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The Satellite That Almost Was: ABIR (Knight), First Indigenously Designed Satellite of Israel

Inbar Tal,

Head, Space Research Center,

Fisher Institute for Air & Space Strategic Studies

P.O. Box 400, Kadima, 60920, Israel. Phone: +972-9-9510260 Fax: +972-3-6844422

talinbar@space.org.il

Abstract

Israel was the 8th nation in the world that launched an indigenously designed and built satellite, onboard its own satellite launch vehicle. It was on September 19, 1988. The satellite was designed and built by Israel Aerospace Industries (IAI), then called Israel Aircraft Industries. It was not known at the time, that another satellite was envisioned and designed by another Israeli industrial complex – RAFAEL advanced defense systems Ltd. (Then – RAFAEL, Armament Development Authority).

The existence of the ABIR (Knight) satellite that was designed by the RAFAEL's teams was revealed only in 2003, and little is known on the project even today. The article will portray the heritage and origins of Israel's first satellite, and will deal with the rivalries between the most prominent defense contractors in Israel (IAI and Rafael), which led to favoring IAI's proposal over Rafael's.

In the beginning

In 1960, the Israeli Academy of Science and Humanities established the National committee for Space Research. The Committee was responsible for research and educational projects in Israel as well as for relations with similar institutions and organizations abroad. However, it did not serve as a national space program. In 1961, the only national effort in the field of space at that time was the launch of the Shavit-2 sounding rocket in July 1961. The reports in the Israeli media emphasized the fact that Israel was the seventh state to indigenously launch such a rocket.

The launching of Shavit-2 was an impressive scientific achievement, but an isolated and un continuous effort.

Another twenty years would pass before a national space program would be established. During these years, several attempts were made to push for establish a national research program that would include a satellite, but none of these initiatives has been materialized.

Dreamers and visionaries of space were scarce in the 1970's Israel. The high tech industries and the aerospace capabilities were in their infancy. During the negotiations with Egypt on a peace treaty that began in 1977 it was clear that after a peace treaty will be signed, Israel will not be able to fly over Sinai Peninsula to observe Egyptian forces. Haim Eshed, then a Colonel in IDF intelligence branch, started to spread the idea that the solution to the problem is to have a

satellite, since space is free of national sovereignty and thus will not be affected by the peace treaty.

It is worth to notice that Professor Yuval Neeman, one of the greatest physicists of Israel, approached Prime Minister Rabin in 1974, as his consultant to national security, and suggested that Israel will ask the United Space to provide Israel with a remote sensing satellite. Rabin dismissed Neeman's proposal as "nonsense". In his memoirs from the first term as prime minister, Yitzhak Rabin wrote: *"I was pushed against the wall in regard to the list submitted to the Americans. On the question – why is Israel asking a billion dollar satellite system – I had no answer, other than the blunt and sincere one, "we don't need it". The list was hastily constructed and included ridiculous and unnecessary items from the imagination of Professor Yuval Neeman, the adviser to the prime minister."*¹

It is interesting to mention, that Rabin, as prime minister and minister of defense between 1992 until his assassination in late 1995, was the prominent advocate for Israeli satellites and space program, and lived to see the products of the first military remote sensing satellite, in 1995. He also apologized to professor Neeman. Neeman was the driving force behind the creation of Israel's Space Agency (ISA) and serves as the chairman of ISA from its beginning in 1983, until his death in 2006.

The earliest initiative was presented to the Space Committee by Dr. Jonathan Mass of Rafael, on October 31, 1965.

¹ Service Diary, Yitzhak Rabin, Maariv press, Tel Aviv, 1979, pp 497-498

Mass is considered one of the founding fathers of the Israeli reconnaissance Satellite. The proposal² stated four goals of space research:

1. Integrate Israel in the overall world space effort and make an original Israeli contribution.
2. Advance Israeli knowledge by original research and development
3. Make practical use of satellites and Rockets for civil use.
4. Use space research for security needs and international policy goals.

In 1980, as a scientist at RAFAEL, Dr. Yonatan Mass, headed a small team that presented a feasibility study that claimed that a small and light satellite, weighing only 240 kilograms, could provide very high imagery capability.³



Dr. Yonatan Mass, the father of the satellite at Rafael

At the same time that Mass's study was submitted to IDF intelligence branch, another brilliant engineer at the MLM division of IAI, Dov Raviv (later the "father" of the Arrow anti ballistic

² Mass, Y., (October 31, 1965), *A Proposal for A Space Research Program in Israel*, submitted for discussion by the Space Committee headed by Prof. Ernest Bergman, p. 1 (The document contains 5 pages), (Hebrew). First cited by Deganit Paikowsky , see IAC-2009.E4.2.1.

³ Rafael, From laboratory to the battlefield, Dr. Zeev Bonen, NDD media, Tel Aviv, 2003, p160

missiles system) also delivered a proposal for a remote sensing satellite.⁴

IDF intelligence branch had studied the two proposals (IAI's and Rafael's) and had decided in 1981 to fully fund the activities at Rafael.⁵ The budget that was transferred to Rafael was enough to several dozens man years (the method of budgeting project was calculated by man years).⁶

IAI was not ready to give up on entering the realm of space technology and satellite building, and appealed the Israeli MOD, against Rafael's proposal.

IDF's Intelligence branch Involvement

Major General Yehoshua Sagi, the head of IDF Intelligence Branch was a true believer in Israeli mad remote sensing satellite.⁷ The Intelligence branch delivered a 5 million dollar budget (in 1981 dollars) for three initial feasibility studies – for the launcher (given to IAI), the satellite (given to Rafael) and the camera, (given to El-Op).⁸ The studies came out positive and were presented to high officials at the Ministry of defense and eventually were presented to Deputy Defense Minister Mordechai Tzipori on March 3, 1981. Tzipori accepted the proposal but demanded that the results of the studies be examined and approved by a committee appointed by Ministry of Defense Chief Scientist Dr. Manes Prat.⁹ The minister of defense

Ezer Weizmann reluctantly approved to start working on a satellite project.¹⁰

Duel of industries

After IAI's appeal to the MOD, the general manager of Rafael wrote (on March 8, 1981) to the minister of defense that "Rafael is the most advanced and capable institute in Israel", and "Rafael will be able to build a satellite, and will share some of the project with IAI.

It does not make sense to establish two knowledge center related to space technology at the same time".¹¹

On August 25, 1981, the general manager of Israel's ministry of defense decided that Rafael will be the prime contractor for the satellite, but it should share some work with IAI's MBT plant.¹²

After another appeal by IAI, the GM of MOD decided that both IAI and Rafael will continue their work on the satellite project for an additional period of three months.¹³ On November 1981 the Rafael team has concluded its work and submitted the report to MOD.

A decision on the prime contractor was not made by 1981, and in 1982, both Rafael and IAI continued to work, and despite MOD directive to do only "paper work", at both industries the work had been exceeded the mandate and had taken place as engineering models, experiments and alike.

⁴ Ibid, p 161

⁵ Ibid

⁶ Ibid

⁷ Dani Shalom, Over the Horizon – 50 years of space activity in Israel, Tel Aviv, 2003, p 58

⁸ Ibid

⁹ Discussion Summary in a letter to the Ministry of Defense Director General's Bureau Chief from Deputy Defense Minister's Bureau Chief dated March 5, 1981, Ministry of Defense Archives, first cited by Dr. Deganit

Paikowsky, in a paper presented at the IAC 2009, Korea (IAC-09.E4.2.1.)

¹⁰ Ibid

¹¹ Rafael, From laboratory to the battlefield, Dr. Zeev Bonen, NDD media, Tel Aviv, 2003, p161

¹² Ibid

¹³ Ibid

1982 - The prime minister approves the satellite project

In 1982 the prime minister of Israel, Menachem Begin, adopted the recommendations of MOD and IDF, and approved the satellite project, but the decision over the prime contractor had not been made yet.



**Prime Minister Menachem begin.
Under his leadership the decision on the satellite was made and the Israeli space agency was created**

Meanwhile, the MOD has established a space directorate, and Dr. Haim Eshed, then a brigadier general, was nominated as its head. (Now a Professor, Eshed still head MOD's space directorate). Eshed decided that both Rafael and IAI will do a full preliminary design review for the satellite. Rafael's director, Dr. Zeev Bonen, felt that the "game" was sold, and according to his memoirs he viewed the competition between IAI and Rafael was not fair.¹⁴

On September 1982, a decision on the prime contractor was not yet made, and Bonen told the MOD R&D directorate that unless they will decide on the issue, he will order to terminate all satellite related work at Rafael on November 1, 1982.¹⁵

Two weeks after Bonen's ultimatum he was approached by Eshed, who asked him to finish the work on the PDR, until December 1982. Rafael's team done it, and the bulky, 500 pages documented, in which dozens of man years were put, was officially submitted to the ministry of defense.

Changes in the Ministry of defense

In February 1983, a new minister of defense took office – Professor Moshe Arens, 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. Under his management, the MOD asked Rafael to give more aspects of the satellite development and manufacture to IAI.

About 140 of Rafael's employees worked on the satellite in 1983, and the decision on the prime contractor was not made until later that year. The general manager of the MOD decided that ALL the work will be transferred from Rafael to IAI on January 1, 1984.¹⁶ What was left for Rafael was a fraction of the project, mainly the third stage of the satellite launcher, and propulsion module for the satellite.

The main argument of the MOD's decision was the cost – Rafael's estimation of the budget needed to develop the satellite was 299 million dollars (of 1983) while IAI's estimate the cost at 150 million.¹⁷ Later estimation culminated in real spending of around 400 million dollars.¹⁸ IAI's head of space directorate was ordered by the MOD to build the satellite

¹⁴ Ibid, p. 162

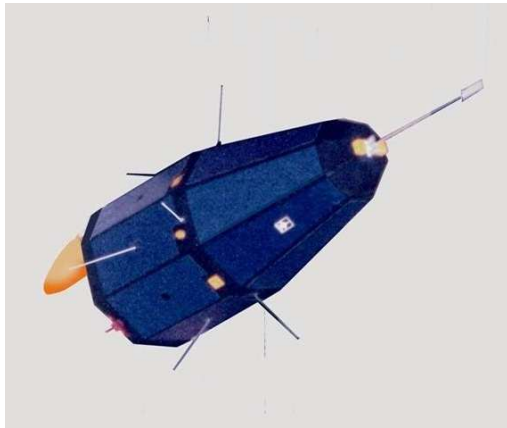
¹⁵ Ibid.

¹⁶ Ibid, p. 163.

¹⁷ Ibid, p. 164

¹⁸ Ibid

according Rafael's original design.¹⁹ It was not until 2003, when the picture of the Abir satellite was released, that the striking similarity between Rafael's design and the actual satellite that IAI built was seen.



**The "Abir" (Knight) satellite.
It is almost identical to the first two
Israeli satellites. Note the Rafael logo
on one of the panels**

Aftermath

Rafael managers felt that they have been treated unfairly by the defense establishment and that their proposal was better than that of IAI. For decades, the involvement of Rafael in Israel's space program was relatively minor and consecrated in few areas:

- ❖ Rafael designed and builds the AUS-51, the third stage, solid propelled rocket motor for the Shavit (Comet) satellite launch vehicle
- ❖ The hydrazine propelled small attitude thrusters that are in use with all Israeli satellites
- ❖ High pressure tanks for space applications
- ❖ Hall effect ion engine, to be used on the French-Israeli remote sensing satellite, "Venus"
- ❖ An initiative to design and build a small, airborne satellite launch vehicle
- ❖ An initiative to design and build micro satellite, in the weight class of around 120 Kg
- ❖ Activities in laser communications, for space use

Three decades after the duel over the satellite, IAI is the official "design house" of all Israeli satellites; However, Rafael is looking to the future of commercially viable space systems like a cluster of micro satellites, operating in formation.

¹⁹ Dani Shalom, Over the Horizon – 50 years of space activity in Israel, Tel Aviv, 2003, p. 59