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## Opportunity for new product development



- Replacement of TRS3D / TRML-3D
- New medium range surveillance radar
- Build radar development capability in South Africa
  - ITAR/BAFA free
  - Leverage SA technology & capability
  - Affordable technology proposition
  - Low development cost

TRS-3D







## New joint product development



Naval Surveillance Radar



Land Surveillance Radar



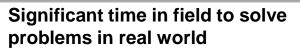




**CSIR** radar history

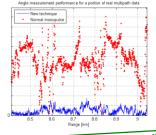
### Detailed technology and technique development

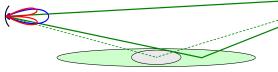






Low angle tracking improvement

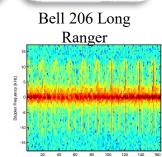




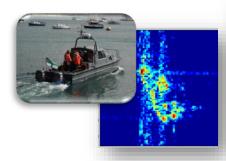
## Micro-Doppler based classification of aircraft

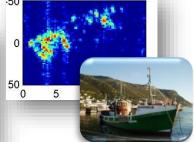


Eurocopter EC120



Radar imaging based classification of maritime vehicles











# CSIR radar history Some examples of industry product collaboration



Reutech Radar Systems



#### **CSIR** tech development -> Tech transfer -> Industry product development

- DoD funded development. CSIR developed technology -> Tech transfer to Industry
- Industry developed product
- CSIR provided bespoke subsystems as products: radar signal processor, antenna and radar waveforms
- CSIR performed specific system level studies

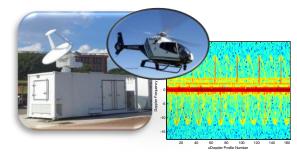
## Reutech Radar Systems DBR-XL Development



### Industry driven product development

- DoD funded development.
- CSIR provided modelling and algorithm support and specific technology studies

#### **CSIR Fynmeet System**



#### Bespoke measurement facilities to international institutes

- Based on facilities CSIR has developed for services to SA DoD as institute
- Single bespoke sales not attractive industry products
- Sold to similar institutes internationally R&D organisations

# CSIR radar history Some examples of industry product collaboration



#### **Meerkat WASS**



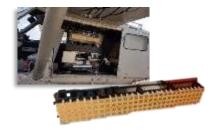
#### **GSCR System**



#### Bespoke solution for user need -> Next gen automated radar

- CSIR developed, integrated and delivered porotype Meerkat systems to aid counter poaching
- DSI funded the development of a next generation radar demonstrator utilising lessons learnt from the Meerkat programme Towards full automation
- Technology push CSIR developing use cases in operational environments
- CSIR developing industrialised version exploring industry partnerships

## **UAV Synthetic Aperture Radar**



#### **Technology Push**

- CSIR developed technology and product concept demonstrator
- CSIR positioned based on tech and market understanding

## Spaceborne Synthetic Aperture Radar



### Partner with RSA space industry to develop system and explore market

- Radar technology development supported by Department of Science and Innovation
- Exploring various models to unlock product development

## Partnership - development agreement





**Hensoldt: Product owner** 

**CSIR: Technology partner** 

- Strongly driven by business case
  - Not specific DoD acquisition
- Hensoldt's strong understanding of the market
- Required price point
- Required features and performance vs nice to haves

#### **Complementary Skills and Capability**



- Product management
- System engineering
- Industrialization & production
- Procurement
- Commercialization
- Log & support



- Core radar development
- Radar system engineering
- Technology management
- Radar system prototype building blocks
- Radar signal processing





### Roles on development

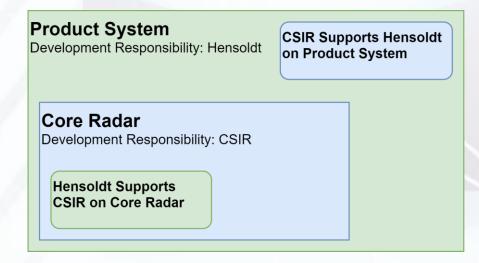
- Team and teaming design: Organisations supporting each other to form one joint engineering team
  - utilising the strengths of each organisation across the development

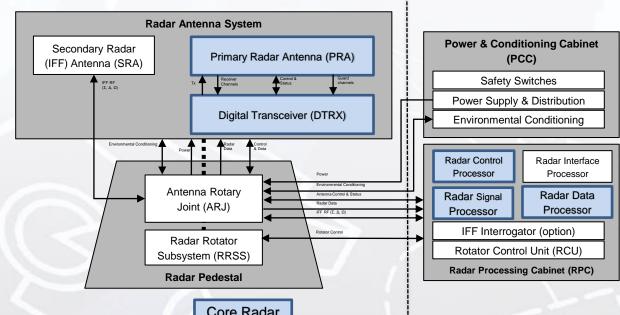
Colour Key

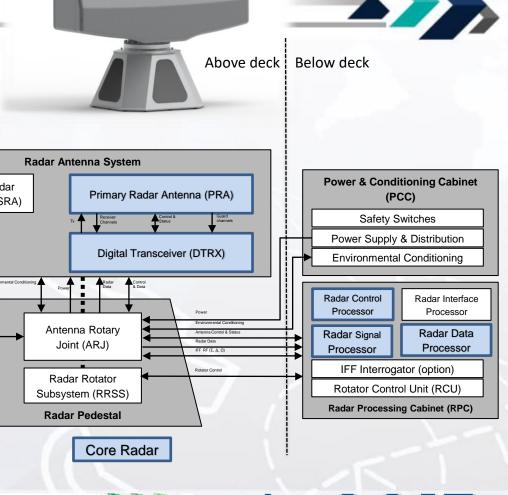
Hensoldt

CSIR

- CSIR role
  - Design authority on Core Radar sub-systems (common to both products)
  - Support product development
    - System engineering
    - Support overall system design
    - Support industrialisation











# Multi Mission Radar Small footprint - ideal for smaller combat vessels & auxiliary vessels

#### **Radar Antenna System**

- AESA antenna
- Guard channel antennas
- Digital transceiver
- Integrated IFF antenna (Mode 5 / S compatible)
- Liquid-cooled

#### **Radar Pedestal System**

- Pedestal
- Antenna rotary joint
- Antenna rotator unit

<850 kg above-deck mass



#### **Radar Processing Cabinet**

- Rotator controller
- Radar processors
- Interface & networking
- Cyber Security
- Optional IFF equipment

#### **Power & Conditioning Cabinet**

- Power Supply
- Liquid Cooling Unit
- Dry air supply



<850 kg below-deck mass



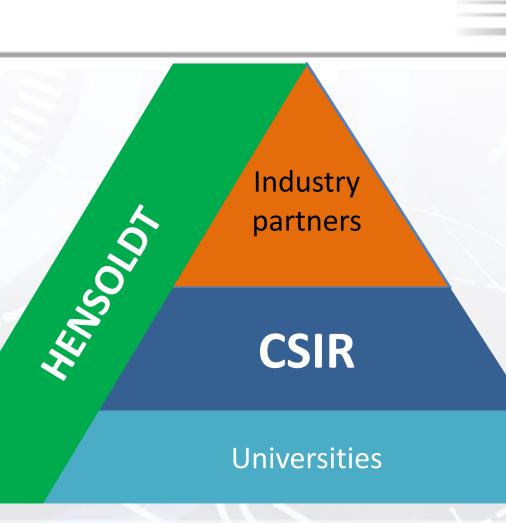
- Fault-finding
- Software update





## SA radar manufacture capabilities

- Key radar capabilities
  - Project management
  - -System engineering
  - -Radar design
  - -Quality
  - Logistics & support
- Partnerships
- Supply chain
- Life cycle support



## Develop radar manufacture supply chain in RSA industry



- University of Pretoria
- Buying houses/agents
- Experts in sub-system and component development
- SMMEs
- Production
- Testing



















## Challenges



Challenge	Approach to mitigate
Very complex system	Mutli-skilled, experienced system engineering team Digital Twin – MBSE, Detailed performance model
Multi-functional system	Diverse team with mixed skills and experience.
Multi-organisational project	Well-organized and structured team. Collaboration across multiple platforms.
Very ambitious schedule	Concurrent engineering – doing work in parallel
Tight budget	Adhered to the planned schedule
Supply chain challenges	Establish a dedicated Procurement team; Early procurement
COVID	Structured and organized the team to work remotely
Geographical separation	Integration through virtual platforms, e.g. MS Teams
Facilities	CSIR complex facilities (e.g. Anechoic chamber and roof testing ) Establish new facilities – Radar laboraoty at Hensoldt Cape Town Use other facilities – IMT, Houwteq, RDM, ARMSCOR, etc.

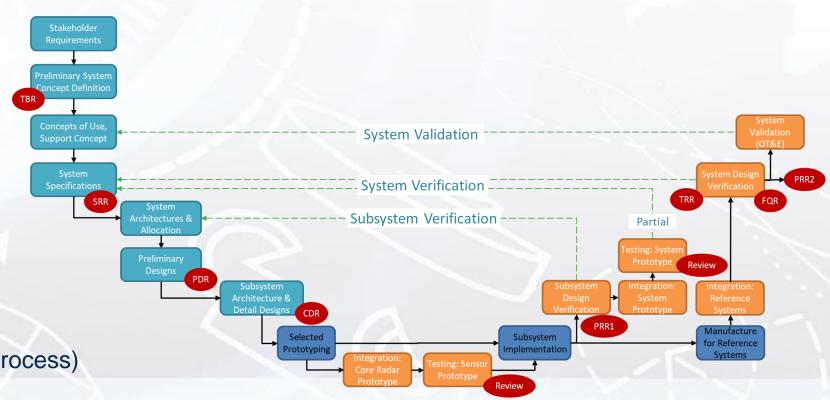




## System engineering process



- V&V model
- Software development process (Waterfall vs Agile)
- MBSE Tool
- Review process
- Baselining process
- Engineering models
- Record keeping & control (config process)



# Overarching engineering approach Concurrent engineering



### Development model

- Hybrid evolutionary/agile approach with defined stage gates
- In contrast to traditional waterfall engineering (stage gates)

### Implications

- Concurrent activity on all main activity lines
- Very close interaction and joint functioning of engineering teams between all the participating organisations
- Require extensive coordination, communication

### Concept design

Detailed design

Implementation and lowerlevel design verification

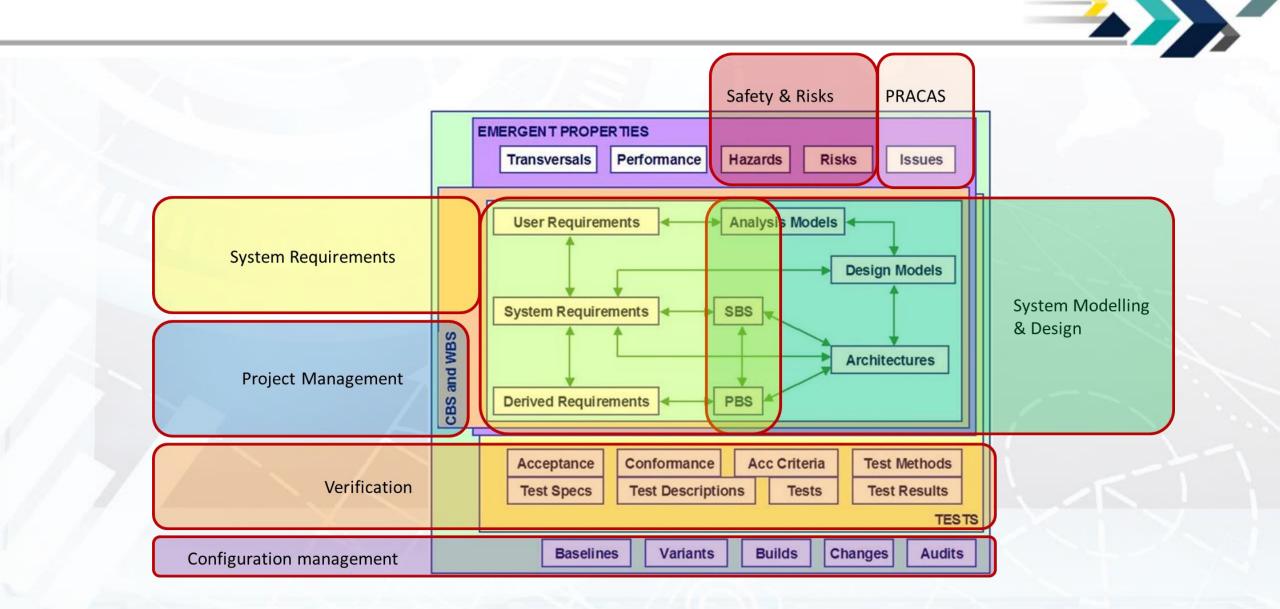
Integrate development models and reference systems

Design verification

Industrialisation



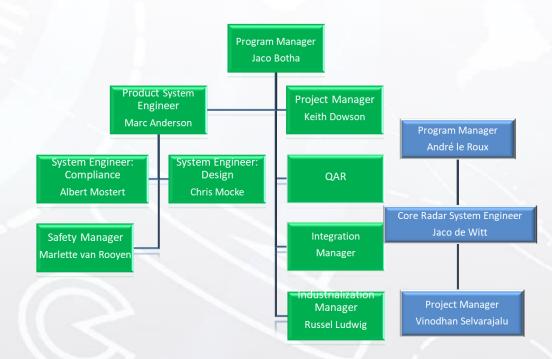
## Model based system engineering



# Lessons learned Organisation & process



- Trust in the partnership
- Project organisation
- Contracting models with suppliers
- System engineering process and tools
- Team integration (IPT)
- Communication & reporting
- Risk management
- Stakeholder management (reviews and steering meetings)







## RSA flagship radar development program



- Proudly South African
- South African IP
- Build radar capability
- Job opportunities
- International sales opportunities







