Techshot's Analytical Containment Transfer Tool (ACT^2) was developed to contain and transfer samples in a safe manner for real-time analysis. Previously, samples had to be collected in space and flown back down to Earth for post-flight analysis

TECHSHOT, INC.

Handling *E. coli* within the confines of the International Space Station might not have been what most astronauts had in mind when they signed up for their missions. After all, this is not exactly a healthy and common bacteria we seek to handle on Earth, let alone in space. But with a newly developed and government funded Analytical Containment Transfer Tool (ACT^2) developed by Techshot, Inc., astronauts can now safely handle these specimens, enabling NASA to launch an entirely new era of off-world DNA research and analysis.

PHASE III SUCCESS
$9.5 million IDIQ contract with NASA

AGENCIES
NASA, DOD, HHS

SNAPSHOT
3-time Tibbetts Award winner Techshot supplies tools and machinery to the International Space Station and has built a name for itself developing complex payloads for microgravity for commercial and U.S. government clients

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"The goal with the *E. coli* experiment is to see how it performs in microgravity," explains Techshot Vice President Rich Boling. "Genes have distinct expressions and behave differently in certain environments. By analyzing the *E. coli* out of its natural element, we can begin to see all sorts of new patterns and eventually learn how biological specimens and DNA behave in space."

ACT^2 was Techshot's answer to a Small Business Innovation Research (SBIR) solicitation posed by NASA back in 2010. At the time, the agency's ability to analyze the DNA of biospecimens in space was more limited. Samples typically were collected, frozen, and analyzed post-flight. Since return capsules didn't exist, the samples had to be sent back down with the crew. In addition, separate tools were needed for collection and analysis – creating a potentially hazardous situation when it came time to transfer from the shuttle to the laboratory. As a small business predominantly serving the U.S. government – mostly by developing complex payloads for microgravity research – Techshot knew it could develop a solution.

The resulting ACT^2 is a device that both contains and transfers samples in a safe manner from unique experiment-specific, spaceflight hardware to on-orbit analytical tools for real-time analysis. There is no need to send the sample back down to Earth, which was the previous protocol. NASA understood the ability to do this was a crucial step for performing in-flight analysis. It's not only safer to use than the previous combination of tools, but because it is disposable, it is cost effective as well.

The team at Techshot poses with several spaceflight-qualified copies of the ACT^2 before they are flown to the International Space Station

Although Techshot is based in Greenville, Indiana, team members regularly communicate with astronauts aboard the International Space Station via its Payload Operations Control Center

"We are a solutions company, and I don't use that term in just the marketing sense," explains Boling. Some companies are built around one technology and they are looking for government uses; we take the opposite approach and say, 'what do you need?' The ACT^2 transpired from that mentality."

In March 2016, several ACT^2 devices loaded with frozen *E. coli*, and a suite of equipment collectively known as Wetlab-2, will launch to the ISS aboard a SpaceX Cargo Dragon. Built by NASA Ames Research Center, Wetlab-2 along with ACT^2, collectively provide a research platform for conducting real-time quantitative gene expression analysis aboard the station.

"When NASA says they have a problem – we raise our hands and say we have a solution – and the best solution always wins. We love that."

RICH BOLING
VICE PRESIDENT

For a company that was founded thirty years ago by an eighth grade science fair participant focused on sending chicken embryos into space, the team has hit its stride recently with a suite of technologies being utilized on the ISS.

Techshot is currently developing a Multipurpose Variable-G Platform for Life and Microgravity Sciences Research (MVP) set for deployment in 2017. The MVP is a single locker sized dual-centrifuge facility for life and microgravity sciences research and it will enable the study of cells, plants, fruit flies and organisms on the ISS. This will join the company's Bone Densitometer – another SBIR funded project – which is already in use on the ISS by biotech companies such as Novartis and, soon, by Eli Lilly and Company in its research on the station.

Techshot was recently awarded an Indefinite Delivery Indefinite Quantity contract by NASA valued at nearly $10 million. Spanning a period of five years, the agreement essentially is a menu of services and hardware, such as ACT^2, that the agency can buy from the company at pre-negotiated rates.

Techshot has effectively developed a spin-off strategy to commercialize new products originally intended for its government clients. One of Techshot's most successful endeavors was its Advanced Space Experiment Processor (ADSEP), which operates in low gravity and provides cell culturing and biphasic, electrophoretic, and magnetic separation capabilities. Techshot spun off IKOTECH LLC to market this technology, and it is currently being used in stem cell and diabetes therapeutics research. Techshot Lighting LLC was created when Techshot produced highly rugged and energy efficient LED lighting that is used in Afghanistan by the Marines and in many Army and Air Force bases across that country. While spanning industries, these innovations all have one thing in common; their derivation from the SBIR program.

"The SBIR program is a terrific field leveler," adds Boling. "We're not near any NASA center – yet we compete with businesses all over the country and other technical hubs. When NASA says they have a problem – we raise our hands and say we have a solution – and the best solution always wins. We love that."

And although the team at Techshot might be far removed geographically from its NASA customers, the team is closer than ever to astronauts on the ISS thanks to its Payload Operations Control Center, which enables real-time communication with the crew operating its hardware.

"We have this perfect storm right now of working with the best people, and providing the best solutions. In the shuttle era, you built a single experiment – you launched it, and you returned it," reflected Boling. "Now we have equipment permanently onboard the International Space Station, and we're continuing to add to that catalog with the help of the SBIR program."