Novel X-Band Counter Airborne and Surface Threat System

Elbit Systems of America's new Digital AI Radar (DAiR) Counter Airborne and Surface Threat System incorporates a novel Staring Active Electronically Scanned Array (SAESA) X-band RADAR capable of simultaneous air and ground mode processing for detection, classification, and tracking of large and small targets both fast and slow moving.

FEATURES

- Multiple independent simultaneous wide beam active transmissions in all sectors
- Staring wide field of view receivers provide constant surveillance in all directions
- Strongly suited for detection and tracking of both fast moving large targets and small targets such as drones
- Operating in X-band, the DAiR provides the best combination of
  - SWAP
  - target location and accuracy
  - low Doppler detection (a problem with S-Band RADARs)
  - all-weather performance (a problem with K-band RADARs)
- Built with COTS components for lowest cost and maximum supportability
- Uses ASTERIX standards for exchange of air traffic services (ATS) information and Cursor-on-Target (CoT), enabling both proprietary and open source systems to communicate with each other

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Elbit's novel Digital AI Radar (DAiR) uses an array of independent tiles containing a sparse array of transmit modules interstitially placed between receive elements. This allows for multiple independent simultaneous wide beam active transmissions in all sectors, while using staring wide field of view receivers to provide constant surveillance in all directions. Due to the decoupling of the transmission and receiving functions, *simultaneous air and ground mode processing upon receipt of the transmitted signal can be done in parallel using the same received signal data fed into independent ground and air signal processing functions.*

DESIGN CONSIDERATIONS

Single Panel size and weight	
Dimensions	523x378x175 (W,H,D)
Weight	31 kg
Power	
Input	18-33V DC
Consumption	350 W
Max Tx power	400W
Max Tx duty cycle	10%
Frequency band	X-Band 9-10 GHz
Cooling method	Conduction/Forced Air (4-panel unit)

INTEROPERABILITY CONSIDERATIONS

Communications architecture	1Gbps Ethernet communication with platform and 8X PCIe lanes GEN 3 for recording and debug
Operating System, data collection/ storage	Radar Computer (RC) - Linux based (ARM 8) cores Signal processing (SP) - Highly Optimized (GPUs) Recording and Debug - 8X PCIe lanes GEN 3
Additional Interfaces	- 2 x UART RS-485 @ 115 Kbps - 1 x 1PPS external input - FPGA JTAG interface - External Reset input - Internal Reset output - Blank In/Out

PERFORMANCE CONSIDERATIONS

Spatial coverage	
Single panel field of regard	- 100^0 in Azimuth direction - $\pm 40^0$ in the Elevation
Track while Scan, and Interrogation	Yes
False Alarm Rate	Does not exceed 1 per hour on average.
Mode(s) of operation	• Ground Border Security • Combined Ground and Air Border Security • Shore Defense • Combined Shore and Air Defense • Storm Mode
Operating temperature range	-40 - +85C
Environmental / Safety	EMC - MIL-STD-1275D/E
Logistics	Calculated overall system MTBF is > 22,000 hrs
Technology Maturity	Currently a TRL-7 system under active development. The first panel of the radar has completed near field range testing, and showed very good performance.

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www.elbitsystems-us.com

Elbit Systems of America, LLC., 4700 Marine Creek Parkway, Fort Worth, Texas 76179

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DETECTION AND TRACKING

Combined Ground and Air Border Defense Mode

Remarks:

- Range Separation ~23m
- The maximum detection range was calculated for probability of 80% at a 95% confidence level (24 successful out of 25 trials).
- Assumes maximum altitude detection of 2000 m.

Target	RCS [m^2]	Minimum Detection Range [m]	Maximum Detection Range [Km]	Minimum Velocity [m/s]	Maximum Velocity [m/s]	Revisit Time [sec]
Human	0.5	30	12	<0.5	10	5
Car	10	30	25	<0.5	55	5
Large Car	30	30	35	<0.5	55	5
Drone	0.05	30	4.5	<1	130	5
Small A/C	1	100	11	<1	130	5
Medium A/C	5	100	16	<1	130	5
Large A/C	10	100	16	<1	130	5

Combined Shore and Air Defense Mode

Remarks:

- Actual maximum range depends on the Radar elevation
- Range Separation – 23m
- The maximum detection range was calculated for probability of Detection Probability >= 70% and 70% confidence level (6 successful out of 7 trials).
- A sea state = 3 is assumed.
- Assumes maximum altitude detection of 2000 m

Target	RCS [m^2]	Minimum Detection Range [m]	Maximum Detection Range [Km]	Minimum Velocity [m/s]	Maximum Velocity [m/s]	Revisit Time [sec]
Dinghy	1	30	14	<1	50	5
Small Boat	5	30	22	<1	50	5
Large Boat	10	30	26	<1	50	5
Drone	0.05	30	4.5	<1	130	5
Small A/C	1	100	11	<1	130	5
Medium A/C	5	100	16	<1	130	5
Large A/C	10	100	16	<1	130	5

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