

A PERSPECTIVE ON TACTICAL COMMUNICATIONS

WIRELESS INNOVATION FORUM TEM Thales Paris

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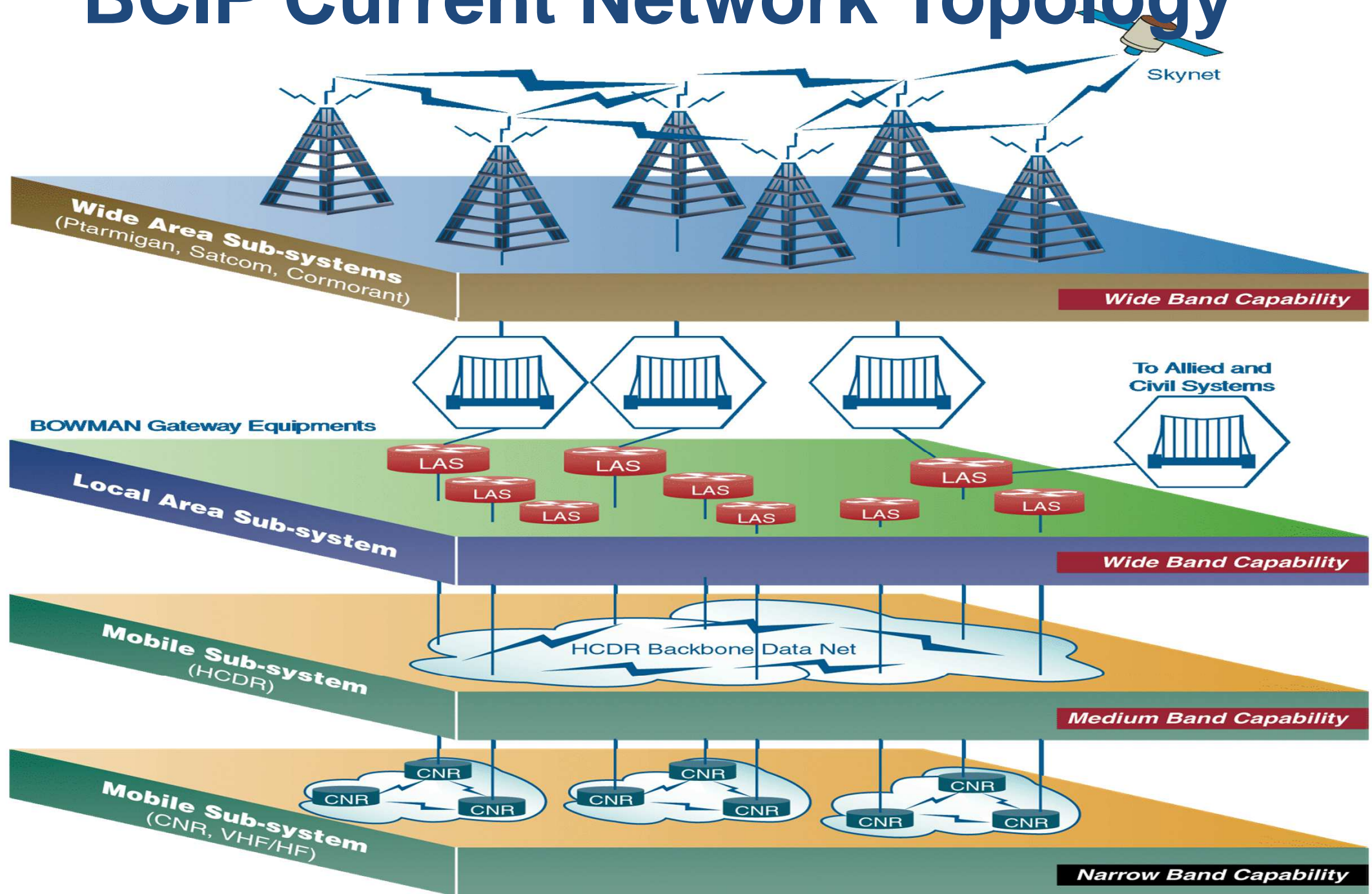
Content

- Tactical Battlespace
- Waveforms
- Tactical Radios
- EM Spectrum
- Interoperability
- UK MORPHEUS

Tactical Battlespace Requirements



BCIP Current Network Topology

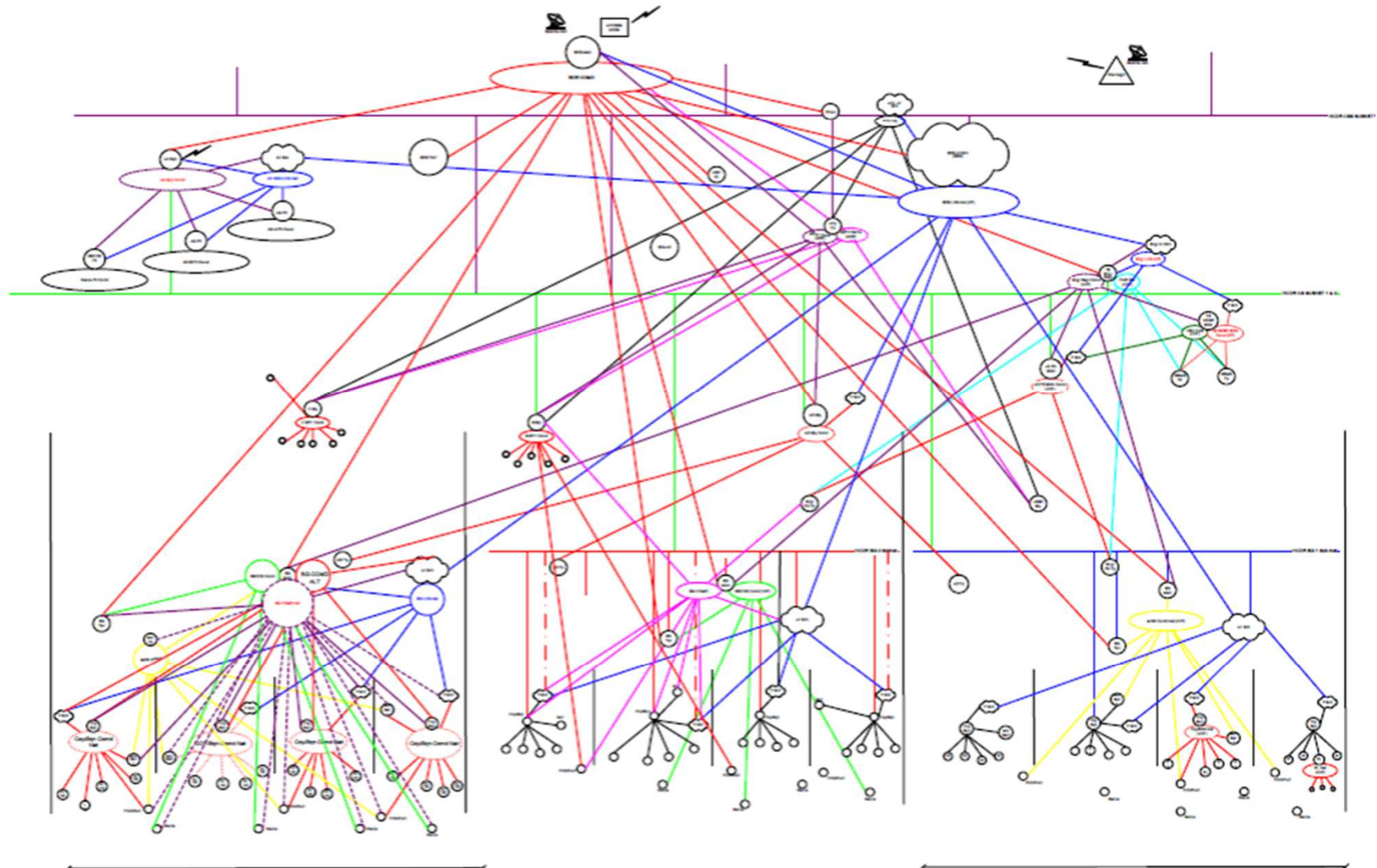


Heterogeneity of the Bowman tactical internet

Tactical networks are big and are always heterogeneous; this makes inter-networking difficult

90+ CNR nets
(VHF and HF) @
1kbps to 50kbps

150 node HCDR
network @
500kbps



Bde-sized deployment

Services

Attempt to bridge technical services and User Services

Users are interested in SWaP, assured Services and not in
kbps, Mbps, SNR, processing power

Collaboration (Point to Point, Group/Forum)

- Chat/Instant Messaging
 - Textual Chat
 - Textual Chat with attachments (documents, imagery)
 - Textual Chat with screen sharing
 - Chat rooms
 - Situational and status updates
 - Voice
 - Low rate, low quality (understood only)
 - High quality (talker recognisable, stress indications)
 - simplex/duplex
 - Conference
 - PTT/mute/monitor
 - Voice Recording
 - Voice to text
 - Voice translation
 - Email
 - Without attachments
 - With attachments
 - High/Medium Grade Formal Messaging
 - Calendar/schedule tracking: de-confliction/opportunity/synchronisation
- Document Collaboration
 - White Board
 - Images
 - markups/overlays of maps/imagery
 - Document amendments/change deltas
 - Full document sharing (sharepoint, file stores...)
 - Collaborative drafting/editing
 - Encyclopaedic information sharing
 - Wikis
 - Video
 - One to One conference
 - Group conference
 - Screen Sharing
 - CCTV
 - Full Motion Video
 - “Smart” video (compressed/reduced frames...)
 - Other social approaches

“Distributed Data”

- Distributed/reference Data
 - Tracks (air, land, maritime, space. Blue, Red, Grey, White...)
 - Weather (area, granularity, forecast range...)
 - Events (time, date, location, description...)
 - Object Status (health/availability, location, stores, range, speed...)
 - Plans/Orders (documents...)
 - Reports (documents...)
 - Intelligence (documents...)
 - Imagery stores (images, overlays...)
 - Video stores (moving images as files, edited, marked up, compressed for areas of interest)
 - Geographic (maps, charts, overlays...)
 - Encyclopaedic
 - Master Data? (!)
 - Logistics (stores, types, locations, time to resupply, priority)
 - Directories (...)
 - Search
 - WWW

Resilience

Resilience

- Operational feedback has highlighted vulnerabilities in communications systems.
- Waveforms must be evaluated, including live-signal testing, against a full spectrum of symmetric/peer threats.
- For resilience (through diversity of means), we need to maintain a degree of redundancy in the ‘minimum’ set of waveforms. ...
- There are concerns on the convergence of the underpinning technologies of many modern waveforms – a single common solution which could potentially be found to be fundamentally flawed.
- For ultimate resilience MOD does need to maintain a range of waveforms with disjoint underpinning elements, hosted on radio and crypto platforms capable of operation in multiple frequency bands.

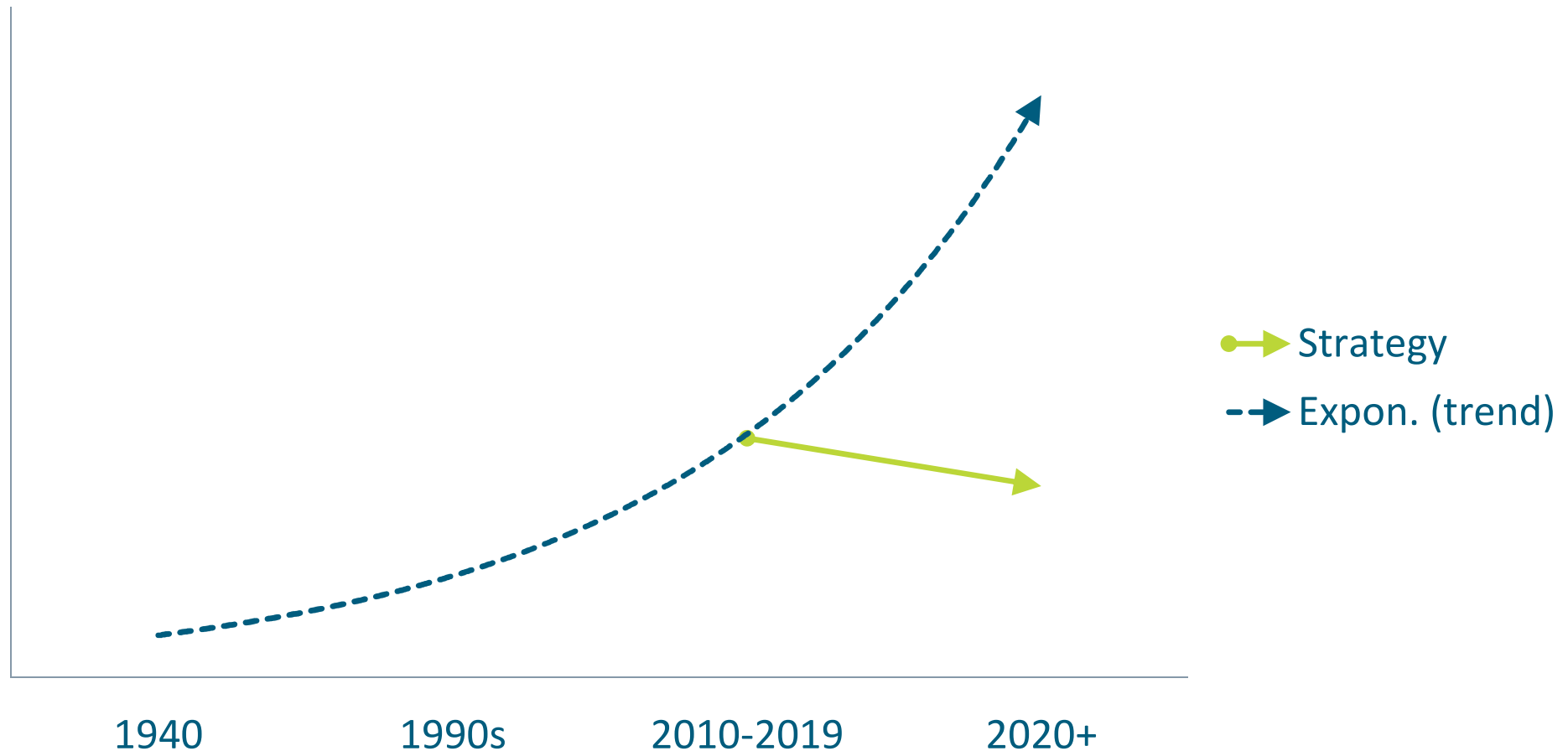
The Wed, 12 Oct Session: “Waveform recognition for SDR based Radio intrusion test platforms” offers a glimpse on modern signal recognition techniques.

Waveforms

Waveform proliferation

- 1940s
- 1990s
- 2010 to 2019+

Waveform proliferation



1990S WAVEFORMS

GPS



MILSAT
Ka

IRIDIUM
3 variants

INMARSAT

MILSAT
X

Link 16
STANAG

Links 11,
HF/UHF
STANAGS

UHF
HQ-II

VHF IM

JFHQ OLRT

LPD (RFTG)

HCDR
HARRIS
(ITT US)

PTARMIGA
N WFs

Land
mobile
radio

PR4G
THALES
FR

VHF-
SEM93
GE

SF

V/ULOS
FF
STANAG

UK VHF
BOWMAN
HARRIS

UK HF
BOWMAN
HARRIS

SINGARS
FH
US Gov

SINGARS
FF
US Gov

2010-2019+ MARKET AVAILABLE WAVEFORMS A SMALL SELECTION

GPS
(C2DE)

ComSat
Ku

MILSAT
Ka

IRIDIUM
3 variants

INMARSAT
BGAN

US MUOS
(F35)

TacSat
IW

TacSat
DAMA

COMSAT
C

MILSAT
GRS

MILSAT
Q

MILSAT
X

Link 16
STANAG

TTNT
V6.9

UHF
HQ-II

UHF
SATURN
STANAG

UHF
SATURN
EDR
STANAG

Links 11,
22
HF/UHF
STANAGS

UHF
MARLIN
STANAG

HF IP
MARLIN
STANAG

VHF IM

Civ-
WiMax
WiFi

TETRA

CIV 4G
LTE

CIV P25
APCO

HCDR
En-HCDR
HARRIS

ANW2C/B
HARRIS

FALCON
THALES,
ULTRA

HCLOS
WPPL-D

NATO
WB-HF
STANAG

LPD (RFTG)

PR4G
THALES
FR

UK Gov
ELGAR

Land
mobile
radio

NATO
NBWF
V/UHF
STANAG

FlexNet
GeoMux
THALES

HCLOS
US
WIN-T

US
Gov
WNW

TSM
TRELLISWAR
E

V/ULOS
FF
STANAG

UK VHF
BOWMAN
HARRIS

VHF-
SEM93
-GE

ESSOR Ph1
FR/IT/SP/PL/FIN
/SWE

US MBITR

US Gov
SRW
3 Versions

SINCGARS
FF
US Gov

PRR/EZP
LEONARDO

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UK HF
BOWMAN
HARRIS

HDR-AJ-NB
ROHDE&
SCHWARZ

TruNet
Rockwell
Collins

S-WAVE
LEONARDO

SINCGARS
FH
US Gov

Extended
Range V/U

Kongsberg
VHF

16

Constraints

- Procurement
 - IP rights; TRL
- EM Spectrum
 - Congestion / non-availability
 - In UK, Europe and in ROW; for training and for operations
- Interoperability: Coalition and Civilian
- Resilience
 - Maintenance of diversity of means as a counter to over-optimisation and concentration
- Vertically-integrated legacy systems

Proliferation, IPR, Export Controls impact:

- Agility and flexibility
- Interoperability Joint and Coalition
- Logistic burden
- Training
- Freedom of defining open standards
- Ability to incorporate, legacy and modern encryption components
- KEYMAT and CI production & distribution
- Procurement options
- Openness - Vendor and Integrator lock-in for a long time!

Way Ahead: Industry should consider a Commercial Environment in which cross-licencing and porting of waveforms becomes business as usual thus realising the SDR perceived benefits since 1990's.

Tactical Radios

Technical Coherence

Not Shown:

G2A

CLB

CLR

TIGR

Handheld

Bowman
PRC 355

Bowman
PRC 354

TacSAT
AN/PRC-117

TIGR (GPS)

EZPRR



'M-5' Generic Host Radios as UK convergence targets

- **Multi-band**
 - (e.g. V/UHF narrow 12.5 kHz, 25kHz and wide-band, UHF/D-Band).
- **Multi-waveform**
 - Variable Throughput (900 bps to >3 Mbps)
- **Multi-role**
 - (Commander's Lightweight radio, Coy radio, Bde radio, utilising where appropriate applique units (e.g. Vehicle PAs/Aerials PSUs)
- **Multi Crypto Personality**
 - (e.g. multiple UK, NATO crypto standards implemented by internal or external programmable chip/module)
- **Multi-Service provision by a single waveform**
 - The radios should be capable of supporting simultaneously multiple User Services depending on channel availability and throughput (e.g. CNR Voice, Chat, Tracks, email, file transfer - **NATO V/UHF NBWF, SATURN SEDR etc.**)

EM Spectrum

Spectrum availability in the 225-400 MHz UHF Band

- For NATO Europe within 225-400 MHz band
 - 5x 5 MHz and 2x 10 MHz blocks totalling 45 MHz (WB Mobile bands)
 - Ground use or low level up to 500 feet
 - Two additional 5 MHz blocks reserved but not currently de-conflicted with AGA
- The 2017 UHF Re-organisation will introduce wideband aeronautical allocations (WBAMS):
 - 4x 1.25 MHz blocks (separate to the WB mobile bands)
 - 2 allocated from Nov 2017 – 2 reserved for future use
- Band is already been used by Nations with operational wideband networking waveforms.
- Band unlikely to support a common Coalition wideband waveform and multiple national waveforms in the same AOR (multinational Battalion/BDE).
- Coalition Lead nation will allocate BW to coalition participants.

Interoperability

NATO Interoperability

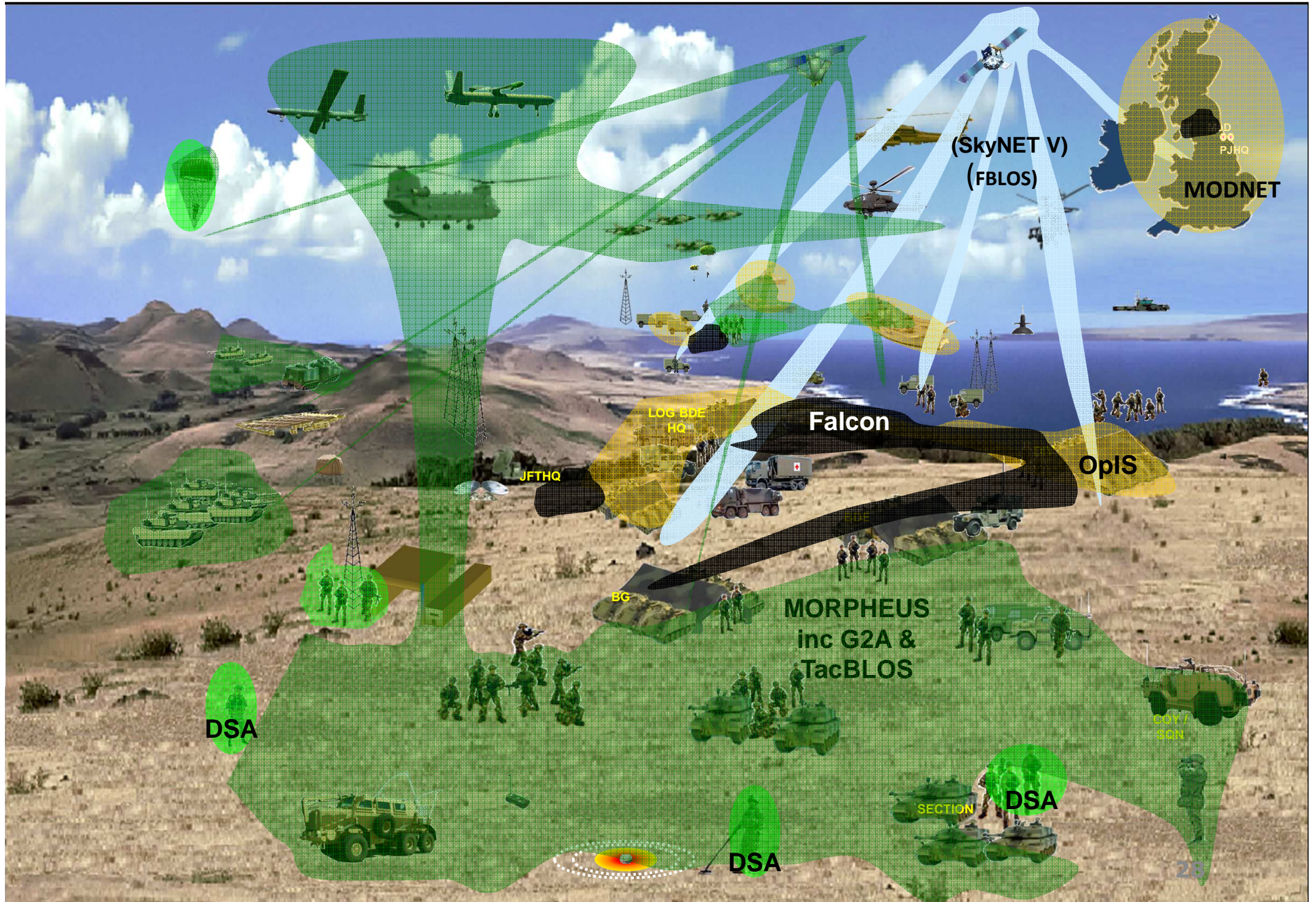
- Clear fixed frequency analogue Voice at HF, V/UHF since 1950's
- Loan of Lead nation radio platforms to coalition members
- No Secure CNR VHF
- A/G/A HQ-II, SATURN STANAGs
- NATO SATURN Enhanced Data Rate
- NATO NBWF V/UHF STANAG with EPM offers a realistic and affordable way for NATO interoperability in the context of a single NS, MS (multinational Battalion) network, simultaneously supporting Combat Voice (CNR), Chat, SA (PLI), e-mail with limited attachments assuming common crypto standards for voice and for data

UK MORPHEUS PROGRAMME

MORPHEUS DaaP Industry Day



MORPHEUS IN A DAAP CONTEXT



Key Messages

MoD is committed to tactical CIS which provides agile, adaptable capability and maximises the scope for competitions through life.

Technical and Commercial openness are central to the delivery of the MORPHEUS project.

MORPHEUS will transition to an open business and technical architecture via an Evolve to Open (EvO) strategy.

There are substantial opportunities for industry, including SMEs, during the Design & Development phases and beyond.

The ISS DA, the Project and Industry will be informed by a Technical Architecture Forum (TAF).

MORPHEUS is the tactical edge of Defence as a Platform (Deployed) (DaaP(D)) and MOD transformation is now underway.



Thank you for Your attention
Any friendly questions?