*Technology Work Session for the South African Army; Hosted by the CSIR*

# Autonomous and Remotely Controlled Systems


## Roadmap for Unmanned, Autonomous and Remote Systems

Dr. Nick Rubin
CSIR Defence, Peace, Safety and Security

Date: 2012-Apr-20; Fri

CSIR
our future through science

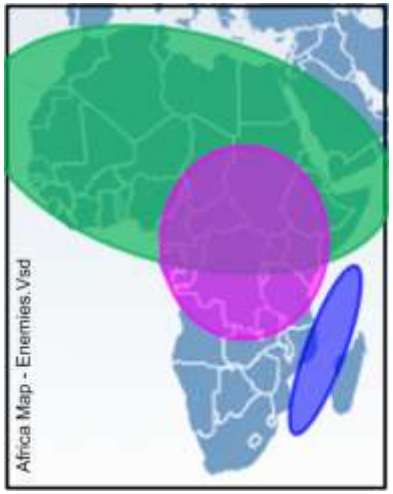
# Outline of presentation

- Assessment of User Needs driving technology
  - Traditional conventional enemies
  - Emerging drivers
    - Market Competitors and Global Threats
- Outline of 10 year roadmap
- Mop Up - FIBUA, comms relay, UUV systems
- Wrap Up – Conclusions and SANDF Implications
- SA Army Technology Competitor Assessment
- Current SA UAS capabilities
- UAS deployments in rest of Africa

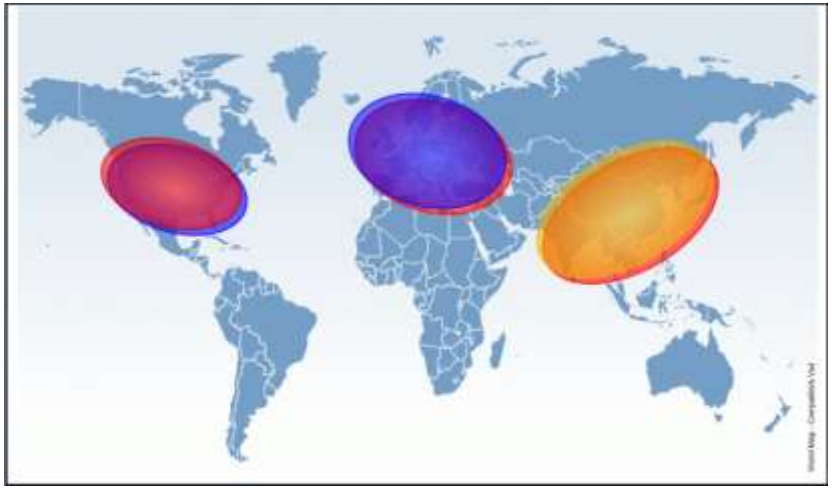

 

# Enemy, Competitor and Threat Benchmarking

Enemies:




Competitors:



Traditional <u>enemies</u> associated with armed conflict

- Armed militia in areas where SA undertakes peacekeeping operations

<u>Competitors</u> may be at state, industry or business level

- Competitors in the military technology areas

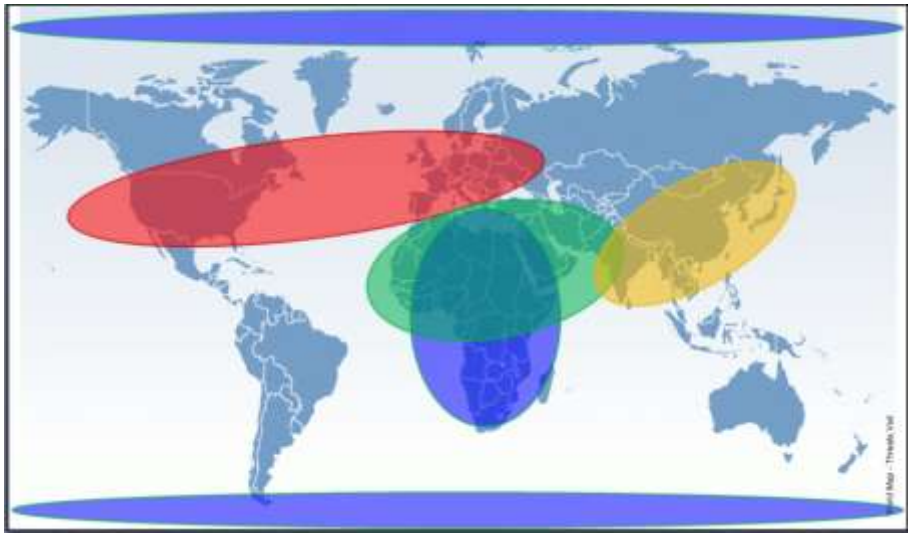


CSIR our future through science

# Enemy, Competitor and Threat Benchmarking

Threats:



Threats are high level adversaries not in the above categories

Trade, sovereign debt, climate change, ideological and terrorist threats

Can act over a distance without hostile actors

Can precipitate unexpected enemies and competitors



# Enemy, Competitor and Threat : Implications

Enemies ➔ Baseline need for sovereign defence

➔ Peacekeeping operations a restrained form of this

Surveillance and information gathering are cost effective defences

Unmanned systems potentially highly cost effective force multipliers

Market Competitors ➔ Hurt GDP and foreign debt

➔Technology and expertise lost

Maintain local continuity, cannot be switched on on-demand

Threats ➔Can precipitate enemies and competitors

➔ Eco-threats can threaten national survival

Mil. and Civ. UAS fore-warn against long term and long range threats



# Competitor Assessment : Implications

Local Uptake

- Small local appetite or demand for UAS of any sort

Export Challenges

- Internationally, early entrants reaped benefits of “first to market”
- Late entrants fail to attract funding :
  - Carrying development costs penalty which established OEMs don’t have
  - Further down the capability / cost curve
  - Marketting to sanctioned nations can tar the OEM

# Rest of Africa UAS deployments : Implications

Potential shared use of data & intel in joint peacekeeping missions

- Marketting entry point : using SA UAS side by side with competitors

But possible hostile use against peacekeeping forces and within SA

- Counter-UAS defences a niche that has not been exploited yet.

# Proposed UAS Roadmap - Motivation

Why a roadmap ?

Create the broad vision for future development and operation of UAS

Motivate for rapid integration of existing technologies

Identify opportunities for new applications

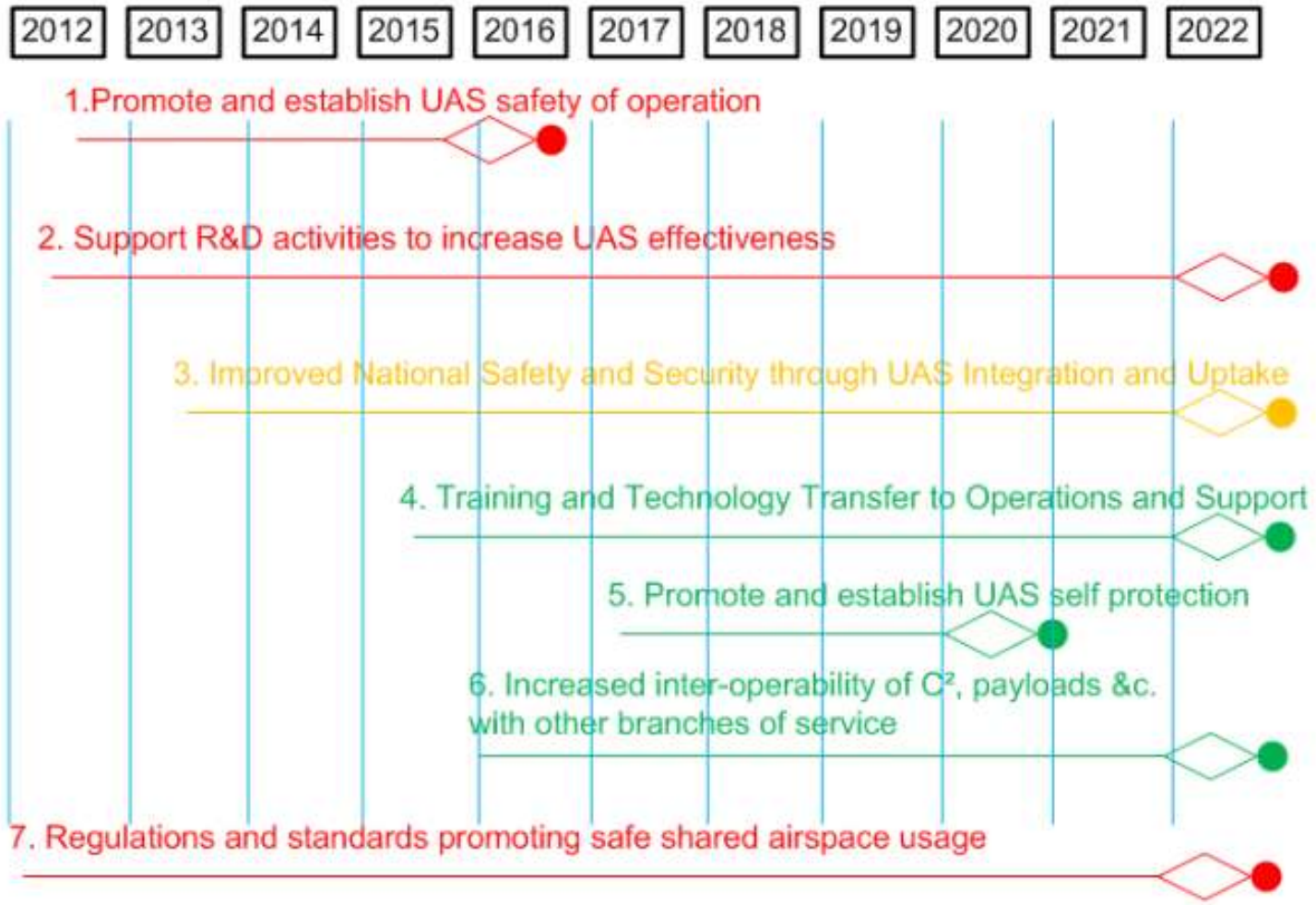
What a ten year roadmap supports

- Defence Applications
  - Smart Buyer advice and Smart User support
  - Ten year anticipation - order of acquisition cycle : ROC → Fielding
- Civil / Commercial Applications
  - Self-sustained uptake driven by growth business opportunities
- Industry and R&D Houses
  - SA could have a competitive UAS industry again



# UAS Roadmap - Goals





# UAS Roadmap - Objectives

1a-c Safety of civilian life; of own forces; anti-takeover

2a-c Stakeholder needs; op. requirements; early validation

3a-b Share technology with arms of service; shared test and evaluation

4a-e Simulator aids; training programmes; commonality with Civ/Com training aids; field reliability and survivability

5a-e Self destruct safeguard; overrule safeguards; anti-jamming; self-preservation; secure data and comms downlinks

6a-b GCS harmonisation; standardised architectures and open system I/F

7a-d Collab. on International Regs and Stds; adoption and enforcement of certification reqts; sense and avoid; interim operation of R&D and MIL UAS systems



# Other Aspects : FIBUA

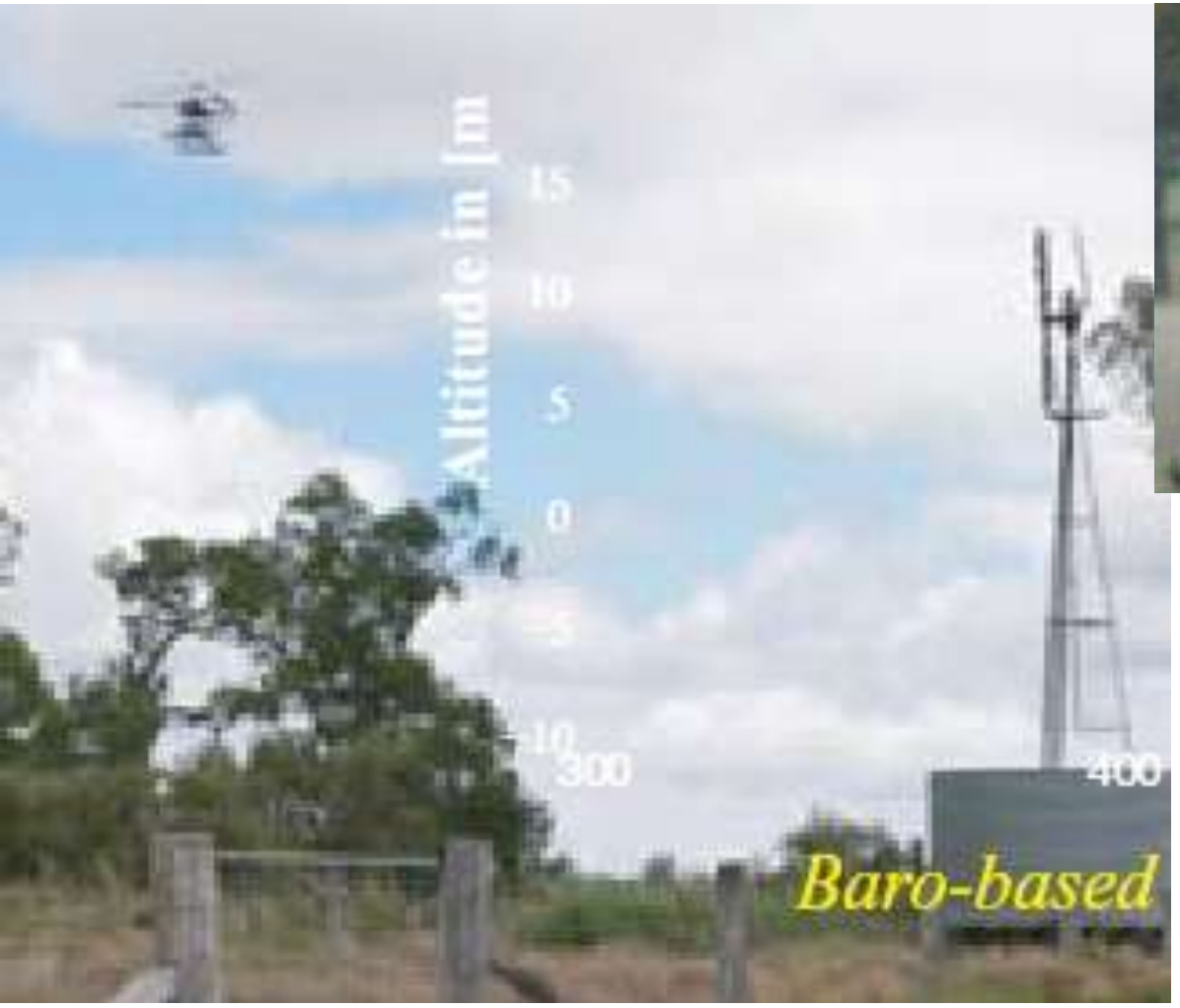
## Architecture of US Army, NASA Obstacle Field Navigation System


Finding: 3D map building and trajectory planning more Effective than 2D slices of 3D space.

CSIR
our future through science

# Other Aspects : FIBUA

## CSIRO LIDAR based reactive obstacle avoidance





Bio-inspired, reactive methods use optic flow to compute an avoidance manoeuvre => lower mass and complexity



CSIR our future through science

# Other Aspects : UUVs used in SA

IMT UUV

R&D on navigation and control

- Photonic INS system with GPS updates when on the surface
- Wireless communication via the antenna when surfaced



# Conclusions and implications for SANDF

UGV advances in robustness and reliability

→Increased application of these militarily, for dangerous and hazardous missions

UAV current and future African usage patterns

→ Potential advantages and threats of competent users

→ Military use of commercial UAS

→ Rapidity of technological advances driven by market competition

Unmanned Aircraft Systems 360° survey

→ SA Army can assess suitability of existing, proven UAS given roles and budget

Field evaluation of man-portable UAS for SANDF

→ Direct stakeholder involvement, and local expertise and industry

SA UAS Roadmap

→ Needs driven by enemies, competitors and threats – SANDF buyer and user

→ 7 goals, to build on current capabilities



# Thank You

Nick Rubin
NRubin@csir.co.za