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Australian Government

Department of Defence
Defence Science and
Technology Organisation

Micro-UAV Challenges

DST technical development and the implications for HADR capability

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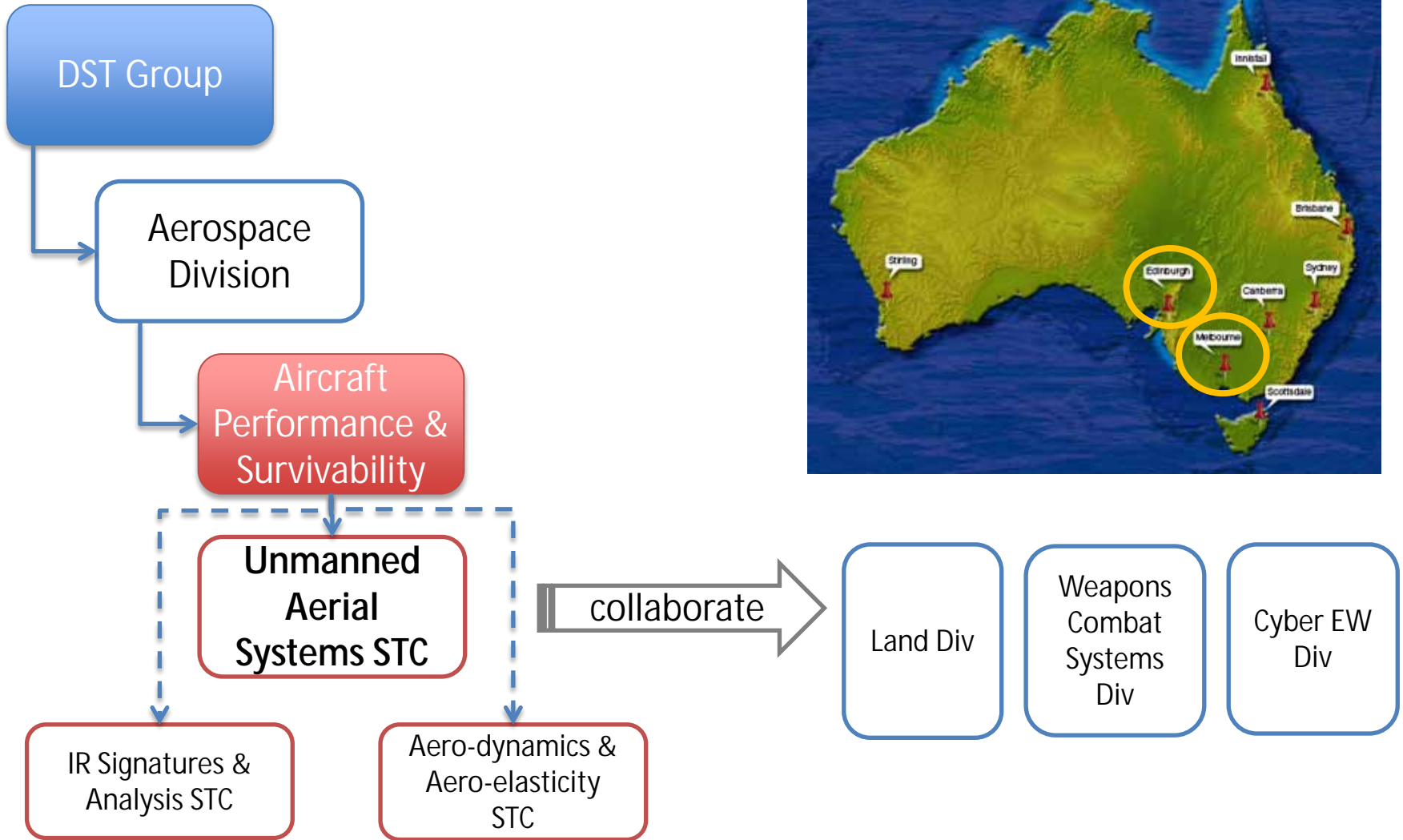
DSTO

Science and Technology for Safeguarding Australia

Structure

- DST's Unmanned Aerial Systems Science and Technology Capability (UAS STC)
- Complexities of HADR operations (from our perspective)
- Technology challenges posed by HADR
- Our research in this context
- An invitation to collaborate
- Summary

The UAS science and technology capability (STC)



Collaboration



Dr Jennifer Palmer and her team

Urban operations
Novel flight mechanics



Australian
National
University



Mr Geoff Brian and his team

UAS signature, materials and energy
Hybrid energy systems



University of
South Australia



THE UNIVERSITY OF
SYDNEY



THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA



Mr Kent Rosser and his team

Multi-modal navigation and guidance
Micro airframe control
Sensor integration



RMIT
UNIVERSITY



Urban ISR for
military or police
action



Chemical and
biological agent
localisation



Emergency
response



Humanitarian
assistance and
disaster relief



Navigation, command, and control

- Collision avoidance
- Assured communications
- Active mapping and mission planning
- Control in large-scale turbulence

Miniaturised sensors

- Radar
- Night vision (SWIR and LWIR)
- Single-photon avalanche diode arrays
- Chemical, biological

Teaming and cooperation

- Human-machine teams
- Distributed mapping and search by robotic teams

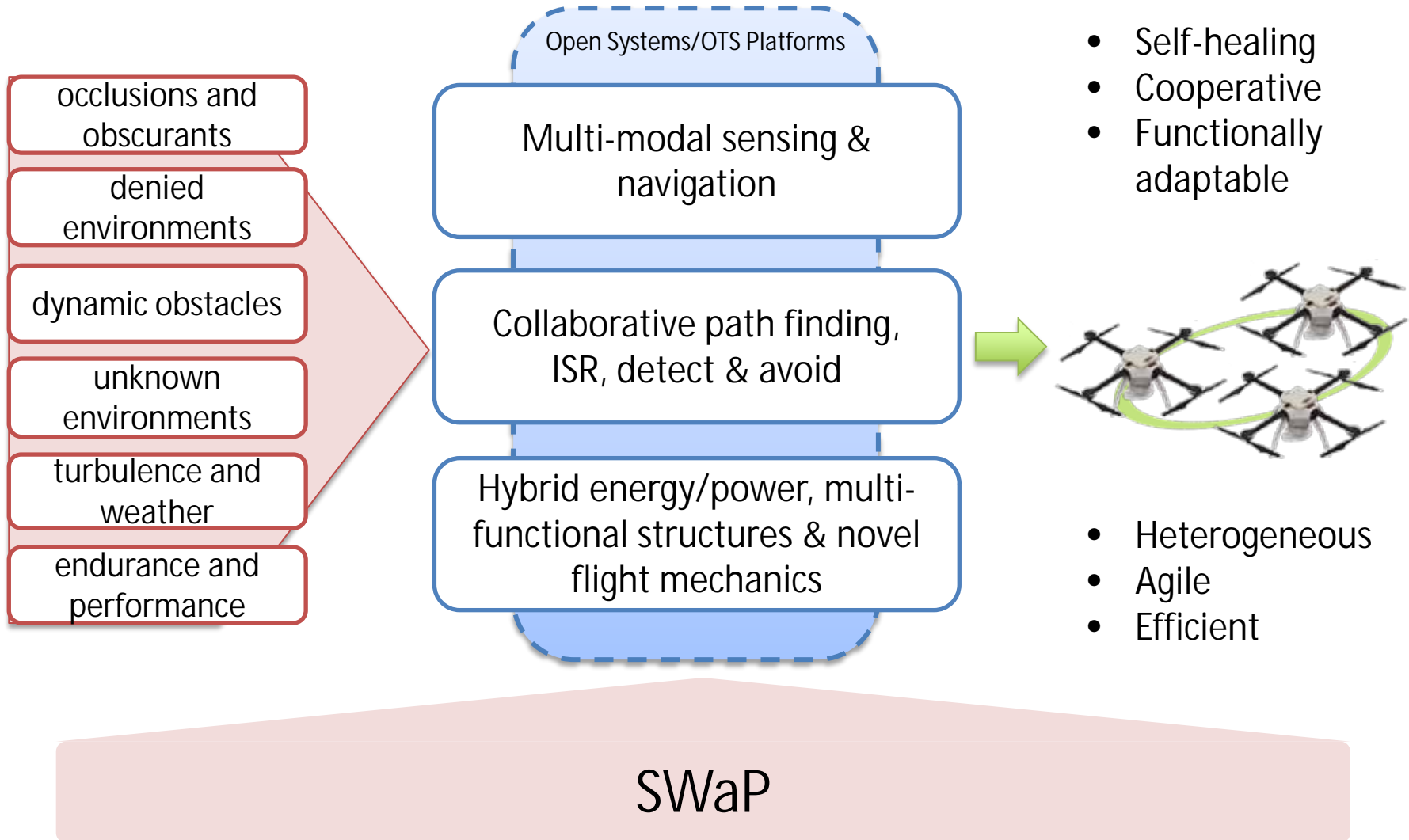
Multifunctional materials and integrated systems

- Integrated power and energy
- Embedded and structural antennas

Specialised platforms

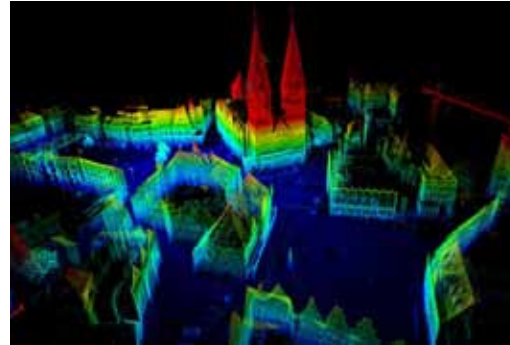
- Agile, efficient micro platforms for indoor operation
- Low signature rotary wing systems

Our S&T

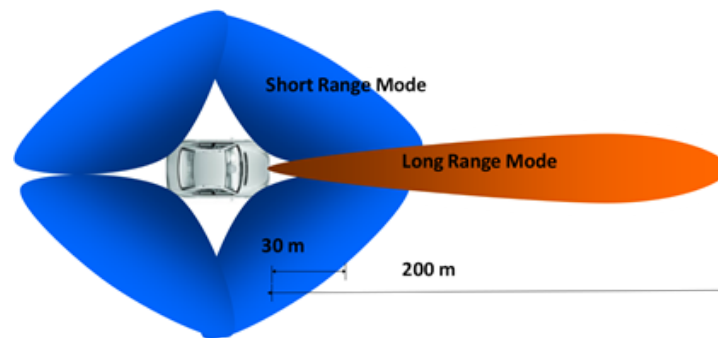
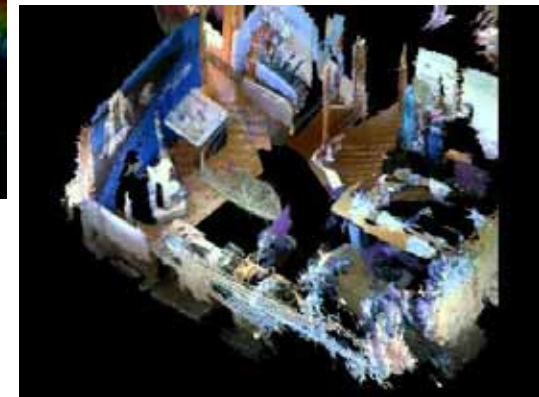


Urban UAS Ops

- § Adaptive control and active SLAM
- § Multi platforms, multi sensor
- § Multifunctional structures
- § Multi-system control architecture
- § Demonstration and validation



Novel multiplatform SLAM with chip based radar



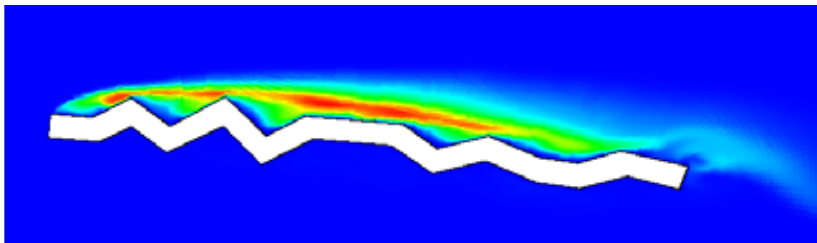
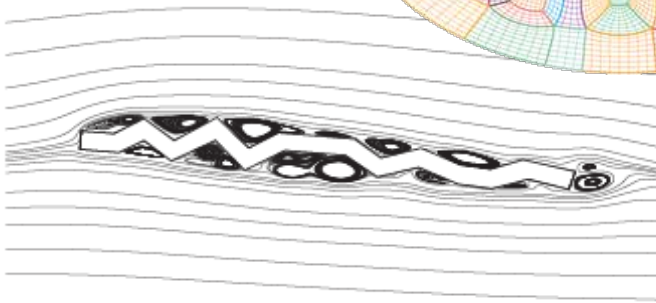
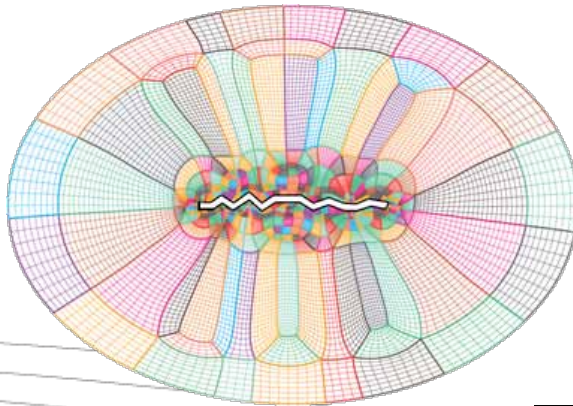
Closed-Loop Alternate Navigation Demonstration

- § Technologies for passive, closed-loop navigation of UAS
- § PA with DSTO / ARFL
- § Demonstration over 100km

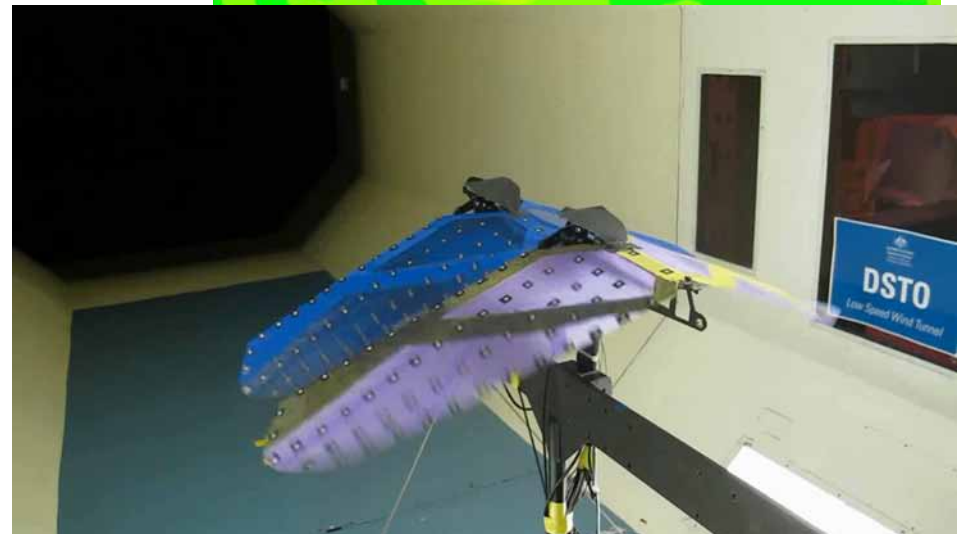
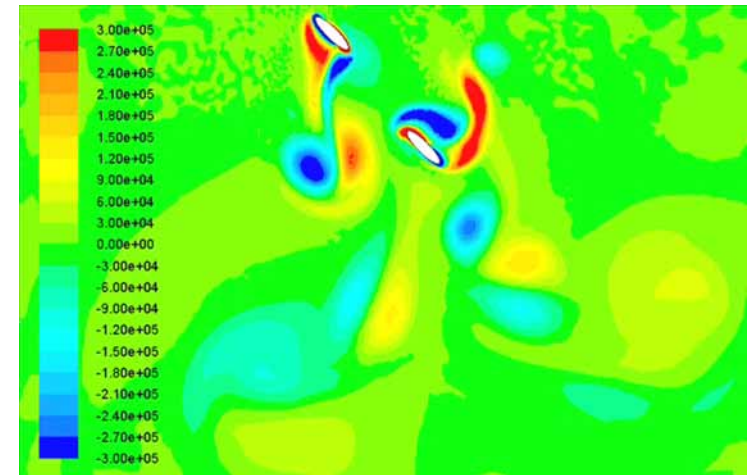


Bio-inspired flight

§ Bio-inspired aerofoil for fixed-wing UAS

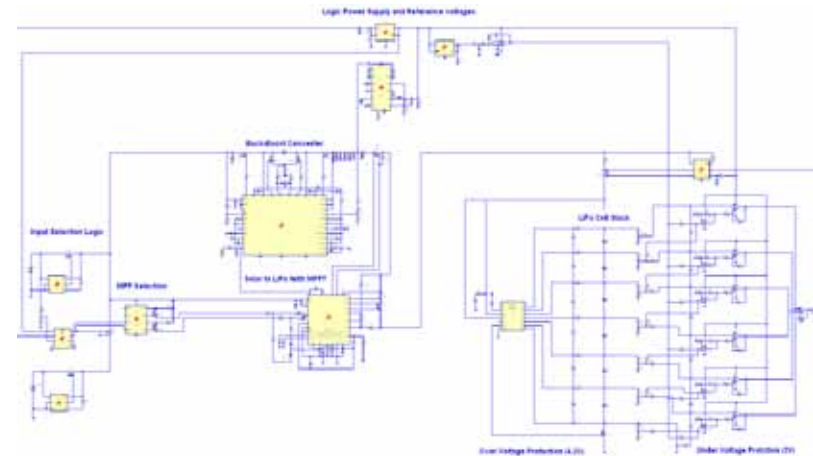
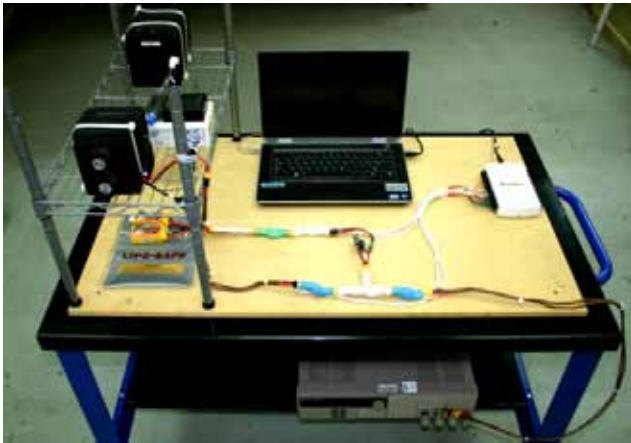
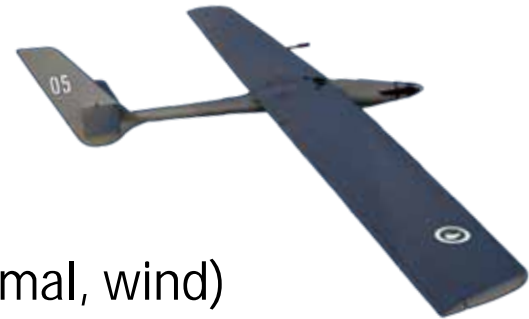


§ Flapping-wing UAS



Power management research for UAS

- § Adaptive energy management
- § Hybrid power systems
- § Power and mission optimisation
- § HiTL facility
- § Environmental-energy harvesting (solar, thermal, wind)



Key Messages

n-dimensional complexity for HADR

Whole of system view essential to meaningful HADR capability

Technical solutions exist in isolation, but not integrated

Open systems and open architectures for stronger collaboration

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