*Dr. Clen Hiel. Photo by Brian L. Gillogly*

# On The Cutting Edge

***"You have to disconnect yourself from the past. That's how you move into the future. That's how you create and innovate."***

**by Brian L. Gillogly**

Dr. Clem Hiel is a trailblazer on the frontier of Space Age "composite materials." Defined as super-materials composed of two or more components, advanced composites are being utilized in everything from tennis rackets to boat masts to Formula One cars. Hiel and his "incredible team" of employees at Composite Support & Solutions Inc. in San Pedro are known for thinking out of the box, merging special resins or ceramics with graphite and glass fibers to take composites in novel directions. The Rancho Palos Verdes resident, in fact, has won several prestigious international awards for breakthroughs in the field, including: firewalls to protect transformers along our aged electrical grid, snap joint units capable of being quickly assembled into huge communication towers, and even a total redesign of the common bread baking pan.

A former NASA engineer and a professor at the University of Brussels, Hiel is actually a native of Belgium. He makes no apologies for his telltale accent, despite over 20 years living and working in this country. Instead, he brings it up as an example of our strong attachment to the familiar and how that urge can inhibit innovation.

"It just shows how incredibly hard it is to disconnect ourselves from our past. And it applies to my field too. Often engineers are only looking for things they know. For example, they may construct a part in composite materials in exactly the same shape as they would in steel, because they are familiar with that part in steel. But it very well may be that in a composite material it shouldn't look like that at all to be functional and a good product."

A primary advantage of composites is that strength can be focused where it's most critical. "You can design the material for its function and have the fibers directed to carry the loads. This cannot be done with any other material. When you buy a piece of steel or aluminum and you are stuck, because the strength is the same in all the directions. If you want a lightweight material with superior strength and stiffness, then you need a composite."

Hiel's 10-year career at the NASA Ames Research Center in the Silicon Valley also gives him particular insight into the fire retardant properties of certain composites. This background was put to the test in the development of his revolutionary firewall to contain conflagrations between clusters of electrical transformers (www.intellifirewall.com). Initially working with Southern California Edison, Hiel's company has installed 13 walls, but expects to go national and international in the coming years. "When we plug an appliance into a wall socket, we don't realize that we just hooked up to one of the most complex machines on earth. The reliability of the electrical power delivery to our homes and businesses is something we expect and take for granted. Our firewalls help keep it that way."

Hiel's snap joints, on the other hand, are both hi-tech and time tested. Molded in an epoxy, glass and carbon fiber composite, the pieces snap together with a technique that originated in traditional Japanese joinery. "The Japanese only had wood and this is how they constructed these

monumental buildings without any screws or nails."

A Caltrans freeway bridge sign hanger has been built using this technology, and a snap joint tower will be erected this year next to the rocket launch pad at Vandenberg Air Force Base in Ventura. The US Military is particularly impressed with the technique as it allows for constructing telecommunications towers that are quickly and easily assembled, and will hold up to the elements. "They have bases where it's snowing, near the water, and in the desert. This is ideal technology for them."

It may seem a stretch for someone like Hiel, who spent a decade working on the Space Shuttle and hypersonic vehicles for NASA, to rethink the low-tech bread baking pan. In fact, it was his brother, a baker in Belgium, who set this innovation in motion. "He said, you're in composite materials, can you give me a plastic baking pan that is non-stick and doesn't get dirty? Bread bakes at about 450 degrees Fahrenheit, and that's a high temperature for any plastic, so the idea seemed to be unfeasible. I explained to my brother that some plastics used in the space program might be suitable, but they would be too expensive."

However, after additional thought and testing, Hiel had a revelation. "I realized that baking bread is also a process of evaporating water. Then I remembered a principle of physics that I learned at age 13. The temperature doesn't increase as long as you are evaporating water. It remains at 212 degrees Fahrenheit. This was the breakthrough that led to an effective, inexpensive polymer."

The resulting pans and molds allow bread to be baked in one-third the normal time, using a combination of microwave and traditional baking processes. "It basically cooks the bread from the inside out, and then at the end we use regular heat to brown the crust. This saves energy, and the baked products are also healthier." This fall, Hiel expects to be selling 10,000 of the "Clean Baking Products" pans a month in Europe (www.cbpb.be) and plans to begin marketing the product in the U.S.

Hiel credits his intellectual curiosity and interest in engineering to early exposure to the field and a strong education. His father, whose own schooling was interrupted at age 14 by WWII, had a knack for repairing mechanical, electrical and electronic devices. "He was considered a technical prodigy by his peers, but he had never formally studied the principles of science or engineering. When I was young, I went out with him to his work, and it was like magic when he fixed things. I learned a lot, but I wanted to know the principles and exactly why things worked."

That desire propelled him through vocational school in the port city of Antwerp from age 12 to 18. "I learned to use machinery, weld, make parts, and read drawings. We even built a 45-foot yacht." He continued his education at the Antwerp Institute of Technology, and then went on to study engineering at the University in Brussels. It was there that he received his first instruction in the futuristic, costly materials called composites.

"This was around `76, `77 and only a few engineers and scientists were pursuing the field of composites. But there was a professor at the University who had an interest and a vision. At first I wasn't too keen on it. I wanted to specialize in advanced and efficient diesel engines. But he finally convinced me saying I would never be able to design and build such engines without first developing the advanced composite materials to do it with."

Hiel went on to serve in a one-year post-doctoral position with NASA in composites. He returned to a teaching post at the University and was offered a full time position at NASA 3 years later. "I talked with my wife about it, and decided that I would never get an offer like this again."

Clem and Hilde Hiel had a daughter, Lynn, and a son, Tom, during Clem's tenure at NASA, and the family eventually relocated to RPV. Lynn is now a junior UC Berkley with a major in civil engineering and a minor in architecture. Tom, who just graduated from PV High and will attend UCSD in the fall, recently won first place in the 2008 LA Science Fair in Engineering Research. Their dad simply remarks, "My kids are capable of critical thought. That may be my wife's and my greatest contribution to them."

Hiel encourages young people to seriously consider science or engineering as a career path. "It's a very demanding field of study, but it's a splendid challenge for any young mind. It's extremely rewarding to be able to build things, innovate and in the process improve life on our planet on a global scale." ***PEN***