THE AEROSPACE AND METAL INDUSTRIES IN ISRAEL

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WHERE COMPANIES COME TO SHINE

THE AEROSPACE AND METAL INDUSTRIES IN ISRAEL

TABLE OF CONTENTS

DEFINING THE AEROSPACE INDUSTRY

The Aerospace industry

is a broad term, sometimes with multiple definitions. In its most narrow sense, it only includes manufacturing of the primary components of the industry (Aerospace vessels, aviation electronics, aviation vessel parts and associated systems, missiles and UAVs – Unmanned Aerial Vehicles).

A more inclusive definition that has been adopted in this review includes other production activities such as R&D as well as propulsion, navigation and communications and software development in addition to maintenance.

THE AEROSPACE INDUSTRY

The Aerospace Industry Global Value Chain

The Aerospace industry value chain operates as a pyramid, with OEMs (original equipment manufacturers) at its top. These are generally integrators that work with clients in the industry (aviation companies, government organizations, etc.) and are responsible for the overall design of the aviation instruments. The companies specify, design and assemble the equipment, distribute and sell the end-product to clients, and provide the maintenance services required.

Sub-manufacturers are generally integrators that manufacture components for all aircraft (such as fuselage, wings or engines) based on the specifications provided by the OEM. In order to manufacture these parts, sub-manufacturers work with aircraft component sub-suppliers (e.g. suppliers of electricity systems or precision metal components). Raw material suppliers, device manufacturers, production tool manufacturers, and others operate behind the scenes.

Maintenance repair overhaul companies (MROs) work for both the manufacturers and their clients. The companies are generally a unit

appointed by the manufacturer (for example, one of the five Boeing departments will be responsible for maintenance).[1]

It should be noted that most manufacturers can be positioned in multiple places on the value chain. Elbit, a leading Israeli company, for example, is an OEM for UAVs but also a supplier of electronic systems for Boeing cockpits.[2]

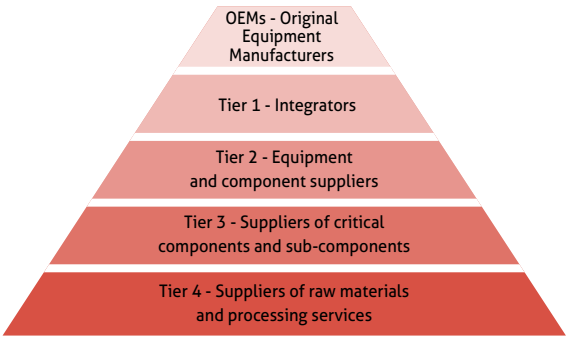

***Illustration 1** – The Aerospace industry value chain*[3]

OEMs: Companies that assemble all parts of the aircraft and distribute and sell the final product.

Tier 1: Companies that integrate, manufacture and distribute major aviation systems.

Tier 2: Companies that develop, design, manufacture and distribute equipment and systems.

Tier 3: Component suppliers that operate as subcontractors for Tier 1, Tier 2 and even Tier 3 manufacturers.

Tier 4: Companies that process and supply raw materials, and supply standard products as well.

The Global Market

In 2015, the global aerospace market was valued at $674 billion, a 3.8% growth compared to the previous year. The growth was primarily driven by the global commercial aerospace sub sector, which grew by 6.3% in 2015. On a non-constant US$ base, global aerospace sector revenues declined 1.9% year over year.

Revenues of the top 20 global aerospace companies accounted for nearly 75% the industry's revenues in 2015, reflecting continued industry concentration.[4]

Illustration 2 presents some of the industry's key financial data.

In 2015, the global aerospace market was valued at $674 billion, a 3.8% increase compared to the previous year.

Over the next 20 years, over 35,000 commercial aircraft, valued at $5.2 trillion, are expected to be sold. Demand will be for 1,840 aircraft per year, while production rates are limited to 1,352 units, thus requiring an increase in OEM production capacities.[6]

The forecasted increase in production is expected to correspond with the ongoing increase in commercial traffic and have an impact on other trends in the aerospace industry such as smarter production processes (digitalization, 3D printing, product lifecycle management) that shorten production time and increase aircraft availability (fewer repairs, etc.).

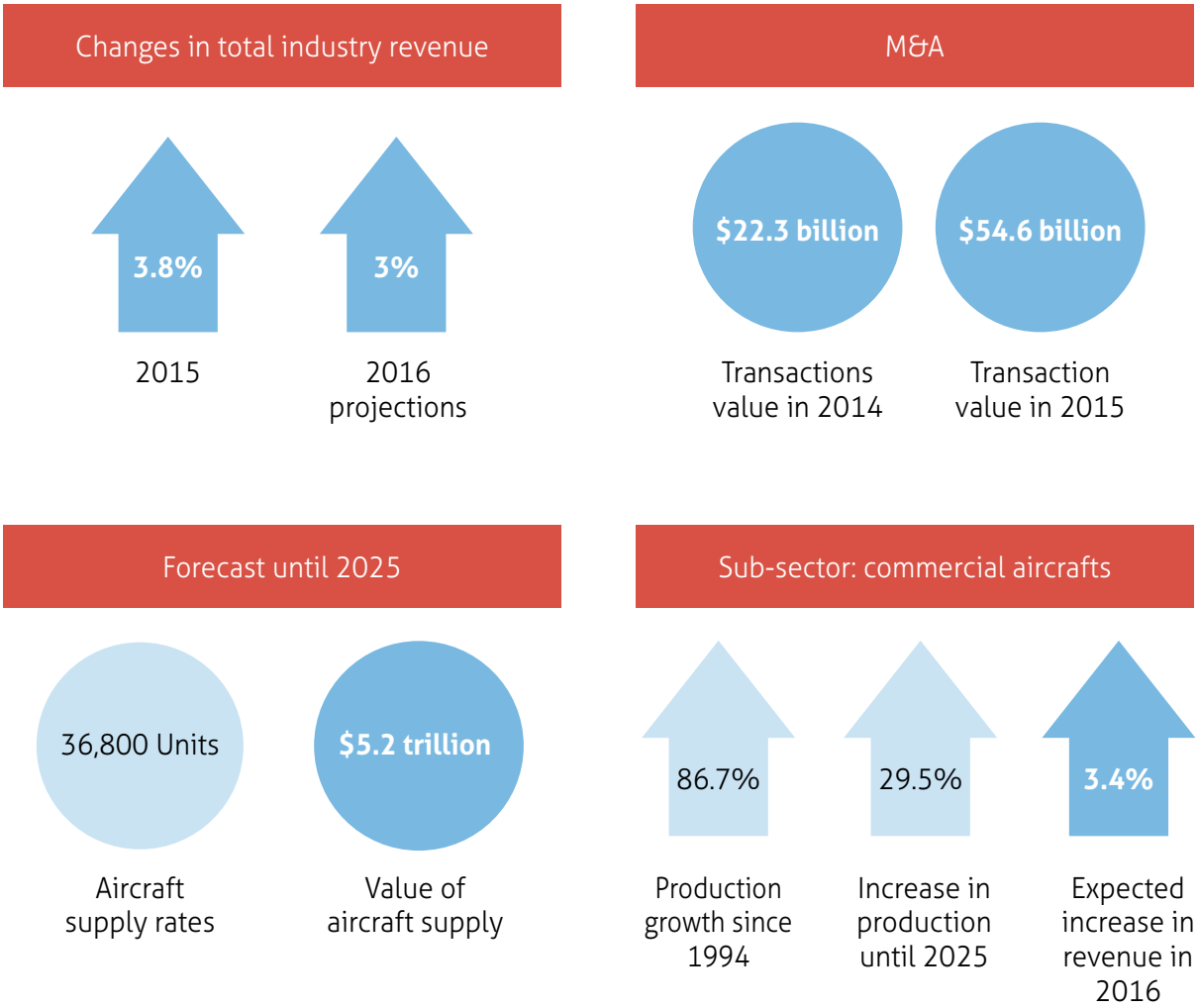

***Illustration 2** – Financial perspective: the Aerospace industry at the end of 2015*[5]

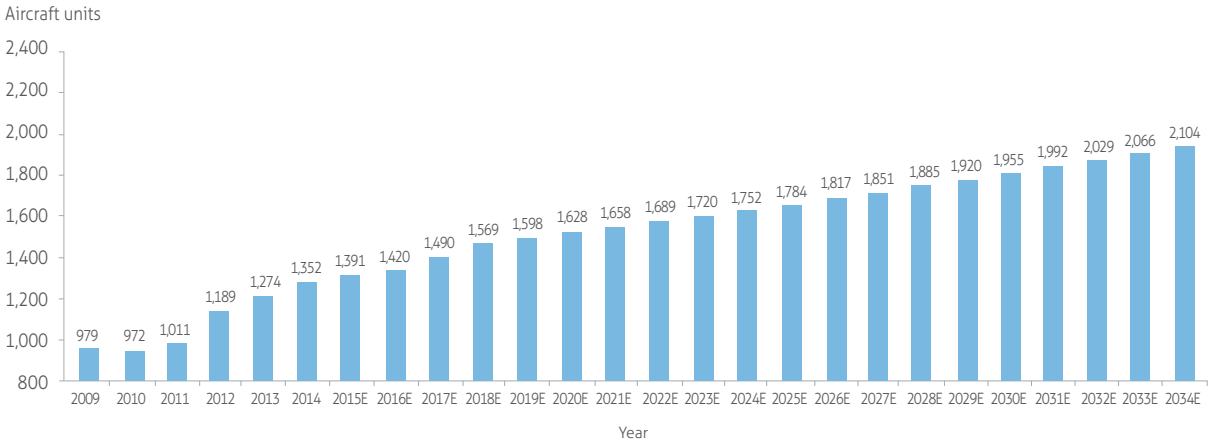

***Illustration 3** – Aircraft units supplied before 2014 and projected number of units per year until 2034*[7]

Source: Deloitte

GLOBAL TRENDS IN THE AEROSPACE INDUSTRY

Increased commercial aviation traffic

Since the 1980s, commercial air traffic has doubled every 15 years. This growth rate is expected to continue over the next 20 years, with an annual increase of approximately 4.6%. International cargo transport is also expected to grow by approximately 4.4% on average each year.[8] As a result, demand has grown for

commercial aircraft that are larger (more seats per aircraft) and more efficient.

Sustainability

More and more companies are implementing production methods that are more environmentally friendly, and have begun to manufacture greener products as well. In addition, sustainability goals have become an integral part of many company and organizational policies. Regulations have also changed in recent years and now focus on limiting damage to the environment.[9]

The sustainability trend includes developing products using composite materials and R&D to develop engines that are smarter and greener, as well as developing alternative fuels and streamlining aircraft engines. Today, certain OEMs and Tier 1 manufacturers require their suppliers to meet sustainability goals similar to their own, and manufacture green products using manufacturing methods that are as environmentally friendly as possible.

Recently, the Israeli company *Ashot Ashkelon Industries* collaborated with two Italian companies (EFESTO and C.F.M. Air) to develop a hybrid propulsion system (HPS).[10]

Composite materials and advanced metals

The characteristics of composite material (high rigidity, light weight, high durability) reduce aircraft weight, conserve fuel, reduce pollutant emissions and more.[11] Composite materials combine two reinforced fiber polymer matrix substances, resulting in a new material with novel characteristics such as strength, resistance

to high temperatures, and lighter weight. The key advantage of composite materials to the aerospace industry is that these characteristics can be calculated and designed in advance in order to balance strength with weight as needed.

The aerospace industry comprises approximately one-third of the global demand for composite materials. Analysts expect an 8%-13% increase in revenue on composite materials by 2020, due to demand from the commercial aircraft segment alone.[12]

The Israeli company Plasan Sasa has utilized it's unique specialty in armored vehicles and ballistic vests to develop special, light, ballistic protection for different aircrafts.

Leading Israeli companies: *Kanfit, Aero Sol,* and *Plasan Sasa.*

Alternative fuels

Alternative fuels are used to reduce the aerospace industry's dependence on oil and its exposure to oil price fluctuations, and to reduce pollutant emissions. Today, several types of alternative fuels are being considered for this purpose, including biological fuels, fuels derived from industrial and urban waste, biomass, and microalgae.[13]

The main challenge is to produce alternative fuels, which currently cost three times the price of regular fuel, on a large enough scale and at prices that are competitive and attractive for commercial airlines.[14]

This trend is still in the R&D and initial use phases only, and it may take many years before these solutions can be implemented on a broad scale in the industry. On the other hand, great efforts are being made to implement these solutions, as reflected by NASA's goals for the upcoming years (as part of the Environmentally Responsible Aviation Project).[15]

The Fuel Choices Initiative, Israel's national program for alternative fuels and means of transportation, aims to establish Israel as a center of know-how and industry in alternative fuels and smart mobility, serving as a showcase to the world in these two fields.

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Digitalization

Digitalization helps streamline production, improve product quality, upgrade associated services and lower costs. In aviation, advanced systems and innovative digital technology

enable real time use of aircraft communications while the aircraft is in flight, and support information analysis that can provide an understanding of the various aircraft parts and facilitate significant savings on replacement parts. In addition, one of the main directions of current digital technology is broader software control over aircraft components. It is possible, using this technology, to shorten flight times, even if only by minutes, conserve significant quantities of fuel and reduce costs.[16]

In production, advanced systems can improve communications between value chain components in order to reduce development time. Technologies such as big data[17], 3D printing, product lifecycle management, communications enhancements and design, engineering and test software will all completely change production processes and other aspects (associated services, integration, etc.) of the industry.

These tools have already been incorporated in certain products (such as the Boeing 787). *X-Sight*, for example, is an Israeli company that developed the RunWize system based on two technologies – FODetect which automatically detects damage caused by foreign objects, and BirdWize, which manages ground monitoring to prevent damage caused by birds on the runway. This system has already been integrated in the Seattle–Tacoma International Airport. FODetect is used at Ben-Gurion Airport, Logan International Airport in Boston and Suvarnabhumi Airport in Bangkok.[18]

Leading Israeli companies: *IAI, Nexus IT Solutions, TAT Technologies, Elmo Motion Control,* and *Astronautics CA.*

3D printing technologies

3D printing technologies are expected to dramatically change the industry value chain. Instead of supplying precise, finished components, suppliers will sell raw materials and design data. This means that digital supply will replace physical product supply. This change may result in fewer production sites, less shipping, enhanced manufacturing possibilities for component manufacturers, and more.[19]

International companies have already begun to use 3D printing technologies. These companies have announced that they will continue to use this technology due to its potential ability to meet the future demands of the aerospace industry. The Israeli companies *Elbit* and *Cyclone* initiated the establishment of an Israeli consortium called Atid (*Future*), for the joint development of generic 3D printing technologies for titanium aircraft components. The consortium includes companies such as *Cyclone, IAI, IMI, Orbit, Algat, CAS,* and *Admar,* and researchers from Tel Aviv University, Ben-Gurion University, the Technion, the Metallurgical Institute and Afeka College.[20, 21]

Leading Israeli companies: *Landa Corporation, Scodix, DigiFlex, XJet, Nano Dimension,* and *Massivit 3D.*

Product lifecycle management

Better product lifecycle management can improve aircraft production processes and product quality while saving time and resources. It combines multiple existing digital technologies (mobile, digital analysis, cloud computing and others) designed to provide the OEM with real time information about the product. Sensors and other electronic-digital solutions offer a better perspective of the production processes and the maintenance required for the aircraft. For example, product lifecycle management will optimize the maintenance stage and streamline routine servicing of the aircraft (reducing the extent of unplanned service by 20%-40%).[22]

ISRAELI AEROSPACE INDUSTRY

Israeli companies can be found among all of the links in the global value chain, from original equipment manufacturing for aircraft to advanced electronic systems and precision metal components. Israel is a world leader in UAV production, with advanced space-launching capabilities.[23] In addition, Israel maintains its classic advantages in fields such as relatively low-cost but high-quality manufacturing for Western countries, innovation and entrepreneurship that produce advanced technologies (UAV's automatic landing and takeoff), and operational experience with use of aerospace defense technologies and products.

The leading Israeli companies (by revenue) are *Israel Aerospace Industries* ($3.8 billion in 2014), *Elbit* ($3 billion) and *Rafael* ($1.8 billion). *IAI* employs approximately 16,000 people, *Elbit* employs approximately 12,000 and *Rafael* employs approximately 6,000. In addition to these leading companies, there are other OEMs in Israel that operate on a smaller scale.

Aeronautics, founded in 1997, specializes in the development, manufacturing and service of small and medium UAVs including software development, technical support, training and equipment. In 2013, the company sold $20 million worth of UAVs to a country in South-East Asia, and in 2015 it signed a deal with the Mexican government for a total of $20-$30 million. The company's revenues in 2014 were estimated at $120 - $130 million.

Gilat Satellite Networks was founded in 1987. The company develops innovative technology in five R&D centers to support a wide range of high-performance satellite ground segment VSAT equipment, and small-cells for an integrated cellular offering. *Gilat* also provides leading satellite-on-the-move communication terminals including antennas, solid-state power amplifiers (SSPAs), block up-converters (BUCs), transceivers, and modems. The company's 2015 revenue was $197 million.

Israeli companies can be found among all of the links in the global value chain, from original equipment manufacturing for aircraft to advanced electronic systems and precision metal components.

Ashot Ashkelon Industries Ltd. is a developer, manufacturer, integrator and supplier of turn-key products for the leading OEMs in the aerospace industry. With a strong emphasis on concurrent engineering, production, quality and highly qualified personnel, *Ashot* is recognized as a high quality supplier, and its products are installed on more than 20 different aircrafts. The majority of the items *Ashot* supplies are flight safety products.

Most Israeli companies are sub-suppliers that specialize in fields such as machining, electronic systems and components, and composite materials.[24] Israeli companies collaborate with leading international enterprises such as *General Electric, General Dynamics, Embraer, EADS, Boeing, BAE Systems, Pratt & Whitney, Northrop Grumman, Lockheed Martin, Raytheon* and others.

Although the majority of satellite, defense and electronics technology development is conducted by the large Israeli corporations, the UAV segment is promoted by smaller Israeli manufacturers that develop exclusive technology. The metal, composite and electronics segments are promoted by multiple companies that apply manufacturing technologies and develop additional products used by the aerospace industry.

Satellite and Space

The space industry is one of the leading technologically innovative fields in the global economy and consists of four primary segments: manufacturing, launching, equipment and ground stations, and companies that provide communications and remote sensing services.

In 2015, the global space market was valued at $324 billion (commercial revenues combined with government budgets), a 1.8% decline compared to 2014, mostly as a result of currency fluctuations. Total government budgets devoted to the space industry worldwide in 2015 were equivalent to approximately 25% of the global space market (a 4.8% decline compared to 2014).[25] In addition, the satellite segment (as part of the space industry) reported revenues of $208 billion in 2015.[26]

Over the last decade, the global satellite industry grew consistently despite the global financial crisis and oil price fluctuations (as opposed to the overall aerospace industry). The market has therefore more than doubled in size over the last decade (growing from $89 billion in revenue to $208 billion).

Israel is known as a world leader in the satellite industry. Ofeq satellites were the first mini-satellites to be developed in the 200-300 kg range, and Israel is one of the 12 countries in the world with independent launching capabilities. The Israeli space industry has also significantly developed its installed equipment capabilities (e.g. cameras, radar, command and control systems, etc.), as well as developing satellites and launching systems. The capabilities that Israel has developed make it a leader in nano-satellite technology, just as it was a leader in mini-satellite technology in the early years of the industry.[27]

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Among the reasons the Israeli space and satellite industry is a global pioneer in small satellite technologies are the fact that it features high-quality human resources and highly effective work processes, the fact it is supported by Israeli cutting-edge academic activities, and that it constantly interacts with the renowned world-leading Israeli hi-tech sector.

Manufacturing and launching is part of all of Israel's top companies such as *IAI*, *Elbit-Elop* and *IMI*, as well as a sub-group of small and medium companies that supply components, materials and innovative technologies that facilitate satellite construction and support the products developed by the large corporations.

Gilat, a leading company in the surface equipment and infrastructure segment, and one of the leading companies in the global space industry, develops, manufactures and distributes products and services for satellite communications networks.

The Samson project, let by Israeli scientists, is the first attempt to launch to space a three Nano-Satellite structure that will orbit in formation in the world. Furthermore, Israel plans to launch to space 70 Nano-Satellites that will fly in formation to mark its 70th independence day in 2018. The satellites are being built by Israel's leading science high-schools, universities and research institutes in collaboration with IAI, the Ministry Of Science, Technology and Space and the IDF.

The Israel Space Agency cooperates with many space organizations around the world, including its cooperation agreements with both NASA and ESA.

Communications and remote sensing services are developed by leading Israeli companies, including *Spacecom* and *RRsat*, which are listed among the top 75 global space companies. *Imagesat International* is another leading company specializing in remote sensing. Another group in this segment includes startup companies (New Space) and consultation companies that specialize in the field, such as *Effective Space Solutions* and *SpacePharma*.

Simulators

The increase in commercial air traffic in recent years has resulted in greater demand for pilots. At the same time, the number of aerial hours incorporated into pilot training programs has decreased in order to reduce costs.[28] As a result, there has been an increase in demand for training tools and simulators with advanced technological capabilities, with an emphasis on the ability to train multiple personnel simultaneously.[29]

Elbit is one of the leading companies in the field in Israel, with domestic transactions valued at tens of millions of dollars, as well as international deals valued at tens and even

hundreds of millions of dollars.[30] EHUD, for example, is a simulator that allows multiple users to train simultaneously, and has been selected by 18 leading air forces in different countries on four continents, including NATO members.[31] In 2014, *Elbit* was awarded the Blue Ribbon for Innovation from Military Training Technology Magazine, along with corporations such as *L-3 Communications* and *Lockheed Martin*.[32]

Leading Israeli companies: *SimiGon (F-35), Hartech Technologies*, and *ISREX*.

Unmanned Aerial Vehicles

UAVs have many military uses (patrol, surveillance, gathering intelligence, assaults), as well as civilian functions (rescue and evacuation, agriculture, photography, scientific research).[33]

Global spending on UAVs is expected to soar over the next decade (from $4 billion today to $14 billion in 2025). The UAV industry is primarily a military one, and only 28% of it is civilian or consumer. In 2015, the market value for UAV payloads (sensors, cameras, communication systems and more) was approximately $3.1 billion.[34]

Israel's involvement in the UAV industry began as early as the 1970s.[35] According to Frost & Sullivan, a consulting firm, Israel is the largest UAV exporter in the world, with total revenue of approximately $4.62 billion by Israeli companies in the industry in 2005-2012, and an annual average of $578 million.[36] There are reports that Israel has exported UAV technologies to some 50 different countries.

The top Israeli companies develop payloads for UAVs in addition to their military products. These companies are also leaders in devices for civilian use such as policing, rescue and agriculture.[37] An international convention on UAVs has been held in Israel annually since 2012 (AUVSI & UVID).[38]

The Israeli UAV industry has many advantages, such as manufacturing high-quality products at low cost; the innovation and entrepreneurship

that produce more sophisticated technology (such as the ability to land and takeoff automatically)[39]; and the fact that Israel is one of the only countries in the world with operational experience with various types of UAVs (assault, intelligence).[40]

Future developments include UAVs that engage in air combat; UAVs that perform as mini-satellites and return on command; and UAVs that are charged using solar energy (keeping them in position over the target for longer periods of time).[41]

A great number of Israeli start-ups are trying to utilized the experience and information gained from the militarized application of UAV to new, ground breaking civil-commercial applications. *Airobotics*, who developed fully automated industrial drones, is only one stellar example.

Leading Israeli Companies: *IAI, Elbit, Aeronautics, Rafael, Urban Aeronautics, UVision Air,* and *BlueBird Aero Systems.*

Aerial Defense

In 2015, the missile and aerial defense system market was valued at $23.7 billion; the market is expected to grow and reach $36 billion within the next ten years. The main market segments are aerial defense systems, which is 40% of total global spending, and surface to air missiles (17%).

Israel is a world leader in aerial defense technology and is known for its Arrow (Hetz) missile systems (developed by the *IAI* in conjunction with other international companies), Iron Dome (developed by *Rafael* in conjunction with *Elta* and *MPrest Systems*), and David's Sling (developed by *Rafael* and *Raytheon*). These systems use cutting-edge technology to provide protection from multiple threats, ranging from surface missiles fired by low-flying helicopters to every type of ballistic threat; exo-atmospheric interception, long-range interception; and interception in large defense zones.[42]

Leading Israeli companies: *Rafael, IAI, Elbit,* and *IMI.*

Metal Products

The metal industry is broad and manufactures many types of products, ranging from raw materials to precise, unique materials. The companies in this industry produce products using iron, steel, aluminum, copper, and other types of non-iron. There are some 75 sub-segments in the industry that can be assigned to one of the following two categories[43]:

- **Basic products:** use of raw material and/or industrial waste in order to manufacture products for other industrial uses. This category includes products such as rods, sheets, wires, pipes, etc.[44]
- **Final products:** products with a specific

commercial, industrial or other purpose. This category includes casting, metal cans, metal treatment, precise metal products, etc.[45] In addition, manufacturers in the industry work with metal and its derivatives such as precision metal products, coating, forging and welding. Metal product assembly (e.g. machining) is also included in this category.[46]

In 2014, some 1665 million tons of metal were manufactured (a 1% increase compared to 2013) and metal industry growth rates are expected to remain stable in the coming years. This is due to factors such as continued growth in other industries that are dependent on the metal industry (vehicles, construction, infrastructure, etc.), and the expected peak consumption rates in China.[47]

Other trends include increasing spending on research and development in the industry[48]; and 3D metal printing trends, particularly for the aerospace and vehicle industries. Though this is not expected to have a significant impact on traditional manufacturing methods in the short-medium term, it may have long-term impact on precision metal production.[49]

Metal and precision component manufacturers are generally Tier 2 or lower on the global value chain. These companies' fields include fuselage, machining, aircraft assembly, structural aircraft components, manufacturing equipment and precision metal components.

The manufacturers use different techniques such as welding, bending, pressing, forging, spinning, electro-erosion, perforating, plasma cutting, stretching and more. They also utilize digital methods of engineering and designing the desired product.

The Israeli metal industry consists of two primary sub-segments – basic metals and metal products. The basic metal sub-segment includes elementary manufacturing and processing to produce metals

for construction, profiles, pipelines, and other products. The metal products sub-segment uses raw materials produced by the basic metal sub-segment in order to process and manufacture final metal products.[50]

The Israeli metal industry employs approximately 60,000 people, and includes nearly 2,800 companies in different fields (welders, equipment companies, machining companies, different types of metal processing companies, etc.). A significant percentage of these companies supply subcontracting services for manufacturers of final products.

There are dozens of Israeli companies that provide metal products and services for the aerospace industry. The majority of these companies specialize in machining, precise metal products, aircraft assembly, aircraft structural components, etc. They provide these services using both traditional methods (welding, bending, etc.) and advanced manufacturing technologies (electro-erosion, plasma cutting, etc.). These processes are occasionally supported by software that designs and engineers the final product. In addition, there are dozens of companies that specialize in composite materials.

Many companies manufacture products that are tailored specifically to their clients' needs, using advanced manufacturing techniques and technologies. These companies supply products for other industries, such as vehicles, maritime, electronics and more, in addition to the aerospace industry.[51]

The Israeli company *Kanfit* specializes in incorporating composite materials and metals using advanced technologies in order to manufacture precision metal products for the aerospace industry. Its clients include *Spirit Aerosystems, BAE Systems, ST Aerospace* and others, in additional to other Israeli companies. The company's products are installed in Gulfstream executive jets (G150 and G280), and include avionic doors, cockpit pedestals and equipment, structural components – parts, sub-assembly, and machining and composite assembly. Body components and parts made of composite materials are installed in Boeing 77X passenger jets and in F-15, V-22, F-18, F-16 and Eurofighter Typhoon fighter planes.[52]

Israel Aerospace Industries (IAI) developed and manufactured components made of composite materials for the Boeing 787, using sophisticated cutting methods and software to design and engineer the product.[53]

Leading Israeli companies: *Ashot Ashkelon, BSEL, Plasan SASA, H.R. Givon, Kanfit, Shimshon Fine Mechanics, Admar Metals, BAZ Airborne Components and Assemblies, Blades Technology, Cabiran, Carmel Forge, MOKED Precision Instruments, Migan, NIDCO, Ramim Engineering Works, Orlite Industries, Ofeq Metal Industries, S.K.M. Aeronautics & S.I. Industries.*

SELECTED ISRAELI COMPANIES

Name	Website	Segment	Brief description
Admar Metals	http://www.admar.co.il/	Metal components	Engineering services, CNC manufacturing, purchasing, quality assurance, mechanical assemblies, logistics
Aero-Maoz	http://www.aeromaoz.com/	Electronic components and aviation systems	Develops, manufactures and markets ruggedized HMI and control systems for Commercial & Military applications
Aeronautics	http://www.aeronautics-sys.com/	Aircraft assembly, electronics and control	Unmanned system platforms, payloads and communications for defense and civil applications
Amicell	http://www.amicell.co.il/	Electric components, electronics, cables	Assembles and markets standard and custom-made battery packs in a wide range of technical formats
Ashot Ashkelon	http://www.ashot.co.il/	Electronic components and aviation systems	Production of build-to-spec and build-to-print products in: Long and short shafts for turbofan and turbofan jet and turboprop engines, high lift system components including universal joints, transmissions and gearboxes, shafts and extension joints, landing gear components, electromechanical assemblies for aircraft, gearboxes, transmissions and gear-based products, tungsten weights
Astronautics C.A.	http://www.astronautics.co.il/	Electronics and control	Airborne computers & displays, mission systems and modern IT solutions that operate in a military/civil airborne environment
BAZ Airborne Components and Assemblies	http://www.bazaircraft.com/	Metal components	Specializes in sheet metal and extrusion fabrication, welding, surface-treatment and assembly

Name	Website	Segment	Brief description
Bental Motion Systems	http://www.bental.co.il/	Engines, electronics and control, aviation systems	AFVs, missiles, satellites , UAVs, jet planes, medical machines and special industrial equipment incorporating sophisticated servo motors, servo actuators, blowers & dust scavengers, spindles, as well as cutting-edge propulsion systems, alternators and starters, and mini stabilized payload systems for surveillance applications
BES Electronic Systems	http://www.bes.co.il/	Electronics and aviation systems	Manufactures electronic systems and products
Bird Aerosystems	http://www.birdaero.com/	Electronics and control	Airborne missile protection systems and surveillance, intelligence and observation management systems for patrol planes and for land and sea observation
Blades Technology	http://www.btl.co.il/	Metal components	Manufacturing of compressor and turbine blades and vanes for gas turbine engines
BlueBird Aero Systems	http://www.bluebird-uav.com/	Aircraft assembly, electronics and control	Design, development and production of tactical UAS and peripheral equipment
BSEL	http://www.bsel.co.il/	Engines	Engine MRO, casting, machining, research and development, assembly and testing of complete modules and turbine engines
Cabiran	http://www.cabiran.com/	Metal components	Manufactures Aluminum products
Carmel Forge	http://www.carmel-forge.com/	Metal components	Manufactures metal products
Controp	http://www.controp.com/	Electronics and control	Development and production of electro-optical and precision motion control systems
EIM Systems	http://www.eimsys.co.il/	Electric components, electronics, cables	Design, engineering, production and installation of electronics and electrical systems

SELECTED ISRAELI COMPANIES

Name	Website	Segment	Brief description
Elbit Systems	http://elbitsystems.com/	Aircraft assembly, electronics and control	Develops, distributes and integrates advanced security electronic and electro-optic systems
ElectroTherm	http://www.electrotherm.co.il/	Electric components, electronics, cables	Heating solutions supplier for the plastic, chemical, electronics, metal and food industries
Elisra	http://www.mw-elisra.com/	Electronics and control	Develops, manufactures and distributes electronic and microwave systems
Elmo Motion Control	http://www.elmomc.com/	Electronic components and aviation systems	Manufactures motion control components
Excalibur Systems	http://www.mil-1553.com/	Electronic components and aviation systems	Manufactures products such as: connectors, cables, cable assemblies, couplers and cards to sophisticated systems for the avionics industry
Gilat Satellite Networks	http://www.gilat.com/	Electronic components and aviation systems	Manufactures satellite communications and hybrid telecommunications solutions
Givon	http://www.hrgivon.com/eng/	Metal components	Manufactures metal products and products from other materials
HarTech Technologies	http://www.hartech.co.il/	Electronic components and aviation systems	Manufactures command and control systems and simulation infrastructure solutions
IARD Group	http://www.iard.co.il	Electric components, electronics, cables	Manufactures radiometry products and custom built electro-optical systems as well as research, development and measurement services
Imco Industries	http://www.imco-ind.com/	Electric systems	Develops, designs and manufactures communication harnesses, electromechanical boxes and other electrical and mechanical components

Name	Website	Segment	Brief description
Israel Aerospace Industries	http://www.iai.co.il/	Aircraft assembly, electronics and control	Develops, manufactures and distributes aviation products, astronautics systems, defense and military systems, unmanned aerial, robotics and electronics systems
Israel Military Industries	http://www.imi-israel.com/	Aircraft assembly, electronics and control	Manufactures air combat systems, propulsion solutions self-protection and security systems
ISREX	http://www.isrex.com/	Electronics and control, electronic components and aviation systems, maintenance services	Aircraft upgrades, telecommunications components, spare parts, electronic systems, simulation systems, special vehicles and more
Kanfit	http://www.kanfit.com/	Metal components	Manufactures primary and detailed parts, subassemblies and "ready to mount" assemblies, production kits, tools, and jigs using metal and composite materials
Magnus Engineering and Maintenance	http://www.magnus-eng.com/site/en/about.php	Electric components, electronics, cables	Manufactures products and kits for inspecting, test and fitting engines
MER Group	http://www.mer-group.com/	Electronic components and aviation systems	Manufactures communications and renewable energy systems
Migan	http://migan.co.il/	Hydraulic systems, metal components	Designing, manufacturing and assembling components and products in the fields of pneumatics, hydraulics, fuel, and gas
Moked Precision Instruments	http://mokedltd.com/	Metal components	Manufactures high-precision mechanical parts, components and sub-assemblies for the aerospace industries

SELECTED ISRAELI COMPANIES

Name	Website	Segment	Brief description
MTC Industries and Research	http://www.mtcind.com/	Electronics and control	Development and manufacture of high-precision measuring, navigating, actuating and control devices for integration into a variety of aerospace and defense applications
NanoMotion	http://www.nanomotion.com/	Electronic components and aviation systems	Designs and manufactures advanced motion systems, sub-system modules and piezo motor/drive components for semiconductors and other industries
NESS TSG	http://www.nesstsg.com/	Electronics and control	Develops security software and telecommunications systems
Netzer Precision Motion Sensors	http://netzerprecision.com/	Electronics and control	Develops and manufactures linear and rotary encoders based on the innovative "Electric Encoder™" proprietary technology
Nexus Systems	http://nexusltd.co.il/	Electronic components and aviation systems	Provides high-performance electric motion and propulsion solutions to aerospace and industrial customers
NIDCO	http://www.nidco.co.il/	Metal components	Machining and metal components and products
Ofek Metal Machining	http://www.ofek.ws/	Metal components	Machining, supplying parts directly to missile and astronautic system assembly lines (ship-to-stock)
OPGAL Optronics Industries	http://www.opgal.com/	Electronics and control	Specializes in thermal imaging and near-infrared illumination camera solutions
Orbit Communication Systems	http://orbit-cs.com/	Electronics and control	Manufactures satellite communications systems, communications management systems for aircraft, and surveillance and telemetry systems
ORLITE Industries	http://www.orlite.com/	Metal components	Manufactures composite materials products for industrial use

Name	Website	Segment	Brief description
Payton Group	http://www.paytongroup.com/	Electric systems	Develops, manufactures and distributes planar magnetic and conventional transformers
Plasan SASA	http://www.plasan.com/	Metal components	Manufactures ballistic armor, fixed and rotary winged aircraft and more products using composite materials
RADA Electronic Industries	http://www.rada.com/	Electronics and control	Develops, designs, manufactures and distributes various avionics systems and upgrades for UAVs, tactical land radars and inertial navigation systems
Rafael	http://www.rafael.co.il/	Aircraft assembly, electronics and control	Develops, manufactures and markets combat air superiority systems and space systems
Ramim Engineering Works	http://www.ramims.com/	Metal components	Command and control centers, area control centers, communication shelters, etc
Rock Wings	http://www.rockwings.net/	Electronics and control, maintenance services	Develops and manufactures night vision illumination, ballistic bulletproof suits, avionics installations and more
RSL Electronics	http://www.rsl.co.il/	Electronics and control	Develops, manufactures and distributes sophisticated electronic products and radars for the aviation and artillery industries
S.K.M Aeronautics	http://www.skm.co.il/	Metal components	Manufactures rubber and metal products for the aerospace industry
SA Industries	http://www.sa-ind.co.il/	Coating and forging, electric components, electronics, cables and metal components	Develops and manufactures electromechanical and optomechanical systems and subsystems
ScanMaster	http://scanmaster-irt.com/	Instruments for manufacturers	Manufactures and distributes ultrasound inspection equipment

SELECTED ISRAELI COMPANIES

Name	Website	Segment	Brief description
Schuster	http://hose.co.il/	Electric components, electronics, cables	Manufacturing hydraulic tubes and flexible/inflexible pressure piping solutions
Shimshon Fine Mechanics	http://www.shimshon.co.il/	Metal components	High-precision machining and high-accuracy metal products
SITAL Technology	http://sitaltech.com/	Electronic components and aviation systems	Develops and manufactures components and electronic systems such as the Smart Wiring Breakthrough Technology for the aerospace industry
TAT Technologies	http://www.tat-technologies.com/	Electronic components and aviation systems	Manufactures heat exchangers, cooling systems, cold plates, vapor-cycle air conditioning systems, flow accessories, as well as secondary and emergency power systems and fuel controls, turbines and valves
TGM (GM Cases)	http://www.tgmcases.co.il	Electronic components and aviation systems	Design, development, production, testing, and support for aviation ground support equipment
Top I Vision	http://www.topivision.com/	Electronics and control	Develops and manufactures tactical observation systems for balloons, mini-UAVs and payloads positioned on light-weight aircrafts
Urban Aeronautics	http://www.urbanaero.com/	Aircraft assembly	Manufactures special VTOL vehicle with no exposed rotors, capable of flying and operating inside complex urban and natural environments
Uvision Air	http://uvisionuav.com/	Aircraft assembly	Develops and manufactures innovative aerial loitering systems.These solutions are tailored for unique flight quality surveillance, advanced airborne guidance and navigation systems, precision attack munitions and command and control stations

FOOTNOTES

1 www.boeing.com

2 www.elbitsystems.com

3 http://aerospacereview.ca/eic/site/060.nsf/vwapj/4-Supply_Chain_Final_Report-Final-eng.pdf/$file/4-Supply_Chain_Final_Report-Final-eng.pdf

4 http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Manufacturing/gx-manufacturing-2016-global-ad-sector-outlook.pdf ; http://www.pwc.com/us/en/industrial-products/assets/pwc-aerospace-defense-2014-year-in-review-and-2015-forecast.pdf

5 http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Manufacturing/gx-manufacturing-2016-global-ad-sector-outlook.pdf ; http://www.pwc.com/us/en/industrial-products/assets/pwc-aerospace-defense-2014-year-in-review-and-2015-forecast.pdf ; https://www.flightglobal.com/news/articles/top-100-aerospace-manufacturers-hit-by-fall-in-reven-428460/

6 http://www.pwc.com/us/en/industrial-products/assets/pwc-aerospace-defense-2014-year-in-review-and-2015-forecast.pdf

7 http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Manufacturing/gx-manufacturing-2016-global-ad-sector-outlook.pdf

8 Airbus Global Forecast, 2015; http://www.boeing.com/resources/boeingdotcom/commercial/about-our-market/assets/downloads/Boeing_Current_Market_Outlook_2015.pdf

9 http://www.sasb.org/wp-content/uploads/2015/03/RT0201_Aerospace-Defense_Brief.pdf

10 http://i-hls.com/he/2015/06/%D7%9E%D7%A0%D7%95%D7%A2-%D7%94%D7%99%D7%91%D7%A8%D7%99%D7%93%D7%99-%D7%97%D7%93%D7%99%D7%A9/ .

11 https://www.nl.capgemini.com/resource-file-access/resource/pdf/The_Changing_Face_of_the_Aerospace___Defense_Industry.pdf.

12 http://www.eucia.eu/userfiles/files/20141008_market_report_grpcrp.pdf.

13 https://www.nl.capgemini.com/resource-file-access/resource/pdf/The_Changing_Face_of_the_Aerospace___Defense_Industry.pdf.

14 http://aviationbenefits.org/media/26786/ATAG__AviationBenefits2014_FULL_LowRes.pdf.

15 http://www.aeronautics.nasa.gov/pdf/green_aviation_fact_sheet_web.pdf.

16 https://www.asme.org/engineering-topics/articles/aerospace-defense/top-5-aerospace-trends-now-future

17 https://www.asme.org/engineering-topics/articles/aerospace-defense/top-5-aerospace-trends-now-future

18 http://i-hls.com/2016/01/israeli-technology-keeps-airports-safe-from-fod/

19 http://dupress.com/articles/additive-manufacturing-defense-3d-printing/?id=us:2el:3dc:dup1064:eng:dup:3dopp:dcpromo

20 http://www.themarker.com/news/macro/1.2617060

21 http://3dprintingindustry.com/aerospace/ , http://www.ibaset.com/blog/3d-printing-trends-aerospace-2015

22 http://prolim.com/wp-content/uploads/2015/09/Product-Lifecycle-Management-in-the-Aerospace-Arena.pdf

23 "Israel Aerospace Industry" by The Israel Export & International Cooperation Institute; Discussion with Dr. Deganit Paikowsky, Fellow at the Yuval Neeman Workshop for Science, Technology and Security at Tel Aviv University; Discussion with Adi Shauli, an economist at the MAI Association of Metal, Electricity and Infrastructure Industries

24 Conversation with Mr. Gil Rieder, Director of HLS, Cyber and Aerospace at the Israel Export Institute.

25 http://www.spacefoundation.org/sites/default/files/downloads/The_Space_Report_2016_OVERVIEW.pdf

26 http://www.sia.org/wp-content/uploads/2016/06/SSIR16-Pdf-Copy-for-Website-Compressed.pdf

27 http://www.herzliyaconference.org/_Uploads/dbsAttachedFiles/SPACESECURITY1.pdf. (in Hebrew)

28 https://www.flightglobal.com/news/articles/in-focus-how-elbit-is-closing-israels-pilot-traini-368997

29 http://www.cae.com/uploadedFiles/Content/BusinessUnit/Corporate/About_CAE/Media_Centre/Documents/2015/CAE_Annual_Report_2015.pdf

30 http://www.globes.co.il/news/article.aspx?did=1001099932 ; http://www.themarker.com/markets/1.2803887

31 http://www.themarker.com/markets/1.579320

32 https://elbitsystems.com/media/Elbit_Sustainability_2015.pdf

33 http://www.aia-aerospace.org/wp-content/uploads/2016/05/AIA_UAS_Report_small.pdf

34 http://tealgroup.com/index.php/teal-group-news-media/item/press-release-uav-production-will-total-93-billion

35 https://dronewarsuk.files.wordpress.com/2014/01/israel-and-the-drone-wars.pdf

36 http://www.frost.com/prod/servlet/press-release.pag?docid=278664709

37 http://qz.com/102200/why-israel-dominates-global-drone-exports/

38 http://auvsi-uvid.israeldefense.co.il/he

39 http://news.walla.co.il/item/2642873

40 https://dronewarsuk.files.wordpress.com/2014/01/israel-and-the-drone-wars.pdf

41 http://news.walla.co.il/item/2642873

42 http://www.mod.gov.il/Defence-and-Security/Pages/multi-layer-defense.aspx

43 http://calmac.org/publications/Final_metalworking_market_characterization_report.pdf

44 Ibid.; http://www.bls.gov/iag/tgs/iag331.htm

45 http://calmac.org/publications/Final_metalworking_market_characterization_report.pdf

46 http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=332&search=2012%20NAICS%20Search

47 http://www.ey.com/Publication/vwLUAssets/EY_-_Global_steel_2014/$FILE/EY-Global-steel-2014.pdf

48 https://www.kpmg.com/FR/fr/IssuesAndInsights/ArticlesPublications/Documents/global-metals-outlook-2015.pdf

49 Ibid.

50 http://www.moital.gov.il/NR/rdonlyres/288592F1-29A1-4042-80CB-9157DC29434D/0/metal2014.pdf

51 Conversation with Mr. Gil Rieder, Director of HLS, Cyber and Aerospace at the Israel Export Institute, and based on the content of various company websites.

52 http://www.israeldefense.co.il/he/content/%D7%98%D7%91%D7%99%D7%A2%D7%95%D7%AA-%D7%90%D7%A6%D7%91%D7%A2%D7%95%D7%AA-%D7%99%D7%A9%D7%A8%D7%90%D7%9C%D7%99%D7%95%D7%AA

53 http://www.compositesworld.com/articles/optimizing-composite-aerostructures-production

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The information included in this guide is relevant for December 2016. The content included is intended to provide only a general outline of the subjects covered and it is necessary that specific professional advice be sought before any action is taken.

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