POLICY BRIEFING

DEFENDING AGAINST THE SMALL DRONE REVOLUTION: GERMAN–ISRAELI PERSPECTIVES ON NEW SECURITY FRONTIERS

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EXECUTIVE **SUMMARY**

- *The proliferation of small drones (sUAS) is transforming the security landscape in Europe and the Middle East, creating new operational, legal, and technological challenges for both military and civilian actors.*

- *Despite increasing incidents and institutional reforms, Germany's counter-drone (C-UAS) framework remains fragmented. Technical, legal, and coordination shortcomings continue to limit its ability to respond effectively to drone incursions over critical infrastructure and military sites.*

- *The war in Ukraine demonstrates how sUAS can redefine modern warfare highlighting the need for adaptive C-UAS capabilities.*

- *Due to the low cost, accessibility, and dual-use nature of sUAS their increased use by non-state actors and terrorist groups, such as those faced by Israel, is very likely.*

- *Israel's combat-proven innovation ecosystem and Germany's strong research, industrial, and regulatory base offer natural synergies for bilateral cooperation to tackle the C-UAS challenge.*

- *As drone technology evolves at unprecedented speed, both nations must pursue flexible, scalable, and interoperable C-UAS solutions.*

Cooperation between Germany and Israel in the field of Unmanned Aerial Systems (UAS) has been revolutionary, at least for the Federal Republic. With the leasing of Israel's Heron 1, the German Armed Forces (Bundeswehr) for the first time operated a medium-altitude, long-endurance (MALE) drone whose reconnaissance capabilities significantly enhanced the protection of German troops deployed abroad in Afghanistan and Mali. The subsequent procurement of the Heron TP and the long-debated decision in Berlin to arm these systems symbolized Germany's gradual departure from its traditional posture of strategic restraint toward a policy defined by security necessities.[1]

Today, Russia's war against Ukraine and the increasing number of reports on illegal drone sightings throughout Germany and Europe highlight a new phase of the "drone revolution", defined by small and often commercially available drones (sUAS). This revolution has fundamentally altered the security landscape. Consequently, driven by the rapid diffusion of drone technology, also to actors in the Middle East, and the accelerating pace of its technical evolution, countering these systems (C-UAS) has become a shared challenge for both Germany and Israel.

C-UAS and Small Drones: Definition

The definition of Unmanned Aerial Systems (UAS) remains fluid, reflecting the rapid evolution and diversification of drone technologies. The term encompasses a broad spectrum of platforms from conventional reconnaissance UAVs to loitering munitions which blur the line between missile and drone categories. NATO provides a useful orientation through its UAS classification system (Classes I-III), which groups systems by size, operational range and mission profile. Germany largely aligns its military standards with this NATO system. Israel does not formally adopt the classification, but Israeli UAS typically correspond to these categories in terms of their characteristics and operational parameters.

Table 1: NATO UAS Classification

Class	Category	Normal Employment	Normal Mission Radius	Normal Operating Altitude	Example Platform
Class III (> 600 kg)	Strike/Combat	Strategic	Unlimited (BLOS**)	Up to 65.000 ft	Reaper
	HALE	Strategic	Unlimited (BLOS)	Up to 65.000 ft	Global Hawk
	MALE	Operational /Theatre	Unlimited (BLOS)	Up to 45.000 ft	Heron
Class II (150 - 600 kg)	Tactical	Tactical Formation	200 km (LOS***)	Up to 18.000 ft	Hermes 450
Class I (<150kg)	Small (>15kg)	Tactical Unit	50 km (LOS)	Up to 5000 ft	Scan Eagle
	Mini (<15kg)	Tactical Subunit (manual or hand launch)	Up to 25 km (LOS)	Up to 3000 ft	Skylark
	Micro (<66J*)	Tactical Subunit (manual or hand launch)	Up to 5 km (LOS)	Up to 200 ft	Black Widow

*Joule: Maximum Energy
**BLOS: Beyond Line of Sight
*** LOS: Line of Sight

Source: NATO Joint Analysis and Lessons Learned Centre

This briefing focuses on the defense against small UAS especially of Class I characterized by high mobility, field availability, and the absence of fixed launch infrastructure or specialized control stations. FPV drones, which have drawn increasing attention in connection with the war in Ukraine, largely fall into NATO's "mini" category. Incidents involving critical infrastructure in Germany show that larger systems classified as "small" drones are also being deployed. In this briefing, both types will be referred to simply as small drones (sUAS). [2]

The related concept of Counter-Unmanned Aerial Systems (C-UAS) describes the integrated measures, technologies, and procedures used to detect, track, identify, and neutralize hostile or unauthorized drones. C-UAS capabilities combine sensors, electronic-warfare tools, kinetic interceptors, and legal-operational frameworks to mitigate the security risks posed by UAS in military and civilian environments.[3]

Increasing Frequency of Drone Incidents in Europe

The German Federal Criminal Police Office (BKA) recorded more than 1,000 suspicious drone sightings in 2025. These incidents occurred primarily over military installations, defense-industry sites, and critical infrastructure.[4]

Between 2021 and 2024, German airports reported 130 to 160 drone sighting annually. By August 2025 alone, this figure had already surpassed 140 reported cases, suggesting a continued upward trend.[5] Munich Airport was forced to suspend operations overnight in early October 2025, resulting in cancellation or diversion of dozens of flights and leaving roughly 3000 passengers stranded.[6] Similarly, Berlin Brandenburg Airport, experienced temporary closure following a drone sighting in October 2025.[7]

The phenomenon is not limited to Germany. Throughout Europe in 2025, several major airports have been temporarily closed or had flight operations suspended following drone sightings, like Copenhagen Airport and Oslo Airport in September 2025 or Brussels and Liege Airport in early November 2025.[8,9] The European Commission, having endorsed earlier calls by the Baltic States for a "drone wall," signaled that the initiative is intended not only to counter drones launched from beyond the EU's external borders but also to address the growing number of incidents at airports, which would include elements of small drone defense.[10]

Info

>1,000

In 2025, the Federal Criminal Police Office registered more than 1,000 suspicious drone flights across Germany.

-Federal Criminal Police (BKA)

While the frequency of drone incidents is increasing, attribution remains a major challenge. sUAS can be easily modified and operated from considerable distances. Their flight paths and control signals are often difficult to trace, and many models can be pre-programmed to follow GPS routes without live operator. Moreover, distinguishing between criminal activity, state-sponsored reconnaissance, and activist interference is rarely straightforward. This ambiguity complicates both deterrence and response. Given the consistency of flight patterns, targeted sites, timing and visual evidence security experts and European intelligence services now assesses with high confidence that many of these drone incursions are linked to Russian reconnaissance operations.[11]

The Ukrainian soldiers trained in Germany under EUMAM UA have been a clear target of Russian intelligence activities, including attempts to intercept mobile and electronic communications.[12] A recent example was the sighting of drones over the Bundeswehr base Gnoien near Rostock, where Ukrainian personnel were undergoing missile-defense training.[13] However, such drone operations also extend to critical infrastructure and military logistics hubs, reflecting the strategic role Germany would play as a key staging and supply center in the event of a broader conflict with Russia. Intelligence assessments suggest that German and NATO naval facilities along the Baltic Sea Coast are particularly affected.[14]

This concentration of unauthorized drone activity exposes significant shortcomings in Germany's counter drone posture. Challenges include the absence of an integrated national detection and response network; fragmented institutional responsibilities between the Bundeswehr, police and civil aviation authorities, limited sensor and radar coverage for identifying small, low-signature drones, and a lack of coherent strategy and procurement processes to rapidly field and coordinate C-UAS technologies across military and civilian domains.[15]

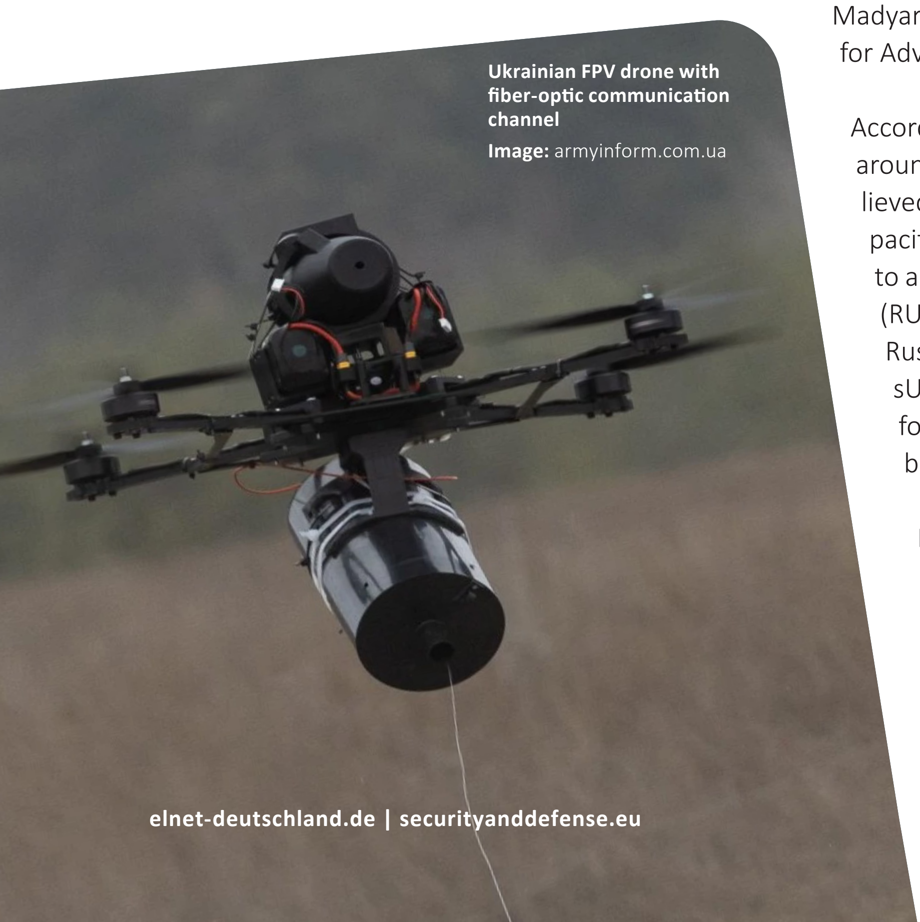
In its coalition agreement, the current government committed to establishing the legal technical and financial foundations for an effective

Drone ban sign at German shipyard
Image: Ein Dahmer / CC BY-SA 4.0 / via Wikimedia Commons

national framework for drone detection and defense, ensuring that both federal and state security authorities are equipped and authorized to conduct counter-drone operations.[16]

The deployment of the Bundeswehr in the domestic arena traditionally faces high constitutional thresholds. In response to the sUAS threat, the legislator has adapted the framework. Recent amendments to the German Aviation Act now allow for Bundeswehr assistance (Amtshilfe) to be approved at a lower level, enabling faster decision-making, at least in theory.[17]

In general, defending against drones in Germany remains a policing task, not a military one. The Federal Police has been assigned the lead operational role in in drone detection and drone response. This is underlined by the establishment of a dedicated specialized counter drone unit. Also in December 2025, the Federal Ministry of the Interior and state interior ministries agreed to establish a Joint Counter-Drone Centre in Berlin, tasked with creating a joint situation picture to enable faster and more coordinated decision making. Despite these steps, commentators argue that Germany's "Zeitenwende" in C-UAS has yet to come. To date, Germany and Europe have been spared of incidents involving armed drones of the type displayed in Ukraine.[18]



Ukrainian FPV drone with fiber-optic communication channel
Image: armyinform.com.ua

Lessons of the Russo-Ukrainian War: The End of NATO's Preferred Way of Fighting?

At the beginning of the Russo-Ukrainian War, the term "drone warfare" was largely associated with larger, medium-altitude long endurance (MALE) systems such as the Turkish-made Bayraktar TB 2 successfully used by Ukraine. Today, however, attention has shifted to sUAS whose rapidly evolving tactics and technologies have transformed the conflict. Small drones previously played a decisive role in reconnaissance and target acquisition, enabling highly precise artillery strikes on enemy armor and positions. Beyond intelligence gathering, these systems are now also employed as direct strike assets, either by dropping explosive payloads or operating as one-way attack drones in the form of FPV-Drones (First-Person-View-Drones) designed to destroy themselves upon impact.[19]

While the use of such drones in the early stage of the war was primarily driven by Ukrainian forces seeking to compensate for their quantitative inferiority in artillery and conventional air power, the deployment of sUAS has since become a central element of both conflict parties. The Battle of Pokrovsk is exemplary in this regard. Both Ukrainian and Russian forces employed dedicated elite drone units, such as Ukraine's 414th Unmanned Strike Aviation Brigade ("Birds of Madyar") and Russia's "Rubikon Unit" of the Centre for Advanced Unmanned Technologies.[20]

According to 2025 estimates, Ukraine produces around 200,000 drones per month. Russia is believed to have reached an annual production capacity of up to 2 million FPV drones. According to a report of the Royal United Services Institute (RUSI) from February 2025, 60 to 70 percent of Russian losses of military systems come from sUAS. Drones are now estimated to account for 70 percent of the casualties across both belligerents.[21]

Faced with the threat, both sides use kinetic (e.g. shotguns), physical (e.g. cages for tanks and anti-drone nets) and electronic means to counter drones. Estimates suggest that in 2024, up to 75 percent of drones used were destroyed by jamming the GPS or communications systems.[22] As a reaction, both parties have increasingly reverted to Cold-War-era control technologies by deploying drones guided by fiber optic cables, which make them resistant to jamming. Especially Ukraine is increasingly relying on AI-enabled systems that allow autonomous target identification, navigation, and strike execution even under conditions of GPS disruption and communication loss.[23]

Info

75 percent

In 2024, up to 75 percent of drones used in Ukraine were destroyed by jamming the GPS or communications systems.

-Royal United Services Institue (RUSI)

Attack drones have fundamentally disrupted Russia's traditional combined-arms doctrine, which relies on coordinated maneuver between armor, infantry, and artillery under centralized command. Constant aerial surveillance by Ukrainian drones has made it nearly impossible for Russian units to conceal movement or mass forces undetected. Likewise, the war raises a fundamental question for NATO. Will sUAS challenge the alliance's preferred method of warfare, Maneuver Warfare? Security experts are divided. Some argue that NATO's superior command integration, electronic warfare capabilities, and airpower should allow it to achieve air superiority, thereby mitigating the tactical impact of small drones. Others caution, however, that the proliferation of FPV and loitering systems across modern battlefields will inevitably constrain maneuver, expose logistics, and complicate concealment even in highly networked Western forces.[24]

NATO intelligence assesses it as plausible that Russia could attack NATO territory within this decade, underscoring the urgency of adapting to an adversary that has drawn institutional lessons from the war in Ukraine and established a dedicated „Unmanned Systems Force"- highlighting the central role of sUAS in a future confrontation with the alliance.[25] For many defense experts, the key to preserving NATO Maneuver Warfare lies in developing effective C-UAS capabilities that protect mobile forces from constant aerial surveillance and precision strikes. This view is shaping the design of the German-French Main Ground Combat System (MGCS), where integrated C-UAS is one of the eight pillars of the project.[26]

The rapid evolution of drone technology in Ukraine illustrates that there is no good single solution for C-UAS. Defensive operations become even more complex outside conventional wartime conditions, where overall readiness levels are lower and legal or procedural constraints may restrict the engagement of aerial targets. This challenge is particularly evident in civilian contexts and asymmetric conflict environments, such as those faced by Israel.[27]

The Calm Before the Storm? The Threat of sUAS Diffusion in the Middle East

Hamas has utilized sUAS equipped with improvised explosive devices and grenades in its combat operations. Open-source reports and video evidence show these drones being used to drop small explosive charges or

Reconnaissance drone of the Israel Defense Forces
Image: IDF Spokesperson's Unit / CC BY-SA 3.0

grenades on Israeli border surveillance towers and observations posts, most notably during the October 7, 2023 attack.[28] Similar incidents have been documented against Israeli ground forces, such as in northern Gaza's Jabalia area, resulting in several casualties.[29] Nevertheless, in the Hamas-Israel war, armed sUAS have played a limited role and did not shape the IDF's approach in Gaza. Instead, Israeli operations were characterized by a more traditional combined arms approach in dense urban terrain, integrating armored units, infantry, artillery support and air-delivered firepower.[30]

The IDF use FPV drones intensely, however mainly for reconnaissance. Their employment as armed FPV strike platforms has been relatively restrained. Nevertheless, media reports indicate selective modifications of commercial drones for delivering small payloads in specific operations. In August 2025, Israel's Ministry of Defense ordered several thousand FPV systems from the manufacturer Xtend, which can be equipped with munitions, signaling a scaling of capabilities on the tactical drone front.[32]

Analysis from the West Point Counter Terrorism Centre argues that because FPVs are inexpensive, easy to modify, and accompanied by abundant open-source construction guides, they bear the potential for rapid diffusion to violent extremist organizations and terrorist groups.[33] Especially the proliferation of armed drones guided fiber optics signify a great potential threat due to their resistance to jamming which is often a preferred mode to counter drones in civilian environments.[34] Experts from Israel's Institute for National Security Studies (INSS) warn that FPV drones are not just capable of changing the open battlefield as seen in Ukraine but also change close combat dynamics typical for the Hamas-Israel war and counterinsurgency operations closer to the IDF's operational reality. According to the experts, the IDF must therefore treat FPV drones as an operational opportunity and as a threat requiring doctrinal and technical adaption.[35]

Drone Detection and Drone Neutralization

Several complementary methods are used for drone detection, each with specific advantages and limitations in terms of range, accuracy, and operational conditions. The most common ap-

Table 2: Examples of Detection Methods

Type	Range	Characteristics	Accuracy	Advantages	Limitations
Audiobased	Short	Multi-directional microphone array	Variable	Detects drones buzzing sound waves	Short range, noise interference
Videobased	Medium	High-distance image capture	Moderate-Low	Goof resolution image capture	High detection failure
Motionbased	Short-Medium	Motion and speed detection	Acceptable	Detects drones among flying objects	Short Range
Thermalbased	Medium	Heat detection	High-Low	Accurate at detecting fixed wing drones	Inacurate at detecting smaller quad-copters
Radarbased	Medium-Far	Heat, motion and noise detection	High-Moderate	Highly accurate at detecting large and medium drones	Inaccurate at detcting small drones
RF-based	Medium-Far	Radiofrequency signal detection, interception	High-Moderate	Succesful at detecting and intercepting signals	Prone to signal interference, unable to detect higher and lower frequencies

Source: The Airpower Journal

proaches include audio-based, video-based, motion-based, thermal-based, radar-based, and radio-frequency (RF)-based systems (see Table 2).[36]

Audio and video detection are effective at short ranges and in line-of-sight environments but susceptible to noise and weather interference. Thermal sensors can identify drones under low-visibility conditions but are limited by distance and background heat sources. Radar offers the most reliable long-range coverage yet struggles to distinguish small, low-signature drones from birds or clutter. RF detection, by contrast, can intercept control and telemetry signals, providing early warning and identification, but becomes ineffective against autonomous or pre-programmed drones operating without active communication links.

Table 3: Examples of Neutralization Methods

Countermeasure	Effect on Target	Limitations
Direct Fire	Destruction	Size of targets, Number of targets, Visibility
Hunting Drones	Destruction	Number of targets, Visibility, Inherent drone weaknesses, Deployment time
Missiles	Destruction	Costs
Laser Weapons	Destruction	Atmospheric conditions, Smokescreens, Target's coating
Microwave Weapons	Disabling	Sealing of electronics
Electronic Jamming	Disabling, Control Taking (Spoofing)	Sealing of electronics, Fiber Optic Drones
Defending Drone Swarm	Individual Destructions Swarm Disruption	Lack of accurate responses, Deployment time

Source: The Airpower Journal

Countermeasures applied against drones are equally diverse, ranging from direct fire and interceptor or "hunting" drones to missile systems, laser weapons, microwave technologies, and electronic jammings (see Table 3).[37] Each of these methods is subject to specific operational and technical limitations. Direct fire and interceptor drones are effective at short range but require accurate tracking and pose risks in urban or civilian areas. Missile systems provide longer range engagement but are costly and often disproportionate for small, low-cost targets. Laser weapons allow precise, low collateral damage engagement but their performance depends on clear atmospheric conditions and stable target tracking. Microwave weapons can neutralize multiple drones simultaneously yet remain limited by power requirements and collateral electromagnetic effects. Electronic jamming is widely used but less effective against autonomous or fiber optic guided drones and can cause interference with friendly systems. As with detection, layered combinations of these approaches generally provide the most resilient C-UAS capability.

C-UAS Ecosystem in Germany and Israel

Israel's C-UAS sector has evolved through decades of continuous operational demand. Its defense industry integrates large, established firms such as

Rafael Advanced Defense Systems, Israel Aerospace Industries (IAI), and Elbit Systems with a dynamic network of smaller startups specializing in drone interception, sensor fusion, and AI-assisted threat classification. Israel's operational approach emphasizes rapid integration of battlefield experience, short procurement cycles, and adaptive layering of sensors and effectors across civilian and military domains.[38]

In Germany, research institutes such as the Fraunhofer Institute for Communication, Information Processing and Ergonomics (FKIE) and German Aerospace Center (DLR) play a major role in developing sensor networks and electronic countermeasures.[39] Germany actively supports research and innovation in C-UAS technologies through several civil and defense programs. The DLR operates a national drone research and testing site in Cochstedt (Saxony Anhalt), where C-UAS concepts and detection systems are developed under realistic conditions.[40] In 2025, the Federal Agency for Disruptive Innovation (SPRIND) launched a dedicated challenge supporting autonomous, non-kinetic C-UAS solutions.[41] The Bundeswehr also invests directly via the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw), commissioning national companies to develop and test drone-defense systems.[42]

The C-UAS landscape in Germany is marked by significant dynamism. A growing number of German companies are active in developing and marketing counter-drone systems. The following overview presents a selection of Israeli and German C-UAS currently on the market (see Table 4):

Table 4: Examples of German and Israeli C-UAS Systems

System	Country	Manufacturer	Type	Primary Method
ASUL[43]	Germany	Hensoldt, Rohde & Schwarz	Integrated	Radar-based drone detection, RF detection and signal intelligence to identify control and GNSS signals, electro-optical and infrared sensors for target verification, soft-kill effects through jamming, and optional integration of non-kinetic and kinetic effectors
Drone Dome[44]	Israel	Rafael	Integrated	360° radar, EO/IR sensors & RF jammer; optional laser for counter-UAS
Horizon[45]	Israel	Sentrycs	Detection	Monitoring of RF environment
ReDrone[46]	Israel	Elbit Sytems	Integrated	Multifunction radar, SIGINT sensors and EO camera with RF jamming (EW) and optional laser
Skylord[47]	Israel	XTend	Neutralization	FPV-controlled mini-drone intercepts hostile drones in flight using a deployable net
Skyranger[48]	Germany	Rheinmetall	Integrated	Vehicle-mounted integrated air defense and C-UAS system with a 30 mm cannon using programmable ammunition for kinetic hard-kill, 360° radar/EO coverage, automatic target tracking and fire control
Tytan Interceptor[49]	Germany	TYTAN Technologies	Integrated	Tracks and physically disables hostile drones using AI-driven autonomous collision kinetics, neutralizing targets through high-speed impact without explosive payloads

Outlook

The rapid proliferation of small Unmanned Aerial Systems (sUAS) is transforming security environments worldwide. Germany and Israel, both exposed to evolving drone threats, share a strategic interest in developing effective Counter-UAS (C-UAS) capabilities. As drone technology evolves at unprecedented speed, both nations need systems that are flexible, scalable, and interoperable across defense and homeland security missions. While Israel's defense industry benefits from decades of operational experience and agile innovation cycles, Germany offers strong research institutions, regulatory expertise, and industrial capacity. These complementary strengths create a powerful foundation for deeper bilateral cooperation in C-UAS technology including joint testing and training. Joint defense tech hubs focused on drone technologies would further evolve and strengthen the cooperation.[43]

Israeli C-UAS technology has been evaluated in Germany, and there is deep and ongoing cooperation between German and Israeli companies in the fields of radar and sensor technologies applicable to small object detection. At the political level, German decision makers have repeatedly emphasized the importance of learning from Israel's operational experience in drone defense. However, these efforts remain insufficient and should be consolidated into a more structured and comprehensive bilateral approach given the size of the problem. Germany's role as the leading European supporter of Ukraine allows it to acquire critical insights into C-UAS in high intensity combat, making a partnership with Germany particularly valuable for Israel should small drones become increasingly relevant on future battlefields in the Middle East.

The successful drone partnership between Germany and Israel, proven with Heron, should now be carried forward into the era of the small drone revolution.

Info

THE ELNET SECURITY & DEFENSE INITIATIVE (ESDI)

Security policy cooperation between Germany and Israel has a long history. The ELNET Security & Defense Initiative (ESDI) was launched in July 2025 to explore new avenues of cooperation in the face of global threats and technological upheaval. The initiative aims to deepen strategic dialogue, tap into joint innovation potential, and place the German-Israeli partnership on a sustainable, structurally sound footing.

European Leadership Network (ELNET)

MORE INFORMATION ON THE ESDI

Image: ELNET/Tobias Koch

ELNET

ESDI ELNET SECURITY & DEFENSE INITIATIVE

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