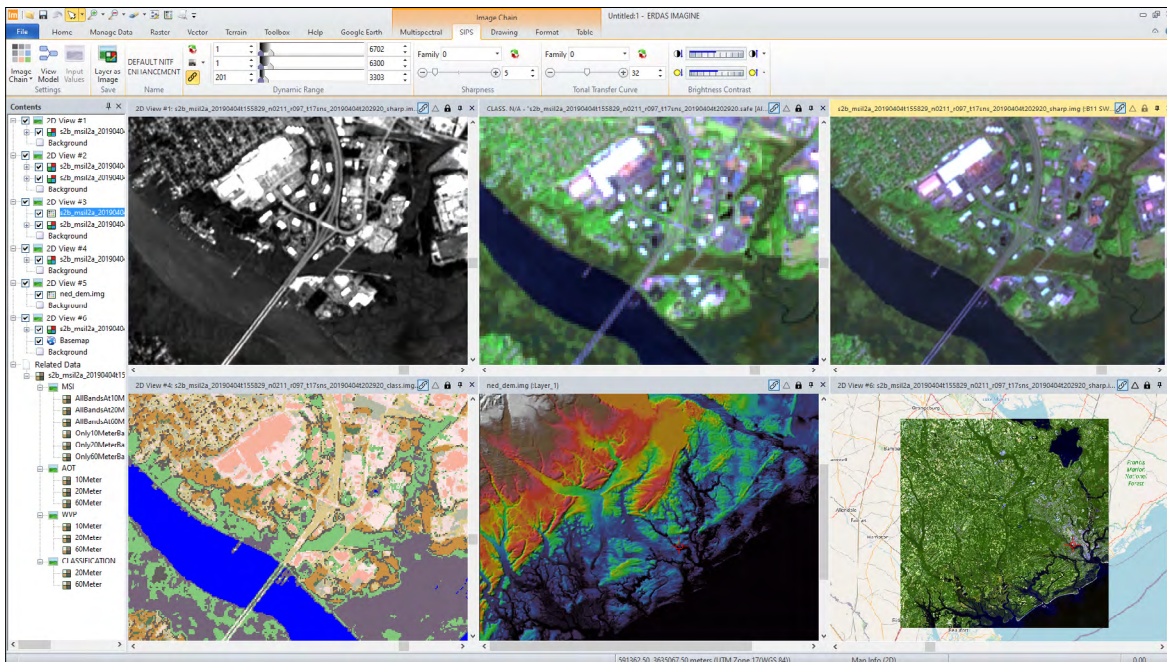
5

Expanding “space force” programs and commercial satellite data exploitation

Outer space is no longer the final frontier. Various nations have started space commands, recognising space as a domain of military importance and focus, along with maritime, land, air and cyberspace domains. While some countries have a space force, most are looking to make complete use of commercial data from existing satellites. Officials can monitor troop buildups or defensive activities with the help of frequent revisits over places of interest by constellations of satellites, whether small or CubeSats or long-term, large-mass satellites. The rising tide of data offers value in automated data retrieval, cataloguing and pre-processing, which notifies analysts of significant items or changes to leverage to adjust mission strategies. These satellite sensors and platforms capture civilian space knowledge that helps defence organisations secure themselves. Defence companies realise how “critical the space domain is and how it underpins not only military operations, but broader everyday activities.”³ Defence organisations can get a production boost from Hexagon’s remote sensing software, which can ingest, process and analyse many disparate data formats and sensor models from a wide variety of satellites.

Autonomous vehicles are being developed for numerous roles in defence and are heavily reliant on space-based capabilities. The navigation of these was highlighted by our customers as a near-term need, for instance maritime vessels making use of data such as maritime charts to route around wrecks, sand bars and weather events in real time. Part of this leads to autonomous decision-making for navigation but can extend to taking data from different sensors and sources to identify targets and decide which integrated weapon is best to use.

3 Air Vice-Marshal Paul Godfrey, Commander, UK Space Command
<https://www.raf.mod.uk/what-we-do/uk-space-command/>



ERDAS IMAGINE simplifies image classification and segmentation, orthorectification, mosaicking, reprojection, elevation extraction, and image interpretation.



Search for and create 2D and 3D military symbols using out-of-the-box defence symbology.

6 Using COTS solutions and common standards for multi-domain interoperability

Interoperability in terms of procedure, understanding and multi-domain integration is paramount for collaboration within a nation's defence organisations – internally as well as with multi-national defence agencies. For data, communicating via known standards and published interfaces means the time to collaborate can be vastly reduced and that information is transferred without translation errors. Another benefit is reduced costs by using more commercial-off-the-shelf (COTS) software rather than bespoke solutions. Because most COTS software is based on common standards, such as OGC or ISO, these standards are designed into the software.

This enables defence companies to “hot swap” solution components in a short time frame when the end of supported life is reached, providing the possibility of continuous upgrades. Across multi-domain solutions, interoperability such as common functionality and uniform symbology can ease integration, as joint operations are no longer seen as sufficient. Because defence companies often have a lower threshold for research and development costs than technology companies⁴, defence companies could get left behind if they are not using COTS technology. Hexagon's long-term involvement with civilian organisations such as Open Geospatial Consortium and support of defence standards are an important part of its research and development efforts to maintain interoperability of its COTS software.

⁴ PWC <https://www.pwc.com/gx/en/ceo-survey/2020/trends/defence-trends-2020.pdf>



Take the power of geospatial intelligence out of the office and into the field, from the frontline to city streets.

7 Harnessing tactical cloud capabilities

The advent of cloud computing is partly thanks to developments in defence research in the 1960s, such as the Defense Advanced Research Projects Agency (DARPA), and the expansion of the internet giving access to hosted solutions. While the defence industry led the development of cloud computing, adoption has been harder in deployment situations. A tactical cloud is now possible with lightweight, easy-to-use software hosted on transportable devices. A tactical cloud acting with automatic data crawling can remove data silos, giving a single catalogue view of data. Deployment can cause frequent issues in a multi-nation environment with frequent personnel changes, continuity of data access, knowledge and management. Having a combat cloud setup can help flag relevant data to any interested and permitted user on a connected device, regardless of media: mobile or fixed. As an example of Hexagon innovation, the repackaging of COTS software will give a tactical cloud capability for deployed units to use.

8 Securing mission-critical data with firewalls and encryption

Data security is the top trend of concern. An increase in connectivity and ease of sharing means an increase in weaknesses and potential for critical data leaks. Whether these are intentionally sought out via malicious cyberattacks or accidentally through a missent email, they need to be minimised through processes and technology. Having integrated data protection at the file level to protect at the data level, as well as at network “firewall” level, can help. Fine-grained data security can be implemented to encrypt file-level data or restrict certain users to distinct geographic areas of data. Grey war zones are where actors are trying to get an advantage over an adversary via non-combat methods. These have grown around digital data. This can happen via methods such as cyberattacks, espionage, disinformation on social media or unintentionally through spread of misinformation. Data and information should be traceable and assured as far as possible.

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Creating realistic digital twins and better UX

Most of the trends identified only exist due to the digitalisation of defence information. As part of this digital simulacrum, real world items, such as battlefields, ships or barracks, are being created. A “digital first” approach taken in data capture to ease updating these in near real time has given rise to digital twins. A digital twin is a current, accurate digital representation of the real world: a smart digital reality⁵. One large benefit and foreseen trend is simulation – being able to show what is, what was, what could be. Digital representations lend themselves to being altered with respect to time and different factors.

5 <https://hexagon.com/our-story/smart-digital-reality>

How the digital reality is presented to the end user is a concern. Data and information should be presented in a consumable manner for machine or human users whether in a 3D view, augmented reality or a bar chart. Often a 3D geographical view helps with information orientation. The 3D view will help a user familiarise himself or herself with the scenario and interrelated items. Likewise, when a human user is interacting with a system, the user experience (UX) should be easy. Having all the right information available is great if the user can access it easily. Functions, such as analysis, options or viewpoints, should not overwhelm the user with alternatives or be detrimental to the information within. Data, information and software should be given at the right place, at the right time and in the correct format to the relevant users. Hexagon is uniquely placed to provide the complete technology required to capture digital realities, manage and analyse the data, then present it to the end user. Users of Hexagon technology can quickly capture data, generate a digital reality and make the visualisation available to designated users through cloud-based processing and data store platforms.



Display cities as a digital twin in 3D.

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Using quantum computing to analyse and understand big data

Computing may make the world seem like a complicated place, but a lack of data sharing and generation of information would make it much harder. Could the adoption of quantum computing help defence get ahead of the big data deluge of the last few years and drive the demand for more data, in terms of velocity, value and volume? Quantum computing will significantly increase our capacity to solve some of the most complex computational problems. In fact, “quantum computing is said to be as different from classical computing, as a classical computer differs from the abacus”⁶. Utilising the power of quantum computing for defensive and offensive purposes will be of great importance.

6 NATO <https://www.nato.int/docu/review/articles/2021/06/03/quantum-technologies-in-defence-security/index.html>

Conclusion

“Change is the only constant in life” is a quote attributed to Greek philosopher Heraclitus. Whether that change is voluntary, enforced, reactionary or in preparedness, it will happen. The pace at which change occurs in the defence domain will only continue to increase.

Hexagon has a unique set of five core competencies: reality capture, location intelligence, positioning, autonomous solutions and design and simulation. Not only are these competencies critical to fusing the physical and digital worlds together to fully connect and leverage data that delivers information, but they are also perhaps the most dynamic and powerful use of data history because they form the foundation of today’s smart digital realities.

Contact us

To learn more about how our [defence technologies and solutions](#) support real-time situational awareness and mission-critical operations, [contact us](#) today.



Hexagon is a global leader in digital reality solutions, combining sensor, software and autonomous technologies. We are putting data to work to boost efficiency, productivity, quality and safety across industrial, manufacturing, infrastructure, public sector, and mobility applications. Our technologies are shaping production and people-related ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

Hexagon's Safety, Infrastructure & Geospatial division improves the resilience and sustainability of the world's critical services and infrastructure. Our solutions turn complex data about people, places and assets into meaningful information and capabilities for better, faster decision-making in public safety, utilities, defense, transportation and government. Learn more at [hexagon.com](https://www.hexagon.com) and follow us [@HexagonAB](https://twitter.com/HexagonAB).