Scott T. Radcliffe (1967–2022)

Scott T. Radcliffe, a chief scientist at APL, died February 3, 2022, in Howard County General Hospital at the age of 55 due to complications from bone marrow cancer and lung disease.

After Scott graduated from Purdue University with a bachelor's degree in electrical engineering, he came to work for APL, where he stayed for 31 years. He spent his entire career in the Asymmetric Operations Sector and its previous iterations. He received his master's degree from Johns Hopkins University.

Scott was known by his coworkers as "a national treasure, and a man of honesty and integrity who could imagine great solutions to things that nobody else could see." He held three patents and received numerous awards from government sponsors and APL, including the Lab's esteemed Alvin R. Eaton Award for sustained performance and exceptional scientific or engineering innovations.

Scott had deep expertise in computer simulation, digital signal processing, and radio communications, and he delivered several game-changing communication, radio frequency (RF) sensing, and RF geolocation innovations for the US government. He formed deep relationships with sponsors and colleagues, some of whom contributed personal remembrances below.

On April 11, 1992, Scott married Margaret, and they spent 29 wonderful years together building a home and raising a family. In addition to Margaret, Scott is survived by his three children, Sarah, John, and Amy; his four grandsons, Titus, Noah, Elijah, and Jacob; his parents, Ken and Gail Radcliffe; and his sister, Beth Bricken.

Ralph Semmel
Director, APL

Scott Radcliffe was a remarkable person whose vision, leadership, and technical contributions have had a transformative impact on our nation and the Laboratory.

Scott spent his entire career at APL. After meeting him as an undergraduate at Purdue University and recognizing that he was already leading original engineering research, our team convinced him to join the Lab. He was hired on December 1, 1990, into an APL rotational technical program, where he met Dr. James Higbie and joined him in the Experimental Communications Laboratory (ECL).

Scott was quickly recognized as a prodigious talent, and he thrived on every challenge sent his way. Always modest, Scott credited James and the ECL team with molding him into the engineer that he became and instilling the spirit that there is no problem a talented and enthusiastic team cannot solve. Before long, Scott became a section supervisor, and he went on to hold a series of leadership roles, most recently that of chief scientist of the Electromagnetic Sensing Systems Branch of the Asymmetric Operations Sector.

Scott led the way in developing APL's tagging, tracking, and locating (TTL) technologies, which combined novel innovations across custom microelectronics, radio navigation, signal processing, and geolocation. Developed largely in response to the September 11 attacks in 2001, APL's game-changing TTL capability became one

of the nation's leading tools in the global war on terror. Led by Scott's discoveries, the Laboratory invented and advanced a breakthrough family of systems that enabled US ground and airborne defenses to set new standards for performance and utility. Incredibly, the TTL systems have played an enduring role for more than two decades, keeping our nation safe from attack and ensuring our people and interests overseas are protected from extreme asymmetric threats.

Over his career, Scott received nine special achievement awards and four letters of commendation from sponsors, and was the holder of three US patents as well as 10 intellectual property disclosures, among many other honors and achievements. But Scott did not seek honors, awards, accolades, or formal leadership roles. He was happiest when leading a truly hard project with a team of dedicated collaborators. He served as a mentor to many, never turning away anyone who needed his help, regardless of how much was on his own plate.

APL is a far better place as a result of Scott's dedicated service, and our nation is more secure because of him. While it will be decades before many of his contributions can be made public, we all owe him a debt of gratitude. His legacy will be long remembered.

Donna Gregg
Head, Asymmetric Operations Sector

Scott had many remarkable aspects that I had the pleasure to witness, but two that stood out were his quiet persistence and his discipline in tackling hard problems. Early in his career, Scott concluded that he was a terrible writer. That in itself is not uncommon for someone early in their career. What was uncommon was Scott's approach to overcoming his weakness. He didn't shy away from feedback, but instead sought it out. He was patient but determined to grow his writing ability, seeking help and practicing until it became one of his many strengths.

He brought those same characteristics to tackling some of the hardest national security challenges this nation has faced. Yes, Scott seemed to have uncanny instincts for figuring out complex technical problems—insights that seemed to come effortlessly. And he seemed to have an endless stream of new ideas to tackle those problems. But Scott was also disciplined. He kept a notebook with him at all times, and when he had an idea, he wrote it down, reflected on it, and was ready to apply it when the right problem arose. There's no question that Scott was brilliant, but solutions that seemed to come effortlessly were in fact the result of persistence, determination, years of study, and trial and error.

Scott's capacity for genuine collaboration and friendship made him one of the most effective technical leaders I have ever known. He was always open to better ideas than his own. He inspired his colleagues to be bold and always made time to help them develop and improve their own ideas. Beyond single-handedly shaping a generation of leaders, Scott also formed deep relationships with our government sponsors, who came to trust his judgment in ways that exemplify the best traditions of APL.

A journey through Scott's feedback from managers and colleagues over the years turns up certain phrases on a remarkably consistent basis—phrases like *rare talent*, *develops original approaches*, *inventive*, and *in great demand*. These sentiments really embody who Scott was, and they recur throughout Scott's 30-plus years at APL—which is striking, yet not at all surprising to anyone who knew him.

James Higbie
Retired from APL in 2013 after 38 years of service

Appreciation is far too weak a word to describe how I feel about Scott Radcliffe. Scott was like a meteor, or a shooting star, that some of us were fortunate enough to see at close range.

In 1990 I was leading a group of really talented engineers in what was then called the Experimental Communications Laboratory (ECL), and we were looking to add a team member from a new crop of recent graduates. In my interviews, I tried to ask a lot of questions in a lot of different areas to find out if the applicants were familiar with certain concepts. Things like, "Do you know where you might encounter a Bessel function?" or "Any idea how hysteresis might be used in op amp circuitry?" or "If you've got an assembly language program that uses so-called no operation instructions, why are those instructions used?"

We subsequently found out—mainly from Scott—that the word had spread that my interviews were a nightmare that should be avoided at all costs. Scott later told me he had heard such horrible things about my interview that he wanted to subject himself to it just for the experience. The irony was, his record was so stellar that it was immediately clear to everyone that we had to have him for our group.

Scott came up with a lot of original and brilliant ideas over the years, ideas that no one else would dream of. But that was only half of his ability, because he always followed through with thoroughness and persistence, and that's what really gave him the ability to accomplish truly great things. Early on in his career, he pioneered a completely new area of radio communications. But in order to do that, he first had to answer a lot of basic questions: How can a weak radio signal be reliably transmitted out of a building to an aircraft or a satellite? How are the strength and stability of the signal affected by the way the building is constructed, the location of the walls and windows and so forth?

And to find that out, he created an experimental program, placing calibrated sensors in many different locations in many types of buildings and flying aircraft overhead and nearby, and he was able to determine how the transmitter's signals traveled in every direction to calculate the statistics of their variability in time and how the signal was received in the air. He even did it in his own house and his mother-in-law's house. That program went on for many years, and it enabled reliable predictions of the feasibility of many experimental communications systems that were subsequently tested. And over the years, that information gave APL a huge credibility advantage when we needed to defend an idea that we proposed to a sponsor, because we could show them that it actually worked.

Another thing that's important about Scott is that he was playful, a showman. At one point he wanted to show a potential sponsor that an electronic device—one that wasn't designed with any intention of being a communicator—could be made to transmit information to a remote listener. And he demonstrated it by writing special software for the device and placing a radio in the next room. And when the radio received the signal from the device, it didn't output a string of binary beeps or some test message—it played the theme from *Mission: Impossible*. They loved it.

When you're inventing a novel device, you're beset by unknowns. If those unknowns don't work out in your favor—your software runs too slow or requires too much memory, or your hardware is too big or too heavy—they can scuttle the entire project. Time and again, when Scott tried to demonstrate a new idea, things would turn out just right.

People say it's better to be lucky than good, but Scott was both. From the beginning, when he sought out my interview because he had heard it was a horrendous experience, it was clear that he had this amazing self-confidence. And yet, he never seemed to consider his amazing competence and creativity as anything but sources of joy, since they enabled him to come up with new ways to solve problems, and to help others see how to solve them, too.

Joseph Haber

Program Area Manager, Asymmetric Operations Sector

If you asked any of us at APL to describe Scott with one word, we'd fight for a while, but I believe we'd agree on *CREATIVE*—with the entire word capitalized, like shouting—so that the only possible response is an enthusiastic "AMEN!"

Scott loved to say, "it's easy to think outside the box; what is really hard is to think INSIDE the box!" He would describe that his very favorite thing to do as an engineer was to rotate a complex problem in his mind until he found the "cheat" that others could not see, the unique way of looking at an entangled mess where the limitations of the problem became the opportunity for a solution. His creativity was a combination of raw intellect, instinct formed from years of honing and study and trial and error, and a final touch of insight that sometimes seemed divine. I think this is what James Higbie would best capture when he would, with usually feigned but sometimes real irritation, accuse Scott of "just being lucky" as results seemed so often to go his way. Scott in response would smile a wide grin and say gleefully "I am!"

Scott told me, and many others, that after the 9/11 attacks, he prayed that the Lord would give him the opportunity to contribute to keeping our nation safe. Scott's prayer was answered, and the best way I can describe what he contributed in this setting is this: under Scott's leadership, we built a system, that became a family of systems, that became an ecosystem, that contributed significantly to the United States' response and helped save many innocent lives.

It is a testament to Scott that I can write "*we* built"—and Scott was always the first to acknowledge, through word and action, how so many people at APL contributed so greatly to this. But, to a person, all involved will tell you that we were following Scott. The importance of this work was also known outside of APL. We would often brief this set of capabilities to some new partner and they would say, clearly aware of the capability and quite impressed with its impact: "I didn't know APL built this!" What Scott did was widely known . . . if you knew the right crowd. Our government colleagues and sponsors often referred to Scott as a national resource and a national treasure.

Scott's answered prayer came with a tremendous amount of stress and pressure and responsibility. But Scott was a man of great character. He was honest. When he interviewed me to join his section he said "We never lie." And in 20 years I never saw him say anything but the clearest truth. This gave us freedom. Scott was humble in the truest sense of the word. He knew he was talented; he did not think he was better. Scott was nice. Don't mistake nice for boring. It means a lot when someone is nice to you.

Scott was a great friend, steady and supportive. One of my most talented colleagues said that we would take on technical risk with aplomb because we knew that Scott would always show up when our backs were against the wall. Always.

Scott was brave. He was drawn to the most challenging problems at APL, time and time again. Scott was brave as he faced down a disease that absolutely terrified me when he described it. He did not complain. We wouldn't fault him if he had, but he didn't.

Scott was optimistic, and to him engineering with his friends was a joy, and that joy was infectious, even to the very end. At our last in-person meeting, he was standing

in front of a crowded room, holding his portable oxygen, pulling the KN95 mask he absolutely should have been wearing away from his face so he could get just enough breath to explain details he was working out on the fly.

What we do in life matters, but not nearly as much as who we are. And who we are also matters, but ultimately, we are broken and flawed, and Scott would say who we love matters even more. Scott loved his family, and he loved us. And Scott was a Christian, and he loved Jesus. Everyone who knew Scott has asked how he had the peace that he had—peace that surpassed all understanding. Scott told us, toward the end, that he had to give "credit where credit is due."

Scott actually sent a few emails related to work the week that he died. He told us he was in the hospital and probably would not be leaving, so he would not be on any more Zooms. He told that small set of colleagues words meant for all of us: "It was an honor working with you all and I hope you have great success in solving this mystery!"

Scott was an icon at APL—a personification of who we are at our very best. He is loved, and his legacy will not be forgotten.

Barry Grabow
Mission Area Executive, National Health Mission Area, Asymmetric Operations Sector

Back in the early days of the Experimental Communications Lab, I was working for Scott on a project, and my job was to assemble this briefcase-sized receiver. I had all the parts spread out on my desk. And Scott comes by, we get to chatting, and he picks up a circuit board, and says "Wouldn't it be great if you could just take this thing and miniaturize it? Imagine the things we could do—we could build handheld receivers, place one on a small craft," and so on. And that planted a seed for me. Fast-forward to today, and we're experts in miniaturization at APL and in the Asymmetric Operations Sector, with a full-fledged integrated circuit capability. And that's because of Scott's vision.

Another time, a bunch of us were sitting around a table trying to solve a really hard problem with tagging, tracking, and locating (TTL). And Scott, with his typical enthusiasm and excitement, says "You know what we need? We need our own spacecraft—we need our own CubeSat!" Fast-forward about 10 years from that meeting, and we're launching two CubeSats, and one of them ran over 100 TTL missions.

One last memory I want to share, only because it still makes me smile. One time we were getting ready to meet a new sponsor, and we're waiting in a conference room. The sponsor walks in, and he's wearing a bow tie. And Scott says, "Did you lose a bet?" And the sponsor says, "What do you mean?" So Scott says, "The bow tie. Did you lose a bet?" And we're all sitting there in stunned silence. The sponsor says, "I wear these all the time." It's pretty funny in retrospect, but at the time we all thought we might lose our jobs. I don't think that guy ever wore a bow tie again.

Scott was a visionary and a national resource, and I'm honored to have worked side by side with him for the past 24 years of my career.

Brandon Healy
Group Supervisor, Asymmetric Operations Sector

It's difficult to overstate the impact Scott had on my career. While studying for my engineering degree, I had been interning at a large defense contractor working on projects that resulted in a lot of PowerPoint presentations, and little else. While that work was important, just coming out of school, I wanted to build something. And when Scott walked me through the lab he was supervising at the time, there was equipment everywhere, people were working at benches—it was the type of place I wanted to work.

That ethos of getting your hands dirty, of actually building things, exemplifies Scott, and it exemplifies APL—and the two are not easily separated in my mind. Scott was driven to dive as deeply as he possibly could into any subject. Very early in my time at APL, I remember chatting with him once in a conference room before a meeting, and he asked me if I played video games. I said yes, thinking about 2 a.m. *Mario Kart* sessions with my college roommates. And Scott goes on to describe how he had disassembled a controller and rewired several buttons to be controlled with foot pedals, and was highly ranked in a popular strategy game—maybe something like *StarCraft*? I thought, "Man, this guy takes video games seriously."

And it wasn't just video games—Scott gave that same focus and intensity to everything he worked on. His whole lab had a DIY atmosphere—a mentality that you should understand the fundamentals and build a solution that you can troubleshoot from the ground up. There were a lot of times when we were trying to develop a solution for something, and we'd buy some piece of hardware from a vendor that had this or that set of advertised features, but it would always fail in some way. Always. It became clear over time that if we were relying on someone else's tools, there would be a limit to what we could do. Scott empowered us to expand our toolset ourselves. No one wanted to see our projects succeed more than we did, so under Scott's leadership we pushed ourselves to build systems that we could own from end to end, so we could fix any problems that arose. Whether we failed or succeeded, it was on us.

Scott's affinity for understanding systems was matched by his honesty, empathy, and generosity with people. Honesty is a core value across APL, and Scott embodied it. He taught us to always give it to the sponsor

straight, to never sugarcoat anything, however difficult it might be. If you lose work as a result, then maybe that was the right result. It set the tone for what it means for us to have good working relationships with our sponsors, and the level of trust and respect that you earn with that approach testifies that it is not only the right thing to do but the most effective thing as well.

Scott was always incredibly generous with his time. He would always drop whatever he was doing whenever I went to his office to ask him a question about something, and I think that was a universal experience among people who worked with him. When I began one of my first tech lead roles, an open-ended study of a particular capability, Scott showed up at all my meetings, listening as I was flailing around, and afterward he would give me a concise set of notes that pointed me in the right direction.

It can't be overstated how much Scott loved his family, and how he clearly prioritized his family over whatever was going on at work. I can remember walking into his office many times and waiting to talk to him as he was on the phone with his wife Margaret talking about their kids' day at school. He and Margaret were an amazing team, and he made it clear to all of us that he was able to do what he did because of Margaret's dedication to their family. It's easy to talk about work–life balance, but Scott modeled it for all of us, and it's shaped how I live now that I have a family of my own.

I can't imagine the kind of pressure Scott was under, given the responsibilities he had and the stakes of the work he led. But you rarely saw it take a toll on his personality. He was always quick to laugh and make a joke, and even when things weren't going well, he exuded an aura of, "This is just another challenge to overcome, let's work it out together." At one point, we were burning the candle at both ends, working nights and weekends, and Scott put his foot down and forbade us from working more than 40 hours a week. I think that says everything about his character and the kind of culture he fostered.

Scott Radcliffe's Publications, Patents, and Awards

Publications

D. L. Fesman and S. T. Radcliffe, "Operational test III-B follow-on jamming analysis (U)," VS-98-027, May 1998, SECRET.

S. T. Radcliffe and E. D. Holm, "Passive multipath traffic sensor," in *Proc. 1997 ITS Annu. Conf.*

Contributed to "Project 784-OT-IIIB, report details (U)," DCC No. APL 9620796, Dec. 1996, SECRET.

S. T. Radcliffe and J. H. Higbie, "Evaluating transform estimators for locally optimum signal processors," presented at *IEEE Mil. Commun. Conf. (MILCOM)*, San Diego, CA, Oct. 1992.

Patents

US Patent 6819103 B2: Lorentz force driven mechanical filter/mixer designs for RF applications. 2004. With J. L. Champion, R. Osiander, R. B. Givens, D. K. Wickenden, D. G. Jablonski, J. H. Higbie, M. A. Darrin, T. J. Kistenmacher, and D. A. Oursler.

US Patent 6011515: System for measuring average speed and traffic volume on a roadway. 2000. With E. D. Holm.

US Patent 5024460: Output filter and method for on/off semi-active suspension control. 1991. With R. D. Hanson.

APL Achievement Awards

2015: Alvin R. Eaton Award, Johns Hopkins University Applied Physics Laboratory (APL), for sustained performance and exceptional scientific or engineering innovations.

2013: Outstanding Mission Accomplishment Award for a Current Challenge, Johns Hopkins University Applied Physics Laboratory (APL), for Frequency Hopped Tag for Geolocation and Ranging (FROGGER).

2011: R. W. Hart Prize for Best Development Project, Johns Hopkins University Applied Physics Laboratory (APL), for Frequency Hopped Tag for Geolocation and Ranging (FROGGER).