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**Optronics, radar and RF EW: eyes
and ears in the battlespace**

Simphiwe Mkwelo

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Agenda

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Outline:

- Nature of modern battlespace
- Spectrum of potential conflict
- EM Spectrum
- Integrated Optronics, Radar and RF EW
- Integration concepts
- Conclusions

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Nature of Battlespace



- Complex
- Use of COTS
- **Asymmetric**
- **Civilians and infrastructure**
- Multi-dimensional
 - Information
 - Air
 - Land
 - Sea
 - Space
- **Violent** and fluid
- Enhanced destruction
- Agility
- ISR

Nature of Battlespace



USMC F/A-18D
Operation Desert Shield
2006



Su-25
Georgia
2008

Su-25
Stinger



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AH-64 (Apache)



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MANPADS Attacks in Africa

- 1 September 3, 1978, Kariba, Zimbabwe.** An Air Rhodesia Vickers 782D Viscount passenger airliner crash-lands after being hit by an SA-7 missile fired by forces from the Zimbabwe Peoples Revolution Army (ZIPRA). Four crew members and 34 of the 56 passengers are killed.
- 2 February 12, 1979, Kariba, Zimbabwe.** ZIPRA rebels strike an Air Rhodesia Vickers 782D Viscount passenger airliner with an SA-7. All 59 passengers are killed.
- 3 August 11, 1983, Lubango, Angola.** An Angola Airlines Boeing 737-2M2 passenger airliner crashes on takeoff. Rebels belonging to the National Union for the Total Independence of Angola (UNITA) claim responsibility for firing the missile that downed the aircraft. The Angolan government blames the crash on a mechanical problem.
- 4 August 16, 1986, Malakal, Sudan.** The Sudan People's Liberation Army fires an SA-7 that downs a Sudan Airways Fokker F-27 shortly after takeoff.
- 5 December 8, 1988, Western Sahara.** Two Douglas DC-7 aircraft chartered by the U.S. Agency for International Development, en route from Senegal to Morocco, are hit by SA-7s fired by POLISARIO militants. One crashes, killing all on board. The other lands safely in Morocco.
- 6 April 6, 1994, Kigali, Rwanda.** A Dassault Mystère-Falcon 50 executive jet carrying the presidents of Rwanda and Burundi and a French flight crew is shot down over Kigali. All on board are killed, sparking massive ethnic violence that resulted in the Rwandan genocide.
- 7 October 10, 1998, Kindu, Democratic Republic of Congo.** A Boeing 727-30 Lignes Aeriennes Congolaises airliner is shot down by a possible SA-7 missile fired by Tutsi militia.
- 8 December 15, 1998, Angola.** A missile strikes an AN-12 transport aircraft en route to Luanda.



- 9 December 26, 1998, Huambo, Angola.** A U.N.-chartered Lockheed C-130 Hercules transport is shot down by UNITA forces.
- 10 January 2, 1999, Huambo, Angola.** A U.N. Transafrik Lockheed L-100-30 Hercules transport plane is shot down by UNITA forces on takeoff.

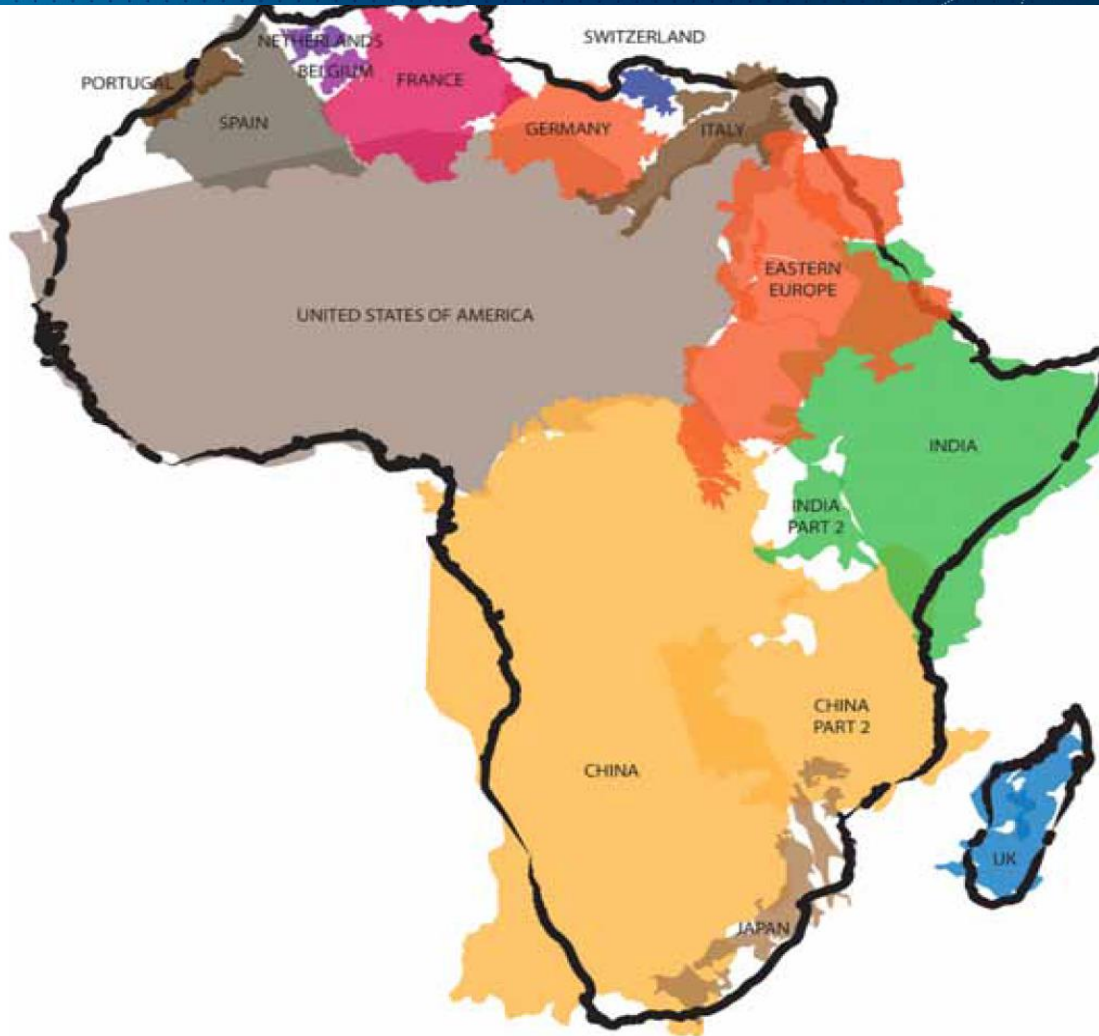
- 11 November 28, 2002, Mombasa, Kenya.** Al-Qaeda-linked terrorists fire two SA-7 missiles at an Arkia Airlines Boeing 757-3E7 on takeoff. Both missiles miss their targets.
- 12 March 23, 2007, Mogadishu, Somalia.** A Transaviaexport IL-76TD cargo plane crashes on takeoff after being shot by two SA-18 missiles fired by Hizbul Shabaab.

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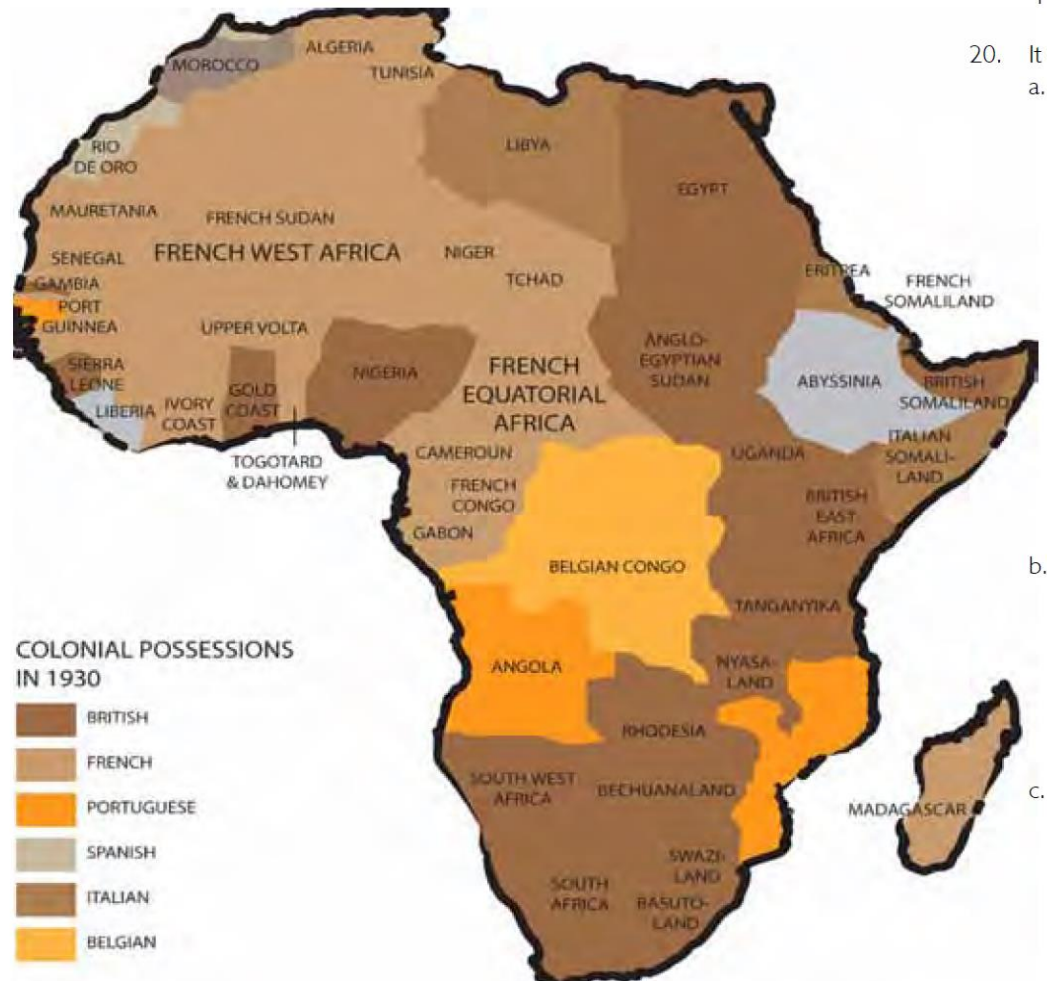
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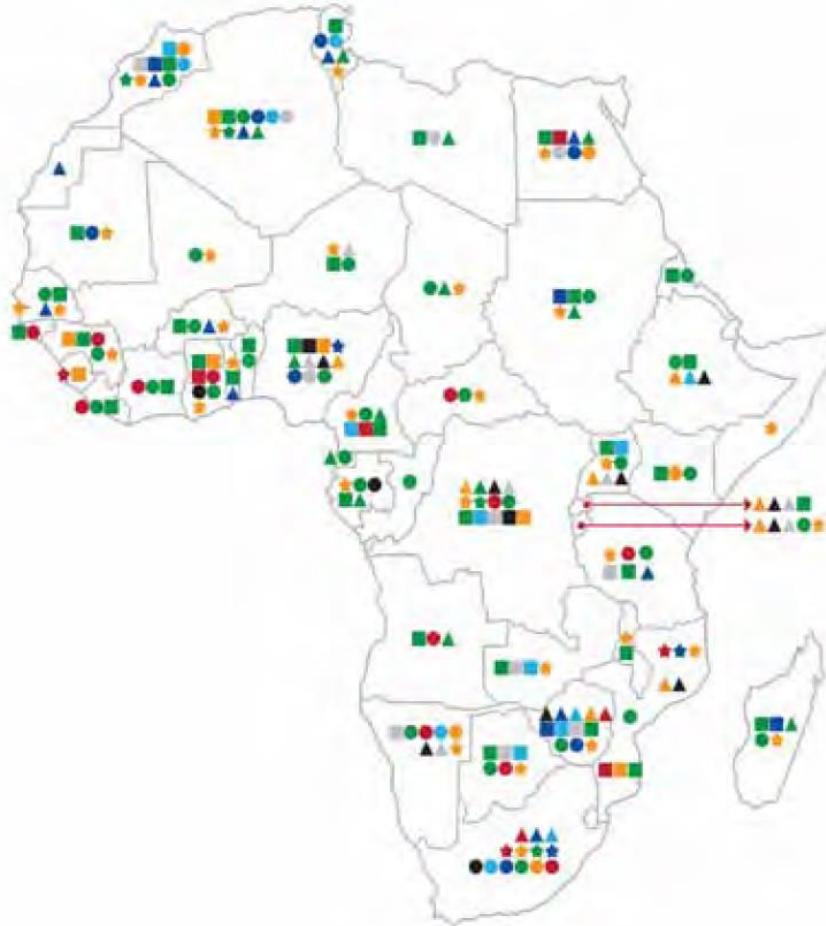
Nature of Battlespace



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Figure Intro-3: Colonisation of Africa as at 1930³

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Figure 2-4: Distribution of African Natural Resources

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Figure 2-10: Incidence of Piracy

Spectrum of potential conflict

INTER-STATE CONTINGENCIES



Figure 2-1: Inter-State Conflict

Nature of Battlespace

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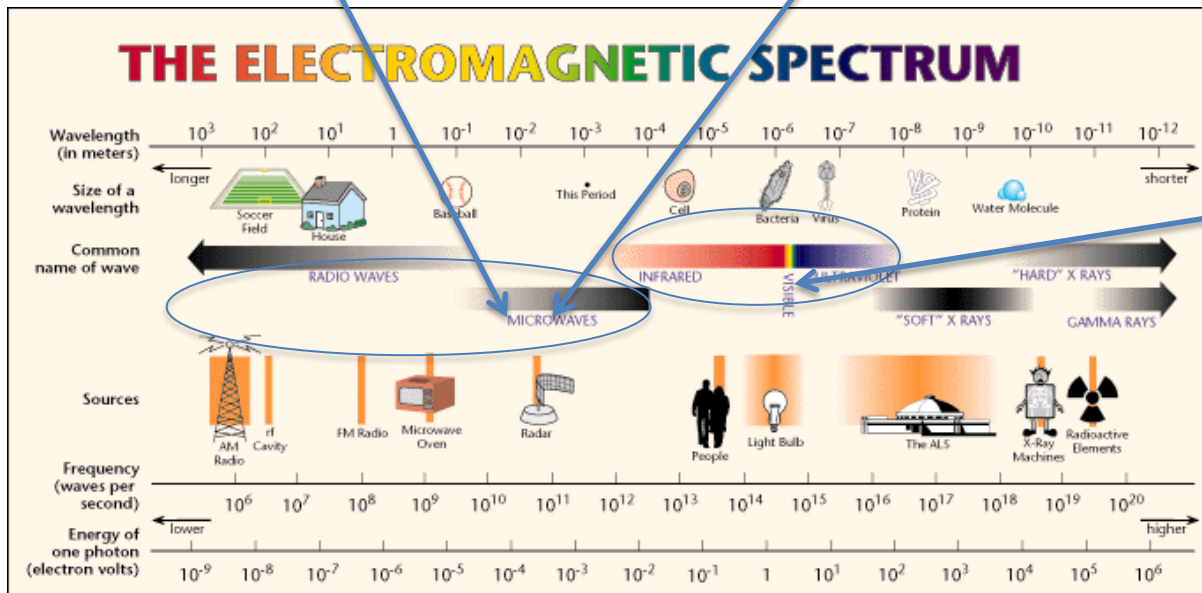
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The EM Spectrum



HTC | Apple | RIM

- Passive vs Active
- Congestion in RF
- Surveillance problems



Radar

A system for detecting the presence, direction, distance, and speed of aircraft, ships, and other objects, by sending out pulses of radio frequency waves which are reflected off the object back to the source.

Radio Frequency (RF) EW

Electronic warfare is any military action involving the use of the EM spectrum to include directed energy (DE) to control the EM spectrum or to attack an enemy

Optronics

The study and application of electronic devices that source, detect and control light

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An Integrated Approach

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- **Primary function:** To provide **integrated defence science and technology support to the DOD** across the DOD value chain at all system levels and across the life-cycle of defence systems – effectively operating as the **‘in-house’ science and technology capability of the DOD**
- **Research, development, test and evaluation** that will enable the DOD to:
 - Be a **knowledgeable buyer** of defence systems
 - Be a **knowledgeable user** of defence systems
 - Be **knowledgeable managers** of defence capabilities
 - Ensure **independence** in identified strategic technology areas
- To **advise on strategic technologies** and do technology investment and development in emerging areas of future importance
- To contribute towards related national objectives such as **industrial growth, aerospace and space and high level skills development**

Dimensions of Integration

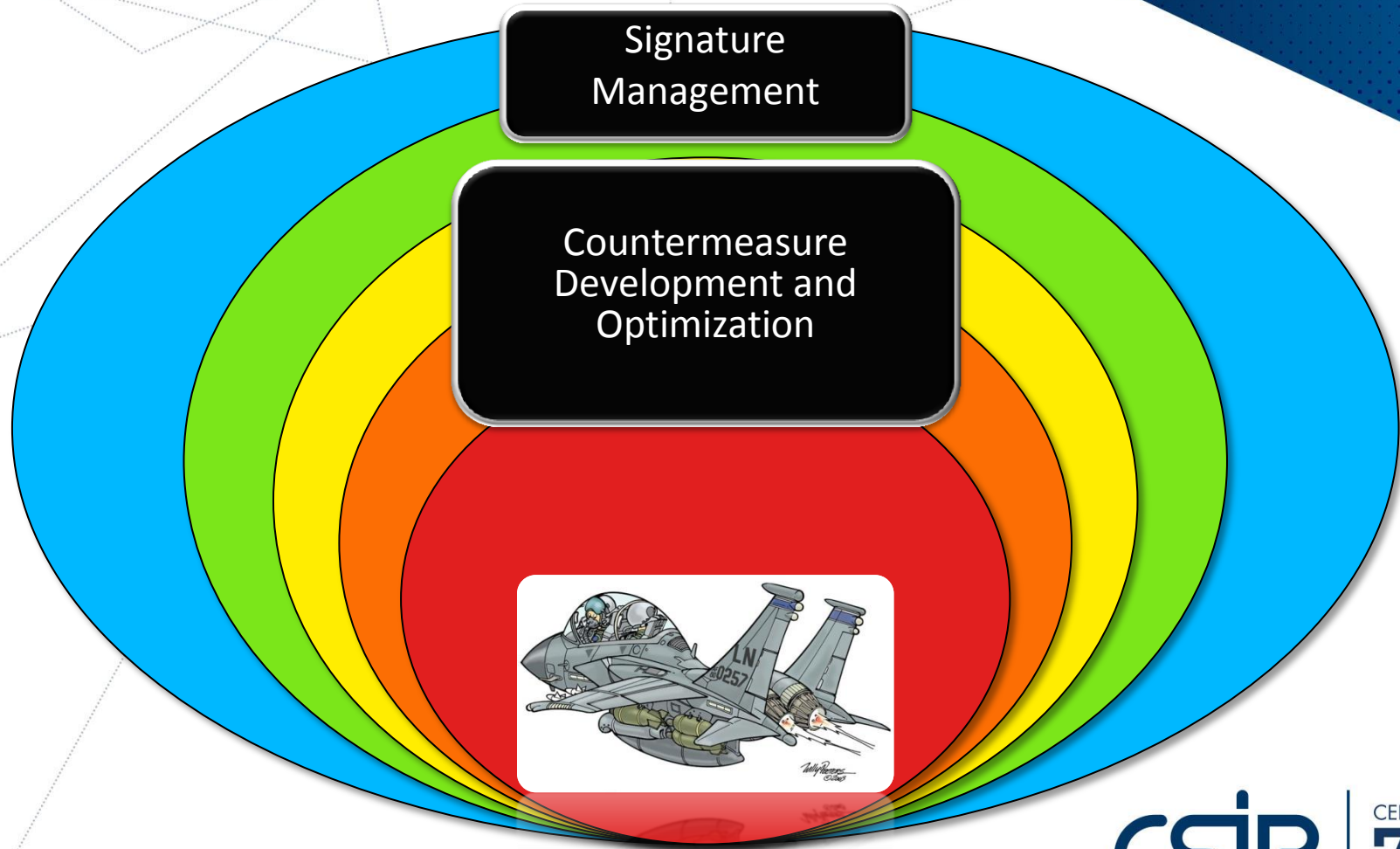
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Enhancing the **indigenous EW capability** by following an **integrative approach** in relation to:

- National System of Innovation
- Defence Systems hierarchies
- Knowledge management
- Arms of Service (Land, Sea, Air)
- Application of the knowledge base (R&D, Modelling and Simulation, Test, evaluation and training)
- Electromagnetic Spectrum
- Industry collaboration

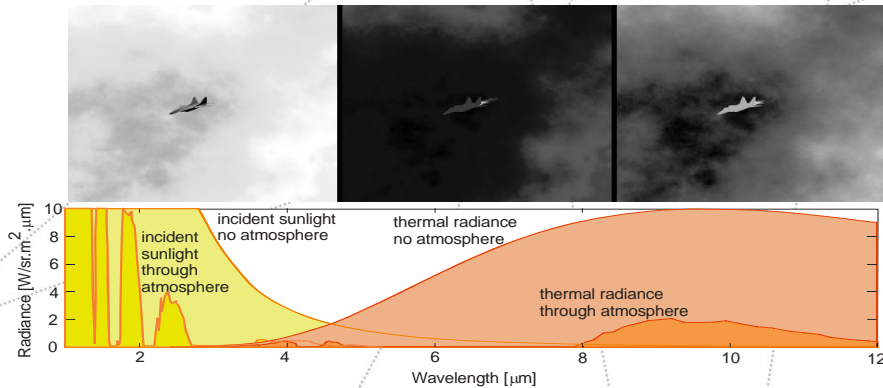
Platform Protection Focus

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Integrated IR EW

Modelling and Simulation



Hardware-in-the-loop

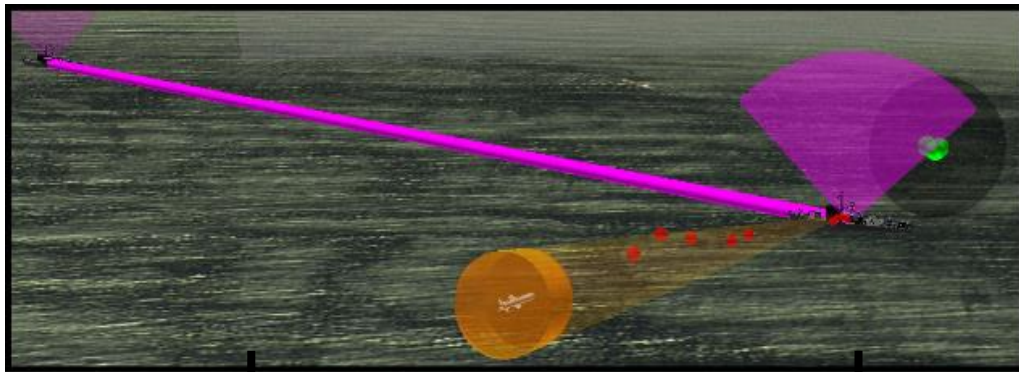


Field test and evaluation

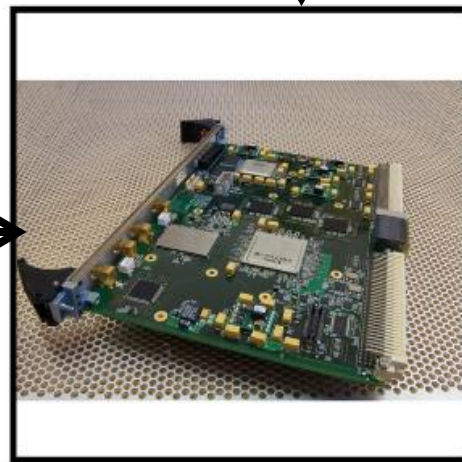
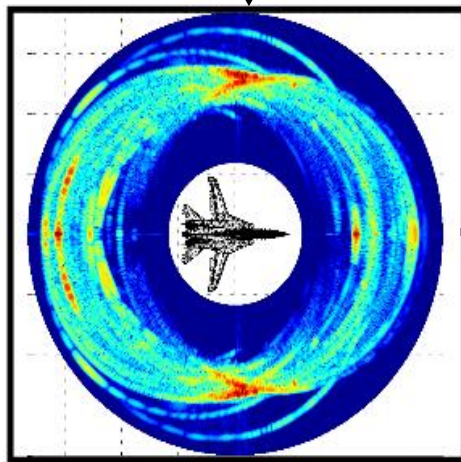


Integrated RF EW

Scenario simulation & control



System under test



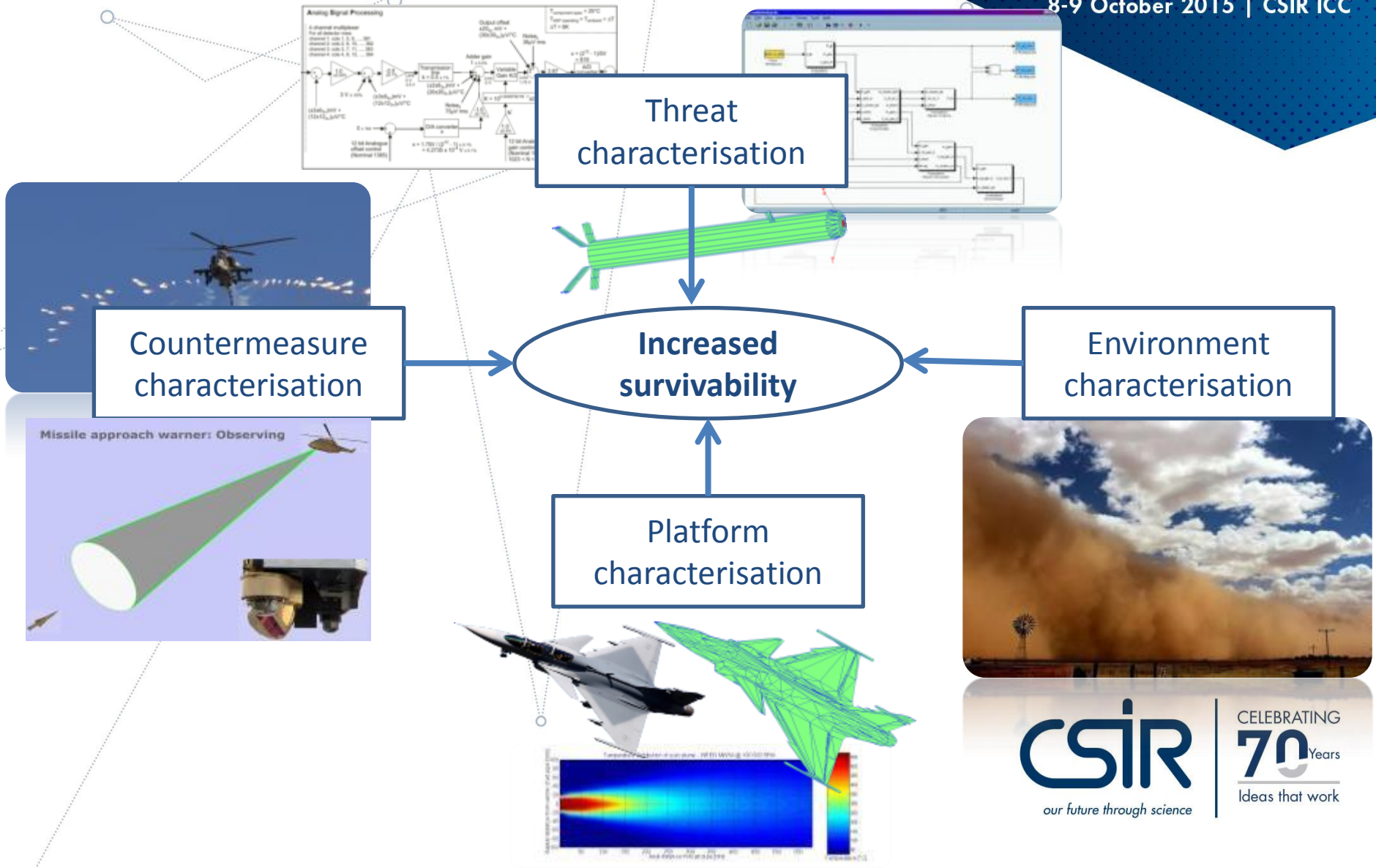
RCS / HRR prediction

HIL simulation

Radar under test

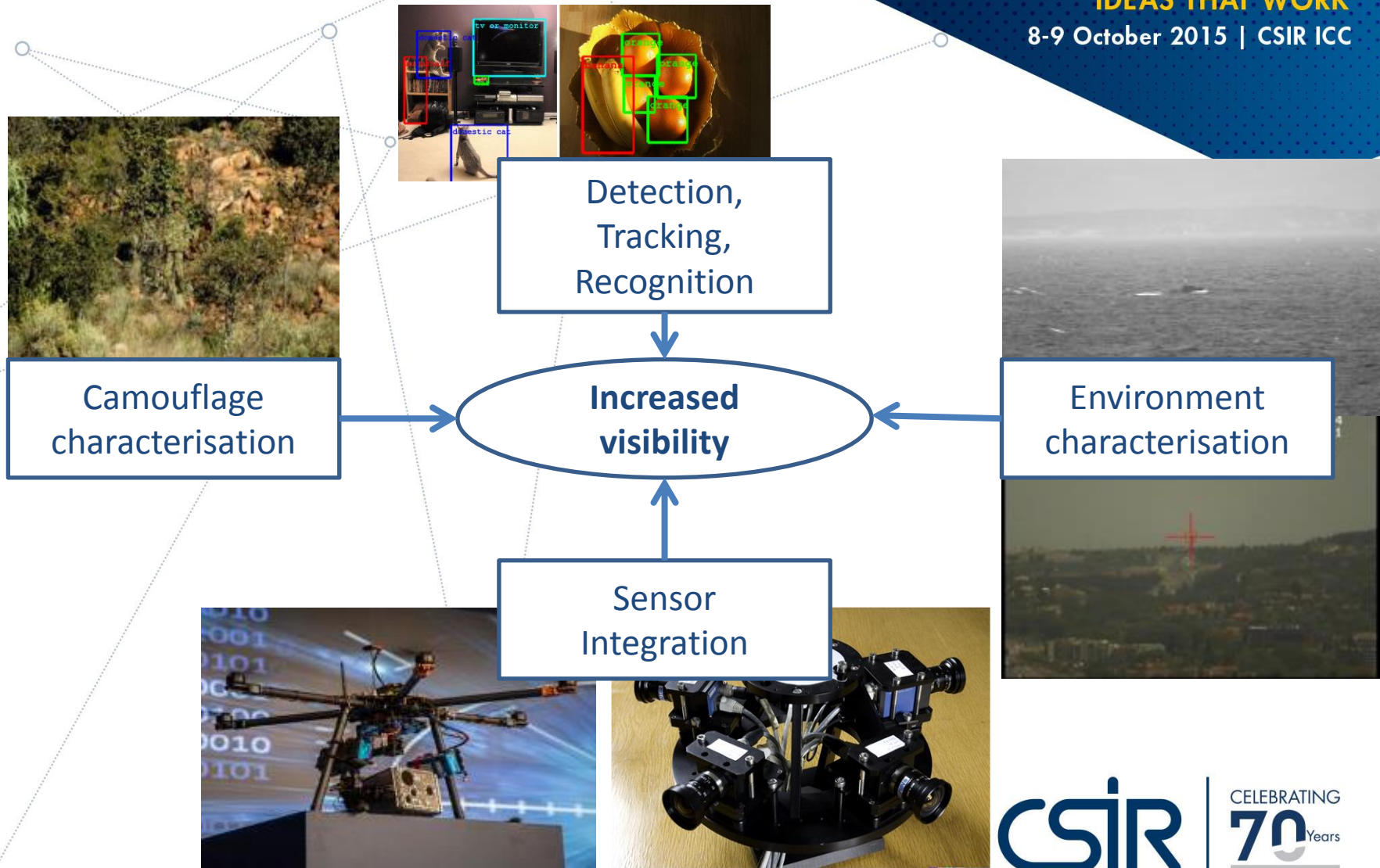
Platform Self Protection

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Surveillance

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Integration Concepts

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- Integrated surveillance capability
 - Radar as a designation sensor for optics
 - Narrow field of view optical sensor
 - More pixels on target, better recognition performance
- Integrated platform protection capability
 - The modern missile threat is integrated
 - IR and RF EW field T&E – measurement
 - IR and RF threat Hardware-in-the-loop laboratory environment
 - IR and RF Simulation and modeling

Conclusions

- Modern battlespace is complex and complicated
- **Integrated surveillance capability**
 - More experiments
 - Application into Anti-Rhino poaching initiative
- **Integrated platform protection capability**
 - New area of research and development
 - Develop and build facility
 - Integrate simulation and modeling capability

Thank you

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