

Geolocation & COMINT Systems for UAV Platforms



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Southwest Research Institute® (SwRI®) is a recognized leader in radio-frequency (RF) signal exploitation and geolocation system development. SwRI provides advanced acquisition, recognition, direction finding (DF), surveillance and tracking systems to government agencies, militaries and commercial clients in the United States and around the world.

SwRI offers a variety of communications intelligence (COMINT) and geolocation systems for a wide range of unmanned aerial vehicles (UAVs). System capabilities include:

- Direction finding (DF)
- Time difference of arrival (TDOA)
- Frequency difference of arrival (FDOA)
- Geolocation/fixing
- Automated and manual tasking
- Wideband and narrowband operations
- Active channel detection
- Signal recognition, demodulation and decoding
- Signal recordings
- Mission results database and data mining

SwRI unmanned aircraft systems accept input from on-board GPS and internal navigation systems (INS), supporting precision time-stamping and precision frequency tuning.

Experience/Capabilities

- In-theater deployment of DF, TDOA and FDOA technologies
- V/UHF frequency bands
- Extremely small form factor
- Vertical tailfin placement of DF antenna array and sensor
- Accuracy of 1 to 2 degrees RMS for all azimuths and polarizations (frequency dependent)

External Payloads

The DF antenna array can be attached to the UAV either externally or internally. The types of antenna elements and the antenna geometry are typically tailored to each UAV platform. Normally, each UAV has a limited set of locations available for attaching antennas. The size and weight distribution of the antennas must be carefully considered so that flight worthiness is not compromised. Thus, SwRI does not force a single antenna configuration for every platform, but instead works with the platform provider to determine a configuration that optimizes performance within the platform constraints. An example of an SwRI UAV DF antenna array is 23.5" W x 26.1" H x 0.125" D.

Internal Payloads

The COMINT and DF sensor is provided as an internal payload. The SwRI payload is modular and scaleable, so system capability is matched to the size, weight and power available on the UAV. An example payload configuration is described in the following table. The form factor for this example is:

Size: 7" W x 5" H x 7" D
Weight: 10 lbs.
Power: < 30 Watts

Specification	Example System Specification
V/UHF Frequency Range	100 MHz – 2,000 MHz
DF Accuracy	2° RMS over 360° azimuth and full frequency range for 20 dB SNR
DF Method	SwRI Beam Steer Vector Match, correlation algorithm based on amplitude and phase response of all antenna elements
Precision Time, Frequency, Position	GPS disciplined time (1 pps and NTP), frequency (10 MHz), and position (lat/long). Aircraft orientation from inertial navigation system
DF/Geolocation Polarization	Multi-polarization
DF Coverage	360° azimuth 180° elevation
No. of Simultaneous Signals Detected	512
No. of Simultaneous Signals for DF	512
Scan Rate	1 GHz/sec
Scan Schedule	Operator defined frequency and dwell time
Instantaneous Wideband Bandwidth	25 MHz (expandable)
Lockout Frequencies	Operator defined
Signal Prosecution Plan	Define signals of interest by duration, frequency, azimuth, sector, externals (modulation type), internals (bits, symbols, call signs)
Priority-Based Tasking	Operator defined for both manual and automatic tasks
Automatic Processing	DF, geolocation, detection, recognition, demodulation, decoding, database storage
Manual Processing	DF, geolocation, recognition, demodulation, database storage, post-processing signal analysis, signal replay

Platforms



There are multiple UAV platforms for SwRI's COMINT and geolocation systems. Platforms capable of supporting the SwRI systems include the Predator (bottom right), Reaper (top right), Mantis, Hermes 450, Aerosonde and Shadow (above).

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Courtesy Carlton Wallace, U.S. Army

Courtesy Tech Sgt. Erick Gundmundson, U.S. Air Force

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

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