European Parliament

Emerging disruptive technologies in defence

Emerging disruptive technologies (EDTs) can potentially revolutionise warfare. The EU and its Member States have recognised the importance of EDTs, launched several initiatives and dedicated substantial funds to EDT research and development (R&D). However, keeping up with China, Russia and the United States (US) in this area will be a challenge.

EDTs in defence

EDTs in the field of defence have the potential to revolutionise warfare as we know it. The European Defence Fund (EDF) Regulation defines a disruptive technology for defence as an 'enhanced or completely new technology that brings about a radical change, including a paradigm shift in the concept and conduct of defence affairs such as by replacing existing defence technologies or rendering them obsolete'. The NATO Science and Technology Organisation defines disruptive technologies as 'technologies or scientific discoveries that are expected to have a major, or perhaps revolutionary, effect on NATO defence, security or enterprise functions …'. The European Defence Agency (EDA) identifies six particularly disruptive technologies: quantum-based technologies; artificial intelligence (AI); robotics and autonomous weapons systems; big data analytics; hypersonic weapons systems and space technologies; and new advanced materials. The US adds directed energy weapons and biotechnology. EDTs for military purposes are being developed globally, in particular in China, Russia and the US. This has led to an arms race in their weaponisation, raising important ethical and legal concerns.

Comparing the EU with major global powers

When comparing the EU with major global powers, it becomes evident that Europe has a long way to go when it comes to defence innovation: most recent EDA data show that in 2020, EDA Member States only spent €2.5 billion on research & technology (R&T), amounting to only 1.2 % of total defence expenditure; this is despite the fact that, under permanent structured cooperation (PESCO) commitments, participating EU Member States have agreed to aim for 2 %. The US spends at least $14 billion on research and innovation (R&I), i.e. 2 % of the US defence budget. The Defense Research Projects Agency (DARPA) – a US agency responsible for defence innovation – alone had a $3.5 billion budget in 2021. Finding comparable data for China and Russia is difficult, owing to limited public transparency – China's R&T budget has been called a 'black box' or murky. A US Department of Defense report on military developments in China finds that the country seeks to dominate the EDT landscape, including AI, quantum technologies and hypersonic weapons systems. For instance, China already has operational HCMs and HGMs (see text box). Russia's specific defence budget allocation is also unknown. While Russia is unlikely to challenge the major players in EDT development and will continue to be affected by the fallout from sanctions, especially in the technology sector, it places much importance on EDT development. For instance, it already has operational HCMs and HGVs. It reportedly used a Kinzhal hypersonic missile in Ukraine, a first in combat; although not technically an HGV or HCM, it poses similar defensive challenges. The US has several hypersonic weapons programmes, which are, however, unlikely to be fielded before 2023. In the EU, only France is making significant efforts and investment in developing offensive hypersonic weapons. Facing these challenges, as the EU High Representative for Foreign Affairs,

Hypersonic weapons systems

Hypersonic missiles reach speeds at least five times that of sound. However, it is not only their speed (intercontinental ballistic missiles can already reach hypersonic speeds) and altitude that render them a threat: it is their manoeuvrability that is most disruptive. Serious development of hypersonic weapons technologies started in the early 2000s. Two in particular have far-reaching strategic consequences. **Hypersonic cruise missiles (HCM)** are boosted to hypersonic speeds by a high-speed air-breathing engine ('scramjet') after target acquisition. **Hypersonic glide vehicles (HGM)** are launched from a rocket and then speed towards their target. Because of their manoeuvrability, speed and flight path, these weapons are very difficult to detect and counter, evading even the most sophisticated radar and missile defence systems.

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Josep Borrell, notes, 'either we invest a lot on defence innovation or we will become defence irrelevant'. Aside from China, France, Russia and the US, India is the most committed to developing these technologies.

EU measures in the area of EDTs

At Versailles in March 2022, EU leaders committed to substantially increasing defence expenditure, investing in critical and emerging technologies and innovation for security and defence, and fostering synergies between space, civilian and defence innovation and research. These commitments were later reiterated in the Strategic Compass. The EU has launched several initiatives in the area over recent years:

European Defence Fund (EDF). The EDF allocates 4 % to 8 % of its annual budget to EDTs. In the first round of selected proposals (2021 call), over 5 % of the budget was allocated to EDTs, e.g. for the development of a next-generation electro-optical sensing device. In the 2022 EDF call, €40 million (4.3 % of the budget) is envisaged for EDT research, with another €54.1 million for non-thematic R&D for small and medium-sized enterprises, which could potentially also address EDTs.

Promoting synergies between civilian and defence R&I. Unlike many revolutionary innovations such as the internet, initially developed by the military, innovation in EDTs is mostly civilian-sector-driven. The European Commission action plan seeks to increase complementarity between EU programmes such as Horizon Europe and the EDF to leverage the disruptive potential of technologies at the intersection between space, defence and civil uses. A roadmap on critical technologies for security and defence outlines how the EU can enhance research, technology development and innovation in critical technologies and reduce strategic dependencies. It invites Member States to contribute to an observatory on critical technologies (currently being set up in the Commission) and encourages dual-use R&I at EU level.

EU Defence Innovation Scheme. With a financial envelope of €2 billion (€1.46 billion from the EDF, €90 million in co-funding from the Member States, and €400-500 million from other sources), the scheme supports innovation and entrepreneurship on essential technologies for the European defence industry. The Commission proposes, among other things, a dual-use incubator and a defence equity facility.

PESCO. Established in 2017 to deepen defence cooperation between its 26 Member States, PESCO can be used to coordinate EDT development. This approach has already been used by Member States to start developing relevant technologies, such as the hypersonic missile defence project TWISTER and Eurodrone.

EDA. The EDA has been involved in defence innovation since its inception in 2004; EDTs are one of its core research and technology activities. EDA has already delivered on EDT projects such as the EuroSWARM project, which tested and demonstrated effective use of unmanned swarm systems in an operational setting. Through its overarching strategic research agenda (OSRA), the EDA seeks to identify and evaluate EDTs and support related collaborative projects. It has developed an EDT action plan for further measures on EDTs. The EDA Defence Innovation Prize stimulates the engagement of mainly non-traditional defence R&T communities in generating innovative ideas.

European Defence Innovation Hub (HEDI). In 2022, an EU HEDI was launched within the EDA to enhance the agency's innovation activities, and catalyse new activities jointly with Member States and stakeholders. It was one of the Compass's first concrete deliverables. The first European Defence Innovation Day (31 May 2022) sought to spur innovation in EU defence, and foster synergies between defence and civilian innovation.

EU-NATO Cooperation. Both the Strategic Compass and the new NATO Strategic Concept mention EDTs as an area where deeper cooperation will be pursued, with experts deeming it an opportunity for EU-NATO cooperation. NATO has made large efforts in this area by launching the Defence Innovation Accelerator for the North Atlantic (DIANA), establishing a €1 billion NATO Innovation Fund and endorsing an EDT strategy.

European Parliament position

The European Parliament calls for particular attention to be paid to the impact of emerging AI technologies, including their potential malicious use, on security and defence. It underlines the importance of transatlantic cooperation on EDTs and calls on the EU and NATO to increase joint efforts to achieve and maintain global technological leadership in military capabilities. Moreover, Parliament calls for the EU to take the lead in global efforts to establish a comprehensive regulatory framework for AI-enabled weapons. Furthermore, a resolution on autonomous weapons systems stresses the need to start international negotiations on a legally binding instrument prohibiting fully autonomous weapons systems.