Inside Dyson's innovation machine

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When Homer Simpson, America's beloved cartoon idiot, was given free rein to design the car of his dreams, he created an abomination, complete with a megaphone attached to the roof and huge bubble-shaped windows. It tanked his brother's fictional car company.

When Dyson, Britain's beloved technology company best known for its high-end vacuum cleaners and fans, gave its design engineers free rein to design the vacuum cleaner of their dreams, they created a cordless sucker with the power of a traditional vacuum and the mobility of a handheld.

Like "The Homer," it looked ridiculous. The body resembled a children's Nerf gun. The power button was a trigger. Unlike the fictional "Simpsons" car, it quickly became a best-seller.

Today, it accounts for 50 percent of what Dyson sells. The company took in nearly $2.1 billion in revenue last year, nearly half a billion dollars of which was profit.

The difference between "The Homer" and the Dyson? Aside from one being the product of a cartoon and the other coming from a real, multimillion dollar company, "The Homer" was a Frankenstein of unnecessary features, including three horns ("You can never find a horn when you're mad!"). The Dyson was the product of engineers using their freedom to solve real problems. And the Nerf gun? The trigger? The bizarre, unconventional vacuum-cleaner design? Yeah, that was all part of the solution.

"The first thing we do at Dyson is identify a problem to solve," said the company's head of new product innovation, Stephen Courtney, who has been with the company for 17 years. "The second stage is working out what technologies can solve that problem. That's why our products look so different. It's because of the technology."

In traditional cordless vacuum cleaners, the bulk of the machine is close to the ground, Courtney said. This makes it hard to maneuver because people are essentially pushing around a vacuum cleaner on the end of a long stick. So why not balance the weight of the machine in the person's hand instead?

Thanks to more than a decade of research and development, Dyson already had developed a powerful motor small enough to fit into the palm of a hand. So instead of copying everyone else's glorified broomstick design, why not build something that's easier and more comfortable to use, even if it means adopting an unconventional Nerf gun form?

Chief Executive Max Conze describes Dyson as a company of problem-solvers. It employs 2,500 people in its U.K. headquarters and has more than 2,000 engineers around the world from all disciplines developing technology that can solve everyday frustrations. The company spends more than $4.5 million a week on research and development and, using those funds, its engineers break down every problem to its simplest form.

"Take hand dryers as an example," said Dyson mechanical engineer Matt Kelly. "You'd start with a pure problem of getting water off hands. For a lot of people, they'd think, 'OK, we need to evaporate the water, we need to heat it and get rid of it.' But the tricky thing is to take a step further back and say, no, we don't actually need to evaporate the water, we need to remove it from the person's hands. What are the ways we can do

that?"

"Eighty percent of the things we work on won't ever see the light of day," Kelly said.

Is it a risk to throw hundreds of engineers on projects that might fail? Of course. Dyson has had no shortage of failures.

Before Oculus and Google Cardboard, Dyson developed a head-mounted wearable computer in 2001. According to Conze, it was too far ahead of its time, and the components available weren't good enough to pull it off. It was put on indefinite hold.

Before the 2015 Dyson 360 Eye vacuum robot, the company developed a larger, clunkier, bright yellow robot vacuum cleaner in 2006. It almost launched, but the company decided it wasn't powerful enough.

In the early 2000s it even tried a corded robot vacuum cleaner. The robot was smart enough to retrace its steps and wind up the cord on its own. Unfortunately, no one else was smart enough to avoid tripping over the cord.

Costly as the failures have been, it's part of the process, Kelly said, and it's a process that has led to vacuum cleaners, hand dryers, humidifiers and fans making Amazon's and Wal-Mart's best-seller lists, despite the devices being much more expensive than competitors'. The latest Dyson cordless vacuum cleaner starts at $599, whereas the average competitor cordless vacuum starts at $100.

"If you want to design something, and if you can see a way of doing it, the attitude is never, 'Ah, that will never work," Kelly said. "It's much more, 'OK, then prove it. Make it. Demonstrate what you want to do.'"

It's this openness to anything that has led to new products and complete reinventions of existing products.

Take the Dyson Fluffy as an example, a vacuum cleaner head that looks more like a fuzzy roller someone might use to curl their hair than a cleaning attachment.

"Conventional cleaner heads on hard floors can snowplow lots of debris and, instead of picking up the dirt, they just push it around," Courtney said. "So we completely reinvented the cleaner head. We've replaced the front edge with a fluffy roller that spins around, and because the bristles are fine and soft, it forms a complete seal with the floor, which means we get really good suction."

It also led to the Dyson hand dryer tap, which is a tap that doubles as a hand dryer.

"When people dry their hands, they have to walk to the hand dryer, and as they do that they drip water on the floor," Courtney said. "So I thought, wouldn't it be cool if we could just reinvent the tap and put the dryer in the tap?"

Dyson's work is never done, Courtney said. The latest version of any of its products may be the lightest, fastest, quietest and most powerful of any on the market, but they can always be lighter, faster, quieter and even more powerful.

And those solutions will come from engineers getting carte blanche to Homer Simpson the heck out of everyday problems. Problems like hair getting tangled in vacuum cleaner brush bars.

"We've got a small attachment tool that solves it, but we don't have a solution for the full cleaner head ... yet," Kelly said, smiling. "I'll say no

more than that."