

# Signal Exploitation and Geolocation

*We design shipboard and submarine antennas to withstand the rigors of the ocean. Prior to installation, staff members evaluate the direction finding performance of each antenna from atop a 73-foot tower to simulate its position on a ship.*

D016624-2608

1



D017139-0901

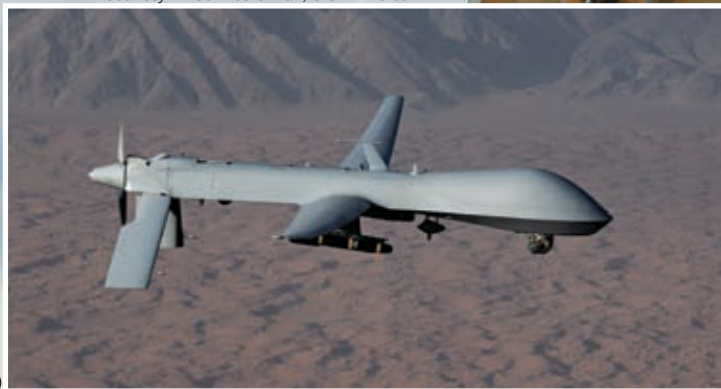
2



Courtesy Lt. Col. Leslie Pratt, U.S. Air Force

D017219

3



*geolocation systems • intelligent SIGINT networks • wideband intercept • automatic signal recognition  
electromagnetic modeling & propagation analysis • system production • information exploitation  
tracking systems • spectrum surveillance • special-purpose tagging & tracking devices • steganalysis  
life-cycle support • repair & refurbishment • field engineering support • signal intelligence systems  
genetic programming • IFF*

**A**s a world leader in radio frequency signal exploitation and geolocation, Southwest Research Institute provides advanced systems to government, military and commercial clients. Our hardware and software solutions in signal intelligence, direction finding, communications and other areas help meet the challenging operational environments of clients worldwide.

In one of our longest-running programs, we continue to design and build antennas using innovative technologies for direction finding, communications and signal intercept applications ([ad.swri.org](http://ad.swri.org)). To meet increasing demands for conformal antennas, designed to blend into the surface and contours of the environment, we are designing new covert systems for vehicle, airborne and man-transportable applications.

We also are developing low-cost antennas made of novel materials to reduce size and weight that can be rapidly deployed and collapsed. These lightweight antennas use cloth and wire bodies to deploy with nearly the simplicity of opening an umbrella.

As of 2009, staff members have designed, built and delivered more than 150 composite antennas for shipboard applications ([pod.swri.org](http://pod.swri.org)). To improve the operation of our designs, we are extending the ranges of our antennas to operate at higher frequencies, up to 10 GHz. We also apply computational electromagnetic modeling techniques to optimize antenna locations, predict performance and reduce calibration time.

Using internal research funds, we are reducing the size, weight and power of VHF and UHF signals intelligence systems. Our approach uses field-programmable gate arrays on commercially available boards, enabling highly efficient data processing capabilities. The reduced size retains SwRI's proven SIGINT capabilities and allows for significantly smaller units to be used in a variety of tactical applications, including man-transportable, airborne and land-mobile operations ([tse.swri.org](http://tse.swri.org)).

We also are developing methods to automatically detect, process and record the copious amounts of data gathered by signals intelligence sensors. While many techniques can be used to lessen the volume of data, this approach can miss unknown threats. Staff members are developing techniques to expand on this technology without reducing the volume of data. We also are evaluating various automated analysis tools to measure their effectiveness in finding high-value information in a timely manner.

Other internal research efforts are examining high-volume data collection and visualization methods and the use of pulsed radio frequency signals to estimate mobile ranges. Using internal funds to develop and prove new technologies creates less risk for our clients. For example, a client-funded electrical

intelligence (ELINT) program originated as a situational awareness internal research effort.

We continue to make facility improvements to meet the needs of our clients. We reinforced our rotary test facility to accommodate the weight of armored vehicles as well as unmanned aerial vehicles, antennas and other electronic systems. We use this facility to evaluate the performance of antennas, for example, by placing a transmitter in a fixed location and then rotating the platform to measure antenna patterns or direction finding performance over 360 degrees.

Our design, development, testing and manufacturing services continue to meet high quality standards. Under our "Business Environment for Effective Management" system, which combines ISO and CMMI® standards into a single business method, we were re-certified to the latest ISO 9001:2008 standard. We also are implementing the Software Engineering Institute's CMMI Level 3 process to assure the highest quality for all signal exploitation and geolocation programs. ❖

Visit [sigint.swri.org](http://sigint.swri.org) for more information or contact Vice President Dr. William G. Guion at (210) 522-2902 or [william.guion@swri.org](mailto:william.guion@swri.org).

1. *The Civil Support for Enhanced Responsiveness system, sponsored by the Florida National Guard, is an emergency communications infrastructure to be used by units deployed following a disaster, such as a hurricane. Our engineers developed a component of the system (shown) that allows units to communicate with an operations center about inventory, alerts, commodity requests and other needs vital to recovery efforts. The system was successfully demonstrated to the Florida National Guard in February and exercised state-wide during the state of Florida annual hurricane preparedness exercise.*

2. *Staff members recently installed an aqueous cleaner that uses a safe, nonflammable, environmentally friendly wash solution to batch clean electronic components ([sp.swri.org](http://sp.swri.org)). The cleaner achieves results that exceed military, medical and other high-reliability cleanliness standards and reduces the probability of circuit board contamination.*

3. *SwRI engineers developed a radio communications relay for use aboard unmanned aerial vehicle platforms, such as the U.S. Air Force Predator (shown), to provide communications over an extended range ([ss.swri.org](http://ss.swri.org)). The system is compact and lightweight, requiring minimal power for operation.*