



# PATENT

## TECHNOLOGY SUMMARY

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## New Patented AFRL Method to Make Gains in Both the Medical Field and on the Battlefield

An Air Force Research Laboratory (AFRL) engineer has earned a patent for a process that can not only make improvements in the biomedical field, but that may one day greatly assist the warfighter on the battlefield.

Retired Lt Col Charles Berdanier served the Air Force and Reserves 33 years, spending a good deal of his time in the intelligence field. However, he decided he wasn't slowing down after that. Berdanier, an electrical and computer engineer with the AFRL's Sensors Directorate (RY), is currently pursuing his Ph.D. at The Ohio State University. His most recent patent – Phase-Based Passive Source Location in Three Dimensions #11,350,845 -- is about determining the location of things in so many words.

"The bulk of my career has been spent overseas locating and identifying transmitters for various intelligence applications. This (current) idea came as a result of my experience and the desire to more accurately locate transmitters without interacting with them in any way," Berdanier said.

The idea came to him when he was researching ways to locate communications transmitters. Berdanier changed the scope of his research, however.

"After going through the literature, I discovered a particular application where this method works very well, and that's in wireless endoscopy," he began. "Think about it this way: there's a limit in a colonoscopy as to how far that instrument can reach. In wireless endoscopy, you swallow a camera, and it travels through your gastrointestinal tract. While it's doing that, it's transmitting a constant tone with nothing on the tone to help you locate it. Because you are so close, other techniques for locating it won't work very well. My technique locates it to about a millimeter."

The method Berdanier used is called Passive Source Localization (PSL), a process using one of four characteristics of a signal – amplitude, frequency, time, or phase -- or a combination. Berdanier's method takes phase information and uses it in a novel way to locate transmitters more accurately. It does require more computations, however, advances in computer processors and their graphics cards have made this a more viable option.

"Passive methods do not interact with the transmitter at all," Berdanier said. "This is advantageous from a biomedical view because the transmitter in that little camera can't interact with you. So, all we're doing is receiving its signal and finding its location based on that. The point here is, when you're able to locate, you can then go back and look at the time tag photographs that are made while it's traveling through your stomach and know precisely where those photographs were taken."

Berdanier believes this method is not only faster but more accurate.

"If a company wanted to use it, they'd have to construct an antenna array they could press against the abdomen. From that they could determine precisely where the camera was at that instant," he added.

Berdanier, who received an Air Force Productivity Award for his work in 1989, says this method will eventually have the capability to help the warfighter against adversaries. Due to the number of permutations needed to get accurate answers over larger areas, he says this feature is not ready just yet.

Whether in an operating room or a battlefield, he says this improved process will make the aforementioned uses relatively inexpensive compared to current methods, which would be a win-win for the Department of the Air Force.