Article

The Future is Here - The Future Tactical Communication Network

Author: Horst Treiblmaier

Photo: Bittium

After having used its Integrated Telecommunications Infrastructure (Integrierte Fernmeldeinfrastruktur, IFMIN) for almost 30 years, the Austrian Armed Forces needed a new deployable communications system. This new system was launched under the name Future Tactical Communication Network (FTCN). Right until the conclusion of the contract, planning was dominated by considerations of technological possibilities and limitations, and the requirements of modern voice and data communications in combination with the requisite military robustness. The troops are to begin operating the system from 2023 onward.

The Truppendienst magazine's issues 3 and 4/2019 (available online) featured articles on the introduction of the IFMIN and the progress made on the road towards a communications system. By the beginning of 2019, almost all the components of the existing deployable telecommunications system had reached the end of their lifespans. For that reason, the initial groundwork was laid in 2011 by the Intelligence and Communications Technology Planning Department (Informations- und Kommunikationstechnik Planung, IKTPl), with the assistance of the end users (the troops), to replace the old system and set a schedule for implementation with the responsible departments. A tentative deadline for submission of the necessary military specifications was set at the end of the first quarter of 2015, and the first quarter of 2016 for the specifications for the call for tenders. This was to start a system upgrade in 2018.

Planning Considerations

The communications system of the Austrian Armed Forces (see Figure 1) is, like its international counterparts, divided into

- the fixed communications system (ofFMSys),
- the deployable communications system (vlgbFMSys) and
- the mobile communications system (mblFMSys).

Fixed Communications System

As it predominantly utilizes civilian technology, the fixed system is continually being updated to meet the technical requirements. Currently, the emphasis is on the routers being replaced and the capacity of the fixed radio relay system being increased to transmission rates of up to 800 Mb/s. In addition, the replacement of the Austrian Forces' private branch exchanges network is currently undergoing evaluation.

Mobile Communications System

The mobile system predominantly consists of the combat net radio system. The most essential function – voice and data radio communications - was implemented at the tactical command level, starting with the introduction of the troop radio system CONRAD in 2008.

Although an overhaul of the shortwave radio system has been commenced, its implementation is being delayed due to technical issues and funding restrictions. Numerous other radio applications require replacement or harmonization; here, the introduction of the Terrestrial Trunk Radio (TETRA) radio system by the authorities and organizations with a security mandate (state security network BOS-Netz AUSTRIA) and soldier radio devices have helped to improve performance significantly.

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Deployable Communications System

The deployable communications system will be entirely replaced by the FTCN project. The deployable and mobile communications systems cannot be renewed at the same time, due to the planning, procurement, technology, logistics, and training personnel required, as well as the budget available. Challenges with the technology lifecycles are consciously being accepted in the process. The process overview for the replacement of the entire comms system over two decades is depicted in Figure 2. In addition, new requirements for communications services must continuously be recorded and integrated into the planning and procurement process.

Changes in the technological and military settings are the essential factors driving the development of communications systems capacities. Networked operations management requires the integration of sensors (e.g., radars, drones, electronic warfare), effective means (e.g., artillery) and all levels of command in one network. Digitalization creates the conditions for networks that are technically easy to implement, for efficient data management and for the future use of artificial intelligence. Ultimately, the diversity of the scenarios, especially the unpredictable and highly dynamic circumstances, require a high degree of flexibility.

Following change drivers have resulted in the FTCN project:

- Equipping the Forces, including at the company level and in other important units, for integration into a broadband communications network (previously only at battalion level);
- Use of Internet Protocol (IP) technology as the standard;
- Reduction of the time required to establish or ensure broadband network integration, also during movement;
- Flexible options for creating communications networks to cover different scenarios (changes in tactical grouping, ensuring civilian-military cooperation);
- Independence of the communications system for key functions at all command levels (minimum requirement).

FTCN Planning

In order to ensure the future security and suitability of the new deployable communications system, the following measures

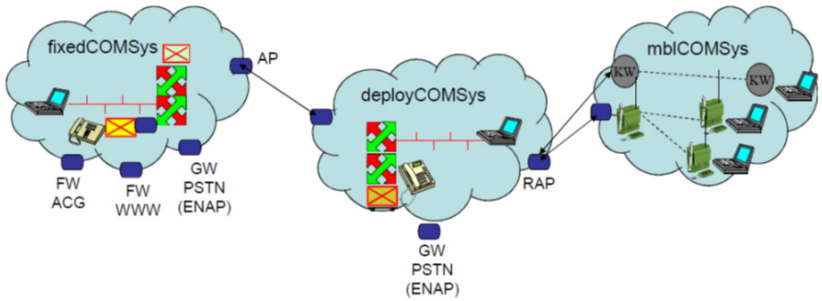

Figure 1. The communication system of the Austrian Armed Forces - an overview (Illustration: Austrian Armed Forces)

were carried out in parallel to the creation of the military specifications:

- Commissioning of a study to a leading Austrian technology company to clarify future technologies in the communications sector;
- Testing individual technologies for "functionality suitable for troops", e.g. Voice over IP, softphone use and new switching systems for communication networks;
- Visiting trade fairs, company contacts, and exchanging intelligence with other armies;
- Clarifying and defining future IT requirements or IT services, such as the development of the secure military network (SMN);
- Introducing a command and control system (C2S);
- Introducing a battle management system with an interface to the command and control system and
- Establishing an independent mail service;
- Introducing information services for other leadership areas, and
- Interfaces with other information fields (domains) such as civil networks and military networks of other countries.

These decisions, assessments, and deductions resulted in the creation of an entire bundle of measures, including the number of FTCN assets needed and supplementary documents for related projects. The military specifications for the Future Tactical Communication Network now stipulate the objectives and the general requirements for the communications system. The specifications also include the general requirements of military-grade strength MIL-STD-810, system availability, training (training facility), and material maintenance for all components of the new communications system. Also, the Army signal force had to be optimized to accommodate unknown requirements (e.g., power supply) and new requirements.

Objective

The aim of the Future Tactical Communication Network is to fulfil the basic requirements of command support for command center in 2023 and beyond, using a communications system that:

- is modular, IP-based,
- provides high data rates,
- integrates users both by wire and wirelessly,
- is quick to deploy,
- is connected with the combat net radio,
- is easy-to-use, self-adapting, and can be developed further,

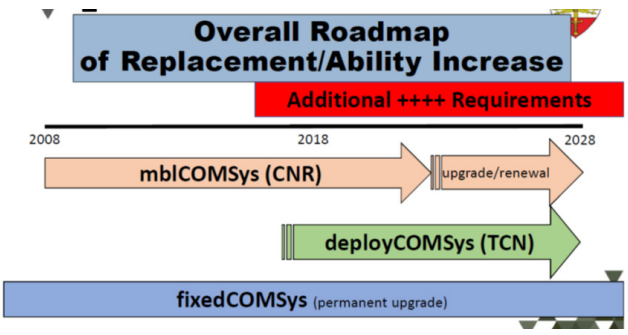

Figure 2. The schedule of the communications system upgrade in the long term (Illustration: Austrian Armed Forces)

in order to make the mission-specific services available in a network for all the deployed troops, as required.

Components of the FTCN

The most important components of the Future Tactical Communication Network are described below.

Bittium TAC WIN Tactical Router

As a core component of the new deployable communications system, the tactical router (see Figure 4) as part of Bittium's Tactical Wireless IP Network (TAC WIN) system has to ensure the integration of all long-distance connections (WAN - wide area network) and local connections (LAN - local area network). The key functions of the router are:

- Encryption of long-distance connections and ensuring security features;
- Possibility to simultaneously connect six long-distance connections (data radio systems, multi-channel satellite communications systems, leased lines, fiber optic connections);
- Possibility to connect five local connections using copper field wire and fiber optic;
- Activation of a media gateway to take over connections in a public telephone network system of the current standard;
- Activation of the RAP (radio access point);
- Activation of WLAN (Wireless LAN) and copper field cables for data transmission purposes (DSL - Digital Subscriber Line);
- Ensuring access to the management system;
- Bandwidth of at least 100 Mb/s at the interfaces;
- Connection and operation of up to 150 data users;
- Connection of up to 100 voice users with an active operation of 50 per cent.

The tactical router will be installed in armored tracked and wheeled vehicles, as well as in shelters and containers used for operations, transport, and storage. Up to 500 tactical routers must be operated in the total network, using standardized routing protocols.

The power supply needs to be based on the standard of the vehicles and must have an uninterruptible power supply to protect against power outages.

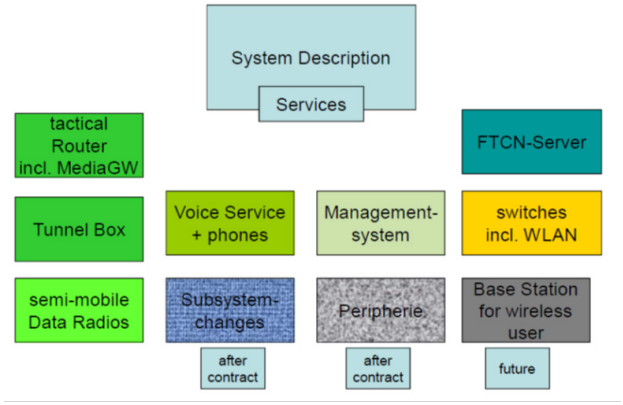

Figure 3. The structure of the future communications system, as defined in the military specifications (Illustration: Austrian Armed Forces)

Bittium TAC WIN Radio Heads

The TAC WIN system's radio heads (the overarching term for all the military long-distance data radio components to be procured) have the task of ensuring remote communications between command centers, for sensors such as radars, and for connecting to the fixed communications system. The radio heads provide point-to-point connections with directional antennas (see Figure 5), point-to-multipoint connections with sectoral antennas, and mobile ad-hoc networks (MANET) with omnidirectional antennas – also known as mesh networks (multiple nodes dynamically transmit network data). The frequency bands assigned to the Austrian Armed Forces are the standardized NATO frequency bands I, III and IV and they will be used with different antennas and antenna masts in order to achieve maximum flexibility.·

Within their field of responsibility, battalions use the frequency band I mesh/MANET radio head, with a typical range of four kilometers (without an antenna mast) and data rates of 11 Mb/s. These radio heads connect the battalion's command post, the companies, the mobile command post, and the network radio group – previously known as radio access point (RAP) – even while on-the-move if required (limited by the vehicle antenna).

In order to ensure a reverse the backlink communication, the battalion uses frequency band III at the command posts and at the net communications station. This means that, in a standard mission, the battalion can be integrated into the communications network without needing support from other forces.

Within their area of operations, brigades use the frequency band III point-to-multipoint and point-to-point radio heads, with ranges from ten to 75+ kilometers and data rates of 22Mb/s. In addition, band IV point-to-point radio head is available with ranges of up to 75+ km and data rates of up to 44 Mb/s.

Figure 4. The Bittium TAC WIN Tactical Router provides numerous connection options (Photo: Bittium)

Figure 5. Bittium TAC WIN Radio Head IV with integrated directional antenna for frequency band IV (Photo: Bittium)

Using antennas and antenna masts, which can be tested and flexibly allocated during the introductory phase, allows a high degree of the requirements to be covered, regardless of the scenario. In addition, an essential requirement is the use of antenna masts either from the troop radio system or the existing radio relay system, and the establishment of communications within 20 minutes of march halt. The installation of antenna masts and the power supply in armored tracked and wheeled vehicles, in shelters and in operating, transport, and storage containers, must be ensured as per the tactical router requirements stated above. The radio heads must be able to be deployed in the field by the command center by means of fiber optic cables where necessary (terrain, risk of electronic threats).

ICT Switching System with WLAN Access Point

The ICT switching system is used at the Austrian Armed Forces' deployable and mobile command center to ensure user integration (voice/data) up to and including the classification level "Restricted". It must therefore

- be IP-based,
- have a modular structure,
- be based on Ethernet interfaces,
- enable connection to the tactical router via fiber optic cables,
- ensure eight to twelve user connections with copper field cable,
- allow cabling for star and ring topologies,
- allow the compression of the LAN structure via fiber optic and provide an access point for wireless users.

The ICT switching system must provide the following components:

- ruggedized switches for use at command posts, in tents or vehicles;
- commercial standard switches for 19-inch racks in shelters;
- ruggedized switches for fiber optic connection
- analogue adapter for setting up to six analogue voice users with military field cables at distances of up to two kilometers;
- xDSL extension module for separating voice and data users with military field cables of up to four kilometers;
- WLAN access point in accordance with the applicable standard, removable up to 400 m from the tactical router or switch using fiber optic cables.

The power supply must be ensured as per the tactical router requirements stated above. Using IP technology, the users are supplied with power using Power over Ethernet (PoE). In other words, the power required is supplied via the network cable directly. The use of WLAN requires a commander's decision due to the risk of electronic threats. Use within the Tactical Operations Centre is strictly prohibited.

The ICT switching system, in connection with the users' (mainly staff) terminals, represents the greatest change in use. Separate voice cabling to the central IFMIN node is currently required; so far, the IFMIN telephones have been provided by headquarters. The user established the data cabling to a central switch (called a LAN box), and this was connected to the router in the switching system. With the new ICT switching system, a fiber ring is established to individual switches for groups of users (e.g. core areas of command) at the command center. At these switches, voice and data connections are available concurrently, and users can join independently (similar to online classrooms). By using softphone solutions for voice, voice and data services are available at the same time. With the additional use of WLAN, the time it takes to establish initial ICT operations at command centers, and when changing command centers, can be reduced to less than 30 minutes.

For communications by and with external (e.g. guard houses), facilities at command posts (e.g. HQ company), and for field camp operations, the analogue adapter and the xDSL expansion module enable almost full network access.

Terminals and Voice Service

With regard to terminals, several user-specific solutions meet the requirements. Users gain access by

- Bittium Tough VoIP Softphone with a headset and a wireless headset,
- standard IP telephones, and
- Bittium Tough Comnode military-grade IP telephones (mostly with additional functions (see Figure 6).

The voice service, Bittium Tough VoIP Service, must be available locally on the tactical router or on the FTCN server. The following basic functions must be guaranteed:

- Personal mobility (location-independent user access);
- Service mobility (user features vary, depending on function and need);
- Session mobility (the rerouting of an ongoing connection – a session – to another terminal, e.g. from a military to a civilian telephone);
- Terminal mobility (type of roaming function in cellular networks, e.g. WLAN).

Figure 6. The web-ready communications device and IP phone Bittium Tough Comnode with its audio extension accessory (Photo: Bittium)

FTCN Servers

The FTCN server must be suitable for operation in the area of the deployable network on the basis of the server clone. Depending on the operating environment, the FTCN servers must be able to be operated in an air-conditioned shelter, transport container, or a combat vehicle while it is on-the-move. In addition to the services available on the server clone, an independent mail service, the use of the IBM Notes client, a voice service according to military specifications, a document management service, a content management system (joint creation, processing, organization, and presentation of digital intelligence, mostly on websites) and the Logis/Operations service and LOGFAS must be capable of running.

Management System

One very particular aspect of the procurement is the management system. The management system is part of the call for tenders and thus part of the contract, but can only be developed once the contract has been concluded, as it is a solution tailor-made for the Austrian Armed Forces.

Its delivery is also probably the most time-critical aspect. The following specifications were set by the Austrian Federal Armed Forces so that a cost estimate could also be provided as part of tender submissions.

The management system is used for planning, configuration, monitoring, and troubleshooting the FTCN. It must be possible to install the management system on the Austrian Armed Forces' server and workstation clones, regardless of the platform. The Global User Interface (GUI) must feature all the following system components (tactical router, radio heads, media gateway, voice switches, end-user terminals) on one management interface.

FTCN Planning View

The Future Tactical Communication Network Management (FTCNM) must enable network planning, even without any connection to the network, for operations or phases of operations. As part of that, core configurations or pre-existing deployment configurations should be ready for use.

FTCN Operational View

The FTCNM must enable monitoring of network operations at the local level and, once permissions have been assigned, monitoring of an entire network or a network area. Two important factors in this regard are the ability to monitor network performance and that the operator can take actions in the event of any bugs.

FTCN Administrator View

The administrator assigns the network components and terminals to a FTCNM, provides them to the users, and monitors them.

FTCN Security

Since FTCNM significantly supports command capacity during any mission, the FTCNM security mechanism is of particular importance. The given requirements are to be met by allocating permissions based on roles and by the corresponding Smartcard-based password management. In addition, a calculation tool is required for radio coverage in the respective area of deployment. This need can be met by an additional tool in the FTCN management system or by adapting the troop radio tools available.

FTCN: Call for Tenders and Awarding of the Procurement Contract

Following the approval of the military specifications, work began on developing the specifications for the call for tenders for the system. Areas of the specifications were implemented separately – due to secrecy requirements or previous experience. The call for tenders was published in February 2016 following the tender standard "Negotiation procedures under the Federal Procurement Act 2012". The call for tenders generated great international interest. A total of ten applicants obtained the call documents. Three initial tenders were submitted in September 2016. Tender review and evaluation started at the same time and was completed in April 2017. In the subsequent negotiations, the "Best and Final Offer" was submitted on 8 September 2017.

As instructed by the Chief of Defence Staff, however, the contract was not immediately awarded to the best bidder. An additional agreement with the Federal Ministry of Finance was established, and the pricing and accuracy of the costs were evaluated by a recognized auditing firm. The contract was not awarded until 18 December 2018 - that is, 15 months later. The key figures of the contract awarded to the best bidder KAPSCH Business Com are: order volume from 2019 to 2023 of approx. 70 million euros, operation from 2023 to 2035 around 12 million euros, planned lifespan: 15 to 20 years.

The scope of procurement of the main components includes

- more than 300 individual tactical routers (Bittium)
- 388 radio heads for mesh network (NATO band I), feeder network (NATO band III) and backbone network (NATO band IV) (Bittium),
- more than 1,300 individual military fiber optic cables (100 m, 400 m and 1,000 m),
- more than 500 individual switches (IP),
- more than 1,600 individual IP telephones (military-grade IP telephones by Bittium),
- voice service (Bittium),
- management system,
- training facility - container solution,
- casing the components in shelters,
- operating, transport, and storage containers,
- command vehicles,
- material maintenance and support over the planned lifespan,
- training of the operational teaching and repairs staff.

Additional Projects

Numerous accompanying FTCN planning and provision projects need to be carried out in the procurement process in order to establish basic operability in the field. Specifically, they are:

- Procurement of multipurpose vehicles to replace the Pinzgauer-type command vehicles,
- Supplementary procurement of the radio shelters,
- Material servicing of the existing shelters,
- Procurement and introduction of multi-channel satellite systems,
- Procurement and introduction of field UPS to guarantee the power supply,
- Adaptation of the existing switch boxes or establishment of new switching points at all properties, to ensure both back-up networks on the properties and a permanent training infrastructure,
- Realization of tunneling to ensure that the networks are separated according to different domains (e.g. Land and Air) or different security domains (e.g. Restricted and Secret),
- Introduction of self-operating services (without reverse connection from the level of battalion up), as well as the
- Introduction of Intelligence Exchange Gateways for international cooperation.

Conclusions

Information superiority is the cornerstone of successful mission management both today and in the near future. The backbone is the deployable broadband communications network, further efforts are still needed for the mobile communications network. The FTCN project is the first major step towards superior intelligence planning. Realizing FTCN will be a Herculean task that can only be achieved through the collaboration of all those involved.

Author: Colonel General Staff, Engineer Horst Treiblmaier, MSD MA
Head of Communications and Electronic Warfare Planning, Austrian MoD