Israel is the largest military-industrial "laboratory." It presents friendly governments with combat-proven, price-competitive solutions quickly and efficiently. MT focuses on a select number of innovations that are appropriate for national defence and civil security.

There are approx. 150 defence firms in Israel, with combined revenues of an estimated $3.5 billion, all of which produce a wide range of conventional arms and advanced defence equipment. In all, the industry employs close to 50,000 people, all of whom share a commitment to high levels of research and development and the ability to make use of the IDF’s combat experience. Israel’s defence exports are coordinated and regulated through SIBAT - the Foreign Defense Assistance and Defence Export Organisation - which is run by the Israeli MoD. SIBAT’s tasks include licensing all defence exports as well as marketing products developed for the IDF, from electronic components to missile boats and tanks. Each year, SIBAT publishes a defence sales directory, an authoritative guide to what the industry has to offer.

\[Having to fight five major wars in its first four decades, Israel built a comprehensive standing army - the IDF - and furnished it with an arsenal of highly advanced military hardware. The government also encouraged the formation of private companies to equip the IDF. The development of a sophisticated defence industry inevitably led to exports, which today account for a majority of its revenues and allows the country’s defence industry to compete against some of the largest companies in the world for foreign contracts, in addition to producing many of the arms needed for Israel’s own defence.\]

\[(All Photos and Graphics: IDF)\]

**From UAV/UGV/MTGR to Self-Protected Armoured Vehicles Optimised for Urban Battles ...**

In July 2012, in the face of new conflicts in urban settings, the IDF was developing new robotic systems that it hoped will provide soldiers with an edge on a future battlefield. One of the systems - the AIRMULE - is a revolutionary UAV that can fly like a helicopter and evacuate wounded soldiers in its hull from any terrain. Developed by Urban Aeronautics, the AIRMULE has VTOL capabilities and would likely be deployed on a division level. A full-fledged mission demonstration is slated for 2015.

Another system, the ADVANCE GUARD, is a new UGV that the IDF Ground Forces Command has been developing for long-range reconnaissance missions. The new UGV would operate like the GUARDIUM UGV that is equipped with advanced sensors, including video and thermal cameras and is used along Israel’s border with Gaza Strip for routine patrols in all weather conditions. An additional UGV, called BORDER GUARD is discussed further below.

\[ADVANCE GUARD’s basic configuration will carry a number of video cameras, with the ability to connect to the IDF’s Digital Army Network and transfer data between other land systems. It will also be capable of carrying a variety of lethal and non-lethal weapons. An officer in the Ground Forces Command explained that, “this UGV would be able to go ahead of a force and scout out what is happening before sending troops ahead.”\]

An officer from the Technological and Logistics Directorate explained that, “the FLYING ELEPHANT will help us get supplies to forces operating behind enemy lines in a way that does not endanger soldiers.” Powered by a propeller engine and launched by a catapult system, the parachute uses a special handle to lift cargo once airborne. It then uses GPS to locate the landing site and has a level of accuracy of about 30m within the designated coordinates and an operational range of about 30 kilometres.

Another system that was developed by the IDF’s Combat Engineering Corps and handed to the elite Yahalom unit in August 2013 was a new robot called TALON IV to uncover and neutralise IEDs. The robot, which uses an automatic navigation system, would enter enemy territory ahead of troops and serve as a "tracker" with the capability to detect hidden bombs.

The issue of IEDs has attracted a lot of attention in Israel. The recently introduced SAHAR all-terrain UGV is a joint development of Israel Aerospace Industries (IAI), QinetIQ NA, and Watarpoli Ltd. SAHAR is an autonomous robotic system designed for the efficient performance of combat engineering missions that are currently executed using manned and remote-controlled mechanical equipment. The challenges of dealing with these missions using existing methods include high-risks to...
equipment operators and to the security forces providing protection; specialised skills are required to operate the mechanical engineering equipment, as well as extremely high-levels of accuracy are required which result in slow implementation of the required tasks. SAHAR was developed to overcome these challenges. As a result, the UGV handles the process of route clearance including functions such as environmental terrain mapping, surveillance, removal of road blocks, and disposal of IEDs. The system’s execution is based on pre-defined path plans and its major features include a remotely-controlled platform, smart terrain awareness sensors and an autonomous manoeuvring and manipulator module.

In addition to the SAHAR UGV, IAI Ramta developed a semi-autonomous capability to detect and detonate mines and IEDs. In late October 2014, the Mine and IED Detection System (MIDS) was unveiled, which is outfitted with both a metal detector and an above-surface detection system, developed by Ramta, and a ground penetrating radar (GPR) from IAI Elta Systems. When an unburied road mine is detected, MIDS can push it aside. In the case of a buried mine, MIDS will mark off the area, enabling troops to safely manoeuvre it. MIDS is also equipped with a weapon system to detonate roadside IEDs. MIDS can operate day and night and through any weather at a rate of 10 km/h for a 270° radius.

MIDS can also be remotely controlled from a vehicle at a stand-off distance or it can be programmed with waypoints for semi-autonomous operation. Ramta’s spokesman said that, “if a customer wants a fully autonomous capability, there are divisions within IAI that can provide that.”

MIDS can also directly link with an overhead UAV to receive ISR data on roadside obstacles or changes in the road that could be the result of a planted mine.

In order to reach the next level of coordinated development between UAV, UGV and unmanned maritime system (UMS), in late July 2013 it was reported that Israel’s defence industry was working on a “networked” system that will enable joint operations of unmanned assets. Industry sources say that the effort is directly connected to a decision made in early July by the IDF to make the Air Force, Navy and Ground Forces “slimmer,” in order to save money and be able to “adapt to new threats.”

In early August 2014, it was reported that in 2015, a new UGV, called BORDER GUARD, is expected to begin patrolling border with Gaza Strip. The remote-control system is based on a Ford 350 pickup truck platform and, according to Maj.Gen. Lior Trabelsi, Head of the IDF’s Mobility and Robotics Department, will have its own surveillance sensors and weapon system: “its means of communications will be improved, and the control will be different. This is an upgrade of all aspects of the existing system.”

Finally, the interagency Combating Terrorism Technical Support Organisation (CITTSO) operating under the US DoD in 2013 has allocated US$15.6 million to evaluate and field Micro Tactical Ground Robot (MTGR) through 2015. Some 100 MTGR robots are already operational with combat teams of the US Army Special Forces. Roboteam’s executives says that the MTGR weighs less than 15kg, can be carried by one soldier and has a top speed of 3.2 km/h. In mid-July 2014 Roboteam won a bid to deliver MTGR to the IDF.

The MTGR is Roboteam’s first of a family of rover robots. It has also 1.1 kg Individual Robotic Intelligence System (IRIS), which functions as a mobile camera for a squad, and can be sent through air vents into a basement or balcony for reconnaissance. It has also developed the Professional Robot (PROBOT), a 120 kg 4x4 that carries nearly double its weight in payload, which was designed for logistics delivery, medical evacuation, and a range of public safety missions. The PROBOT joins an infantry squad in the field.

**To Self-Protected Armoured Vehicles Optimised for Urban Battles and Anti-Tunnels System**

In mid-December 2012 was reported that Israel’s MoD was about to launch initial development of RAKIYA (Horizon), a family of light, lethal and self-protected armoured vehicles optimised for urban battles beyond 2020. The IDF hopes for the Future Manoeuvre Combat Vehicle (FMCV) family of...
vehicles be operational by 2020. Managed by the recently established Rakia unit with MoD’s Directorate of Defence R&D (DDR&D), the programme involves nearly all branches of MoD and Israel’s Ground Force Command, starting with MERKAVA Programme Directorate and Armoured Corps and extending through Infantry, Artillery, Ordnance and Combat Engineering. Military officers say that the new vehicles are likely to be wheeled, agile and nearly half the weight of the 65t MERKAVA Mk-4.

Sources in Israel insist that the FMCVs will not replace MERKAVA Mk-4s or LEOPARD (Namer MERKAVA APC) but rather the envisioned FMCV variants will be "integrated" with heavy armour into the same digitalised C2 network, providing war planners with more options that can be tailored to specific scenarios for manoeuvring warfare. An Israeli defence source says that, "we are not talking about a multi-mission vehicle, but rather a family of vehicles, each of which will have its own mission."

In an extensive report on the Israeli tank MERKAVA MK-4 Brig.Gen. Baruch Matzliah, Director of the MERKAVA Tank Programme Administration at the MoD, said: "The tank has outstanding ability to move through the rough terrain of the Golan Heights. It passes through boulders and rocks without trouble, faster than any other tanks, with a 1,500hp engine and firepower that enables it to identify, locate, and destroy the enemy. The supremacy in battle on land is achieved only through good manoeuvrability, which is achieved by the tank and the LEOPARD."

Every MERKAVA tank delivered to the IDF in the past few years is equipped with Rafael’s TROPHY active protection system. During operations in Gaza, the TROPHY-HV succeeded in neutralising attempts to use missiles to hit tanks before the crews were even aware of them.

Brig.Gen. Eitan Eshel, Head of R&D for the MoD’s Administration for the Development of Weapons and Technological Infrastructure (known as Mafat), said that the US was weighing the purchase of Rafael Advanced Defence System’s TROPHY-HV tank protection platform that automatically intercepts ATGMs and RPGs. The US was testing TROPHY out on its Ground Combat Vehicle (GCV). TROPHY offers 360° defence against incoming threats and was first used operationally in 2011 by an IDF tank crew near Gaza. Eshel added that TROPHY, "also identifies the source of fire and enables the tank’s weapon systems to quickly take aim at the source."

Yiftah Kleinman, the Marketing and Business Development Manager at Rafael’s Advanced Armoured Systems Directorate, informed MT: "The TROPHY-HV version is capable of transmitting the coordinates of the source of the fire to ground platforms, enabling a rapid closure of the sensor-to-shooter cycle. This allows ground manoeuvres in environments with intense anti-tank threats to become significantly more offensive."

In late July 2014, it was reported that Magna BSP founder and CEO Haim Siboni believes that just like an IRON DOME missile intercepts a rocket, a tunnel 30m deep loaded with sensors and radar on the border with the Gaza Strip can provide a decisive solution to attack tunnels designed to enable terrorist squads to penetrate into Israel and commit massacres. He explained that, "we are proposing an operative engineering solution that consists of digging a 70km tunnel along the border. When it is completed, our underground radar can be installed fairly easily. Maintaining the system is not complicated. According to our plan, convenient access can be provided to maintain the components installed in the tunnel. The system will provide real-time alerts of any tunnel digging that crosses our tunnel, whether above or below it. The IDF will know exactly where the attack tunnel is and how many people are in it, and can monitor the progress of digging it in real time, and decide accordingly."

**Marine Environment: From Unmanned Underwater Vehicles (UUV) to Aqua Shield**

Mafat has set the next challenge for Israel’s defence industry: Do for UUVs what it did for unmanned aerial warfare. While Israel rushes ahead with UAVs, and is developing UGVs and UMS, Mafat says that the challenges of developing UUVs are huge. In contrast to UAVs, which are operated by command from ground C2 systems via satellite communications, these are unavailable beneath the oceans. Undersea communications is acoustic-based and thus have limited volume and range. UUVs will therefore need high level of automation and independent navigation.

Unmanned submersibles, which are linked to the supply ship by cable, already exist, but they are short-range vehicles and have limited utility. Nonetheless, UUVs have huge potential, if only because in a future battlefield, they can replace Navy Commandoes for special operations or plant intelligence devices off a hostile shore.
In late August 2014, scuba terrorists, who made their way from the Gaza Strip to Israel, came through an area of "shallow water" (author’s italics) a few dozen metres from the coast, where swimming is possible, but not deep enough for naval vessels to patrol and operate there. DSIT’s AQUA SHIELD Diver Detection Sonar (DDS) gives marine terrorists no chance. A senior analyst noted that, "over the years, sonar technology has been improved. The quality of the signal and its processing have undergone about the same process as improved of radar. The technology has become more miniature; now a person in a boat can carry sonar for detecting divers, lower it from the side of the boat, and operate it. There is almost no need for an operator to decode the signal. The system does it."

In addition to its mobility and reliability, AQUA SHIELD has extended the detection range from a radius of a few hundred metres to several kilometres, giving the coast guard or the navy some time to prepare to meet the threat. AQUA SHIELD is a land-based sonar designed to protect stationary targets, such as coastal facilities and drilling sites. DSIT also offers POINT SHIELD, a smaller mobile system with a shorter range, designed for vessels moving about in the open sea.

**And the Civilian Market**

In mid-June 2013 was reported that Elbit Systems was expanding its civilian activity. Elbit has unveiled its CLEAR VISION system, designed to allow commercial aircraft to land safely even in stormy weather and in low visibility conditions. CLEAR VISION is a spill-over from military aviation particularly from a system mostly installed on F-15 and F-16 fighters. Dror Yahav, Elbit System VP for Civilian Aviation, told MT that, “the need for a new civilian system arose following an increase in cases of delays in craft landing and disruption to air traffic as a result of bad weather conditions such as rain and thick fog. Those conditions cause visibility problems and made landing difficult.”

The new system is based upon an advanced multi-spectral camera that displays its pictures on transparent glass in front of the pilot, enabling him to receive real-time information even when he is looking outside the aircraft in preparation for a safe landing. The pictures streamed to him and thus enable him to identify the landing area without interference from the weather.

Yahav added, “At a time of economic constraints, many airlines will be glad to save the high cost of the fuel consumed when a flight is extended and diverted to land somewhere other than the destination airport because of the problematic weather conditions. At some airports, the system can improve landing capability by 70%, and at some by 100 percent."

In early November 2014, Israel has adopted the FLIGHT GUARD missile protection system to protect its national airliners from the threat of MANPADS. Flight Guard utilises the Elbit Commercial Multi-Spectral Infrared Countermeasures (C-MUSIC) system adapted for the mission under the Israeli government’s SKYSHIELD programme. FLIGHT GUARD is a passive system that employs a IR missile-tracking camera and an IR, ultra-violet, or radar missile-approach warning system sensor to detect a missile launch in the very early stages of an attack. Once detected, a laser beam is fired at the missile, jamming its seeker and causing it to be diverted away from the aircraft. The system is self-contained and housed on the underside of fuselage in a single aerodynamic and unobtrusive pod, and so is relatively easy to install.

**Looking Into the Future**

According to Joseph Weiss, IAI Chief Executive, “the upcoming innovations will mainly be in the area of UAV payloads which the platform will carry.” At the moment defence industrial companies have developed payloads for long-range intelligence gathering, marine operations, real-time surveillance of targets, and even Electronic Warfare.

In late November 2013, for the first time ever a possibility of unmanned air-to-air combat was mentioned. Although it may sound like science fiction, in the words of retired Maj.Gen. Eitan Ben-Eliahu it is a feasible option. Ben-Eliahu said that although, "we pilots are the decision-makers and the claim to fame of fighter pilots are dogfights, part of the process of replacing combat craft with UAVs will be the ability to start dogfights between UAVs." Ben-Eliahu added that UAVs are highly dependent on networked C2, which renders them more vulnerable to cyber-attack than manned fighters, "which know how to perform their mission in total silence."

Still, Ben-Eliahu envisions a time when UAV platforms will replace manned fighters, provided that UAVs are sufficiently equipped to perform traditional fighter missions. Perhaps high reliance of UAVs on C2 and their not so silent performance should also be taken into consideration. Shaul Shahar, General Manager of the IAI’s Malat Division, said that Ben-Eliahu’s support for dogfighting UAVs reflected a serious, albeit embryonic R&D trend.

To conclude, the sheer volume of industrial solutions shows that captains of the Israeli defence industry together with their military counterparts are constantly seeking solutions for saving life of soldiers. As a result, Israeli solutions have a strong appeal to the customers worldwide that for the time being operate in a slightly lesser violent environment. Spill-over into commercial market undermine the importance that Israeli defence companies also pay to the untapped possibilities in the commercial sector.

\< On 7 July 2014, following incessant rocket fire from Gaza at Israel, the IDF initiated Operation "Protective Edge." On the 10th day of the operation, after continued terrorist attacks on Israel from land, air and sea, the IDF commenced the ground phase of the operation.\>