The Space Dynamics Laboratory (SDL) and the Naval Research Laboratory (NRL) have developed an open architecture for sensor mission management, enabling an autonomous unmanned aerial system (UAS) to accomplish an intelligence, surveillance, reconnaissance (ISR) mission without human intervention. Handling sensor command and control, processing algorithms, and data collection, the embedded SIGMA (Systems Intelligence Manager) architecture can adapt to dynamic missions across the DoD enterprise.

SIGMA reduces the need for 1-to-1 slaving of sensor-to-operator, increases the value of ISR data streams by increasing probability of detection, maximizes asset tasking while minimizing necessary user interaction, enables adaptive autonomous missions, turns generic sensors into modular assets, and enables networking of in situ sensors for meshed situational awareness.

SIGMA has proven flight heritage under multiple DoD programs and has demonstrated multi-faceted autonomous cross-cueing (e.g. SAR, SIGINT, EO, WAMI, FMV, etc.) from multiple airborne platforms.

**SIGMA ARCHITECTURE**

- **Agent Manager**: Handles data subscriptions & algorithms, including 3rd-party plug-ins
- **Agent**: Process sensor data & provide intelligent cues to SIGMA for autonomous mission intelligence & dynamic retasking; remote or local & user or autonomous
- **Mission Manager**: Handles mission execution & configuration of all components
- **Sensor Manager**: Handles command & control for all sensors
- **Sensor Interface**: Provides an interface from SIGMA to the sensor for data collection & sensor cueing
- **Database Manager**: Data repository & server-in-the-sky for collected ISR

**FEATURES**

- Autonomous mission coordination
- Command, control & data processing for multiple sensors
- Cross-platform air/ground autonomous sensor teaming
- Correlation/fusion of targets for disparate sensors
- Dynamic mission tasking including operator oversight & control
- Supports throttled data links & disadvantaged users
- Government-owned SIGMA code base
- Multi-platform, real-time, dynamic operation
- High fidelity Position, Navigation & Time (PNT) distribution

**SPECIFICATIONS**

- Publish/subscribe architecture for changing missions
- C/C++ code designed for tiny real-time hardware footprint, COTS
- Command & Control (C2) interfaces for sensor payloads
- Data routing, storage & management, store-and-forward
- Plug-in algorithms for data analysis, ATR & cross-cueing
- Shared GPS/INS navigation to all sensors
- Data link management & remote user connections
Onboard auto-processed SAR image of target area
512 m x 512 m, 1 m GSD

9 POTENTIAL TARGETS DETECTED
· By auto-target-detection algorithm
· All tasks performed on embedded hardware ( Cue results ordered by strength of target detection)
1] Large corner reflector
2] Large corner reflector
3] Medium corner reflector
4] SUV
5] Roadside berm
6] ~2' metal cube
7] Metal water tank
8] Terrain
9] Terrain

Auto-imaged high-resolution EO/IR inspection area

Subsequently, high-resolution EO/IR auto-collects inspection images for all cued targets

AIRBORNE SAR CUEING EO/IR
Illustrates how SIGMA performs SAR to EO/IR cross-cueing in real time.

Fly surveillance collection flight pass: SAR, hyperspectral, wide-area EO

Autogenerate SAR sub-image in flight (via full backprojection)
Perform automated target detection and analysis on SAR, HSI and wide-area EO images
Promote target detections to image inspection requests (cues)