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Out of Obscurity: 3 private Israeli rocketry projects of the 1960's and 1970's

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Abstract

The paper will describe three rocketry projects held in Israel during the 1960's and 1970's, which - however successful - remained as a side note in the historiography of Israeli rocketry. The three institutions which built the rockets were the technical school of the Israeli Air Force, a Yeshiva (Jewish institution that focuses on the study of traditional religious texts, primarily the Talmud and the Torah) and a technical high school. The "rocket race" between high schools in Israel yielded a bunch of rocket programs of considerable success. The Air Force technical school, for example, launch a sophisticated rocket to a height of 18 kilometres. Recently discovered pictures allowed to reconstruct a lot of new data on one of the projects, which until now was known only by news report of the time. The paper is the 4th part of the series by the author, uncovering the early history of Israeli research rockets. Previous paper dealt with rockets of the Technion and BOSMAT technical school.

Preface

This paper is a continuation of previous papers presented at the IAC, part of an ongoing effort to track the history of Israeli research rockets, from the 1960's onward. Included in the paper are some rockets never known to the researcher's community, and by tracking their origins some interlacing connections to other early rocketry projects can be observed. **The author whishes to express deep gratitude to Israel Zeierman, for his will to share his archive, and his comments and recollections to make the paper as accurate as possible.**

The "Yeshiva Rocket"

One of the elusive projects I've encountered is the rocket built at the "Bnei Akiva" Yeshiva (Yeshiva is a Jewish institution that focuses on the study of traditional religious texts, primarily the Talmud and the Torah). Some accounts on the existence of such a project where known to the author from Israeli archives of newspapers, but good quality photographs and accounts from the people who built the rocket - were missing. This changed during 2017, when a wealth of photographs of the rocket was discovered at the huge archive of Harvard University that contain many Israel related photos. [1] For the first time it was possible to analyse dozens of pictures depicting the rocket - from which a technical account can be re-constructed.

Furthermore, I've contacted the lead engineer of this rocket, who was able not only to provide valuable information on the project from his memory and accounts, but also additional pictures – some in colour – from this 1969 project.

The rocket project of the Bnei Akiva Yeshiva Highschool in Netanya (a city on the coast of the Mediterranean Sea, about 25 kilometres north of Tel Aviv) was unique in several aspects:

- The high school was an orthodox Jewish one with no technology and science orientation;
- There was no prior experience at the school with this kind of hands on rocketry
- There was a strong opposition within the religious patrons of the school to the project.

The Bnei Akiva rocket on the launch pad[2]

One account from a daily newspaper was very critique about the rocket program and stated that "It was a disaster that instead of learning the Torah, there was a scientific project of building a rocket"[3].

The Design

The rocket was a single stage rocket, 1.3 metres in length and 0.127 metres in diameter. Launch mass was 20 kilograms. The rocket was powered by a solid fuel rocket motor, with no scientific payload of any kind. Tracking of the rocket was achieved by 2 pyrotechnic flares attached to the fins and a smoke grenade near the forward end of the rocket. These devices were activated electronically by the mission controller prior to launch. This tracking method was common in early rocketry projects in Israel such as those of the Technion and the BOSMAT technical high school. [4] The projected flight altitude was 10 kilometers and a parachute used to retrieve the rocket.

The engineer of the rocket was Israel Zeierman, then a young engineer from the Technion and veteran of several rocketry projects. He was asked to assist the project and brought his experience and expertise to the Yeshiva. Professor Yaakov Timnat from the Technion assigned Zeierman to the project. Other faculty members were Hezi Reichental, (later an engineer at MBT plant of the Israel Aerospace Industries) and Avi Sternfeld from RAFAEL, then a branch of the Israeli Ministry of Defense, who provided the rocket motor - which was of Polyester and Ammonium perchlorate design. [5] Ephraim Michaeli, a RAFAEL engineer, was also part of the team (as well

as other embryonic rocketry project of the period at the Technion and BOSMAT).

First launch attempt

The first launch attempt was made on April 24, 1969. The accounts from daily newspapers only stated that the rocket "refused" to lift and no technical reason was provided. The general attitude towards the launch failure was generally negative and the high profile of the event was also mentioned (deputy minister, member of the Israeli parliament, officers of the IDF, and local official of the Netanya municipality attended the launch). The newspaper quoted Zeierman who explained that mishaps such as these are common. On 2017, Zeierman provided the author with the actual reason for the failure: "During the hectic (and amateurish) preparations for the launch, we activated the smoke grenade and the pyrotechnical flares, but the flares burned the electrical cords connected to the rocket motor - so the motor did not ignite. After the smoke cleared, we took all the necessary measures to safe the rocket motor. We disassembled the rocket and the launch equipment and after careful consideration we decided to go ahead with a second launch later". [6] When one examines photographs from the launch preparations, one can see the crude and rudimentary equipment that had been used and the lack of satisfactory safety measures.

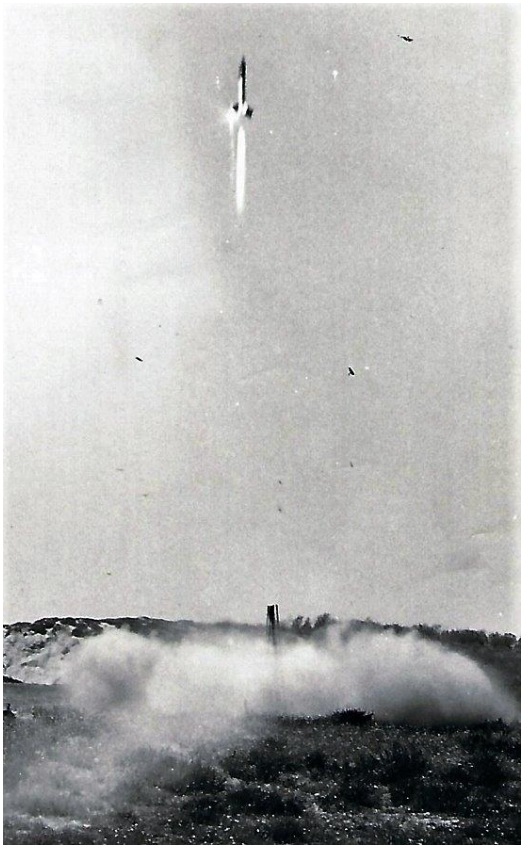
The rocket is moved towards the launch pad on the first launch attempt[7]

The Second launch attempt – and a success

The second launch attempt was made on May 9, 1969, at the same location – sand dunes near the coast of Netanya. This time some pre-emptive measures were taken to protect the cables and cords.

The rocket lifted off successfully as planned.

The rocket flow to an approximate altitude of 10 kilometres before ejecting its parachute.



Lift off. The rocket has cleared the launch pad.[8]

The reaction towards the launch was one of high spirit and favour. One newspaper even stated that the municipality of Netanya gave the Bnei Akiva Yeshiva a grant of 1700 Israeli Lira (at the time the currency of Israel, an approximately 600USD - a considerable amount of money at the time). [9] Plans to construct a two-stage rocket were also mentioned[10] but never materialized. The rocket that flew on May of 1969 was the only one constructed at the Bnei Akiva Yeshiva.

Jubilation after a successful launch[11]

A rare colour picture of the rocket[12]

The rocket had no official name – all that is written on it is the name of the Yeshiva and the city of Netanya. Ironically, after the first launch attempt, it was given the name "de Gaulle 2", after Charles de Gaulle weapons embargo on Israel.

The Israeli Air Force Technical School Rocket

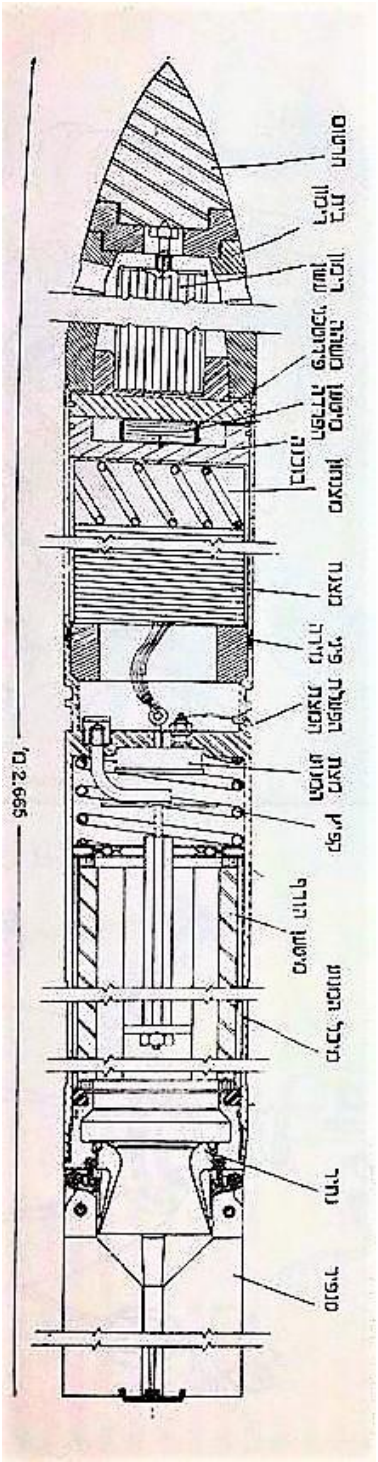
The second rocket portrayed is an elusive one – for more than 20 years the author was unable to locate good quality photographic account of the rocket and launch or to locate people who worked on it. However, there's just enough information to include the rocket in this paper.

As rockets were built at the Technion and BOSMAT technical high school (adjutant to the Technion), it was just a matter of time before a major technical school - that of the Israeli air force - started to work on its own rocket project. The air force technical school was in the city of Haifa, the city within was the Technion and BOSMAT school, and near RAFAEL.

The rocket itself was built under the professional supervision of Ephraim Michaeli, an engineer at RAFAEL, who was involved in all experimental rockets of the period.

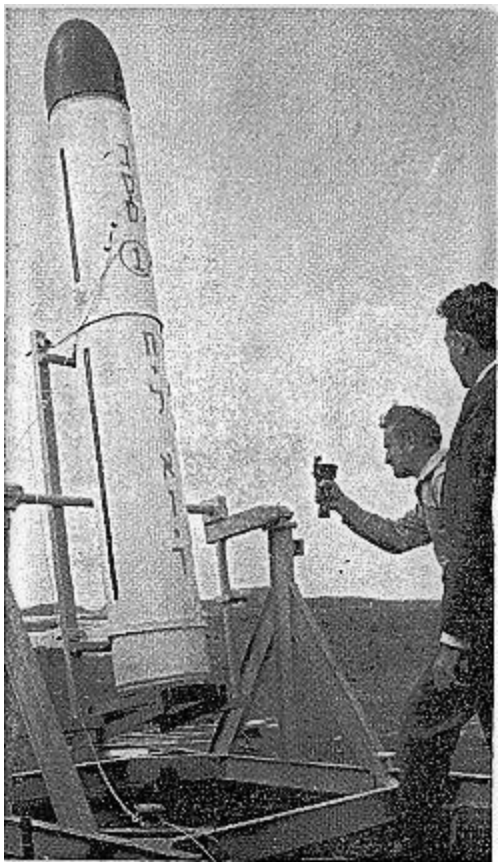
The rocket was a single stage rocket powered by a solid fuel rocket motor. But the rocket was of different design from the ones implemented on the Technion, BOSMAT and the Yeshiva rockets. The rocket was launched from a canister and had folding fins. The intended (calculated) altitude of the rocket's flight was 18.5 kilometres and a parachute was used for retrieval.

The rocket was 2.7 metres in length and 0.13 metres in diameter. The launch mass was 49 kilograms. The trust of the motor was 3400 kilograms with burn time of 1 second.



Cutaway of the rocket[13]

The rocket was named "BST-1" – an acronym for "Technical School' in Hebrew (pronounced BASAT). The decision to build two identical rockets had proven correct, since the first launch failed after the rocket's stabilizing fins didn't opened correctly after the rocket exited its canister.



BST-1 rocket on the launcher. Note the canister.[14]

The second rocket was launched successfully on March 1971. All in all, this rocket project was unique in the history of the air force technical school, as there were no follow-on projects. About 20 students from the school participated in the effort, with the guidance and assistance of RAFAEL (who provided of the rocket motor) and several engineers.

BST-1 rocket inserted to the launch canister[15]

BST-1 rocket at launch[16]

The Ort Rockets

The third rocket project depicted is the least known one. Like the BOSMAT technical high school, ORT is a network of technology oriented high schools in Israel, which still exist today (in contrary to BOSMAT). In the early 1970's, a rocketry project emerged at the Ramat Gan Ort high school (near Tel Aviv) under the guidance of a teacher from the school named Oded Kirsh.

On June 21st, 1971, two rockets from Ort where launched near the northern beach of Tel Aviv. According to a news account, three rockets were launched at the event:[17]

- One small rocket served as a test vehicle – reached an altitude of just 500 meters. It was 0.25 metres in length and weighted 400 grams.
- Immediately after the launch of the small rocket, a launch of a bigger and heavier rocket was attempted - but failed as the rocket exploded almost immediately after lift - off.
- The third rocket was launched successfully and reach an altitude of 3 kilometres, and a velocity of 1.3 mach. The rocket was 0.60 metres long.

Further accounts [18] stated that on September 21, 1973, another Ort rocket was launched. This launch was of a larger and heavier rocket and the launch site was near the city of Rishon LeZion (15 km south of Tel Aviv). It reached an altitude of 4.5 kilometres. The rocket was 1.36 meters long, 0.09 metres in diameter, with a mass of 10 kilograms. The newspaper short account on the launch stated that the rocket was built with assistance from the IDF ordinance corp.

The fifth and final rocket built by Ort students, again under the leadership of Kirsh, was a two-stage rocket. According to Kirsh, it was launched within an Israeli Air Force base[19]. No pictures of any of the rockets from the second and third launches emerged to this day.

An Ort rocket on the launch pad, 1971[20]

After the last launch, there were no further rocketry projects at Ort since the man behind the effort all left Ort on 1974. All the rockets built at Ort Ramat Gan had engineering support from engineer Avi Sternfeld of RAFAEL. This explains many similarities and common design features that these rockets had with some early Technion and Bosmat rockets.

[1] See https://images.hollis.harvard.edu/primo-explore/search?vid=HVD_IMAGES&sortby=rank&lang=en_US

[2] https://images.hollis.harvard.edu/primo-explore/search?query=any,contains,students%20missile&tab=default_tab&search_scope=default_scope&vid=HVD_IMAGES&lang=en_US&offset=0

[3] Mentioned in an August 11 article at "Hatzofe" (The observer)

[4] See other papers by the author.

[5] Information provided by Israel Zeierman on March 9, 2017

[6] A conversation with I. Zeierman on March 7, 2017

[7] Harvard library archive

[8] Israel Zeierman collection

[9] Hatzofe, 11.5.1969

[10] ibid

[11] Israel Zeierman collection

[12] ibid

[13] Mada (Science) bi-monthly, published by the Weizman Institute of Science, 1971

[14] Maariv, 26.3.1971

[15] ibid

[16] ibid

[17] Maariv, June 21, 1971

[18] Davar, 23.9.1973

[19] Probably Palmachim AFB, from which Israel is launching its satellites since 1988

[20] Picture from the Facebook page of Oded Kirsh, the organizer of the rocketry projects at Ort