A Quantum Leap in Electronic Warfare Training

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Background

Rapidly evolving threats on the electronic battlefield pose daunting challenges to modern air forces. Air combat crews must be prepared to complete their objectives in the face of increasingly sophisticated long-range radars, surface-to-air missiles, and electronic countermeasures. These systems, with their flexible, digital operating systems, are able to easily and swiftly change their operating parameters, implementing different modes during times of relative calm, tension, and conflict. While 4^{th} and 5^{th} generation fighter aircraft have sophisticated onboard systems to assist in coping with the latest threats, they are unable to practice effectively against legacy training systems, which cannot properly emulate them. If air forces are to be prepared, then It is imperative that they train in a realistic environment that accurately recreates the air defense systems they are likely to face.

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Scorpius-T is based on ELTA’s breakthrough achievements in staring multibeam wideband Active Electronic Staring Array (AESA) technology for EW. AESA supports an extremely flexible architecture that facilitates multiple system configurations using the same basic building blocks for easy, effective optimization to specific Customer operational training requirements. And of no less importance than scalability, AESA

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AESA EW: Game Changing Technology

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The use of wideband AESA technology endows Scorpius-T with multi-beam operation and fast beam steering capability, which enable the simultaneous engagement of multiple aircraft in support of large scale, complex exercises. Moreover, AESA's wideband frequency coverage gives Scorpius-T the flexibility to emulate many emitter types and modes: search, acquisition, tracking and illumination. Wideband multi-beam staring reception by the system's embedded high sensitivity spatial

receiver enables Scorpius-T to assess the responses of airborne radar and self-protection jamming systems. Finally, software defined programming of the emulator by the user, enables the quick adaptation of new waveforms and emulator behavior, ensuring up to date training against the latest threats.

AESA technology provides a tremendous increase in receiver sensitivity, effective radiated power (ERP), and scan rate – far exceeding earlier EW solutions. This enables Scorpius-T to emulate modern air defense radars that employ fast electronic scanning and advanced modes such as simultaneous search and track as never before seen in EW trainers.

The ability to efficiently reproduce the threats and radar modes, legacy and modern, encountered in today's aerial battle arena and transmit tailored signals directly toward participating training aircraft ensures the most realistic, signal-dense, multi-threat, multi-platform training environment available for aircrews and EW operators. These same capabilities also support EW system testing and evaluation.

Effective Preparation

Scorpius-T is equipped with an operator friendly mission planning tool that enables easy programming of the threat parameters database into the system. Scorpius-T provides the operator with complete control over both the emitted signals and the threat logic cycle. The combination of easy programmability and a readily updateable database ensures that the system consistently delivers realistic and up-to-date training.

The flexible operating system provides users with the ability to efficiently implement the various training scripts and rules of engagement. The latter are defined by programmed waveforms, mode transitions, time in each mode, reaction to

maneuvers and to jamming. During operation, the system implements internal logic together with the pre-defined rules to determine mode, transmission pattern. Scorpius-T's unique capabilities support diverse training scenarios that challenge fourth and fifth generation fighter aircraft equipped with advanced radar and EW systems. Pilots experience a close simulation of the actual threat – effecting cockpit alerts as if the aircraft was being engaged by an advanced missile system.

In contrast to legacy threat emulation solutions, Scorpius T enables full formations to train together and hone their operational skills as a group. Scorpius-T's multi-beam AESA technology emulates the multi-beam concept of operation employed by technologically advanced air defense systems to simultaneously engage multiple targets.

Let the Training Begin

The exercise commences – fighters, unmanned aircraft, Airborne Early Warning (AEW)/Signal Intelligence (SIGINT) platforms, and helicopters move through the arena according to their scripts. Multiple threats engage them and surprises such as missile attacks are introduced. Scorpius-T reacts quickly, updating threats in the shifting scenario while the highly sensitive AESA receivers continuously evaluate the aircraft Electronic Countermeasures (ECM) response. Conversely, ECM can also be transmitted against aircraft radars to test pilot reaction.

Upon completion, the participants review their performance in an in-depth post-flight debriefing and analysis utilizing the system's extensive recording capabilities. This session includes mission highlights and "what-if" analysis geared towards improving flight tactics, the use of on-board systems, and more.

Ready for Deployment

Scorpius-T is easily deployed from a single off-road vehicle. The system is operated via a standard Ethernet interface and is easily controlled from a remote location using wireless Ethernet communications. Units can be combined for networked operation. Several emulators can be integrated by interfacing to a centralized command and control, enabling them to work together in an orchestrated manner in accordance with the selected training scenario.

Finally, the system is easily maintained. Extensive Built-In-Test (BIT) gives the system the capability to self-check the operability of all functions. BIT is performed periodically and can also be initiated by the operator. Modular design makes any necessary servicing simple and efficient.

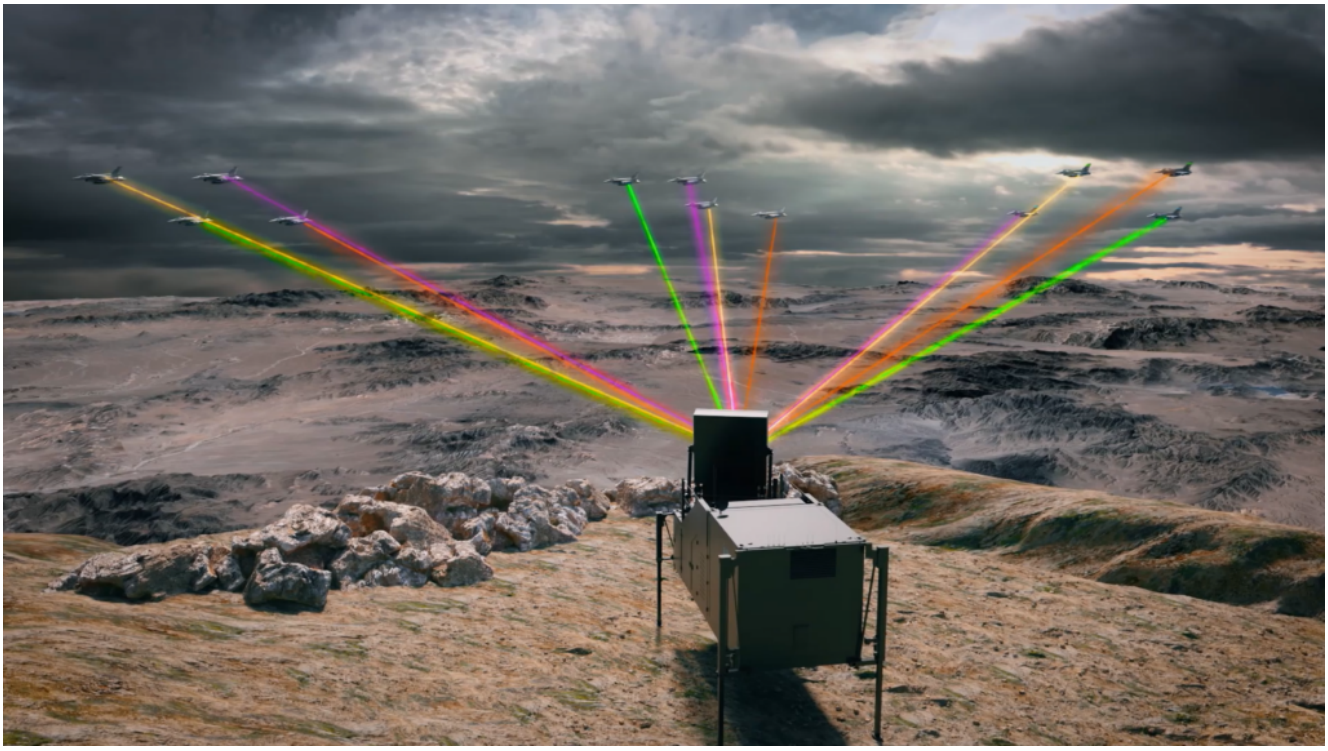
With the ability to prepare air crews to contend with the latest threats, Scorpius-T represents the apex of ground-based threat emulator solutions. Moreover, its advanced capabilities have already been proven in extensive field testing. The system’s first publicized deployment took place in October 2021 at the Israeli Air Force’s biannual Blue Flag exercise. Attended by seven air forces from around the world, this event constituted the first ever live combat training against new, advanced air-defense threats.

Meet the Family

Scorpius-T belongs to a family of advanced EW solutions that incorporate ELTA's trailblazing AESA EW technology and unique processing techniques. These include: the land-based Scorpius-G EW System; the naval EW System, Scorpius-N; and two airborne systems – Scorpius SP for self-protection, and Scorpius EJ for escort jamming.

Scorpius-G (ELL-8256SB) is a powerful ground-based system designed for long-distance RF Electronic Countermeasures (ECM). Scorpius-G performs accurate, multi-beam, multi-technique electronic attack against advanced fire control radars, search radars, AEW radars and SAR radars. In addition, the system provides high performance Electronic Support Measures (ESM), continuously intercepting and tracking hostile electronic emissions, and building a detailed Electronic Order of Battle (EOB). Mounted on a rotating pedestal, which can be deployed from a single rugged all-terrain vehicle, Scorpius-G is able to bring its advanced capabilities to bear even in tough weather conditions and difficult terrain. Moreover, networked operation enables multiple Scorpius-G units to create a unified protective umbrella over a wide geographical

area, securing critical areas and facilitating the maneuver of large mobile units.



Scorpius-N (ELL-8256SB) is ELTA's powerful shipborne EW suite combining advanced Electronic Countermeasures (ECM) and Electronic Support Measures (ESM) capabilities. It comprises four conformal antenna array panels, each housing transceiver arrays that cover a wide frequency range, a control unit for processing and managing operations, and an operator console that includes maintenance and training functions. Scorpius-N provides naval forces with the critical tools needed to contend with current and future threats.

Highly developed multi-beam, multi-technique power management capabilities enable Scorpius-N to efficiently jam multiple emitters, including all types of radars and RF missile seekers. The system detects and then tracks, engages and jams multiple threats over a wide geographic sector to create a protective hemisphere around naval forces. It will disrupt the operation of long-range, sea anti-ship skimming missiles before they close range and lock on to the vessel.

Scorpius-N employs ELTA's "Intelligent ESM" technology to

generate an automatic Electronic Order of Battle (EOB), including emitter classification, and deliver a comprehensive situational awareness picture of the electromagnetic environment. It also supports radio-silent operation by providing an Emission Control (EMCON) mode, whereby the ship enters a fully passive mode for situational awareness.

Scorpius technology allows for exceptionally high EW performance in a small form factor – advantages that enabled the development of the **Scorpius-EJ (ELL-8251SB)** and **Scorpius-SP (ELL-8222SB)** systems. Designed for deployment from fighter and transport aircraft, these systems deliver unprecedented capabilities relative to their respective size and weight class thanks to AESA and GaN technologies.

Scorpius Escort Jammer (EJ), the larger of the two, is designed to suppress all types of air surveillance and fire control radars, creating a safe corridor along a mission flight path. This flexible system can be installed as a pod on the centerline station of a fighter aircraft. Transport and support aircraft can accommodate the pod on an external mount and a version configured for internal installation is also available. The pod configuration employs a RAM air turbine to generate additional internal power.

Scorpius-EJ covers a wide frequency range. Its transceivers provide 360° coverage, while AESA based multi-beam electronic steering is used for independent directional transmissions, enabling simultaneous jamming of multiple threats. With its exceptionally high RF sensitivity, high effective radiated power (ERP), and time/frequency selectivity, Scorpius-EJ provides unmatched detection and suppression capabilities even in dense emitter environments. The user-friendly system is easily programmed from the flight line for mission adaptability. Moreover, customer furnished threat libraries and jamming techniques are readily updateable by the customer to keep up with the latest developments.

The little brother of the EJ, Scorpius-SP is designed to provide advanced protection to individual aircraft. This cutting-edge Electronic Countermeasures (ECM) pod, like all members of the Scorpius family, exploits the advantages of AESA technology to achieve high sensitivity target detection and the transmission of accurate narrowly focused high-power directional beams. Mounted within ELTA's proven, compact, lightweight, low drag pod configuration, which is similar in contour to an air-to-air missile, the system can be installed on all wing stations. Scorpius-SP provides the most effective target jamming capability available today in self-protection pods.

ELTA, together with its parent company, IAI, the largest defense and aerospace company in Israel, offer a wide range of platforms – from strategic ISR satellites, multi-mission aircraft and UAVs, to tactical drones and ground systems – as well as an extensive portfolio of high-performance, field-proven payload solutions covering integrated Electronic Warfare (ESM/ECM), Radar, Electro Optical/Infrared (EO/IR), Imagery Intelligence (IMINT), Launch Detection Systems (LDS), Synthetic Aperture Radar/Ground Moving Target Indication (SAR/GMTI), Signal Intelligence (SIGINT), and cyber.

The ability to deliver a comprehensive range of game changing solutions at the tactical and strategic levels, as epitomized by the entire Scorpius EW family, is a key factor in ELTA's ability to maintain its position as a global leader in defense systems.

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