



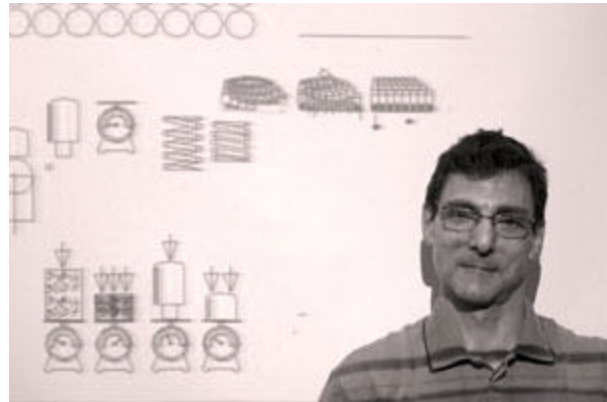
Smart Surfaces aims to put bedsores to rest

March 30, 2009 by *Alan Siegel*

The (literally) visionary "rolling diaphragms" in the Billerica, Mass., startup's mattress are designed to eliminate pressure ulcers

Tim Moutafis has visions.

Sitting in his racing green Triumph TR7 convertible one summer afternoon in August 1993, the [Smart Surfaces Inc.](#) founder envisioned miniature robots roaming around the human body, fixing problems. A decade later, daydreaming at work, he saw a living, breathing blob.



"A blob that knows your body very well and listens to it," Moutafis explains from his office at [Science Research Laboratory](#) in Somerville, Mass.

"It sends information, it sort of heals you, protects you, rejuvenates you."

Lest you write off these dreams as the whacked-out ruminations of a would-be science fiction hack, as Moutafis explains the origin and development of his ideas it becomes clear they're born of practicality rather than fantasy. And the man clearly has a knack for turning his visions into reality.

The first — tiny surgery bots — was the basis for Billerica-based [HydroCision](#), which specializes in surgical tools that cut, remove and clean tissue using a tiny jet of water. The second — the animate blob — was the genesis of [Smart Surfaces](#), which is developing a mattress designed to eliminate pressure ulcers.

If that sounds ridiculous, you've probably never met Moutafis. The 57-year-old isn't bothered by doubters. Twenty years ago, he was diagnosed with Parkinson's disease.

"I could be dead. As a matter of fact, I should be dead right now," says Moutafis. "But I'm doing the best I can to live a healthy life." As proof of his vitality, Moutafis offers that he is an avid windsurfer and can still be found sailing off the beaches near his home in Gloucester.

His visions, he explains are really an extension of his personality. He spends time refining them, formulating what he calls entry and exit points — in basic terms, he creates a portal between the dream world and reality. Moutafis knew he couldn't produce the surgery-aiding robots of his visions. But, he could develop a tiny tool to achieve the same end in reality.

“An option for the exit [point] for [HydroCision](#) was to have a stream of water to cut,” says Moutafis. “Create tubes that are less than a millimeter in diameter. You cut anything you want to.”

Moutafis founded HydroCision in 1994 and resigned his official position on its board 10 years later, according to the [company's website](#). He's no longer employed by the company, but remains a shareholder and says he can attend board meetings as an observer if he chooses.

The “blob” concept was one of several “very far out ideas” Moutafis had, he says. Another was a mattress that levitated patients on a micro-layer of air, much like a puck floating on an air hockey table.

“The patient,” Moutafis explains, “would never contact [the mattress] at all.”

It was a great idea in theory, but not in practice. So Moutafis retooled the vision.

“If you choose an exit point that's still a little too far, you go a little back,” he says.

And, so he wondered, what's the next best thing to floating on air? His answer: Small, air-powered cylinders. An array of devices — he calls them “rolling diaphragms” — that cradle the body and eliminate the pressure points between skin and mattress that cause ulcers.

“It compensates for the anatomy, weight and geometry of the person,” Moutafis says. “If the person goes sideways, it should be able to compensate. It recovers as the patient rolls, as the patient changes position.”

In time, Moutafis hopes to refine the concept so that the diaphragms heat, massage and even reposition the patient.

“Have I done that? No,” he says. “But I'm going in that direction.”

Moutafis hopes Smart Surfaces, which he founded in 2006, can help solve what the [Journal of the American Medical Assn.](#) calls an \$11 billion-a-year problem.

“We feel,” Moutafis says, “that we have the answer.”

If he builds it, will they come?

Hooks Johnston, Steering Committee chairman of the [Massachusetts Medical Device Development Center](#) (M2D2), tells [MassDevice](#) he was quickly sold when he heard Moutafis' idea. Smart Surfaces, one of five companies selected from 75 applicants to receive matching funds via M2D2's [fast-lane program](#), met Johnston's three fundamental requirements:

“Do I understand it?”

The idea is straightforward: Unlike new pharmaceuticals, which require years of expensive clinical trials, mattress prototypes can be built and tested in fairly short order.

“You see very quickly if they work,” Johnston notes.

“Is the need pretty obvious?”

Pressure ulcers, commonly known as bedsores, are difficult to treat and potentially fatal. According to the 2006 JAMA study, 2.5 million acute care patients in the U.S. develop pressure ulcers every year, with roughly 60,000 dying from complications.

“Do the economics make sense?”

Moutafis estimates that the Smart Surfaces mattress will sell for \$6,000 apiece, about three times the price of a normal mattress at a retail chain like Sleepy’s; high-end bed systems for hospitals and nursing homes can run as much as \$30,000 each.

“Much better results for less money,” Moutafis says of the Smart Surfaces product; he thinks the company will need about \$5 million to begin mass production. Moutafis estimates that the total market for controlling and treating pressure ulcers is worth about \$1.5 billion.

With a market that size, Smart Surfaces faces heavy competition from medical device giants such as [Hill-Rom](#), [Kinetic Concepts Inc.](#) and [Stryker](#) — which sold roughly \$540 million worth of medical beds in 2007 alone.

[Dr. Dan Berlowitz](#), a professor at the [Boston University School of Medicine](#), has studied pressure ulcers extensively. He says prevention is often a logistical challenge. Even patients who can afford the best care available are susceptible.

“How do you ensure that a patient at risk is turned every two hours?” Berlowitz says. “In a busy hospital unit, you have lots of sick patients.”

High-end bed systems, Moutafis notes, may work. But their astronomical price tags force many hospitals to rent, not buy. And while existing mattresses and mattress pads may not cause the same kind of sticker shock, they aren’t nearly as effective.

Even so, Berlowitz isn’t sure a new mattress will revolutionize pressure ulcer care.

“I am very evidence-based,” he says. “There are lots and lots of products out there. It’s difficult to show one specialized bed is better than the other. The reality is, most clinical trials aren’t able to show that.”

Although Berlowitz isn’t expecting a miracle cure for pressure ulcers, he’s all for an inexpensive but effective mattress.

“If there was something that was low-cost and had convincing evidence [of its efficacy],” he says, “that would be useful.”

For his part, Moutafis is confident investors will sink \$300,000 into the company over the next few months; overall, he's looking to raise \$1 million by the end of 2009 for "reaching the point of production readiness," according to a Sleep Surfaces presentation to potential investors.

As for how close he is to reaching his fundraising goals, all Moutafis will say is that, "It's being negotiated now."

From frustration to fruition

Johnston likes to say he looks straight through the inventor to the invention. With a dynamic character like Moutafis, that's a difficult approach.

"He's sincere, honest and a hell of a hard-working guy," Johnston says. "Some inventors are just closed off."

Through M2D2, UMass-Lowell's engineering department is helping analyze materials used to construct molds for Smart Surfaces' diaphragms. Moutafis is working directly with undergraduate students on the project.

"That is one of the most gratifying parts of it," notes Stephen McCarthy, a professor of plastics engineering at UMass and the co-director of M2D2. "Students would rather work on something real. Everything they do is useful to the inventor."

Moutafis, who moved to the United States from Greece in 1973, was once in their shoes. He graduated from Northeastern University with a degree in mechanical engineering in 1979.

"By the time I went to college, I knew precisely what I wanted to do. I wanted to make the packages, the devices, the hardware that make things run," he says.

The medical device industry, Moutafis adds, "was really perfect for me."

After spending the 1980s in the field, at times feeling unfulfilled, one day in 1993 his frustrations came to a head. The consulting job he was working at the time was infuriating.

"It was an awful project," Moutafis recalls.

Still, he tried to remain calm.

"I don't get angry at people because they are who they are," he says. "Nevertheless, I needed a paradigm shift."

Despite his exasperation, he couldn't help but notice that day's gorgeous weather.

"What a great day for windsurfing," he remembers thinking. "I could be windsurfing all day and do business at night and have it all."

The fantasy led to an epiphany: Why not start his own firm?

“Once you start the company, you position it in such a way that you can’t fail,” he says. “If you believe in yourself that you’ll do the right thing, or at least try to anyway, you will never fail.”

It was at that time when he was visited by the vision of tiny robot healers.

“Immediately I dropped everything, went windsurfing and I was pumped,” he wrote in an e-mail. “That moment empowered me to start the vision and work hard at it. That moment is still with me.”

He soon founded Surgijet — renamed HydroCision in 1996 — and served as the company’s chief technology officer for the next decade.

“I needed a new life,” he says. “Basically, the company was moving by itself. I was trying to contribute [but] I was not sure I was contributing.”

In 2002, the blob plopped into his head. He left HydroCision in 2004; Smart Surfaces was incorporated in 2006. And in June 2008, roughly a year and a half after Moutafis applied for it, his “rolling diaphragm” patent was granted.

“This time, I needed something simple” compared to the complicated HydroCision technology, he says.

Eventually, he hopes the mattress is simple enough to be sold in retail stores.

“He’s an unusually creative guy,” says Jon McGrath, the interim CEO of Smart Surfaces, who was brought on board when the company entered the M2D2 program. His boss, McGrath notes, is “impressively sharp.”

Moutafis, who freely acknowledges that Parkinson’s should’ve taken his life by now, isn’t physically limited by his condition. Since his diagnosis, he’s learned to ride a unicycle, snowboard and windsurf, his current passion.

Moutafis says his children, Alexi (22) and Niki (19), and wife Denise keep him going.

“I have two kids that I love and a wife in my life,” he says. “I’m not ready to let go yet.”

Every day, he tries to reach at least one point at which he feels completely disease-free. Moutafis says the key is to trick himself into disbelieving he has a debilitating illness.

“Once you’re convinced [you’re sick],” he says, “you’re screwed.”