ASSOCIATION OF OLD CROWS

ASR DEFENCE

See smarter, act faster

"The next war will be won by the side that best exploits the electromagnetic spectrum."
Soviet Admiral Sergei G. Gorshkov, Commander of the Soviet Navy, 1973

"We have lost the electromagnetic spectrum."
Alan Shaffer, Pentagon's Research and Engineering Director, *2014*

Electromagnetic Combat

EW is over 100 years old (Russo-Japanese War) and has become quite sophisticated. Libraries, ELINT, SIGINT, COMINT, Electronic Attack, Deception, Denial, spoof, cyber insertion, paralyse, destroy…

Modern electromagnetic warfare -

Go Low SWaP using UAS, USVs – get in close $1/R^2$ advantage (kW to W)

Software Defined RF Systems – no longer fixed devices (digital RF)

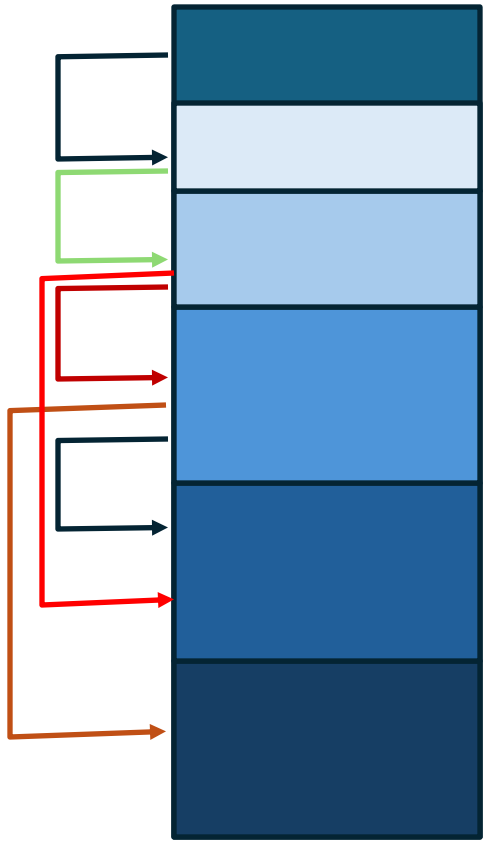
Reconfigurable RF systems (RF Digital-to-analogue – direct RF, functional materials)

Reconfigurable/multi-band antennas (Multi-Octave apertures – 5G, 6G driving this)

Radars/EW/Comms becoming one with multifunction apertures

Electromagnetic Combat Stack

Feedback loops



- Distributed controller/system optimisation
- Tracking/AI
- Resource management and control
- Software Defined Transceivers – waveform/matched filtering/frequency
- Dynamic/reconfigurable RF components (future functional materials will replace components)
- Multi-octave antenna integrated with RFSOCs, meta materials, DSP **at the aperture – especially phased arrays**

EW is Changing

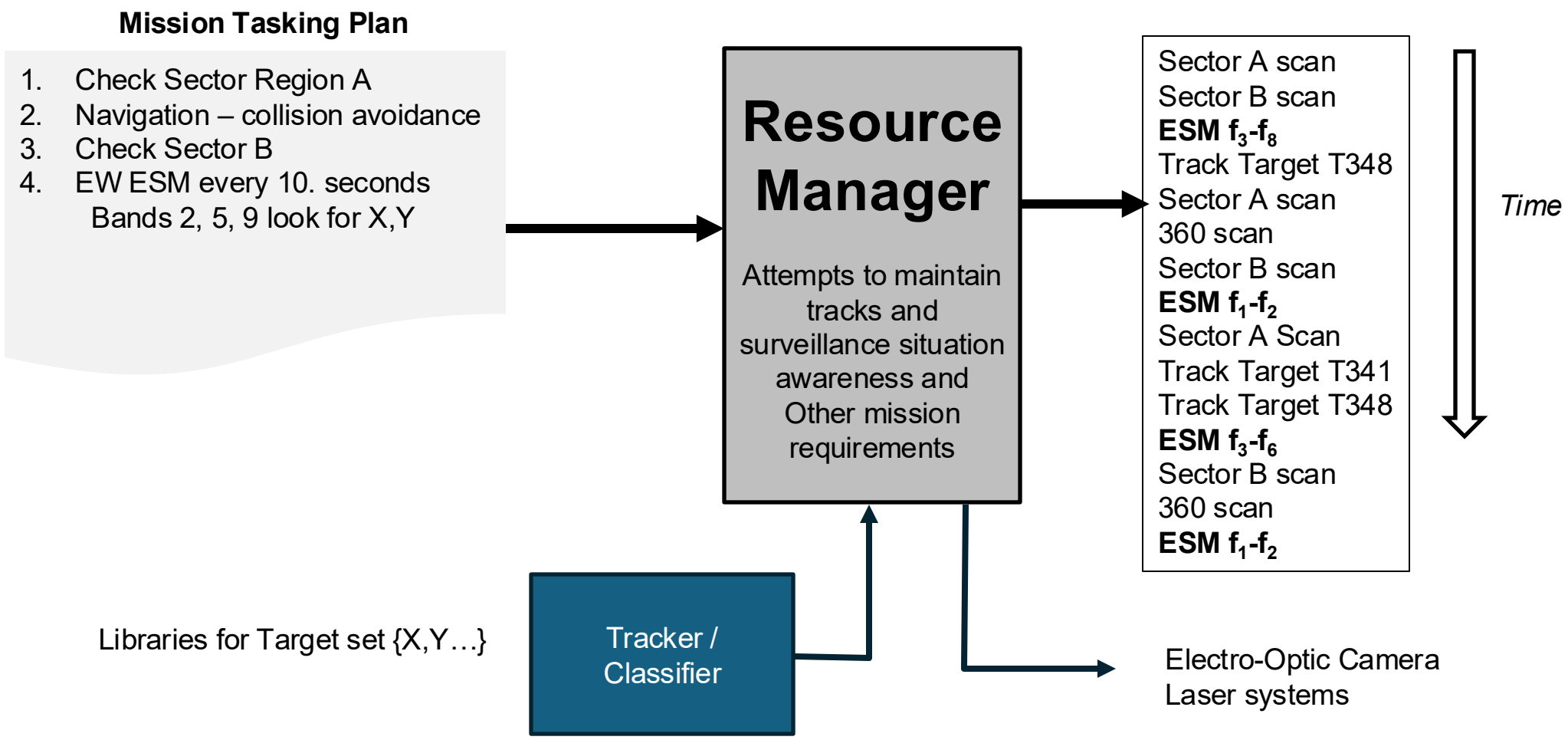
Modern Software Defined RF systems can transmit many types of waveforms across a very broad spectrum.

What is the signal descriptor library entry for:

- A radar that cycles randomly doing different functions
- Sector scanning using waveforms {1-M} with varying bandwidths
- 360 search using waveforms{1-N}
- Tracking or staring at a target with multiple frequencies (either simultaneously or sequentially)
- Has adaptive power control when illuminating targets?
- And perhaps cheekily is simulating other radars or communication systems

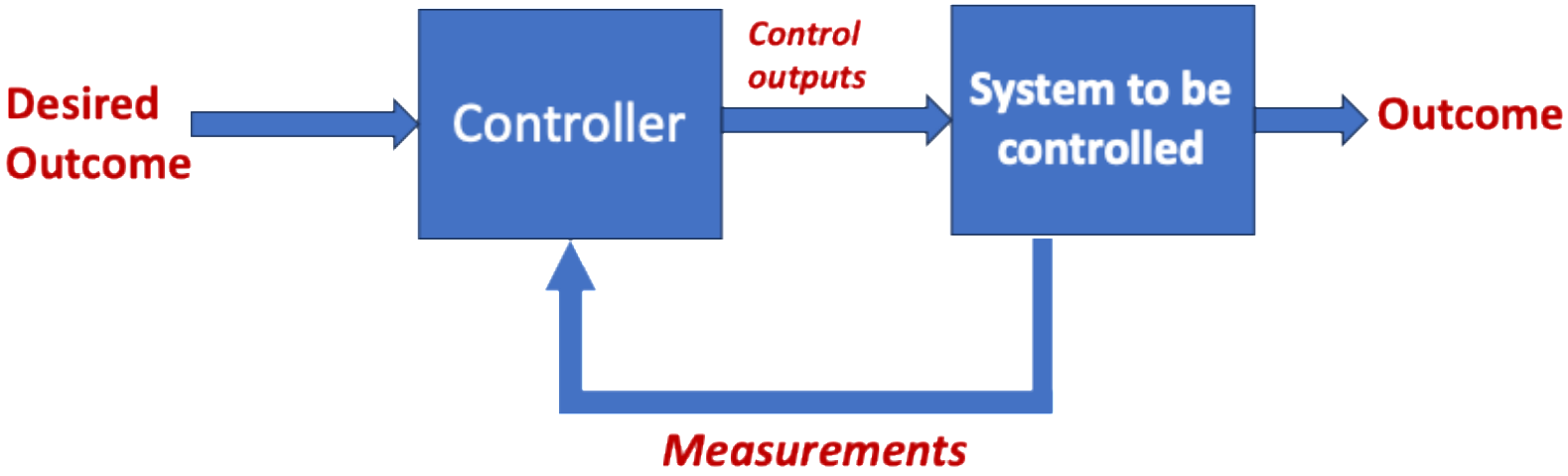
Modern Antenna systems can be multi-band – 5G/6G technologies driving wideband (decade wide).

Multifunction Sensors – Radar, Electromagnetic Combat, EO



No longer the purview of large AESA systems. ASR Defence is doing this in its Vanguard Low SWaP USV radar Single aperture does Electromagnetic Combat and Radar.

FEEDBACK- Stochastic Control and RL



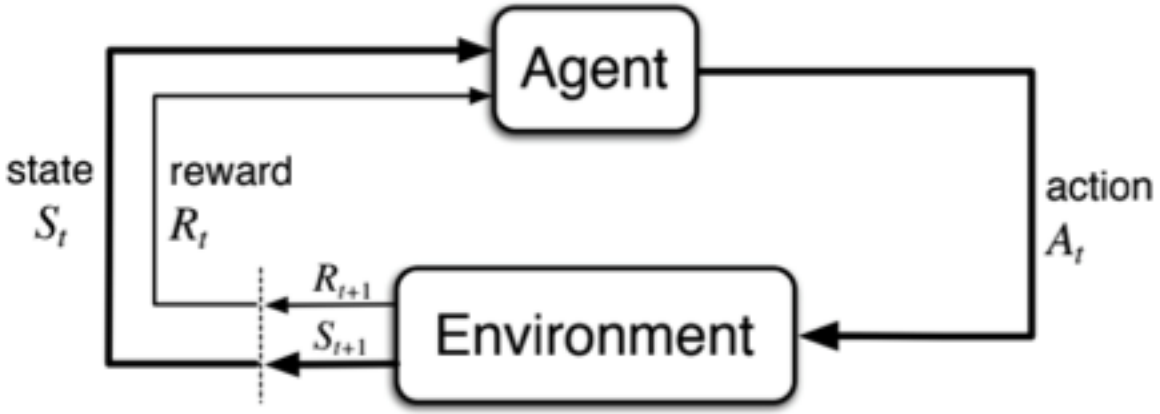
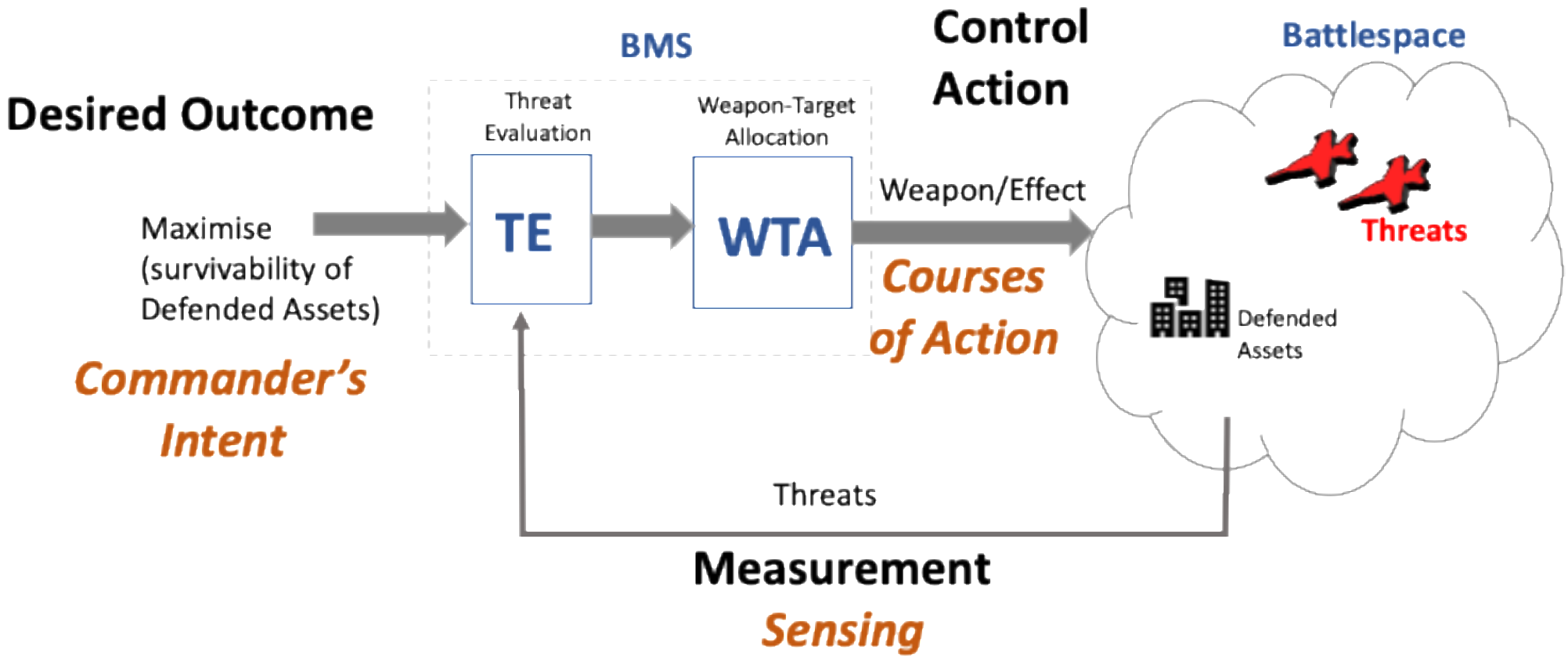


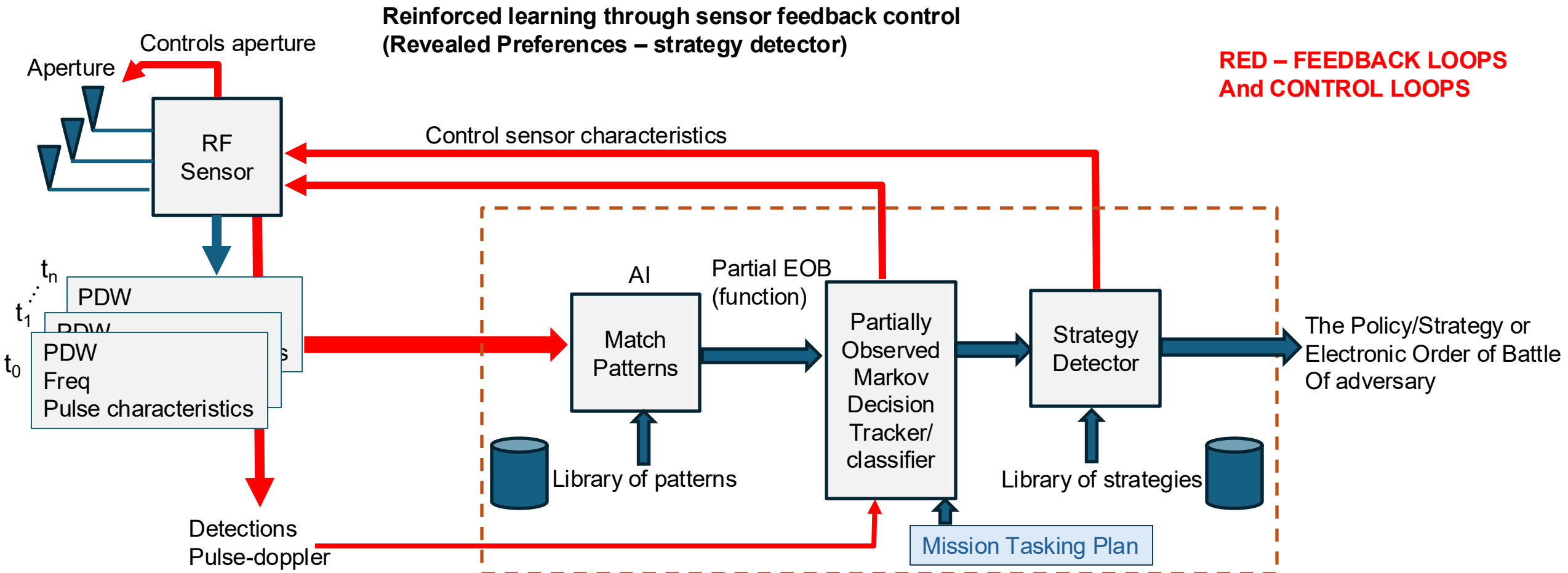
Figure 3.3: *Principle of operation of the MDP*

Battlespace Control



Future Electromagnetic Intelligence (ELINT, SIGINT, COMINT)

- Future Radar and Emitters – dynamic/adaptive RF
- Look for sets of playbooks or orders of battle – not specific emitters.
- Identify strategies – not devices

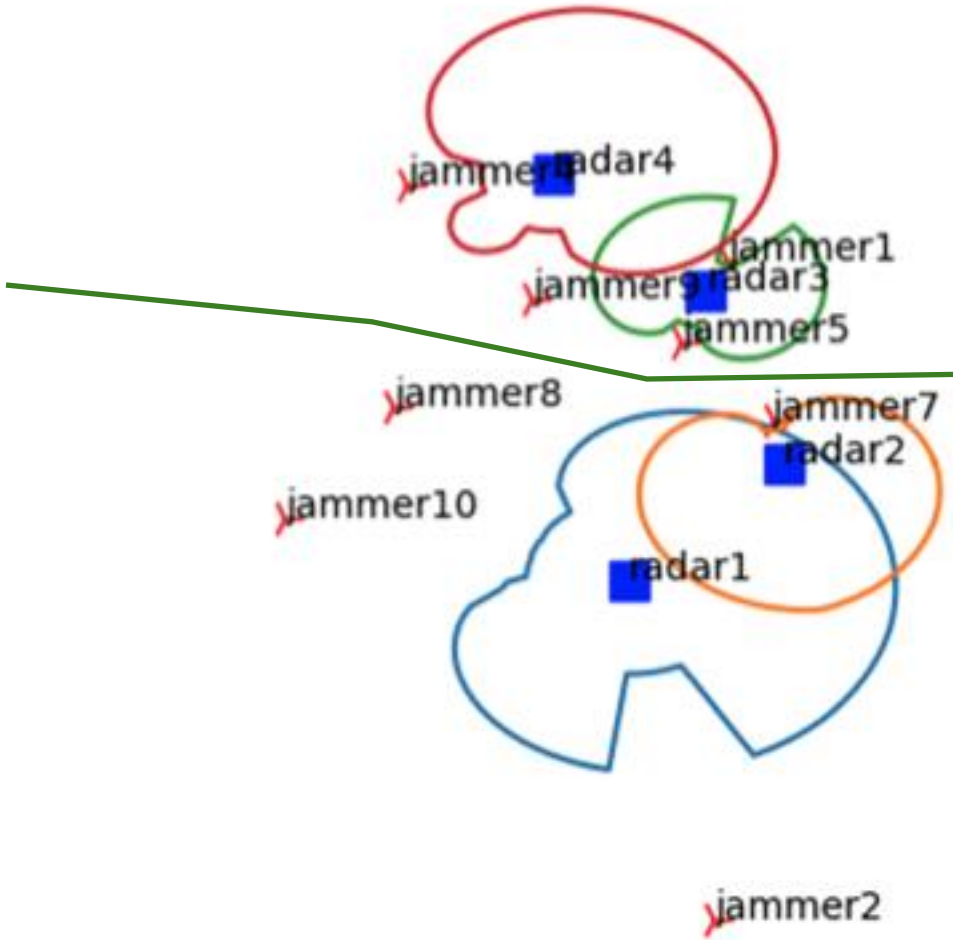


Autonomous Low SWaP EM Combat

- Radar and EW is one device
- Control-based Electromagnetic Combat
- Highly suited to autonomous systems
- Spatial diversity/Spectral diversity
- $1/R^2$ advantage of Low SWaP (Size Weight and Power) EW/Sensors
- Many platforms with Electronic Attack capability
- Cause EM confusion on the battlefield
- Maritime Concept of Operations - Systems lay dormant until they detect an anomalous signal.

Swarm SEAD

Suppression of Enemy Air Defences



Corridor for safe passage through GBAD sentries

*Acknowledgement: Esty Yap, L-P. Le Goc
ASR Defence/UoM/French Air Force
2022. “Swarm-Based SEAD”

Future Conflicts

- I can’t say “future” as ECT is here now.

The first wave may be mainly Electromagnetic

- Distributed coordinated EM effects
- Disable satellites
- Disable internet
- Disable communications in the battlefield
- Disable Air and Missile Defence
- Jam Drones
- High-end Patrol craft up against “low-end” platforms with lots of EM devices

The Demise of Regulations

Singapore PM Wong recently warned…”it is every country for themselves…”

- No more WTO

BUT…

- No more Geneva Convention
- United Nations?
- International Telecommunication Union? ACMA, FCC, ECC, NTIA….
- No more spectrum regulations
- Devices will have to “hunt” for free space in the spectrum.
- Like a mobile phone is multiple devices – RF devices will not have one function.
- A Radar will be able to use any frequency between L-Ka++ during a conflict – no one will stop it from doing that. Its antenna or RF components certainly won’t limit it.

Where is Australia's Electromagnetic Industry Base?

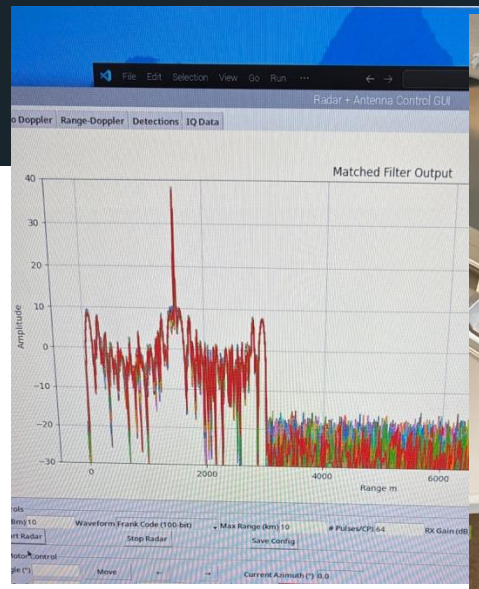
- CEA Technologies
- Raytheon Australia
- ADT/Penten
- JEDS
- Mellori
- Benelec
- Phasor Innovation
- QuantX
- Whipbird
- Consunet
- Defendtex
- RFTeq
- DEWC
- A2AD
- Others?
- ….ASR Defence - I hope

What is the Defence Industry program to drive and build this capability?…

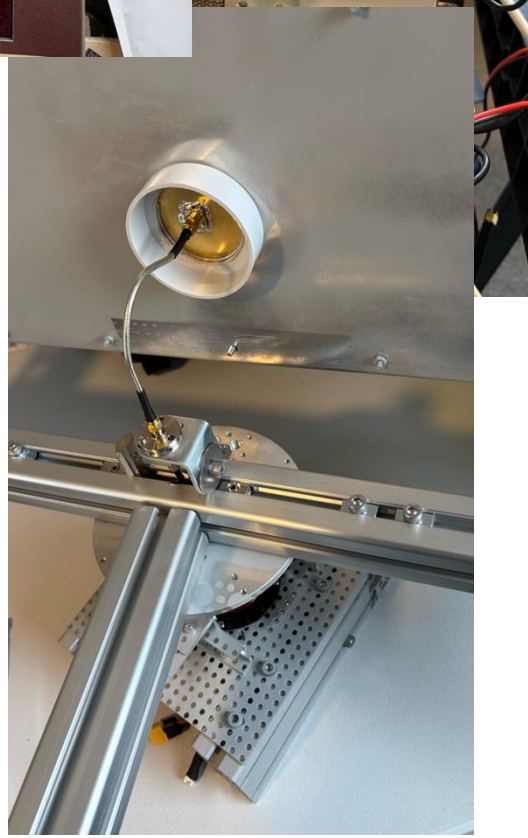
Focused on CURRENT and FUTURE threats?

Agile Labs

At ASR Defence…but probably typical of many other SMEs



Stack of 4 SDRs and Spectrum Analyser



SDR

- Ettus, HackRF, Nooelec

Computing

- Raspberry Pi 4/5, Arduino, Laptops, GPUs, Linux, etc
- NVIDIA Jetson devices

Workshop

- Mechanical workshop/Garage – Drill press, drills, tools, metal cutters, welding, wood cutting, screws/bolts, mechanical assembly (Maker Store mechano) GoBilda, positioners, encoders, motors, gearboxes.

RF Lab

- VNAs, Spectrum analysers, SigGen, oscilloscopes, Equip benches, horns, antennas, GPSDO, RF components (circulators, limiters, LNAs, PAs, up/down converters, cables, RF connectors/adaptors), power supplies (5V, 12V, 28V, 48V), portable Li battery power supplies for trials, soldering station, White Board

Approximately - $30k-$40k to setup + workshop tools

Australia and Electronic Combat Technologies

- **How will our existing EW systems deal with low SWaP EW/Radar/Comms devices in the battlefield?**
  - A system could be using Comms waveforms for sensing or the other way around.
  - A system may switch frequencies or even transmit multiple frequencies simultaneously
- Our Industrial base needs AI and cyber, yes, but also deep tech in Electromagnetic Combat Technologies. This is hardware, Low SWaP commercial off-the-shelf adaptations.
- Large scale production and access to RF infrastructure.
- Supply chain access to chip sets (RFSOCs), FPGAs, RF components.

Supply chain for Ukraine and Low SWaPC OEMs

1M-1GHz 2W 37db RF Power Amp 1M-1000MHz Br
VHF UHF Transmitters

1 - 9 Sets $21.50

10 - 29 Sets $21

Contact supplier | Chat now

Recommended for you

150W Anti-Drone **RF** Signal Modules 500-2500MHz Wide Ban...

US$200-1,000

Min. order: 1 piece

Drone Defense Detection **RF** Power Amplifier Module 10W 2300-...

Ready to Ship

US$45-60

Lora VCO DDS M
UAV Module 10W

Ready to Ship

US$38-45

US Made Devices – Prices $5000 - $50000
+10% tariff. 3 Month lead time.

AliExpress

Ina 40db

amplifier

5.0 7 Reviews | 84 sold

ChoiceDay · Welcome deal Ends : Aug 6, 16:59 AEST

AU$1.55 Save AU$52.53

AU$54.08

Tax excluded, add at checkout if applicable ; Extra 1% off with coins

Color: Without battery

Related items

1W RF Power Amplifi...

AU$33.39

Nanovna MAX2180 H...

AU$411.39

15PCS Radio Film Var...

AU$33.79

1PCS Key Press 2W 5...

AU$53.69

AD8138 Single Ende

AU$13.39

Agile ECT - suggestions

- Government **Support Infrastructure for EW OEMs**
- **AOC facilitate** the ecosystem – much like ADSUN does for defence
- **ECT Maker Space per region** ($15m establishment, $3m a year to run) perhaps associated with an industry or University
    - Brisbane
    - Townsville
    - Sydney
    - Melbourne
    - Adelaide
    - Perth
    - Darwin
    - Hobart
- **Government Grants for Agile Labs** (e.g. $25k-$30k per Lab/company) $1m/year
- **Project JP9999** – Electromagnetic Combat Technologies – run by a Project office within DSTG. $60m a year over 5 years. Renewed every 5 years following a Continuous Improvement review.
- Total: $65m a year, $325m every 5 years.
- BUT – **Manufacturing/access to supply chains for equipment/chipsets**? What is our appetite for Made in Asia/China? vs battling high costs and long delivery times as we stand in line with Agile Labs in the US and Europe?

“The spectrum is a bad place to be second, and if we lose in the spectrum, or are unable to affect the spectrum, the joint force will lose, *and we’re going to lose very quickly*.”

Col. Josh Koslov
(U.S. Air Force, Commander of the 350th Spectrum Warfare Wing)
2024

ASR DEFENCE

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