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# UNDERCOVER GEARS



**TOP SECRET**

**CODE NAME: Ginger**

**MISSION: Design, prototype and test a transmission for a new device. The transmission must be compact and efficient. It should have almost no backlash, and it must be able to operate in both forward and reverse. Most importantly, the transmission must be quiet. In fact, it shouldn't sound like a transmission at all. It should blend in with the environment and sound like music or the wind. This mission, should you choose to accept it, is top secret. Not even your employees can know what you're working on...**

Sounds like something out of a spy novel, right? Well, not exactly. This "mission" was a real assignment, accepted by Axicon Technologies Inc. of Pittsburgh. It was given to Axicon by a startup company called Segway L.L.C. of Manchester, NH, whose Segway personal transportation device was unveiled in December after years of speculation, rumors and—towards the end—considerable hype.

Segway L.L.C. was founded by eccentric and renowned inventor Dean Kamen. For some time, there was a buzz about what he'd been working on, a project code-named "Ginger," which was also sometimes referred to as "IT."

Now, the secret is out. The Segway human transporter is designed to carry a single passenger at speeds up to 12.5 mph in a pedestrian environment. It was unveiled in a media blitz on *Good Morning America* and has been fea-

tured on *The Tonight Show* with Jay Leno. Highly engineered, it's equipped with all sorts of mechanical and electronic gadgets to ensure balance, smoothness of ride and safety.

Thanks to Axicon Technologies, the transmission is also highly engineered. For example, Segway's engineers were very particular about the sounds made by the gearbox. They wanted not only a quiet gearbox, but also one whose sound was consistent with the rest of the device.

Riding the Segway is supposed to be a "light, efficient and magical" experience, says J. Douglas Field, Segway's vice president of product development and chief engineer. "We wanted noise to be low in level and high in quality."

Working with gear noise is one of Axicon's specialties, says Brian Ahlborn, vice president of sales and marketing.

In this case, Ahlborn says, Axicon was instructed to make the gears "sound like the wind." To do that, the gears were carefully "tuned" to achieve just the right sound.

"It's pure music theory," says Field. He explains that by controlling the number of teeth in each mesh of the two-stage transmission, it makes sounds that are exactly two octaves apart. By tuning the transmission in that way, the engineers hoped to eliminate any dissonance and make the transmission sound pleasant to the ear.

Axicon also held jury tests, during which people listening to the transmission rated its sound quality. The transmission was continually improved based on those ratings.

According to Ahlborn, Axicon's strengths include a mix of proprietary technologies and engineering approaches, as well as a corporate culture that emphasizes creativity and technology. "We're pretty unique in how we do some of those things," he says, describing the corporate culture as "Silicon

Valley meets the Rust Belt."

Field says it also helped that Axicon could act quickly and knew what companies to contact for manufacturing. According to Ahlborn, Axicon delivered working, sound-tested prototypes in five months. Axicon did some gear manufacturing in-house, but Schafer Gear of South Bend, IN, did most of the gear manufacturing as Axicon's gear supplier for the Segway project.

Now that the secret is out, Segway and Axicon are getting ready for mass production. Segway has built a 77,000 square foot factory in Manchester, NH. The facility will be capable of producing 40,000 Segways per month. Although the consumer version is not scheduled to go on sale until late in 2002, the Addendum team will be among the first in line to try them out, if for no other reason than to hear the gears. ☉



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