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Embracing Big Data and AI Strategically

The Digital Transformation of the Israel Defense Force

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ABSTRACT

The Israel Defense Forces (IDF) is leading a concentrated push to strategically transform into a network-enabled combat machine. Integrating the Israeli Air Force with the land forces, navy, and military intelligence into a common digital architecture has been the defining feature of this effort, with artificial intelligence (AI) positioned as a centerpiece enabler of IDF strategy. AI is contributing to delivering a unified combat network by connecting large databases, a vast array of sensors, and other hardware to drastically compress sensor-to-shooter timelines. Significant progress has been achieved through the Momentum multi-year IDF force build-up program, initiated in 2020, in optimizing real-time intelligence-sharing and harmonizing interactions between operational units across multiple IDF commands. It is not just AI by itself but, more broadly, the embrace of 'big data' that represents a game-changer for Israel. The transformative impact of AI in exploiting big data, its conversion to intelligible information, and rapid dissemination to users positions AI as a critical component of the IDF's future warfare paradigm, promising exponential gains.

BIG DATA AND THE UTILITY OF ARTIFICIAL INTELLIGENCE

This century has begun to witness the rapid and broad-ranging transformative impact of artificial intelligence (AI) – and the military sphere is no exception. Israel is at work to strategically incorporate AI into military systems. A complex threat environment has provided fertile ground for the IDF to pioneer techniques with novel digital technologies and innovative uses for AI. AI has a tremendous role to play in exploiting big data to generate exponentially higher outputs using existing and future sensors and intelligence sources, and can already boost actionable intelligence output significantly with almost no need to expand the sensor network (Frantzman, 2022b; Lappin, 2022). Data has become the basis for modern operational planning and execution processes; scaling its exploitation is key to making the IDF "more effective, faster, and more efficient," according to commanders (Frantzman, 2022a). These developments can be seen as part of a trend in which Israel seeks to establish itself as an AI superpower over the coming years (Williams, 2023).

The ability to detect time-sensitive adversary targets embedded in hostile, often built-up, surroundings and rapidly convert intelligence into precision firepower that can be delivered from across any domain has been a significant challenge for the IDF in responding to asymmetric threats emanating from non-state and hybrid actors. The IDF has developed a reply to this challenge with the Momentum program, which formulated the objective of connecting the Israeli Air Force (IAD) with other combat commands and military intelligence into a scalable common digital architecture using AI to process, exploit, and allocate vast quantities of data to appropriate units. Momentum addressed the necessity of digitally transforming the IDF within a multi-command framework (Frantzman, 2022b). The results of the IDF's multi-faceted transformation are already demonstrating significant gains. For example, it has become possible for a platoon commander to exploit intelligence gathered from an airborne IAF platform and vice versa (Frantzman, 2022b). On the other hand, the IDF's new Targets Center, established in 2019, has used AI to generate the same number of targets in a month that previously took more than a year to produce (Lappin, 2022).

Working closely with contractors from its domestic industrial base, the IDF's growing embrace of AI runs across the processes, the command and control, and the targeting capabilities of its air, land, and naval commands and intelligence directorate. In particular, the IAF is deploying a growing range of AI-assisted capabilities supporting the accelerated execution of tasks ranging from generating pinpoint coordinates for targeting to optimizing logistical planning (Edelson, 2023). The IDF's recently established Fire Factory AI platform is one such example: Using historical data collected from past operations, it optimizes operational efficiency and performance by assigning thousands of targets across platforms, computing optimal ordnance loads, and recommending timing schedules for fires (Edelson, 2023). Shortly, the IAF will induct Oron, an intelligence-gathering aircraft developed

with Israel Aerospace Industries (IAI) providing persistent wide-area surveillance. Based on the Gulfstream G550 executive jet, Oron is equipped with automatic data systems working on advanced algorithms and AI that detect and analyze thousands of targets across thousands of kilometers in seconds (Lappin, 2023; Air Force Technology, 2021).

The IAF has not been alone in its embrace of AI or the operational gains it can enable. AI has augmented the analytical capabilities of the IDF's Military Intelligence Directorate with game-changing effects. A system called Stargate has improved output fifty-fold since it was operationally deployed in 2020. By rapidly scanning multiple video feeds from many sensors, Stargate can identify objects of interest with unprecedented precision and speed, tremendously reducing the labor hours required to complete the same process manually (Shahaf, 2020). On the ground, IDF combat vehicles are being designed with AI-assisted onboard systems to deliver seamless interfacing with the IAF. For example, Athena, an AI server being developed by IAI, builds a shared picture of the battlespace and can cooperate with and even command and control (C2) remote platforms, acting as the 'brain' in a system of systems. Another system, Starlight, launched by IAI in 2021, is described as a next-generation cloud-based 'multi-INT [integer] analysis system,' which amalgamates data from various sensors to generate unprecedented operational insights and provide decision-making support (Lappin, 2021). These are some among many growing examples of the expanding use of AI-assisted systems by the IDF and Israeli defense industries to address challenges arising from 'data deluge.'

The growing range of IDF capabilities that use AI to optimize systems-level performance to compress planning and operational decision-making timelines reaffirms the ability of AI to expand and accelerate data processes. AI has enabled the IDF to sift through massive datasets originating from multiple domains, create actionable intelligence, and rapidly allocate information to relevant units. This guiding approach has attempted to resolve the problem of commanders, intelligence analysts, and warfighters "drowning in data but starving for information," in the words of one American general (Lappin, 2021). Militaries, as big data-centric organizations, do not just collect sufficient data but have to be able to organize, analyze, fuse, and disseminate information rapidly across the digital network. AI-assisted big data approaches hold enormous potential to unleash unprecedented operational decentralization and faster decision-making that will redefine the IDF's command and control (C2) in the complex terrain and fluid dynamics of future operational environments (Lappin, 2022).

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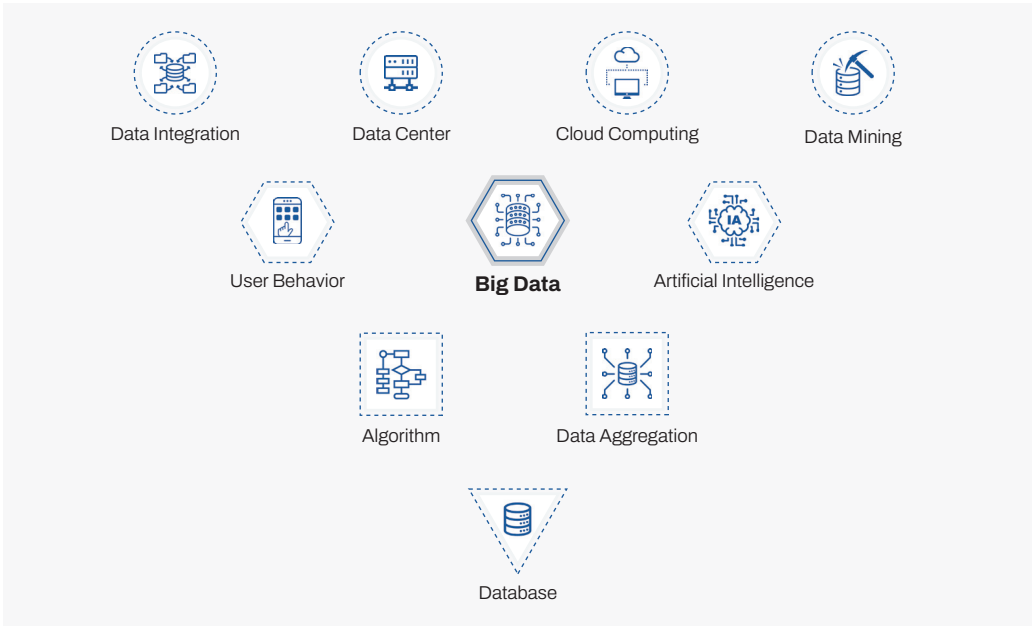

Figure 7.1: Harnessing the Power of Big Data

CREATING MOMENTUM FOR AN AI-ASSISTED JOINT FORCE

The utility of big data has been explicitly recognized by IDF leaders, with concerted efforts being placed on using AI to facilitate cross-forces integration and the development of a common digital architecture. The vision for this transformation saw early articulation in 2014 by the then-commander of the IDF's Military Intelligence Directorate, Aviv Kochavi (Kochavi and Ortal, 2014). Kochavi proposed networking intelligence across disaggregated units within a unified architecture that could fuse and share information rapidly at the joint level. These ideas evolved and helped influence the IDF's first big data-driven multi-year program as Kochavi assumed command of the IDF in January 2019. Within a year, Kochavi initiated a multi-year modernization program dubbed Momentum, described by Ortal (2020) as follows:

"By donning a 'smart suit,' Israel's existing military force can adapt to the challenge of fires-based stealth enemies without harming its immediate readiness for war and without demanding impossible budgets. In practical terms, this means a reconnaissance screen based on squadrons of UAVs belonging to tactical forces, synergy in intelligence and sensing means all connected to joint databases, and effective information extraction systems. This will allow us to locate the enemy

more precisely and more rapidly. Creating this platform is not cheap, but the 'smart suit' allows us to base our solution on the existing force while clothing it in affordable and practical modernization elements."

Following its inception in 2020, Momentum delivered an instructive guiding framework for digital transformation within the IDF. The effort included a remodeling of the IDF to respond more effectively against time-sensitive targets, particularly those embedded in civilian areas where operational responses are complex. The development of the Elbit-made Torch 750 battle management system marked a major turning point by successfully unifying ground units from the infantry, armored corps, artillery, and combat engineering and making dynamic interactions with every other force component (including the IAF) possible. Torch 750 provided a system that seamlessly integrated sensors, shooters, and communication systems, manned and unmanned platforms, enhancing cross-force coordination, planning, and comprehensive battle management using AI while reducing cognitive load at all echelons to facilitate superior decision-making (Elbit Systems, n.d.).

With its ability to process and precisely allocate real-time intelligence on threats and friendly forces, Torch 750 enabled commanders, operators, and tactical units to gauge the operational dynamics of adversary and blue team forces at any time in any given theatre. IDF tactical headquarters in the field now receive the full suite of IDF intelligence battlefield services and are able to contribute to the joint picture by tactically deploying drones and an array of advanced intelligence-gathering systems, for example. The benefits for the IDF have come at the joint level, allowing for faster and more precise targeting operations. AI has been critical for executing the essential processes necessary at every step to achieve these gains, from data and intelligence processing to allocating information and coordinating targeting across air and surface units. Following a major operation in 2021 during which Torch 750 saw its first significant operational deployment, senior officers credited algorithms for automating intelligence to service frontline requirements in a way that no human operator would be able to (Dombe, 2021).

BUILDING AN ADAPTIVE WARFIGHTING ENTERPRISE

The success of Torch 750 in rapidly transmitting critical intelligence to users on the frontline was not just technology-driven; it was augmented at the human capital and process levels with the creation of 'back office' intelligence centers (Lappin, 2021). Bringing together a multidisciplinary workforce tasked with exploiting big data using AI and machine learning to separate useful data from background noise and generate high-quality, actionable intelligence, these 'back office' workforces reflect an innovative restructuring of the IDF. To keep pace with the technological breakthroughs that systems

such as Torch 750 present, the IDF has been adaptive with its operational structure and agile in being able to shift away from traditional models where operators rely on slower command, control, and communications (C3) through the traditional chain of command. These shifts have been facilitated by vital contributions from the IDF's C4i and Cyber Defense Directorate, where various departments and branches are tasked with specific mission sets to develop innovative solutions using new digital technologies.

One such player is the Digital Transformation Administration of the C4i and Cyber Defense Directorate, which is responsible for assessing warfighter needs, identifying capability gaps, and delivering program-based solutions. The Administration has spent approximately three years developing the framework for the IDF's joint operational network under the Momentum program, building on the early work of the Digital Operational Processes Department, which brings together a staff of officers with leadership experience in operational units from across the IDF's service branches. Within the same Directorate, the role of another branch known as Sigma, which has responsibility for researching, adapting, and implementing breakthroughs in AI and digital technologies to ensure the IDF remains at the leading edge of what these technologies make possible, has played an instrumental role (IDF, 2017). To direct the IDF's experimentation and testing of AI and digital technology capability enablers, Sigma introduced an instructive model, depicted in *Figure 7.2*, on the military use of AI across three categories: Descriptive intelligence, Predictive intelligence, and Intelligent decision-making.

Descriptive Intelligence	Predictive Intelligence	Intelligent Decision-Making
Systems process context and recognize and categorize information	Systems forecast the impact of data and information.	Provide recommendations to users based on the outputs of descriptive and predictive systems

Figure 7.2: Sigma's Instructive Model for AI Applications

In the lead-up to the formulation of the Momentum multi-year force build-up program, every Major General and Brigadier General across the IDF service branches and directorates were convened in planning groups to discuss at length the operational strengths, capability gaps, and future transformations necessary for the IDF. This deep introspection resulted in several outputs to direct future strategy, explicitly emphasizing the need to compress operational timelines and execute effects that rely on exploiting joint network-based operations at scale. Achieving buy-in from senior officers who did not grow up in the digital era represented an important cultural challenge (Frantzman, 2022b). AI has been earmarked as a vital enabler to transform the IDF for a new digital age. To ensure long-

term cohesion, Momentum addressed the risk of divergent approaches with the establishment of a digital transformation division tasked with bringing common digital infrastructure and standards so that every new application introduced was cloud native and any new systems were spectral efficient (Frantzman, 2022b).

As part of its evolution, the IDF's updated strategy, some of which is publicly available, called for cooperation with numerous start-ups and technology providers to achieve its transformation goals (Frantzman, 2022a). This updated strategy adopted a multi-branch and multi-command approach.

Looking ahead, AI will challenge traditional warfare approaches: IDF leaders assess that it is only a matter of time before combat pilots will eventually be completely replaced by unmanned systems (Bob, 2023). This aligns with predictions elsewhere that the F-35 may be the last major combat aircraft that relies on human pilots. At the same time, the ethical implications of removing human control and judgment from life-or-death decisions run contrary to existing IDF values (Bob, 2023). Therefore, even as AI is embedded within kill chains, decision-making will remain with humans firmly in the loop. The IDF's approach to AI will continue to be anchored around employing AI to exploit big data and generate high-quality, actionable intelligence more rapidly. This way, AI is positioned as a capability enabler, a force multiplier, and a decision support system for commanders and operators – but not as a replacement for human decision-making, particularly when it comes to activating firepower.

CONCLUSION

Having pursued various initiatives to adopt and adapt AI and new digital technologies into the IDF for the past several years, various programs focusing on compressing sensor-to-shooter timelines are now underway. Some results of these efforts were demonstrated in *Chariots of Fire*, the largest war exercise held by the IDF for decades, in May 2022. Israel has developed a strategic framework to identify how AI-assisted systems can deliver future warfighting requirements, creating the necessary mechanisms with people and processes to adapt, test, and integrate novel digital technologies. The IDF's search for an enterprise-level solution has revealed

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a massive potential for AI to support the processing and exploitation of big data. With a powerful role in integrating large, disaggregated databases, AI will assist in identifying threats and patterns earlier and generate decisive operational insights to support planning and execution. As such, AI is viewed by the IDF as being critical to increasing the qualitative gap against adversaries after many years in which threats were able to challenge the IDF's force superiority by asymmetric means.

Significant progress has been achieved by the IDF with Momentum, laying the basis for a follow-on multi-year program named *Ma'alot*, or 'Ascent,' which aims to expand the functional capacity and resilience of its rapidly advancing shared combat network. Meanwhile, the IAF is forging ahead with exploiting AI for a growing array of operational tasks and processes, optimizing targeting capabilities, and developing a joint multi-domain C2 service architecture. The IDF's inaugural International Operational Innovation Conference, held in September 2022 at Tze'elim Base in southern Israel, gathered over 200 international participants from across 24 military delegations, reflecting growing interest among its international allies and friends in Israel's pioneering work to address future warfare challenges (Lappin 2022). Despite the advances being achieved with AI, the IDF remains committed to human oversight in operational decision-making, emphasizing the growing utility of AI as an enabler of capabilities rather than a replacement for human decision-making. As the importance of man-machine interaction expands with the growing use of AI, the IDF will focus on optimizing man-machine synergies to achieve the operational agility and effectiveness promised by collaborative combat concepts.

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