Out of This World: Israel’s Space Program

New Frontiers

Israel Space Agency: Current and Future Programs

Written by Professor M.G. (Ret.) M.K. Isaac Ben-Israel – Israel Space Agency, Chairman and Dr Zvi Kaplan – Israel Space Agency, Director General Ministry of Science, Culture & Sport

The debut of “Ofek-1” the first Israeli satellite on September 19, 1988, is a landmark for the beginning of the Israeli “Space Age.” This happened approximately 30 years after the beginning of the world’s Space Age – the launch of Sputnik 1. Nevertheless, a posteriori, the Israeli Space Program was viewed as a tremendous success. A small country joined the exclusive club of seven space “superpowers.” Israel was skilled enough to achieve a status of a world leader in the important niche of small but highly sophisticated space platforms, exhibiting outstanding performances.

At present, the State of Israel is standing at a watershed. In order to leverage the already acquired achievements, it should be pursuing space technologies and space systems to further improve its position in three important dimensions: Strengthening its strategic defense status, elevating the level of excellence of its society and increasing its economical growth.

Historical Notes:

Israel’s space program began with university-based research in the early 1960s. The Israel Academy of Sciences and Humanities formally established the National Committee for Space Research in 1963. The growth, in scope and depth, of related research activities led to the creation of a strong academic community that fostered a new generation of scientists and engineers.

Next, at the beginning of the 1980s, Israel set its sights on developing the industrial and scientific infrastructure required for full-fledged membership in the “Space Community.” The government established the Israel Space Agency in 1983 in affiliation to the Ministry of Science, Culture & Sport and charged it with the coordination of the nation’s space program. The emphasis continues to be on building a broad space infrastructure, and following the Ofek and its Shavit launcher, a diverse scope of activities was established both for defense led by Israel MOD and for civilian applications under the leadership of ISA.

The creation and the advancement of the Israel’s space industry was a natural outgrowth of the defense industrial infrastructure. Later on, private initiatives were established to develop space components and space-based services. The industry’s prime contractor and system house is the Israel Aircraft Industries. Other Industries such as “El Op” and “Rafael” are producing important core technologies and main sub-systems, and in the third circle, there are additional medium and small companies creating jointly a fully indigenous capability.

The Present Status

Israel’s space activities are highly focused on High-Resolution-Imaging satellites in Low Earth Orbits. The funding levels for Israel’s space program are relatively modest. Nevertheless, the program’s

WEB RESOURCES:

Israel Space Agency: www.most.gov.il/english/units/science/israel+space+agency

Ministry of Science, Culture and Sport: www.most.gov.il/english

BELOW: The launch of the communication & science satellite OFFEQ 5.
achievements are among the most impressive of Israel’s high-tech industries. On the basis of cost-to-performance and weight-to-performance, there is no doubt that Israel’s imaging satellites are among the best in the world.

At present there are five earth observation active satellites in orbit:

**EROS A** – operating as a commercial venture supplying imagery to the international market. To be followed by OFEQ 5, EROS B, OFEQ 7, (the second generation of Electro-Optical Remote-Sensing satellites).

**TecSAR** – Launched in 2007, employing a state-of-the-art Synthetic-Aperture-Radar payload. It will enable night images and penetration through clouds.

In the coming years (under development and construction) the next generation of satellites will include:

**OPTSAT** – 3rd a new generation of high-resolution Electro-Optical remote-sensing satellites.

**VENUS** – A Joint Israel/France Multi-spectral Mission, to monitor vegetation and coasts (water quality). Partners: ISA – Israel Space Agency and CNES the space agency of France.

The AMOS4 program was started in July 2007 and is planned to be launched by the end of 2011. AMOS4 will be placed in a different location mainly to serve Africa and Asia. AMOS4 is a medium-class (up to 4.0 ton) Satellite. IAI/MBT-SPACE also provides the satellite owner (SpaceCom) with control operations service.

**Propects for the Future**

Where are we going from here? The inventory of the state of Israel includes the following assets:

- Industrial infrastructure for space systems including communication satellites and earth observation satellites.
- Unique know-how in the domain of small systems of 200-400 kg.
- High quality and gifted scientific manpower with a world reputation for its research in space exploration astronomy and our planet.
- A modern advanced society with the ability and willingness to consume space products and services (global communication, media etc.) and a growing modern economy based on electronics and computation expertise.

We have an unparalleled opportunity to utilize these existing assets to establish an aggressive space program that will bring the state of Israel the following benefits:

- Improve the economy. Each 1 percent increased share of the global world revenues would result in a $1.5 billion increase in sales. Therefore, based on this projection, a world’s share of 3 to 4 percent seems practical.
- Increase the status of the Israeli space affiliated sciences.
- Contribute to the survival of our planet and to the quality of life on it.
- Stop the worrying phenomenon of the brain drain from Israel because of the lack of challenges and adequate jobs for young professionals.
• Increase bilateral and multi-lateral collaborations with national and international space agencies, thereby strengthening the status and the position of Israel in the world scientific community.
• Last but certainly not least, there are the defense-related advantages both from the long-term strategic dimension and the immediate contribution to the effectiveness of our military capabilities.

Q&A with ISA Chairman

Isaac Ben Israel

Written by Eric Silver

On-line maps, international mobile phone calls, satellite television, the battle to save the planet from global warming: Israel’s 25-year-old space program is a pioneering force in developing these digital marvels of the 21st century, far beyond the country’s size, wealth and population.

Israel is one of only seven countries that both build their own satellites and are capable of launching them. More than 40 other countries buy from those seven.

Israel recently launched its first-of-a-kind reconnaissance satellite that uses advanced radar technology. Unlike earlier models, fitted with conventional cameras, it doesn’t need light. It can send back high-definition images taken at night or through clouds.

The satellite, known as TECSAR, was designed and built by Israel Aerospace Industries. Only the United States and Europeans have built anything similar, but theirs weigh ten times as much as the Israeli version. In space, smaller is cheaper – and thus more competitive in a burgeoning world market.

The Israeli space program was a byproduct of the 1979 peace treaty with Egypt. Spy planes could not fly over Sinai to make sure Egypt, now a friendly country, was not moving missiles into the demilitarized peninsula. Spy satellites were the answer. Israel didn’t want to rely on anyone else to collect and convey the intelligence. So in 1983, Yuval Ne’eman, an eminent nuclear physicist and former Science Minister, was tasked by Menachem Begin with creating the Israel Space Agency.

Within a decade, his team found themselves with an industry. If they could produce military satellites, why not use the same technology to produce civilian satellites, too? Currently, Israel has eight Amos communications and Eros reconnaissance satellites orbiting the earth at an altitude of 36,000 kilometers.

Professor Isaac Ben-Israel, a Tel-Aviv University physicist and former director of research and development in the Defense Ministry, has been the agency’s chairman since 2005. He explains here why Israel is punching above its weight and is looking to earn as much as $15 billion a year in exports.

Q: Who Are Your Clients?
A: Google Earth, for one, is a big customer of satellites. There are four companies in the world which sell the kind of images it needs for its maps. Two are American, one is French. The other is Israeli. Google buys from all four. Then there are big cities. If you want to monitor what’s going on, even to see if there is illegal building, it’s easier to use an image taken from space because in one image you can cover the whole city. And it doesn’t cost them more than $10,000.

Q: What Makes Israel’s Space Research Different?
A: We specialize in developing micro satellites weighing 300-400 kilograms. The telescopes should be very light. So should the mirrors, the lens, the electronics. We needed satellites light enough to launch from Israel. Because of the neighbors, we can only launch westwards, over the Mediterranean. Since the earth rotates in the opposite direction, you lose a lot of energy. So we put a lot of effort into miniaturizing. The launch doesn’t cost so much, the sub-systems cost less. So we found ourselves with the capability of building sophisticated satellites that were relatively cheap. And the world started to show an interest.

Q: For example?
A: We are now building a satellite called Venus in cooperation with France. The whole satellite is built here in Israel; the French participate in financing the project. They approached us because there is a growing need for such light satellites because of their cost. The French want to compete in bids being released by the European Space Agency.

⇒ ISRAEL’S SPACE PROGRAM
of Israel Aircraft Industries (2000-2002). In the Knesset, Prof. Ben Israel is: Chairman of the Subcommittee for Home Front Readiness, a member of the Foreign Affairs and Defense as well as the Science and Technology Committees.

He served in the Israel Air Force (IAF) after graduating high school (1967) and served continuously until his retirement (June 30, 2002). During his service, he held several posts in operations, intelligence and weapon development units of the IAF. He headed the IAF Operations Research Branch, Analysis and Assessment Division of IAF Intelligence, and was the Head of Military R&D in Israel Defense Forces and Ministry of Defense (1991-1997). In January 1998 he was promoted to Major General and appointed as Director of Defense R&D Directorate in the Ministry of Defense.

Q: What will Venus do?
A: It will be a scientific satellite, monitoring the environment and pollution. Satellites are perhaps the best source for monitoring global warming and environmental problems. They can help scientists to develop the right model for protecting the earth. You can take photographs of fields, for instance, and identify certain diseases affecting plants. You can look at the sea with multi-spectral cameras, which can detect and identify all the chemicals in the water. This is good for monitoring pollution. The scientists will use those measurements in order to build or verify or change the model, which can predict all these phenomena.

Q: The civilian world market for communications and other satellites is estimated to be worth $150 billion a year. How well is Israel placed to win its share?
A: Israel is one of the few countries that have the capabilities. There is no reason why we shouldn’t have 5 to 10 percent of the market. High-tech is the main source of our economy. We have the right people, the right universities, the right education. We intend to be involved.

Q: When we think about space programs, we think of manned space flights. Does Israel have ambitions in that field? Might we see others following Ilan Ramon, Israel’s first astronaut, who died when the Space Shuttle Columbia disintegrated on re-entry in 2003?
A: We have an ambition, but it’s too big for a small state like Israel. Still, we think it’s very important, because space is something which ignites the imagination of the young. If you want to fight the brain drain and attract young scientists to come back to Israel, space is very good. And for this you need manned space, too. So we will consider, as we did in the past, doing it in cooperation with someone bigger than us. There will be more Ilan Ramons. I hope with a better end.

Moshe Arens

Present at the Creation of Israel’s Space Program
Written by Eric Silver

As Defense Minister in 1983, Moshe Arens was the right man in the right place when Prime Minister Menachem Begin founded the Israel Space Agency. Arens was a professor of aeronautical engineering who had served as chief engineer of the Israel Aircraft Industries for 10 years. Before that he had taught on space-related matters at the Technion, Israel’s MIT.

Israel’s first involvement in space, the retired Likud politician and former ambassador to Washington recalled, had to do with ballistic missiles. Once Israel reached the point where it had developed ballistic missiles, launching a satellite into orbit came within the realm of the possible.

“Once we had the capability, we were on our way. Then we saw the advantage of a satellite for intelligence purposes. We wanted independent capability because information is not always made available to you, even by your best friends.”

In its missile development, Israel focused at first on outgoing missiles, being able to retaliate for any missile attack. “At that point,” Arens said, “nobody took seriously the possibility of intercepting missiles in flight.” That came later with the Arrow theater missile defense system, which Israel has developed with the United States.

Security was the trigger for space research, yet at first the military were unenthusiastic. “When I was Defense Minister,” Arens said, “some of the senior army people though they had better use for the funds. But looking back, you won’t find anybody today who would argue that the space program was a waste of money.”

From Creation to Creativity