49th IAA HISTORY OF ASTRONAUTICS SYMPOSIUM (E4)

History of Israeli contribution to astronautics (3)

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ABY HAR EVEN, A ONE MAN SPACE AGENCY

Abstract

This is the story of Aby Har Even, the former director general of the Israeli Space Agency (1995-2004). During his term as the head of Israeli Space Agency (ISA) the agency signed numerous international agreements and memorandum of understanding with various countries; Israel experienced its first spaceflight of an Israeli astronaut, cooperation between the space industries and international partners flourished – and all was made when he was the only space professional on the payroll of the space agency. Before joining ISA, Aby Har Even was leading the enormous challenge of building Israel's indigenous satellite launch vehicle Shavit. Years after leaving ISA, Har Even's voice still sounds in international conferences, at the academy and on various consultant positions.

The first career: The Army years

Har Even was born in Romania on on March 7th, 1937 as **Aby Hartstein**, and immigrated to Israel on August 1950. He was living in Jerusalem and went to the Hebrew Rehavia Gymnasium in Jerusalem.

Har Even served initially at the Artillery corps, and pursue a military career. During his military service he attended the Technion – Israel's Institute of Technology, and graduated as an electrical engineer on 1963.[1] From 1963 till 1968, he served in the artillery corps, in various positions including R&D and commanding the officer's course of Anti-aircraft artillery.

On 1968 he was assigned to the weapons R&D branch at the IDF general staff, which later was merged with the R&D of the MOD (Ministry of Defense) branch for research and development, and was promoted to the rank of colonel.[2]

[1] All personal information was confirmed on numerous talks and interviews with Har Even, and especially on September 2015.

[2] From Har Even's CV he prepared in the late 1983.

From 1968 to 1978 he was responsible for a variety of R&D programs, including R&D defense cooperation

Programs with other countries.

Aby Har Even receives the rank of colonel, from the IDF Chief of Staff, Lt. Gen. Mordechai (Mota) Gur (at the right)

On 1977 He was decorated with the Israel Defense Prize, the most prestigious award to people who developed breakthrough defense and weapons systems.[3]

On October 1979 he retired from the military service as colonel. (During his intensive and demanding service, Har Even graduated from the Tel Aviv University School of business administration - M.B.A.).[4]

The Second career The IAI (Israel Aerospace Industries) years

After retirement from the IDF, Aby Har Even tasted the private market technology sector, by joining the Fischer & Porter Company - on which he was the director general of Fischer & Porter Israel subsidiary. On July 1982, he joined the IAI (Israel Aerospace Industries) were he was the head of the special programs administration.

On July of 1983, he joined the department of IAI's internal auditor – a position he chose to better understand and know IAI – and as a tool to decide on which part of the company he wants to be. After several months in the Auditor's department, Aby was asked to join MLM plant of the electronics division, and got the position of the head of development for Israel's first indigenously developed satellite launch vehicle – the Shavit (Comet).[5] He continued to work at MLM on various advanced projects until his retirement from IAI on December 31st 1994.

The Third career: The Israeli Space Agency years

Aby Har Even assumed the helm of the Israeli space agency as director general on January 1st, 1995. The Israeli space agency was a tiny organ within the Ministry of science (which, during the years, was re-

[3] The project on which Har Even was awarded the prize is still classified and was never became public.

[4] On 1975.

[5] For farther reading on the Shavit launcher, see Inbar, Tal, "To ride a comet – 25th anniversary of the Shavit launch vehicle, IAC-13,E4,2,6,x18366

structured and renamed several times – it was called the Ministry of science, Ministry of science and technology, Ministry of science, culture and sport (!) and today it is known as the Ministry of science, technology and space). Previous directors of the agency were academy people, that hold the position of the director general as part time job, often with no money from the agency itself. Har Even was the first ISA director general who hold the position for years, enabling him to embark on various long term endeavors.

The highlight projects and accomplishments during his time as the head of ISA includes the followings:

- A series of inter-governmental space agreements with space agencies around the world;
- Cooperation with the Dutch space agency on the SloshSat project;
- Qualification of C.N.E.S.'s components and subsystems in Soreq N.R.C.
- The Israeli astronaut project (and MEIDEX)
- The Tauvex space telescope project;
- Initiation of the Venus satellite - joint venture between Israel and France;
- Establishment of NASA affiliated project at the Tel Aviv University(ISA-MEIDA);
- Laying the foundations for space cooperation with India;

International agreements

As the Israeli Space Agency is a coordination and policy oriented organ within the government of Israel, it lacks the funds needed to directly transform the ideas into hardware. The way to do it is first to sign an agreement with a foreign space agency or government. After an official space cooperation agreement (or MOU – memorandum of understanding) is signed, the governments then allocates funds for projects of mutual interest. During his term at ISA those agreements and MOU's have been signed:[6]

- CNES[7] cooperation agreement – 1994. Although this agreement was signed shortly BEFORE Har Even took office, he was responsible to transform it from a "paper into hardware";
- DLR[8] agreement - 1995
- NASA cooperation agreement - 1996

[6] The full list is cited from Aby Har Even report "Israel cooperation in space with other countries", published (in Hebrew) by the Begin-Sadat center for strategic studies on May 1st 2009, and on a September 2015 interview I made with Har Even.

[7] Centre National des Etudes Spatial, functions as France's space agency.

[8] The German space agency.

- General cooperation agreement with Ukraine – 2000
- GALILEO project[9] agreement– 2004 (was signed by MATIMOP ,initiated by Har Even shortly after his retirement from the Israeli Space Agency and becoming a consultant to MATIMOP on satellite navigation)
- SloshSat agreement with the Dutch space agency
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Har Even with NASA administrator Dan Goldin, on Goldin's official visit to Israel on 1998

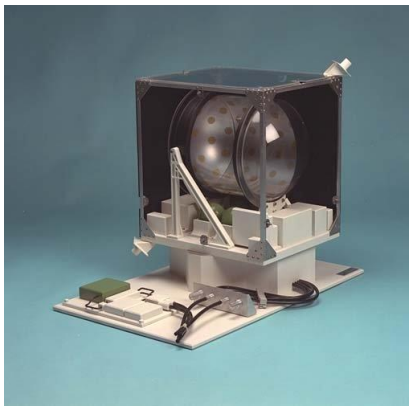
Signing ceremony of a space agreement cooperation between Israel and Ukraine, 2000.

The SloshSat project with the Dutch Space Agency

SloshSat/FLEVO was a microsatellite launched to investigate the dynamics of fluids in microgravity. **FLEVO** stands for

[9] Galileo is the European Union endeavor for creation of a satellite navigation system.

Facility for Liquid Experimentation and Verification in Orbit. Multiple sensors were used to monitor the behavior of water in an instrumented tank and how sloshing affects the attitude control of launchers and space vehicles The project was a joint program between ESA, the Netherlands Agency for Aerospace Programs, and the Israel Space Agency with the propulsion system being designed and built in Israel by RAFAEL.



The SloshSat satellite was a Dutch made satellite within ESA. Israel built the propulsion system for the satellite

The Israeli astronaut and MEIDEX experiment

Surely the pinnacle achievement – at least as from public point of view - of Har Evem's term at ISA was the first Israeli astronaut project and the MEIDEX scientific experiment conducted by him on the STS-107 mission of the US space shuttle Columbia (January 16 – February 1 2003).

Har Even at the helm of the US space shuttle simulator, during a visit to the Johnson Space Center, NASA

The **MEIDEX** project, the Mediterranean Israeli Dust Experiment, was set up to explore the phenomenon of desert dust as a pivotal factor in global warming. The experiment was planned by a team from the Department of Geophysics and Planetary Sciences in Tel Aviv University, and it was an Israeli-US collaboration that was part of the program to send an Israeli astronaut on a NASA space shuttle.

The late Colonel Ilan Ramon, Israel's first astronaut, performed this experiment on board the Columbia, along with other data he collected on an almost unknown lightning phenomena (Sprites) at heights of 80-100 km.

Ilan Ramon , was the first Israeli astronaut on the Space Shuttle Columbia (STS-107) that was launched on January 16, 2003. The seven astronauts died on February 1, 2003, when Columbia broke apart during reentry into the atmosphere over Texas on its way to Kennedy Space Center in Florida. Ilan Ramon, 48, a colonel in the Israeli Air Force, was the only payload specialist on STS-107. Ramon received a bachelor of science in electronics and computer engineering from the University of Tel Aviv, Israel, in 1987. Ramon, as a member of the Red Team of STS 107, was the prime crew member for the Mediterranean Israeli Dust Experiment (MEIDEX), using a multispectral camera that was supposed to measure small dust particles (dust aerosols) in the atmosphere over the Mediterranean and the Saharan coast of the Atlantic.

Aby Har Even with Israel's first astronaut Col. Ilan Ramon (left), the minister of science and technology Silvan Shalom and backup Israeli astronaut Lt. Col. Yizhak Mayo, on a visit to the Johnson space center, Houston Texas[10]

[10] Scanned by the author, courtesy of Aby Har Even

MEIDEX emblem[11]

David satellite

DAVID was a small satellite for advanced remote sensing purposes - designed to meet the specific requirements of today's and tomorrow's Earth observation users in the fields of environmental monitoring, hazard warning and damage assessment. The development is a joint German-Israeli co-operative project. The satellite was designed to provide earth images with high spatial and spectral resolution and good radiometric sensitivity, despite its small size and low cost. The partners for the project were the German ministry of technology, the German OHB Company from Bremen and the Israeli company ELOP. The Israeli space agency led the effort from the Israeli side. The Satellite was a microsatellite built by OHB and its payload was a 3 wavelength remote sensing camera designed and built in Israel by ELOP.[12] The project was halted by Germany over an incorrect news report in Israel stating the satellite as "spy sat"[13] although it was **purely civilian**. Later, OHB continued funding the project on its own resources.[14] The satellite was launched and the performance of the camera was excellent.

VENUS project

Vegetation and Environment monitoring on a New Micro-Satellite (**VENμS**) is a near polar sun-synchronous orbit microsatellite being jointly built by the Israeli Space Agency and CNES.

The project was signed upon in April 2005 and is planned to be launched in 2016. The microsatellite, was designed and built by IAI and Rafael under ISA's supervision.

For the mission, CNES is responsible for supplying the super spectral camera (developed by ELBIT/ELOP) and the science mission center.

[11] Courtesy of Meir Moalem, the air force project officer for the MEIDEX experiment
[12] Telephone interview with Dr. Rafael Schnitzer, former Israel's science attaché to Germany, September 24 2015.
[13] Ibid.
[14] Interview with Aby Har Even, September 21 2015.

It is interestingly to note – **CNES chose ELOP as the camera contractor** so the satellite is 100 percent Israeli made. ISA is responsible for the satellite control center, the spacecraft, and the launcher interface for the VEGA launch vehicle.

Although the contract was signed shortly after Har Even left the space agency, he led the meticulous negotiations with CNES for years.

GALILEO project

The Galileo Joint Undertaking (GJU) and MATIMOP - Israeli Industry Centre for R&D reached agreement on the future participation of MATIMOP in the GJU in order to contribute to the Galileo Program.(including financial contribution and scientific and practical navigation applications)

MATIMOP is a nonprofit organization, under the Ministry of Industry, Trade & Labor, which promotes technological and R&D cooperation and technology transfer activities between Israeli and foreign industries.

The GJU has been set up in 2002 by the European Union (EU) and European Space Agency (ESA) to manage the development phase of Galileo, the European global satellite navigation program. The participation of an Israeli entity in the GJU was welcomed by the EU and Israel in the cooperation agreement concluded between EU and Israel in 2004.

The Israeli space agency played an important role in the negotiations with the European space agency, and contributed a lot for the fulfilment of the agreement which was signed between MATIMOP and the GJU.

Leaving the agency

At the time of his retirement from the Israeli Space Agency it was due to mandatory practice of civil servants to leave their positions at the age of 67. When Aby joined the agency, few people considered to run for office. When he left, ten prominent figures asked to succeed him - a small token of his success transforming the agency into a real organ with esteem, prestige and real work behind it.

Special honorary diploma presented to Aby Har Even for his "Initiative, vision and promotion of Israeli space industries", Signed by ALL the defense industries directors.[15]

An active player in the space arena – the recent years

Har even is a research associate at the Bar-Ilan University's *Begin-Sadat Center for Strategic Studies* from 2005. On that capacity, he published several papers on Israel's space policy and activities.

He is a frequent speaker at the Fisher Institute for Air and Space Strategic studies and sits on the program committee for the annual International Ilan Ramon Space Conference.

Aby Har Even. Note the insignia of the Israel Defense Prize on his suite's lapel

Aby Har Even served as a selector and scientific evaluator of the European Union's frameworks for research and development (FP7, Horizon 2020) and was a consultant to the Israeli Ministry of Economics on various space related issues as well as the GALILEO project.

[15] Photographed by the author, courtesy of Aby Har Even

Legacy

Aby Har Even's term as the director general of the Israeli Space Agency was the longest (almost 10 years) since the establishment of the agency. He served under 11 ministers of science (!) and although the budget of the agency was unbelievably low, he managed – almost single handedly – to lead the agency for new grounds, creating a global collaboration and cooperation with states and space agencies, and bring the Israeli astronaut from an almost science fiction idea – to reality.

During his career at ISA, Har Even was very keen towards education as a whole, and scientific and space sciences education for young students in particular.

He was very cooperative in many ways with non-governmental organizations such as the Israeli Astronomical Association and the Israeli Space Society[16] and attended numerous conferences and public appearances as a true space advocate.

There is little doubt – if any – that Aby Har Even laid the strong and solid foundations for the Israeli Space Agency, on which it stands today with grand visions.

Aby Har Even and the author on the 48th IAC in Turin, Italy, 1997

[16] Which was founded on 2003 by the author and 3 co-founders