

Rotary Wing Platforms

Delivering Information Advantage to the Joint Force

Brief at DSEI, London



—
September 2019



Overview

- Future Operating Environment
- Information Advantage
- Rotary Wing Capabilities
- Rotary Wing Platforms
- ISR Sensor Capabilities
- Demonstration Activities
- Concluding Remarks





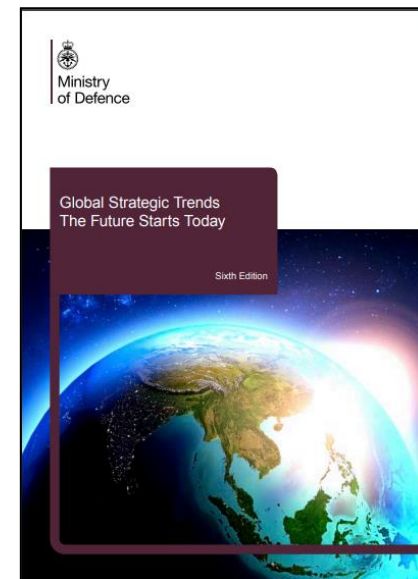
Future Operating Environment - Trends To 2035+

- Future operating environment will be complex, unstable, uncertain; information will be pervasive
- Adversaries will threaten the stability of rules based international order
- Anticipate state-on-state and non-state competition, contested access to and control of all domains
- Bringing influence to bear on adversaries, stakeholders and audiences will be more complex, yet will be required to deliver future strategic, operational and tactical success
- Provides context to Joint Concept Notes 2/17 Future of Command & Control, 1/18 Human Machine Teaming and 2/18 Information Advantage
- Basis of Capstone Concept for Strategic Integration (CCSI) / Integrated Operating Concept (IOpC) that will define how (UK) Defence will operate and fight by integration across all domains and information environment



Joint Concept Note 1/17
Future Force Concept
Published by the UKMoD;
July 2017

Informed by Global
Strategic Trends
5th Edition

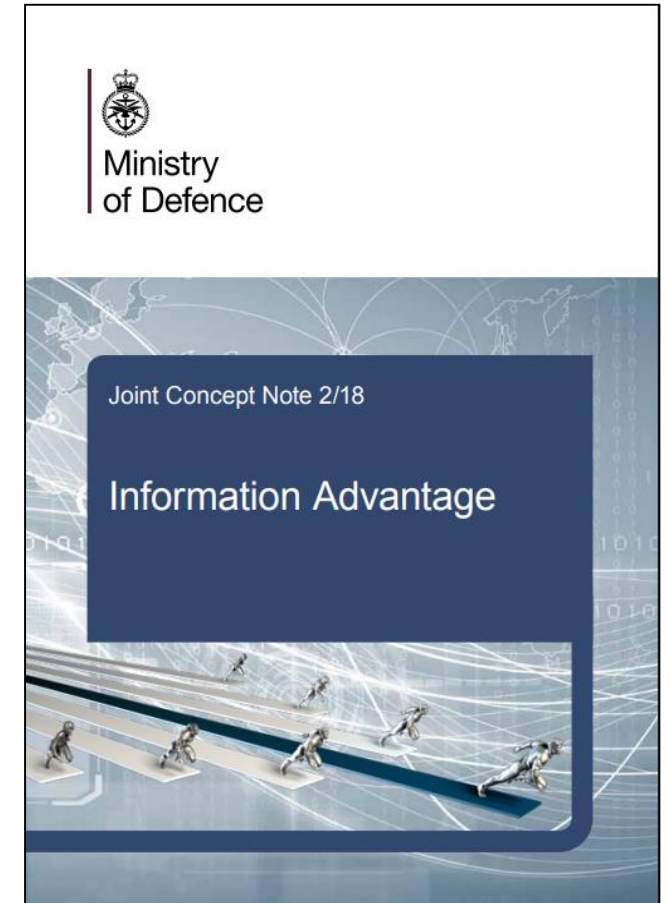


Global Strategic Trends
6th Edition
Published by the UKMoD;
November 2018



Information Advantage - Context

- Propaganda and disinformation is not new – however, the ease, global reach, speed of propagation of ideas, efficiency and low cost of such efforts, coupled with political sensitivity to national and global opinion is
- Defence must therefore become a more potent and agile actor; effective in constantly evolving sensing and shaping activity against adversaries
- Doing things differently requires better integration of information & physical activity across multiple domains – cyber, space, maritime, land and air
- At the joint force level, joint action seeks to undermine an adversaries will
- Achieved by affecting an adversaries understanding and capability through the integration of information activities with fires, outreach and manoeuvre to provide more options and greater potential to gain advantage in time and space underpinned by capability and will to escalate to the use of force

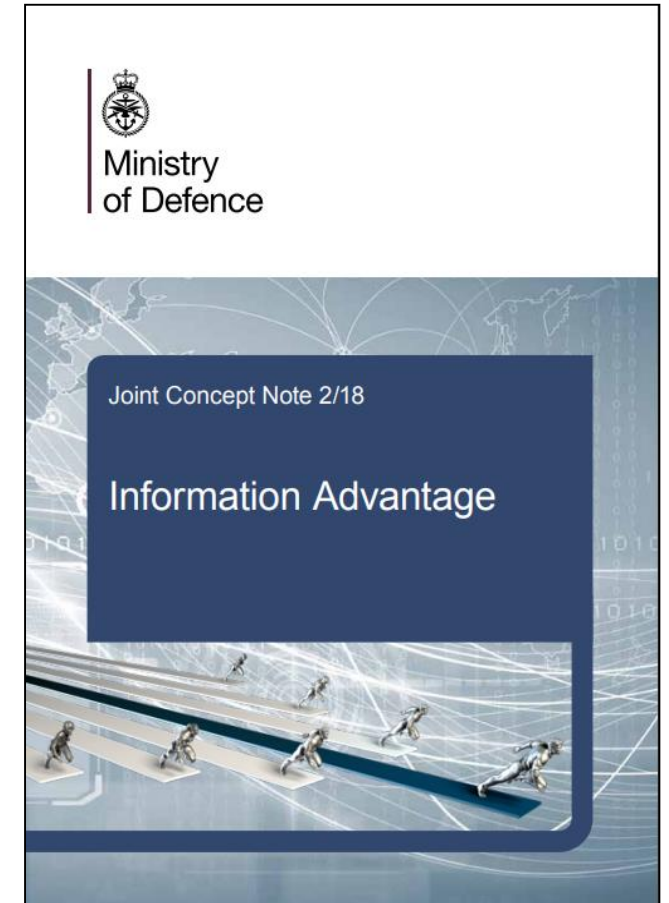


Joint Concept Note 2/18
Information Advantage
Published by the UKMoD; Nov. 2018



Information Advantage - Construct

- The credible advantage gained through the continuous, adaptive, decisive, and resilient employment of information and information systems
- **Information is a critical enabler** to understanding and decision making to enhance tempo and momentum; timely analysis and assessment will require more dynamic lateral networks allowing decision making to be delegated and exploitation of the most relevant information at speed
- **Information resilience** is an essential element for deterrence and defence against hybrid threats – multi-layered and multi-spectral ISR systems will help deliver agility, contingency and offer ability to continue when attacked
- **Information denial** to degrade an adversaries understanding will include concealment and deception though to jamming across the EM spectrum
- **Information as an effector** to stakeholder understanding, perceptions and behaviour by integrating and synchronising kinetic and non-kinetic activities across the physical and virtual domains



Joint Concept Note 2/18
Information Advantage
Published by the UKMoD; Nov. 2018



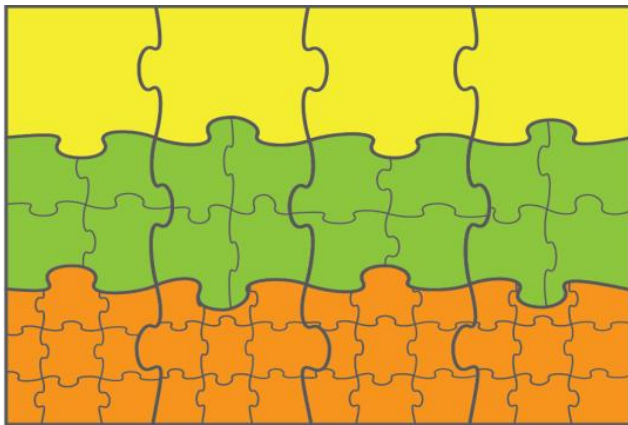
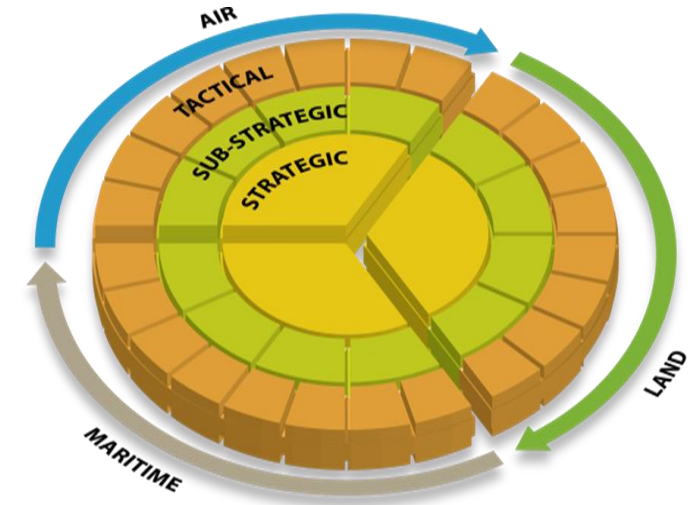
Information Advantage - ISR Collect

- Normally the first capability a commander requests to increase upon the initiation of military operations often increased ISR operations persist even after major combat operations have ended
- ISR defined as an activity that synchronises and integrates the planning and operations of sensors; assets; and processing, exploitation and dissemination systems; in direct support of current and future operations; this an integrated intelligence function encompassing ISR, AEW, C2 and Battle Management Systems
- Balanced and combined ISR force has multiple layers, overlap and redundancy to provide commanders with confidence to make decisions - combined ISR information is far more valuable than the sum of its parts
- Layered ISR includes strategic satellites, large manned fixed wing aircraft and high altitude long endurance unmanned systems and tactical smaller manned and unmanned fixed wing and rotary wing systems
 - Provides coverage - not every sensor/platform can detect all activity and no sensor can be everywhere
 - Enables substitution of one capability for another to achieve the same effect
 - Provides operating economics substituting expensive manned with unmanned or cheaper platforms
- Rotary wing contributes to resilience of a layered ISR system with ISR enabled platforms operating from dispersed sites on land and at sea and typically embedded within the joint force structure in numbers

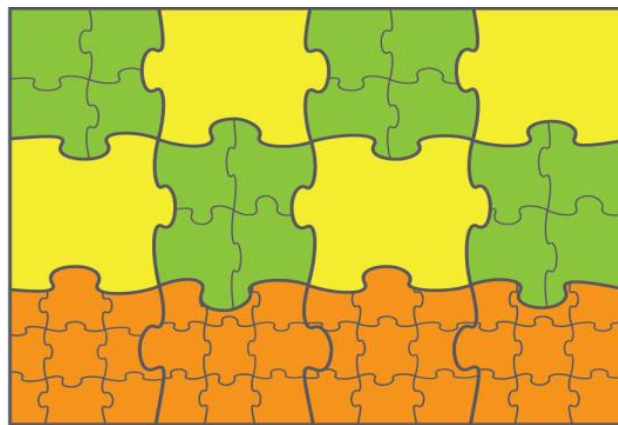


Information Advantage – Trends in ISR Collect

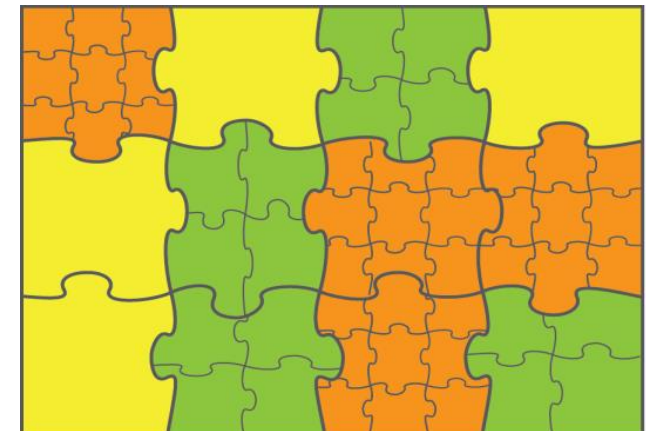
- Boundaries between strategic and tactical ISR are blurring:
 - cost pressures and potential vulnerabilities to emerging threats resulting in reduced fielding of high cost strategic assets
 - Increasing levels of sensor, mission management and tactical processing capability combined with increasing networking capability mean that all aviation assets can be ISR Collect platforms
- Joint approach to develop Common Operational Picture using full range of ISR Collect assets required - any Platform, any Partner integrated to provide strategic picture



Traditional ISR Collect



Strategic / Sub-Strategic Mix



Strategic / Sub-Strategic / Tactical Mix



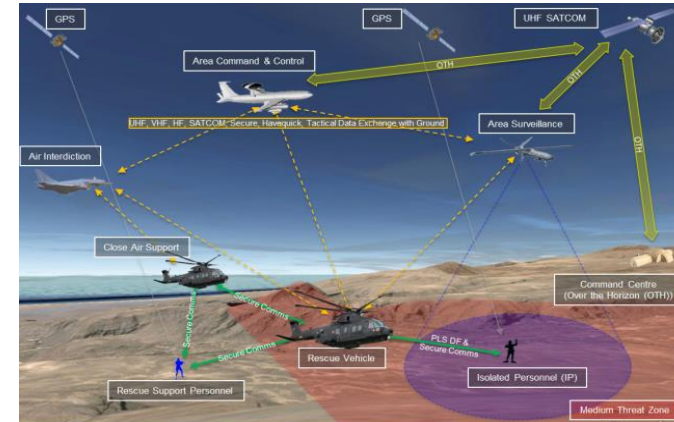
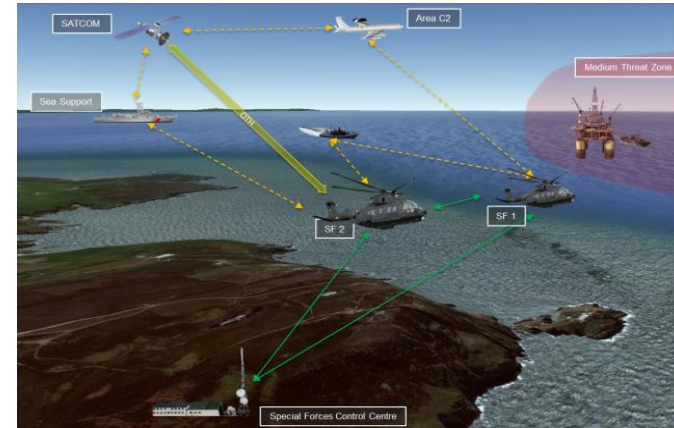
Implications for Rotary Wing Operations

Future Operating Environment

- Operate efficiently as dispersed elements to mitigate threat of massed weapon effects and reassemble to deliver decisive effect
- Reach, sustainment and mobility required to conduct opposed theatre entry and manoeuvre in contested environments
- Urban operations will increase requiring manoeuvre and mobility in urban terrain and precision weapons to minimise collateral damage

Information Advantage

- Collect, Process and Disseminate ISR information to C2 nodes, vehicles, soldiers and other air assets using on-board sensors, processing and data-links to disseminate actionable tactical battlefield data / imagery to the force
- Integration into robust multi-path communications networks that deliver assured, secure resilient connectivity between Collect, C2 and User nodes to enable widespread sharing of coherent and aligned information to improve interaction of force elements and broadest distribution of decision making
- Transmission and receipt of concise actionable messages, clearly articulated to increase information integrity, resilience and confidence





Rotary Wing ISR Capabilities

Collect

Electro Optic / Infra-Red Device with Laser Range Finder

Tactical Processor / Mission Management Computer

Electronic Warfare suite incl. RWR and ESM

LPI Surveillance Radar with GMTI, SAR, ISAR, SpotSAR capabilities

Communications Intelligence (COMINT) System

Mission Data Recorder and Data Transfer Device

Process

Integrated Cockpit Displays including Tactical Plot

Optional Cabin Crew Mission Console

Secure Line of Sight / Beyond Line of Sight Communications

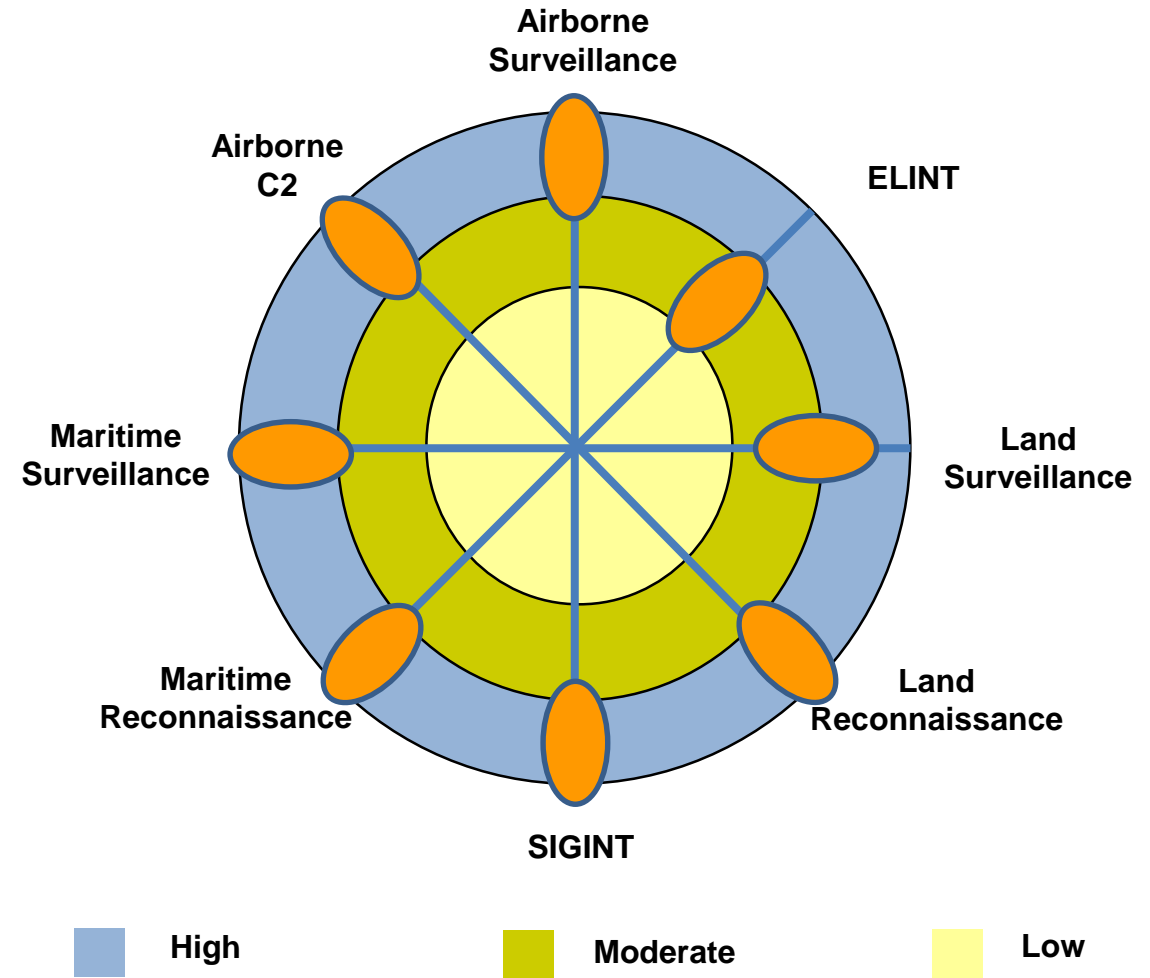
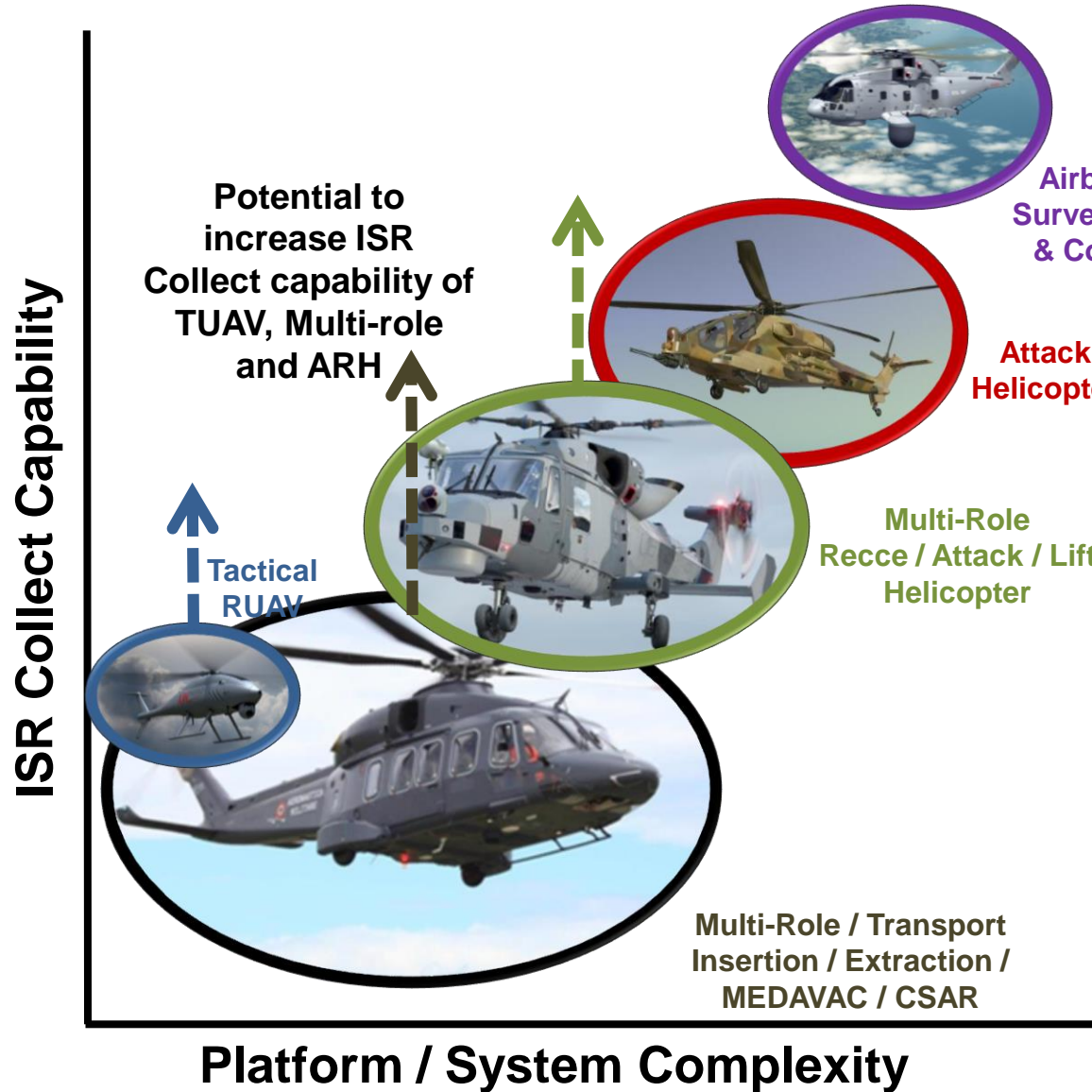
Tactical and wideband data links for data, imagery and video

Disseminate



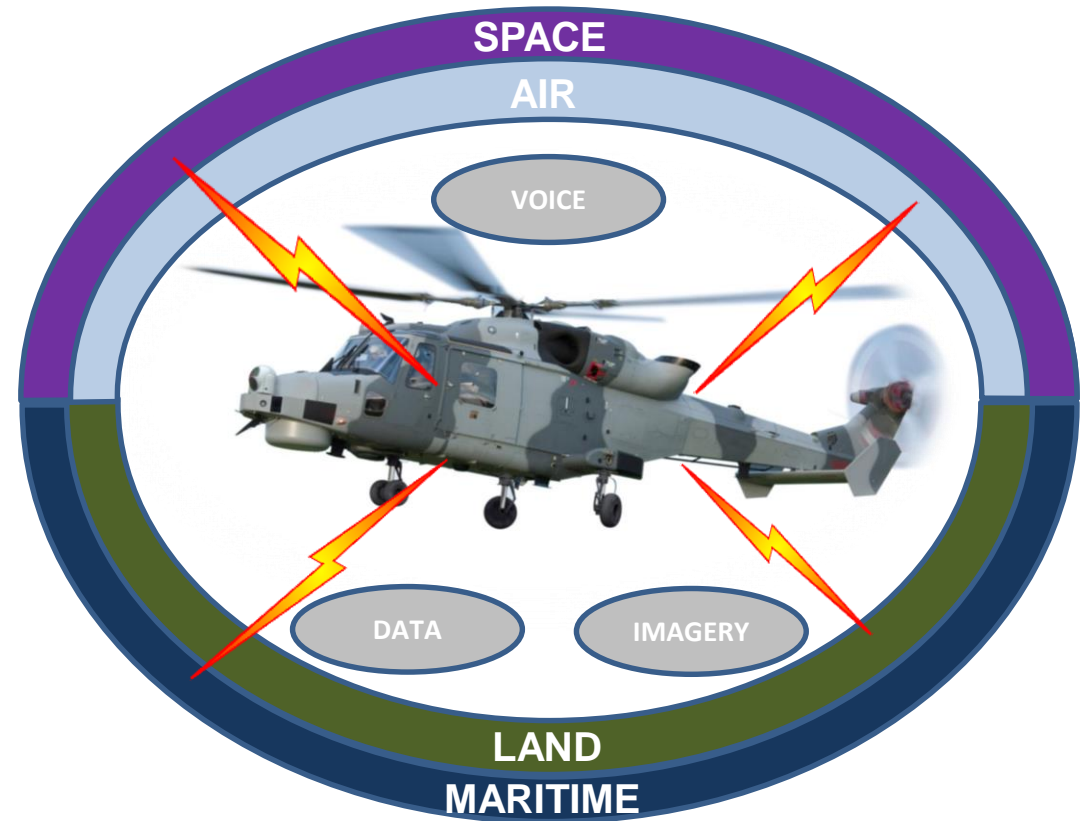
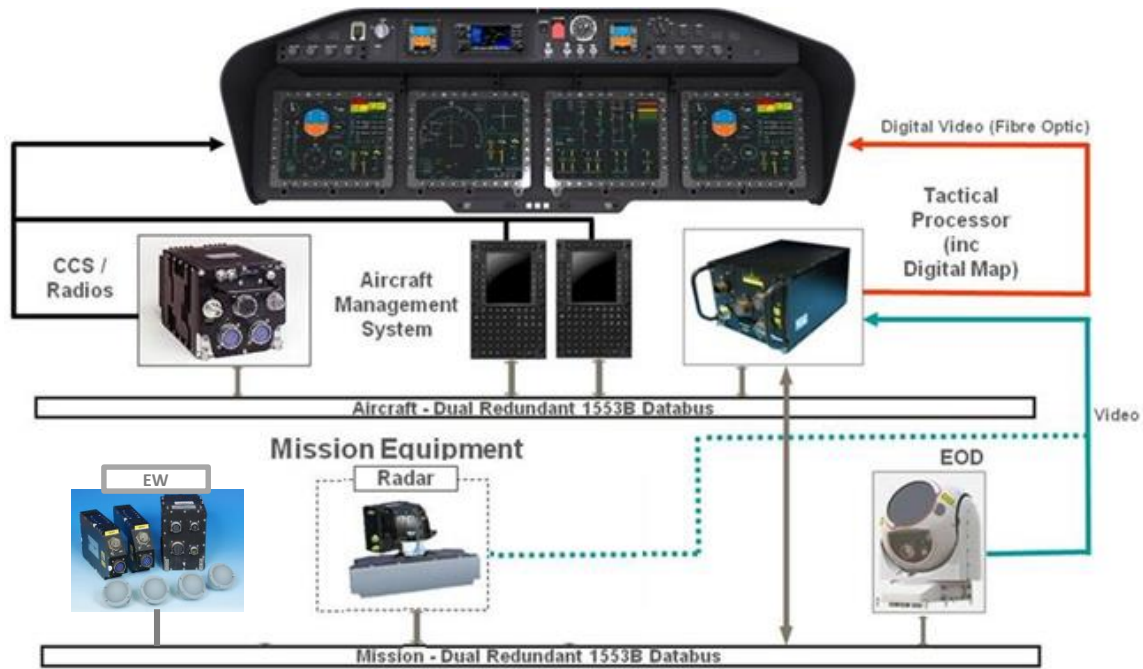


ISR Collect - Rotary Wing Battlefield Platform Capability





Digital Rotary Wing Platforms – Sensor / Platform / Network Integration

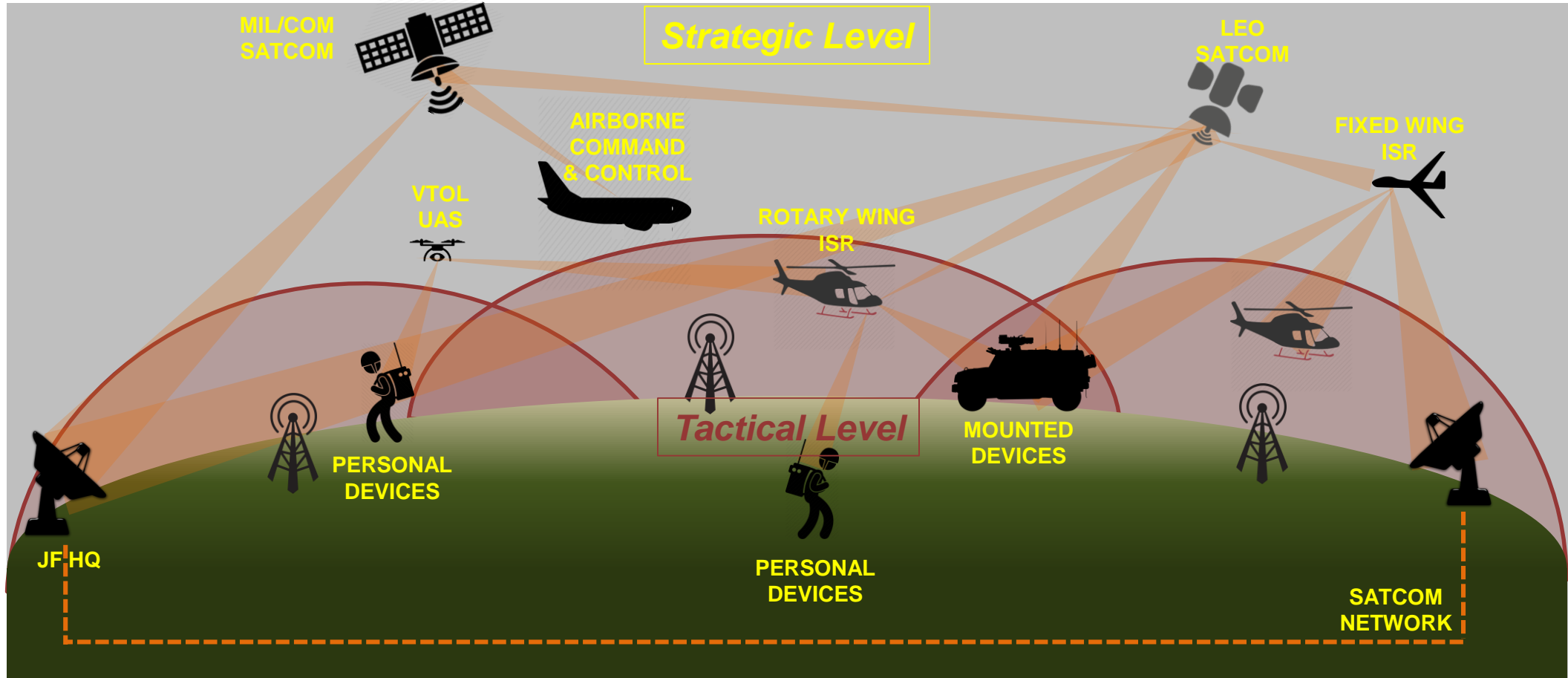


Sensor / Platform Integration

Network Integration



Network Integration



Rotary Wing ISR contributes to resilience of a layered ISR system – potentially less vulnerable than larger assets as more platforms operating from dispersed sites – proving tactical and sub-strategic ISR



Rotary Wing Platforms – Multi-Role

7 tonne class AW139M – Best selling in class; selected by United States Air Force (Boeing MH-139)

- NVG compatible VFR/IFR glass cockpit, FMS, DAFCS and Digital Map
- EO/IR sensor, EW systems detect and identify targets; ground surveillance radar capable
- Tactical communications and datalinks enable transmission / receipt of data.



8 tonne class AW149 – Cost effective, survivable battlefield capability

- Next generation helicopter with battlefield capabilities derived from AW101
- NVG compatible VFR/IFR glass cockpit, FMS, DAFCS, Mission Management System (incl. Digital / Tactical Maps) and Mission Recorder
- EO/IR sensor, EW systems to detect and identify targets; ground surveillance radar capable



15 tonne class AW101 – World's most capable medium / heavy helicopter

- Combat SAR, Transport, Amphibious variants In service with Italian Air Force, RDAF, RN
- ASW, ASuW, AEW, AMCM variants in service with Italian Navy, Royal Navy, Japanese Navy
- Fully integrated NVG glass cockpit, FMS, DAFCS, MMS and Recorders
- Advanced EO/IR, EW systems and surveillance radars provide excellent ISR capability
- Wideband and tactical datalinks enable transmission / receipt of data





Rotary Wing Platforms – Multi-Role / Recce / Attack

3 tonne class AW109 Trekker – Latest evolution of AW109 military helicopters

- NVG compatible VFR/IFR glass cockpit, Flight Management System (FMS) and digital AFCS (DAFCS) reduce two crew workload
- Advanced EO/IR sensor enables rapid detection and identification of targets
- Tactical communications and datalinks enable transmission / receipt of data.



5 tonne class AW169M – newest generation type in its category; selected by Italy's Guardia di Finanza

- Leverages capabilities from AW139M, AW149 & AW101
- NVG compatible VFR/IFR glass cockpit, Flight Management System (FMS), Digital AFCS, Mission Management System and Digital / Tactical Maps
- Advanced EO/IR sensor and EW systems to detect and identify targets



6 tonne class AW159 – 5th Generation Digital Helicopter

- In service with British Army and Royal Navy performing ISR and Strike
- Fully integrated NVG glass cockpit, FMS, DAFCS and Tactical Processor
- Advanced EO/IR, Electronic Support Measures and Surveillance Radar
- Wideband and tactical datalinks enable transmission / receipt of data





Rotary Wing Platforms – Attack

6 tonne class AW129 and T129 Combat Helicopters

- AH-129D in service with Italian MoD; T129 development produced by TAI
- Advanced Targeting System incl. HMDS, IR Night Vision & Laser Range Finder
- Electronic Warfare package including Radar Warning Receiver
- Mission recording and data transfer device
- Network communications system including voice and data
- Interoperability and teaming with other platforms
- Mission system with situational awareness aids to reduce pilot workload



7 - 8 tonne class AW249 New Exploration & Escort Helicopter; in development for the Italian Army; offered to the international market

- Only new combat helicopter in design and development
- Open systems architecture to guarantee future growth
- Mission system with situational awareness aids to reduce pilot workload,
- State-of-the-art communication and battlefield management system for network centric battlefield
- Interoperability and teaming with other platforms





Rotary Wing Platforms – Airborne Surveillance & Control / Special Mission

AW101 (RN Merlin Mk2 CROWSNEST)

- Lockheed Martin lead programme delivers Airborne Surveillance & Control (ASaC) capability for Royal Navy's new Queen Elizabeth Class carriers
- Destined to work with 5th generation combat aircraft such as F-35
- Role fit high power radar and mission management system provides:
 - long range maritime detection and tracking capabilities enabling surveillance of the entire fleet and ensuring detection of potential surface and airborne threats
 - long range ground moving target detection and tracking



AW101 (AMI HH101A CAESAR Helicopter)

- In service with Italian Air Force for Special Operations, Personnel Recovery, SAR/MEDVAC and Slow Mover Intercept operations
- NVG Compatible cockpit, HMDs with Head Trackers
- Radar with GMTI capability, High Definition EO/IR, Integrated Electronic Warfare Suite/DAS, Mission Recording, Data Transfer Device
- Tactical and wideband datalinks for transmission / receipt of data





Rotary Wing Platforms – Tactical UAS

AWHERO - 200kg class Tactical UAS for Land and Maritime ISTAR operations

- Heavy Fuel Engine for military operations, 3 blade main rotor reduces noise
- Triple redundant Flight Management System and redundant power systems
- Nose and Fuselage Modular Payload Bays - EO/IR, AESA Radar, AIS, ESM, IFF, LIDAR, Hyperspectral Camera, Communications Relay – up to 3 concurrent payloads
- Air & Land Transportable in 20ft ISO Container; Maritime Capable



Command & Control and Payload Management

- Common Ground Control Station with Operator “In the Loop”
- Secure C2 and payload (wideband) datalinks – LOS 100km range
- Flight / Mission Planning and Re-planning using DTED map / Way Point Nav
- Auto-takeoff, Auto-land, Autorotation and Lost Link profiles



SW-4 SOLO – 1.8 tonne Optionally Piloted Helicopter

- SW-4 EASA certified; on board pilot enables remote operation in uncontrolled airspace
- Facilitates trials / demonstrations of latest unmanned systems / technologies
- Integrated FMS/FCS (Triplex architecture)
- Nose and fuselage payloads - EO/IR, AESA Radar w/ AIS, ESM, IFF, LIDAR





Rotary Wing Platforms – Future Capabilities

AW609 Tilt Rotor – Further, Faster, Higher

- Game-changing capability combining the vertical take off, landing and hover of a helicopter with the speed, range and altitude of an airplane.
 - Max Cruise Speed: 270 ktas
 - Ceiling: 25,000 ft
 - Max Range (dry tank, aux fuel): \approx 1,000nm
- Integrated ISR sensor and mission management capabilities
- Mission console in pressurised cabin



Next Generation VTOL UAS – Performance and Modularity

- Circa 2,000kg MTOW providing circa 1,200 kg Payload & Fuel (Trade Space)
- Endurance 12 hours w/ 125kg equipment
- Secure BVLOS operations over land; maritime operations in Sea State 6 plus
- Multi-role platform - Maritime Surface & Land ISR capable (Radar, EW, EOD)
- Transportable in ISO 20ft containers
- 50% of acquisition and through life costs of 6,000kg maritime helicopter
- Minimise manpower – lean manning / multiple-platform capable



“Thunderbird 2”
Large VTOL Aircraft with
Modular Cargo Bay



AESA Radar - Capability to support Ground Manoeuvre

- AESA radars herald a new era in lightweight, reliable, multi-mode radar technology for land and maritime environments
- Seaspray 7000 series integrated on AW159 Wildcat and fixed panel Osprey 30 (120° in azimuth and +/-30° elevation) integrated on AW101
- Osprey features a comprehensive, multi-domain mode suite:
 - Powerful air-to-ground modes:
 - High accuracy detection of low velocity ground movers
 - High resolution SAR imaging modes, compatible with change detection processing
 - Air to air – for detection and awareness
 - Air to surface – the radar also has a full range of long range maritime and imaging modes , including high sensitive small target detection and ISAR
- Specifically for the Battlefield Commander, the GMTI and High Resolution imaging modes, traditionally delivered by strategic theatre surveillance platforms, can now provide assured ISR support at the tactical level



Seaspray 7000



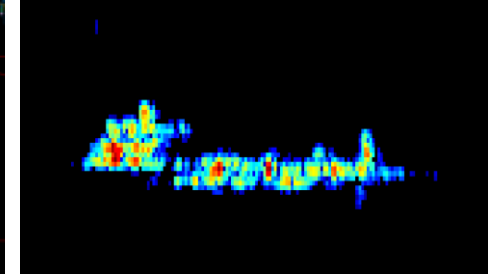
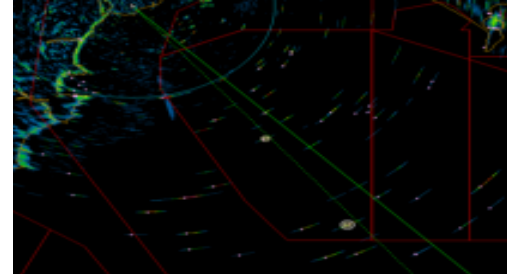
Osprey 30



Osprey 30 Mode Suite Offers Extensive Operational Capability

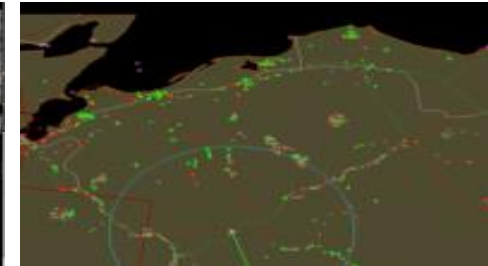
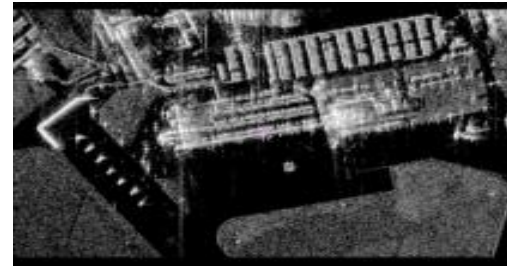
MARITIME

- Wide area, long range search and tracking (1000 tracks)
- Dedicated small target and maritime moving target detection mode
- Long range ISAR to aid classification and ID
- Integrated AIS
- Enables any host platform to assist in maritime SAR, homeland security and disaster relief



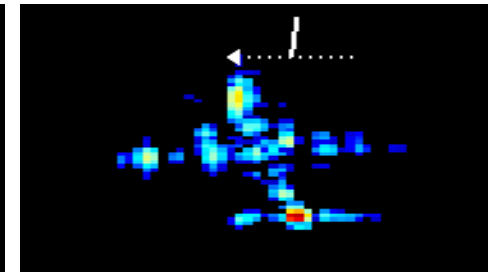
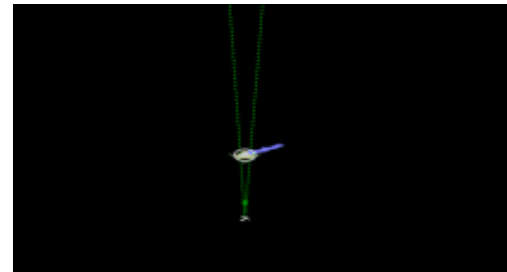
LAND

- High and Ultra-high resolution Spot SAR (NITF 2.1 compliant)
- Medium and high resolution Strip SAR (NITF 2.1 compliant)
- Low Minimum Detectable Velocity GMTI (STANAG 4607 compliant)
- Change detection over time with persistent surveillance



AIR

- Multi-channel Air-to-Air mode with TWS & Single Target Track (STT) functions
- Dedicated Weather Mode which can be interleaved with other modes for platform safety
- ISAR mode also possible with accurate target height
- ADSB capable for civil traffic awareness





AESA Radar - Exploitation of High Resolution Imagery for Battlefield Support



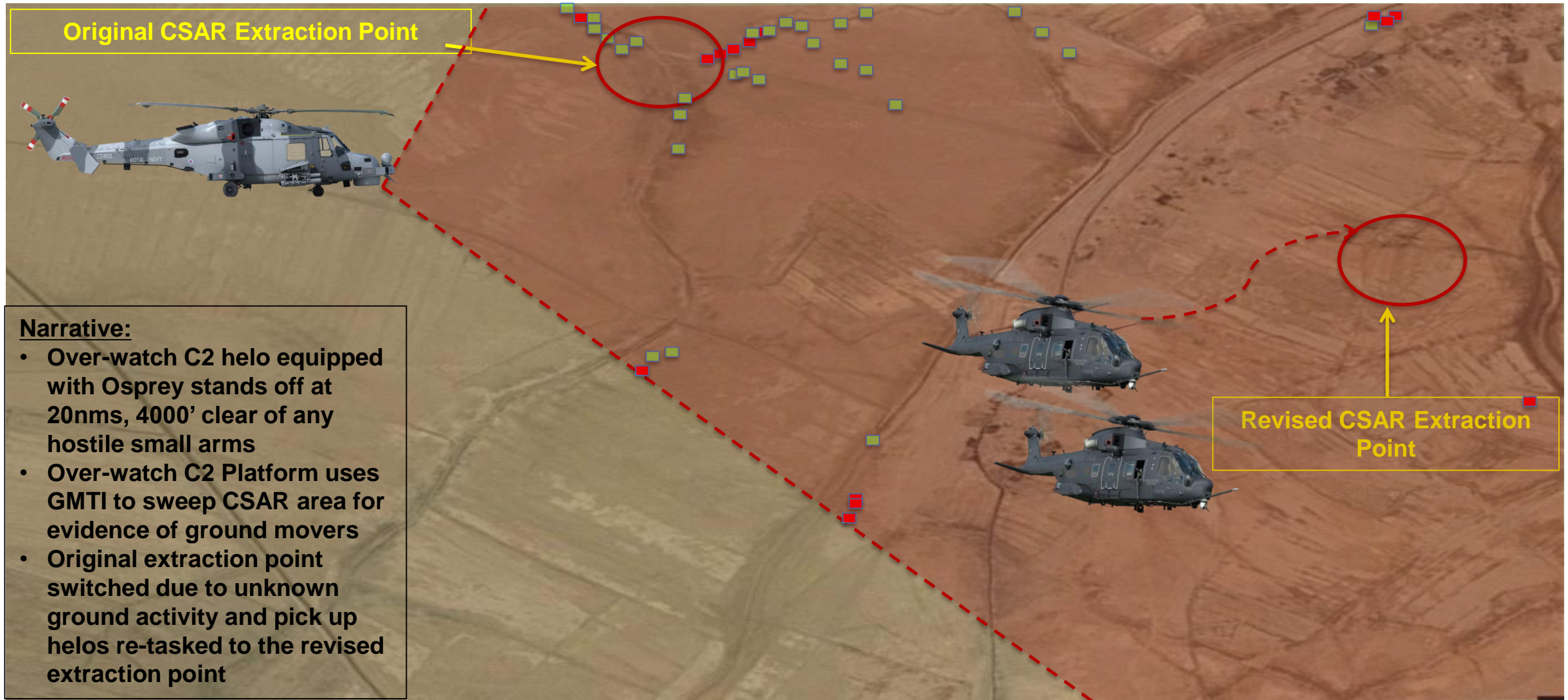
SPOT SAR detects multiple aircraft on airfield

Narrative:

- Cloud cover and stand-off range denies use of any EO/IR sensor
- Over-watch C2 helo stands off at 20nm, 6000' clear of any hostile small arms
- Over-watch C2 Platform uses High Res SPOT SAR to image airfield and gather real-time intelligence



AESA Radar - Battlefield Manoeuvre with Stand Off GMTI Capability

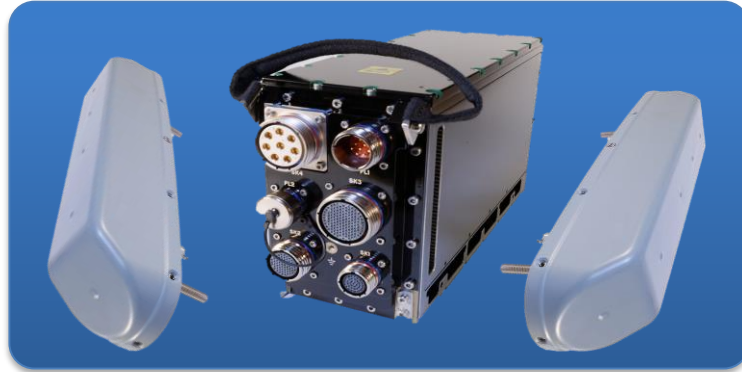


Narrative:

- Over-watch C2 helo equipped with Osprey stands off at 20nms, 4000' clear of any hostile small arms
- Over-watch C2 Platform uses GMTI to sweep CSAR area for evidence of ground movers
- Original extraction point switched due to unknown ground activity and pick up helos re-tasked to the revised extraction point

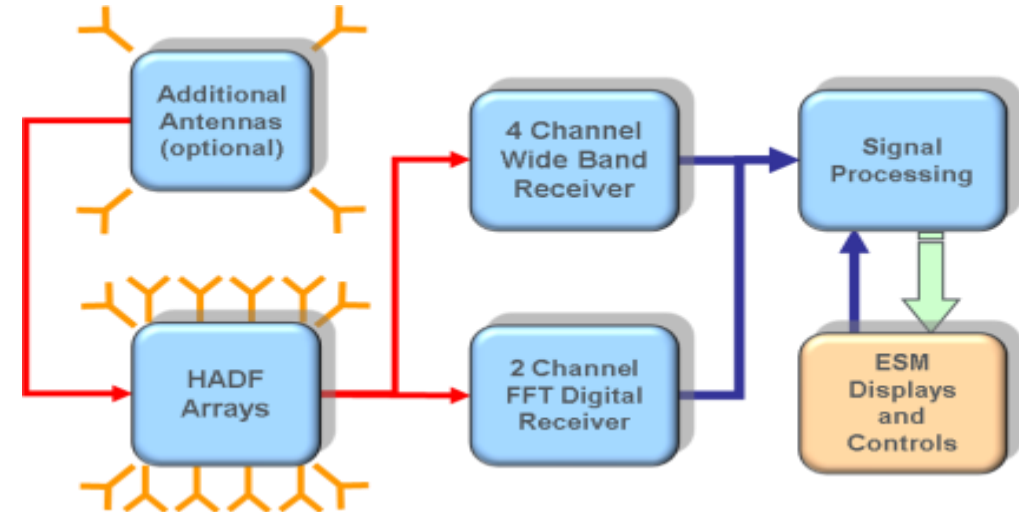
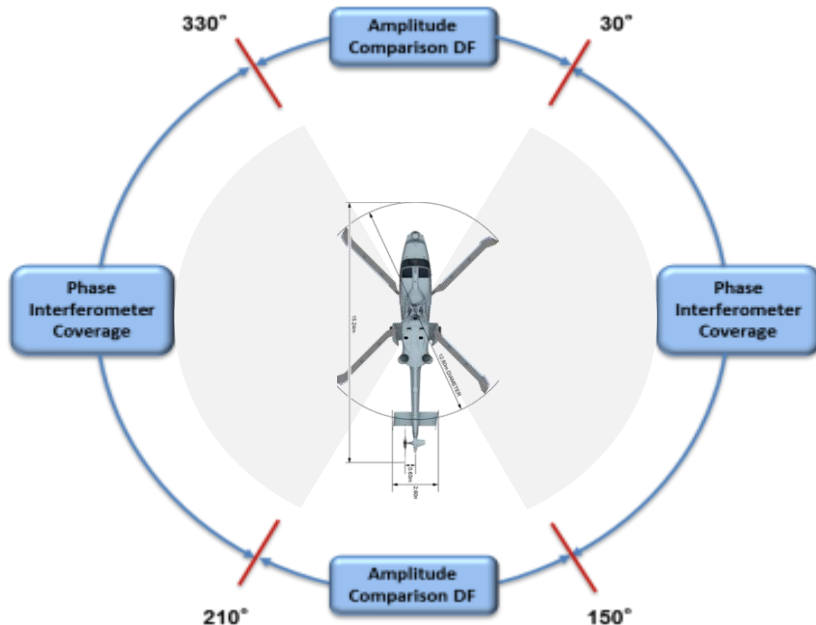


Electronic Intelligence (ELINT) – SAGE Electronic Support Measures



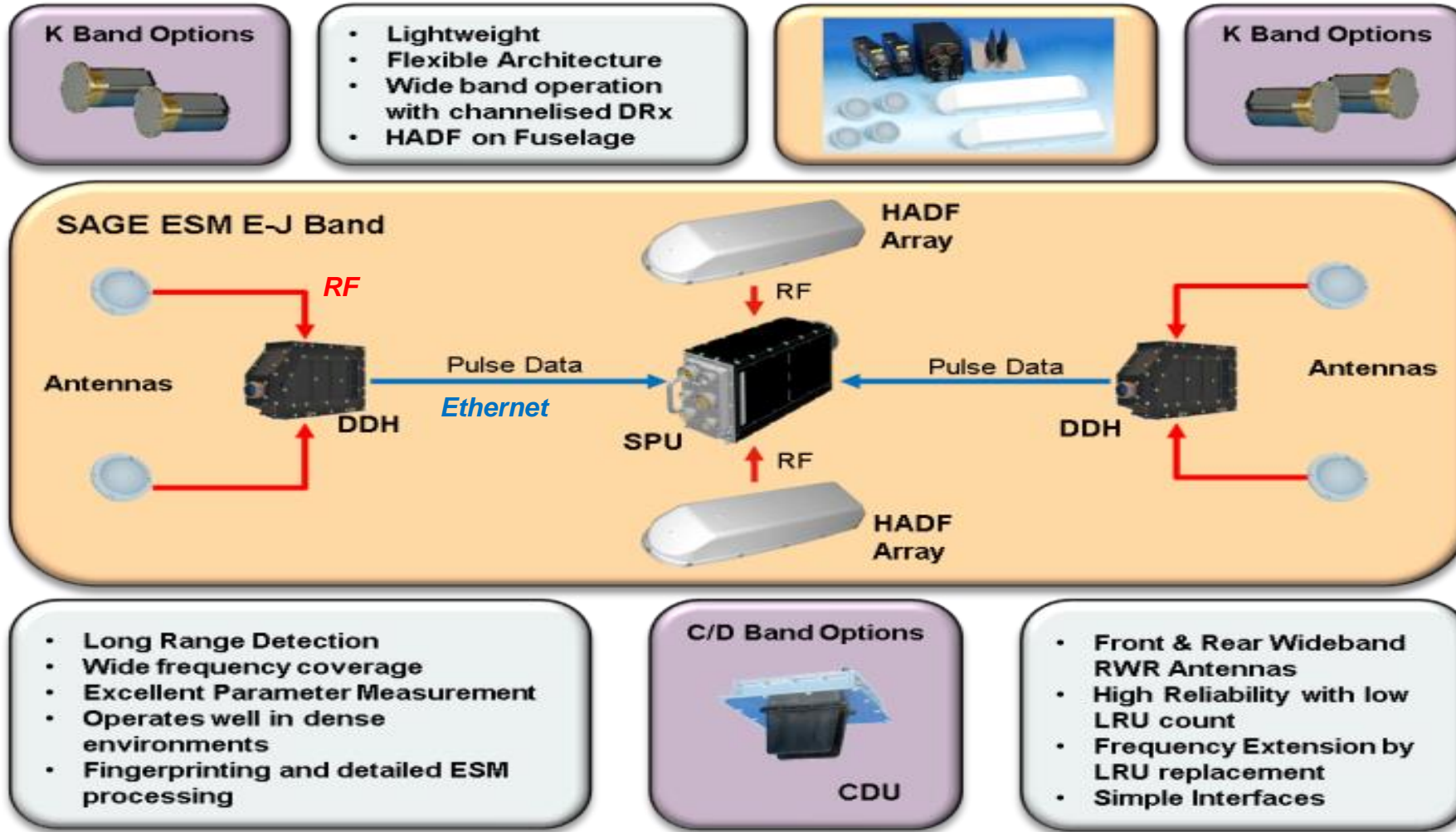
Key Features

- 360° coverage
- Very high sensitivity and DF accuracy in ESM mode
- High accuracy single platform geo-location
- Very high probability of interception - RWR
- Fine analysis of designated emission
- Fully programmable Mission Data File



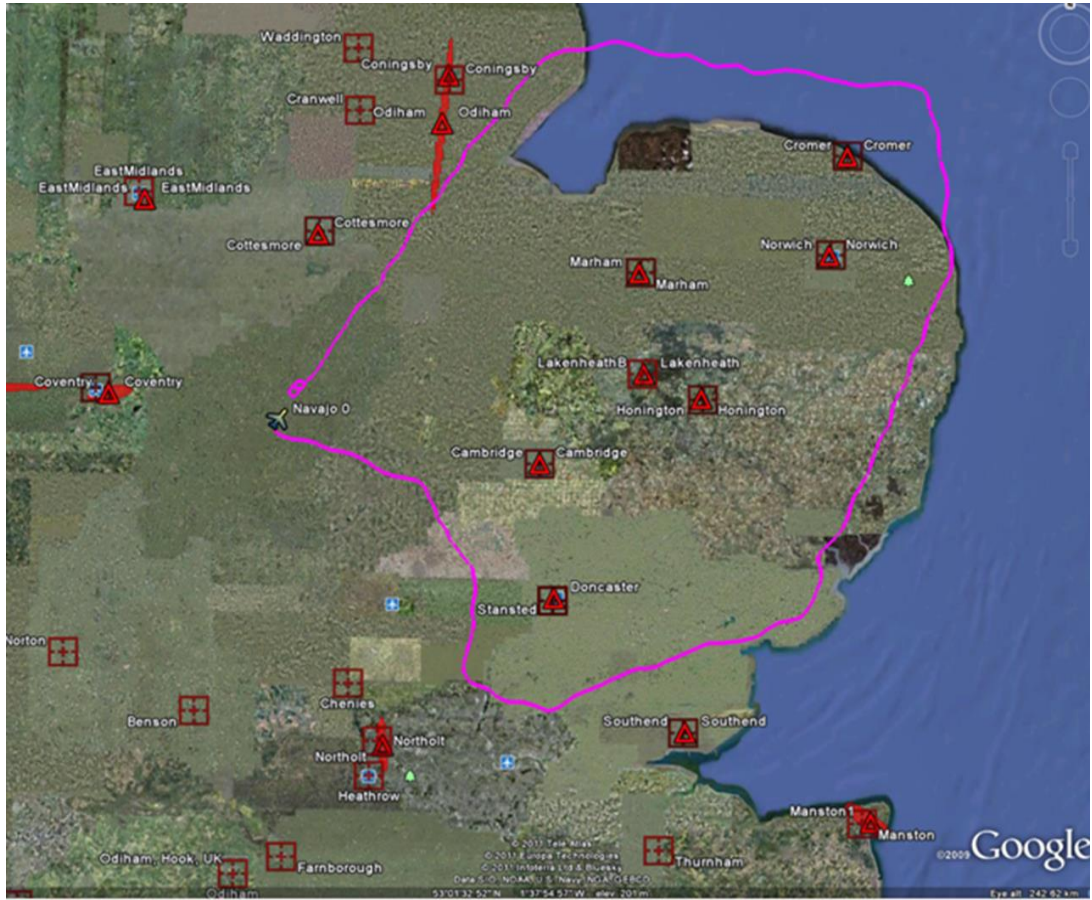


SAGE – Options





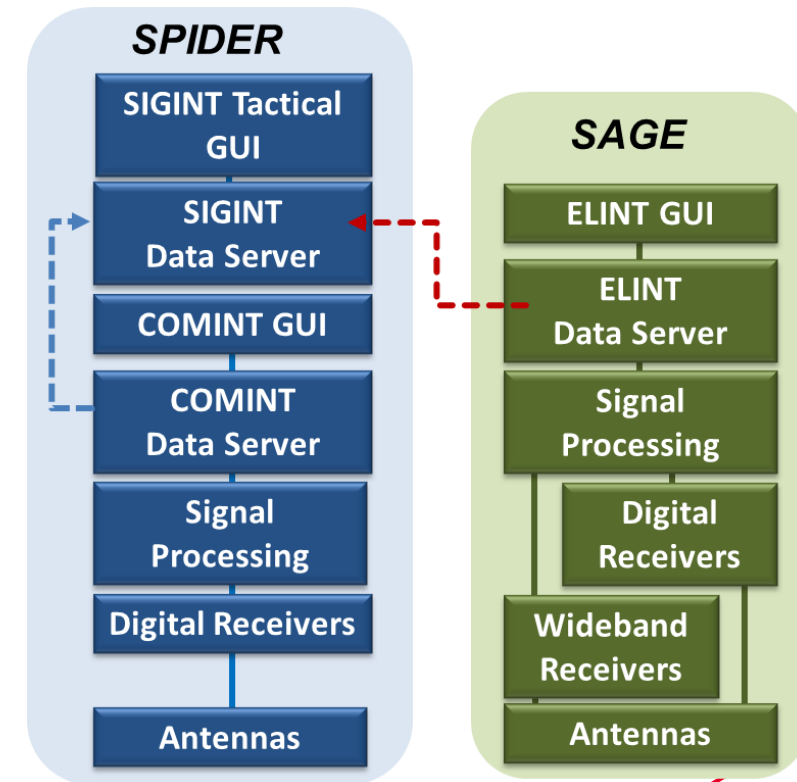
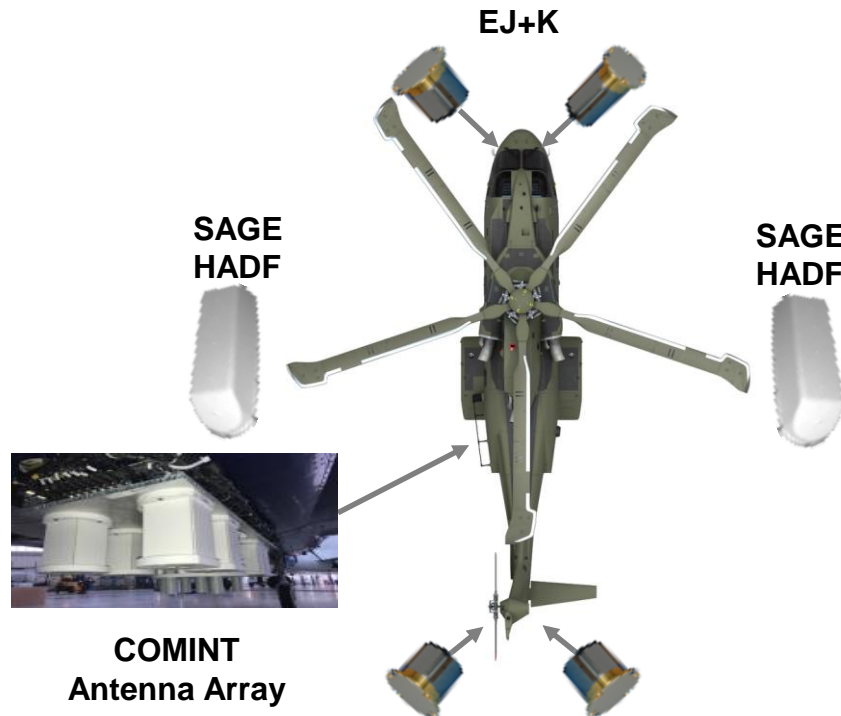
SAGE – Single Platform Geo-Location of RF Emitters from 10,000ft, 120kts





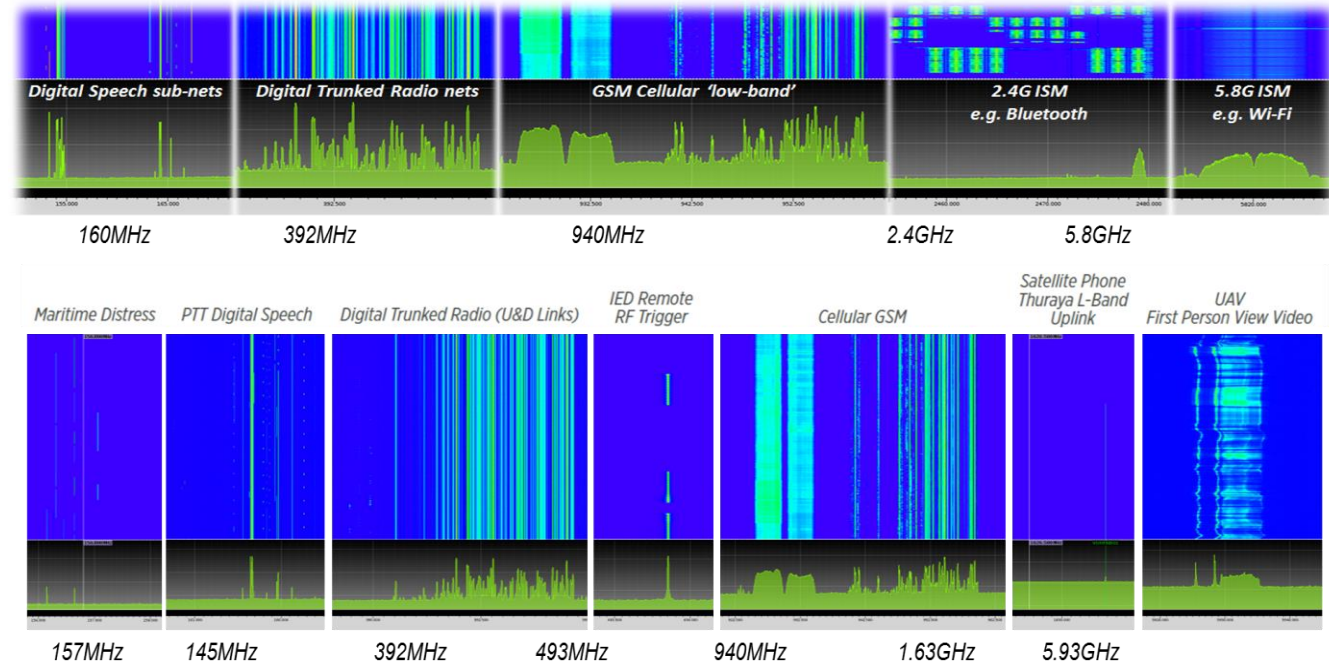
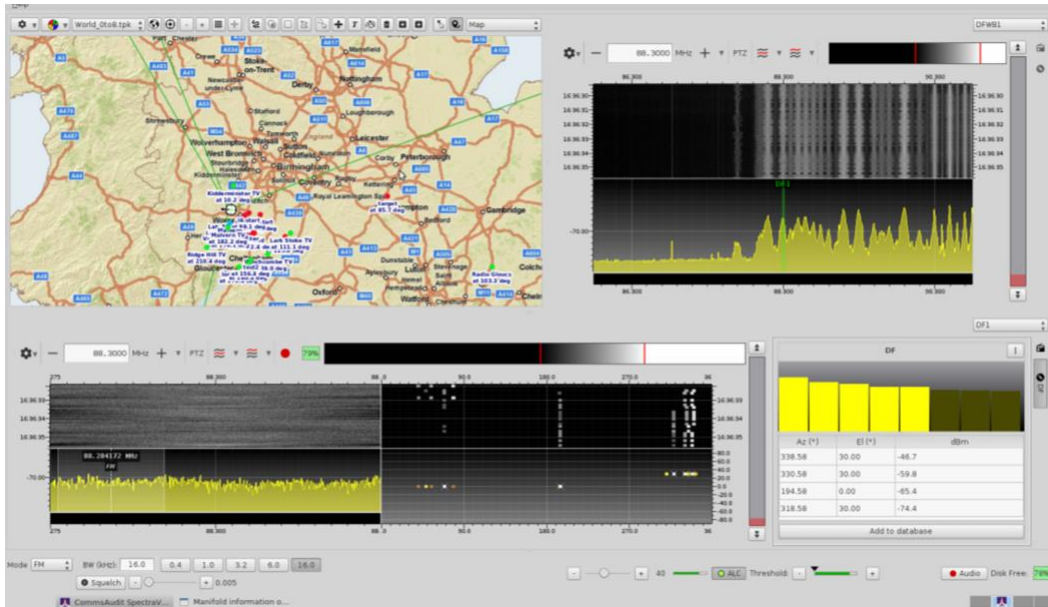
Communications Intelligence – SPIDER COMINT System

- Communication Type, Frequency, Geo-location, Recording, Decode
- Scalable configuration based on SAGE ELINT family and COMINT Processor
- SPIDER provides a COMINT system operating 20MHz to 6GHz
- SPIDER accepts direct feed from SAGE ELINT and provides integrated data on common SIGINT Tactical GUI





Sample Outputs from the SPIDER System

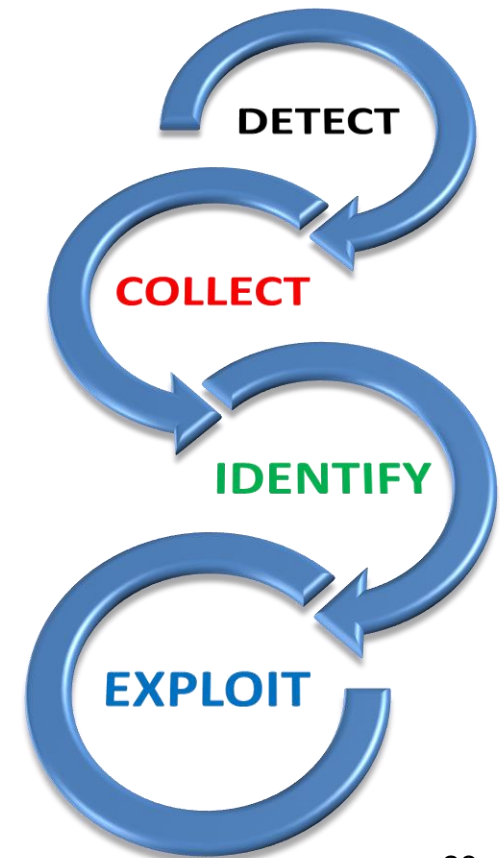


- Available Demodulation:
 - Analogue : AM / FM / LSB / USB
 - Digital : DMR / DPMR / TETRA / TETRA Pol / DSTAR (Dependent on CODEC availability)
- Available Decoding:
 - TETRA handset identification (where not encrypted)
 - SATCOM / SATPHONE handset identification (where not encrypted : Inmarsat / Thuraya / Iridium)
 - GSM/Cell handset identification (IMEI)



SPIDER COMINT Benefits

- **World leading instantaneous digitised bandwidth (100MHz)** incorporating multi-channel parallel processing resources.
- **Adaptive digital beam-forming** enhances weak target signals even in the presence of strong interfering signals, enabling the user to distinguish specific emitters in a congested band e.g. GSM
- **Sophisticated Super Resolution DF algorithms** accurately prosecute multiple co-channel targets in congested communications environments.
- **Co-channel interference reduction** providing coherent audio demodulation and signal content, accurate DoA of each signal and enhanced co-channel separation e.g. DoA of up to 7 individual simultaneous transmissions on the same frequency.
- **Dynamic internal calibration** significantly reduces calibration timescales and manpower as compared to traditional means, providing improved installed performance and delivering greater DoA accuracy through altitude and temperature variations.





Teaming – Battlefield Helicopters / SW-4 Solo

- European Defence Agency Exercise in 2015, Viterbo, Italy
- SW-4 Solo and AW-129D, UH-90 and CH-47C helicopters operated as Tactical Comms Nodes exchanging digital information to support Close Air Support (CAS) and Close Combat Attack (CCA) ops
- SW-4 Solo's radar and EO/IR sensors provided target position, still pictures and FMV to manned helicopters using ROVER4
- SW-4 Solo Ground Control Station received data from manned helicopters for re-tasking / re-positioning of SW-4 Solo





Teaming – AW159 Wildcat / Attack Helicopter / Ground Vehicles

- Demonstration of transfer of tactical data and FMV video between AW159 Wildcat Reconnaissance Helicopter, WAH-64D Attack Helicopter and Foxhound Protected Patrol Vehicle (pseudo AJAX) during October 2018
 - AW159 Wildcat Full Systems Integration Rig with L3 VORTEXi and Improved Data Modem (IDM)
 - WAH-64D Mission Avionic System Rig with ROVER6i and IDM fitted
 - Foxhound with Joint Common Remote Viewing Terminals and BOWMAN
- Tactical data transferred from AW159 via BOWMAN and IDM and Full Motion Video transmit / receive via L3 VORTEXi system and JCRVT
- BOWMAN Common Operating Picture integrated into AW159 Wildcat Tactical View enabling aircrew to fight aircraft from single tactical picture
 - Improved situational awareness, reduced errors and transmit time
 - Supports spiral development to Army's next generation of tactical communications and information system --- MORPHEUS





Teaming – AW159 Wildcat / WAH-64D Apache

- British Army Wildcat laser designated a target for two Hellfire missiles launched from an Apache attack helicopter during summer 2018
- Exercise demonstrated what AW159 Wildcat can bring to UK Defence as part of the newly established Attack Reconnaissance Team (ART) that brings Wildcat and Apache helicopters close together to simultaneously find, track and strike.
- *“The Wildcat is part of a specialist Aviation Reconnaissance Force specially trained to find targets deep in enemy territory, which allows them to coordinate attacks using a wide variety of weapons, including Attack Helicopters, Artillery and Fixed Wing close air support.”*
- *The Hellfire guided missiles followed the Wildcat laser to a target mounted on a barge around 6 miles out to sea. Both missiles hit their designated targets, demonstrating the substantial capability and the effects of using Wildcat and Apache helicopters in tandem.”*
- The British Army say that this new concept brings together the unique skillsets of the reconnaissance helicopter pilots, trained to seek out enemy locations, with the powerful effect of the Apache AH.





Teaming – AW159 Wildcat / UAS

MUMT Demo

- Undertaken as part of dstl sponsored Advanced Mission Systems - Demonstration & Experimentation - to Realise Integrated System Concepts(AMS-DE-RISC) programme during June 2019
- Demonstration of battlespace digitisation and teaming in a synthetic environment to reduce OODA* loop timescales to increase ISR capability
- Demonstration of inter-platform integration – AW159 and RWUAS
- Level of Interoperability (LOI) Level 4 (flight path control, excluding take-off and landing) was enabled for front seat aircrew of AW159.

Defence and Security Accelerator (DASA) Demonstration

- Leonardo Helicopters UK MOD DASA contract to support the British Army Warfighting Experiment (AWE19) exercise in Q1 2020
- Demonstration of STANAG 4586 compliant Manned Unmanned Teaming up to Level of Interoperability (LOI) 4 of the 2 crew AW159 and a UAV
- The AW159 HMI will be developed with the UK MOD to optimise aircrew workload.

*Observe – Orient – Decide - Act



Teaming – Rotary UAS / Surface Combatant

- World's first large scale demonstration of marine robotic systems hosted by the UK during Unmanned Warrior '16
- Over 50 aerial, surface and underwater Maritime Autonomous Systems (MAS) demonstrated surveillance, intelligence-gathering and mine countermeasures capabilities.
- SW-4 Solo equipped with Leonardo Opsrey ASEA radar with AIS, Leonardo SAGE ESM and EOD
- SW-4 Solo exchanged data with representative Type 23 Frigate Ops Room / Combat Management System through UK MoD sponsored "OACS / MAPLE" system architecture
- Leonardo operative in Operations Room was in direct communications with GCS operatives to provide the required connectivity between the "taskers" and the "operators"





Teaming – Multiple UXV / Multiple Ships / Networking

Operational Objectives

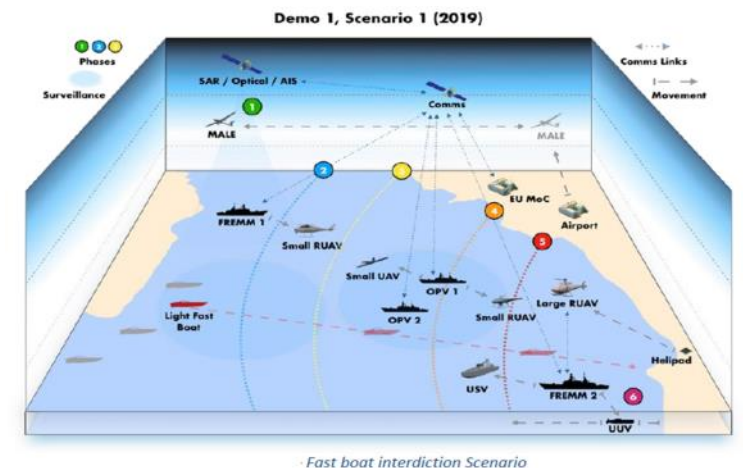
- Significant improvement of maritime Situation Awareness through the integration of UXVs with ISTAR payload capabilities
- Interoperability by use of open architecture and recognised standards

Technical Objectives

- High integration among EU countries and heterogeneous systems: full-scale demonstrations
 - Mediterranean Sea in 2019 (SW-4 Solo / AWHERO / NH-90)
 - Baltic Sea in 2020
- Development of EU C4ISR open architecture
- Integration of EU/NATO/civil data framework
- Advanced data and information fusion techniques for shorter decision time at CMS and MOC levels
- Increased autonomy for UXS, swarm operations, cooperation of assets



SW-4 Solo / AWHERO
Mediterranean Demos (2019)





Concluding Remarks

- Multi-layered and multi-speed battlespace requires more comprehensive understanding, faster decisions than the adversary and ability to act first
- Agile, adaptable and interoperable forces will have to deliver full spectrum situational awareness to help create/maintain the intelligence picture, identify changes and aid delivery of predictive intelligence
- High demand ISR platforms not always available every platform, especially embedded manned and unmanned rotary wing should contribute to an ISR system of systems on land and at sea
- Capability demonstrations confirm that Rotary Wing platforms:
 - Collect and Process ISR data over Land and at Sea
 - Disseminate ISR data to Joint Force via Tactical / Wideband Datalinks
 - Effectively team with Air Assets, Land Vehicles, Troops and Ships
- Rotary Wing platforms can make extremely valuable contributions to the provision of Information Advantage and realisation of Integrated Operations by the Joint Force – they just need to be enabled to do so





Questions?





THANK YOU
FOR YOUR ATTENTION
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Contact details

Tony Duthie

Head of Land & Maritime Marketing

Leonardo Helicopters

Yeovil, BA20 2YB

United Kingdom



leonardocompany.com

GBAD Threat Frequencies – From Open Source Data

