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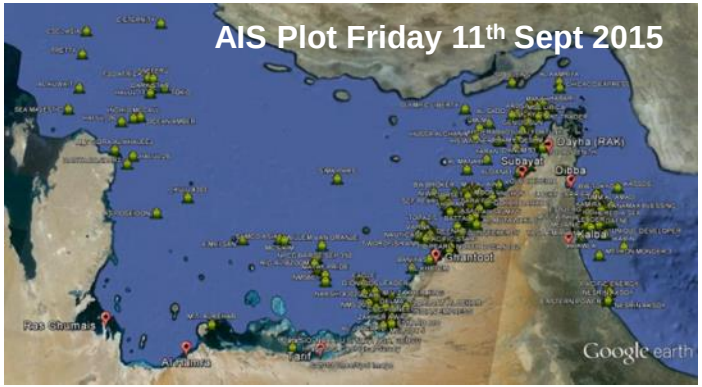
Distributed Sensing and Effects

In the Congested and Contested EME

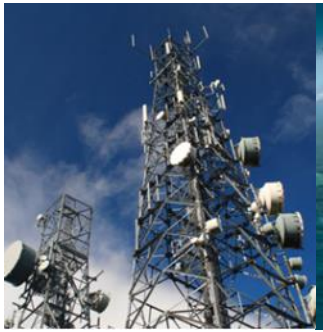
Andrew Burnside

Congested and Contested Electromagnetic Spectrum

The electromagnetic spectrum is growing increasingly complex and congested and as demand for bandwidth grows and complexity of emitters increases the problem will only get worst



- There are a total of 759 platforms
- Equates to over 2000 persistent Merchant Ship emitters



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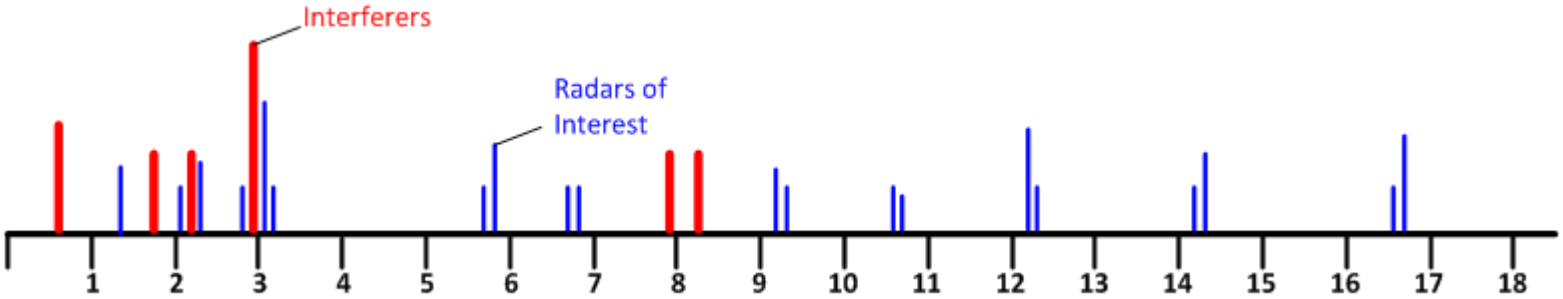
Electromagnetic Spectrum



In todays Electromagnetic Spectrum Radars of interest are present within a background of commercial and military interferers including:

- TV, 2G, 3G & 4G mobile phone base stations
- Co-located high duty-cycle & multi-function radars
- Commercial and military SatCom ground terminals.

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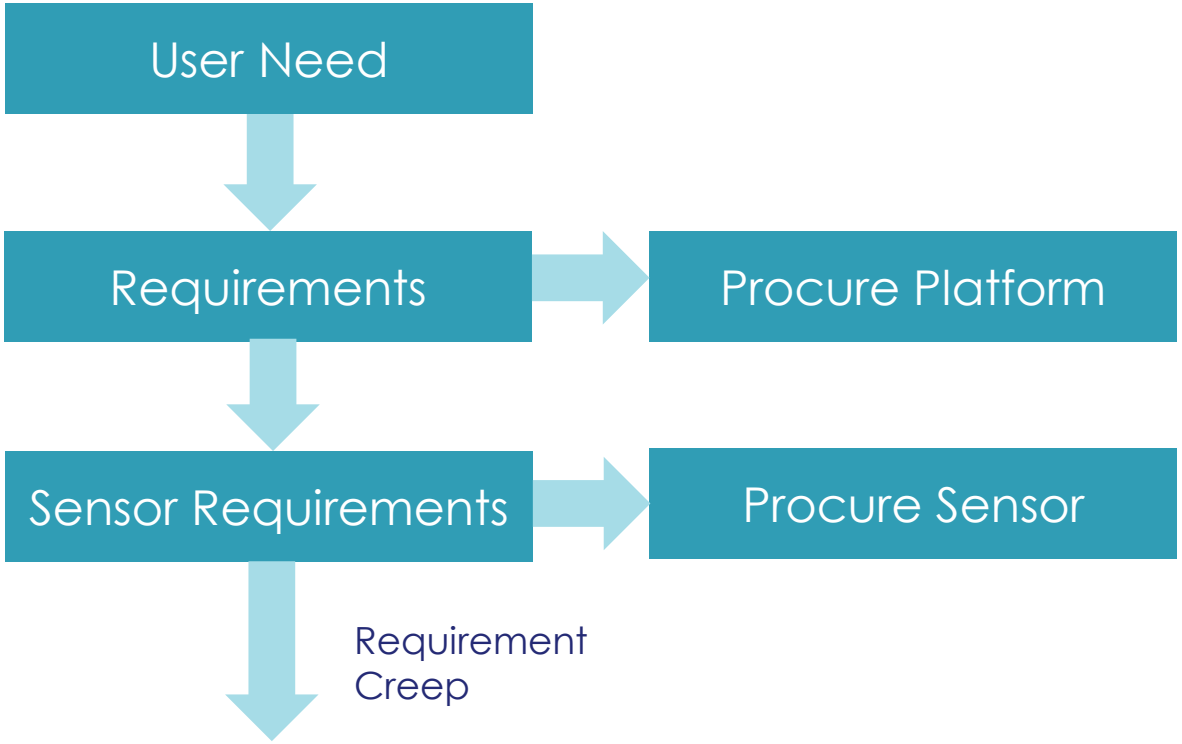
Hypothesis of Single Sensor Evolution – A Personal Opinion



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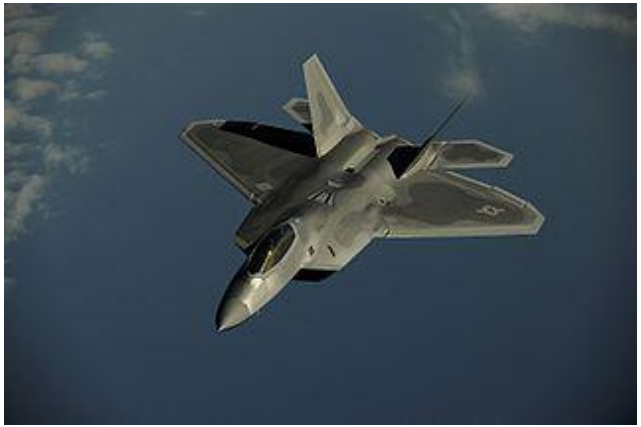
Platform Examples apply to Sensors as well

F-22 Raptor
$339m per aircraft

F-35A
Circa $100m per aircraft



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The Distributed Sensing Opportunity

What is good enough?

Does one sensor have to do everything? -> ££££

- Affordability
- Development Timescales
- Resilience
  - Attrition
  - Interference / Jamming

Upgradability

- Homogeneous or Heterogeneous Sensors

Does the Sum of the Distributed Parts exceed a Single Whole?

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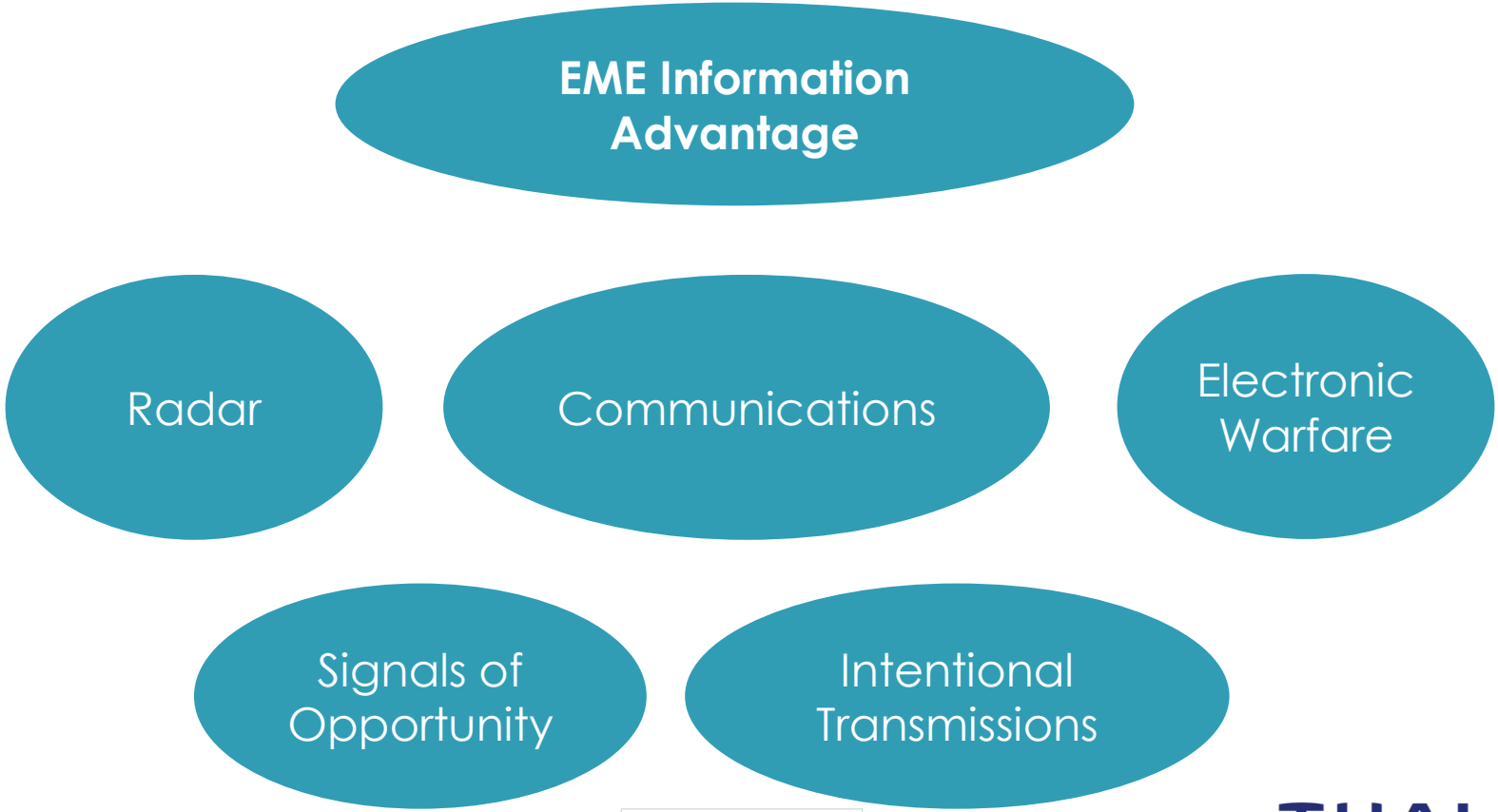
Gaining an Information Advantage requires a holistic approach



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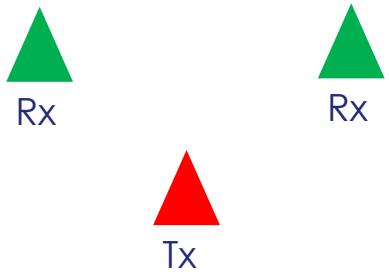
Multistatic or MIMO?

Conventional Multistatic

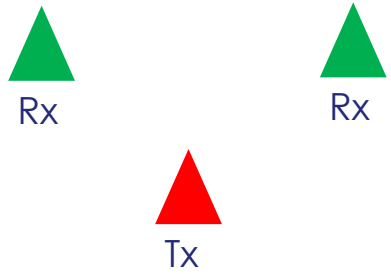
SIMO



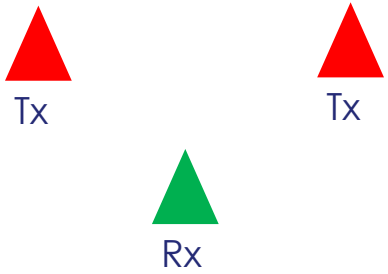
Multistatic or MIMO?

Conventional Multistatic

SIMO



MISO



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Multistatic or MIMO?

Conventional Multistatic

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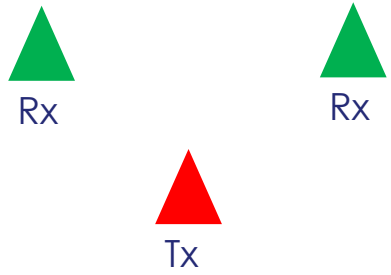
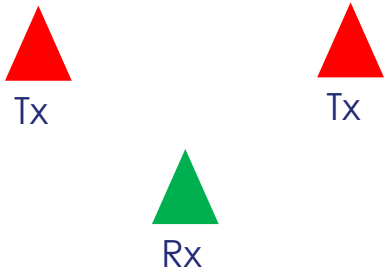
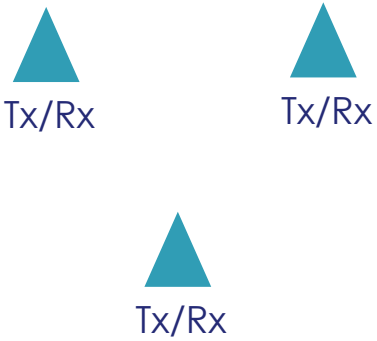


MISO



Multistatic MIMO



How does ES and EA work against Multistatic MIMO systems?

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Multistatic MIMO

Untapped Potential

- Pd / Pfa
- Characterisation of targets
- Diversity – Spatial, Spectral and Waveform

Challenges

- Theory - What is Possible?
- Delivery
  - How does this translate to a robust, deployable system?
  - Hybrid Mono/Multi static systems?
- Inter-node Communications – What is sufficient?
- Distributed Decision Making / Fusion
  - Plot to Plot
  - Plot to Track

EW

Conventional

ES

DF
Rx

2nd Platform
for
geolocation

Tx

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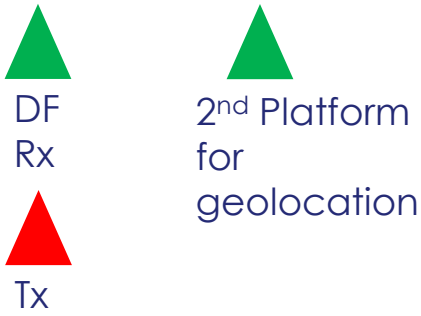
EW

Conventional

ES



EA

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EW

Conventional

ES

DF
Rx

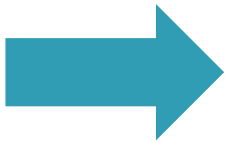
2nd Platform
for
geolocation

Tx

EA

Tx

Monostatic Radar
/ Comms System



Distributed

Distributed ES

Detection
Deinterleaving
Geolocation

Distributed EA

Combined Effect
Power and Wave front

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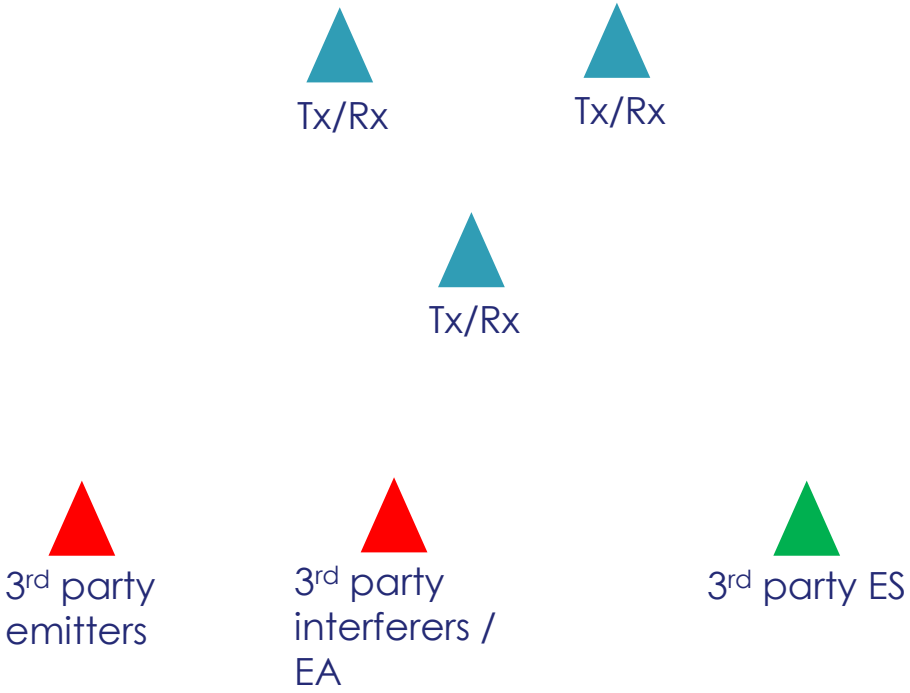
Holistic Approach

Combined Radar / EW / Comms



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Making it Real

Operational Analysis

- Future operational concepts for distributed systems need to be elaborated
- It is not just a matter of doing things N times

Research

- Significant challenges to achieve EME dominance
  - Performance Assessment and Sell Off
  - Detection
  - Characterisation
  - Distributed Decision Making
  - Communications

Industry

- Business model - Product vs Delivery of Capability
- Performance Specification - Marketing

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