

Practical Applications of Hybrid Technology C21 Virtual Conference

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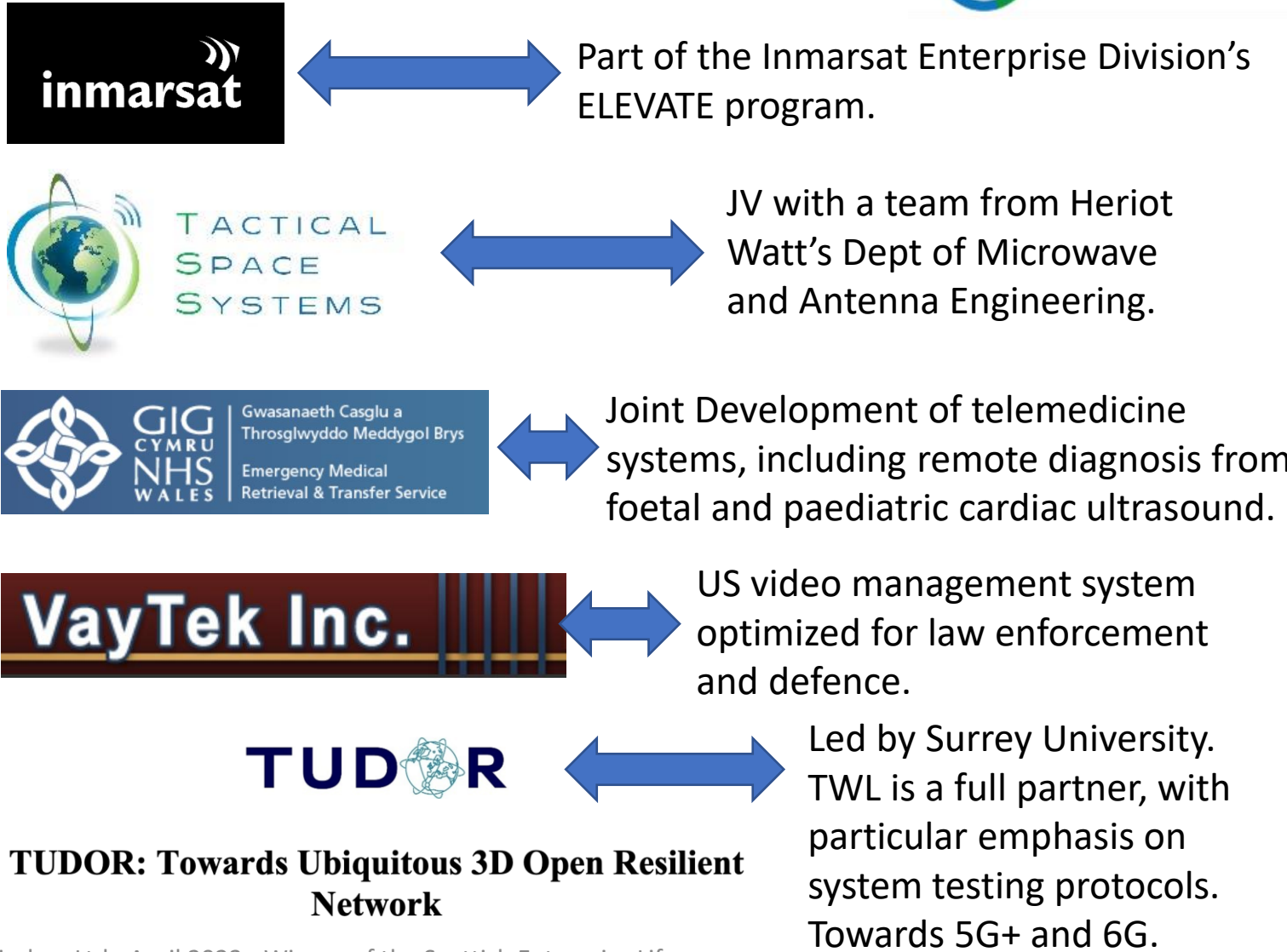
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Please note that the presentation is based on some of the projects undertaken by Tactical Wireless Ltd (TWL), without any proprietary client information.

Tactical Wireless Ltd (TWL) – Selected Current Partnerships:



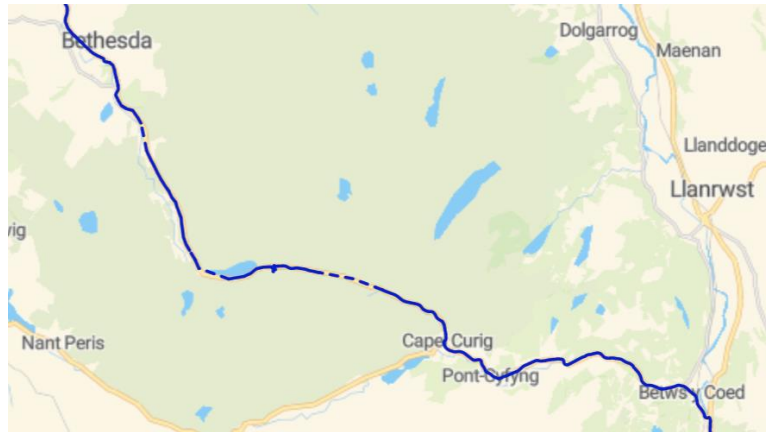
1. TWL is a system integrator that is hardware and software agnostic, working on communications solutions for remote and poorly connected areas; 3G/4G/LTE/5G/Satellite.
2. WiFi LAN (100 metres range) and WiFi WAN.
3. TWL is involved in a number of sectors that include but are not limited to:
 1. Healthcare.
 2. Transport.
 3. Policing.
 4. Defence and Security.
 5. Wildlife.
4. In May 2021, TWL formed a JV with a Scottish Enterprise funded spinout from Heriot Watt University (SpaceTeg LLP), to create Tactical Space Systems, which is involved in the development of onboard systems for small satellites and advanced RF technologies.



TWL's integrated cellular system - Omni-Route[®]



Maximises connectivity up to the limitations of the cellular networks, which can be enhanced by using multiple networks and/or satellite:



Cellular 4G only connectivity thro' Snowdonia – dotted line denotes some black spots but, across Wales, 96% connectivity was achieved – transmission of cardiac ultrasound over hybrid cellular and KA-band. Some routes repeated with 5G.

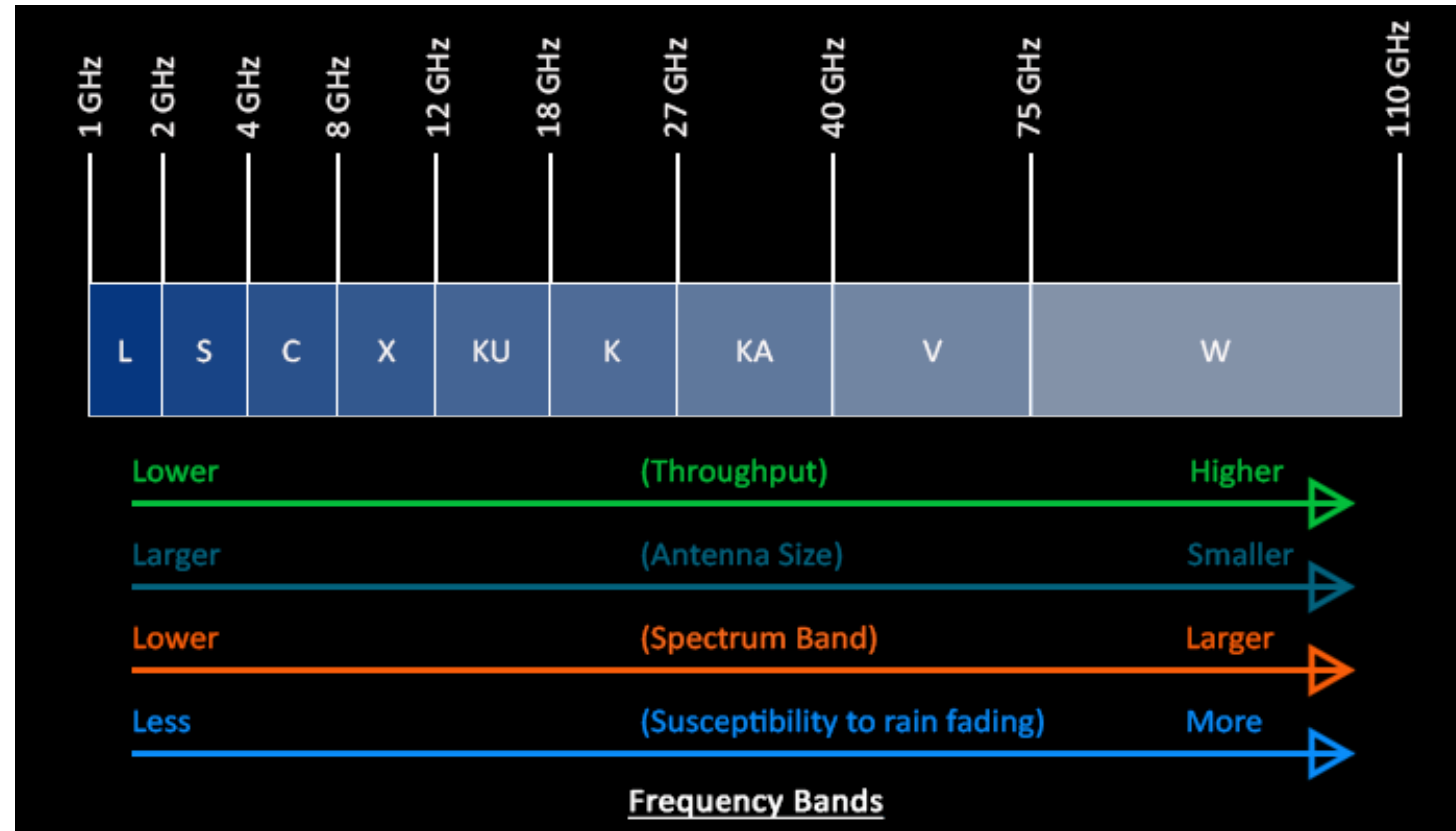


Scottish survey of – L-band and cellular operated independently and as a hybrid.

- Cellular connectivity was 99% on 2 independent systems:
 - A balanced router with 4 modems, each with a different network SIM.
 - A bonded router with 4 modems, each with a different network SIM.
- Operation of 2 L-band satellite systems:
 - Iridium Certus via Thales terminal
 - Inmarsat BGAN via Cobham terminal
 - Comparative results not published.

Key Parameters and Equipment Selection

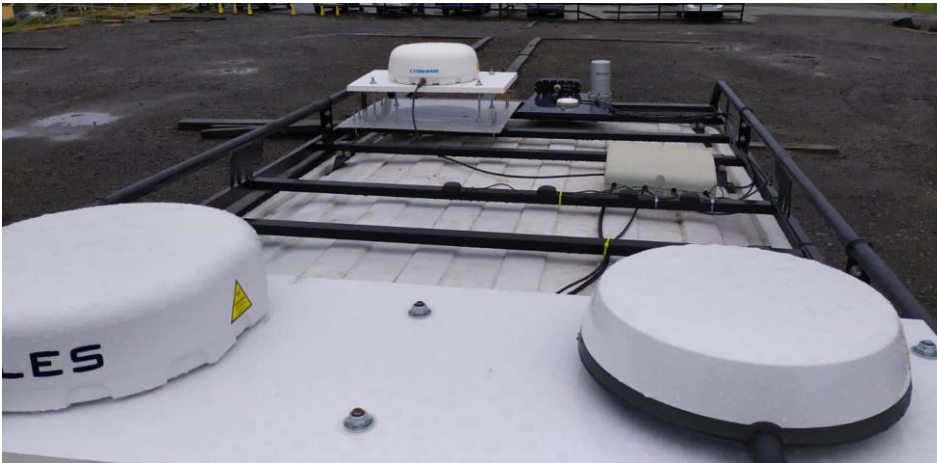
- Cellular:
 - Network performance –area specific – MNO coverage, latency, uptime, contestation, bandwidth availability.
 - The application – thorough analysis – mobile, nomadic or fixed - throughput required, mission criticality.
 - Balancing versus bonding.
- Satellite:
 - See chart opposite.
 - Mobile, nomadic or fixed.
 - Mission Criticality.
 - Costs.
- Hybrid – optimised to end user requirements – 3G/4G/5G/Satellite.



TWL Hybrid Projects - examples:

MOBILE

- L-band satellite on-the-move uptime trials: (Thales/Iridium, Cobham/Inmarsat 325 and 323) - north of the Central Belt in Scotland:
- Alongside cellular trials that showed 99% uptime, using a balanced and a separate bonded, 4-modem router.



MOBILE

A high throughput Starlink terminal, temporarily fitted on a TWL vehicle.

- Trials completed successfully.
- Very high uptime.
- Used as an extra WAN on an Omni-Route®.
- Very high throughput.



NOMADIC

A KA-band satellite dish on a trailer for Heriot Watt University.

- Auto steering.
- Typical contract - 22 Mbps down and 6 Mbps up.
- Provides a mobile office/workshop.



Hybrid Comms – control example.



PEPWAVE | Dashboard | SpeedFusion Connect | Network | Advanced | AP | System | Status | Apply Changes

WAN Connection Status

Priority 1 (Highest)

WAN	<input checked="" type="checkbox"/> Connected	Details
Cellular 1	<input checked="" type="checkbox"/> Connected to EE LTE	Details
Cellular 2	<input checked="" type="checkbox"/> Connected to voda UK LTE	Details

Priority 2

Drag desired (Priority 2) connections here

Priority 3

Wi-Fi WAN on 2.4 ...	<input type="checkbox"/> Standby	Wireless Networks Details
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Priority 4 (Lowest)

Drag desired (Priority 4) connections here

Disabled

Wi-Fi WAN on 5 GHz	<input type="checkbox"/> Disabled	Details
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LAN Interface

Router IP Address: 192.168.40.1

Wi-Fi AP

ON Details

OMNI-HUB.NET	
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PepVPN with SpeedFusion

Status

MANC	<input checked="" type="checkbox"/> Established
VAYTEK	<input checked="" type="checkbox"/> Established

[Logout](#)

- PepLink 2-modem router and an M2M BGAN (Inmarsat terminal).
- This example is on a private, secure network, Omni-Hub.Net.– central hub at TWL head office.
- This example uses PepLink’s cloud-based router portal which provides:
 - Tracking and fleet management.
 - Group-wide configuration.
 - Cloud-based access for diagnosis and remote changes to the system

Network Security – some considerations:

- Three elements of secure communications:
 - Software and network protection.
 - Hardware thefts.
 - Suborning of individuals by bribery or threats of violence.
- IP routing – username and password protocols.
- Availability of secure, private network, with controlled third party access via IPsec VPN's.
- Use of VPN tunnels.
- Packet splitting – across multiple VPN's.
- Encryption – each tunnel independently to AES 256, or even military encrypt.
- Need to look at what will happen once Quantum Computers are used by malintents to break encryption – next stage development.

