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TECHNOLOGY

This Earbud Could Rival Neuralink. Its Inventor Just Needs to Build a Business First

Look out, Elon Musk. Dave Segal's revolutionary device could let anyone control a computer with their head—no brain implant required. [🔗](#)

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● This past April, Dave Segal found himself onstage at the Edison Awards, the annual Oscars of innovation, delivering a midday demo. The audience was a collection of the world's most pedigreed nerds: Gwynne Shotwell, COO and president of SpaceX, was there, as was Laurie Leshin, director of NASA's Jet Propulsion Lab. Attendees included elite scientists and executives from every corner of tech, from adhesives to robotics.

Segal doesn't fit the profile of the typical inventor. Forty-seven years old and built like a grappler, he doesn't have a PhD or even an undergrad degree. But there he was on that spring day, a few yards up the Caloosahatchee River from the old Thomas Edison estate in Fort Myers, Florida, presenting his creation to the brainiac assembly. "Roughly 10 years ago," he recounted, "I read an article about an Iraq war veteran who stepped on a roadside bomb, lost his limbs, and suffered severe paralysis. He was getting fashioned with a brand-new, shiny, 'thought-controlled' prosthetic arm. And as a technologist, I asked myself, *Wow, is thought control even real? What if I can create a novel neural interface that would allow somebody to command, control, and navigate computers, phones, wheelchairs, smart homes, IoT,*



Dave Segal, inventor of the Naqi Logix earbud. Photo: Micah E. Wood

robotics, AI—in a hands-free, voice-free, and sometimes even screen-free manner? It’s fair to say, that was really the beginning of the journey.”

Segal gestured for a young man in the wings to take center stage, and William Smith, a 26-year-old proposal specialist for Kansas City, Missouri-based engineering firm Black & Veatch, rolled up to the mic in a power wheelchair. Without a word, equipped with only a standard-looking wireless earbud Segal had just popped in for him, Smith lowered his eyes to a laptop on a stand. Spectators saw the cursor zip across a huge projection screen as Smith pulled up a web browser and navigated to Amazon, motionless except for almost undetectable movements of his face and head. They watched him search for a Patrick Mahomes jersey and add it to his cart. Then he opened a blank Word document on his desktop and, as the cursor moved from one letter to the next, the words “Hello Edison” formed on the page. Gasps and cheers went up from the crowd.

“That was pretty cool, right?” said Smith, looking up from the computer. He explained that at age 23 he’d been paralyzed from the neck down in a car accident and now relies on a cumbersome suite of assistive technologies including a head array to steer his chair and what’s known as a sip-and-puff straw that translates his breath into computer commands. “The Naqi Neural Earbud is like a new superpower,” Smith said, before making the comparison with Elon Musk’s [Neuralink device](#) obvious, if anyone had missed it: “I would rather put one earbud in my ear than have a brain implant,” he said with a sly smile. “*That’s* a no-brainer.” That night, the Naqi Logix Neural Earbud won a gold in the Edisons’ Social & Cultural Impact category. And Dave Segal looked like a very happy inventor indeed.

Naqi Logix today remains an extremely early-stage company with three employees, another dozen or so working as contractors, around 60 copies of its signature earbud—and no revenue.

At first blush, Segal’s tech seems to be a new entrant in an emerging market that’s expected to grow from \$4 billion to as much as \$11 billion by 2031: brain-computer interfaces, or BCIs. BCIs are broken into two classes—invasive and partially invasive on the one hand, and non-invasive on the other. Invasive BCIs, which last year represented about 14 percent of that market, are surgically implanted. The most famous example is Musk’s eight-year-old Neuralink, a bottlecap-size device that’s inserted by a surgical robot into the human skull, with probes punched into the [cerebral cortex](#). (The company recently announced that its first patient was able to move a virtual chess piece “just by thinking,” as Musk put it, but far more impressive [achievements](#) are actually taking place in the research community, particularly in the BrainGate consortium that includes Brown, Stanford, and Emory universities.) Non-invasive BCIs, meanwhile, mostly take the form of headgear equipped with skin sensors that can gather biodata and, with enough training, even allow users to play a [video game](#). Both technologies are in their early days; no one knows what they might one day accomplish.

It would be easy to lump the Naqi earbud in with BCIs, but it is in fact quite different. It represents a conceptual shift in how we think about what tech people call device control. Naqi’s earbud doesn’t sync up with specific neurons or harness so-called brainwaves; it detects the motion of the human head, as well as electrical signals emitted by specific facial movements, so users can navigate a menu of commands and execute them. It is a tool for making machines do what we want them to—without using hands, voice, a joystick, a mouse, or in many cases even a screen. Segal’s friend Keith Parsons, a quadriplegic since 1990 whose condition has motivated

Segal for years, recently used Naqi to play the video game Breakout. “These earbuds will just open up my world tremendously,” Parsons told me. “This is basically gonna give me back my hands.”

But Naqi is not only for people with mobility challenges. Anyone can use it to control a cellphone, laptop, TV, drone, or even (in theory) a car. Segal can pilot a 737 on a commercial flight simulator using nothing but his earbud and a Bluetooth connection. Workers on an assembly line could control an industrial robot remotely without setting down their tools or leaving their station; a McDonald’s manager could change an oven setting, flick an order-up button, and signal a lunch break without abandoning the register. Potential applications are legion, from the military to medicine. And because Naqi is an earbud, it avoids most of the awkward adoption hurdles that sank Google Glass and many other wearables.

Naqi’s simplicity and utility represent a real competitive advantage. If Musk and his BCI ilk are engaged in a laudable but quasi-magical undertaking, Naqi is essentially an AI-enhanced replacement for the desktop mouse—technically straightforward by comparison with Neuralink, and vastly more useful in the here and now. As a result, Naqi has the potential to become a platform for innovation and company formation on a scale other BCIs may never attain, or at least to get a serious jump on them. A non-invasive, low-cost, hands- and (often) screen-free device like Naqi, says Tim Marler, senior research engineer at the Rand Corporation and co-author of a major 2020 study of BCI technology, “really could be disruptive.”

But Dave Segal is not Elon Musk. Naqi Logix today remains an extremely early-stage company with three employees, another dozen or so working as contractors in exchange for a combination of cash and equity, around 60 copies of its signature earbud—and no revenue. The company could not be much smaller, or its prospects more uncertain. What Naqi does have, though, is word of mouth: In the past year, it not only won an Edison, but was voted one of *Time* magazine’s best inventions. At CES in January, Microsoft CEO Satya Nadella made a personal visit to Naqi’s booth, and then designated one of his lieutenants as Naqi’s “conciierge” should Segal need anything from Redmond. The “novel neural interface” Segal mused about a decade ago, while still formative and sometimes a bit clunky, is becoming very real. Now it needs to become a business. Pronto.



Segal has been building tech companies since he was scarcely out of high school. His father, Robert, a mining industry chemist, moved his family of four 14 times before Dave turned 18. Starting at age 3, computers were a rare constant, and young Segal turned out to be a tiny prodigy: Over the next decade he taught himself to program by, he says, “eating the elephant one bite at a time,” becoming fluent in at least five computer languages. When he enrolled at York College in Pennsylvania, he quickly learned that he knew more about coding as a freshman than students on the verge of graduation. He lasted one semester. Before long, Segal co-founded his first company, a distance-learning outfit called CyberGrad. The business took a hit in the aftermath of 9/11, when a crucial contract with the Navy fell apart. After relaunching as SpiderWeb Communications (“Zoom before Zoom”), the company ultimately was acquired, and Segal spent the better part of a decade as VP of U.S. sales, banking enough to buy a modest house in York.

It was then, in 2013, that he read about the Iraq war vet’s prosthetic arm and asked himself, *Is thought control even real?* A little research led him to the BrainGate group’s work, and he began to question the utility of a brain implant if there was no screen or monitor to connect the user visually to a given device and keep them oriented within its system of menus and commands. He thought immediately of a Rubik’s Cube. “I had this

vision of an invisible cursor navigating a three-dimensional structure based on left, right, up, down, forward, and back, using mental commands,” he says. He calls the moment his “Naqi epiphany.”



The earbud detects the motion of the human head and also facial expressions. Photography by Micah E. Wood

Bluetooth, an earbud equipped with a biosensor—and paired with an integrated inertial measurement unit to capture head speed, angle, and direction—can turn the human head into a remote control.

Segal’s Rubik’s Cube became the conceptual core of what he calls his “invisible user interface,” or IUI. Think of it as a layered menu similar to the one on your smartphone. The IUI can be programmed as a dead simple grid of just a few apps or commands, or expanded to encompass a very large number, on the basis of individual users’ needs or preferences: A lathe operator might have just four functions baked into her Naqi earbud; her floor manager might have a dozen or two; their CEO, a hundred. Audio cues and predictive AI let users navigate options and commands without relying on their hands or voice—or, in many contexts, even a screen.

(Segal’s IUI even gave Naqi its name: The Anunnaki were deities that appeared in ancient Sumerian tablets inscribed in cuneiform, the earliest known written language, whose arrowlike lines and wedges informed the way Segal mapped out the logical flow of his interface.)

So when William Smith was ordering his Mahomes jersey at the Edison Awards, he was using all-but-invisible movements of his head to guide the cursor through the menu and specific micro-contractions of his facial muscles to launch an application or execute a mouse click or keystroke. No brain surgery required.



Convinced he was on to something, Segal filed a provisional patent application with the U.S. Patent Office. That protected his idea for a year, while he scrambled to make something of it. He spent \$1,500 on an Emotiv headset, a skullcap with non-invasive sensors that picks up electrical signals—a.k.a. brainwaves—through the scalp. But those signals are an extremely fraught source of data, and Segal quickly concluded that he’d tumbled down “a rabbit hole of bullshit.” If he wanted to achieve “thought control” in any kind of practical time frame, and to build a product around it that would actually be useful at scale, he’d need to find another way.

And find one he did. Turns out, the Emotiv set uses EEG (electroencephalography) signals to try to decode the brain activity of the user, but relies on what are known as EMG signals (as in electromyography, the study of electrical impulses emitted by musculoskeletal activity) to control the device itself, to turn it on and off, for example. Just about any human can clench their jaw, raise their eyebrows, or blink; each of those movements produces a signature spike of electrical output that can be used as a “trigger,” as Segal calls it, to tell a machine to execute a preprogrammed command. When connected to a device via

Segal says he knew “within minutes” that his mental model for Naqi’s technology would work. But having a big idea is not the same as knowing how to turn it into something useful. A theoretical invention is not a business. Segal lacked connections. He lacked polish. And he lacked a product.

Segal’s IUI patent was granted in 2016; his second came the following year. But getting there was crippling: To pay his first patent attorneys, he’d taken an unsecured \$100,000 loan from a friend and local banker, Bob Pullo, and drained a small 401(k). By 2017, he was obliged to draw down another \$100,000 from Pullo.

Counterintuitive as it might seem, that approach gradually established an underlying value for Naqi, before the company itself even existed. Those patents proved to be enough of an asset to open one more door.

“He approached me like a mad scientist,” recalls Eric Darr, president of Pennsylvania’s Harrisburg University. Segal had contacted Darr in the hope of scrounging up some local support; during their first meeting, he slapped on his Emotiv headset, conductive contact lens solution leaking down the sides of his face. It wasn’t a great start. Darr deputized one of his faculty members, Glenn Mitchell, an engineer, MD, and medtech entrepreneur, to vet Segal’s work. “My first diagnosis was, ‘He’s crazy,’” Mitchell told me. But Mitchell eventually came around, and Darr was impressed enough by Segal’s patent successes to offer him some office space at HU’s new Center for Innovation and Entrepreneurship.

“It’s a really interesting strategy,” Darr says. “That patent portfolio was the thing that gained the attention of other serious CEO types or investor types who you now see associated with his company, and the board and management team he’s put in place.”

One of those serious types was Mark Godsy, a Canadian lawyer-turned-entrepreneur. Segal met Godsy in late 2019 with the help of Sinan Tumer, a former executive with German software giant SAP who would become Naqi’s COO (he’s now an adviser with an equity stake in the company). “What I saw was a person who was, I’ll say, desperate for help,” Godsy told me in his lawyer’s conference room, high above Vancouver’s Coal Harbour. “Dave had a few advisers, but basically was on his own. He hadn’t built a prototype, hadn’t built any code. It was just an idea.”

Godsy is not your standard-issue CEO. He made his bones in fields as diverse as medtech and mining, selling one of his companies, a vaccine maker, to GlaxoSmithKline for C\$1.7 billion. He retired at 40 but now fixes companies that have what he considers a noble mission.



Using a flight simulator, Segal demonstrates the earbud at Harrisburg University's e-sports arena. Photography by Micah E. Wood

Segal and Godsy founded Naqi Logix in the summer of 2020 as a Canadian company based in Vancouver. Segal assigned all of his patents—13 at that point, all in his name—to the company. By then he'd been hustling for seven years to develop his idea, and he was almost ready to tap out. "Dave was saying, if this doesn't work, I'm going to find a real job," recalls Tumer.

"If creating a startup were a sport," says Segal, who's now chief innovation officer, "a top CEO would be your No. 1 draft pick. But you probably won't be able to afford one, so be prepared to give up a significant percentage of the company." Godsy now holds a bit more than 10 percent of Naqi; Segal has less than 8 percent but says he's happy with the outcome. "The moment I worked with what one could consider an elite-level CEO," he says, "it became apparent that I couldn't do what they do."

Over the next four years, Godsy and Segal took the company from "just an idea" to an impressive team with a functional device. After Segal had struggled for years to attract talent that investors would take seriously, he marvels at how "Mark filled in the company with top-level people and we ended up closing out our \$2 million seed round after just a few weeks of opening it." (They've since raised another \$5 million directly from private investors and are pursuing a round worth another \$15 million.) They brought in a head of hardware strategy who led the team that built Motorola's Iridium satellite handset. Their head of software helped develop Adobe Acrobat and Barnes & Noble's Nook. And in June they persuaded Sandeep Arya to leave Samsung, where he'd spent 13 years, to become chief business officer.

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Segal has now won 26 patents for Naqi, with more in the pipeline; he says he has never lost an application. Tumer, who trained at Georgia Tech as an engineer and computer scientist, estimates the value of Naqi's intellectual property alone at between \$40 million and \$50 million. "It would be very costly for anyone to invalidate this patent portfolio," says Michael Haggerson, one of Segal's attorneys at DLA Piper in New York. "We've got multiple layers of protection." That protection is powerful enough that a European company with its own earbud technology recently approached Godsy and asked to be acquired rather than face a messy patent feud; that process is likely to be finalized in the coming months.

As for Naqi itself, "I did my research when I was going through the four-month hiring process," says Arya, whose job as a senior director at Samsung was to evaluate new technologies and forge strategic partnerships. Asked to put a projected value on Naqi, if it were to reach its full potential, he cites the \$5 billion valuation Neuralink received last June as "the upper end" comp. Value is based on utility, he points out, drily, "and we know how much Neuralink is capable of doing at the moment."



Naqi is at a pivotal, if not perilous, moment, as Godsy and his team hunt for traction in the market. They have good reason for caution: A recent Stanford [study](#) of some 4,500 inventions marketed between 1970 and 2020 by the university's eminent Office of Technology Licensing found that the total net income for *all of them* was \$581 million, with an average of \$0.13 million. The study found that "overall, most inventions have a negative net income," with only 20 percent producing positive net income. Failure is definitely an option.

Like many young companies, Naqi is vulnerable not only to failure but predation. Bob Pullo, the York banker who staked Segal to those two \$100,000 notes (and, as soon as Segal repaid them in 2021, used the money to buy Naqi stock), has watched his younger friend toil for a decade. Pullo says he has seen too many clients get robbed or reverse engineered or just vanish in a cloud of debt and exhaustion. He thinks Segal should take "not the biggest check, but the best check, the best terms for getting out quick."

No one would blame Segal if he did just that—after a decade of banging on the anvil, toiling in obscurity on a quest that risked every penny he had. But he, Godsy, Tumer, and Arya all feel there's a bigger opportunity in front of them. The question is, how to seize it without making a fatal error, and there are only so many options: They can sell Naqi's patent portfolio outright and call it a day; license the patents and the right to produce the earbud to a consumer electronics beast such as Samsung and let it do the heavy lifting of manufacturing and distributing the devices; forge a partnership with the open-innovation arm of a company such as Sony that would give Naqi capital without its having to give away tons of equity and control; or suck it up, raise a bunch of venture capital—giving away a huge piece of the company in the process—and try to build a vertically integrated operation all by themselves.



Segal in his office at Harrisburg University. Photography by Micah E. Wood

All four men told me they like a hybrid approach. Arya knows all too well how easy it is for a company like Samsung to bail on exploratory partnerships that represent a rounding error on its own balance sheet but life or death to its partners. He's pushing for a diversified strategy that would allow Naqi to enter into agreements with specific divisions within big companies; he thinks that as the tech proved itself and companies got comfortable with it, they would find ways to apply it more broadly across other lines of business. "Microsoft will talk about productivity. Samsung might say gaming. Apple might say health care," he explains. "So my strategy would change; it is not a one-size-fits-all."

Arya and the team know that the closer Naqi can get to a line of Naqi-branded earbuds, or a "Naqi inside" sticker across multiple brands, the more leverage they'll have. In the meantime, exclusivity is the enemy. "Unless you put a billion-dollar offer [on the table] and we are ready to sell," says Arya, Naqi is not giving up control. "We need freedom to work with others as well." Giving big-brand manufacturers short windows of exclusivity within focused subsets of their various products and services would allow Naqi to train the market while growing both its own business and brand. (The Stanford study reinforces this instinct: It found that higher net income is associated both with first-time inventors and technologies "licensed by the inventors' own startups.")

Part of the challenge for Naqi is the sheer magnitude of its potential. Segal is clear that assistive tech for the William Smiths and Keith Parsons of the world represents the company's "initial beachhead market," but it's hard not to get distracted by the colossal possibilities that lie just beyond it. That's why one of the most essential contributions Godsy has made to the young company is patience, the ability to resist shiny objects. More than

400 companies approached Naqi in the wake of CES; at Godsy's insistence, some nine months later, the team is still assessing them for fit—a methodical pace Naqi can afford thanks to cheap capital and a low head count.

Naqi has spent months working with Smith's employer, Black & Veatch, investigating use cases in industrial AR and assistive tech that could lead to a co-development deal. Naqi is in the final stage of a yearlong technical evaluation by the Canadian government that could open the door to tens of millions of dollars in contracts. The company participated in early June in the U.S. Special Operations Command's invitation-only Sofwerx demo session and is in talks with the Air Force's YokoWERX emerging tech arm as well—both slow-moving but high-dollar possibilities. And there are “strong expressions of interest,” says Arya, from a variety of potential partners, including a major cable company and two automotive companies, as well as AR/VR and robotics shops.

Nothing is certain, but the door is open just wide enough for Dave Segal to see, finally, a sliver of what's out there. “They say an exit changes your car, your house, or your life,” he told me early on. If consumers truly embrace Naqi—and if Segal's tech gives rise to a new ecosystem of products and services—his life won't be the only one that changes.