Contributions to Tactical
Multi-Domain Operations

Content

AFCEA 21 Joint Presentation
Stands F18 / A05 / A06 / A07
by griffity defense

Preface

The Ukraine conflict and the deployment of combat-UAV at Nagorno-Karabakh has clearly shown NATO that adversary systems have reached a new quality in terms of range, speed of reconnaissance and impact triggering in recent years, which must lead to a redefinition of the chain of command with regard to speed, mobility and information distribution.

One possible way to meet these challenges is through network-centric operations involving tactical cyber forces, increased use of unmanned land and air systems (UMS) as manned-unmanned-teaming (MUM-T), positioning of forces in expanse (deployment) and implementation of highly mobile command posts (mobility) with simultaneous redundant networking.

By shifting tasks to the rear and automating support functions using AI, staffs can be downsized so that command elements located in the area of operations can be integrated into mobile platforms (containers, protected command vehicles, helicopters).

Under the leadership of griffity defense and the FFG, renowned companies have jointly developed and prototyped a conceptual framework for mobile command posts and command centers based on military-tactical considerations and analyses.

Under the motto "Contributions to Tactical Multi-Domain Operations", we will showcase solutions at AFCEA 2021 with a focus on the networking between a command post and mobile ground and airborne units.

With this brochure, we would like to introduce you to this conceptual framework and present our considerations and proposed technical solutions based on various exemplary implementations.

We hope you enjoy reading this brochure and look forward to receiving your feedback.

Norbert Frank
griffity defense

**AFCEA 21 Joint Presentation
stands F18 / A05 / A06 / A07
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1. Introduction

Today's global security challenges are changing in ever shorter timeframes. Emerging technologies such as artificial intelligence, hypersonics, machine learning, nanotechnology and robotics are fundamentally changing the nature of conflict.

The developments of security policies in recent years have shown that the line between war and peace is blurring and eruptive events with little to no warning time are changing the environment.

Our adversaries are highly adaptive and confront us in all dimensions – land, sea, air, as well as space and cyberspace. Warfare today is asymmetric, symmetric, and hybrid. For forces, this means permanently ensuring rapid response capability and targeting accuracy.

1.1. Multi-Domain Operations

Multi-domain operations are the evolution of what began several years ago as multi-domain combat. Thus, U.S. forces envision a joint battle management concept that brings all kinetic and non-kinetic firepower together to ensure or regain superiority in an increasingly contested, inaccessible world with near-peer competitors. By synchronizing major systems and key data sources, multi-domain operations are able to generate a nearly complete picture of the battlefield and enable forces to make decisions quickly and translate them into action subsequently.

According to the U.S. Armed Forces definition, multi-domain operations are:

"Operations conducted across multiple areas and contested spaces to overcome an adversary's strengths by confronting him with multiple operational and/or tactical dilemmas through the combined application of a coordinated force deployment, the employment of formations across multiple areas and the interaction of capabilities across areas, environments and functions in time and space to achieve operational and tactical objectives."

Analysis of Future Operating Environment – the Future Conflict Area

Technological advancements over the past decades, particularly in the area of IT, have made weapons systems faster, more accurate, and more effective. New systems whose effect is to impair, disrupt, paralyze, or destroy information systems have emerged.

The addition to and combination of reconnaissance UAVs of various sizes and ranges, improved reconnaissance and targeting accuracy, faster engagement cycles (against stationary targets within a few minutes) and improved effectors (thermobaric warheads, self-guided multi-purpose sub-munitions), as well as the extended range of effectors up to 300 km and more, have massively increased the already high threat potential. A prominent example from the war in Ukraine is the destruction of two Ukrainian battalions within minutes. The attack on the energy infrastructure in Saudi Arabia and the use of Turkish drones in Syria and Nagorno-Karabakh also clearly underlines this. For forces, this means that precise and rapid response capabilities must be permanently ensured. This has consequences for the structure and organization of battle groups.

1.2. Requirements for Future Command and Control

Future battle management must:

- be able to convert a level-appropriate situation awareness picture into information superiority and thus quickly into effect superiority;

- have the capability to communicate safely even under massive EW threat;

- have the ability to configure and reconfigure operational contingents "on the move" in accordance with the threat, as well as to integrate secured capability contributions of other dimensions and partners/allies "on the move";

- respond quickly and accurately to enemy force concentrations in all dimensions;

- be able to influence actions, opinions, and developments in and for the theater of operations.

(out of Thesenpapier Kdo Heer: Wie kämpfen Landstreitkräfte künftig?)

1.3. Command Posts of the Future

To meet the challenges of the future battlefield, a networked operational command including tactical cyber forces and increased use of unmanned land and air systems as manned-unmanned-teaming (MUM-T) as well as a positioning of forces in expand (deployment) and implementation of highly mobile command posts (mobility) with simultaneous redundant networking is to be aimed at.

1.3.1. Dislocation (of Tasks)

Tasks and actions within the framework of missions are to be completed, as far as possible, in the protected rear area. Only absolutely necessary resources are moved to the front zone/combat zone. By automating support functions and using AI, high-quality results can be achieved faster with fewer personnel. Consequently, staffs can be reduced and increasingly placed in mobile platforms (containers, protected command/lead vehicles).

1.3.2. Mobility

The adversary reconnaissance works quickly, and an attack follows quickly. Being on the move means not providing the enemy with a static target. Therefore, it is necessary that the units in the area of operations are highly mobile in order to be able to evade and quickly initiate countermeasures.

This means that in the future, highly mobile platforms will be preferable to stationary or deployable command posts, because only these can quickly change location and regain operational readiness.

1.3.3. Networking

To ensure that the advantages of dislocation and mobility in the combined command-control-reconnaissance-effectiveness chain can be fully exploited, redundant comprehensive networking at national and international level is of crucial importance.

Since each communication technology and waveform has its own advantages and disadvantages, a combination of different technical solutions should be sought in the field.

The illustration above shows, using the fictitious example of a multinational operation, the networking between the home base and the respective command posts (division – brigade – battalion – company) up to the soldier. To realize this networking, a range of technologies and systems is available, which differs in range, bandwidth and interference resistence.

2. Demo Scenarios

For a better understanding of the interaction of the exhibits, displayed on the stands we have developed a demo guide, based on three different scenarios:

- Defense according Art. 5 NATO
- Special Reconnaissance and Close Air Support (CAS)
- Mobile Anti-Terror Deployment

2.1. Demo Scenario 1: Defense According to Art. 5 NATO

In this scenario a defense case according to Art. 5 NATO is presented by using the example of the Suwalki Corridor. The Suwalki Corridor is the approximately 100 km long border area between Poland and Lithuania, which at the same time separates the Russian exclave Kaliningrad from Belarus.

The area forms a corridor for NATO to deploy ground forces to the Baltic region and it represents the closest land route for Russia, via ally Belarus, to Kaliningrad, so it is clearly strategically important terrain.

In the present scenario, opposing forces are leading an attack against Lithuania. One objective is to capture the Suwalki corridor as a key terrain in order to have free access to Kaliningrad and to be able to advance against Lithuania from there as well.

For this purpose, an enemy airborne battalion jumps off in the area and takes up position near the village of Lazdijai in order to subsequently establish a passage along the Lithuanian country roads between Belarus and Kaliningrad.

After the expiration of a NATO ultimatum, the order is given to break through this passage. An armored infantry company is tasked to restore Freedom of Movement (FOM) in the Lazdijai area and to force adversary troops on the defensive. In doing so, the mission is accompanied by massive V/UHF jamming aimed at disrupting NATO tactical communications.

2.2. Demo Scenario 2:
Special Reconnaissance and
Close Air Support CAS

This scenario is related to scenario 1 and is aimed at suppressing enemy weapons deployments.

In the course of preparation for the attack on the Russian airborne battalion in Lazdijai, satellite reconnaissance identified missile positions of the Russian artillery forces in the Chernyakhovsk area. Since the possibility of disrupting the own attack from there cannot be ruled out, it is decided to reconnoiter this area more closely and, if necessary, to paralyze the positions. The EW reconnaissance detects RADAR and radio activity between Chernyakhovsk and Goesev.

A Special Forces (SOF) detachment dropped in the area finds out that a mobile command post and a Pantsir-S1 (SA-22 Greyhound) air defense system is located there. Both squads are assigned to the enemy 152nd Missile Guard Brigade.

This enemy position can reconnoiter and operate into the countries of allies and poses a threat to the own forces; it must therefore be eliminated. Since the fighters have to fly into the combat zone of the Pantsir system in order to be effective, SOF switch off temporarily the Pantsir before the final approach and illuminate the targets by laser for the fighters. After the mission is completed, the SOF retreat to the landing zone. The entire mission is coordinated from the SOCCE (Special Operations Command and Control Element) in the rear.

2.3. Demo Scenario 3:
Mobile Anti-Terror Deployment

A local terror commander and a bomb maker (IED) are suspected in an urban building complex. These two persons are listed on the JPTL (Joint Prioritized Target List) as "to be arrested" because they have been involved in attacks and raids on own and allied units in the past.

The building complex is located in an inaccessible and hostile environment, i.e. regular troops cannot carry out the operation and so the responsible AOR (Area of Responsibility) commander assigns a Special Task Unit to carry out the mission.

The preparation of reconnaissance information (location/environment, living habits of target persons) is one of the first activities, involving also HUMINT, drone surveillance and local cameras. In order to divert attention away from the actual target area, a deception maneuver is carried out in a neighbouring district.

The actual mission begins by driving in convoy out of the own base. The target area is sealed off by the security forces, the special forces enter the building and after a short firefight the two people are captured and taken to the vehicles.
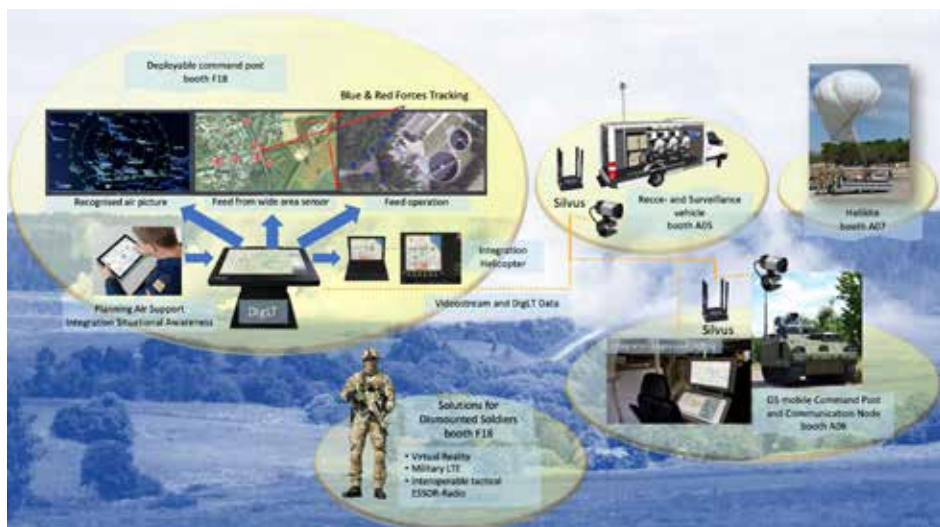
Links between indoor and outdoor stands

3. Network of Solutions – Stands F18 / A05 / A06 / A07

3.1. Overview

The joint presentation by griffity defense and its partners includes contributions for multi-domain tactical operations in the following areas:

- Deployable command post and dismounted soldier (stand F18)

- Mobile command post, using exemplary a PMMC G5 equipped as a command vehicle and communications node (outdoor stand A06)

- Helikite (outdoor stand A07)

- Mobile reconnaissance vehicle (outdoor stand A05)

The underlying system architecture is based on openness – it relies as much as possible on international standards and standardized interfaces. Subsystems were selected that the team considers technically mature and future-oriented and that can be adapted to other platforms (e.g. vehicles, aircrafts).

The connection of the stands is realized via an IP-Manet network using Streamcaster SC42004E.

Schematic display of a command post

3.2. Command Post/Networking

The deployable command post model displayed at AFCEA 2021 is equipped as follows:

- As command & control support
  - and visualization tool, with a digital map table DigLT; in addition to the standard monitor version, the advanced virtual variant DigLT^{VR} (Fraunhofer IOSB) is also shown
  - with the OPTARION system (OptaPlan planning module) for airborne operations (HENSOLDT)
  - with the multi-sensor evaluation tool MAuS and distribution system VIDIS (video/images/data) (M4Com)
- Computer modules from the M3X computer family for information processing (Cubic)
- Communication equipment
  - Bittium Tough SDR Vehicular radio (Manet, ESSOR), as well as network planning tool
  - Cordis Phased Array Radio CRE2-179 (Radionor)
  - MIMO radio Streamcaster (Broadcast Solutions)
  - WiSPR intercom system (Intracom Defense)

- Jammer detection (HENSOLDT)
- Power management and storage GENAIRCON (Intracom Defense)

In addition Broadcast Solutions shows by leveraging the latest communication and video technologies, the linking of distributed, mobile and fixed units so that each part of the group has access to the data relevant to it. Data can be generated by body-worn solutions (helmet and scope cameras, low-latency encoders), PTZ cameras, drones or by satellite and transmitted wirelessly via hubs to intermediate units and mission control. Bidirectional communication is ensured under the harshest conditions.

Schematic display soldier

3.3. Dismounted Soldier/Networking

As C3 equipment for the dismounted soldier we show:

- Soldier system INVISIO T7 speech and hearing system with control unit and connection to the intercom (Imtradex)

- Bittium Tough SDR handheld (ESSOR waveform, Manet)

- Bittium Tough Mobile as LTE device with ATAK situation awareness app

- helmet-mounted radio CRE2-144 with camera (Radionor)

- Portable SatCom terminal SatCube for long-range connections (MBS)

- Micro-computer M3-LITE (Cubic)

The communication equipment also enables the soldiers to collaborate with the comrades in remote locations via the Digital Situation Table DigLT (display- or VR-based).

Schematic display G5 demonstrator

3.4. Mobile Command Post

The platform for the mobile command post is FFG's PMMC G5.

FFG has completely redesigned the PMMC G5 with the aim of replacing existing tracked vehicles worldwide and as efficiently as possible. Even in its basic version, the G5 offers a high level of integrated mine and IED protection, which can be easily and safely increased with ad-on modules. The extensive use of MOTS and COTS products and a very robust vehicle design, combined with a simple service and maintenance concept, make the G5 a versatile, cost-effective solution with low life cycle costs.

Due to its modular design with standardized mission modules, the PMMC G5 is available in different variants, e.g. as a personnel carrier (up to 12 soldiers), armored recovery vehicle, medical vehicle, transporter or, as shown at AFCEA 2021, as a command post tank/ command vehicle.

By consistently maintaining open architecture models as well as technical standards and interfaces, modular-ly structured overall systems can be configured and realized in such a way that various specialized suppliers

can each contribute suitable products/services. The use of standardized racks enables fast and cost-saving installation or replacement of equipment.

At AFCEA 2021, we will be showing a prototype G5 equipped as a command vehicle, in which various equipment elements are scaffolded as examples, which can be combined, supplemented and exchanged as re-quired/type of deployment:

Reconnaissance Options

- UAV Black Hornet VRS system with 4-fold launcher, control station inside the vehicle (Teledyne FLIR)
- Tethered UAV TELEVATOR (Vectorbirds) equipped with radio communication (LTE/Radio Relay)
- Helikite/tethered aerostat (Booth A07) can be equipped with various payloads such as sensors and radios (LTA Technologie)
- Jammer detection (HENSOLDT)

Command and Control

- Visualization: DigLT in vehicle version (Fraunhofer IOSB)
- Planning tool OPTARION (HENSOLDT)

Communication

- SatCom-on-the-Move: broadband mobile satellite communication even while driving (MBS)
- Tethered UAV:
  - Phased Array Radio Module CRE2-144-M2-SMA (Radionor)
  - LTE cell BlackWolf (Cubic)
- Radio relay: Radiohead IV on telescopic mast for high data rates (TAC WIN family, ESSOR)
- Tactical communications Bittium Tough SDR Vehicular
- LINK 16 terminal (communication to flying/swimming platforms)
- Communication node TVS as gateway to subsystems (e.g. weapon system, communications, etc.) (RUAG)
- Antennae and telescopic mast (Comrod)

- Intercoms
  - INVISIO intercom with transition to dismounted soldiers (Imtradex)
  - Integrated inercom system WiSPR (Intracom)
- Optional: PRC117G, PR4G (interoperability to allies)

Navigation

- Inertial Navigation System Advans URSA (iXblue)

Cross-Functional IT and Information Processing

- M3X hardened mission computer family (Cubic)
- Crew station roCCs and displays (roda)
- Data management system Data Fabric (NetApp)

Energy Management and Storage

- GENAIRCON (Intracom Defense)

3.5. Reconnaissance Vehicle – MoSa-M4

The MoSA (Mobile Situational Awareness) platforms developed and manufactured by Broadcast Solutions enable flexible tactical communication in mobile units of various designs and sizes.

The MoSA-M4 platform (to be seen at the outdoor stand A03) is a vehicle that facilitates command,

control, communication and computer infrastructure (C4), optimized storage solutions and logistics. Additional possible equipment includes hydraulic masts, PTZ cameras, video management systems (VMS), and further sensors, with optional drone detection or drone defense systems (with selected partners).

Stand A05

Highlights:

High-performance and resilient IP transmissions (ad hoc networks, MESH topology, NLOS, COFDM, MIMO, full-duplex for voice, data, video)

High-quality, low-latency video transmission (live HD and 4K videos)

C4 on board (3-4 operator positions, monitoring, recording and analysis of feeds from the field, can be combined with GIS system, digital intercom system for communication with units in the field)

Drone detection and drone defense

Mobile power supply and optimized energy management

Mobile data backhaul (via mobile radio or SatCom)

Stand A05

4. Solutions/Products

4.1. Reconnaissance

4.1.1. Nano-Drone System
Black Hornet VRS (Teledyne FLIR)

The Black Hornet VRS system is currently the smallest and lightest UAV reconnaissance system worldwide.

The starter unit comprising four UAVs is mounted externally and fully integrated into the vehicle. Automatic start capability and continuous operation ensure real-time awareness of the situation for the crew protected inside the vehicle.

The entire system is easy to integrate, even in modern battlefield management systems (BMS). Mastery of the system can be learned quickly.

Black Hornet   *Launcher Unit*

Black Hornet VRS

- EO/IR – videos, pictures
- Weight 33 g, length 168 mm
- Up to 6 m/s; 25 min flight time; range 2 km
- Wind up to 15 knots/gusts up to 20 knots
- System integration via GVA interface

Stand A06

4.1.2. TELEVATOR – Vehicle-Bound Tether UAS (VectorBirds/ValoFly)

The TELEVATOR system essentially consists of an Unmanned Aircraft Vehicle (UAV) of the type Kite75T (Vectorbirds), as well as a Tether Ground Station type TGS Avior (ValoFly), which is integrated into a carrier platform and supplies the UAV with power. With the system, there is almost an unlimited flight time of the UAV possible.

TELEVATOR is developed especially for vehicle mounting. This enables the tethered and simultaneously on-the-move operation of the drone at flight altitudes of up to 80 m including fully autonomous take-off, flight and landing on the vehicle.

The control of the Kite75T, as well as the data transmission to the vehicle takes place via radio or the tethering cable of the TELEVATOR. The TGS Avior acts as the interface between the UAV and the control station, located inside or outside the vehicle. If necessary, the Kite75T can be converted to a purely battery-powered system in less than 30 seconds without tools. Extended use of the UAV is possible in this way.

The maximum take-off weight of the Kite75 is 9 kg, with a rotor diagonal of 90 cm. In addition to classic cameras (EO/IR) as a payload, the TELEVATOR can be equipped with appropriate communication technology and thus used as a mobile radio mast with up to a height of 80 m. So time-consuming erection of an antenna mast is eliminated which supports a fast set-up of communication connections.

Stand A06

4.1.3. Helikite Systems/Tethered Aerostats (LTA Technologie)

Lighter-than-air systems require no energy or propulsion to stay on top. Therefore, they can be used longer than drones and other aircraft. They do not cause any emissions such as noise, exhaust gases, vibrations, etc. and therefore do not falsify the "image" they take. They can be varied in size and configuration depending on the task and the required payload.

- Payloads: cameras, radio technology, measuring devices, ...

- Applications: surveillance & monitoring, airborne communication, science, ...

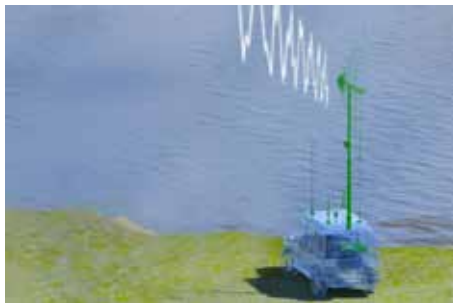- Products: Helikite Airhooks with approx. 200 g up to Desert Star with over 50 kg payload.

Stand A07

4.1.4. Spectrum Dominance – Jammer Detection (HENSOLDT)

In symmetrical and asymmetrical conflicts, the use of the electromagnetic spectrum for communication purposes is crucial for successful use. Each party to the conflict will ensure that their own communication is guaranteed, while the opponent's ability to communicate is largely blocked (Denial of Service – DoS). Therefore, the adversary's use of disruptive means is not only possible, but probable. For countermeasures, it must first be determined that a jamming attack is present. The next steps are geolocation and the initiation of countermeasures.

Such a passive interference detector typically consists of a receiver that covers the relevant frequencies, a corresponding antenna or antenna set and a processing unit with algorithms that analyze the digital signals, as well as geolocate the emission. The results are displayed in various forms, from a simple alarm to the provision of detailed information, or transmitted to other applications for further use.

Stand F18 / A06

4.2. Command & Control and Information Processing

4.2.1. Situation Visualization
DigLT (Digital Map Table) (Fraunhofer IOSB)

The underlying software is modular and can easily be custom-tailored towards specific needs and extended depending on the requirements. Its uses range from educational use to mission preparation, mission execution, and review. A diverse range of data sources and geodata can be integrated to provide the right information for each use-case. This provides the basis to correctly judge the situation and make the right decisions.

Stationary, deployable and mobile systems (existing and new technologies to be introduced) can be merged in such a way that national and international interoperability is given and the information required for command & control is available on time and as required.

The core of the Digital Map Table is the server, the DigLT^{Core}, which, in addition to geodata, also provides all layers, configurations and functions. The server can

Virtual Digital Map Table   Virtual Site Survey
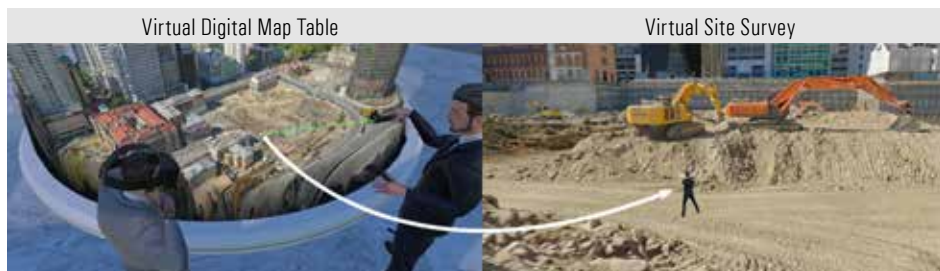
then be accessed by the web-based client DigLT^{Web} and the virtual reality client DigLT^{VR}. Due to the flexibility of a web application, this client can be used on almost all end devices, especially the high-resolution DigLT^{4k}.

- Scalable, highly mobile solution
- Interactive teaming over long distances
- Can be used flexibly in stationary, mobile command posts, command vehicles down to soldier level without media disruptions
- Simple operation by using a user interface known from the civil world (smartphone/tablet/PC).

Stand F18 / A06

4.2.2. Android Team Awareness Kit ATAK

ATAK is a tactical real-time application for tablets and smartphones such as the Tough Mobile from Bittium. It provides geospatial data and enables soldiers to work collaboratively at different locations, using voice, chat, video, a shared interactive map, etc.

ATAK began as a simple situation display tool and developed into a wide application. The flexibility of ATAK allows a quick integration of new technologies. For example, the raw video of an unmanned system (UAS/UGS) can be processed by software on site and fed into ATAK, which enables the operator to quickly display georeferenced and other processed images.

Another example: one of the most difficult challenges on the battlefield is disrupting troop communication by the enemy. In combination with additional tools from third-party providers, ATAK can track down and detect possible interference attempts and alert soldiers.

In conjunction with the digital situation table (DigLT), it forms the front-end in the tactical area.
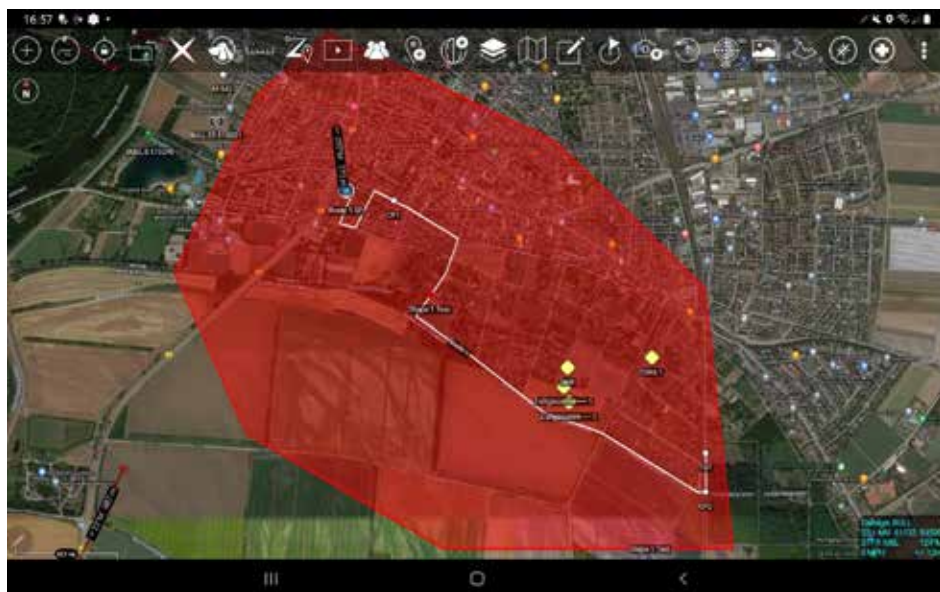
Stand F18 / A06

4.2.3. Airborne Mission Support OPTARION (HENSOLDT)

Also known in Germany under the term Einsatzunter-stützungslage (EUA), OPTARION is an network-based and modular solution for missions in the airborne field.

Stand F18 / A06

OPTARION Moduls:

- OptaFEP (web-based fleet management)

- OptaPlan (mission planning and 2D simulation)

- OptaMission (secure radio communication)

- OptaLog (technical & logistical support)

- OptaDebrief (3D mission debriefing and restitution)

- OptaCloud (4D mission planning as a service)

- OptaSIR (Surveillance, Intelligence and Reconnaissance)

At AFCEA 2021 HENSOLDT present the OptaPlan module. It supports the processes in both tactical planning and route planning. Tasks are automated as far as possible, a state-of-the-art GIS facilitates and accelerates the pilot's work. The pilot's risk of getting into an unforeseen situation is reduced by monitoring inputs for inconsistencies and indicating if critical points arise, e.g. from flight performance data, the schedule or terrain conflicts.

4.2.4. ISR – Process Chain & Information Management (M4Com)

M4Com solutions cover the entire TCPED operational cycle:

- Planning/tasking: planning, creating, transferring of missions

- Sensor control: operating/controlling different sensors

- Command and control: coordinating and controlling of forces

- Collaboration: joint exploitation in teams within network

- Exploitation: multi-sensor exploitation, fusion, analysis of raw data

- Reporting, messaging: dissemination, export interoperable products

- Live situational awareness: display of sensor data and situation info

- Big data: storage, processing and distribution of mass data in RT

- NEC: networked operation management

For the design of mission systems or its sub-functionalities M4COM uses the following in-house developed products and its sub-components:

- MAuS: Modular Multi-sensor TCPED System (tasking, collection, processing, exploitation, dissemination process)

- VIDIS: Video, Image and Data Distribution Service

- LinkFinity: Full Duplex IP LOS datalink

Stand F18

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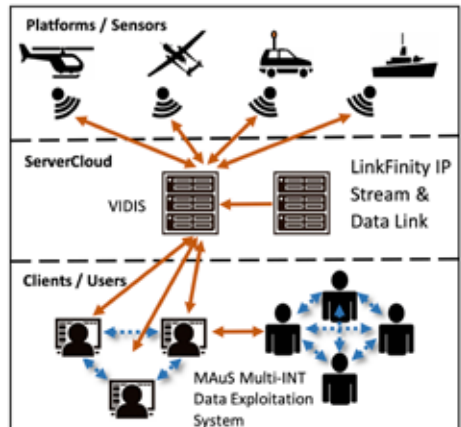
4.3. Cross-Sectional IT (Data Processing & Data Management)

4.3.1. Micro-Router, Switch, Power Supply – M3X (Cubic)

Mobile. Micro. Modular if there is no space for 19".

The **M3X** product family from CUBIC Mission Solutions (DTECH LABS) is the ultimate powerhouse for small, secure, portable communication systems. A "cuboid" consisting of a computer, router, switch and power module weighs $\sim$ 8 kg and is just $\sim$ 21 cm long/deep and $\sim$ 26 cm high.

The patent-pending design transmits power and data between the modules via Ethernet without the need for cabling via plugs, which significantly reduces set-up time and complexity.

An interlocking rail system enables the modules to be pushed together horizontally and vertically. A special lever construction enables quick release and reconfiguration.

Modules from the M3X family:

M3X-RTR: uses the Cisco 5915 Embedded Services Router. Offers 3 POE + capable ports in standalone mode as well as two rear NonPOE ports. An automatic connection function associates two of the rear connectors with the raised angle connector when they are connected to other modules.

M3X-SW24: uses the Cisco ESS-2020 switch. The auto-connect function assigns two switch ports to the raised angled connectors when they are connected to other modules, which significantly simplifies expansion without external cables.

M3X-APP: uses the latest Intel-based I7 processors in an IP-67 housing. Optional: radio module with Wi-Fi or cellular function. The M3XAPP is an application server, a virtual router, a firewall or a network accelerator.

M3X-BPS: battery supply and failover in the event of a power failure with a programmable LED screen that allows the user to see various functions, status and battery life.

M3-LITE small form factor general purpose computer designed for body-worn or light vehicle deployment; with an Intel Atom processor, enables users to deploy software definable capabilities, such as the Cisco 5921 Embedded Services Router, at the very edge of any IP network; battery powered, IP67-compliant, supports several wireless connectivity options.

M3X Module in Stack

4.3.2. Rugged Mobile IT Solutions (roda)

roda offers a wide range of hardware (tablets, handhelds, notebooks, displays, power supplies) in various versions for mobile use and vehicle integration under the toughest conditions, e.g.

roda Common Crewstation (roCCs)

a (N)GVA compliant (smart) display solution with touchscreen, Intel Core-processor, Video-over-Ethernet and a large number of interfaces and individually programmable keys.

19"/2 Form Factor Series

high flexibility through modular design for use in vehicles and mobile TuLBs. computers, servers, switches, routers and power supply are available in compact 19"/2 format.

Stand A06 / F05

4.3.3. Data Management
Data Fabric (NetApp)

Data Fabric is the data layer architecture and offers consistent and integrated data management services with a focus on data access, protection and security, as well as applications for data visualization.

The provision of resilient and equal data in the EDGE, CORE & CLOUD layers is ensured by the mission-dependent selection of the relevant NetApp product. The products are part of the Data Fabric architecture, are modularly scalable and can be deployed in both stationary and mobile environments.

Maximizing data benefit thus contributes to information superiority true to the motto: "Data @ Machine Speed enables Fight @ Machine Speed."

Possible Products of the Data Fabric Architecture:

- ONTAP (data management software)

- StorageGRID (scalable, software and object-based storage solution for large archives, data stores and media repositories

Stand A06

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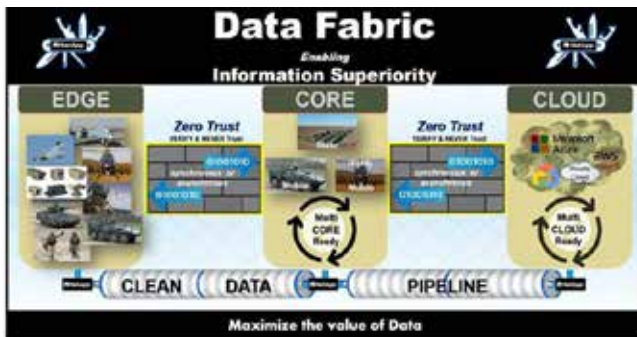
4.4. Communications

4.4.1. Satellite Communications
MBS (Media Broadcast Satellite GmbH)

4.4.1.1. Satcom-On-The-Move

As the time between reconnaissance and action becomes shorter and shorter, mobility or the rapid deployment of troop units is becoming increasingly

important in order to avoid presenting the enemy a static target in battle. A modern Satcom-On-The-Move (SOTM) solution makes it possible to provide high data volumes while the vehicle is moving, without having to unload and commission a communications terminal first. SOTM systems available today transmit up to several Mbps and, due to their flat shape, can be mounted in such a way that they hardly affect the contour of a vehicle.

As an example, we show a KYMETA -SOTM antenna mounted on a G5 vehicle (stand A06).

Features:

- Ku-Band
- + 4 Mbps Downlink, up 2 Mbps Uplink
- Automatic pointing without moving parts
- Fully automated commissioning
- Dimensions: 82.3 x 82.3 x 7.1 cm / 15.9 kg

Stand A06

4.4.1.2. Satcom-On-The-Pause

To enable broadband satellite communications on-the-pause (SOTP), lightweight and compact terminals are becoming increasingly important. With a weight of 8 kg and dimensions of 47 x 30 x 5.5 cm as well as data rates of up to 20 Mbps via HTS (High Throughput Satellite) the SATCUBE, for example, represents a bandwidth-enhanced alternative to previously available solutions such as BGAN.

The SATCUBE terminal contains space for 3 batteries (for 3 hours of transmission), which can be replaced without interrupting operation.

The alignment of the antenna is visually supported by a pointing system via an LCD display, so that commissioning only takes about one minute.

Stand F18 / S30

4.4.2. LINK 16 Terminal

Today, especially in a national and/or alliance defense situation, it is a matter of coordinating the deployment of all assets on the battlefield of a division, brigade or battalion. In terms of coordination, it is irrelevant from which dimension the assets are deployed. The basic idea is centrally coordinated fire support at all command levels with direct links to the corresponding higher command posts.

For networking with land-based platforms, too, the LINK 16 network, which has been introduced NATO-wide and has already proven itself in the air force and navy for years, offers a good solution.

4.4.3. Interoperability with Allies

The majority of current and future missions take place with NATO and EU allies. In many cases, however, tactical communication has grown historically and is not compatible between the individual allies. Radios with PR4G, SINCGARS and ANW2 waveforms are widely used. With a modular set-up concept, such as the G5 shown here, these and other radios can be easily integrated into vehicles and command posts according to operational requirements.

4.4.4. Cordis Array II – Long Range Video Streaming & Tactical Data Link Radios (MBS/Radionor)

The global defense sector is currently undergoing major changes to meet tomorrow's demand for network centric defense. Radionor Communications meets these challenges with a mature product line, the CORDIS ARRAY. The system is based on the Phased Array Smart Antenna technology and is particularly suitable for robust, secure, resilient, and high mobility communications.

The CORDIS ARRAY system offers electronic beam steering with instant change of direction. When a link is established, both transmitter and receiver focus their beam and track the other node, even at high speeds. Due to the narrow and precise beam, the RF power is optimally utilized, enabling long range, high bandwidth and making the signal difficult to monitor, jam or block.

Features

- Data rate: 15 Mbps (200 km range)
- Frequency range: 4.4 to 5.9 GHz (antenna integrated)
- Point-to-multipoint IP connectivity (ad-hoc)

At AFCEA 2021 you will see:
Stand F18 / A06

- Field-tested (NATO Defence Innovation Challenge 2017 award)
- Navigation capability in denied areas
- Blue Force Tracking (even in denied areas)
- Active EW Self-Defence tools

Product variants are available for command posts, land vehicles, aircrafts/helicopters/UAVs, ships/vessels, soldiers (attached to helmets) and as embedded versions (e.g. for ultra-light UAVs).

CRE2-179

352 x 352 x 65 mm/9.5 kg
for vehicles and small
vessels/RHIBs

CRE2-144-M2 with Camera

146 x 78 x 43 mm/295 g
(Camera 84.5 x 50 x 50 mm/140 g)

CRE2-144-M2-SMA

148 x 78 x 32 mm/295 g
for UAVs (smaller variant available)

4.4.5. Tactical Wireless
TAC WIN and Tough SDR (Bittium)

With the Software Defined Radio (SDR) based Bittium Tactical Wireless IP Network (TAC WIN) system, combat groups can create high data rate wireless IP networks as the backbone to support command and control data transmission (C2) during military operations. The flexibility to use the Bittium solution in different frequency bands and network structures offers cost-effectiveness, ease of use and efficiency compared to existing tactical data link networks.

Bittium Tough SDR™ –
Newest Generation of Tactical Radio

The software-defined tactical vehicle and handheld radios provide voice and data over the widest frequency range and the highest data throughput across multiple frequency bands. Together with flexible configuration options and routing networks, the radios support even thousands of radios in one network.

Bittium is a member of the ESSOR industry consortium. Porting the waveform to the national software-defined radios enables compatibility between radios used in European coalition operations, in line with the objectives of the ESSOR program.

Waveforms:

- Bittium Narrowband Waveform™ (25 kHz)
- Bittium TAC WIN Waveform™ (5/10 MHz; data rate up to 25 Mbps)
- ESSOR High Data Rate Waveform (1.25 MHz, data rate up to 1.25 MHz/Radiolink)
- Porting of other waveforms on request

At AFCEA 2021 you will see radios and devices as follows:

Bittium Radiohead IV™

- Point-to-point with integrated Beam-Steering
- Range LOS approx. 40 km (under ideal conditions up to 80 km)
- Frequencies: 4,400-5,000 MHz
- Channel width 5/10/20 MHz
- 10 kg/385 x 520 x 67 mm

Bittium TAC WIN Tactical Router™

- Routing und Waveform Processing Unit
- 19.4 kg/223 x 356 x 400 mm
- Multiple interfaces

Bittium Tough SDR Vehicular™

- 2-Canal Radio/Manet
- Frequencies: 30-512 MHz and 22-2,500 MHz
- Channel width:
  Ant 1: 25 kHz-10 MHz
  Ant 2: 25 kHz-5 MHz
- <15 kg/210 x 270 x 300 mm
- Application sandbox for C2 applications such as BMS and Blue Force Tracking

Bittium Tough SDR Handheld™

- Connection of Tablet PCs or Smartphones through cable or air
- Frequency range: 30-2,500 MHz
- Cannel width: 25 kHz-25 MHz
- 74 x 244 x 47 mm
- 70 Wh chargeable lithium-ion battery

Bittium Tough Mobile 2™

- Secured hardened Android-based 4G LTE-Smartphone
- Dual SIM with Dual SIM Standby (DSDS)
- Hardware-based security platform
- Integration customer-owned and 3rd party security solutions
- 3 variants: standard, restricted, confidential
- PTT, privacy button, up to 4 containers
- Secure Suite VPN, MDM
- Shown here with ATAK software.

Stand F18 / A06

Bittium Tactical Network Management™

Network management system and toolset, optimized for Bittium tactical communication networks:
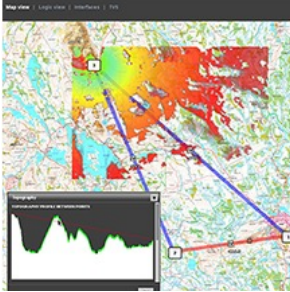
Bittium Tactical Network Planner Tool

for optimized network planning including calculation of the link quality and simulation of the coverage area

Bittium Tactical Network Manager Tool

for optimized network planning including calculation of the link quality and simulation of the coverage area
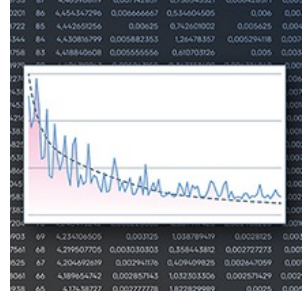
Bittium Network Analytics Tool

collects information from the network for your own evaluations/ statistics and recordings

4.4.6. LTE-Network – BlackWolf (Cubic)

BlackWolf is a robust, 4G LTE base station with an integrated core network (EPC Evolved Packet Core) that can be used as an independent LTE network or as a backhaul to larger networks.

BlackWolf can serve up to 64 active users at a download data rate of up to 150 Mb/s and a distance of up to 15 km.

Technical data

	Vehicle variant	UAV-Variant
Dimensions (WxHxD)	23.03 W x 19.30 H x 9.39 D (cm)	23.03 W x 19.30 H x 6.0 D (cm)
Weight	1.7 kg	1.0 kg
Frequency band	B1, B5, B28, B40 (further bands on request)	
Channel space (MHz)	5, 10, 15, 20	
Power	35 W	
Operational temperature	-20° C to +50° C	
Protection code	IP67	

There are also pure base stations (without EPC) with capacity for 64 or 128 users available.

4.4.7. Communication Node – Tactical Vehicle Switch TVS (RUAG)

The TVS is a tactical communication router which simultaneously fulfills several functions in military communication scenarios. This enables reliable voice and data communication between strategic, public and existing networks to be implemented in an interoperable, non-hierarchical manner and ensures effective communication at all levels. A decisive advantage is the possibility of integrating existing communication devices (legacy), with which a step-by-step replacement can be made and nonetheless seamless communication is guaranteed.

Features:

- Gateway to peripheral systems (vehicle, weapon system, position, navigation, etc.), intercom, communication

- Central interaction/configuration

- Tactical routing, voice integration in vehicles, tactical telephony, messaging, etc.

Dimensions/weight: 279 x 215 x 85 mm (WxDxH)/4 kg

Interfaces (Konfiguration 600):

Switched electrical Ethernet	4 x 1000 BASE-T, 8 x 10/100/1000 Base-T incl. PoE
Radio Analog Terminal Adapter	4 x Audio, PTT, COR/Squelch, serial interface
USB	2 x USB 2.0
Service	1 x 100 Base-T, 1 x USB, 1 x VGA
Option	further interfaces on request

Stand A06 / S62

4.4.8. Soldier and Intercom Systems

4.4.8.1. Over-the-Ear-Active Hearing Protection Headset – INVISIO T7 (Imtradex)

The INVISIO T7 Over-The-Ear headset combines latest technology. Without battery it is lightweight and available in different wearing styles, headband, neckband and helmet-mount. Interchangeable in less than 2 minutes. The 28dB SNR hearing protection secure your hearing. The market leading 360° situational awareness provides directional knowledge of your surroundings. In combination with the In-Ear Headset X5 it increases the hearing protection to 42 dB SNR. The headset can be used at heights of 12,000 meter+ or down to 10 m submersible. Immediate situational awareness after emerging due to the innovative drainage technology.

4.4.8.2. Control Units of the Latest Generation – INVISIO (Imtradex)

The latest GEN II of the control units gets an innovative software driven step ahead for the communication equipment. The system is highly flexible. With support of AI technology, it allows better hearing and transmission. The patented IntelliCable™ auto-sensing technology is providing plug&play capabilities. All comports are dual-net ready and can be used with different radios and intercom systems straight forward. The voice prompts provide enhanced user experience. The control units are available with single comms versions V10 and V20, dual comms version V50 with internal power supply and the triple comms version V60.
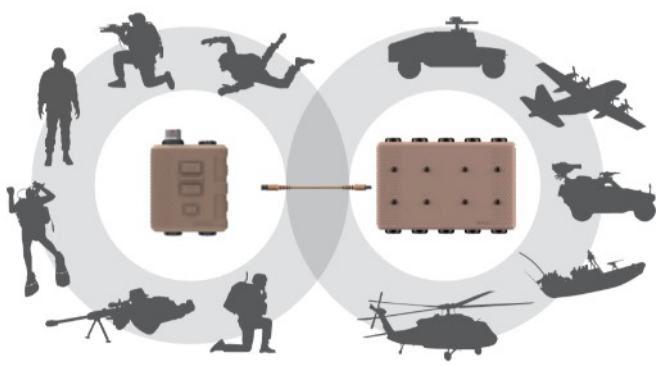
Stand F18 / A06

4.4.8.3. Intercom – INVISIO (Imtradex)

The INVISIO intercom system allows a seamless flow between the mounted and dismounted soldiers. The combat proven INVISIO soldier system can easily be adapted to the intercom providing enhanced features.

Whether the intercom is fixed installed or flexible fitted as a backpack solution, it provides state of the art functionality. It does not matter you are in the air, at sea or on land.

Stand F18

4.4.8.4. Integrated Intercom System WiSPR (Intracom Defense)

Scalable intercom system for use in a variety of wheeled and tracked vehicles; features high reliability, very good noise reduction, and low life cycle and maintenance costs.

With advanced Dynamic Noise Reduction (DNR), WiSPR provides unmatched performance in very noisy vehicles, remarkable speech intelligibility, improved crew hearing safety, increased situational awareness.

Key Features:

- IP technology with Power Over Ethernet (PoE)
- Unmatched noise reduction & adaptive suppression of wind noise (-39 dB)
- Noise-free wireless networks
- Both ear cups separately controllable
- Audio alarms and notifications

- Radio silence mode
- Automatic radio message forwarding
- Covert operations through disengageable display
- Software API for remote control of other systems

4.4.9. Antennae and Masts (Comrod)

Every radio transmitter and receiver requires an antenna. With the increasing number of radios and the increasing use of multi-channel radios, the number of antennae on vehicles and shelters has risen continuously.

The intergration of antennae onto limited platform space, while achieving antenna separation to maintain pattern performance, is the largest challenge of modern communication. Comrod offers multi-band antenna solutions together with passive or active antenna combiners for connecting multiple transceivers to a reduced number of antennae. Sharing antennae reduces the pattern distortion associated with co-site antenna interference.

As a specialist for antennae and positioning systems, as well as the planning of entire antenna systems, Comrod has created an antenna concept for the G5 command vehicle/communication node (stand A06) in order to be able to operate the radio systems used in the vehicle at the same time and corresponding multi-band antennae and a telescopic mast (TM170) for attachment of the Bittium Radiohead IVTM proposed or provided.

Product	VHF30512DB	UHF727VM	TM170 Telescopic Mast
Band	VHF 30-89 MHz, UHF 225-450 MHz (2 channel-radio)	LTE (Band 28 b and civil bands), LINK 16	Equipped with Bittium Radiohead IV
Frequency	VHF: 30-88 MHz UHF: 225-512 MHz GPS: L1/L2 1575/1227 ± 10 MHz (option)	700-2700 MHz	NA
Length	1.53 m	0.74 m	Un-guyed heights up to 10 m
Weight	Pole: 1.1 kg Socket: 2.6 kg	Pole: 0.8 kg Socket: 1.8 kg	
Operating temperature	- 55° C to + 71° C	-55° C to + 71° C	-55° C to + 71° C

4.5. Navigation (iXblue)

iXblue is a leading global provider of innovative solutions and services for navigation, positioning and imaging on land, air and sea.

In the area of land systems, iXblue has developed a wide range of inertial navigation systems for blue force tracking and light weapon systems through to the navigation and route guidance of tactical artillery and armored vehicles. From this iXblue will present at AFCEA 2021:

Stand A06

Advans Ursa is an INS (Inertial Navigation System) based on FOG (Fiber Optic Gyroscopes) technology that continuously supplies position, direction and altitude information for tactical navigation, blue force tracking, in combat missions and the use of light weapon systems, even if no GNSS/GPS signals are available.
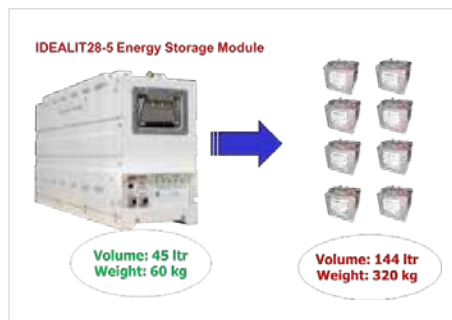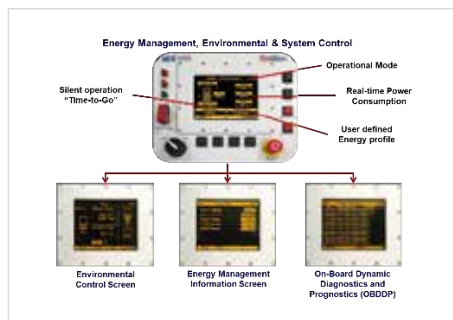

Advans Ursa 5 connected to a Tablet PC

4.6. Power Management & Storage – GENAIRCON (Intracom Defense)

Platform-customizable system that provides integrated hybrid power supply and energy management, as well as a dedicated energy storage system (ESS).


Central Management Terminal (CMT)

• Intelligent management of all vehicle streams
• Allows feeding into networks
• Configurable energy profiles and schedules
• Central monitoring unit or vehicle display
• Automatic diagnostics and forecasting functions

Energy Storage System (ESS)

• New Li-Ion technology with high auto-ignition temperature
• High packing density
• Long lifetime
• BMS with active cell balancing
• SAE J1939 CAN bus communication
• MIL-STD & tested bullet resistance
• Continuous power and pulse power

5. Overview Participating Companies
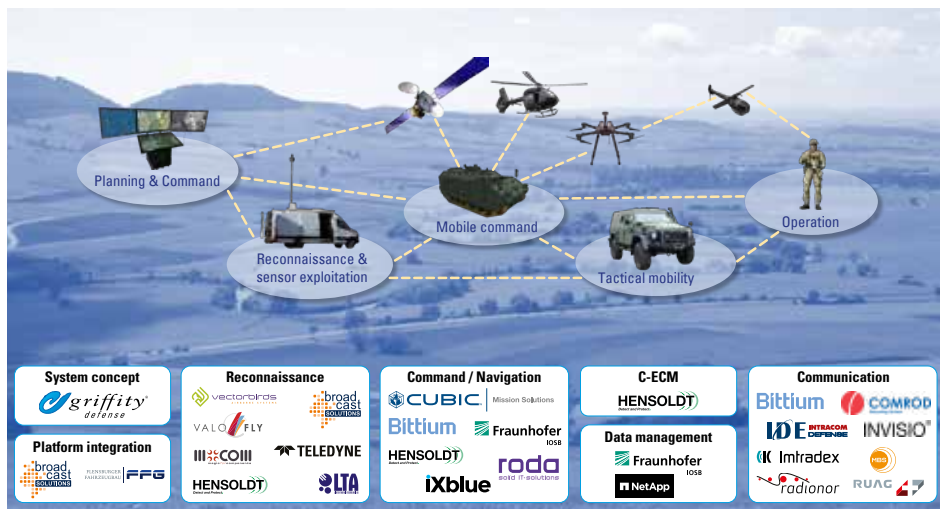
Participating companies and their role

5.1. Bittium

In addition to radio communication with tried and tested information security solutions for the tactical area, which provides the troops with broadband data and voice, Bittium also offers modern LTE technologies for use in the field. For secure communication, Bittium has proven mobile devices and cyber security solutions that are certified up to CONFIDENTIAL level in its portfolio.

5.2. Broadcast Solutions GmbH

is one of the largest system integrators in Europe and plans and implements projects in Europe, Asia and the Middle East for action forces, emergency services, BOS and first responders. We offer state-of-the-art tactical wireless communication and video solutions for both mobile and fixed units as well as body-worn equipment – on land, at sea and in the air. By combining with other technologies, products and solutions, we deliver customized and turnkey integrations. They are used in the areas of situational awareness, covert investigations and networked operations.

5.3. Comrod

Comrod Communication AS is headquartered in Stavanger, Norway and has facilities in Norway, France, Hungary and the USA. The group develops and manufactures antennae, antenna combination and control systems, telescopic and section masts, power supplies and battery chargers for the tactical communications market. Comrod also designs and manufactures marine antennae for the commercial marine market.

Comrod antenna products cover all frequency bands in the HF, VHF, UHF and SHF spectrum and include broadband, multiband and multiport products. These products can solve problems with co-site interference or availability of platform space. In addition to the extensive range of vehicle and manpack antennae, Comrod has a wide range of remote antennae for use with wide area networks and to expand the range of tactical networks.

5.4. Cubic Mission Solutions

develops network and communication technologies for the mobile tactical area that offers extreme modularity, redundancy, reliability and high performance in your world-leading SWAP package.

The CMS product range includes high-speed servers, routers, switches, radio gateways and solutions that enable the transmission of voice, data and video across a wide range of technologies (e.g. PTT radios, cellular networks, WLAN, SatCom).

5.5. FFG – Flensburger Fahrzeugbau Gesellschaft mbH

In addition to modernization, conversion and repair of military vehicles, FFG also offers in-house developments such as the PMMC G5. Taking into account current requirements for standardized armament sets, also in existing vehicles, FFG has worked out a number of concepts with partners and will be showing a prototype of a PMMC G5 equipped as a command vehicle (outdoor stand A06) at AFCEA 2021.

Over the past fifty years, FFG (Flensburger Fahrzeugbau Gesellschaft mbH) has consistently developed from a repairer for the German armed forces and armies of friendly nations via upgrade specialization into a vehicle manufacturer and system provider.

These activities have led, among other things, to extensive further developments, such as for vehicles of the Leopard 1 family, M113 and the current development of the NDV Wiesel 1. Within the last few years, FFG has invested in its own developments and has since been represented on the market with its own vehicle systems.

The highly protected vehicle platforms ACSV, G5 and WiSENT 2 with their modularity offer the customer a wide range of possible applications and pave the way for FFG to establish itself as a system house on the world market. The focus on maximum flexibility of in-house developments and low life cycle costs form the cornerstone for future-oriented and economical emergency vehicles with a long service life.

5.6. Fraunhofer Institut für Optronik, Systemtechnik und Bildauswertung (IOSB)

The core competencies of the IOSB are the generation of images and related sensor signals, the associated signal processing and the use of images in systems. With the Digital Map Table DigLT and its virtual reality version DigLT^{VR}, the IOSB offers a contribution to the visualization of situational awareness and command & control.

5.7. griffity defense GmbH

offers comprehensive services around the development of complex technical and application-related scenarios, from concept development to support during implementation, e.g. by finding the right partners. One focus is system design and the development of cross-platform architectures and concepts including tactical scenarios.

5.8. HENSOLDT

ranks among the market leaders in the field of civil and military sensor solutions and develops new products based on disruptive approaches for data management, robotics and cyber security to combat increasing threats. For the rapidly growing area of cyber security, the company develops hardened basic IT systems that are resistant to hacker attacks or system-inherent hardware weaknesses. Thanks to its many years of experience in the field of electronic warfare, HENSOLDT is also ideally positioned for cyber defense. The HENSOLDT product range also includes mission avionics, such as avionic computers, mission planning and autopilot systems. With its broad portfolio, HENSOLDT covers all defense and security missions and ensures the superiority of its customers in monitoring the entire electromagnetic spectrum. The company's solutions are deployed on a variety of platforms including helicopters, aircraft, drones, ships, submarines, armored vehicles and satellites.

5.9. Imtradex Hör- und Sprechsysteme GmbH

supports its customers under the motto "command & control" in security-critical applications. IMTRADEX sells the world's leading INVISIO hearing/speaking system exclusively in the German market. The system is already being used reliably and accepted by users in over 50 nations. Over 200,000 systems have been delivered and are used by the military and special forces in a wide variety of operational areas and climatic zones around the world. Whether the connection of different headsets or different radio devices, cell phones, intercom systems in vehicles, airplanes or helicopters, the simplicity is leading.

5.10. Intracom Defense (IDE)

INTRACOM DEFENSE (IDE) is a highly acclaimed Defense Systems Company in Greece, with an outstanding record of participation in domestic programs and exports to quality-driven international customers including Finland, France, Germany, Israel, UK and USA.

IDE utilizes high-end technologies in the design and development of advanced products in the areas of Tactical IP Communications Systems, Integrated C4I Systems, Missile Electronics, Surveillance, Hybrid Electric Power Systems, and Unmanned Systems. The company retains its international recognition through the long-standing participation in European and NATO new technology development programs.

5.11. iXblue

is a world leader in the development and manufacture of innovative solutions for navigation. With its unique technology, the company offers its defense customers turnkey solutions with optimal efficiency and reliability.

iXblue is industry recognized for pioneering fiber optic gyroscope (FOG) design. In all these areas, the group works to ensure that their products offer high accuracy and unmatched performance and reliability. iXblue produces all relevant parts by its own in France and the products are 100 % ITAR free. Due to the production depth, there is a high precision and performance.

5.12. LTA Technologie AG

At LTA Technologie AG, everything revolves around aerostats – tied up or free-flying. The Wiesbaden-based company sells and operates aerostats from various manufacturers. Typical fields of application are in particular surveillance & monitoring, there are also resourceful applications in the advertising & event sector and science.

In the security sector, our products are the Helikite aerostats of our partner Allsopp Helikites (UK), which have been extremely successfully established by the military, authorities and civil organizations for 25 years.

We support our customers with configuration and system integration and, with our special know-how, offer training, maintenance and service.

For suitable projects, we also offer the use of Helikites as an operational service.

5.13. M4Com System GmbH

System house with over 20 years of experience in providing defense and security solutions for turnkey ISR process chains and ISR information management. We offer

• open, interoperable high-performance S/w and H/w technology for real-time information management and data processing in the areas of Image Intelligence (IMINT) and Signal Intelligence (SIGINT) from airborne reconnaissance platforms as well as land or sea-based platforms;

• provision of ITAR free, NATO STANAG compatible solutions, each with an open standard, generic interface and cross-functional connection in a network-centric environment;

• provision of conceptual advice, standard assessments, assessment of IT security, accreditation and implementation of studies for public clients.

5.14. MBS (Media Broadcast Satellite GmbH)

As the operator of Germany's largest teleport, MBS offers its customers highly available, flexible satellite connections and is a competent partner for the integration of additional radio systems into the communication network on the tactical level.

As a partner of Radionor, MBS also offers their Cordis Array product family based on phased array technology, which offers significant advantages over conventional radio systems through "electronic beamstearing".

5.15. NetApp

cloud and data management software provider, specializes in the secure and efficient storage, encryption, backup and replication of data. In addition to the storage itself, this includes the management, backup, storage and provision of data. The hardware and software available on the market from NetApp offers a broad portfolio of hybrid cloud data services that simplify the management of applications and data across cloud and on-premises environments. On the basis of the wide range of competencies, innovative and low-risk NetApp technologies – for both civil and military use cases – can be put together in a modular manner in order to generate maximum data benefit.

5.16. Radionor Communications

Radionor Communications is a supplier of next generation tactical broadband data links based on phased array antennae. The technology provides unmatched range and stability and is ideal for high-mobility applications. The technology has been proven to offer unique performance for tactical operations for manned and unmanned aircrafts, vessels, vehicles and man-carried equipment.

The Cordis Array II technology has, since its introduction, reached a mature state with an increasing number of users and application areas, especially within the defense and unmanned segments.

5.17. roda computer GmbH

specializes in the development, manufacturing and sales of rugged IT systems, network components and power supplies. Continuous further developments of laptops, tablets, displays and power supplies have made roda one of Europe's leading providers of mobile full-rugged IT solutions. roda products are characterized by high reliability, long durability and a high degree of customization and needs-based modifications and have proven themselves in the toughest areas of application worldwide since the mid-1990s.

5.18. RUAG GmbH

RUAG make a significant contribution to the security of Switzerland. As a future-oriented technology partner of the Swiss Army and other national armed forces, the focus is on life cycle management, operation and availability of military systems.

The comprehensive product and service portfolio includes reliable information and communication solutions, unique subsystems and components for tracked and wheeled vehicles. In addition, there are fighter jets, military helicopters and air defense as well as comprehensive maintenance and repair services.

Customers are primarily national and international armed forces, authorities and civil security organizations.

5.19. Teledyne FLIR

constructs, develops, manufactures, markets and sells technologies that improve perception and awareness. We make everyday life easier for many people with innovative detection systems. Cameras for infrared light and visible light, position determination systems, measuring and diagnostic systems as well as high-performance systems for the detection of threats. Our products expand the possibilities for interaction with the environment, strengthen public safety, contribute to increased energy efficiency and promote the productive development of society.

5.20. Vectorbirds/Valofly

As young, German start-up companies in the field of unmanned aviation, the two companies Vectorbirds and ValoFly develop drone systems and accessories. Their joint developments include the TELEVATOR mobile UAS port presented here, which stands out for its special performance features.

6. Contact Information

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Bittium · broadcast SOLUTIONS · COMROD · CUBIC | Mission Solutions · FLENSBURGER FAHRZEUGBAU FFG · Fraunhofer IOSB

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