ISRAEL AIRCRAFT INDUSTRIES

ISRAEL AIRCRAFT INDUSTRIES, A PROMISE FOR THE FUTURE

Israel Aircraft Industries (IAI) is an extensive syndicate, active in various sectors of aviation with several establishments in- and outside Israel and therefore a very interesting candidate more than worth while visiting. The syndicate is – with more than 14.500 employees – the largest industrial complex of Israël. If IAI before was interweaved with IDF/AF (Israel Defence Force/Air Force), nowadays the company is operating independent and self-reliant and we were told several times that there is no more than a coorporating level with IDF/AF. Orders have to be earned by delivering quality products, also inside the country. Mind that because of security not all details can be revealed, but IAI delivers many times in a better climate compared to foreign concurrents. As for the different activities the company exists of a division structure, all self-supporting in delivering products, management and accounts. We were not just allowed to have look at the different company-divisions but we were also allowed to picture almost anything we'd like to and that may be called an exeption !

Civil- and military aviation are interweaven in IAI. Next to a commercial aircraft group and the Bedek Aviation Group who mainly have affinity with the civil aviation included the development of complete aircraft. Aviation-parts, maintainance and repairs there is a large extensive Military Aircraft Group divided into three large divisions. These three important parts are called LAHAV, MATA and MALAT division each with it's own specialties.Next to that there is a Missile & Space Systems Group who specialises in rocket- and satellite technologies and a large Elektronic Group which is called Elta Electronics Systems Ltd. A highly accutare form of coorporation exists and components of one division fit perfectly into projects of the others. Though IAI designed and built several own airplanes (a.o. the Arava, Westwind, Kfir en Lavi) the present activities more or less focus on design and delivery ofavionics and modifying / modernising existing weapon-systems and platforms. They also take care of maintainance and upgrading for Israeli Air Force, foreign customers, production and selling parts for airplanes. All this within the highest thinkable quality-demands for industries and within required ISO-certification. IAI tries to anticipate in the changing needs with innovating thoughts, developing eminent technologies. Specially the Military Aicraft Group and ELTA will be described in this article.

LAHAV-DIVISION, REBUILDS YOUR JET-FIGHTER

The Lahav-division at Ben Gurion International Airport in Jerusalem has a main activity in modernising jets (also packages for helicopters). More than 30 years experience in development and production-techniques lead to more interesting projects. Lahav gives a face to that what makes IAI so well known. Offering the ultimate rebuild-package for a row of present older generation jet-fighters And helicopters so these planes remain fully operable under the present conditions. Take for instance the ultra-modern cockpits (unfortunately not to be pictured) with highly balanced and figured-out electronics available for F-4, F-5 , Kfir (Kfir 2000), Mig-21, Mig-23, Mig-29, Su-22 and the early F-16 versions. The last mentioned about

comparable with the MLU-kit of our Dutch Klu F-16's. Potential customers are te be found all over the world. Though sometimes contractsgo to the concurrents (it's a hard business) like the Romanian LanceR Mig-21 modernisation-project which was given to Elbit (also israel) IAI remains trying to enlarge it's influence in this sector. There still are major users of former named types who – sooner or later – will have the need to upgrade. Sometimes the lack of proper funds makes that new planes are to expensive to buy so these customers find their ways to options like IAI offers them. Very large orders were given to IAI like USAF's T-38 talon fleet (500 examples) who needed modern cockpit equipment.

Orders resulting from these projects and support-orders mostly follow. Central stands the wish of the customer, and many things must be made possible to realise these wiskes, so states Beni Manes, head of division. All different kinds of technologies, necessary to realise the complete product can be bought and applied within IAI. They also don't care to cooperate with the concurrents, like the order from the Turkish Air Force which was shared with Elbit. That is dealing with commerce ! 'Concurrents or friends' whatever suits best at the very moment. The things that are possible for fighters can also be applied on helicopters, and this way a very lucrative order was gained from India, who wanted to have for it's ALH's (Advanced Light Helicopter) or "Dhruv" avionics-kits from IAI. With Hindustan Aeronautics Limited (HAL) a contract was signed about this by Lahav.

LAVI, FAR AHEAD ON IT'S TIME

A very famous project in 1980 was the 'Lavi' a project in which Israël made a sensation. The Lavi was it's time far ahead, a jet-fighter which had the looks of an F-16 and who certainly was a match for it as technologies concern. After the success of the Kfir, a further developed Mirage-5, the Lavi was a complete new design, which made IAI a very grown-up company as it comes to design-capacities ! A total of five prototypes were build, 3 single-seaters and 2 twin-seaters. Unfortunately the Lavi didn't make it as a series production machine (did the Americans mind, perhaps ?...) but it became a perfect technology-demonstrator ! An enormous concurrence-competition took place between the Lavi and the F-16 by the time they started thinking of replacing types like A-4 Skyhawk, F-4 Phantom and Kfir.

The breaking down of the Lavi project was a political choice. It is out of the question that it should have been a technologic debacle, on the contrairy. Many technology came out of it and several 'Lavi-systems' were sold, 'for 2 billion dollar out of this aircraft' Beni Manes told us so you can hardly call it a miscarriage. By that time the following matters were spectacular new; the use of 22% composite materials, digital techniques in modular construction, fly-by-wire capacity, LCD-technology and multi-mode Pulse Doppler radar. Though the main constructor was IAI/Elta, many small parts came from American companies. The American authorities made it impossible by blocking these parts from delivery to realise such a direct concurrent for the F-16. This lead to the fact however that IDF/AF who saw it's Lavi project die an early death got acces to modern American planes and helicopters while this was very sensitive in the past. Large numbers of F-16's and F-15's, AH-64's and UH-60's found their ways to the Israëli Defence Force. IAI, stronng in developping and delivering of "stand-

alone parts" at her turn was allowed to participate in the F-16 project, Lahav produced the F-16 wings for years and also was the brain-chaild behind the high F-16 back (filled up with avionics) and the Conformal Fuel Tanks (CFT's) of the brandnew F-16I. Also rights of license were obtained for Lockheed and Boeing and productionrights for the Grumman G50 and G100 Gulfstream.

REMAINING CONCEPTS, CENTRAL THE PILOT

Other welcome activities in the world of aviation were the Virtual Training Systems (VTR) of IAI and Pilot Evaluation System (PES). Large numbers included software were put into the market. With PES in just one day it is to be decided with a score of 90% if a candidate is suitable for the very expensive flight training or if he isn't. Another amongst pilots well known system is the GATM (Global Air Traffic Management) wich was developped mainly by IAI. GATM is delivered with an upgrade-kit for transportplanes together with a digital map and sensor as well as self protection technology. Finally we can mention that Lahav has a name to save in the hydrolics of which many equipment is implemented in transport helicopters. The confirmation of orders is about 2,8 milliard dollar of which 80% export orders.

MATA-DIVISION, A DYNAMIC COMPANY

Mata division, also to be ound at Ben Gurion Airport seems at first sight to have overlapping activities with Lahav like systemintegration with avionics. But when you take a closer look at the activities of Mata they just take care of a little different territory. Mata is specialised in rotating parts for helicopters such as rotorblades (of compositmaterials), rebuilding of helicopters in general and cableing planes, helicopters and even rockets. Mata next to that is an important point of support for helicopters and is specialised in maintainance at all levels of many helicopter-types for Airforce as well as civil customers. Mata is a official Bell Customer Service Facility (CSF) just about all Bell typen, and also servicing-rights were given by Sikorsky and Mil for their helicopters. Not without pride a complete serie of certificates are shown to us that proove these facts. Mata, together with the smaller Tamam division brougt modern upgrade kits into the market for Mil Mi-17 and Mi-24. These types are still in use in large numbers over the world. These ' Peak 17' and ' Mission 24 kits' have a cockpitconstruction with instruments and avionics from Elta. Restructurising the helicopters and supplying them with nightvision equipment is a mani activity of mata division. The kits include also a Electronic Warfare Suite with FLIR (Forward Looking Infrared), radar-doppler detectors and chaff and flare dispensers. Next to that night targeting equipment and capacity for Rafaël anti-tank rockets.

The infrared detector of the Mi-24 is a very special finding of Mata which exists of two 360 degrees lightsystems that cannot be seen from the ground. This detector enables the pilot to ' see' with his NVG's (night vision goggles) under 360 degrees ! They are aiming at India's military market which is very large, but competition is also present like Rosvertol from Russia and Sagem from France. Other items are a rebuilding kit to attack version of the 412 (a.o. for the Slovak Airforce) and Hughes MD-500E. For the civil market on demand of the customer there are possibilities of "customisation" of the helicopter and also self-defense kits are available. A terrain in which IAI is spear-head because Israël knows better than anybody else that a civil

target suddenly can be vulnerable for terrorist attacks. For years already the Flight Guard Self-Protection System with Elta parts is delivered by Mata inside Israel and also abroad for the millitary helicopter and since the disreputable september 11th disaster in New York now also actual for the civil helicopter. Incoming missiles who endanger the planes are detected and the unit supplies in minor time a response of effective counter measures who make the missile change course.

An important order for Mata came from the IDF/AF had 29 CH-53 transport-helicopters rebuild in the project Yas'ur 2000 with complete new cableing, restrenghtened landing-gear, air-to-air refuelling system and several avionics modifications. Through their experience with airframes and engine-inspection and maintainance of both Mata is within IAI the best unit to recover planes and helicopters after a crash, if possible. All their activities Mata likes to collectin a term as Total Aircraft Support ofcourse by ISO-9001 norm. Mata has a reputation to keep up , but with all the certificates under your nose they hardly have to explain.

MALAT DIVISION, UNMANNED AVIATION

Malat is the division of IAI that specialised itself in the world of Unmanned Aerial Vehicles or short UAV's. This market is growing and offers good perspectives for the future. There where tasks of the manned aeroplanes can be replaced by unmanned, there is the terrain and challenge of the ISI designers. The present generation UAV's (4th generation) have been designed as reconnaissance-platforms. They make their own start (lift off) or have to be catapulted to get them airborne. Different systems are in the market such as the Hunter, the Ranger, Searcher MkII and the Heron. Israël has experience for years on this territory where the need was already clear after the Yom Kippur war which in some way gave a "boost" to the further development of the UAV. Loads of advanced technologies are on board such as electro-optical day/night sensors, synthetic aperture radar, maritime patrolradar, lasertargeting and various forms of data-link (included satellite data-link). Optical systems can generate "real time intelligence" through datalink which means as much as that the battle commander gets a permanent sight of the situation by all sorts of data and video images. A special sort of missions which are important are the MALE-missions (Medium Altitude and Long Endurance) who take place at average flight-altitude in ‘ long endurance flights’. For this goal the Heron is very suitable, the most advanced platform for gaining large strategic information can remain in the air for 52 hours.

A special design version , the Eagla-1 has a range of 1000 kilometers ! Scan capacities sometimes go up to 200 miles. The systems are ideal to trace down enemy-units, but also reconnaisance missions can be flown after a raid to provide the commander the necessary "battle damage assesment". IAI worldwide has 20 customers for the UAV’s and some of them today find their application in frontier territories like Afghanistan and Iraq. Just looking at Europe, the airforces of France, Switzerland, Finland and the army of Belgium fly Malat’s UAV's. Also the USA and India belong to their customers and the number of orders is still increasing. The UAV’s fly on automatic pilot, but the mission commander can take action ad hoc from distance and take decisions in the program without heimself beeing in the middle of the battle. Without any risk for the own life, one can be ‘ present’ at the spot and gather information without the chance of beeing captured by the enemy. When we

asked if there is not a problem when the UAV should fall into enemy hands, and the UAV and it's technology can be carried off as a prize, we didn't quite get a clear answer, although, in some way actually we did. Malat told us that it was thought about very well, and that the enemy will not get the technologies on a silver salver ! ' The enemy will not be able to use these technologies, which will be no longer recognisable, no further details'. Draw your own conclusions…. Because of all the avanced technology the UAV has a ' decent sized' price-card and the question is if some airforces can afford this. By building cheaper and smarter you can release more in the market. Another possibility is to lease the UAV's for a certain period for temporarily operations. Malat works on a number of new concepts like tactical and low-tactical UAV's. The I-SEE concept is some kind of a motor-glider of about 2 kilo's, to be transported by a private in his rucksack, with a capacity of about 2 square kilometers scanning-reach, to be used at all time and every place. Another some larger system is the I-View started by catapult and landed by parachute which can also be used on the spot in the battle-area. IAI-Malat takes a look in the future and tries to play a major role ! Next step in development will most probably be armed UAV's with real battle-tasks !

ELTA SYSTEMS LTD – SUPERSPECIALIST IN ELECTRONICS !

One of the most interesting parts of IAI is Elta, simple said the electronic department. Elta is specialist in ISR, Intelligence, Surveillance and Reconnaissance and marketleader in radar and Early Warning (EW) communication as well, with 1,4 miljard dollar business done. To be short, it implicates elektronic information gathered by sensors (Electronic Intelligence = ELINT) through communication systems (Communication Intelligence = COMINT) and radar. Their territory contains all systems, necessary to gather all information about the environments of an airplane in what form so ever, to be able to react specificly to that plane and it's environment (for example activating selfdefense systems) or to influence these signals actively by means of electronic warfare ECM. (Electronic Couter Measures). Also active systems like fire-guiding and lasertechnology come from Elta's kitchen. Self-evident these technologies are to be implemented in ground-systems or naval applications (ships) Elta systems itself - with their head-quarters in Ashdod – is devided in a sort of division structure with for each section a specialisation on a certain specific terrain. The radar division takes care of the radarsystems in the ground-defense systems, Airborne Early Warning (AEW) or radartechnologies for maritime tasks like search-radars for surface ships. Also tactical systems for situation-awareness like "battlefield Surveillance" and missile approach warning radar (sees incoming missiles) for planes and helicopters belong under this radar division.

IMINT

An upcoming system is IMINT (Image Intelligence) where a synthetic aperture radar in combination with elektronic and optical sensors generates a sort of image. Imagine: Within two minutes it is possible (from distance !!) a strip of 50 km² in "near real time" can be 'photographed' . One should expect that this results in a picture under a certain vague flat angle, though after processed by a computer it exactly looks like you look right on top of the far away object ! Because the image was made

of a radar profile this technique can be used under all weather circumstances, and that is something the AWACS cannot do. Interesting detail is that this systemhas been certified for 'under sea-level' which is possible because the Dead-Sea lies 900 meters below the official sea-level. IMINT-technology can be implemented in the F-16 , a UAV but also in a sattelite. It offers great possibilities. The Communications Systems division focusses on COMINT and COMJAM, This last term means jamming of communication. Many systems – mostly guided from distance – can be implemented in the customers wish. Next to that protecting VHF/UHF equipment is brought on the market. The Electronic Warfare division is operating very broad. Wellknown is the electronic self-defence for planes, built in in the fuselage or in a pod underneath it, or inbuilt technologies for helicopters. ELINT systems found their way to the export-market. Elta's EL/L-8300MPA, a system for maritime patrol-planes was ordered for the English Nimrod-2000MPA and Australian Orions. A combination of ELINT and COMINT can be delivered in the form of SIGINT (Signal Intelligence). The Information Systems division and division of advanced technology contribute on their turn in software and in fact a multiplicity to applications to make the electronic systems functional.

PHALCON, TECHNICAL LONG-ARM IN AEW

In what important way Elta anticipated with radar technology proved to be the IAI Phalcon 707 when demonstrated to the world. To both flanks of the front of the fuselage of a boeing 707 a fore-part with a large electronic Unit. In it a large Phase Array radar is built which works with electronic scanning. But not only this large a Phase Array radar was unique, also some sort of fusion technique was applied and that was also new. THE AEW&C plane where c stands for Control has multiple sensorsystems. Phase Array radar and Phase Array IFF in 1 Unit are combined with ESM/ ELINT and CSM/ COMINT equipment (ESM/CSM = Electronical and Communication support Missions). All information can be sent by means of data-link to Command and Control (C&C) centre on the ground, but the plane itself of course also has possibilities for C&C and can be used strategically.

NO ESCAPE POSSIBLE UNFORTUNATELY

The performance of the Phalcon is impressive. 360 degrees can be monitored around at on time and even low flying objects can be discovered at a distance of hundreds of kilometers, day and night and uner all weather circumstances. The unit produces some sort of electronic pulse wit a so called high update rate (much higher than the AWACS) with "no loss of tracking" and "no escape zone" which means once tracked (trapped) there is no escape possible anymore.The electronic pulse han no problem what so ever with high-speed objects specially because a full track takes no more than about 2 to 4 seconds in contradiction to a regular AWACS which needs some 20 to 40 valuable seconds ! The computers constantly cross-lonk the information with different ways of observation, many objects can remain in the track and new ones can be traced down at the very same moment. There are eleven consoles on board with very high resolution displays. Nice to find out that the Phase Array Radar technology came out of the Lavi Ans is also used for firing-guidance radar for the Arrow defence-missile and the Nautilus anti-rocket laser. These systems

use the "Green Pine", the most powerfull mobile search-radar that Elta produces. As concerns the Phalcon a large order came from Chile who ordered the Phalcon in 1995. Overthere they call it the 'Condor', but what's in a name anyway. Big deals with China were broken by heavy pressure of the United States. Afterwards large amount of money was paid by the Americans to compensate IAI. At this very moment negociations take place with India about the deliverance of three Phalcon systems which can be mounted on a Ilyushin-76 with a total order amount of 1,3 milliard dollar. Elta themselves say that their systems can be built in the fuselage or on top of the plane and within that concept are mentioned Boeing 707, 747, 757 and 767, MD-83, Airbus 321 and C-130 as potential carriers.

THE FUTURE

IAI has a bright look at- and confidence in the future with an increasing business and a very customer minded approach which is a 'holy issue' to the company. In principal there is not any "not done" territory exept ofcourse all that falls aside Israels political doctrine as forbidden territory. The meddleness from the USA could mean a certain threat for the company though correct political management can result at it's turn in (back)orders to the USA in case the Governament throws up a blockade. A unique three-rings structure takes care of the customers desires, with complete protection and full privacy. The most inner circle of the three-ring structure represents the knowledge and technology as developed, the middle ring concerns the strong hyper-speed signal processors and interfaces who help to make the technology employable. The outside ring takes care of inventing specific solutions. IAI can deliver systems that – ofcourse – can function 100 %. But as important as that IAI wishes to deliver systems that also fit to the customers wish for the full 100 %, 98% isn't good enough for them. IAI can offer a large selection in systems and what might not be in-house, is directly ordered through a 'close loop' system by the concurrent.

IAI has high expectations of the concept for the Multi Mission Aircraft (MMA) where SIGINT (ELINT & COMINT) and IMINT are combined and processed a Intelligence Information Dissemination Station. This at it's turn again is some sort of ' can do everything' which can be put in service multifunctional for Image Intelligence, Signal Intelligence, AEW&C, maritime patrol and electronic tactical support. The concept could be built in a Boeing 737, but also even smaller planes like Light Multi Mission Aircraft systems. Other new developments are an even more powerful radar shaped like a rotodome, but in a fixed three-part system and naturally equipped with the Phase Array Technique, a Multi Mission Radar (MMR, suitable for as well as Navy, Army and Air Force) and a Multi Mode Fire Control System (MMFCC). Next to that electronic variants of the Gulfstream are to be built who - like the Phalcon - are going to be taken into service. The Gulfstream project is going to be called G550 Nachson and there are two versions, A SIGINT-version with IAI Elta EL/I-3001 system and a Compact AEW version (CAEW) with the IAI Elta EL/W-2085 system.

Next to other Division managers and technicians of IAI who gave interviews and information no-one less than General Manager Ami Davidsohn, the absolute topmanager of IAI came to give us information. Therefore he exclusively flew from Tel Aviv to Ben Gurion for 'Piloot en Vliegtuig'. (magazine Pilot and Airplane)

He, as well as the overwhelming impressions and the outspoken information made clear that IAI is a very many-sided company with plenty possibilities and interesting ideas. A company that in future will demand a enduring and important part in the market !

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