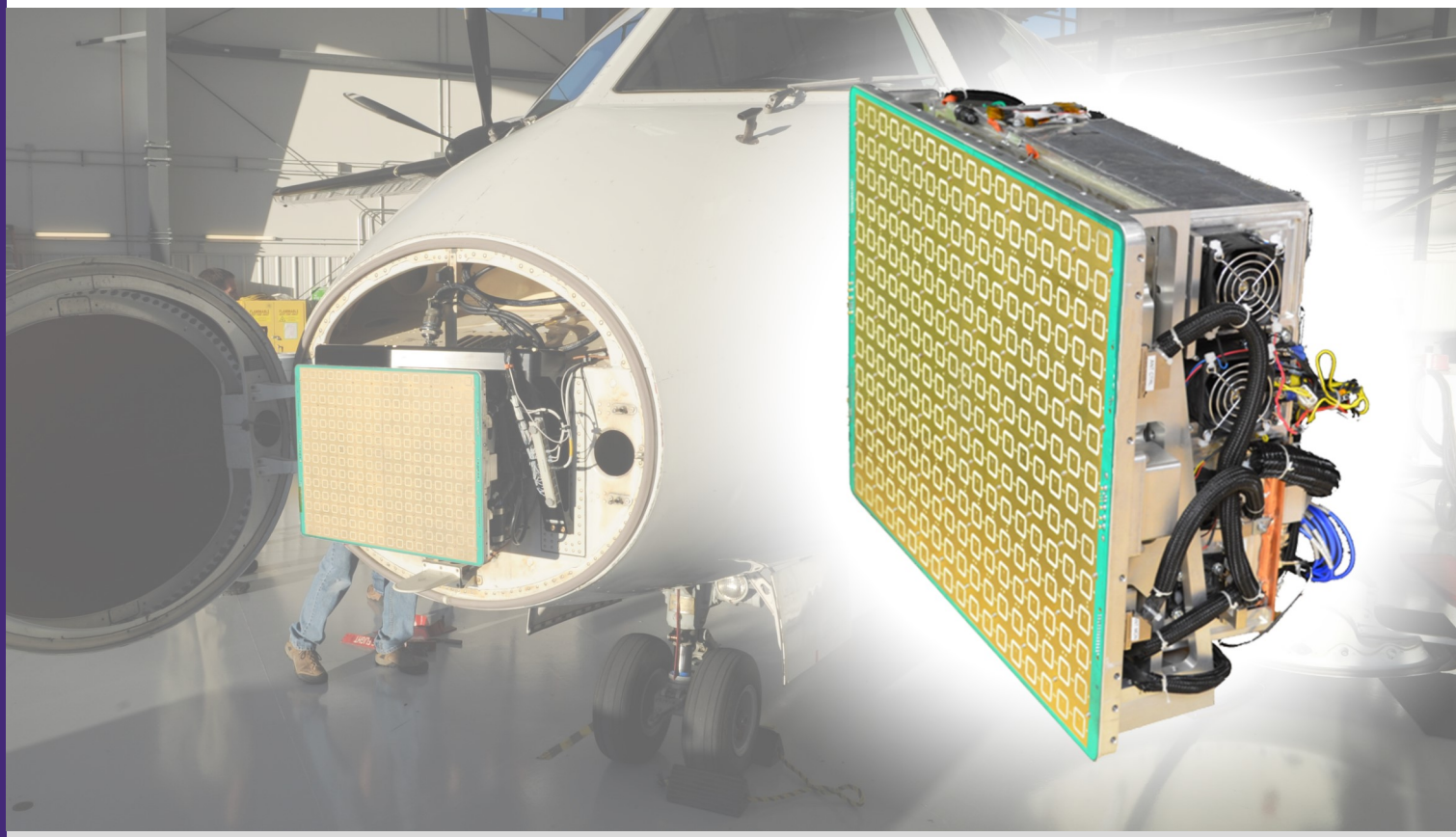
RADAR SYSTEM

Skyline

Active Electronically Scanned Array Radar System

COLORADO ENGINEERING, Inc.



PRODUCT CAPABILITIES

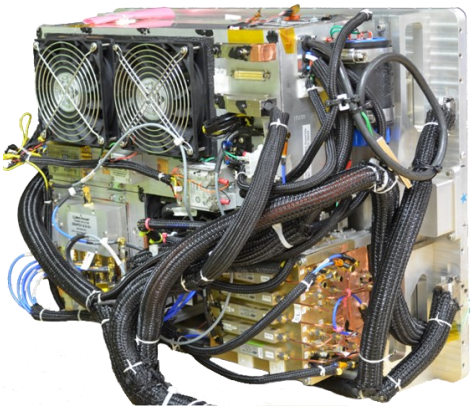
The Skyline radar system brings together high performance, ease of programmability, low cost, and commercial I/O flexibility in a modular, open systems and standards architecture to realize an adaptable radar for multiple applications. Skyline has been designed to detect, track, prioritize, and report objects and intruders within its Field of Regard (FOR). This unique system has been architected to support land, sea and air platforms by combining leading-edge phased array antenna technology with advanced radar signal processing. Additionally, the Skyline design utilizes FPGA technology which provides rapid reprogramming, minimizing reconfiguration times for fast changing environments. With nearly 200 hours of flight time and over $10 million invested by the USAF, Skyline takes performance and flexibility to a whole new level.

FEATURES

- Pulsed Doppler
- Phased Array
- Low Cost
- Compact Form Factor
- 30+ Target Tracker
- FoR ± 60 º EL ± 60 º AZ
- 10 nmi Range (1 m² target-SW1)
- Forced Air Cooling
- Dynamic Scheduler Capable
- Programmable Scan Vol./CPI/ etc.

APPLICATIONS

- Military and Civilian Environments
- Sense and Avoid
- Air and Surface Search
- Navigation
- Maritime
- Ground Surveillance
- Homeland Security



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PERFORMANCE & SYSTEM METRICS

Frequency (GHz)	5.350 – 5.460 GHz. The system supports three channels in that band for frequency diversity; Swerling 1 (SW1) to Swerling 2 (SW2) Probability Distribution Function (PDF) adjustment for higher probability of detection and lower probability of false alarm.
SWaP: Size (inches)	9" (Depth, taking into account room for system cables); 21.25" (Width); 16" (Height)
SWaP: Weight (not including any aircraft cables)	68 lbs. – This includes significant antenna cooling and mechanical structure for mounting under the nose of a Lear Jet.
SWaP: Average Prime Power Consumption	350 Watts @ 28Vdc (includes power consumption of cooling fans; radar itself is less than 300W)
SWaP: Peak Prime Power Consumption	420 Watts @ 28Vdc - this would include the cheek antennas to increase the AZ Field of Regard (FoR).
Thermal Management	Current system is air cooled. Skyline's underlying modular technology has been used by CEI to realize conduction cooled systems in other airborne applications.
Transmitter Power at (0˚, 0˚) Scan	Peak: 70 (Watts); Average: 14 (Watts)
Duty Cycle	20% for waveforms used during test flights. This parameter is programmable in Skyline and can be varied as needed.
Field of Regard	Current single panel system supports ±60˚ Azimuth; ±30˚ Elevation, programmable in software. The production system would employ three panels to achieve ±110˚ Azimuth. The prototype antenna can physically support up to ±60˚ Azimuth, ±60˚ Elevation. Skyline receives ownship state data leveraging an Inertial Measurement Unit (IMU) to generate Roll, Pitch and Yaw (RPY) and stabilizes beam positions accordingly.
Beam width at (0˚, 0˚) Scan	4.3˚ Azimuth; 5.5˚Elevation
Detection Range	> 10 nm ($1m^2$ RCS, SW1 target; P(d) = 0.9; P(fa) = 10^{-6})
Minimum Range	500 ft.

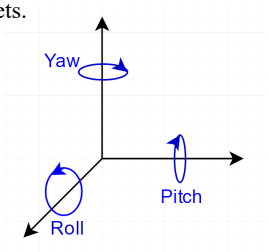
Range Accuracy	Range resolution = 5.6 meters (accuracy is a function of target SNR).
Range Rate Accuracy	< 10 ft. / second. Skyline can provide unambiguous Doppler measurements at velocities up to 885 KTAS.
Angular Accuracy	< 0.7 degrees.
Multiple Target Resolution	2K ft. spacing w/in 6 nm
Minimum Operating Altitude	Skyline flight testing has occurred at 3,000 ft. AGL over land and up to 20K ft. AGL over Lake Ontario. Skyline supports MTI and contains programmable software notches to mitigate clutter.
Volume Scan Time - FoR	The single panel prototype Skyline can scan a ±60° azimuth, ±30° elevation field of regard in 3.25 seconds using its 256 pt. coherent integration mode. The radar also supports a 1024 pt. mode for increased sensitivity. A typical scan uses a combination of both sizes, with the 1024 pt. mode primarily focused on head-on geometries. In that use case, Skyline can scan a ±60° azimuth, ±30° elevation field of regard in 4 seconds. Cheek panels would extend the azimuth field of regard and simultaneously scan with the forward facing array, resulting in a 4 second field of regard scan for the full field of regard production configuration.
Tracking	• 10 prioritized target tracks. • Up to 5 high priority targets revisited every 600 ms. • Up to 5 lower priority targets revisited every 1.2 sec. • Programmable reporting frequency (currently set to 50 ms) Track priority is automatically set based upon the degree of a potential collision threat, the track duration, and other criteria. This capability is a function of the scheduler which dictates when radar resources are used to search and when they are used to track. Skyline's scheduler is programmable and can be adapted to specific platform requirements. It is a Dynamic Scheduler – no fixed tracks, tracks are added to search, Built-in-Test (BIT) and Calibration (Cal) time occupancy slots.

FUNCTIONS

EFK Track	Devoted Search and Track dwells, 30 targets

Advanced Tracking on Any Platform

Skyline's tracking algorithms have been designed using a matrix Kalman filter to support its platforms roll, pitch and yaw movements to continuously track targets.



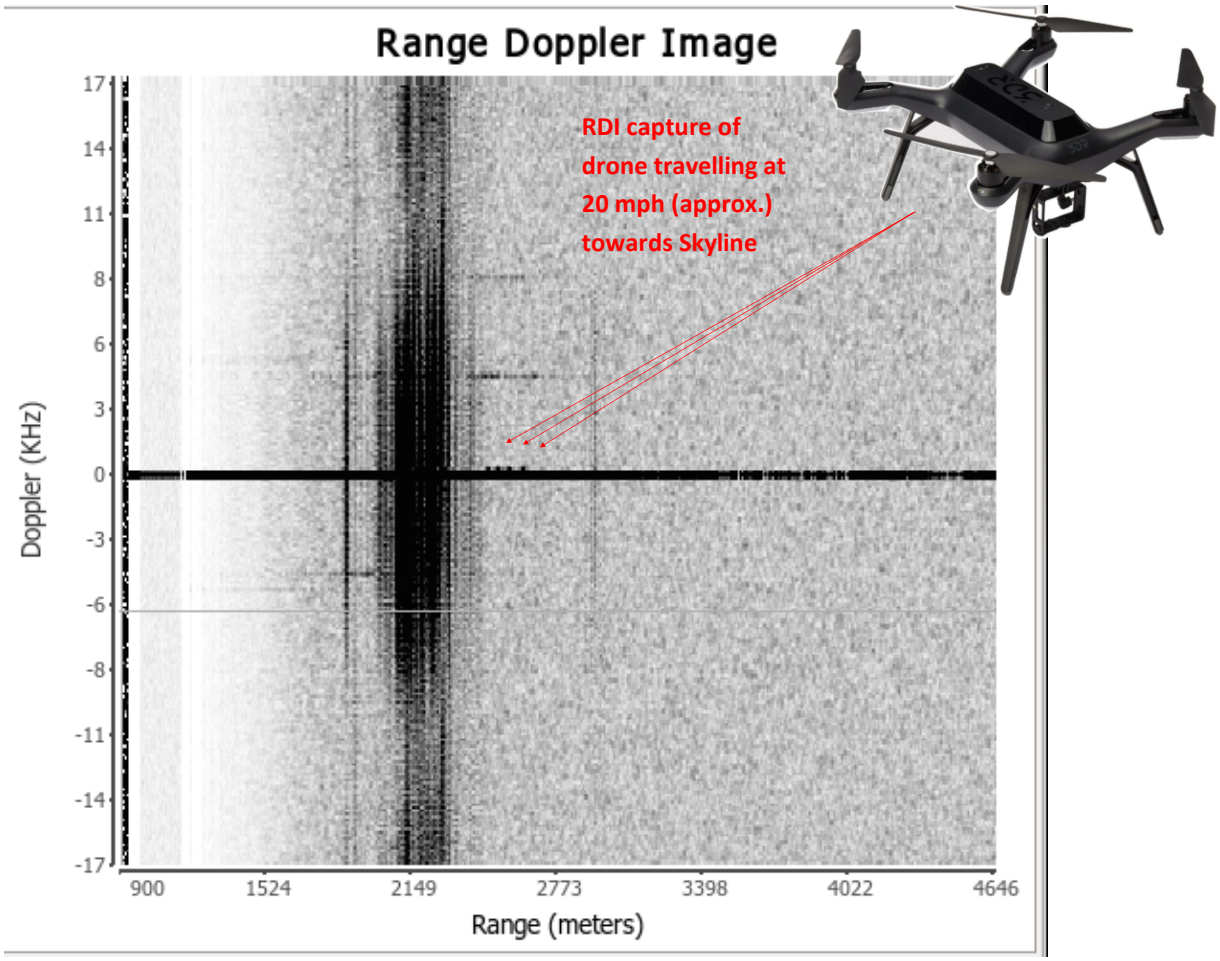
Example of Class 1 UAV Detection

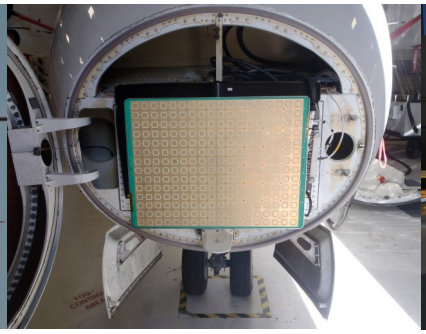
Modular Architecture

Skyline's Digital electronics are housed in the L-shaped enclosure mounted on the back of the array with the RF modules contained in the upper left box. Both subsystem enclosures are mounted on the back of the phased array antenna. The Skyline system can be configured to support terrestrial, sea and air platforms.

Rapid Reconfiguration

Designed using cutting-edge backend processing technology, The Skyline Radar system utilizes FPGA technology to allow for rapid reconfiguration to support multiple different environments and target types.





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