Cambridge Consultants

Holographic radar brings a new dimension to sensing and instrumentation on T&E ranges

Collision avoidance, wind farms and scoring

50 YEARS OF INNOVATION

NDIA test and evaluation conference

Gary Kemp

A world leader in technology and product development

- Established in 1960
- 300 engineers and scientists based in Cambridge UK and Cambridge MA.
- We serve a wide range of industries – defence, wireless, transport, consumer, industrial, medtech
- We design, develop and manufacture innovative products, processes and systems using multi-skilled teams
- We have a long track record of technology based spin-out companies
- We manufacture and supply specialist radar systems

50 YEARS OF INNOVATION

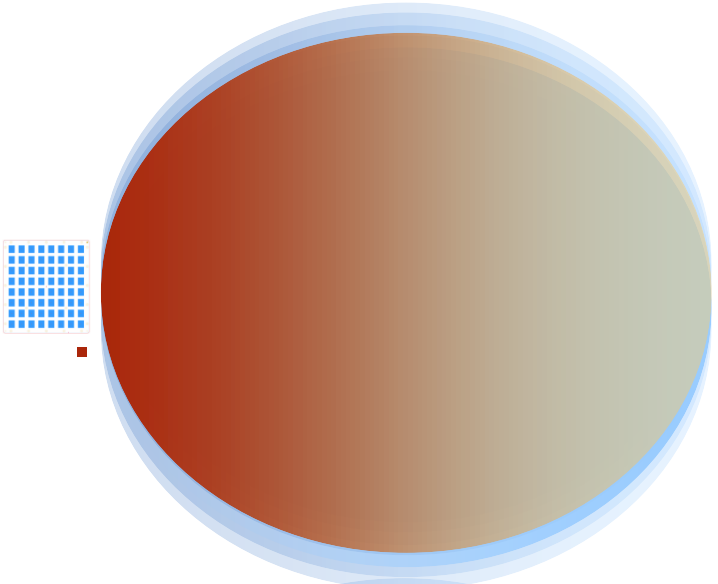
THE QUEEN'S AWARDS FOR ENTERPRISE 2009

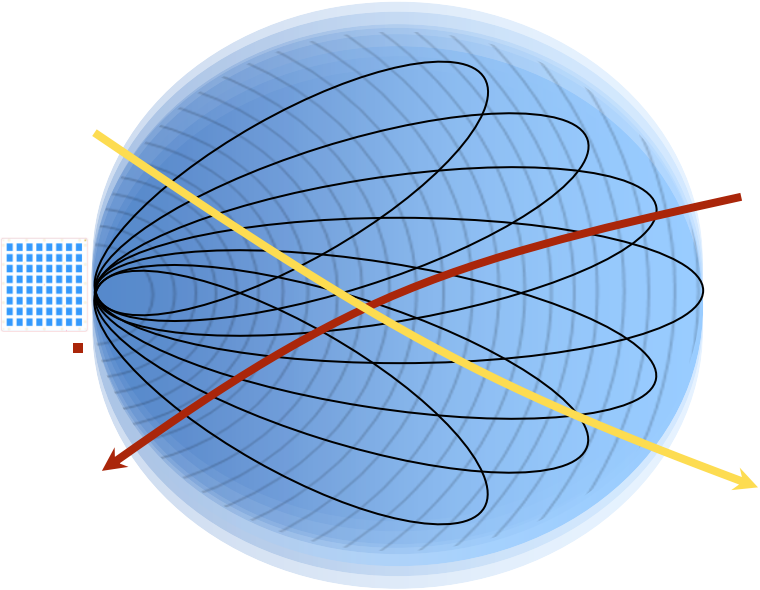
Holographic radar implements Skolnik's vision of Ubiquitous Radar

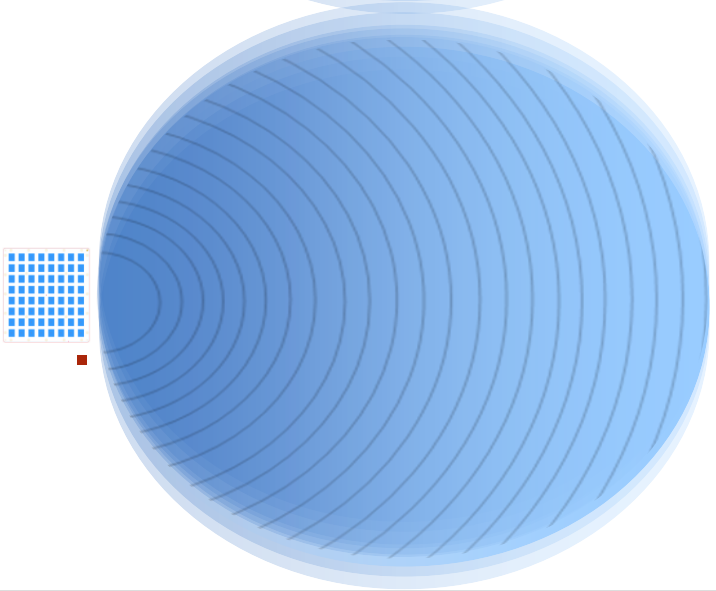
- Holographic Radar looks continuously at a whole volume of space (rather than scanning).
- It acquires fully sampled amplitude and phase information from every object within the volume.
- It provides range, azimuth, elevation and Doppler information for every detected object.
- Tracking algorithms discriminate moving targets and clutter.
- Clutter is removed without loss of sensitivity.

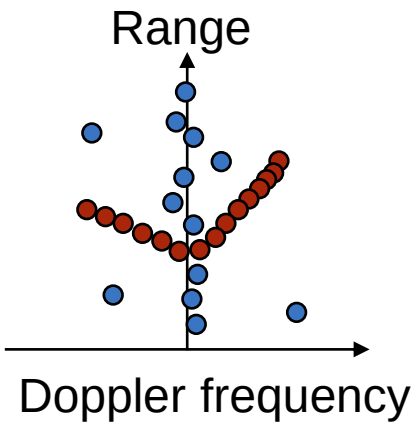
- Practical holographic radar is possible in the modern day due to the availability of high-power processor devices at reasonable cost.

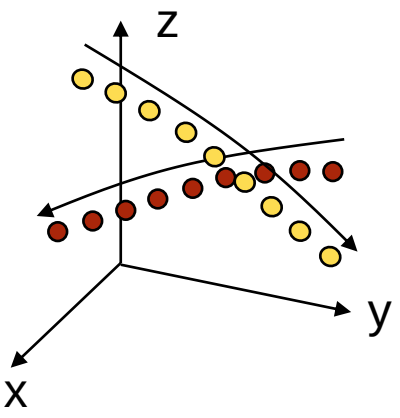
Holographic radar



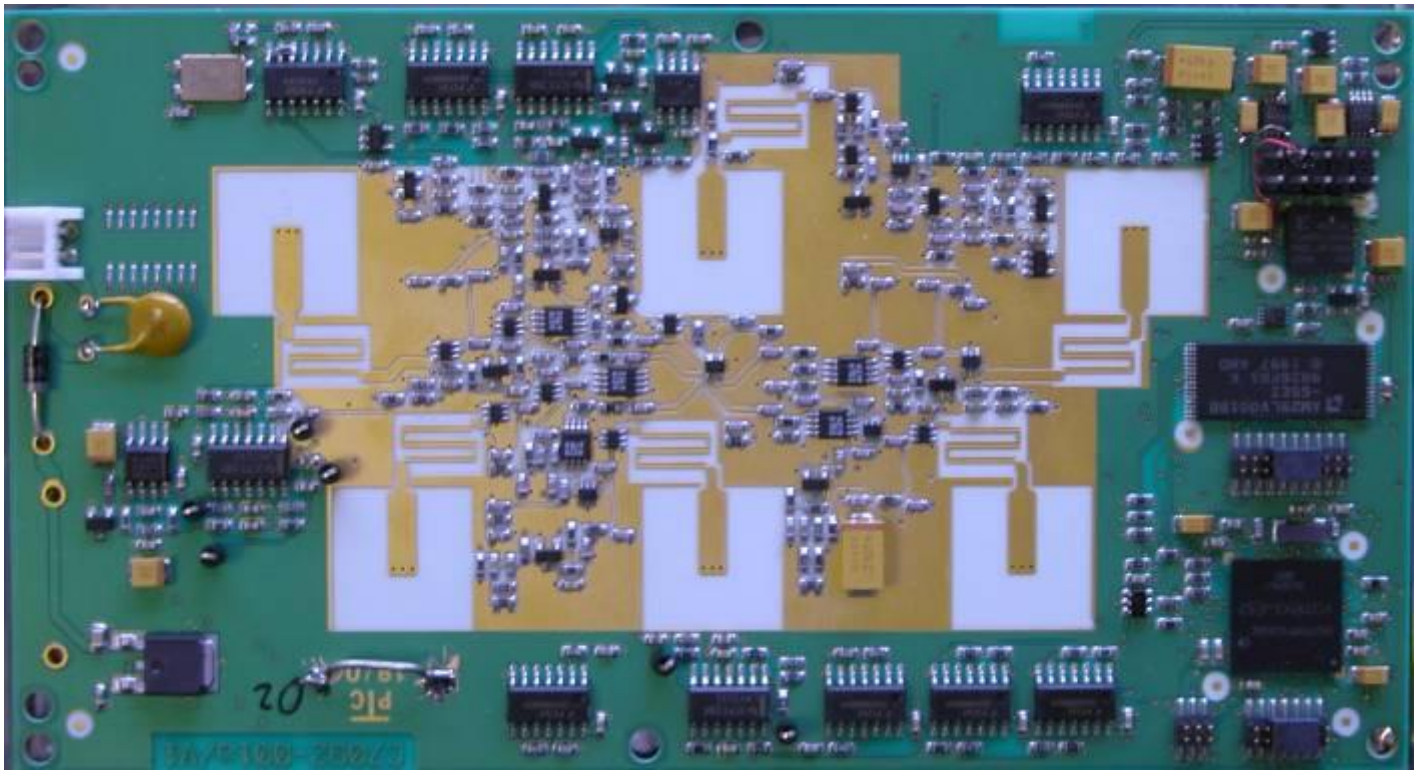








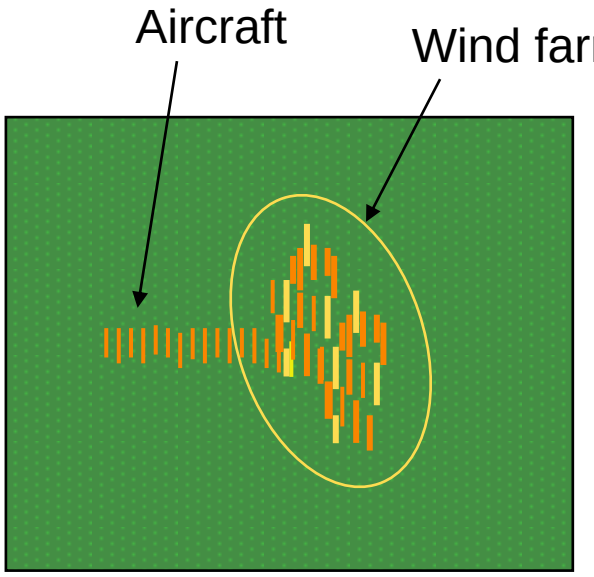
Collision warning radar



5-channel array for automotive pre-crash sensing – a minimum holographic array

Collision warning radar

Many wind farm planning applications are stalled



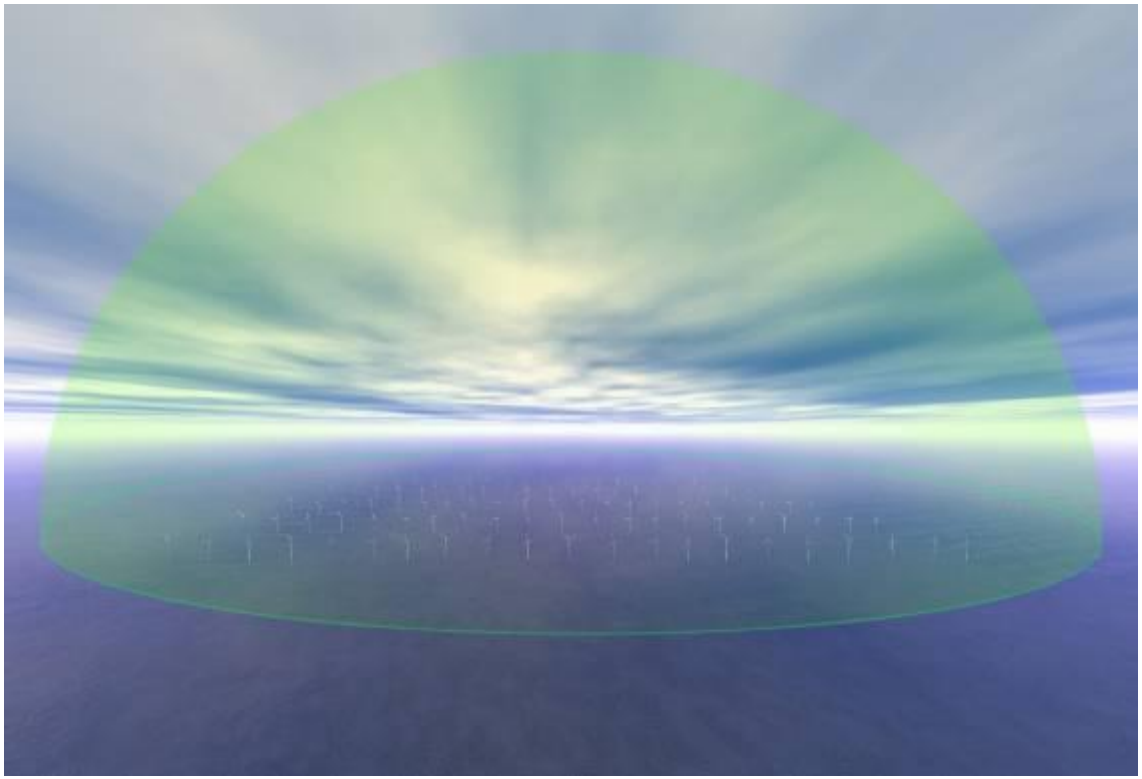
Absence of vertical discrimination combined with scan aliasing makes it impossible for a PSR to separate the track from the clutter.

Holographic radar provides the solution.

CH-InFill is a holographic radar located at or near a wind farm to generate local, high-resolution, 3D infill data

- The sensor is located in or near the wind farm
- It sees through and around the turbines without disruption
- Nothing else has been shown to do this

- Range up to 13km / 43,000ft
- Reporting rate 3-10Hz



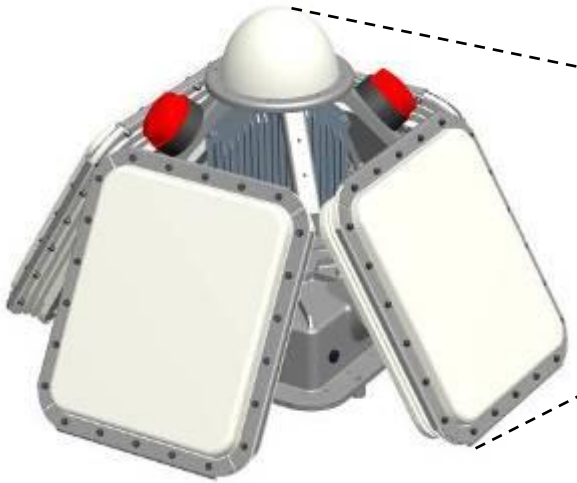
Wind farm infill radar - testing

66m diameter wind turbine

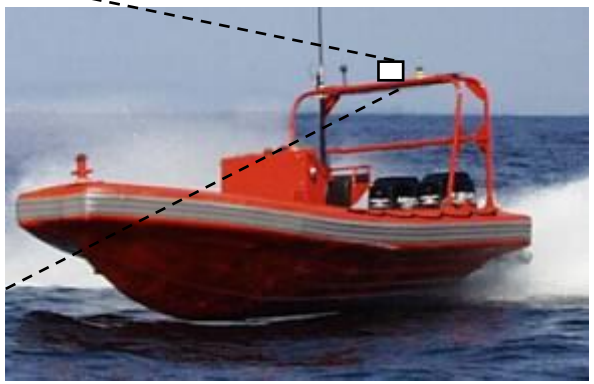
Remote-controlled helicopter with 2.2m^2 radar reflector

Land and Surface Target Scorer (LSTS) system – in development

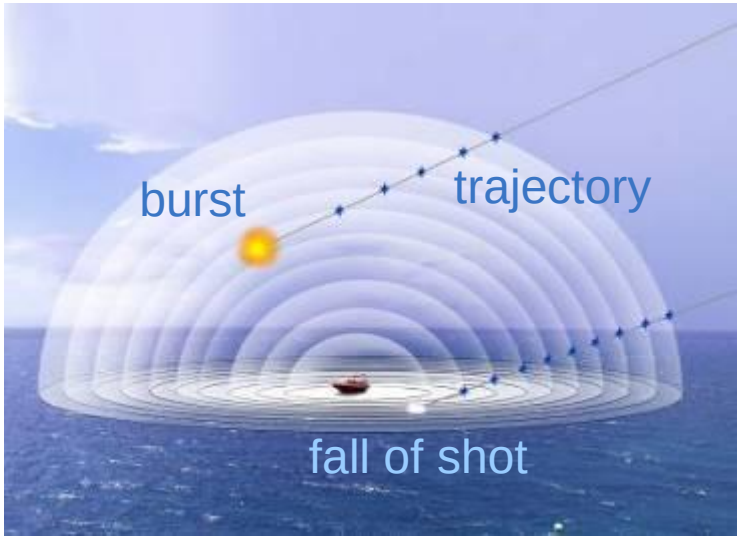
- The Land and Surface Target Scorer is a real-time vector scoring system for highly mobile targets operating in very cluttered environments.
- LSTS application of the CH radar is funded by the OSD Target Management Initiative program, sponsored and managed by NAWC-WD, Point Mugu, Target Systems Division, 5.3.1



LSTS sensor head

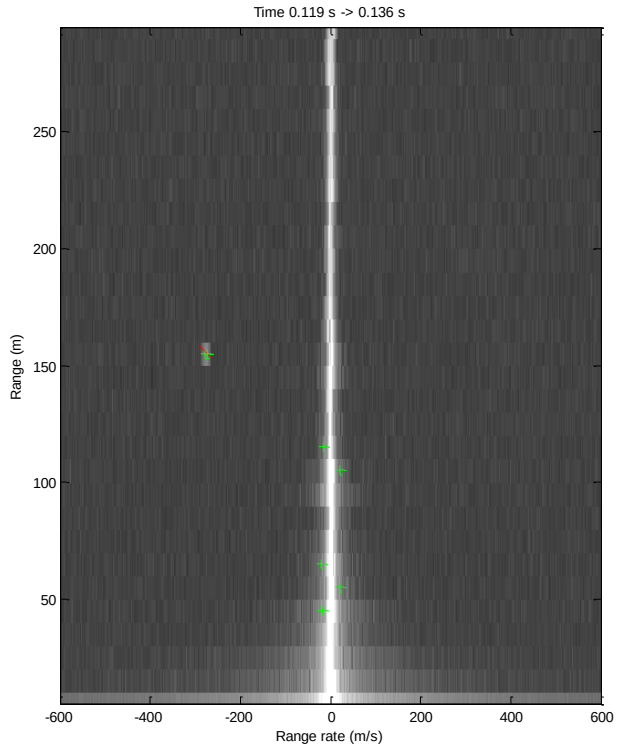


HSMST



1000ft scoring volume

Two views of how LSTS will perform:



Migration process rejects clutter

Accuracy and throughput

Range (5” Shell)	50ft - 1000ft
Firing rate	Up to 20 rounds / minute
Along-track position accuracy	13ft / 5% at longer range
Target speed	Up to 46kts (at SS3) Up to 100mph (land)
Sea state	Up to sea state 3
Trajectory reporting	Within 3 seconds of projectile arrival

Performance measured to date:

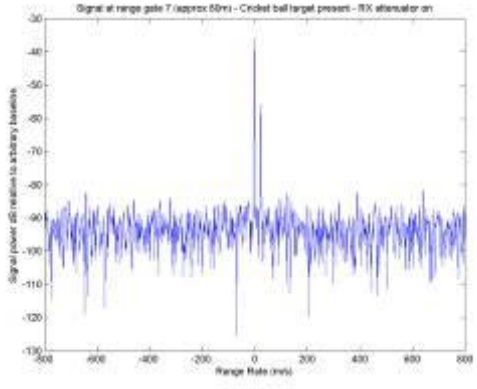
Cricket ball

RCS 0.004m^2

Cricket bowling machine – 100mph

Radar head

Performance measured to date:

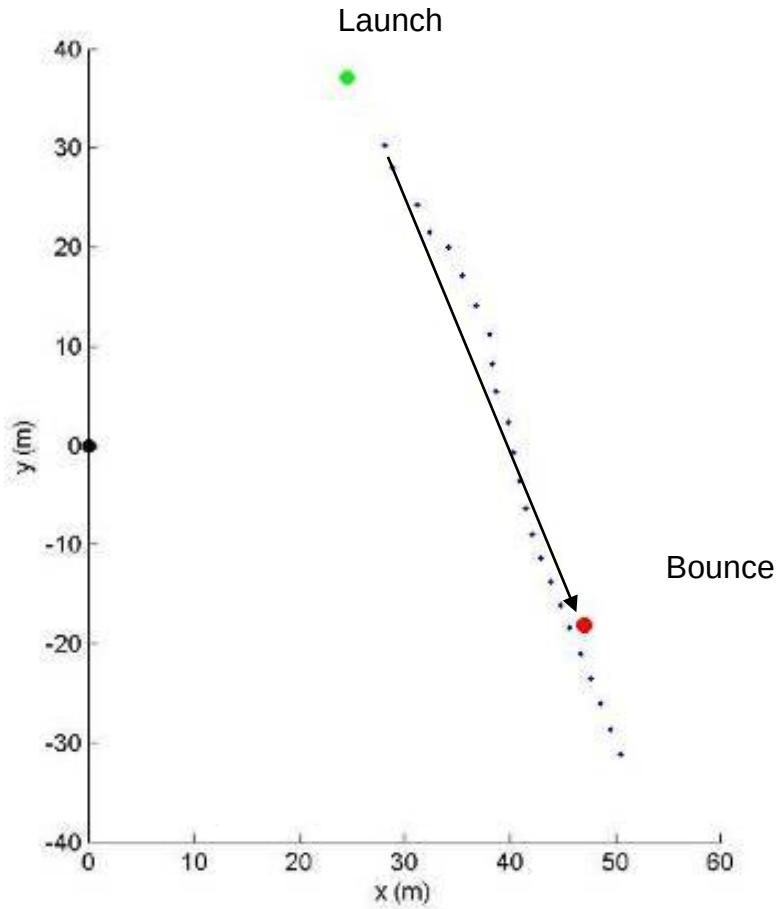


SNR at 80m 35dB (25W Tx)

Proof of concept trajectory processing takes 15 minutes

Beta Prototype trajectory output will be continuous and real-time

Detection, tracking and best-fit 3D trajectory



LSTS program

Proof of Concept Phase (system design and single face build)

- Start date: Jan 2010 ✓
- System Requirements Review: April 2010 ✓
- Preliminary Design Review: June 2010 ✓
- Critical Design Review: September 2010 ✓
- Test Readiness review: February 2011 ✓
- Proof of Concept System trials with 5” shell: March 2011 (in progress)

Beta-prototype phase (complete system build and test)

- Start date: April 2011
- Trials with 50 cal rounds: June 2011
- Sea trials on HSMST: December 2011

Holographic radar is the best you can do in very cluttered environments

- **Target and clutter separation**
  - Continuously gather signals from a large volume of space
  - Fully sampled amplitude and phase data from every target
  - Separate targets of interest from clutter through tracking processes
- **Applications** in collision avoidance, PSR infill, scoring, through-wall, asset protection, border monitoring, other…
- **LSTS system** under development
  - 5” and 50 cal projectiles
  - Land and sea surface targets
  - Proof of Concept sea trials underway

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