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MARCEL KLAJN, DREAMER OF SPACE, BUILDER OF SATELLITES: THE UNTOLD STORY OF ISRAEL'S SPACE PROGRAM PIONEER

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Abstract

The history of Israel's space program is relatively short, as it was officially in the early 1980's, and its roots stretched back to the late 1970's. Among the founders of Israel's space program in general, and the leaders of its launching and remote sensing satellites in particular, there are very few individuals whose names are known to the general public. Amongst the few space pioneers of Israel, one name should be shining as a bright star, yet it is still almost unknown; it is the name of Marcel Klajn, a visionary dreamer of space, and a genius engineer. He was the chief scientist of RAFAEL (state own national R&D institute, later it became Rafael advanced defense systems Ltd.), the head of Israel's space agency, the head of the effort to develop a satellite – to name just few of his posts. The unsung hero of Israel's space program, Marcel Klajn, is portrayed in this paper for the very first time. The paper will portray the role of this unsung pioneer of space programs, and it will be a continuation of the author's works on the history of Israel's space program, especially the papers that were presented in previous congresses of the IAF.

In the beginning

Dr. Klajn was born in Paris, France, on July 25, 1937. Part of his childhood he spent during the Second World War with his parents as a refugee in St. Cézert, a village near Toulouse. As a Jew, he escaped from deportation to death camps in occupied Poland, and was saved by a family of courageous and honest French. Back in Paris he attended the renowned Lycée Charlemagne School before immigrating to Israel at age 15. Marcel kept his close ties with his benefactors until the death of the family father. Upon his arrival to Israel, he turned to study auto mechanics at a professional high school in Tel Aviv that was then considered one of the worst educational institutions for young students. Regardless of this, Marcel was an excellent student, and excelled in his studies. The school's headmaster told Marcel's father that he could be a good mechanic, but could achieve much more than that. With such a recommendation, Marcel applied for the Technion (Israel's top technical institute for engineering and sciences).

The Rafael career – phase one

In 1960 he completed his B.Sc. studies in Aeronautical Engineering, Cum Laude, at Technion, Israel's

Polytechnic Institute at Haifa, where he also took his Master's degree in 1969. He went on to obtain his Ph.D. at M.I.T. in Mass., U.S.A., in 1974. During all those years he worked as a research engineer at Rafael, Israel's Armament Development Institute, as head of various and diversified projects, mainly in the fields of rocket propulsion, interior and exterior ballistics, aerodynamics and satellite systems. At his first step at RAFAEL, Marcel was a research engineer at the aerodynamics group. This work included performance evaluation of missiles and aircrafts, flight test design and evaluation. During the first period at RAFAEL, Marcel was involved in various classified projects, but one became public – the “*Shavit 2*” experimental rocket.¹ From 1962 to 1964, He joined the propulsion group of RAFAEL, in which he was carrying out experimental work in the field of solid rocket propulsion, internal ballistics and developing measurement methods for dynamic tests of various missiles and rocketry projects.² Marcel

¹ For more on Shavit 2 rocket see: Inbar Tal, “*Reaching for the stars? 50th anniversary of Israel's Shavit 2 rocket*”, IAC-10.E4.3.8

² Most of the data regarding Marcel's RAFAEL career is based on official RAFAEL CV that was provided by the Klajn family. Due to secrecy of some project, not all the data

was responsible for the development of the first software developed in Israel for missile trajectories prediction and analysis. From 1964 to 1966, he was research engineer in system analysis section. That work included evaluation and analysis of missiles in various field experiments, computer program development for missile trajectories and missile dynamics calculations. During this time frame, Marcel continued to work on various high flying meteorological rockets. In 1966, Marcel became the head of the system analysis section. In parallel, he was in charge of research efforts at RAFAEL, on external ballistics. In 1968, Marcel became the head of the propulsion unit at RAFAEL, a position he held until 1971. In 1971, he went to MIT, until 1974, when he earned his PhD in aeronautical engineering. His thesis was on investigation of mercury vapor electro fluid dynamic generator.

The Rafael career – Phase two: Chief Scientist

After his PhD studies in the US, Marcel came back to RAFAEL. He was appointed chief research engineer of the aeromechanical division. He was responsible now for activities of a

available to the author could be presented at the time of the IAC 2012.

larger scale and scope, including supervision of research projects of various RAFAEL divisions. From 1982 till 1984 he led the satellite team at RAFAEL. In 1987 he was appointed Chief Scientist at the R&D Department³, a position he held until his retirement from Rafael in 2001.



Young Marcel Klajn, circa 1960's

Godfather of the first Israeli satellite

Marcel Klajn was the head of the design project for Israel's first satellite, named ABIR (Knight).⁴ He was responsible for every aspect of the design, including characterization of every sub-system of the satellite⁵, and led the satellite program until a successful PDR⁶ (preliminary design review). Due to political issues and inter industry rivalries, the decision

³ At RAFAEL headquarters

⁴ And see Inbar Tal, "*Knight, the satellite that almost was*", IAC-10.E4.3.8

⁵ Marcel Klajn official Rafael CV

⁶ Ibid

was made to transfer the satellite project to IAI.⁷ In an unprecedented move, Klajn was allowed by RAFAEL CEO⁸ to work at MBT-Space, and to lead the IAI team.



Dr. Marcel Klajn (left) and Dr Yonatan Mass (right) discusses the Abir (Knight) Satellite with Professor Yuval Ne'eman, Minister of Science and Technology and founder of the Israeli space agency

Builder of Israel's indigenous launch capabilities

His greatest professional achievement can be considered having set up the outstanding team of scientists and technologists who developed and built, under his leadership, Israel's first satellite launcher, the *Shavit*, which has successfully lofted 6 satellites, including 4 operational remote sensing satellite of the *Ofek* (Horizon) class. Israel thus joined the exclusive club of

countries launching their own satellites.

Head of Israel's space agency

During his 1993-4 Sabbatical year⁹ Dr. Klajn was appointed as the General Manager of Israel's Space Agency, from which he contributed to the development and launching of *Techsat*, Technion's first research satellite.¹⁰ He established good working relations with CNES, the French Space Agency, which eventually led to a joint venture project – the *Venus* (VEN μ S = Vegetation and Environment on a New Micro Satellite) satellite.¹¹ Dr. Klajn was a key player in the development of Israel's space program and capabilities

⁷ "Knight, the satellite that almost was"

⁸ The late Zeev Bonen, who, for a short period of time forbade the IAI personnel to enter Rafael's facilities, as an act of protest against the decision.

⁹ On his First sabbatical in 1980-1981, he went to Berkeley University.

¹⁰ Successfully launched in 1998, and functioned flawlessly until 2010.

¹¹ Scheduled to be launched on 2014.



Dr. Marcel Klajn enjoys a ride in a 3 axis simulator during the 1999 IAC

Retirement years

After mandatory retirement from Rafael (due to age – then 65), and in spite of suffering from diabetes and its complications, he continued working as Chief Scientist in the framework of Israel's Space Research Administration. His "retirement" years, until his untimely death in 2008, were as productive and full as his early career. Among the functions and tasks Marcel was responsible to, are the chief scientist of the Israeli Ministry of Defense space directorate, special adviser to the IAI – a work that dramatically improved the reliability of the Israeli launch vehicle "Shavit"¹².

¹² The loss of the "Ofek 6" satellite during launch, because of a technical problem of the launcher, was a major blow to the space

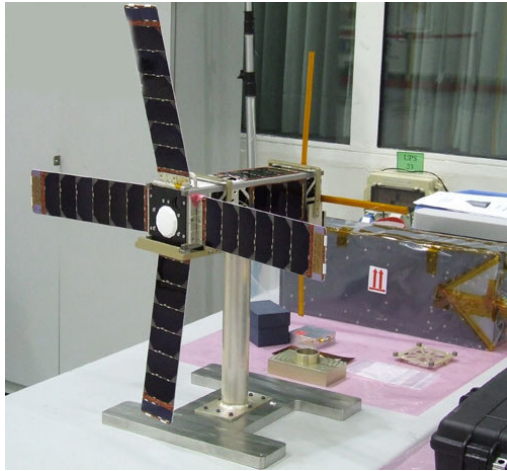
Dr. Klajn was amongst the first – and the few – Israelis accepted as members of the International Academy of Astronautics.

Legacy

Marcel was one of the most influential figures on Israel's space program, and on generations of engineers and students. His two sons turned to science and engineering. One of them is deeply involved with space activities of Israel. Marcel's name is known to the many who knew him, but not to the general public. Due to his modesty on the one hand, and the nature of his classified work on the other, he remained almost anonymous to the general public. The conference room at space launch vehicles directorate at IAI is named after Marcel, and a modest dedication plaque is mounted on the RAFAEL campus as well. A very unique commemoration, and one that Marcel probably would have loved the most, is the first Israeli nano satellite, named after him – *InKlajn*. The satellite was designed and built by the Israeli Nano Satellite Association (INSA) with the support of IAI's

program in general, and to the launchers program in particular. Marcel's work ended up with two successes in a row, of which he has witnessed to the launch of "Ofek 7" in 2007.

MBT-space. Marcel Klajn son is one of the engineers who built the satellite.



InKlajn 1, the first Israeli built nano satellite

The InKlajn-1 nano-satellite contains seven scientific and commercial experiments, where the behavior of terrestrial components is to be tested in space. In this nano-satellite project, teams of engineers and technicians are using experience gained while working on IAI's range of observation and communication satellites.

Marcel, on his last public appearance at a space conference in Israel, attended the nano satellite conference held in 2008, just a few months prior to his untimely death. At the conference he was able to see the design and mock up of the satellite that later would bear his name.