THE JERUSALEM POST
Israel's best-selling English daily and most-read English website

Rafael's guardian angels

By SHLOMO MAITAL

11/28/2012 11:52

Defense technology is not solely about mass destruction; it can be about saving lives.

Photo by: Darren Whiteside/Reuters

Oh, whom do we thank? Whom do we bless?" asks Chaim Nachman Bialik in a famous 1932 verse written for children.

For a start, let us thank and bless Rafael Advanced Defense Systems Ltd., the government owned company that created Iron Dome, the system that tracks and destroys enemy rockets and mortar shells. By intercepting hundreds of Gaza rockets aimed at Israeli cities, many lives were saved directly.

By obviating a ground incursion into Gaza by the IDF during Operation Pillar of Defense – which would have become necessary, had the rockets taken a large toll of lives – Iron Dome saved the lives of IDF soldiers and Gazans, indirectly.

But whom, specifically, do we thank? A very long chain of events occurred to create Iron Dome, dating back to before Israel existed – a chain that reveals much about the start-up nation's resilience, creativity and culture.

"Jewish science does not disappoint… [it] can give us weapons to deter our enemies," David Ben-Gurion said in 1963, in an address to Rafael staff, quoted in Munya Mardor's 1988 book on Rafael.

As head of the pre-state Jewish Agency, he initiated a civilian defense research department that in 1958 became Rafael, a Hebrew acronym for Armament Development Authority (the company's name until 2007).

In 2002, Rafael became a government company.

Today, it employs 7,000 people, and in 2011 had revenues of $2 billion, profits of $111 million, and an order backlog worth $3.5 billion. Sales have nearly tripled since 2005, and nearly 60 percent of its sales are exports. Rafael recently raised NIS 450 million, ($115 million) in bonds, with a top-notch AAA rating.

Rafael is partly responsible for Israel's high-tech industry. I recently interviewed Gen. (res.) Amos Horev, who led many IDF technology breakthroughs and served as chairman of the board at Rafael for six years.

"In the 1970s, Rafael started to get involved in air-to-air missiles," he tells *The Jerusalem Report*.

"The most important element was the sensing device. Rafael turned to the Technion. Prof. Yitzhak Kidron took it on himself [to create it]. In a matter of two years, he came up with an infrared detector for missiles. You can't imagine how important it was to build our capability in that area."

Rafael's Shafrir air-to-air missile was a great success in the 1973 Yom Kippur War. And Kidron's Microelectronics Lab was the tiny seed that led to many Israeli high-tech start-ups in electronics.

The late Dr. Zeev Bonen, Rafael's legendary CEO in 1970-78 and 1982-87, made a crucial and controversial decision that Rafael would not only design missiles but also manufacture them. At the time, few believed Israel could do this. Bonen once told me how he invented a "system of systems" for linking development and production, creating new technologies rather than relying on existing ones.

Rafael's ability to produce Iron Dome and accelerate its production as needed have proved to be vital. A fifth Iron Dome battery was recently shifted directly from the testing grounds to Tel Aviv, and hours later intercepted a medium-range M-75 missile launched from Gaza.

Rafael works closely with the IDF and, in particular, with the Defense Ministry's Administration for the Development of Weapons and Technological Infrastructure known as Maf'at. In 2007, then defense minister Amir Peretz insisted on allocating funds to develop Iron Dome, against fierce opposition.

IDF generals traditionally favor offense over defense.

Vilified for his inexperience and fumbling in the 2006 Second Lebanon War, and mocked for a viral YouTube video showing him looking through binoculars with the lens cap still on, Peretz is now regarded as a hero for this decision. The cost of Iron Dome was partly offset by American funding, authorized by Congress.

The name Iron Dome was invented by project leader Colonel S., who consulted his wife. They first chose "Golden Dome" but decided that was ostentatious and changed gold to iron. The interceptor missiles they named Tamir, a Hebrew acronym for til meyaret (interceptor missile).

From conception to becoming operational, Iron Dome took only four years, an exceptionally short time. The first battery of Iron Dome was deployed on March 27, 2011 near Beersheba, and 11 days later, on April 7, successfully intercepted a Grad rocket. The success rate

against missiles that could potentially strike civilian dwellings is said to be 90 percent.

Iron Dome is a complex system with three parts. First, radar built by ELTA, a subsidiary of Israel Aerospace Industries, tracks incoming rockets or projectiles. Second, the control center decides in seconds whether to intercept the rocket and, if so, fires two interceptor missiles.

The control center uses sophisticated software built by mPrest Systems, a start-up now half-owned by Rafael.

Third, the interceptor missiles themselves are highly maneuverable, with electrooptic sensors (here, a small blessing to Prof. Kidron's breakthrough 40 years ago) and steering fins. Iron Dome can decide on its own whether to intercept an incoming rocket, but Rafael has chosen to leave that decision to the men and women who operate it, part of the Israel Air Force's air defense unit. If the radar deems that the rocket won't hit an inhabited area, no Tamir interceptor is launched.

Ma j. Gen. (res.) Ilan Biran, Chairman of the Rafael board, goes out of his way during an interview with the Report to thank the US for its help with the Iron Dome project: "We owe deep gratitude to President Barack Obama, Defense Secretary Leon Panetta, Senator Daniel Inouye and other senators and supporters for the $205 m. in aid that paid for four batteries, including the one deployed to defend Tel Aviv."

Biran says that the success of Iron Dome was part of an evolutionary process at Rafael noting that in the second intifada, the Jerusalem neighborhood of Gilo was fired on and the source proved hard to identify. A Rafael engineer invented a device to pinpoint the source.

"Iron Dome sensors were later based on it," he says. Biran is proud of the fact the proportion of women among Rafael workers is rising and points out that the head of the Iron Dome radar project is a woman.

The Rafael chairman outlines his company's business goals. "We have clear objectives: 22 percent gross margin, 6 percent net margin, $300,000 value added per employee and a ceiling of 35 percent of costs as wages.

We invest 7.5 percent in our own R&D, to develop ideas we ourselves initiate." Regarding exports, he notes that Rafael sells tactical missiles to 20 countries.

To better understand the culture of Rafael that created Iron Dome, I spoke with my colleague Dr. Gilead Fortuna, now a Neaman Institute researcher who held senior positions at Rafael for 30 years, including VP for operations, and for marketing and business development. Fortuna explains that Rafael's mantra was, and remains, "in the forefront of technology and national need."

Rafael projects include what Fortuna calls "technology gaps" (projects whose feasibility has not yet been proven anywhere in the world). Creating that technology creates products surpassing anything on the market.

"At Rafael," Fortuna notes, "we had the freedom to decide. Research teams always have the power to push crazy ideas ahead, into systems."

Iron Dome itself is a crazy idea, if only for purely economic reasons. Gaza terrorists produce homemade rockets for next to nothing.

An Israel Radio reporter once recounted seeing an unexploded rocket made of metal stolen in Israel and smuggled back into Gaza; it was a road sign that still said, “Tel Aviv, turn left.” Yet each Tamir missile (and two of them are always fired to bring down a rocket, just to be sure) costs between $35,000-60,000. In response, current Rafael CEO Vice Admiral (ret.) Yedidia Yaari insists that Iron Dome intercepts are cheaper, by an order of magnitude, than any alternative taking into account the cost of the damage to life and property if the Gaza rockets hit their targets.

Over the years, I’ve been privileged to lead management development programs for Rafael engineers and managers, at the Technion Institute of Management (TIM). They explained their fundamental motivator: The systems we invent, develop and build, they said, will keep our own children safe. For them, working at Rafael is extremely personal.

They save lives, including, potentially, those of their kids who serve in the IDF.

A key part of Rafael culture is chutzpa, the audacity to tackle projects that seem impossible.

Rafael engineers developed Popeye, an air-to-surface missile that enables pilots to remain up to 350 km (210 miles) from their targets, safe from harm. Some were sold to the US, making Rafael one of the few non-US firms able to sell missiles to America. They created explosive reactive armor that protects tanks from missiles, and Trophy, a tankbased missile that destroys anti-tank missiles.

And, incidentally, it was Rafael alumni who founded Given Imaging, a company that uses Rafael-originating technology to create tiny video camera pills that help doctors diagnose intestinal illness. Rafael owns 9 percent of the company.

A turning point in Rafael’s history was the decision to transform it into a limited company in 2002, with growth and profitability as key goals. I spoke about this with Giora Shalgi, who was Chief Executive Officer from 1998 to 2004; before that he led the key Missile Division. Shalgi tells me that this major change created a decade-long crisis, which ultimately proved highly successful for Rafael. Late Prime Minister Yitzhak Rabin was behind this move, he said.

Shalgi, who now lectures on transformative change based in part on his achievements at Rafael, explains how he shaped a blend of two management styles, which he calls “disorder within order,” that is, freedom to create with discipline to implement wild ideas. Shalgi recounts how he spent most of his time as CEO in designing Rafael’s new “genetic code” and management systems, delegating finance and operations mainly to others.

He credits one of his predecessors, Zeev Bonen, with imbuing him with “systems thinking.” Veteran Rafael engineers complained about the radical shift to becoming a bottom-line company, asking, for instance, how one can place a dollar sign on human life. But in the end, the new organization triumphed.

Will Iron Dome become one of Rafael’s hit exports? We’re not selling right now, CEO Yaari says. Israel will need to deploy a total of a dozen batteries, in the North as well as in the South, to protect its citizens. The sixth battery will be deployed early in 2013.

As always, Rafael will face the tough dilemma of making money to support costly development, while keeping secret from our enemies crucial breakthroughs. Meanwhile, we offer to the largely anonymous engineers and workers of Rafael a silent prayer of thanks.

They have shown us that defense technology is not solely about mass destruction. It can be about saving lives, many hundreds of them.

We should all be deeply grateful.

Shlomo Maital is a senior research fellow at the Technion's Samuel Neaman Institute.