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PMG Medica brings
missile technology
safely into the home

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"It's as if we used to fight each other, while today we work together," PMG Medica cofounder and general manager for business development Dr. Jacob Levy was glad to tell us. During part of his 26 years at Rafael (Israel Armaments Development Authority), Levy, a physicist by profession, managed the Popeye missile project. Cofounder, president, and chief scientist Prof. Jona Zumeris worked on a Russian government missile project. When Levy and Zumeris met in late 1988, they found their qualifications complemented each other, enabling them to create a technology platform to support an ultrasound system, ceramic materials, and precision motion. Let us, however, begin at the beginning.

Zumeris, who immigrated to Israel in 1990, set up one of the first incubator companies in the Technion incubator – Nanomotion, which to this day develops miniature engines with a crystalline base. He resigned from the company in 1996 and sold his share. He founded PMG Medica in 1996 with Dr. Zadik Hazan of Tel Hashomer Hospital as a partner. The company already has a beta product version of its first product – Babycom. This device, the size of the average hair remover, makes it possible to hear an embryo's heartbeats and send them on to the doctor. This is actually an application of the scanning technology used in interceptor missiles (Levy's invention), together with ultrasound technology.

Babycom currently has beta sites with gynecologists and various distributors at 15 locations around the world, including the US, Japan, Britain, Australia, and France. The device combines ultrasound with phenomenon understood only by physicists, such as the continuous Doppler Effect. In simple terms, the device measures the embryo's heart movements by the degree of expansion and contraction of the surrounding space. This is nothing new; the problem is that the embryo is only 3-4 cm long and its heart is measured in millimeters. "You have to make a bullseye," says Levy, undoubtedly using terminology from his work on the Popeye missile. "An ultrasound pulse has a diameter of 8 mm, but if you don't hit the heart right on, the wave will miss it."

PMG Medica's solution is to have the wave move not in a straight line, but with high frequency oscillations. The zigzag wave sends signals in various directions within the placenta, thereby enlarging the scanned area by a factor of 10. The company also has a registered patent for this device, which turns out to be inexpensive. Levy and Zumeris say other products in the market cost the physician \$250. Their monitor is expected to cost \$100, including a home version for concerned, expecting mothers.

Who are the investors? After Zumeris and Levy kept the company afloat with their own money for the first year, the Ministry of Industry and Trade's Chief Scientist approved a \$350,000 grant, while private investors provided complementary financing. The Chief Scientist granted another \$500,000 in the second year and they received money from a private investor ("He's a doctor of microbiology"). Zumeris and Levy say the company is now on the verge of signing a term sheet for raising \$3 million from an Irish investment bank, which is also expected to help with overseas marketing connections. The identity of the investor is not being disclosed, but the investment bank has already invested in an Israeli auto accessories company.

"Globes": Are you giving up in advance the possibility of applying to the funds?

Levy: "We're currently in touch with investment companies. Until we have money in the bank, however, we're sticking to the large investment companies. Perhaps we'll go to the funds at a later stage."

PMG Medica will not say so, but the impression is that they prefer money from private investors. If we assume the company has enough money for another year at its burn rate and their products are coming out at the same rate, why should they hurry to dilute themselves? PMG Medica also takes special pride in its independent work, without any intermediaries or external consultants.

Don't you need a strategic consultant?

"In the first two years, we concentrated on improving the company at the technology and intellectual property level. Costs were low, but I don't have \$50,000 for a strategic consultant. He might have 15-20% more experience and know-how than we do, but we'd have to pay another 90% for the extra 20%. It's not justified in this case. When we're established on a firm footing, we'll undoubtedly take on an international marketing specialist, who will cost a lot of money. Right now, we are doing what we have to do."

The explanation appears reasonable, until the key sentence comes along. "At our age, we want freedom. We don't want someone to come and tell us what to do." The two old friends ("This is the second time around for both of us") want to be free, and Zumeris apparently defines freedom as freedom to play around in his piezo laboratory.

A brief definition – piezo (pressure) is a feature of several crystalline materials, including crystal, quartz, Rochelle salt, and enriched ceramic. When mechanical pressure is exerted on these materials, the crystalline structure produces an electric

current with power proportionate to the degree of pressure. When an electronic circuit is connected to the material, electrical currents are created and the material's structure is altered.

The principle involved is similar to that of children's exercise shoes that flash when they move. PMG Medica uses a rather cheap ceramic material. In principle, the effect is well known and recognized. Anything can be done with the piezo-ceramic material, as long as the right vibration is transmitted.

Toy cars, toothbrushes, toothpicks, and soft drink cans are all mixed together in the tiny laboratory, ready and waiting for micro-vibration games. Excuse me, another term from the world of physics – micro-vibrations are mechanical vibrations created in materials, which cause one-micron oscillations. For the sake of comparison, the average piece of paper is 80-100 microns thick. The microscopic oscillations, which cannot be felt with a finger, can move objects visible to the eye, turn wheels, create bubbles in cola water, and move toys back and forth.

The number of applications is infinite. One specific example is an electric toothbrush without a motor. Piezo ceramic material is put in the base of the toothbrush, miniature batteries are inserted, and voila – automatic vibration.

Zumeris suggests all sorts of outlandish possibilities. Pedals can be moved on tracks and used for virtual reality, together with suitable sensors. Drugs can be guided to a specific location in the body and "sprayed" there using microscopic vibrations. Routes for guiding visitors on organized museum trips can be indicated, and shoes that move by themselves can be constructed. "I made such shoes at home, for a game," Zumeris says. It can all be done with a 0.07 mm-sized actuator, powered by a miniature battery. More commercial applications are a credit card imprinted on piezo-ceramic material that cannot be put out of action by any magnet, and a ceramic key for security doors.

Four actual products are emerging from all the company's games. The beautifully designed prototypes are already on the shelves of PMG Medica's offices, including the packaging. There are two versions of Babycom, a pen for measuring blood flow by means of a finger, and an electrode that functions as a disposable ultrasound probe. The pen is designed for surgeons operating on blood vessels, based on a similar principle to that of Babycom – an ultrasound probe utilizing the Doppler effect. The disposable electrode is designed for use in mass disasters, for example, in order to separate the wounded from the dead.

The blood flow in the carotid artery can be examined in order to determine if the person is still alive. PMG Medica is in touch with Israel Defense Forces Chief Surgeon and the US National Guard to examine the idea. “We can turn ultrasound into an available tool, at a price that will make it practical to keep large quantities of devices. Every medic and ambulance can afford to have several of them,” Levy says.

That is not the whole story, though. These two feverish brains have come up with another use for ultrasound technology – sterilizing catheters (ultrasound kills bacteria). The plan is to insert disposable units into existing catheters. And while we are discussing sterilization, there is also an idea for an ultrasound generator to purify water. These devices could be included in home pipes, in greenhouses, or used to purify water for vacationers. Laboratory test results show clearly that water pollution fell from a bacterial concentration of 10 to the eighth power to less than ten.

The company currently receives revenue from development and manufacturing agreements.

Business Card

Name: PMG Medica

Owners: Prof. Jona Zumeris, Dr. Jacob Levy

Founded: 1999

Product: Piezomicromechanics and ultrasound technology devices

Owners: Founders, private investors.

Previous financing round: \$850,000 from the Chief Scientist