FIERCE FROM THE FIGHT: Nathan Cohen's Tortuous Path

Nathan Cohen's company turned thirty this Summer. In the Bedford, Massachusetts headquarters of Fractal Antenna Systems, commemorating the day, Cohen sat amid circuit boards, acoustic arrays, and a whiteboard scrawled with equations that seemed to belong as much to an astrophysics lab as to a workshop. On the table lay a coil of wire—an early fractal antenna prototype—which he joked is "my spaghetti of progress." It was a rare moment of uncoiling the past. He was exploring, and explaining, in a single uninterrupted stretch, how fractal geometry led to next-generation antennas, how ultrasound could bring down drones, and how innovation stumbles through pitfalls on its way to success.

This is how conversations with Cohen go. He traces lines where others see walls, moving—without preamble or apology—between fields that most people keep rigidly separate. Ultrasound leads to propellers. Cloaking leads to drone swarms. The physics of antennas turns, almost seamlessly, into acoustic warfare. To anyone else, the leaps would sound erratic. To Cohen, they're obvious. Connected.

At seventy, with ninety-four U.S. patents to his name and a passel of prestigious awards—including the Lee DeForest Award for invention and the Arno Penzias Award for outstanding contributions to basic radio science—he has spent three decades leading innovation at Fractal Antenna Systems, a company with a unique innovative influence on wireless technology. Even after thirty years at that helm, he shows no sign of slowing down. To wit: this year, he started the firm's OWL WORKS™—a special projects initiative devoted to rapid creation and development of new technologies, aided by AI and executed by the expert FRACTAL team.

THE INNOVATOR'S LENS

Cohen is, above all, a polymath—an astrophysicist, historian, retired professor, a prolific inventor and innovator, and a man with an unusual ability to see unexpected threads between fields. Trained in radio astronomy and arrays at Cornell, he saw his thesis work on gravitational lenses now become an entry, 40

years later, as the cutting-edge fad of cosmology. But Cohen refused to wait out the dead-slow inertia of scientific recognition for that field. “We live in real-time and we all must use our talents. I’m told I have a knack for finding technical solutions others have to sweat through,” he says with characteristic dryness. He spent years at Boston University, MIT, and Harvard, working in imaging, electromagnetics, and acoustics. His first patent was in medical ultrasound, a universe apart from gravity lenses, and his career since has been a long chain of unexpected but deliberate leaps.

He also has strong views on how innovation actually happens—and how, in his opinion, the U.S. often gets in its own way. He contrasts PAR (Push Ahead Regardless), a lean, iterative model of innovation exemplified historically by figures like the Wright brothers, with PROP (the Process Paradigm), the structured, risk-mitigating ecosystem of contests, perfect hair, pitch decks, venture capital, and middlemen. PROP works, he allows, but it also misfires: two-thirds of venture financings lose money; fewer than four percent return tenfold. “Venture capitalists would go bankrupt in a casino,” he says.

In PROP’s obsession with short-term ROI, promising innovations are often left to hibernate until someone else, much later, rediscovers them—a phenomenon Cohen calls ‘hibervation’. When they finally emerge, it’s the Phoenix Effect: ideas rising from their own neglect. “The VC model has benefits peppered by dysfunction. But innovation isn’t always the roll of the dice, and most successful innovations show traction 10–50 years after they started. PROP is not designed for the long-term stretch.” Cohen isn’t just being an innovation historian—he’s lived through hibervation more than once.

Cohen’s intellectual reflex is to look past process and toward patterns—physical, historical, technological. Over and over, he finds structures where others see noise. That habit has made him the pioneer in more than one field.

FOUNDATIONS LAID

His own work has often been foundational, laying the groundwork for growth and market acceptance. Fractal Antenna Systems began with a simple but radical idea: that fractal geometries—self-repeating patterns seen in coastlines and

snowflakes—could be harnessed to make antennas smaller, wider-band, and more efficient. It worked. “Our antennas are widely deployed,” he says. “Ground-based. Airborne. Mobile. One very recent and successful example is the ARRO™ antenna, now installed for full coverage at the largest stadium in North America. Our antennas enabled efficiencies no other antenna technology could. Compact, wideband, hidden away. You won’t ever see them.”

The work didn’t merely improve existing designs; it changed the underlying geometry of how antennas were conceived and what uses they could enable.

That same geometrical insight led him, almost inevitably, toward creating cloaking physics in 2003. If one could shape fields so elegantly, why not redirect them entirely? From work spun off from a DARPA-funded study, he patented—not *an* invisibility cloak, but *the* invisibility cloak. U.S. Patent 8,253,639 set down the first framework for controlling electromagnetic waves in ways that could render objects undetectable over a wideband. Later academic work blossomed, unknowlingly, on that foundation. Cohen mentions it almost offhandedly, as if it were an obvious next step. For him, it was. He bundled over a dozen patents related to invisibility cloaks and remains at their cutting edge. Harry would be proud.

Then came acoustics. For most people, acoustics and electromagnetics are distant cousins at best. For Cohen, they are parallel domains. He worked for years in ultrasound, echolocation, and audio engineering. He sees sound as a physical field like any other—different medium, analogous underlying mathematics. This polymathic lens led him, in 2014, to a strange and revealing moment: bringing down a toy drone with a Marshall amplifier and a Les Paul guitar. It was a stunt, but it wasn’t just a stunt. It showed him that drones could be disrupted by targeted sound.

The following year, he and his colleague filed the first U.S. patent application for acoustic drone mitigation, dubbed “ARM,” weeks before a Korean academic group’s presentation that is often cited—incorrectly—as the field’s origin. The duo’s work became U.S. Patents 10,006,747 and 10,935,350. “Those are the foundations of drone and electronics disablement with sound,” Cohen says flatly. “Everything builds on that, whether others admit it or not. And I haven’t been idle since.”

THE ACOUSTIC FRONTIER

The technology has matured into Jerecho™, a wideband acoustic testbed that looks like something out of a sci-fi movie. From a rural site, Jerecho™ projects tailored acoustic fields at drones, testing their vulnerabilities. Smaller arrays hum in his lab. He focuses on the propellers, IMUs, gimbals, cameras, and airframes—the parts that vibrate. “A drone is a propeller system supported by sensors and a control system—and with a payload strapped on,” he explains. “Everything vibrates. Everything has a resonance. Find it, and you have leverage to control, deny, disable.”

This is not casual tinkering. Cohen developed a “multiphasic sensitivity analysis” as he calls it, for drone disabling with ARM (Acoustic Resonance Mitigation), mapping how variables—frequency, humidity, distance, altitude, sensor architecture—interact to best disable drones. The result is what colleagues call the “Cohen Well”: a shallow trough on a performance-versus-distance graph where effectiveness becomes nearly frequency-independent. Atmospheric absorption plays a role, but it doesn’t dictate. The key is the interplay of structure, medium, distance, and resonance. “This wasn’t a ten-minute exercise,” he says. “It’s easily the equivalent of several Ph.D. theses, accelerated by AI as a tool and executed by the Owl Works™ team.”

Cohen sees acoustics as part of a broader defense toolbox. Kinetic interceptions (guns and missiles) are expensive. Lasers and microwaves excel at moderate ranges but have to be shlepped around. Acoustics shines in short- to mid-range engagements—particularly aerial dogfights—where it can act as a low-collateral damage deterrent. “You use every tool you’ve got,” he says. “ARM is the surprising, new, ace in the hole.”

The urgency of this work has grown as drone warfare evolves. The past two years have seen rapid escalation: Ukraine’s attack by drone swarms; Iran’s April 2024 strike of around 170 drones on Israel; the swarming assaults of 2025 that strained Israeli defenses. These real-world dangers have forced innovations out of their deadeningly long sleep. Cohen’s acoustic patents from 2015 had spent nearly a decade in hibervation, waiting as the world caught up. That moment has arrived.

“The ARM Phoenix is rising,” Cohen says. “Ten years later, reality has unfortunately, in this circumstance, made the case that hibervation actually happened in plain sight. And it’s time for all of us to wake up.”

Narrowband acoustic arrays, like those demonstrated by a Canadian team, strike him as dangerously limited and poor predictors of the magnitude of performance and utility of ARM. China’s CamShield system—advertised as a museum anti-photography blocker—he regards as something else entirely. “Get real,” he says. “In my opinion this is PRC working on acoustic phased arrays for bringing down our drones and blocking our smart phones and electronics. With sound. Scaled-up hardware, different mission.”

Blocking smartphones? The proof is astounding: Jerecho™, on its low power setting, makes the compass on a smartphone spin like a pinwheel, from an ultrasonic hit. “It’s at a specific ultrasound frequency. Now imagine that same electronic compass on a drone, a robot—and what could happen. Chaos from sound you can’t even hear.”

Cohen repeats that chilling likelihood: “Chaos from sound you can’t even hear.”

Throughout all this, Cohen moves between domains as someone who recognizes recurring physical patterns and knows how to use them. The same intellectual reflex that shaped fractal antennas now shapes acoustic defenses. The same understanding of fields that produced the invisibility cloak underpins targeted resonance attacks on drones. His polymathic logic binds these seemingly disparate pursuits together.

As our conversation winds down, he doesn’t offer a grand manifesto. Instead, there’s a dry, slightly knowing smile. “Welcome to my world,” he says.

It’s a world built on foundations—on laying down ideas before anyone else sees their value, on drawing unexpected lines between fields, on making the improbable work. Thirty years in, Nathan Cohen continues shaping the turns of the coil of innovation for what needs to be discovered, uncovered, and made useful, next.