From wildlife surveillance to critical infrastructure protection: A modern situation awareness system

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(On behalf of Meerkat and GSCR teams)

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Meerkat Wide Area Surveillance System

Video snippet from Peace Park Foundations video published on youtube.com: https://www.youtube.com/watch?v=Z3kYa9vCdNE

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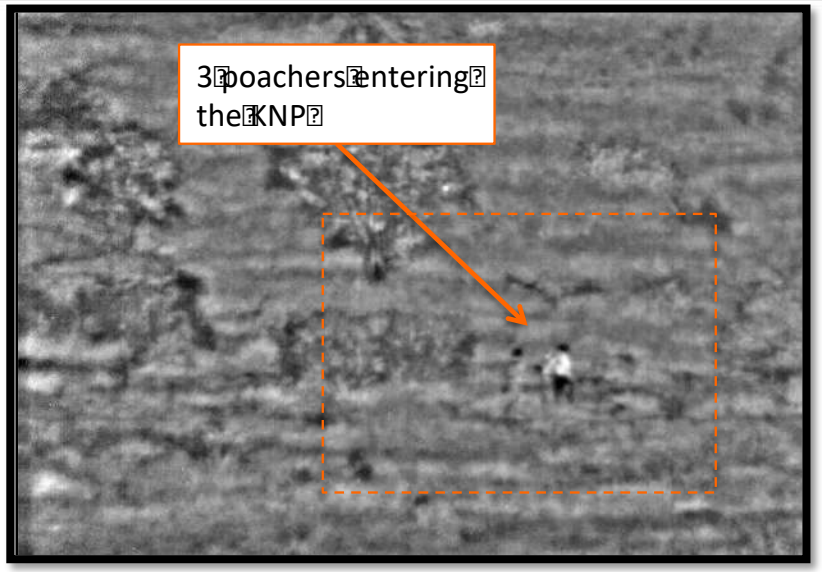
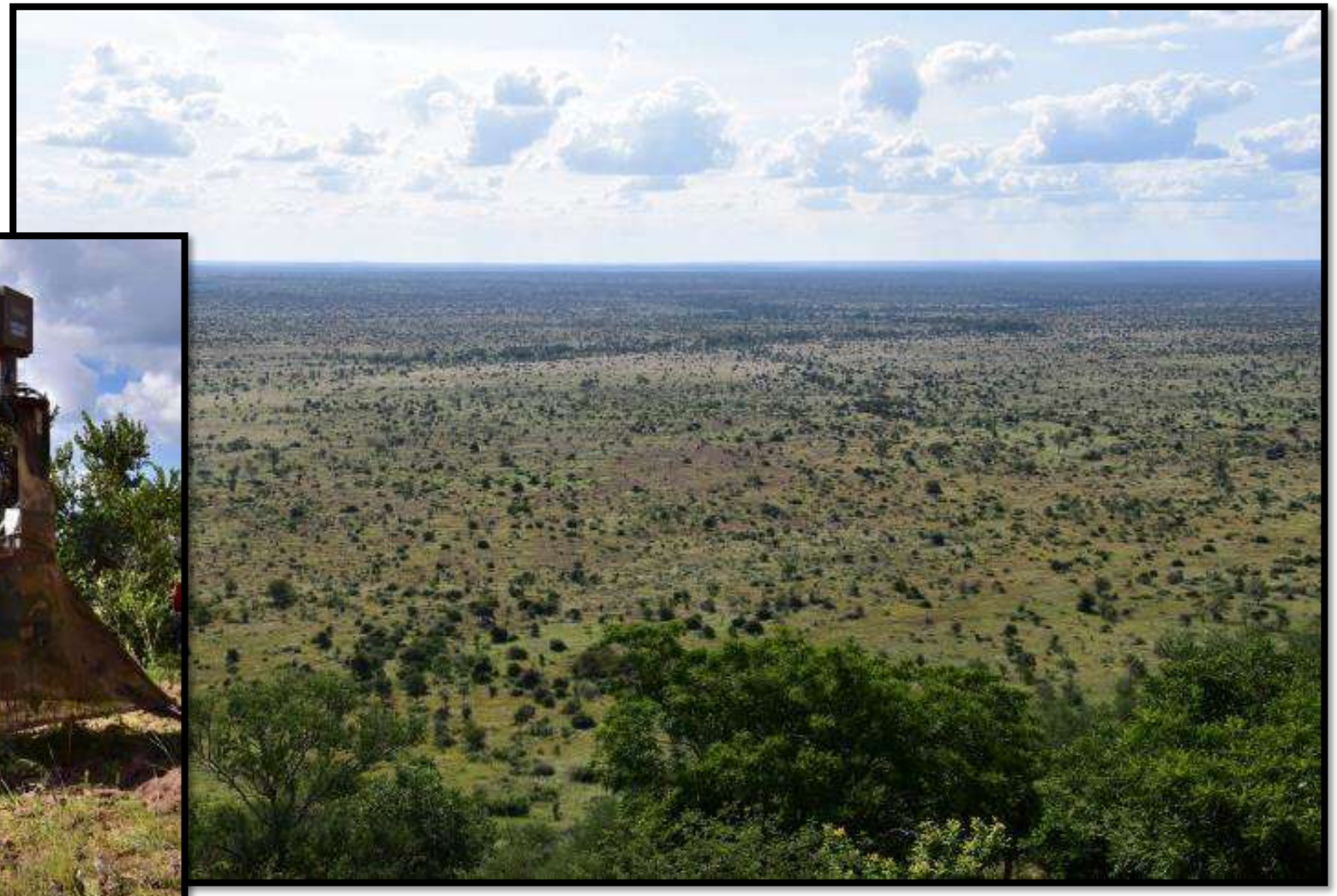
Meerkat Wide Area Surveillance System
Collaboration with the Kruger National Park



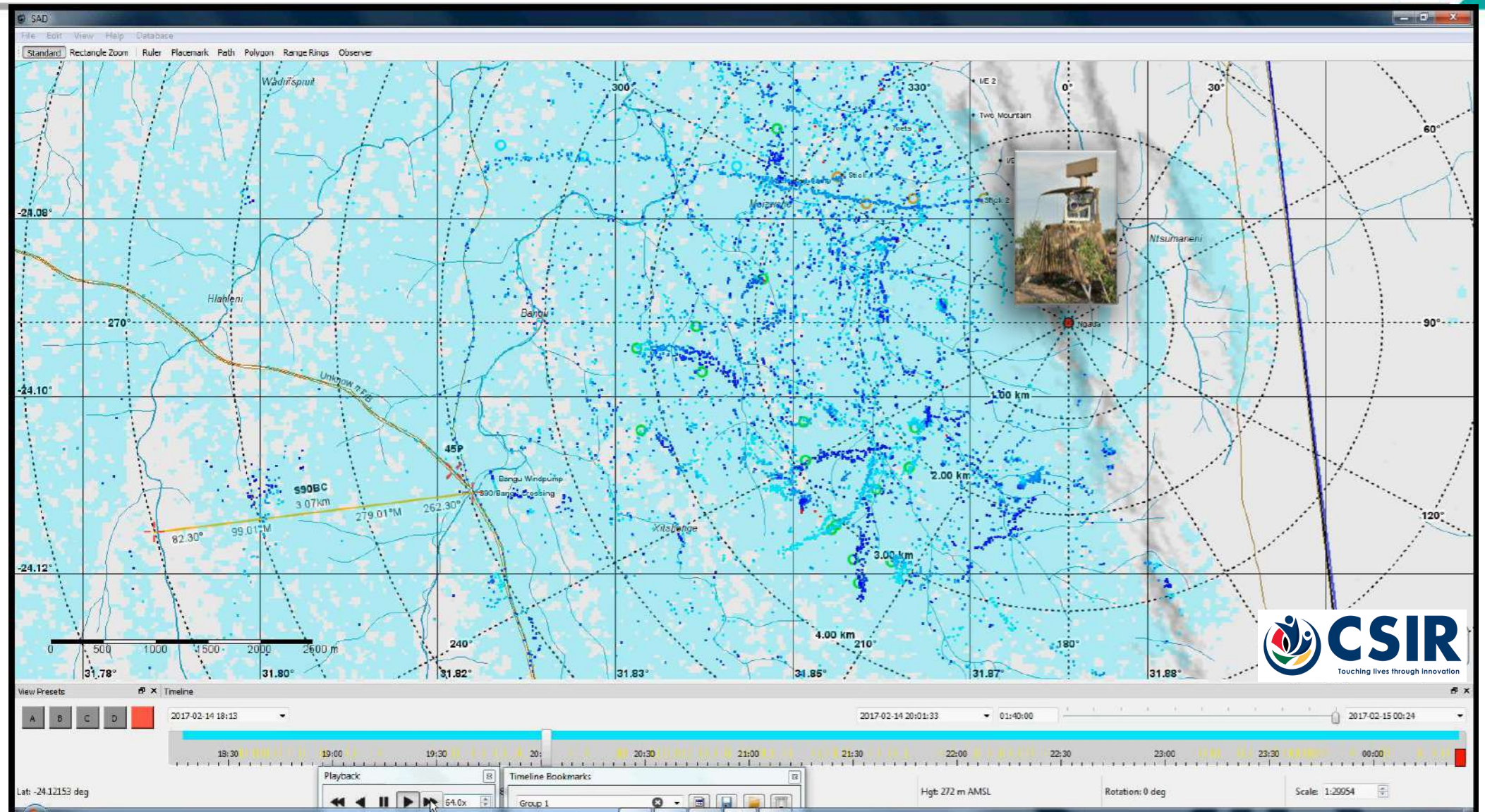
- **Integrated sensor system designed to supply situation awareness** of an area of interest.
- Bespoke Solution
  - **CSIR** Developed system
  - **Reutech Radar Systems** RSR940 – target detection, tracking and localization
  - **CSIR** bespoke long-range camera – target classification
  - **CSIR** optimised tactical command and control station
- Work closely with the user to optimise for real operations
  - From sensor to integrated user system to solve the problem

- Focus was to make an operational difference as quickly as possible
  - Operator driven solution

Typical meerkat deployment

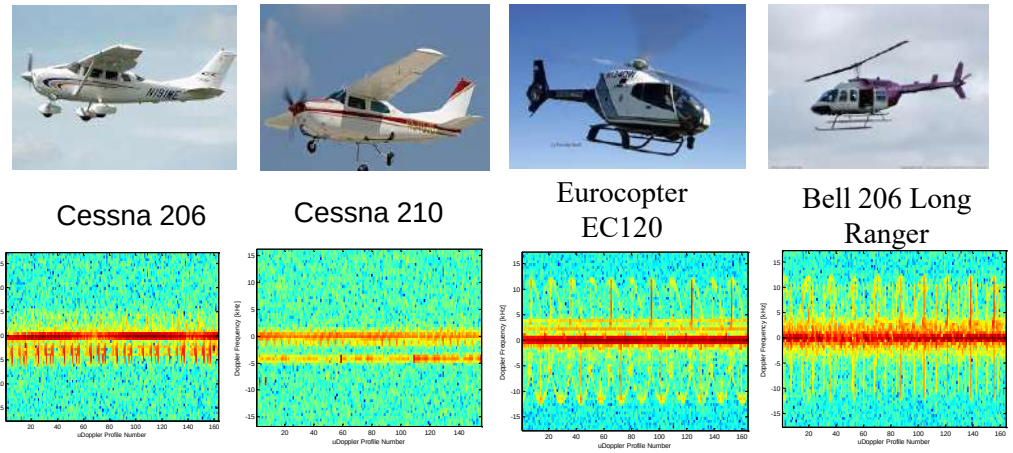


Meerkat tactical display

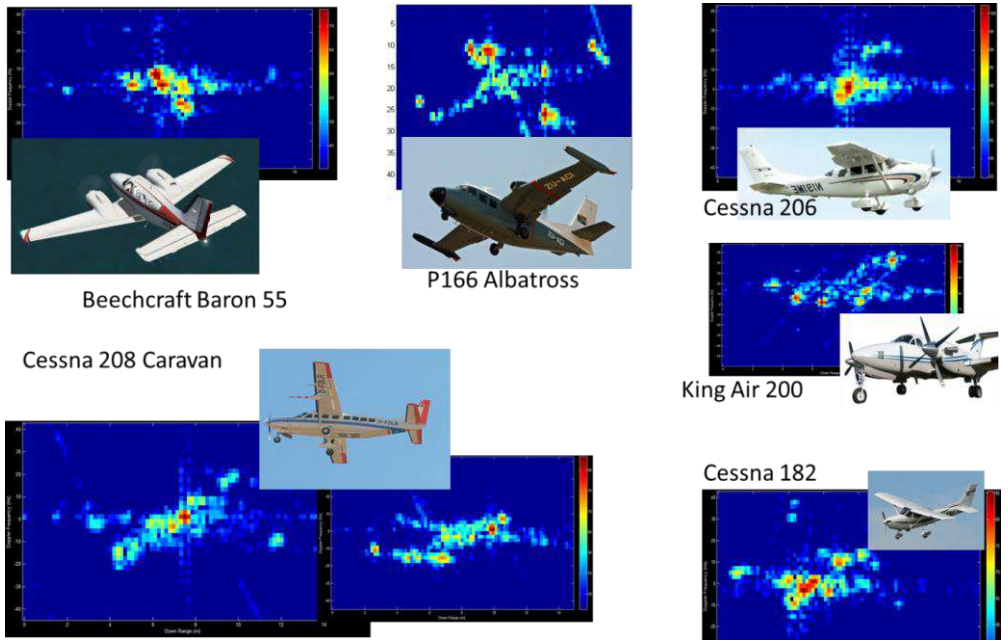


CSIR radar history
R&D Into Automate Classification Techniques

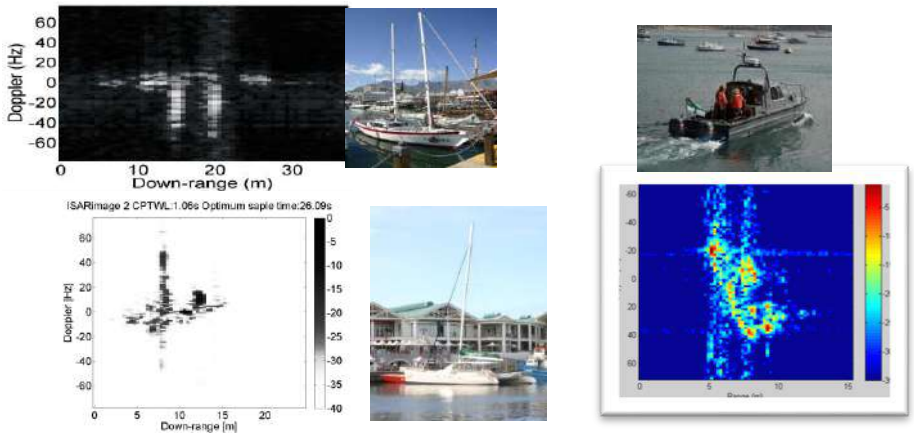
Aircraft Classification Using Micro-Doppler



Aircraft Classification Using ISAR



Boat Classification using ISAR



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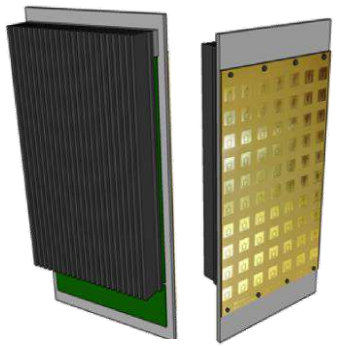
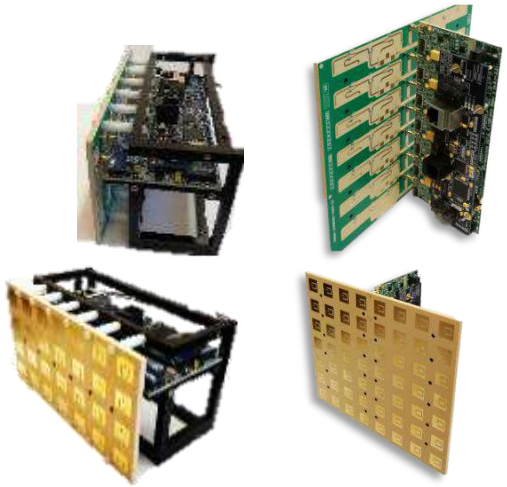
Phased array technology

C-band Phased Array Front-Ends



Phased Array Tx Panel



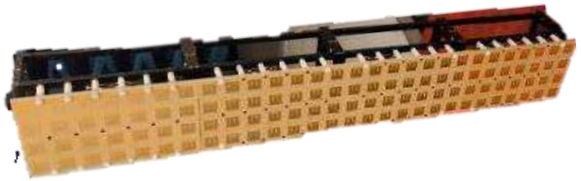
Phased Array 4x7 T/R Panel

Phased Array 8x7 T/R Panel

Flexible digital beam control
Very low-cost design
Active Tx elements
Modular design
Light weight

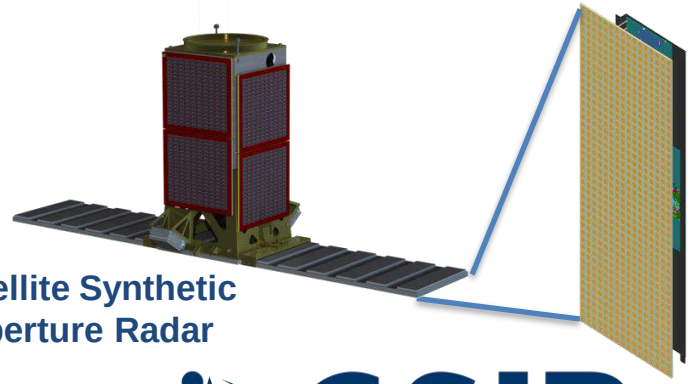
Systems Utilising C-Band Phased Array Technology

Drone Detection R&D Facility delivered to armasuisse in Switzerland



UAV Airborne Radar (Synthetic Aperture Radar)

GSCR Technology Demonstrator



Satellite Synthetic Aperture Radar

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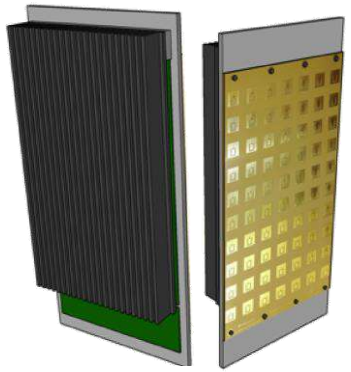
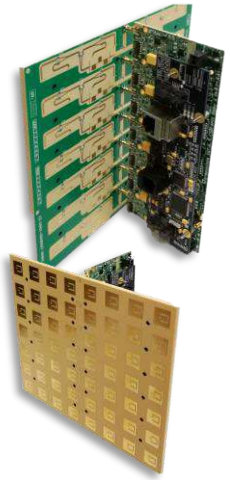
Phased Array Technology

C-band Phased Array Front-Ends



Phased Array Tx Panel

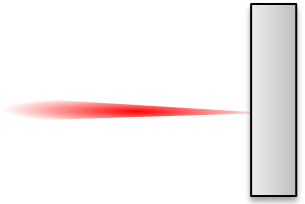
Phased Array 4x7 T/R Panel



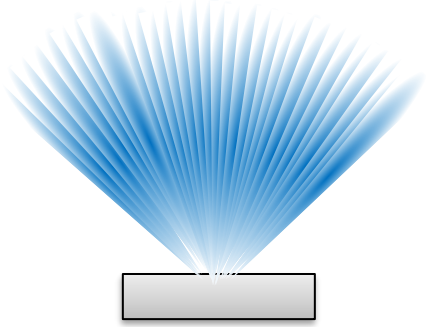
Phased Array 8x7 T/R Panel

- Flexible digital beam control
- Very low-cost design
- Active Tx elements
- Modular design
- Light weight

Traditional Mechanically Scanned Operation



Electronically Scanned Operation



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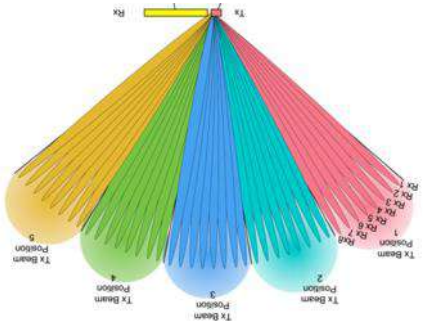
Ground Surveillance and Classification Radar (GSCR)

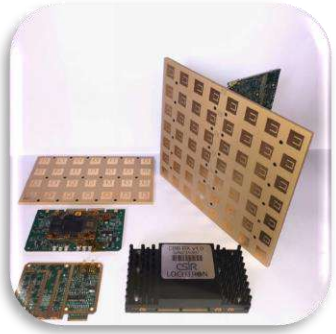
Meerkat

- Next generation surveillance radar
- Radar designed to specifically enable classification
  - Potential to classify everywhere-at-once
- Goal is unattended automated operation
  - Ranger obtains cell phone notification of intrusion

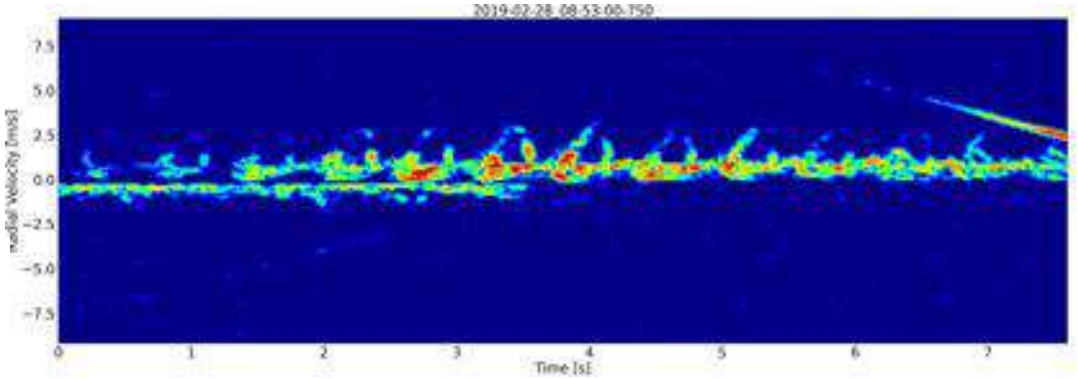


Active Element Beam Formed Radar Antenna

Array Antenna Technology



Target Classification R&D



Radar spectrogram of walking person

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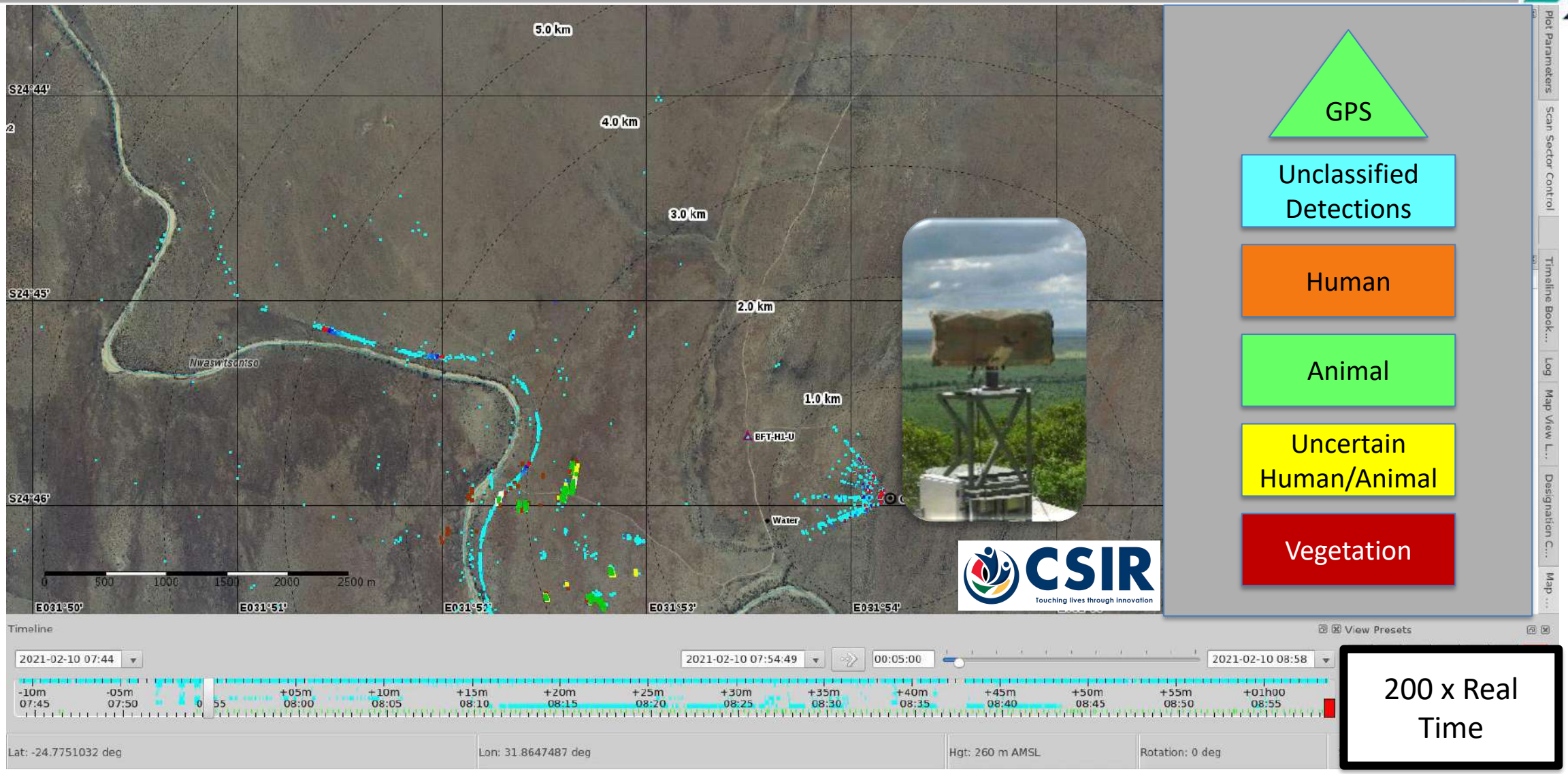
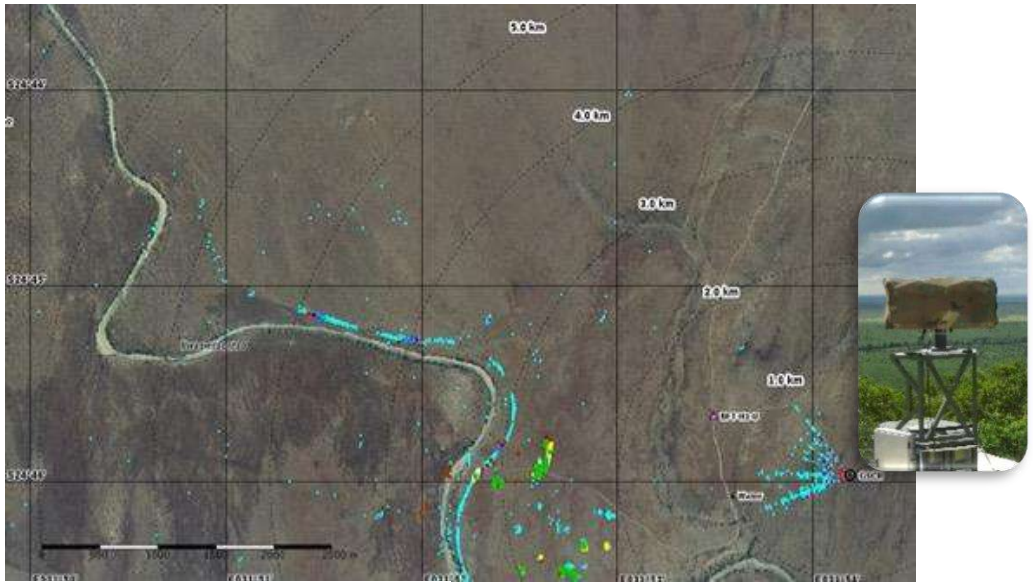
Walking test in Kruger National Park

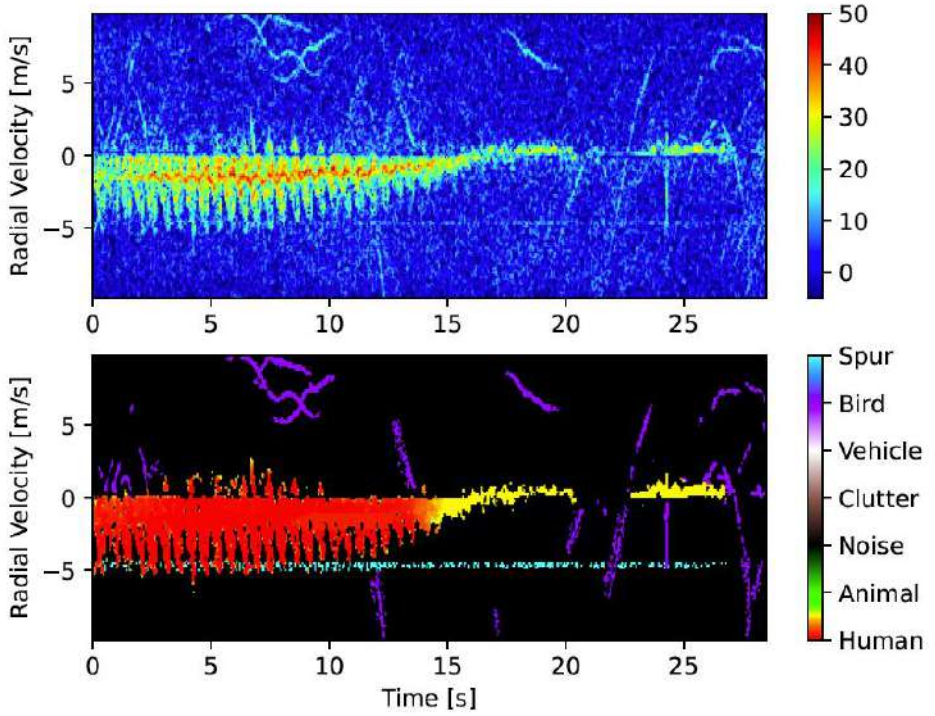


200 x Real Time

Classification based detection

- Utilise Artificial Intelligence to detect based on Classification Information
- Advances in processing hardware makes it possible to process vast amounts of information
- “what is there”, not only “is there something there”, everywhere in scene
- Requires Staring view available with GSCR





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GSCR key technical value proposition

Higher update rate

Smooth update of movement

- Higher probability of intercept
- Better track initialization and maintenance

Improved minimal detectable velocity (x 2-3)

- Increased dwell times increases Doppler resolution
- Stepped scanning removes beam scanning modulation

Radar target classification

- Classify designated targets
- Classify targets continuously
- Suppress unwanted entities

Classification aided detection

- Reduce false detection on wind blown trees
- Reduced CFAR losses

Classification aided tracking

- Improved track initialization
- Improved track maintenance
- Much improved automated radar processing allows much reduced operator costs

Scalability

- Number of panels changes the radar detection range and angle measurement accuracy
- Allows performance and cost trade-offs

Fixed panels, 90 deg segments

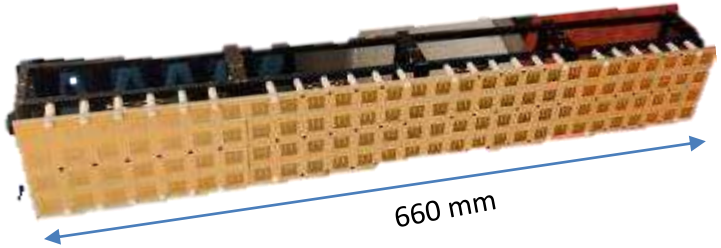
- Easy installation on existing/new towers
- Can avoid obscuration by close-in obstructions
- No sliprings or moving parts
- Engineered for challenging environmental conditions

Wide Local Area Real Time Surveillance - Roadmap

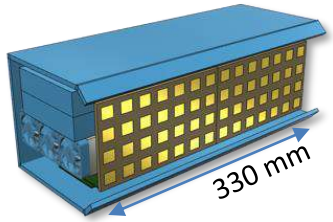
GSCR Facility
10 km range on human
Antenna size: 1.3 m x 0.53 m

3rd generation CSIR panels (more compact)
Scaleable – family of radars

- With new generation technology – creating scaled family of surveillance radar systems
- Scaled versions optimised for different use cases (detection ranges)
- Potential to place flat panel radar against buildings or on static lattice towers to provide surveillance over a sector (no moving parts)



4 panel radar
4.5 km range on human



2 panel radar
2.5 km range on human

GSCR

- Wildlife Protection Systems
- Land Border Safeguarding
- Maritime Border Safeguarding
- Counter crime on farms, open sub-urban areas
- Industrial, Farming District, Key Point Security
- Counter air intruder systems
- Counter-drone Systems

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