COMPELLING HOOKS

An Illinois company creates a new high-performance steel

QuesTek's T-45 hook shank, manufactured from Ferrium M54 steel.

In January 1911, Eugene Ely, an aviation pioneer, successfully landed his plane on the USS Pennsylvania, anchored in the San Francisco Bay. This was the world's first arrested landing on a ship. The landing platform featured a tailhook system designed to arrest the plane upon touch down. Highly applauded for his achievement, Ely supposedly told a reporter of the daring feat: "It was easy enough. I think the trick could be successfully turned nine times out of ten."

A century and more later, Navy pilots receive highly specialized flight training that regularly includes takeoffs and arrested landings on aircraft carriers. Each pilot must master landing on a flight deck that's shorter than two football fields set end to end. Their aircraft still feature a tailhook on the rear of the plane, designed to snag one of four tethers on the flight deck, each spaced about 50 feet apart. The pilot commonly aims for the third wire as it provides the safest distance from either edge of the flight deck. Once the tailhook engages with a steel tether, the wire pulls and transfers the energy to hydraulic cylinders below deck, arresting the plane.

The hook shank attached to the aircraft is an essential part of the arresting gear, and, to ensure pilot safety, needs to meet the highest standards of reliability and performance. In the early 2000s, the Navy became concerned about seeing cracks and corrosion in these parts earlier than their expected life cycle, and wanted to replace the hook shanks with new ones made from stronger steel.

QuesTek Innovations, LLC, a small company based in Evanston, Illinois, received a Small Business Innovation Research (SBIR) contract from the Navy in 2008 to design what became Ferrium M54—a new high-performance steel for aircraft components. QuesTek then used the Ferrium M54 to manufacture new hook shanks for the Navy T-45 training aircrafts. They also established a new supply chain that allowed the Navy to quickly and reliably source parts, keeping their training aircraft in rotation and pilots in the air.

Arianne Molina at Naval Air Systems Command (NAVAIR) spoke highly of QuesTek's leadership in finding a solution: "After moving forward with the SBIR, QuesTek was always really responsive, and moved along quickly with development, fulfilling every requirement we set. Not only were our standards met but QuesTek was uniquely able to pull the right people into the project to solve any issues."

The Navy certified Ferrium M54 as having double the service life of other, more commonly used steels, and estimated at least $3 million in

cost savings over the service life of the product. In addition to hook shanks, QuesTek's Ferrium M54 has come to be used in other demanding applications in the aerospace, energy, oil and gas, and racing industries. As opposed to other commonly used steels, Ferrium M54 reduces component size, weight, and cost, even while increasing service life, safety, and reliability. Current applications include landing gear, driveshafts, fasteners, and load-bearing oil and gas tools.

Utilizing the SBIR program to benefit the warfighter as well as the successful commercialization of the technology has been a win-win situation for all involved. Jeff Grabowski, QuesTek's Manager of Business Development, said, "These SBIRs from the Navy, as well as all of the other ones we have received, have enabled us to develop advanced materials such as our Ferrium M54 via computational methods, and have in part helped create about 40 full-time technical jobs at QuesTek over the years in advanced materials research. Our staff has gained significant career experience and technical knowledge in this highly competitive field. We have leveraged our know-how gained from the SBIR program to increase projects directly with industry to resolve their most pressing materials challenges."

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QuesTek is aware of the dreaded "valley of death"—the inability of a company to secure funding, resources, and personnel to commercialize a new concept and take an idea from the lab into the real world. Grabowski explained that it's not unusual for the company to have multiple new materials in various stages of technical readiness, and that QuesTek credits the success of the Ferrium M54 partially to the company's approach of interacting with the entire supply chain as early as possible. As a small business, QuesTek can produce an ounce or even a pound of material in its lab, but anything beyond that requires collaboration with an alloy producer that will take over the manufacturing.

Jeff Grabowski

Grabowski said that thanks to their early SBIR successes, such as receiving a coveted Tibbetts award for excellence in commercializing their SBIR-developed technologies, QuesTek has broadened their interactions with different industries.

"Most of QuesTek's efforts and successes have been in aerospace high performance steels," Grabowski explained, "but we are seeing an increased amount of projects funded directly from industry to design new materials for lightweighting of automotive transmissions, increase the life and reliability of oil and gas pipelines, and develop more crash-resistant materials for the transportation industry. After being in business for more than 20 years, we'll continue to be thought leaders and problem solvers addressing the most challenging material issues across industries."

QuesTek does more than just steel design, and has expertise in additional metal alloy systems including aluminum, copper, titanium, nickel, and tungsten. They have also formed a joint venture in Europe, and see growth opportunity in Japan.

Grabowski takes pleasure in knowing that QuesTek is providing support for mission-critical endeavors by developing strong, reliable, high-performance metal alloys and advanced materials: "We pride ourselves on using our expertise to solve real world problems for the warfighter and industry."

QuesTek Innovations, LLC • Evanston, IL
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