

Tinker Engineer's Invention Challenges Mother Nature's Authority



Illustration and functional description of the Ice Monitor. (Courtesy of David Jamison)

Tinker Air Force Base, Okla. – The need of quality-tested aircraft engines for our nation's warfighters is ever-present, but when bad weather prevails, sometimes the ability to meet that need comes to a halt. Now, thanks to an innovative idea of a local aerospace engineer, the days of weather-induced delays will become a thing of the past.

By signing an Exclusive Patent License Agreement on January 21, 2021, the Department of the Air Force and the Oklahoma City small business Integrated Icing Solutions has teamed to develop a real-time ice detection system in the jet engine test cell at Tinker. Titled "Ice Detection and Precautionary System Shut-Down Event Reduction Systems and Related Methods", this patented invention by Tinker Jet Engine Test Cell lead engineer David Jamison aims

to eliminate costly shutdowns whenever icing conditions are predicted by weather reports.

"I noticed through my many years here," says Jamison, with 22 years on record, "engine testing would stop due to the potential of ice formation inside jet engines." This testing cell downtime, a result of using conservative predictive tables instead of monitoring systems, was causing Tinker to lose up to 45 days of testing each year. Once his invention is implemented, Jamison projects a 75% recovery of lost time due to actual measurement of ice formation, not weather predictions.

"The patent's purpose is to detect icing inside the intake of an engine during performance testing," explains Jamison. "It uses four different methods to monitor for direct indication of ice formation without modification of the test engines equipment. I began considering ways to reduce cell downtime caused by icing conditions. The first thought was to put ice detection sensors on the engine intake, but this has potential negative impacts on equipment and correction factors used to baseline engine test parameters."

The idea of ice sensors for engine testing has been around for many years. Jamison's

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David Jamison, Tinker Jet Engine Test Cell Lead Engineer

technology is unique, in that the sensors are mounted remotely and simulate an environment that mimics the inlet of the engine. He has been working on the idea for nine months, but gives credit to David Sheely and Chris Monsey for its adoption by the Air Force Sustainment Center, or AFSC, at Tinker.

Sheely heads the Office of Research and Technology Applications at the AFSC.

ORTAs, as they are commonly referred to, are responsible for developing collaborative interactions with industry, academia, and other government entities through an Air Force program called Technology Transfer and Transition. Sheely is in full agreeance with Jamison on the need of this invention by the Air Force.

"Test Cell shutdowns are very costly and delay getting engines to the warfighter," adds Sheely. "Every jet engine test cell in the Air Force and commercial world needs this ice detection sensor system. Some German firms want this ice detection sensor today."

Monsey works as the local intellectual property attorney at the AFSC. Together with Jamison, they developed the detection idea and drafted the provisional patent application for filing in November 2020. This is AFSC's first patent as well as their first patent license agreement.

The now-patented idea of the Ice Detection Sensor System was first conceived while Jamison was formulating a plan to modernize Tinkers test facilities and prepare for the next generation of engines. "My first step," Jamison details, "was to perform a computational fluid dynamics study to see if I can design a machine that can match the conditions of the engine intake being tested. The engine is very powerful and the device needed to be reasonably sized while still providing similar conditions to the engine intake. I was able to develop a shape that could do what I needed for this to be successful.

"Throughout the world when the temp is below 40°F and dewpoint is 20°F or higher, there are limitations on engine testing. In order to meet the mission, engines need to be tested so they can get into the supply system and, from there, installed onto a waiting aircraft. The commercial world is even more impacted, they run large numbers of engines through their facilities and when icing is possible it puts their whole production chain behind schedule."

In addition to this patent license agreement, Integrated lcing Solutions recently signed a Cooperative Research and Development Agreement with the Oklahoma City Air Logistics Center. CRADAs are legal agreements used to establish research collaborations between Air Force scientists and engineers and other parties, such as private-sector companies, universities, and industry associations. This CRADA will allow the Air Force and Integrated Icing Solution to jointly refine further development of the Ice Detection Sensor System.

Sheely admits this patent license agreement, which is the first for AFSC, was not obtained in a traditional manner. "This first patent application took a lot of time," he says, "and there were a lot of first-time learning challenges. Most of the patent license support offices are tele-working."

Despite the challenges, Sheely is supportive of inventors and promotes the patent process. "I encourage any Air Force employee with an invention to not be discouraged by delays," he states. "Patents are now possible and inventors will get royalties when those patents are sold."

Jamison is appreciative of the assistance he has received and concurs with Sheely's outlook on the process. "I haven't really had many roadblocks," he reveals, "but the path takes a lot of time." As far as partnering with AFSC and the Air Force, Jamison says they are already fulfilling their obligation. "It has been very good so far."

Jamison also has encouragement for inventors and anyone with great ideas. "Don't let people talk you out of an idea you feel has merit," he insists. "There are a lot of naysayers, but in the end if you believe in your idea and yourself, your idea could come to reality. Hard work will be required."



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