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Short Study on Performance of Air Surveillance Augmented by Twin Radars

BALAJTI István[1]

Detection of targets at low altitudes with a low Radar Cross Section (RCS) such as drones and stealth could challenge Air Surveillance systems and this situation must be addressed in a cost–effective way. This paper summarizes the newly emerged technical challenges of the Control and Reporting Centre (CRC) and gives solutions on how to overcome recognized shortcomings. In addition it highlights problems and requirements related to drone maneuvering capabilities and their very low RCS. This article summarizes challenges and gives a synthesized solution to the network centric approach based on the short distance Gaussian bi–static radar concept called twin radar coherent signal fusion. The idea is to explore advantages of the twin radar concept such as doubled detection range, increased, superior angular resolution of the system and increased plot update frequency. Examples for the twin radar performance demonstration are based on VHF radar, which has unique capabilities such as exploitation of multipath and resonance frequency for drones. A few peculiarities of the new signal processing are introduced with the extended air traffic control and monitoring network structure.

Introduction–motivation

New challenges for air surveillance of CRC (and Civilian Air Traffic Control — CATC) have emerged in the last decade. The main outcomes of the air target detection, tracking, and recognition problems can be characterized as follows:

- Risk of accidents in the low altitude of long range air surveillance radar networks shall be reduced.
- Natural disaster monitoring and rescue support in case of earthquakes, flood and forest fire.
- Increased interest for control and monitoring drones with less than 20 cm^2 (8 $inch^2$) Radar Cross Section.

Populations of the homemade drones or civil and commercial UAVs are rapidly growing. Several features such as flexible route planning, adaptive communications and control mechanism are built in the system. These functions have been designed to allow easy installation and operation keeping the operational cost down. The danger for drone's illegal application such as traditional smuggling, terror threats or more sophisticated airborne cyber–attacks, hijacking mobile phone calls are increasing. Most of the drones are lightweight with very low RCS, due to latest fiber composite technology and the typical size, which is less than 2x4 m in length and wing span consequently. e.g. in case of the drone shown in Fig. 1 the length is 1.7 m and the wing span is 3.7 m.

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Figure 1. Commercial UAV[2]

Maneuvering capabilities of the drones are increasing beyond man piloted aircraft performance, which redefines the plot update time requirements required for track initiation and maintenance. One of the simplest ways to characterize the required data update time of the highly maneuverable targets is if one determines its plot correlation time, which could be expressed in a simple way as "cos" curve fitting. Details on the target characteristics such as kinematic properties of its maneuvering capabilities and tracking could be found in [1]. Usually the Civilian Air Traffic Centre takes care of the airplanes having acceleration maximum 3G and are well equipped by IFF/SSR systems. Fig. 2 shows that a target with low speed e. g. 500 km/h, has no correlation among updated plots at a 2G maneuver if the radar network plot update is 12 sec. The reliability of track initiation and maintenance is *critical* in case of intensive false plot production even with a well–designed Kalman Filter in the region of NO CORRELATION among updated plots. Consequently, Air Traffic Safety needs an air surveillance radar network augmented by a new type of radar such as twin systems to detect, track and recognize all types of flying objects. [2]

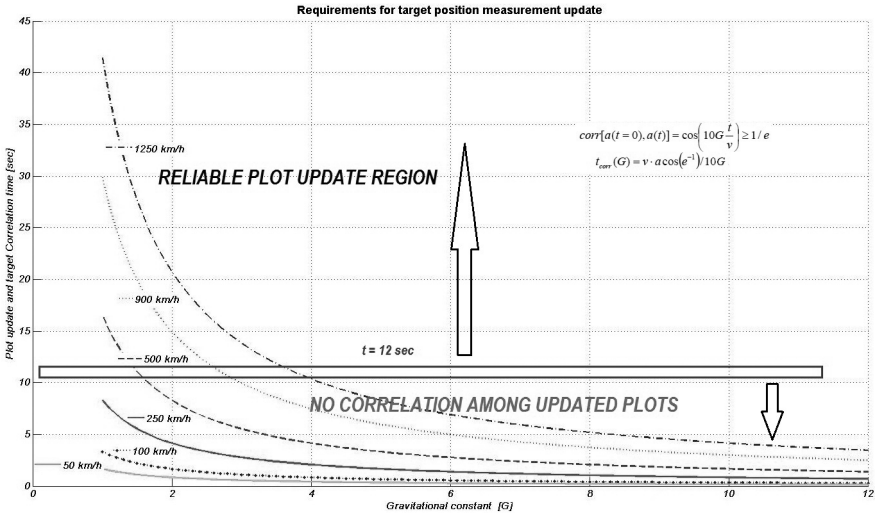

Figure 2. Plot update requirement for reliable tracking [16: 20, updated – upd.]

2 http://www.bhe-mw.eu/bxuav.pdf (downloaded: 19 10 2012)

Characterization of traditional and twin radar performances

The traditional way to solve newly emerged detection, tracking and non–cooperative target recognition problems is to increase the required Signal–to Interference–Noise power Ratio (SINR), while the radar concept designer's task is to maximize available technical solutions and advantages at the lowest cost and development risk. The receiver noise is determined as:

$$N_R = k_B T_S B_n = E\left[w(n)^* \; w(n)\right] = E\left\{\left|w(n)\right|^2\right\} \quad (1)$$

Where:

k_B – Boltzmann–constant,
T_s – System noise temperature,
B_n – The effective noise bandwidth of the receiver,
$w(n)$ – Receiver noise after ADC (Analogue Digital Converter) by *"n"*–sample,
$E\left[w(n)^* \; w(n)\right] = E\left\{\left|w(n)\right|^2\right\}$ – Auto–covariance of the receiver noise as the complex conjugate representation of the samples.

A simplified situation of the twin radar concept is plotted in Fig. 3. Two identical radars (e. g. Air Traffic Control radar or mobile VHF) are interconnected and are working in coherent signal processing mode for transmit and receive. Antenna beam pointing, surveillance methods and the triggers of transmit and receive signals are synchronized. The two radars have common exciters and signal processors next to the mono radar equipment, with maximum similarity in order to obtain maximum cross–correlation between the dedicated channels.

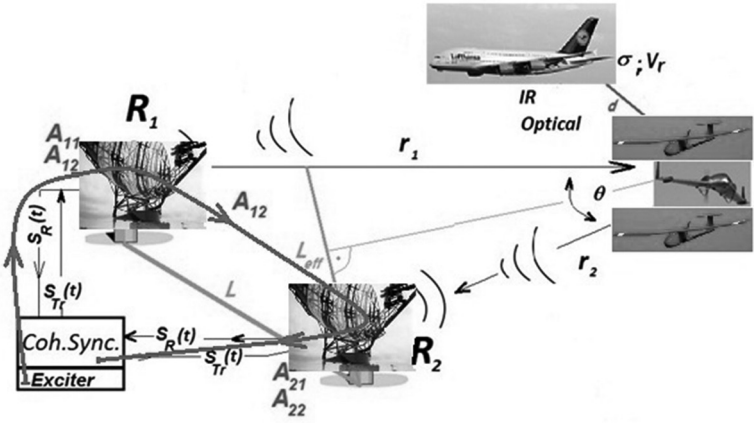

Figure 3.
Short baseline (Gaussian) bi–static topology of twin VHF radar system [16: 73]

Where:

Θ – aspect angle <0.3º, because L_{eff}<<$r_1 \cong r_2$ This parameter separates the bi–static concept from twin radar concept.

R_1 – Radar 1, R_2 – Radar 2,

$S_R(t)$ – signal power received by radar antenna: $S_{R1}\begin{bmatrix}1\\ \rho\end{bmatrix} = S_{R2}\begin{bmatrix}1\\ \rho\end{bmatrix}$;

$S_{Tr}(t)$ – signal power transmitted to the antenna: $S_{Tr1}\begin{bmatrix}1\\ \rho\end{bmatrix} = S_{Tr2}\begin{bmatrix}1\\ \rho\end{bmatrix}$;

$\rho^T[1\rho]$ – Correlation coefficient between R_1 and R_2,

$\rho(t_1–t_2)$ – Correlation transfer function of the envelope detector signal between time interval t_1 and t_2,

A_{11} A_{12} A_{21} A_{22} – Correlation coefficients in loops: exciter-R_1-Coh.Sync; exciter-R_1-R_2- Coh. Sync; exciter-R_2-R_1- Coh.Sync and exciter-R_2- Coh.Sync consequently,

r_1 – Distance between Radar 1 and Targets,

r_2 – Distance between Targets and Radar 2,

L_{eff} – effective base length, the projection length of baseline onto the plane of antennas,

σ – Radar Cross Section, RCS,

v_r – Radial velocity of the target related to radar antennas.

The determining key parameters of the concept are the Coherent Parameter Estimation and the "effective base length" -L_{eff}, which is perpendicular to the bisector of the angle between directions from the target to diverse radars. The modulated signal is generated in the exciter (Coh.Sync./Exciter block), amplified and radiated with the R_1 and R_2 antennas in the direction of the targets. The electro–magnetic energy is scattered in all directions from the surface of the target, with the energy level determined by the RCS and the Doppler shift proportional to the radial velocity of the target to the directions of separated antennas.

A portion of energy is collected by the R_1 and R_2 antennas and the received signal's SINR is increased by amplification, filtering and signal processing gain. After detection, the target's parameter estimation by the system allows target tracking. *The realization of this technology is required to manage parameters of the radar equation while keeping the related correlation coefficient high >0.95.*

Challenges of the concept realization

It requires centralized control of spatially separated radars with spatially coherent signal processing fully or instantaneously in the case of degraded correlation coefficients. It is necessary for:

- synchronization, phasing and control on mutual coupling/reflection of separated antennas, transmission of reference frequencies and signals that depend on the type of operational mode;
- additional phase shift control of radar subsystems, such as short distance bi–static Doppler and Range peculiarities in ambiguities over relatively long time intervals requires phase adjustment between adjacent systems in order to keep the system correlation coefficient high;
- cooperative beamforming, e.g. VHF multipath condition, signal reception frequency

and signal waveform emitted by the transmitting radars must be known at the receiving counterpart;
- increased requirements for signal–, data processors, computer systems and data transmission from radars to the common signal processing centre, and for control command distribution;
- coordinate conversion of radar data from local coordinate systems into the common coordinate system, because errors in the determination of antenna positions and the orientation of local coordinate axes influence directly the accuracy of output information traditional phased–array technology which is maximizing the coherent processing gain at the transmitter, beamforming and the receiver side [3].

Symulation results of the realization

The realization biggest uncertainties are related to the RCS of the target for related correlation coefficients. In narrow–band radar ***(B_n/fo <<1 at frequency "i")*** applications, contributions from all scattering centers combine coherently to produce a single value for the target RCS at every aspect angle. In the proposed multi–band application, a target has target motion and can straddle many range bins, therefore maintaining the coherence of the received signals could be complicated, and may also be limited. Equation (2) depicts that RCS fluctuates as a function of RCS of the *m*th scattering centre, radar aspect angle on frequency "*i*" (or in frequency diversity mode of narrow–band radar operation). The individual amplitudes of the electro–magnetic field corresponding to $\sqrt{\sigma_m}\ i$ at the envelope detector output are added vectorized, taking into account their phases. The complex RCS of the target could be rewritten as [3, 4] (Summation by frequency additionally included by author):

$$\sigma_i(\Theta) \cong \left| \sum_i \sum_{m=1}^{M} \sqrt{\sigma_{m\,i}}\, \exp\{j(2k_{oi}\cos(\theta/2) d_m \vec{r} + \varphi_{mi})\} \right|^2 \qquad (2)$$

Where:

$\sigma_{m\,i}$ – RCS of the *m*th scattering centre for the polarization of the radar on *i*th narrow–band radar frequency,

$\varphi_{m\,i}$ – Initial phase shift introduced by *m*th scattering centre into reflected field on *i*th narrow–band radar frequency,

"*m*" – Refer to scatters 1, 2, … and subscript "*i*" to narrow–band radar operating frequency,

$d_m = |(r_1+r_2)_{m-1} - (r_1+r_2)_m|$ *– distances among scattering centers,*

$\vec{r}$ *– unit vector directed to the radar (does not change in Gaussian bi–static situation,*

k_o *– Wave number,* $2\pi/\lambda_o$*,,*

λ_o *– Transmitted wavelength of Radar 1, or carrier frequency* (f_o)*,* $\lambda_o = c/f_o$

$\exp\{j(2k_{oi}\cos(\theta/2) d_m \vec{r} + \varphi_{mi})\} = \delta\theta_{mi}$ *– Complex representation of the Phase.*

Please note: the bi–static RCS of a target, $\sigma_i(\Theta)$, at the frequency "*i*" is equal to its mono–static RCS for a radar located at the bisector of the angle Θ and working at the wavelength $\lambda_i/cos(\Theta/2)$, when "the mono–static – bi–static equivalence principle" is valid.

Findings related to the radar cross section

The amplitude at the output of the *i*–th narrow–band radar receiver will be proportional to $\sqrt{\sigma_{m\,i}}$ and depending also on other parameters of the radar equation marked by K_i. It is known by basic radar theory that the SINR is the Key Measure of the Radar Performance and defined as ratio of signal power to noise power at the receiver output and the total energy ratio for coherent signals can be calculated. Fig. 4 shows the genetic receive and signal detection structure of the twin radar. The system has up to $X_I(t)$ simultaneous channels and *MF* — Matched Filters, where $X_1(t)$ and related transmit part is the reference. Compared to reference the time delays and the phase shifts are measured, adjusted to improve the signal coherency in transmit, beamforming and receive for maximal SINR. The envelope detector "Σ" sum the signals in phase and comparison with the threshold detects the targets in the traditional way.

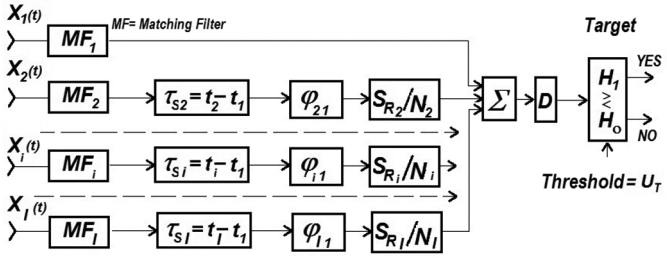

Figure 4.
Receive and signal detection structure of the twin radar [3: 123, upd.]

In case of coherent signal processing an *envelope–detector* receiver output amplitude from the narrow–band such as "VHF', "L"and "S"band radar receivers are added. It would be possible to define a composite RCS as:

$$\sigma_i(\Theta) \cong \frac{1}{\sum_i k_B T_{Si} B_{ni}} \left| \sum_i \sum_{m=1}^{M} \sqrt{K_i \sigma_{m\,i}}\, \delta\theta_{mi} \right|^2 = ... \qquad (3)$$

$$... = \frac{1}{\sum_i k_B T_{Si} B_{ni}} \left| \sum_{m=1}^{M} \sqrt{K_{VHF}\sigma_{mVHF}}\, \delta\theta_{mVHF} + \sqrt{K_L \sigma_{mL}}\, \delta\theta_{mL} + \sqrt{K_S \sigma_{mS}}\, \delta\theta_{mS} \right|^2$$

Where the term $\sum_i k_B T_{Si} B_{ni}$ represents the summed noise powers of the three ("*i*" – *in general case*) narrow–band radar receiver outputs. Let's assume that the two sets of radar parameters are equivalent with $K/k_B T_S B_n$. In case of noncoherent signal integration a square–detector receiver output amplitude from the radar receivers is added. The total RCS can be expressed as:

$$\sigma_i \cong \sum_i \left(\frac{\sqrt{K_i}}{k_B T_{Si} B_{ni}} \sum_{m=1}^{M} \left| \sqrt{\sigma_{m\,i}}\, \delta\theta_{mi} \right|^2 \right) = ... \qquad (4)$$

$$= \left| \left| \frac{K_{VHF}\sigma_{VHF}}{k_B T_{SVHF} B_{n\,VHF}} \delta\theta_{VHF} \right|^2 + \left| \frac{K_L \sigma_L}{k_B T_{S\,L} B_{n\,L}} \delta\theta_L \right|^2 + \left| \frac{K_S \sigma_S}{k_B T_{S\,S} B_{n\,S}} \delta\theta_S \right|^2 \right|$$

Putting the total RCS value into the radar equation the system output signal amplitude can be normalized to "r. m. s" noise amplitude. Equations (3) and (4) show that *the temporal correlation is determined by the target rotation angle during time on target interval and by the target dimensions to the wavelength ratio.*

A first–order approximation of RCS for a complex object can be obtained by summing the major specular RCS components. This is shown in Fig. 5 with a simulation performed on spheres in the VHF frequency band, showing RCS changes relative to the angle of radar pulses. The 3 small spheres are 9.84 inches (25 cm) and the two big spheres are 13.8 inches (35 cm) with the positions and parameters of Fig. 5.

The random aspect of the target RCS is the result of a rotation from the mean position of the target through a small random angle. Averaging should be made over the random target aspects, which are small in our cases, relative to spatially diverse antennas. The spatial correlation function of signal fluctuations for *3D moving targets of an arbitrary shape proves that a target RCS containing many scatterers is not random.*

The target's RCS dependency on the frequency band, shows advantages if the target size determined by the resonance region of the allocated frequency. The key performance is that *the RCS signal fluctuation is relatively steady for a large aspect angle* relative to the radar. Consequently random and fluctuating signals at the receiver input are a result of *summing many partial signals from small non–random scatterers with sharply changing phases.*

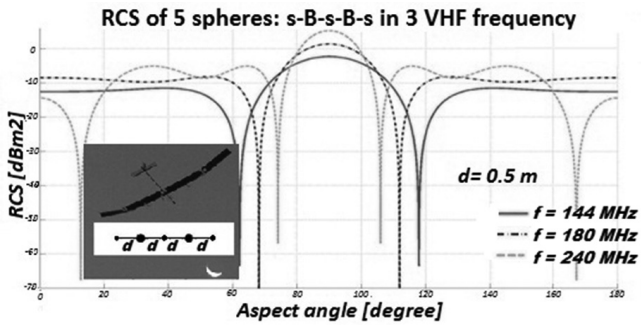

Figure 5. Drone RCS models based on 5 spheres in 3 VHF frequency (no source – n s.)

Further investigation is required with the comparison of advantages and disadvantages to find the proper frequency for the required radar system for dedicated targets recognition. Fig. 6 shows plots of the composite RCS of the modeled spheres. Table 1. summarizes findings of the analyzed scatterers signal processing statistics related to situation displaced at Fig. 6.

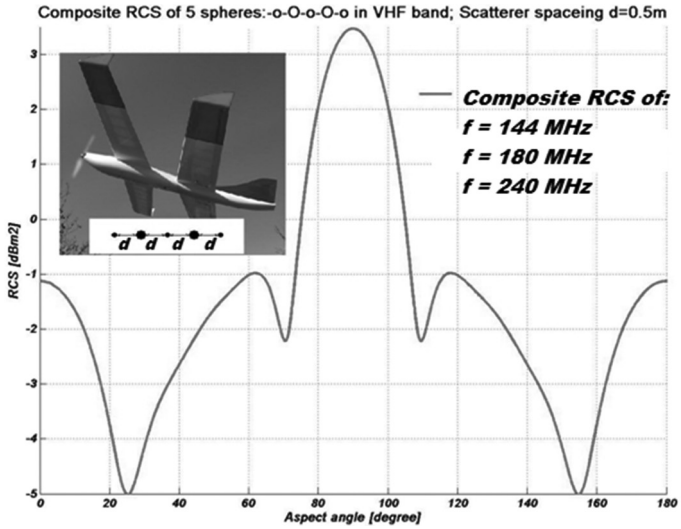

Figure 6. Composite RCS statistics for twin VHF radar signal processing (n s.)

RCS statistics:	**f=144 MHz**	**f=180 MHz**	**f=240 MHz**	**"Composite"**
MEAN	-12.36	-8.899	-9.425	-1.513
median	-12.19	-8.819	-7.376	-1.637
mode	-28.54	-11.85	-67.67	-5.02
STD	6.483	5.75	8.695	2.099

Table 1. Twin VHF radar signal processing statistics

The main advantages of the twin VHF radar composite signal processing are the *increased RCS and the moderated signal fluctuation*, which increases the achievable SINR of twin radars.

Further information on the bi–static and multi–static radar could be obtained from [5, 6]. Note: applicability of the concept on the VHF radar has some peculiarities "well known" by radar experts that require attention and detailed clarification such as the multipath effect, mutual coupling, reflections and environmental interferences that frequently block the new VHF radar developments.

IV./b. Findings related to the twin antenna patterns

Fig. 7 shows two conventional phased–array radar which are connected to twin radar phased arrays. The whole transmitting array is considered as one array (Resultant Directivity Pattern), which has an overall illumination function containing two identical illumination functions related to R_1, R_2 and a few hundred "m" isolated gaps between. The receive patterns contain sum and simultaneous different channels. Frequency diversity modes are foreseen with 3 waveforms emitted at ± 3 dB beamwidth shift to the center beam. The uplink and downlink channels are to be separated by traditional beamformer networks. The two radars,

introduced above are interconnected and working in coherent signal processing mode as simplified situation is plotted in Fig. 3. The phased array antenna patterns have been analyzed in the literature so far [6] and do not needed deep explanation. Consider a phased array with *M* transmit and receive elements, where the beamformer produces its output by forming a weighted combination of signals:

$$y(n) = \sum_{m=1}^{M} c_m^* x_m(n) = c^H x(n) \rightarrow \qquad (5)$$

In case of twin phased array, such as Fig.7:

$2\sum_{m=1}^{M} c_m^* x_m(n) + D^*(n)$ – *the antenna gain is doubled* compared to a mono–radar case because the beam forming networks of the joint phased array complex conjugate pattern productions are common.

Where: $c=[c_1^* \; c_2^* \; c_3^* \ldots c_M^*]^T$ – column vector of beamforming weights, $x_m(n)$ – signal on the phased array element *m* and *D*(n)* – is the complex mutual coupling/reflection coefficient of two phased arrays.

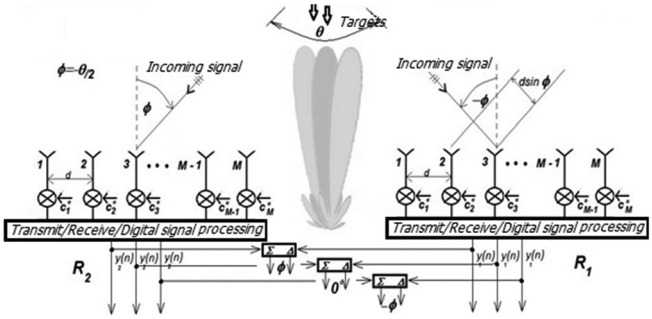

Figure 7. Phased array of twin radar (unpublished – up.)

To demonstrate the peculiarities a simplified simulation was carried out where the phased array of R_1 and R_2 radar contain 32 elements with the same illumination functions of R_1 and R_2. The distance between the phased array antennas is 500 m, where the real part of the complex mutual coupling/reflection coefficient is 0.3, 0.1 and 0.05 respectively. The beams are calculated using Fast Fourier Transform (FFT). The calculated far field antenna pattern of the two closely located VHF radar antennas is displayed at Fig 8. The receive pattern situation has been simulated and the results analyzed also. The receive SUM channel is identical to the transmit array tapering, while the DEL channel`s array tapering phase of R1 radar which has been shifted by 180 degrees produces the complementary antenna far field pattern.

As predicted by phased array antenna theory the "grating lobes" of the far field patterns are increased. Details of the effect can be seen in Fig. 9. The main beam pattern has deep notches with a magnitude of 20–30 dB which can be observed. These notches cause additional signal fluctuations regarding the complementary channel delta, in case of operational frequency change. The effect of mutual coupling/reflection between two phased arrays is changing by antenna positions, which has significant effect on the antenna patterns as Fig. 8 shows. Consequently, the notches in the twin VHF radar main beam one shall be precisely calculated and measured during the calibration of the system and adjusted continuously during operation.

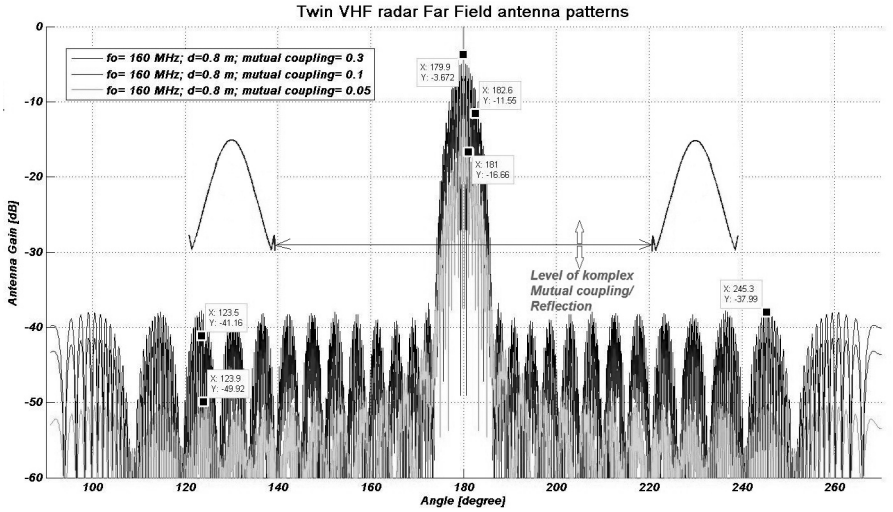

Figure 8. Twin VHF radar far field diagrams with the transmit illumination functions (up.)

The notches in the main beam comparison caused by frequency differences and/or antenna rotation show a similarity to the monopulse angular measurement techniques, where simultaneous offset beams are compared. This effect has to be exploited for improvement of angular accuracy as we see in the case of mono–pulse or multi–beam systems. (In the case of different carrier frequencies the notch positions move with the frequency change giving possibilities for further increase of the angular resolution measurement accuracy of the twin radar system.) See Fig. 9.

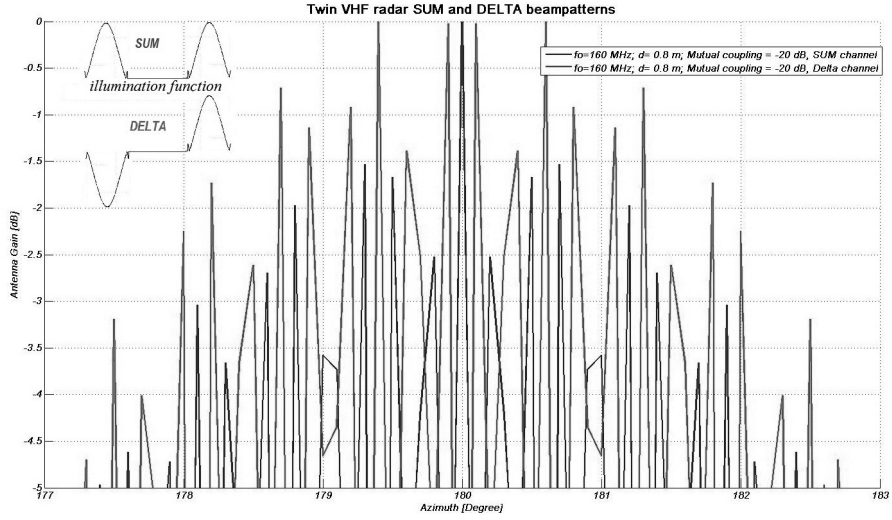

Figure 9. Magnified view of the twin VHF radar far field patterns (up.)

IV./c. Findings related to Range and Doppler Ambiguities'

Fig. 10 shows geometry and kinematics of the target motion in a twin radar system as characterized in Fig. 3. As target position relative to the receive site is required to be known in twin radar implementation the Gaussian bi–static Range (R_u) and Doppler (v_u) ambiguity peculiarities at the receivers can be calculated. Both of them depend on the Pulse Repetition Frequency (PRF) of the twin radar system. The ambiguous range in each PRF is followed by an unfolding and correlation process. [7] The unfolding creates a vector of possible ranges for valid detections by adding a set of integers [*0…K*] times the unambiguous range interval:

$$R_u = R_{amb} + \frac{c}{2f_r}[0 \dots K] \qquad (6)$$

$$v_u = \frac{f_r \lambda}{2}\cos(\delta)\cos(\Theta/2)[-J \dots 0 \dots K] \qquad (7)$$

Where:

c – speed of light, f_r=*PRF*, The set of integers *[0...K]* are referred to as the range ambiguity number, with *K* determined by the maximum range of interest, λ – operational wavelength of the radar, $f_r\lambda/2$ – is the first blind speed (PRF velocity), δ, Θ – related to the target movement in Fig. 10, and *[-J…0...K]* represents the set of Doppler ambiguity numbers covering the maximum negative and positive Doppler–velocities for the targets of interest.

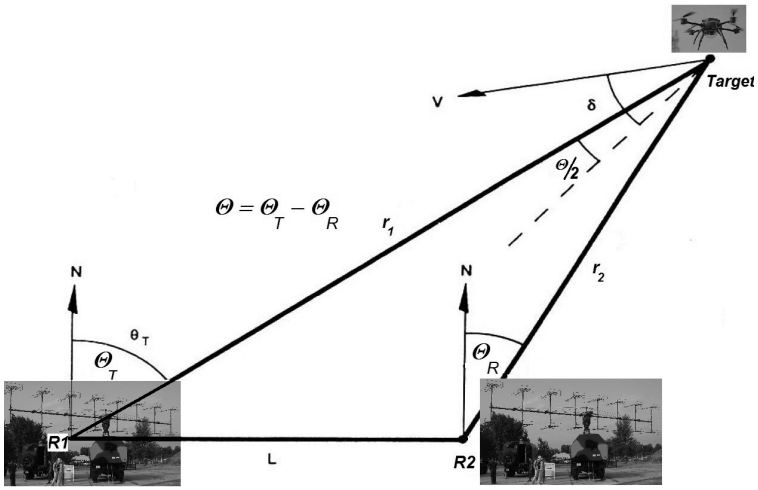

Figure 10. Twin VHF radar and target movement geometry (up.)

As the example assumes: the VHF radar antenna rotation is 6 APM (Antenna rotations Per Minute, operational frequency =160 MHz, Target radial speed = 0.1–1000 m/s, its amplitude = 100 mV and the target radial speed fluctuate due to change of heading and/or acceleration. Fig. 11 draws the attention to the proper Pulse Repetition Frequency selection complexity while remaining unambiguous of Range and Doppler velocity in the required margin. First of all, *the Doppler unambiguous margin is critical up to 100 Hz PRF for low speed targets* and reduces in higher PRF.

Secondly, the range unambiguous margin has opposite behavior, but *both cases are very sensitive for targets at low speed with high acceleration capabilities* as speed vector change indicates. (Such targets can be drones and other types of small airplanes that could be problematic from tracking points of view.) This situation could be resolved by increased resolution of the twin radar system.

Increase of resolution performance of the twin radar is convenient to calculate with approximate expression (Resultant Directivity Pattern) based on Rayleigh criterion to echo from point target. [3] The thermal noise error of monopulse estimate, for high SINR can be expressed [8]:

$$\sigma_{\alpha} \cong \frac{\Theta_3}{k_m \sqrt{2(1+S/N)n}} \quad (8)$$

Where the

$\sigma_{(\alpha)}$ – denotes the r.m.s. error of the resolution estimation in the bi–static plane,

Θ_3 – Resultant Directivity Pattern beamwidth at 3 dB;

k_m – denotes the r.m.s. error of the monopulse slope can be determined directly from measured Σ and Δ patterns,

n – denotes the number of the received pulses.

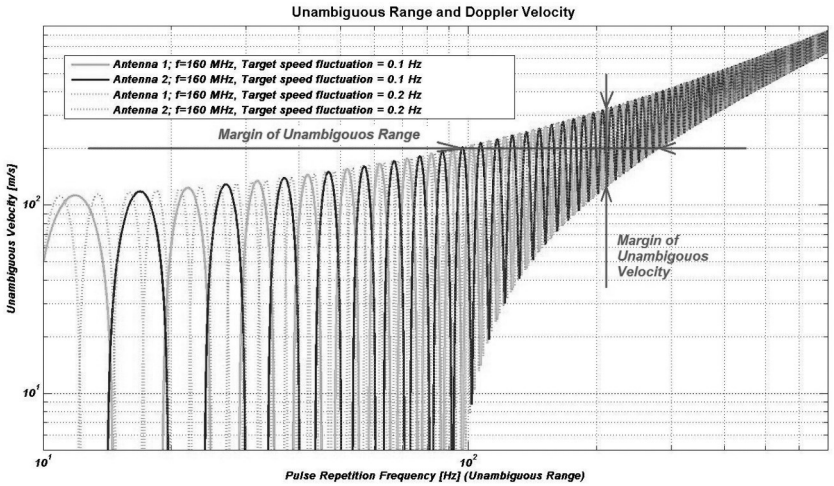

Figure 11. Twin VHF radar unambiguous Range and Doppler velocity vs. Pulse Repetition Frequency (up.)

Detection capabilities of a twin system could be proven by Barton's MRSAS 3.3.2 Program calculations. [9] This method allows easy comparison of the radar system performance changes, while it looks "not important" enough to be implemented for comprehensive studies. The author's experience of this article shows that the "apples and oranges" type of comparison's confusion can be reduced significantly if researchers more frequently use the "old fashioned Blake charts" for showing the Row Order of Magnitude of the applicability of the idea. Related to the subject twin radar performance calculations have been introduced in [10].

The summary of the calculations show that the detection range of the target is doubled for default circumstances. The reason is that the new system itself shall have advanced capabilities such as 6 dB Power–Aperture search advantage in simplified operational mode and 9 dB Power–Aperture–Gain. Additionally 7–10 dB increase of RCS for same types of targets and 2–2.7 dB multipath effect can be explored in the case of VHF radar band offered circumstances [11].

Additional *3 dB advantages in the twin radar signal processing can be exploited* as pointed out in Fig. 12. This Fig. has been produced applying findings [12] to the MATLAB Phased Array Toolbox.

The P_d increases from 0.1 dB to 0.5 dB at fixed $P_{fa}=4\cdot10^{-6}$ in twin radar signal processing or the P_{fa} reduces from $8\cdot10^{-4}$ to $4\cdot10^{-6}$ at fixed $P_d=0.5$ dB. A compromise has to be found among the reduced probability of detection, probability of false alarm and the required SINR for a good quality of target detection. One of our future tasks is to characterize the centralized signal fusion with a correlation gate feedback control function applied to three different Pd (0.9; 0.3; 0.1) related to "optimal" Pfa of the radars as is it looks to be one of the most promising solutions for twin radar applications.

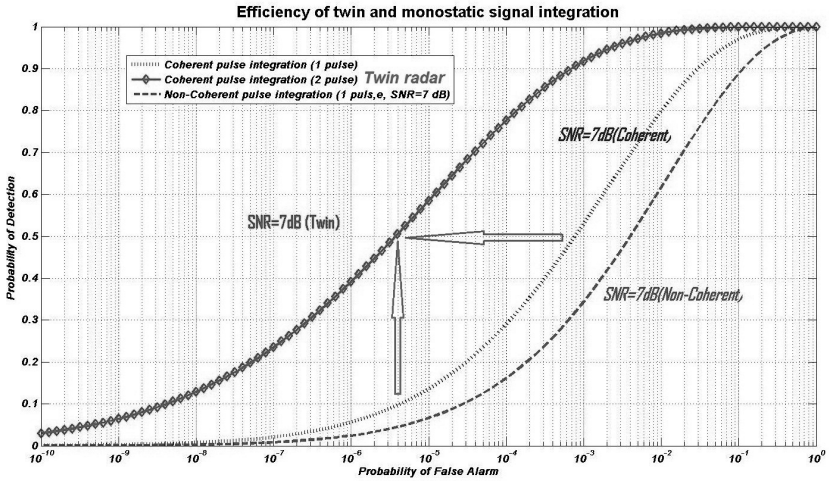

Figure12. P_d vs. P_{fa} in case of mono and twin VHF radar cases [16: 80]

Fig.13 depicts the generic structure of the extended military–civilian air traffic control and monitoring network. Different types of narrow–band radar such as short, long range, "VHF", "L" and "S" band radars are connected. The bone radar network contains military and civilian radars that are installed under RADOME and all of them connect to the air traffic control centers for centralized plot fusion. There is no plot exchange among radars in the traditional structure at all. The plot based radar networks performances and capabilities have been analyzed in the literature so far and do not require further explanation.

The extended detection range requires increased performance of the radar which could be enriched by added mobile or fixed counterparts for realization of twin radar offered performance, where the twin passive systems are an essential part of the structure. The method based on twin radar concept offers a sort of coherent video integration in the Sensor Fusion

Post (SFP) at the signal fusion level, which could be allocated inside, or close to the radars. The twin radar concept advance performances, increase of target detection and angular resolution, could be extended further as is shown in the middle of the figure. The signal level data exchange among radars such as “VHF”, “S” and passive (“P”) systems are required because hits of the radars are collected from all radar correlation gates, in three different threshold levels, commutatively. This information is then compared, merged, filtered and the targets are extracted with standard target detection requirements. Advance passive radars can be installed on board of drones too. This solution offers extended air surveillance performances from the air for “S”, “L” and “VHF” radars applying so called sparse phased array technology on the board of mutually cooperating drones.

The low frequency band such as HF and VHF radars importance are increasing recently in modern air surveillance systems because their RF pulse propagation peculiarities can be exploited for target detection even in extreme weather conditions. Hungary has large flat surfaces that are very suitable for exploitation of the multipath effect of the VHF band radars. Consequently they are very cheap from operational and maintenance points of view and VHF radar type shall be kept in the radar fleet and should be modernized time to time. Nowadays the twin radar concept solves the biggest shortcoming of low frequency band radar because their angular resolution can be increased as equation (8) points out.

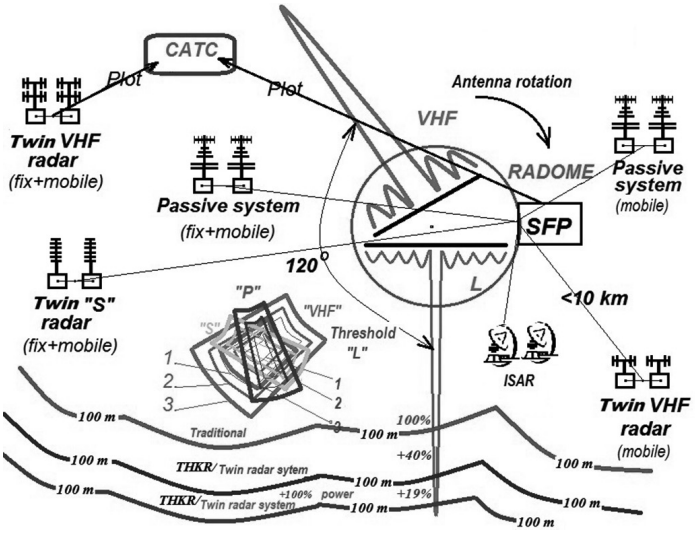

Figure 13. Extended air traffic control and monitoring network structure [16: 84]

This system concept supports the track initiation and maintenance of the highly maneuverable targets too. It solves uncertainties introduced in Fig. 2 because the radars marked under RADOME are synchronized in antenna rotation in such a way that the “L” band radar follows the “VHF” band radar surveillance sector with a 120 degree delay. If both radars independent plot update time is 10 sec, the target position and speed vector update sequence is 0 sec -3 sec -10 sec -17 sec -20 sec etc. This feature increases the target initialization probability up to 12 G.

Two, Inverse Synthetic Aperture Radar (ISAR) were an integral part of the Hungarian Air Defense system in the past. The ISAR is a known technique to generate a two–dimensional high resolution image of a target. The image of ISAR radar has had sufficient quality to allow it to be used for target recognition purposes. In situations where other radars display only a single unidentifiable bright moving pixel or scope of the target, the ISAR image is often adequate to discriminate between various drones, missiles, military and civilian aircraft. The difficulty in utilizing this capability is the object motion and its periodicity, which is measured in 2–dimensional Fourier transform of the received signal as a function of frequency and target aspect angle. The twin concept could be extended to the Inverse Synthetic Aperture Radar when two ISAR coherently connected and formulate an *Interferometric* Inverse Synthetic Aperture Radar with 3–dimensional FFT applications. The twin ISAR shown in the Fig. 13 should be an essential part of drone recognition and increased safety measure support of the airplanes in the near future.

The twin radar can also be subject to intentional interference initiated by hostile transmissions. Thus it is essential to examine how the performance will be affected under such an environment. A few aspects of the investigation and related simulations have been already carried out in open literature. [13]

Summary

General overview on the air surveillance system augmented by twin radar is introduced. The system elements connections and main performances highlight the fact that management of the extended volume of the air surveillance space is required in detection range of the low RCS signature targets, such as drones, Stealth with high maneuvering capabilities and in the very low altitude down to the highway level at low cost. It was pointed out by this article also that the twin radars, which are based on very high correlation coefficients of the transmitter, antenna and receiver sub–systems have unique performances. Most important among these are: the capability of the double detection range of the Stealth, drones constructed with low or very low RCS technologies.

Main challenges of the twin radar concept realization are reviewed and analyzed. Behaviors of the target RCS in case of coherent and non-coherent signal integration is demonstrated, the antenna pattern peculiarities, the Range and Doppler ambiguities are analyzed, and the angular resolution increase is introduced briefly. The results show that newly proposed system itself shall have advanced capabilities such as *9 dB Power–Aperture–Gain* sensitivity advantage and more than *3 dB signal processing gain. Additionally 7–10 dB increase of RCS* for some types of targets and *2–2.7 dB multipath effect* can be explored in the case of *VHF radar band* offered circumstances. The author's field experiences show that the target signatures RCS in the VHF band usually give *5–10 dB stronger reflections* than in the "S" band. The twin radar signal processing offers a significant increase in probability of detection, and false alarm reduction. The main drawback of the VHF radar was in the past the angle measurement accuracy and resolution capability which could be eliminated too.

Additional benefits can be obtained at a relatively low–cost, under the assumption that the system is set up by integrating operational radar, or by adding remote Passive Location Capabilities applying the findings of advanced MIMO technologies to the twin radar concept. From a logistic support point of view the performance of the radar systems shall be foreseen

guaranteed and checked regularly for 20 years. Cost efficient realization of it requires well developed and maintained "in situ" performance measurement technologies, which are required for tests above the Built In TEst (BITE) capabilities of the radar. It is important to note that the twin radar concept gives improved reliability and operational availability of the air surveillance radar systems.

These benefits are among others focused on the possibility to implement fully coherent transmit, antenna, receive and signal processing methods into the wide area distributed radar systems. The topic has got more attention and importance recently as patent [14] and article [15] highlights this fact.

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Evidence Based Military Medicine – The NATO Trauma Registry Initiative

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For thousands of years Medicine was practiced in empiric and authoritarian ways. Physicians and other medical personnel always treated sick people with the principle of "nil nocere", meaning "do no harm", but the procedures sometimes either were not effective or did cause harm. Modern scientific methods in medicine enabled the scientists to provide firm results and evidence of a particular treatment or procedure in health care provisions.

In a controlled clinical environment the prospective, double blinded, multi–centric, randomized trial became the golden standard of research, because this method provided the most solid basis of testing a hypothesis.

In Military Medicine the operational environment and battle rhythm define the framework for the practice. It is impossible to design a trial with all the aforementioned requirements in battlefield settings, however small scope prospective trauma care studies are now getting approval and some of them have been already published. The tools for this research are the national Military Trauma Registry Systems, which are available now in a few countries. The NATO Trauma Registry Initiative is a multinational effort for the exchange of operational trauma care data among the NATO Military Medical Services, to foster the improvement of Military Medicine and to provide more solid evidence for treatment.

Foreword

The chronology of the NATO Trauma Registry (NTR) takes one back in time to 2008. The successes of the few national military trauma registries became apparent and the Chiefs of Military Medical Services in NATO (COMEDS) requested a study from the NATO Research and Technology Organization[3] (RTO). The RTO described the national trauma registries and released a firm recommendation and the summary of the benefits of a common database. This technical report was published in March 2008. [1] The report provided the reference point for the development of the NTR.

Executive Summary

"One of the precepts of military medical support is to constantly maintain and improve the quality of healthcare which is available to our deployed personnel. When there is a political

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3 New name is NATO Science and Technology Organization (STO)

decision to put troops in harm's way, there is a concomitant duty to implement processes that will improve quality of care in an institutionalised way. One tool which has been found useful in this context by several nations is that of a trauma registry." [1]

Continuous improvement of health care in operations needs to be supported by various analyses of injuries sustained in combat situations. The underlying data should be captured, stored and utilised for comprehensive research and performance improvement.

Although the imperative of such a tool is admitted, there are only few nations employing trauma registries on a national level. There is a particular limitation for nations whose casualty numbers and case loads are not sufficiently large to allow scientifically and statistically robust analysis. Moreover, there is no standardized means of communication or exchange of information. This factor limits the systematic exploitation of lessons learned.

The NATO Trauma Registry Task Force (NTR TF) was established in late 2010 to accelerate the process of the implementation of a common Trauma Registry in NATO. COMEDS endorsed the initiative and mandated the Task Force to validate the progress by using a pilot study [2].

Methodology

The pilot study assessed the feasibility of the NTR. It is a descriptive study. Besides the analysis of virtual patient data MILMED COE performed field health data collection in the Area of Responsibility of the International Stabilisation and Assistance Forces (ISAF). The field deployment included one week data collection in Kabul FRA Role3 hospital and one week in Mazar–e–Sharif DEU Role3 hospital. From 15–30 JAN 2012 two MILMED COE medical staff officers, who have been previously trained in US trauma system, were deployed to execute the task.

During the pilot study the NTR Core Data Elements (defined by different COMEDS Working Groups and Expert Panels), US JTTR v3.2 Data Collection Form and UK Trauma Audit Form v5.1 were utilized.[4] The team collected anonymous patient data according to the data handling policy. The collected data is classified as UNCLASSIFIED.

The team mission was affected by one major limiting factor:

- The theatre weather conditions limited the data collection in FRA Role3 hospital to three days.

Parallel with the planning and performance of the field data collection, the TF member NATO Consultation, Command and Control Agency (NC3A) constructed the experimental NTR import interface. NC3A tested the NTR–US–UK exchange capabilities using the NATO Trauma Registry Core Data Elements. The technical report from the Agency will be discussed in this report concisely.

Major conclusions

Having proven the technical feasibility of communication and data exchange between different registries further standardization of data elements and development of related processes are needed.

4 All three data collection forms are available from the authors.

Key recommendations

- Development of a standardized data dictionary (in accordance with STANAG 2231)
- Engagement of the TF in further development from “Registry” to “System” during the initiated commercial development phase of the NTR

Introduction

The NATO Trauma Registry (NTR) is a military medical tool that will link participating nations to improve operational medical awareness, monitor casualty care, share experience and analysis of trauma management among nations and so ensure that state–of–the art trauma care is provided. The principle purpose of a NTR is to act as a quality assurance system for the management of military medical trauma from point of injury to rehabilitation. It is a tool to support continuous detailed clinical audit and research and improve the provision of care for frontline personnel.

The NTR project was initially outlined by the NATO Research and Technology Organisation (RTO). Human Factors & Medicine (HFM) was tasked to analyse the current national trauma registries and make proposals to implement such a tool NATO–wide. RTO predicted the following potential benefits:

- Aid in the classification of injuries sustained in military operations
- Track casualty outcomes and impairment
- Develop standardized clinical treatment guidelines
- Ensure effective process monitoring
- Improve the development and use of protective equipment and vehicle protection
- Inform and focus medical research
- Assess and improve treatment quality[1]

It is crucial that the final RTO report recommended establishing a common NATO trauma registry.

The Committee of the Chiefs of the Military Medical Services (COMEDS) endorsed the project, tasking the Military Health Care WG (MHC WG) and the Medical Command Information Systems Expert Panel (MedCIS EP) to work on its development. Later MHC WG involved the Emergency Medical Expert Panel (EM EP) to provide its expertise and help to define the NTR core data elements. The Medical Communication and Information Systems Expert Panel (MedCIS EP) contributed STANAG 2543 promulgated in 2009 and STANAG study draft 2231, but this was later withdrawn from the ratification process.

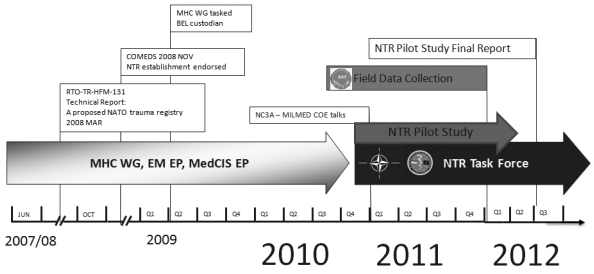

Figure 1. NATO Trauma Registry timeline[5]

In 2010, acknowledging the comprehensive work done by the custodian, the NATO Trauma Registry project was reaffirmed. A NTR Task Force (TF) – upon receiving mandate from COMEDS – was established under the umbrella of MHC WG, with MILMED COE as coordinating secretary supported by volunteer participating nations (BEL, CZE, DEU, FRA, GBR, NLD, USA) and Allied Command Operations (ACO). NC3A was tasked by Allied Command Transformation (ACT) to support the project and facilitate the project development [3]. The TF got the mandate to accelerate the process and validate the progress using a pilot study. The timeline of the TF activities are shown in Fig. 2.

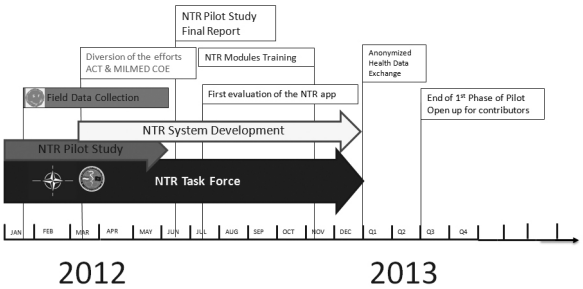

Figure 2. NATO Trauma Registry Task Force Timeline[6]

Problem Statement

A number of nations are employing trauma registries but they are doing it on a limited national level. There are no standardized means of communication or exchange of information amongst the involved nations and this fact limits the opportunities to learn quickly from the experience of others and prohibit a broader analysis of trauma to support best medical practise in military deployments. This is a particular limitation for nations whose casualty numbers and case loads are not sufficiently large to allow scientifically and statistically robust analysis. The result is that only anecdotal information is available about the current combat trauma care of the casualties.

In order to facilitate and structure the further development of a common NTR, with the benefits for all contributing nations, the TF has designed this pilot study.[2]

5 Author's own figure created in 2012, presented in Trauma Innovation Conference in London UK
6 Author's own figure created in 2013, presented in Trauma Innovation Conference in London UK

Pilot objectives

Goals/Overall Objectives:

1. To assess the feasibility of the NTR.
2. To assess that the validity / significance of military medical research is higher in multinational than in national approaches.
3. To determine that evidence in military medical research can be achieved when it is based on a qualitatively and quantitatively sufficient set of standardized data.[7]

Purpose:

1. To develop a working model of NTR; to merge the numbers of national cases into a single database and henceforth provide a scientifically robust pool of information for studies and analysis.
2. To encourage nations to exchange and share anonymous data.

Output

1. Established functional interface among national trauma registries
2. Communication strategy among NATO TF Nations.

Activities

1. To identify a limited number of parameters for a descriptive study design based on NATO TRAUMA REGISTRY CORE DATA ELEMENTS [10]
2. To identify participating nations and their current systems (internal system model compared to NTR model)
3. To utilize the UK/US JTTR as a template of national trauma registries
4. To develop a Trauma Registry System Data Model in order to exploit the trauma registry data
5. To develop an NTR Data Exchange Model to enable exchange of core data elements
6. To utilize algorithm for Global NTR ID in order to avoid data redundancy
7. To design the preliminary rules and procedures to support the NTR model
8. To do a test run of import / export based on available systems
9. To define communication media and periodicity for the data exchange (CD, mail, attachments, etc.)

Methodology

Type of study:

This pilot study is designed to assess the feasibility of the NTR. It's a descriptive study.

Inclusion / exclusion criteria:

NTR inclusion criteria are defined in Annex B of RTO TR–HFM–131: all patients (military and civilian) with physical trauma seen at Role 2 or above requiring one of the following [1]:

- Surgical procedure/treatment
- Activation of the trauma team, partial or full.
- Admittance in MTF

7 Goal 2 and 3 require further research and will be discussed elsewhere.

- Transport to a higher level
- All deaths

Data collection

Data collection and "Minimum Data Set" are defined in Annex C of RTO TR–HFM–131.

After the data collection phase, national data (AFG, DEU, FRA, GBR and USA) were imported into the NTR Database.

Evaluation Criteria[8]

- Quantity of anonymous trauma data
- Functionality of communication among systems
  - Timeliness
  - Centralised control and handling
  - Accessibility
- Collection method
  - Effectiveness and efficiency
  - Quality and standards
- Usability of collected data for lessons identified
- Further need of data standardization (e.g. ICD–10) or any interoperable standardized nomenclature according to STANAG 2231.
- User–friendliness of the manual and the requirement for specific training for data collection and registering.

Study Results / Observations

Results of the field experiment

The field data collection aimed to populate trauma patient data available in theatre military treatment facilities (MTF). The two weeks period of deployment was split into two parts. In the first week the team visited the FRA Role3 hospital in Kabul International Airport (KAIA), the second week was spent in the DEU Role3 hospital in Mazar–e–Sharif (MeS), ISAF Regional Command North [5].

Description of activities

The COE team met the MEDAD of RC North that included discussion of current epidemiological trends and preventive medical trends.

The team received a hospital familiarization brief and situational awareness presentation in the facilities. The multinational medical team in both facilities were aware of the NTR project. Trauma patients were selected with the active assistance of the hospital leadership according the NTR inclusion criteria.

8 Summary of Evaluation criteria results in Annex A

In Kabul the FRA hospital included BGR, CZE, HUN and USA personnel. The patient documentation was mainly in English; FRA military casualties sometimes were documented only in French. Our team was affected by the French hospital rotation and transfer of command in the particular week. The number of days spent in Kabul was reduced due to the weather and the consequent flight restrictions.

In Mazar–e–Sharif the hospital consisted of DEU, HUN and USA medical personnel. The patient documentation was in English and German, for non–DEU patients the medical record was always in English. The DEU hospital provided office space and a standalone laptop with fixed IP (internet protocol) address.

The team tested data availability in coherence with the NATO Trauma Registry Core Data Elements, and the UK Trauma Audit Form v5.1, US JTTR v3.2 Data Collection Form. These forms were available electronically as MS Word documents except the US form, which was in Adobe Portable Document Form (PDF). The US dataset was employed on printed paper forms.

NTR Core data elements

NTR Core Data Elements are based on NATO RTO HFM–131 report recommendations. COMEDS tasked the Military Health Care Working Group (MHC WG) to provide minimum requirements for collectible trauma data. In the MILMED COE field data experiment the data set was utilized and recommendations are the following:

1. Some of the fields are not collectible from current medical documentation.
2. Some data fields affect national sensitivity e.g. weather conditions, vehicle and personal protection classification, definite geographic location of the incident/accident.

UK Trauma Audit Form v5.1

The UK employs a comprehensive joint trauma theatre system. The trauma registry is the backbone of the system providing a significant pool of data for patient care and also for personal protection improvements. UK JTTR is managed and maintained by the Defence Analytical Services and Advice (DASA), this organization supports scientific research and provides advice to different military levels.

In the operations the registrar is embedded in the clinical staff, those patients who meet the inclusion criteria are registered in the Trauma Audit Form (TAF). This is an MS Word document template where the entry fields are only open for editing and formatting. Drop down menus are provided in most of the entry fields.[7]

The TAF form is emailed when completed, and the data import to the registry is performed by the Academic Department of Military Emergency Medicine (ADMEM), in Birmingham.

GBR kindly distributed the latest version of the JTTR to MILMED COE and other nations on a bilateral basis. COE is entitled to install and experiment with the application. The team did not get training on the system, however the user manual provided with the UK JTTR application was sufficient.

In the MILMED COE field data experiment the data set was utilized and observations are the following:

1. All data entry fields have instructions/dictionary

2. The TAF represents the UK national perception of casualty care flow. There are limited options for deviation if the patient care is performed by other national standards (e.g. not merging of Role1 and Pre–hospital).
3. Performance indicators are embedded in the form and reflect the most important quality control elements.
4. Coding and classification is done by the registrar, wounds are classified according the Red Cross standards. Trauma scoring codes (AIS, ISS, NISS, RTS, TRISS, and ASCOT) are calculated also by the registrar. In the form the diagnosis is narrative and not coded to WHO ICD or SNOMED.
5. DASA are coding the diagnosis to ICD 10 and OPCS 4 during the data procession.

US JTTR v3.2 Data collection form

The Joint Trauma System (JTS) is the Department of Defense global trauma system. The Joint Theatre Trauma System (JTTS) is the deployed team into the operational Area of Responsibility (AOR).

The Department of Defense Trauma Registry (DoDTR), is the combination of the Store–and–Forward and web–based Joint Theater Trauma Registry (JTTR) and they are the backbone of JTS [6]. Main objectives of the Trauma Registry (JTTR) are to support trauma care development and to facilitate performance improvement.

US DoDTR is maintained to provide accurate data for clinical practical guidelines, for prospective and retrospective studies and it provides important input for medical planning.

The MILMED COE team was trained on US DoDTR in a three weeks programme, together with other Trauma Nurse Coordinators (TNC) as part of the regular pre–deployment training of the JTTS. The TNCs are dedicated to take care of the DoDTR and rotated on a six months basis.

The US kindly distributed a limited version of Store and Forward JTTR application for MILMED COE experimentation. A user manual was also provided.

In the MILMED COE field data experiment the US DoDTR data set was utilized and observations are the following (data collection form was printed out and used for data capture):

1. Records are facility orientated and focusing on Role3 hospital level. Optional Role2 / Forward Surgical Team data collection is under development.
2. US DoDTR has a strong coding capability; the application has embedded calculators transforming narrative text to different diagnosis codes and trauma scoring codes. The current disease classification is ICD–9. The US most likely skip the ICD–10 and will adopt ICD–11. The coding, diagnosis, procedures and severity of trauma allow statistical analysis and also association of different cases.

Result of the NC3A data exchange experience

NC3A[9] created a schema in Extensible Mark–up Language (XML) to enable the data exchange between the NTR prototype and the national registries. This schema was created in a specific type of XML called XSD.

9 NCIA is the new name of the agency

This XSD schema is functioning as an interface ahead of the NTR database layer and controlling the data messages before integrating data into the NTR.

The NTR XSD schema was created according the Core Data Elements and was modified after the NTR TF Budapest meeting (mid–October 2011). Currently version 1.0 is published on the MILMED COE NTR portal.

Summary of results of data exchange episodes:

- US DoDTR
  - NC3A received the same message (containing one trauma record) a number of times, and at the beginning of Feb 2012 we were able to successfully import this record into NTR. It helped prove the concept of the pilot study.
- UK JTTR
  - At the end of January 2012 NC3A received a CD with data files, but this data is NOT compliant to the NTR schema, therefore we could not import it. Due to resource constraints, the UK could only have sent compliant data later.
- NC3A has been working on the NTR User's Operational Requirements (UOR) / SRS rather than on developing the NTR capability further; this is in line with ACT requirements.
- To develop the NTR capability further test imports and exports are essential to carry out.
- UOR work revealed that changes should be made to the schema.

Discussion and Recommendations

Discussion of IT interoperability

Data export and data message construction is a national task. The current and future NTR contributing nations have to adjust their data set in line with the minimum core data elements. Data export tools should be capable of extracting the minimum core data elements and sending them in a defined and standardized XML language.

The UK and US DoDTR were amended to include the minimum core data elements; nations are free not to share elements they find sensitive or classified by a national decision.

NTR Prototype I. needs further adjustments to enable more effective data exchange. Constraints of the XSD schema need to be opened, the current model data fields are restrictive and refuse non- fully compliant data transmission.

1. Example 1. If One element is sensitive for sharing and one nation sends no–data the system rejects all the message, there is no option to integrate partially
2. Example 2. XSD schema was able to receive only the literal text for the particular data field, if the text was altered by the sender the schema rejected the whole message and lost the other data field elements

The recommendation is to further develop the schema, "open the gates" and eliminate constrains. The NTR model/prototype II will enable the test patient data exchange while the received data will provide a pattern for data standardization and data dictionary development.

Upon refinement of the NTR model/prototype II the final model will enable the Task Force to perform real patient data exchange.

Fig. 3 and 4 depicts the proposed data flow and data management from point of data collection to final analysis.

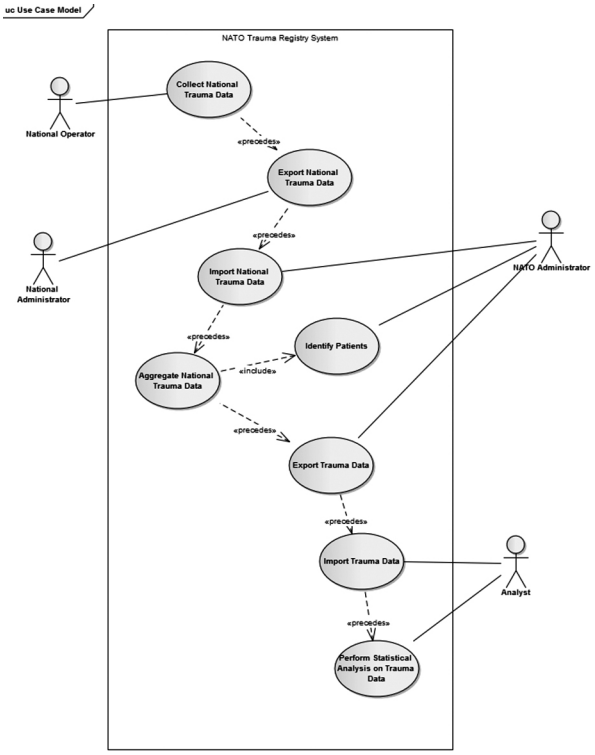

Figure 3. Data flow [11]

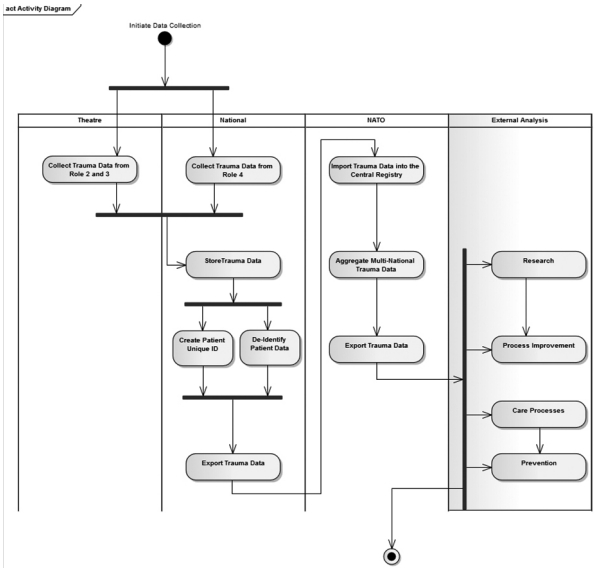

Figure 4. Proposed data management [11]

Discussion of data elements collection

As a result of the individual data entries and the discussions with medical planners there were strong links identified where quality improvement in trauma care and epidemiological surveillance conjugate, and Force Health Protection approaches apply.

Due to the low sample size statistical analysis was not carried out on captured data. Efforts were focused on practical observations regarding data collection in a clinical environment where trauma registry is a novel tool. Additional findings were made from the parallel utilization of the three datasets.

Entering the same cases there was different achievable compatibility with the UK and US data form. As far as all three forms are concerned there are major variances in inclusion criteria, data sets and data dictionaries as well. The current main deficiency of the NATO Trauma Registry Data Elements is the lacking data dictionary and missing specifications of numerous entries.

The available registries focus on hospital care and do not fully capture pre–hospital data.

Conclusion

Medical solutions in extensive kinetic military operations in austere environments have been under continuous evolution. The evolving changes in casualty management policies require continuous adaptation of the injury surveillance techniques. It is important to ad flexibility to the different national and NATO injury surveillance systems, but in the meanwhile a core common standardization is necessary to ensure Completeness and Data Quality.

Further research recommended:

1. Data dictionary for all entry fields needs to be elaborated. It is advised to take over data definitions from the UK/USA trauma registry if available and feasible.
2. Explore NTR related Quality Improvement and Epidemiological Surveillance aspects and assess the links between Clinical Governance in Trauma Care and Force Health Protection.
3. Survey the NTR tactical level users' operational requirements and support the development of the System part. (collecting, analysis, reporting and dissemination)
4. Evaluate the deliverable products in terms of simplicity, flexibility, data quality, acceptability, representativeness, and timeliness.

If the quantity of data is sufficient, and further data standardization is performed statistical analysis (case control studies for example) should be realized in a second time approach to evaluate the impact of different factors on survival and general outcome.

Description of the establishment of a new trauma system

NTR development is in the phase when the major difficulties could be examined and dissolved through various trials and experiments in multinational environment. The NTR Pilot Study is now concluding the phase 1 (feasibility), but the Task Force has already proposed to maintain their future presence in order to continue the work in coordination, harmonization of the NTR, providing expertise for the nations, and providing assistance for standardization in the further (planning) process. (Fig. 5).

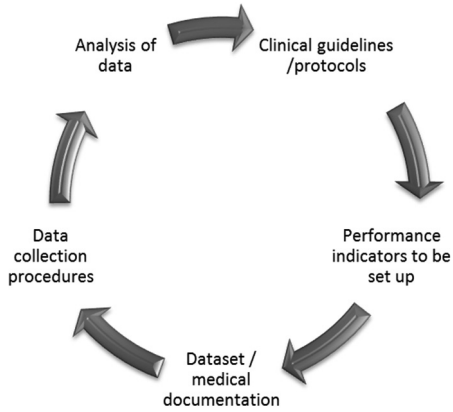

Figure 5. Proposed cycle of trauma system development[10] [11]

The cycle depicts the continuous process and drive of the different elements in the trauma system development. Any of the five steps can be an entry point; a nation perhaps already has operational medical guidelines available, another nation only has some collected data, but has no analysis capability in place. Perhaps the simplest way is to start collecting available data, and later refine the clinical documentation and broaden the data collection matching the findings. When enough clinical data are available than clinical guidelines can be developed.

10 Figure was created by the author, published in 2011

Annex A

Evaluation Criteria results

- Quantity of anonymous trauma data
  - According to data availability, in Multinational Medical Units there are a sufficient number of multinational casualties
- Functionality of communication among systems
  - Available with the NTR interface
- Timeliness
  - Can be evaluated after enabling smooth communication between individual registries not forgetting that NTR is not a "near real time tool"
- Centralised control and handling
  - Depending on future set up and structure of a NTR
- Accessibility
  - Requires standardization between individual registries and data sharing agreements
- Collecting method
  - Dedicated personnel for collection is recommended
- Effectiveness and efficiency (e.g. integrated function or extra posts in theatre)
  - To be evaluated ("system") later when the system is operational
- Quality and standards
  - To be evaluated ("system") later when the system is operational
- Usability of collected data for lessons identified
  - To be evaluated ("system") later when the system is operational
- Further need of data standardization (e.g. ICD–10) or any interoperable standardized nomenclature according STANAG 2231.
  - To be initiated asap (next step)
- User–friendliness of the manual and the need for specific training for data collection and registering
  - To be evaluated after the finalization of the data dictionary

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[3] Allied Command Transformation (ACT): *Point Paper on NATO Trauma Registry Development*. 2011.
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Component based IT interoperability solutions, a novel approach

MUNK Sándor[1]

In our days the range of information activities supported by IT equipment, and the volume of information stored in IT systems is continually growing. So cooperation among different organizations is practically impossible without extensive, meaning preserving information exchange between their IT systems. Practically all today's interoperability solutions are based on a previously agreed intermediary representation (formatted message standard, or standard data elements), but these solutions have a number of limitations. This paper outlines the foundations of a novel, component based realization of IT interoperability solutions. For this reason it summarizes the foundations of IT interoperability, analyses the goals, and possibilities of component based solutions outlines an architecture of component based interoperability solutions, and finally determines basics of its components.

Introduction

Due to the evolution of information technology it is continually expanding the range of information activities; processes supported by IT equipment, as well as the volume of information stored in IT systems. Consequently cooperation among different organizations is already practically impossible, or at least not sufficiently effective without extensive information exchange (specifically data exchange) between the IT systems of these organizations. This necessitates that IT systems be able to exchange information without human intervention, preserving the meaning, that is to say be interoperable. The significance of IT systems' interoperability is particularly great in such complex systems of organisations as the defence sector (military forces, law enforcement, disaster management, etc.), public administration, as well as alliances and regional integrations of such spheres.

Interoperability between IT systems can be assured by dissolving the differences between the systems, and by meaning preserving transformations between data with different formats, contents, and interpretations. Practically all interoperability solutions of our days are based on previously agreed intermediary representations, formatted message standards, or standard data elements. Traditional IT interoperability solutions typically devolve the tasks of transformation between different information representations to the relevant IT systems, so the interoperability capabilities, functions embodied in these solutions do not become "public property". Another significant problem is, that the adaptation to emerging, and changing information exchange needs, the improvement of interoperability capabilities are limited, and time–consuming.

Dominant components of IT interoperability solutions are software applications, application components that implement meaning preserving transformations. The effective develop-

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ment and maintenance of capabilities flexibly adapting to dynamically changing interoperability needs requires application of state–of–the–art IT development methods, and solutions. These include, among others, component based, service oriented, or middleware solutions. From an interoperability point of view the most important properties are: the utilization of available capabilities, the dynamic expandability, so it seems appropriate to research the application of component–based solutions.

The purpose of this paper is to outline a novel, component based realization of IT interoperability solutions. For this reason it:

- summarizes the foundations of interoperability, and IT interoperability, the types, limitations, and problems of IT interoperability solutions;
- presents the essence of component based software development, analyses its goals, and possibilities in IT interoperability solutions;
- finally outlines an architecture of component based interoperability solutions, and determines concepts, types and main attributes of its basic components.

IT interoperability solutions

Interoperability between IT systems is not an end in itself; its objective is to ensure the conditions of operational interoperability, and as a part of this, information interoperability of organizations, necessary for their effective cooperation. In practice today's solutions based on standardization increasingly face implementation barriers and problems. In the following (based fundamentally on [1], [2], [3], [4], [5]) we summarize the conceptual basics of IT interoperability, then we introduce the concept, and types of IT interoperability solutions, finally we analyse the limitations, and problems of these solutions related to characteristics of interoperability environments of our days.

Basics of interoperability

Different interpretations of ***interoperability***, a concept first appearing in the military sphere, agree that it is a relation, a mutual capability between or among two or more objects to support cooperation and interoperation. A fundamental type of interoperability is operational interoperability between active actors (organisations, forces, etc.), a relation between/among actors cooperating to achieve a common goal and the overall mutual capability necessary to ensure successful and efficient cooperation. The preconditions of cooperation and operational interoperability are different part–capabilities, such as interoperabilities on functional areas (command, and control, logistics, etc.), as well as information interoperability, and technical interoperability, which are the basis of any kind of interoperabilities. (see details in [1])

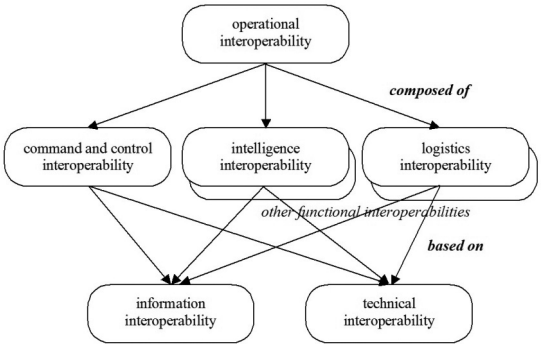

Figure 1. System of interoperability types [1: 129.]

Information interoperability is a key prerequisite for cooperation, for operational interoperability. A fundamental condition of successful and efficient operation of complex organisations, organisational systems, and groupings is the sufficient level of information exchange between the components, the sharing and coordinated exploitation of information necessary for cooperation. According to our interpretation, information interoperability is a mutual capability of different actors necessary to ensure exchange and common understanding of information needed for their successful cooperation. [1: 128.] This is made up of two basic components: the ability to exchange information, and the ability of the common understanding of information.

During *information exchange* one party (the sender) converts a portion of its knowledge into a form suitable for transfer; this representation will be transferred to the other party (the receiver), who interprets it, and builds into its knowledge. So in fact not the information itself is transmitted, but a representation, and an "other" information is created based on this representation. Common interpretation means that the intended meaning of the representation owned by the source — to the extent necessary for cooperation — equals the interpretation of the receiver.

Information interoperability requires different components, and capabilities. According to the *levels of abstraction of information representations* these components can be classified into three (technical, syntactic, semantic) levels. The technical level is related to the handling — creation, transmission, delivery — of material (physical) representations carrying information. The syntactic level is the level of the intermediary — perceptual or symbolic; traditional, or technical — representation, handling what is related to the languages, and formats used during information exchange. Finally the semantic level is the level of meaning carried by syntactic representations, the systems of concepts, and the knowledge representations used. To implement information interoperability it is necessary to ensure the conditions of meaning preserving information exchange on all the three levels.

IT interoperability has become an increasingly important, essential condition of information interoperability. Information exchange between cooperating actors increasingly happens without human assistance (machine to machine = M2M), by direct data exchange between the actors' IT systems. During exchange, and if necessary, transformation of data stored, handled in IT systems, it is necessary to ensure, that source and target data carry the same meaning, or to be more precise similar enough meaning for cooperation, for all the concerned actors. So IT interoperability is a mutual capability of IT systems, devices, applications to

send, receive, exchange data — with possible transformations — preserving the meaning assigned by the primary user community. [2: 105.]

Basics of IT interoperability solutions

In case of IT systems (devices, applications, application components, hereinafter briefly IT systems) exchanging information with each other, an interoperability problem occurs, when at some level, there are differences, disagreement in the representations used, or in their interpretations. If the representations and their interpretations are the same, then nothing is to be done. However if there are differences, either the capability to use a shared, uniformly interpreted intermediary representation should be created, or the meaning preserving transformation between different representations should be realized during the process of information exchange (communications).

An ***IT interoperability solution*** is an IT system, device, application, or application component that's purpose is to resolve heterogeneity between disparate, heterogeneous IT systems, to ensure conditions of meaning preserving information exchange. Information exchange between two IT systems is always implemented with the help of a certain intermediary representation, which is carried by the communication network used. Meaning preserving transformation, the essential component of the IT interoperability solution, or parts of it can be implemented in relation to, as a part of the related systems, or independently from them.

The purpose if interoperability solutions, forming part of the systems, *interoperability interfaces*, *connectors, wrappers* is to implement the meaning preserving transformation between the system's internal, native representation, and the intermediary representation used. A given system may be connected to a more collaborative environment, so it can have more interoperability interfaces to different intermediary representations.

Interoperability solutions that are independent from the related systems — analogously to appropriate network devices — can be *interoperability gateways* performing transformations between intermediary representations used by the different collaborative environments. In addition to the centralized solution, the necessary transformations can be implemented in a distributed manner, in the form of an *interoperability infrastructure* based on the services of multiple components. Interoperability infrastructure can be a value–added service layer of the IT network, or an independent middleware layer. The advantage of the system independent solutions is that each system may use their own intermediary representation, and do not have to conform to other systems, to the changes in their range.

Today's IT interoperability solutions in practice are primarily standardization solutions. They are based on standards widely accepted, or agreed on by a community of interest for the different forms, components, and levels of information exchange that in the following we summarize based on [3]. The essential characteristic of interoperability solutions is based on global, or community of interest specific standards, established by formal agreements, or developed from practical experience, and the ability to exchange information by standardized solutions is the responsibility and task of the cooperating IT systems. Standardization of IT interoperability affects the three levels of interoperability to varying degrees. The technical level is characterized by general, widely used solutions, and this gradually covers the syntactic level. At the same time a semantic level dealing with content oriented questions is basically characterized by community of interest specific solutions.

Today the ***standardization solutions*** can be classified into three major groups, including document format standards, message format standards, and data element standards. *Interoperability solutions based on document format standards* standardize the formats of different (textual, spreadsheet, drawing, image, audio, and other multimedia) documents exchanged between IT systems. They do not address the issues of production, processing, transmission, and reception of these documents.

The basis of *interoperability solutions based on message format standards* is formatted messages belonging to semi–structured information. To meet the specific information exchange needs of a community of interest, standard messages are defined, which are based on standardized data elements, message fields, and standardized message structure processable by IT equipment. Message fields are standardized for each message, but can be re–used in more messages. Bit–oriented message formats are intended to support time–critical (real–time and near–real time) information exchange, while character–oriented message formats support the less or non–time critical information exchange.

Interoperability solutions are based on information exchange data models, which are based on the set of standardized data elements satisfying all the relevant information exchange needs of a community of interest. Data elements describing the characteristics and relationships of objects, which are subjects of information, are arranged into a single data model, where each data item can have only one version, specifying the content, format and possible values. These standardized data elements then can be used both in formatted messages and during database replication. Meaning preserving transformations between data models of the different IT systems and the common information exchange data model are the responsibility of the respective systems. Nowadays different communities of interest have designed and develop continuously a number of information exchange data models.[2]

Limitations and problems of IT interoperability solutions

During the examination of specialities of IT interoperability solutions, including their limitations and problems, one cannot abstract from the scope of interoperability to be ensured. Interoperability problems and the range of applicable solutions of a given IT system are determined by the characteristics of its interoperability environment. IT interoperability environment of a given IT system can be interpreted as all those IT systems (devices), that are in direct information exchange relation with the given system (without human interaction). IT interoperability environment includes information (or rather data carrying this information), handled, or exchanged by the given systems (see details in [4] and [5]).

Today's existing, as well as planned IT interoperability solutions mostly related to the so–called *elementary interoperability environment,* that is characterized by a well defined, permanent, close, functional area cooperation, and functional similarity of cooperating partners. These solutions are based on the same conceptual and methodological basis, the application of a *single common intermediary representation* (standardized messages, standardized data elements). Their implementation requires the following tasks:

- definition of information exchange needs of the given cooperation group;

2 Joint C3 Information Exchange Data Model (JC3IEDM), National Information Exchange Model (NIEM), Justice Information Exchange Model (JIEM), European Information Exchange Model (EIEM), Aeronautical Information Exchange Model (AIEM), etc.

- comparison, and reconciliation of the content (interpretation) and format of information by different actors, involved in information exchange;
- creation of the intermediary representation used in information exchange, and its agreed interpretation;
- finally the implementation of the necessary transformations between the internal representations of the different actors and the intermediary representation.

Functional similarity implies the identity or similarity of the scope, and content of information handled, which facilitates the establishment of the common intermediary representation, and the implementation of meaning preserving transformation between the internal and intermediary representations.

In order to maintain interoperability satisfying the requirements, in case of new, emerging information exchange needs, or changes in existing needs the above tasks should be cyclically repeated. The main characteristic of interoperability solutions based on common intermediary representations is the significant *turnaround time* (measured in half years, or years), which follows from the time required to reconcile changes, and on the other hand the implementation of appropriate modifications.

With the expansion of the scope of cooperating partners and the content of cooperation (the range of information exchanged) the implementation opportunities of elementary interoperability solutions are gradually narrowing. In case of a so–called *complex interoperability environment*, that is an extensive cooperation group and widespread information exchange with differentiated content, on most communities of interest the possibility to coordinate application domain specific versions of information decreases. Due to specific needs of different functional, application areas, standardization, and realization of uniform solutions is limited, particularly on a semantic level. This is because each community of interest has its own terminologies, which have concepts identical, or partly different to those used by others, as well as concepts unique to them. Consequently instead of a single intermediary representation *more*, complementary, existing parallel to each other *intermediary representations* are needed.

In a complex interoperability environment a given IT system is in connection with more IT systems that are members of more previously known communities of interest, and these communities develop their interoperability solutions independently of each other, or only a partially coordinated way. The number of these communities is usually few, rarely greater than 2–5. IT systems know, and use intermediary representations of more communities of interest ("they speak several languages"). Conditions of interoperability in this case can also be created in advance; the appropriate interoperability solution for the given system can be previously developed, and continuously maintained.

In a complex interoperability environment different intermediary representations in many cases form a multilevel, hierarchical system. The core of the system is a representation, which is shared by the whole cooperation (application) area, and ensures the exchange of information relevant for all, or the majority of cooperating actors. Some parts of intermediate representations related to specific communities of interest are common with the central representation (overlapping it, or are mapped to it), other parts are area–specific.

In case of *dynamic interoperability environment* a given IT system is also in connection with IT systems of more communities of interest, but their number is far higher than in the complex environment of interoperability, their range is dynamically changing, some of them

appear only in relation to a specific task, operation. Consequently, unlike in the case of the two types mentioned before, conditions of interoperability previously can be ensured only partially, or only in the previously known areas of cooperation. In case of dynamically occurring cooperation areas of interoperability solutions should only be (fully) implemented and adapted to the given situation during the phase of the preparation, and/or the execution of the operation.

In dynamic interoperability environments implementation of interoperability requires other then pre–planned and prebuilt ways, and methods. To describe an adequate capability of an IT system in such an environment, a new concept should be introduced. *Adaptive interoperability* is a capability of an IT system to ensure the necessary conditions of the meaning preserving information exchange in a dynamically changing cooperation (interoperability) environment with other — previously known or unknown — IT systems, without IT development efforts, within user defined time limits. [4: 71.]

The *overall conclusion* is that currently used IT interoperability solutions based on intermediary representation provide an efficient solution only in case of well–defined, long–term and close cooperation. In addition their development and maintenance requires considerable coordination and time, they reaction to new information exchange requirements is difficult and slow. Finally the implementation of the necessary transformations between the internal and intermediary representations is fully passed on to affected systems.

Component–based approaches and interoperability solutions

In case of some level of heterogeneity of cooperating systems the conditions of interoperable (meaning preserving) information exchange between IT systems is implemented by IT applications realizing the transformation of the information flow. These applications, apart from simple cases, are complex software systems which realize a number of different — syntactic, semantic, and procedural — transformation functions. For effective and efficient software development different development approaches, methodologies have emerged, one of which is component–based software development. In the following (based essentially on [6], [7], [8] and [9]) we summarize the fundamentals of component–based software development, and then examine how this approach can be utilized, realized in case of interoperability solutions.

Basics of component–based software development

Component–Based Software Development (CBSD), or Component–Based Software Engineering (CBSE) is a software development methodology, based on the idea of an engineering approach, which states:

- do not invent, and do not fabricate everything again;
- build on reusable components;
- take, and adapt existing parts, components;
- standardize. [8]

This approach is based on the separation of software system development, and software components development. Accordingly, software systems should be built up (as far as possible) from prefabricated, existing components, and software components should be developed so that they can be used in different systems. This approach occupies an intermediate position between a completely individual development and the use of ready–made solutions.

The basic objective of component–based software development, fitting the line of former modular programming, structured programming, object–oriented programming, distributed software development, and other similar methodologies, is faster, more scalable product manufacturing, matching user needs; ease of modification and expandability; as well as reusability of partial results of development. Component–based software development difficulties include those not easy to find, learn or adapt to the appropriate components, and those where it is more difficult to make reusable components, then unique ones.

According to a widely accepted definition a *software component* "is a unit of composition with contractually specified interfaces and explicit context dependencies only. A software component can be deployed independently and is subject to composition by third parties." [7: 41.] Software components are cohesive units (from some, usually functional, point of view), implementing specified functionality, loosely coupled with their environment.

The concept of components are strongly connected to such general design, and development principles as decomposition, modularity, abstraction, and encapsulation. Effectively usable components can be developed by decomposition — that is division into more manageable parts — of complex systems (functions). During decomposition the intent is to increase the strength of internal relationships, and reduce external dependencies. For their users the components are abstractions of a particular function, or group of functions, whose quality significantly determines the usability of the component. Finally the components, by encapsulation, include data and procedures necessary to accomplish the functions provided, at the same time hiding the details from their users.

Software component interfaces are those means between the users and the component that enable the interconnection. Technically an interface is a set of operations that can be invoked by clients. Each operation's semantics is specified and this "contract" is normative for the users and for the developer of the component too. Specification of an interface is an abstract description of functionality; services provided by the component can be informal, formal, and mixed. A specification always contains functional aspects, usually includes pre– and postconditions of operations and possibly extra–functional elements (performance, capacity, availability, security information, and environmental requirements) too. [7: 50–57.]

Software component models and infrastructures (frameworks) are fundamental conditions of component–based software development. Component–based systems rely upon well–defined standards and conventions (component model) and a support infrastructure. A component model is a set of rules that determines the framework of a component's development (forms of communication, data representation, conditions of deployment, etc.), while a component infrastructure is a platform, on which the components 'work' and which provides different (e.g. communication, or resource management) services to the components. [9: 23–25.] In practice many different software component models and related infrastructures have evolved.[3]

In addition to dissimilarities, there are many similarities among *component–based approaches and service–oriented approaches* so popular nowadays. Both approaches are based on loosely coupled, interoperable, reusable components. However, compared with existing component–based solutions, service–oriented approaches took a step forward, because in fact they regulate only communication between components and do not contain provisions

3 Microsoft Component Object Model (COM), Microsoft .NET Framework, Enterprise Java Beans (EJB) and Java Platform Enterprise Edition (J2EE), Common Object Request Broker Architecture (CORBA).

for their language, and platforms. There are also differences in performance and security between components deployed in their environment and web services available through Internet protocols. Of course, in changing the interfaces, it is possible to implement the functionality of a software component as a web service, or provide a web service in the form of software component.

Basics of component based interoperability solutions

For the analysis of the application of the component based approach in interoperability solutions:

- first we overview the arguments for and against this approach and what opportunities exist;
- then we outline a basic framework of a component based interoperability solution.

The use of component based software solutions are justified, if on the given application area there exists *widely used functions, in many IT systems, products,* implementation of which, in the form of software components can be economical. This is obvious in the case of interoperability solutions, since most of the systems involved in information exchange use the same or similar information representations[4], and several types of data elements (temporal characteristics, spatial characteristics, names, etc.) used in many systems.

However this 'simple' condition in practice often does not appear to be sufficient. According to experience, the application of the theoretically suitable methodology is mostly bogged down in the business interests of software product manufacturers and in the diversity of component architectures. Software solutions implementing the same and similar functions are typically used only in various products of one manufacturer (and not necessarily in the form of software components), and not in products of different manufacturers (see e.g. different image and video format converters). The same is the case of existing interoperability solutions.

Another aspect of the use of component based solutions can be the *contribution to specific capabilities, properties of the software product.* The literature formulates a number of system properties (so called "ilities"), that can be easier, and reliably achieved with component–based solutions. These include among others extensibility, tailorability, and through these adaptability (to changes, changing needs).

In case of an appropriate support architecture, by replacing software components, or adding new components, capabilities, services of a component–based system — in a plug–and–play manner, similar to technical solutions used as examples — can be extended, enhanced without software development. In the world of interoperability solutions, due to dynamic changes in cooperating partners and their information exchange requirements, the new and changing message formats, and data elements, the significance of this option is invaluable. Limitations of the implementation are first of all the variety of component models and infrastructures, and the lack of a unified interoperability architecture.

Finally the reason for the component–based solutions can be the *special expertise needed to implement some functions.* In case of interoperability, in a lot of application areas there are (domain specific) knowledge intensive functions, where implementation of software requires

4 EDI, military message formats (Message Text Format, MTF), XML, etc.

not primarily IT, but domain specific expertise. Technical and syntactic level transformations usually require minimal knowledge of speciality. However semantic level transformations are basically based on speciality based knowledge, after that their IT implementation — a bit of exaggeration — is simple, almost mechanical. For example it is the domain experts' responsibility and capability to determine the order, and rules of transformations between different, but similar classification attributes, or between dates in different calendar systems. These domain area expertise functions should be implemented in the form of widely usable components.

The conclusion is that in case of interoperability solutions there exist a number of sub functions, which play an important role in many, or almost every system, so their implementation in form of reusable components could provide significant benefits. Without a detailed analysis these include for example the decomposition of structured information representations (e.g. formatted messages, tabular data, etc.) into elements and their relations, or the meaning preserving transformation between different formats of data elements. In case of interoperability solutions, due to dynamic changes in information exchange requirements and limitations of solutions based on preliminary coordination, standardization is of the utmost importance for the role of component–based solutions supporting extensibility, adaptability. Finally the independent implementation of interoperability components can be justified by the need of specialized domain knowledge.

The *basics of a framework for component–based interoperability solutions* can be built on functional decomposition, partition into functional components of a meaning preserving information exchange between IT systems. In our opinion two basic dimensions of decomposition are the abstraction levels, and the structural architecture of information representations.

It is easy to see how *transformations between technical (physical), syntactic and semantic representations* can lead to different functions, independent in nature, and may form individual components. In the following — although their role in specific interoperability solutions (e.g. tactical data links) is significant — we do not deal in detail with components handling physical representations. This is common in the interoperability literature: in case of analysis of interoperability solutions the lower levels of information exchange are usually considered solved, and a communication infrastructure is assumed, that provides an existing bit– or character–oriented channel for information exchange between cooperating systems.

It is also fairly clear that a meaning preserving transformation of a complete information exchange unit (document, message, query, response, data stream, etc.) can be decomposed into *transformations of composite and elementary information units*. Software structure determined by data structure, object–structure has long been used and is a still prevailing approach of software development. From our point of view it is important to emphasize that individual information exchange units typically are made up of parts used more than once, and these parts are built from often used elementary units. Thus software components implementing transformations of intermediate and elementary level representational units may be ideal for multi–use (reusable) building blocks. Hereinafter — due to reasons of brevity and differences in characteristics — we do not deal in detail with the issues of interoperable transformations of natural language texts and multimedia representations, our discussions will be narrowed to structured and semi–structured data, information representations.

In the following we outline *a comprehensive model of interoperability solutions* that could form the framework for the analysis of the structure and components of component–based solutions.

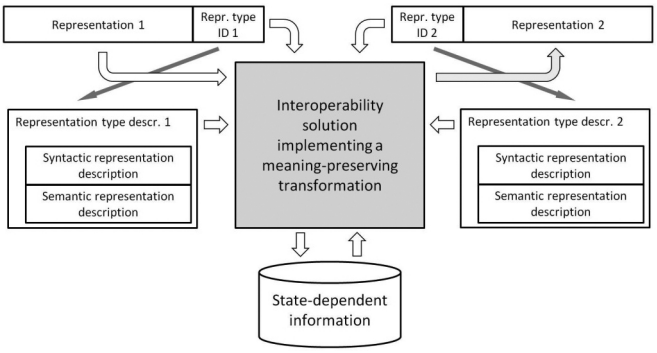

Figure 2. Overall model of interoperability solutions
(Created by the author)

The fundamental input of the interoperability solution — whether it is centralized or distributed, or part of the system(s) involved, or independent from them — is a given type of information representation (belonging to source side), and its fundamental output is another type of information representation (belonging to received side). For processing, and the creation of particular representations, syntactic and semantic descriptions are needed that can be provided, published by the involved parties, or may be generated by the interoperability solution providers.

In many cases permanent specifications are not sufficient for meaning preserving transformation; information from previous process of information exchange may also be needed. For the period of the information exchange, this information should be temporarily kept by the interoperability solution.

Architecture of component based interoperability solutions, interoperability functional units

As outlined in the previous section the basic function of an interoperability solution is to transform a given type of information representation to another type of information representation. In case of a component–based implementation to achieve this goal a comprehensive architecture and its constituent component types must be defined, which form the basis of the development of components fitting into this framework, and usable in several solutions. In the following we first outline an interoperability solution architecture, and then determine the essential features of its functional units.

Architecture of component based interoperability solutions

The functional architecture of interoperability solutions can be determined according to the three phases of transfer–based solution of computer (machine) translation. Its essence is that:

- with morphological, syntactic and semantic analysis the source text is transformed into a language–specific intermediate representation;
- source language intermediate representation is transformed into a target language intermediate representation;

- finally target language text is generated based on the target language intermediate representation.

Since our study is focused on the meaning preserving transformation of structured and semi–structured data (information representation) and the goal (requirement) is a 'perfect' solution, without the loss of information due to application circumstances, statistical translation techniques – considered nowadays the most popular – based on substantial preliminary data collection are not feasible. It can be easily stated that analysis (decomposition into component parts) and generation (building from component parts) of structured and semi–structured information representations, in relation to the processing of natural language texts, are practically not a problem. Based on the foregoing a proposed overall architecture of component–based interoperability solutions is shown in the following figure:

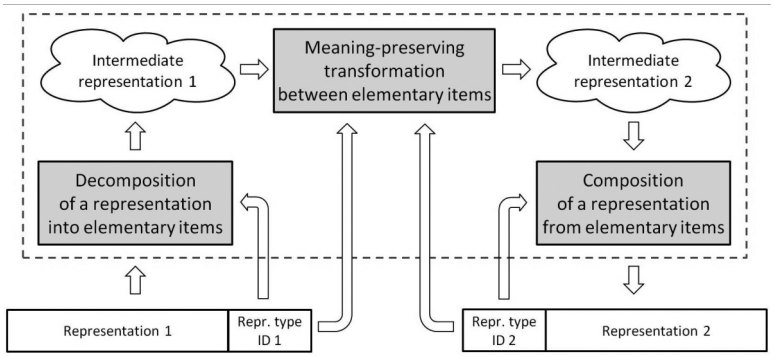

Figure 3. Overall architecture of an interoperability solution (Created by the author)

Key components of the architecture are the *two intermediate representations* that form a connecting link between three functional units. The required degree standardization of these representations is the basic prerequisite of the component–based solution. To facilitate further transformations intermediate representations carry the information content of source and target representations divided into elementary components, in form of elementary statements related to individuals (objects), their characteristics (properties), and relationships. In case of structured and semi–structured data any knowledge representation language[5] suitable for description of propositional (statement oriented) information is appropriate for intermediate representation. According to the literature these knowledge representation types can be mapped to each other [e.g. 10, 11], however in this paper we are not dealing with this in detail, conversions between different types we consider solved by general purpose components.

Subtasks of an interoperability solution are implemented by three broad functional units. Two of these, *decomposition of the source representation into elementary components and composition of target representation from elementary components* are related to the system of interpretation (conceptual system) and format rules of a given side; they are independent of the features, characteristics of the other side. In case of structured (tabular) and semi–structured data (e.g. formatted messages) realization of the two transformations, based on

5 Resource Description Format ~ W3C Recommendation, Topic Maps ~ ISO 13250, Conceptual Graphs ~ ISO 24707.

database schemas, and message formats, is not a significant problem, it largely encompasses commonly used sub functions.

The third functional unit, *transformation between intermediate representations of the source and target contexts* is the essential component of the meaning preserving transformation. This functional unit resolves the differences in concepts, interpretations, and formats of the two contexts. Based on the needs of the application area, the transformation can be achieved in two ways:

- complete (as possible) transformation of source information into target information;
- production of required target information from the source information available.

Of the two, the second approach is more difficult, because its implementation — in case of source information is not sufficient — may require additional information. These may be available in the source environment (but outside of the source representation), or can be acquired from a general knowledge base, or a knowledge base established specifically for interoperable transformations.

Transformation between intermediate representations can be divided at *syntactic and semantic levels* and corresponding functional units. In practice syntactic transformations are conversions between data values appearing in elementary information, representing the value of a given characteristic of a given object. In this paper we consider a transformation as syntactic level transformation when it takes place between two different representations of the same data element concept[6]. They also include conversions between composite representations (e.g. dates, quantities). However we do not consider as syntactic the transformations between classification characteristics represented by different codes, since actually they are transformations between class concepts.

Semantic transformations are necessary when there are conceptual differences between the two parties, such as case transformations between the concepts – including object, characteristic, and relationship concepts – of the two interpretation environment required. Transformations between concepts and between data values sometimes are connected: to determine object concept data values (classification, or other characteristics) may be necessary, and data values (e.g. classification characteristics) may be determined based on object concepts.

Component based interoperability functional units

Basic components of interoperability solutions' functional architecture outlined on the previous section are interoperability functional units. A functional unit is a basic concept of IT: an entity of hardware or software, or both, capable of accomplishing a specified purpose. [13: 11.] Accordingly an *interoperability functional unit* is a hardware and/or software entity whose purpose is to accomplish meaning preserving transformations between different information representations.

Interoperability functional units may be IT application/device components, standalone IT applications/devices, and complex IT systems built on each other and other type functional units. For extensive usability, the interface of the interoperability functional units can be generalized in such a way that their input and output consist of bit sequence format information

6 Concept that can be represented in the form of a data element, described independently of any particular representation. A data element concept is composed of an object class [concept] and a property [concept]. [12: 5., 10.]

representation(s), and globally unique identifiers defining their type. Specifications, knowledge components of this representations (defined by the unique identifiers) may appear, may be available 'built in' to functional units, or independently, in some form of knowledge representation.

The following provides a broad, one by one overview of the basic characteristics, features of functional units implementing decomposition, composition, and transformation, and possibilities of their implementation in the form of reusable components.

The basic purpose of *decomposition and composition functional units* is to create elementary information representations from a composite information representation, and to build a desired (composite) information representation from elementary representations. During decomposition data values appearing in representations are extended with data type identifier, and object–, property–, and relationship–type concepts (more accurately with their type identifiers). In case of structured and semi–structured information representations in practice we encounter only a few structure types. These include tabular (matrix), and graph (basically tree) data structures.

In case of decomposition and composition functional units, the most appropriate sub functions to implement as widely reusable components are sub functions that implement syntactic analysis of the given representation[7] (analysing a sequence of symbols according to the rules of a formal grammar, and building a language data structure), and sub functions of syntactic generation (building sequences of symbols from a language data structure).[8] In case of general purpose components, for implementation, it is necessary to provide a standardized formal specification (database schema, or message format specification) of the representation structure.

In case of formatted messages another obvious possibility for component–based implementation is the decomposition of messages into message parts, and composition of messages from message parts. One of the basic objectives of major message format standards is the individual standardization of reusable message parts, and data elements. So in case of a new message, to create an interoperable transformation it is just enough to implement the decomposition, and composition functional units for the new message parts.

The purpose of *syntactic transformation units* accomplishing transformations between source and target intermediate representations is the meaning preserving conversion between different representations of the same data element concepts. This includes transformations between different formats of numbers, dates, times, and spatial characteristics, or character set conversions between textual characteristics. These are already available in the form of general purpose programs and subroutines. In fact their component–based implementation is only a question of implementing a suitable interface; it is not a major technical problem.

Transformations between textual (character string) data having internal structure, e.g. person names[9], and organization, organizational unit names, including their different language versions form a more interesting, and more significant task. To solve these tasks by component–based functional units, deeper level knowledge components are needed. Due to the need of the identification of objects that are of interest, meaning preserving exchange of name features (appropriate for identification) between different interpretation contexts is crucial. (in detail see [14]).

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7 Parsing.

8 We can meet such solutions (XML parser, MTF parser, etc.) in the practice.

9 Surname (family name), given name, titles, other name parts, etc.

Purpose of *semantic transformation units* accomplishing transformations between source and target intermediate representations is the meaning preserving transformation between the conceptual systems (object, property, and relationship concepts). The background of this task is provided by the alignment, matching, and mapping of ontologies explicating these conceptual systems. This is obviously easier in case of interpretational contexts closer to each other, and much more difficult in case of more different ones.

Semantic transformation units, by concept categories, may be classified into object concept, property concept, and relationship concept transformation units. These include: organization concept, activity concept, part–whole concept, etc. transformation units. For transformation of a given concept, in addition to source and target ontologies, and the concept itself, additional information is available in the intermediate representation may be needed.

Transformations between source and target concepts are not always feasible clearly, with complete accuracy, e.g. in case when there are differences between levels of detail of the two conceptual systems. Moreover conceptual differences between application requirements or different points of view may also make it difficult, or prevent the 'transmission' of meaning. As a consequence semantic transformations are the most difficult parts of meaning preserving transformations.

Conclusion

As a conclusion it can be stated that information interoperability is a key prerequisite for cooperation, for operational interoperability. Moreover IT interoperability is an increasingly important, essential condition of information interoperability, a mutual capability of meaning preserving information exchange between IT systems of cooperating actors without human assistance.

Existing IT interoperability solutions are primarily standardization solutions that can be classified into three major groups, including document format standards, message format standards, and data element standards. Currently used IT interoperability solutions based on previously agreed intermediary representations provide an efficient solution only in case of well–defined, long–term and close cooperation. In addition their development and maintenance requires considerable coordination and time, their reaction to new information exchange requirements is difficult and slow.

Component–based software development is an up–to–date approach of software development that is based on the separation of software system development, and software components development. Its principle is that software systems should be built up (as far as possible) from prefabricated, existing components, and software components should be developed so that they can be used in different systems.

The application of component–based software solutions is justified first of all when on the given application area there exists widely used functions, in many IT systems and products. Another aspect of the use of component–based solutions can be the contribution to specific capabilities, properties of the software product (e.g. extensibility, tailorability, and through these adaptability). Finally the reason for the component–based solutions can be the special expertise needed to implement some functions.

The basics of a framework for component–based interoperability solutions can be built on functional decomposition, partition into functional components of a meaning preserving in-

formation exchange between IT systems. In our opinion two basic dimensions of decomposition are the abstraction levels, and the structural architecture of information representations. The functional architecture of interoperability solutions can be determined according to the three phases of transfer–based solution of computer (machine) translation.

Basic components of interoperability solutions' functional architecture are interoperability functional units, hardware and/or software entities whose purpose is to accomplish meaning preserving transformations between different information representations. These have more widely used sub functions which may be effectively and efficiently implemented in form of reusable components.

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Analysis of upper respiratory tract infections in mission circumstances

FEJES Zsolt[1], KORODI Gyula[2]

During this research a specific partial data set of the UN database was analyzed from different aspects and evaluated in order to create an image about the prevalence and probable reasons of upper respiratory tract infections among soldiers serving in the operation area.
The research indicates that the prevalence of upper respiratory tract infections (URTIs), and the previously performed tonsillectomies, was the highest in one contingent. The statistical data demonstrates that the tonsillectomies may influence the frequency of upper respiratory infections within the contingent.

Introduction

The objective of the study was to process the accumulated medical database of the United Nations Peacekeeping Forces in Cyprus (UNFICYP) and make an analysis of URTIs among military troops.

Discussion

Analysis of the UN medical database has demonstrated that the prevalence of different illnesses varies between nationalities. [1] Dental and stomatological problems are most common within the Argentinean contingent (ARG), whereas the most dominant problems among the British contingent (BRIT) are musculoskeletal and sports injuries. Within the Hungarian contingent (HUN), the most common medical problems are URTIs. [1]

In order to explain why the highest rate of URT was among the Hungarian soldiers in the mission, we looked for medical and microbiological connections.

Research methods

During the research a specific partial data set of the local, UNFICYP database was analyzed from different aspects. *The analysis was made with the co-operation of soldiers in the United Nations Peacekeeping Force in Cyprus (UNFICYP), from four nations — Argentina, the United Kingdom, Hungary and Slovakia — using data between 2009 and 2012.*

Considering that the countries select the participants of the mission based on standard methods and requirements we examined a homogenous, healthy population looking at age, work, working conditions, and general physical conditions. The standard system that created the sta-

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tistical basis of the research is provided by the UN standardized data processing and reporting system. [2] The research was made with three different methods and the following phases:

Retrospective data acquisition, statistical analysis

Medical records from 1st January, 2009 to 31st December, 2012 have been analyzed. This consists of data from troops from four contingents: Argentina (ARG), United Kingdom (BRIT), Slovakia (SLOV), and Hungary (HUN). After the primary analysis of 15,749 diagnosed cases, 2,521 URTIs were identified and highlighted for further process and study.

Survey

Surveying was also completed with the participation of all four contingents. This survey aimed to determine the proportion of patients with and without tonsillectomies within each national contingent. Almost 600 questionnaires were evaluated and ear, nose and throat physical examinations were carried out.

Microbiological laboratory examination

Microbiological laboratorial examinations — throat swabs [3] — were performed in 200 cases in order to detect the differences in quality and quantity of the oral bacterial flora.

Results in connection with URTIs

We found out that, among all the registered diagnostic groups of diseases in mission level, the rate of URT–infections was between 17% and 21% annually. The numbers of the URTIs over the 4 years are without any peak. We found out that the rate of URTIs was highest among the Hungarian contingent. This observation is true for each of the 4 years. (Table 1.)

Year	ARG	BRIT	SLOV	HUN
2009	15%	26%	13%	30%
2010	14%	16%	11%	26%
2011	17%	17%	11%	28%
2012	14%	11%	11%	32%

Table 1. Rate of upper respiratory affections in the mission between 2009–2012

Results in connection with group of diagnosis

The URTI group was separated into two further diagnostic sub–groups:
Group 1– Infections with cold–like symptoms:
acute rhinitis, allergic rhinitis, rhino–sinusitis
Group 2 – Infections with throat pain symptoms:
pharyngitis, tonsillitis

We further examined how URTIs were spread across the two diagnostic groups. Considering both the data of the whole mission, and the reduced data of each contingent, Group 1 was affected, as a proportion, more than Group 2. (Table 2.)

Diagnostic–groups	2009	2010	2011	2012
No.1 group	70%	68%	77%	68%
No.2 group	30%	32%	23%	32%

Table 2. Prevalence of URTIs within the diagnostic–groups between 2009–2012

Results in connection with number of cases per 100 capita

We specified the number of cases and diagnoses per capita using an Upper Respiratory Tract Score.

Statistical analysis highlighted that, comparing different medical indexes and diagnosis–frequency, both subgroups of URT–infections were in the highest proportion among the Hungarian soldiers during the surveyed four years. (Table 3.)

	ARG	BRIT	SLOV	HUN
Mean of the URT Score	0,6	0,8	0,5	1,3
Rate of number of cases per 100 capita	60	80	50	130

Table 3. Mean of the URT Score of four contingents

Results in connection with tonsillectomy

We could not disregard the fact that certain previous surgical interventions, like adenotomies or tonsillectomies, may affect the current medical status, and thus may influence the prevalence of URT–infections among solders. Because of this possible connection, we extended our research to the qualitative and quantitative processing of the previously performed operations whereby we analyzed the operations in relation to two main groups:

- Throat–related interventions (adenotomy and tonsillectomy)
- Other operations (all operations except the above mentioned two)

According to the results of the survey 47% of the Argentine contingent, 55% of the Brit contingent and 53% of the Slovakian contingent mentioned some kind of previous surgical intervention, while 57% of the Hungarian contingent mentioned the same.

According to the processed data of the previously performed surgeries, 20% of the Argentinean contingent had undergone a tonsillectomy, 64% among the British soldiers, and 24% among the Slovakian soldiers. The rate among the Hungarian soldiers was 65%.

Next we analyzed the operations according to their dates and types (performed operations in childhood or in adulthood; adenotomy or tonsillectomy, or combined tonsillo– adenotomy). We stated that the typical intervention among Hungarian soldiers was the tonsillectomy in adulthood while interventions in childhood dominated among the other three contingents. (Table 4.)

Contin-gents	No previous operations	Had previous operations	Other operations	ENT operations	Tonsillec–tomy in childhood	Tonsillec–tomy in adulthood
ARG	53 %	47 %	80 %	20 %	87 %	13 %
BRIT	45 %	55 %	36 %	64 %	91 %	9 %
SLOV	47 %	53 %	76 %	24 %	89 %	11 %
HUN	43 %	57 %	35 %	65 %	71 %	29 %

Table 4. Rate of operations among contingents

According to the hypothesis based on the present results, termination of the protective role of pharyngeal tonsils — which is an intervention altering the protective system, microbiological integrity, anatomical and functional status of the organism — could influence the number of acute URT–infections. [4]

As a consequence of the results of the data in our research material we found out that after the termination of pharyngeal tonsils the number of URT–infections in adulthood increases without any known reason. This assumption was proved indirectly by the fact that in our research the URT–infections have less prevalence among those people who still have their tonsils. We assumed that there was a traceable relation between tonsillectomies and the frequency of URT–infections in adulthood. We thought that in those cases where pharyngeal tonsillectomies had been performed oro–pharyngeal bacterial flora were changed without any known reason and the protective function without the functions of the tonsils was decreased assisting the colonization of certain pathogens along with increasing the frequency of URT–infections. [5]

Microbiological results

Towards proving the theory, confirming its microbiological reasons and showing the direct relations we took throat swab samples from 200 patients and performed microbiological analyses. The examinations were performed on an equal number of soldiers with tonsillectomies and without tonsillectomies. From the 500 pathogens, which create the oral bacterial flora, we were focused on 15–20 bacteria. [6]

From the 200 samples, which were sent for microbiological analyses 68 samples had positive results (10 phyla, 5 subtypes, 1 fungus were detected), which means 34% positive samples all in all. In the group with a tonsillectomy the number of human pathogens was double (+28) than in the control group under the same number of cases. Among the detected pathogens all have major roles in causing those disease–groups of URT–infections, which we examined.

Among those 100 patients with a tonsillectomy and among the 100 patients of the control group the following pathogens were detected. (Table 5.)

	Name of the pathogen	Group with tonsillectomies	Control Group	Dis-crepancy
1	Staphylococcus aureus	13	4	+9
2	MRSA	2	0	+2
3	Streptococcus	9	3	+6
4	Pseudomonas aeruginosa	2	0	+2
5	Acinetobacter	2	2	0
6	E.coli	5	2	+3
7	Enterobacter cloacae	4	4	0
8	Lactobacillus	0	3	-3
9	Klebsiella pneumonia	4	3	+1
10	Serratia	1	0	+1
11	Pantoea agglomerans	0	1	-1
12	ESBL	0	0	0
13	Candida albicans	4	0	+4
	Total	*46*	*22*	*+28*

Table 5. Detected pathogens in throat swabs

Discrepancy of the detected pathogens among soldiers with a tonsillectomy was more significant than in the control group. Especially if we take into consideration that, under the same number of cases, the numbers of the detected human pathogens [7] was double among soldiers with a tonsillectomy compared to soldiers in the control group without tonsillectomy.

Summary

The rate of the URT–infections and tonsillectomy was the highest among the Hungarian contingent. According to the processed statistical data, it is proven that the examined factor has a dominant role in the frequently occurred URT–infections among Hungarian soldiers.

Termination of the protective function of pharyngeal tonsils could cause the presence and colonization of certain pathogens in pharyngeal area. In our research the pathogens detected from microbiological samples exceeded in numbers more significantly among soldiers with a tonsillectomy than among the solders without a tonsillectomy. As a direct correlation it is verifiable that the presence of the pathogens in greater numbers in the pharyngeal area could cause the frequent URT–infections. Through the results of our research it is detectable that certain bacteria, which are basically part of the normal and healthy throat–microflora, appear more often among patients without tonsils, while others typically colonize in patients' pharyngeal area that still have their tonsils. All this could mean a microbiological correlation between the different aptness for URT–infections among patients with a tonsillectomy and patients without a tonsillectomy.

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Implementation of Goal–Oriented Budgeting in the Defence Sector

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This article describes the starting points for implementing goal–oriented budgeting (management by objectives) into the Ministry of Defence of the Czech Republic. It also focuses on the principles and factors that affect implementation.
Keywords: planning, budgeting, goal–oriented budgeting (MBO), goal.

Introduction

On the 1st of January 2009, Decree No. 415/2008 Coll. establishing the scope and structure of documentation for the development of the medium–term national budget outlook became effective. On the basis of this Decree, the budgeting was initiated in compliance with the methodology for goal–oriented budgeting (MBO) not only at the Ministry of Defence of the Czech Republic (MoD, CR), but also in other budget chapters in the Czech Republic. The implementation of the new system which has an impact on the finance management began in 2009. Under the new rules, the budget was compiled for 2010 for the first time. [1]

Goal–oriented budgeting

The concept of goal–oriented budgeting is used in two basic meanings. The first concept is broader and represents the resource management system. The second concept is narrower and it is the budget method. Thus, the nature of goal–oriented budgeting is rationalizing resource allocation.

Goal–oriented budgeting is such a resource management system that enables the transformation of identified public needs into the form of a particular ministry *goals* and the cover of these goals with regard to their priorities and limited resources. [2]

Goal–oriented budgeting is a new allocation system that is to make it possible to answer the question: "What is to be achieved, how and with what amount of money?" To find the answer to this question means the following: [3]

- To realize the mission of a given institution and the benefits of its activities for the public and the state (general goal setting including the time horizon),
- To analyse activities, to determine their purpose and how they contribute to the set goals, and thus to create their homogeneous units (the definition of expenditure block structure and a more detailed division),
- To assign expenditure to these activities (expenditure assignment to expenditure blocks and a more detailed division).

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To implement a new approach to be successful, it is necessary:

- To know the source and target state of goal–oriented budgeting (Table 1.),
- To adapt the program structure of the Ministry of Defence, the thinking of responsible workers as well as the software support of the entire system.

The successful implementation is further subject to the adequate regulation of the external and internal legislative documents. Goal–oriented budgeting should allow the workers of the Ministry of Defence to fulfil the obligations resulting from Act No. 320/2001 Coll., on financial control, i.e. the efficient, economical and sensible use of financial resources. Currently, we are able to identify inputs (we have information on expenditure), but we are not able to identify our outputs in relation to the fulfilment of economic evaluation of financial resources. This new system should enable these deficiencies to be removed.

Field of state budget creation in the Czech Republic	**Initial state**	**Target state**
Methodological approach to budgeting	Supply	Demand
Final recipient of financial flows	Institution	Targeted activities (goals)
Budget method used	Index or incremental leaning against a historical basis	Goal–oriented budgeting
Method of budgetary treatment of incomes	Gross–budgeting	Net–budgeting
Method of budgetary treatment of expenditure	"Consumer" system of expenditure treatment	Production system of expenditure treatment
Method for monitoring public expenditure	Formal control (accounting and documentation)	Factual and content control (control of purpose, effect and impact of realized expenditure)
Public inspection	Performed by external audit as audit of compliance with the accounting and legal documentation	Factual control of public policies through the monitoring of expenditure goals of the state budget individual chapters
Accounting	Single–entry bookkeeping, accounting for expenditure	Double–entry bookkeeping, managerial accounting, cost accounting
Time horizon	Short–term or medium–term with insufficiently long outlook	Medium–term (rolling, moving) budget

Table 1. Initial and target state in the creation of the state budget of the Czech Republic [4: 18]

This is a completely new system for preparing and implementing the budget through the Management by Objectives (MBO) method which will be introduced in phases in the course of several years. In this context, a set of objectives has been created at the Ministry of Defence, which is expressed in Figure 1. The budget structure is represented by homogenous units of activities which constitute *expenditure blocks* (EB) – the first level objectives. These are further divided into *expenditure areas* (EA) – the objectives of the second level and the lower level division (the similar method of specification applies to objectives as well), while a higher level is a complete sum of the directly subordinate levels. The determination of EB and EH is mandatory, other lower–level divisions are voluntary.

Implementation principles

The implementation principles of goal–oriented budgeting at the Ministry of Defence — Article 6.4 — regulate the area of "creating objectives and working with objectives in the budget preparation" which define the objectives as projects / sub–projects. The *"target manager"* is responsible for the content and development of various kinds of objectives. He/she is an "official of the Ministry of Defence selected by the top management and is responsible for the development and management of objective (project) implementation and provided with adequate authority"[5]. Within the process of developing objectives in each level, target managers should use the "SMART" method in compliance with the *principles of goal–oriented budgeting*. *"The requirement for setting measurable parameters to evaluate the accomplishment of goals must always be taken into account when the content of the goal is defined"[6].* The goals are determined according to particular levels from the highest one, usually called the zero level (goal "0" order) up to the n–th level which is necessary for the management of the organization. The goals of the lower level are not set forth unless the higher level goal divide at least into two sub–goals. The goals of the zero level are based on § 16 of Act No. 2/1969 Coll. of the Czech National Council *on the establishment of ministries and other central bodies of state administration of the Czech Socialist Republic* (the so–called Jurisdictional Act) and are the basic mission of the organization. These goals are elaborated and clarified in lower levels as strategic, tactical and operational ones. Within the Ministry of Defence, the first level of goals is determined by long–term strategic goals of the Ministry of Defence which result from the Long–Term Development Perspective of the Ministry of Defence and are regulated by the Directive. The second level goals are medium–term goals and are laid down by the Directive. The third level goals are determined by managerial personnel directly subordinated to the Minister of Defence in relation to the higher level goals and are approved by the Planning Conference. The length of experience will show how the given method will be applied in creating particular goals. Subsequently, these goals are divided into the lower levels of goals which we call measures and tasks.

The goals are elaborated in a hierarchical structure – the goal tree:

- The first level goal – the expenditure block (the first level goals are shown in Table 2.)
- The second level goal – the expenditure area,
- The third level goal,
- Task,
- Measures,
- Activity.

Number of the first level goal	Name of the goal
1.	Provision of the Czech Republic defence by the armed forces.
2.	Creation and development of the national defence system.
3.	Provision of the Public Administration operation at the Ministry of Defence.
4.	Provision of strategic intelligence.
5.	Providing support for the President of the Republic as the Commander in Chief.
6.	Provision of pension insurance benefits.
7.	Provision of other social benefits.
8.	Support of national sports teams.

Table 2. The MoD system of goals for the planning cycle for 2013–2017 (the first level goals) [7]

Factors affecting the implementation

Currently, the planning and budgeting area occurs in the so–called transition period. There is a continuous reduction of expenditure (allocated financial resources) at the Ministry of Defence. This entails undesirable consequences. Then there are problems with the implementation of goal–oriented budgeting. The Ministry of Defence elaborates analyses in the area of planning and budgeting which highlight the problems concerning the implementation of goal–oriented budgeting. These are mainly:

- The used concepts have not been clarified within the implementation,
- Provision of internal standards has been implemented only partially,
- The workers involved have not been trained adequately,
- Inability / unwillingness of the workers concerned to learn new things,
- The issue of management by objectives is considered to be an "economic" discipline, the personnel of planning components take part very unwillingly,
- Lack of cohesion of the factual and financial planning,
- The planning is not able to respond to changes in the source frame,
- Etc.

The issue of the new budgeting system is characterized by the following advantages and disadvantages.

The new budgeting system – advantages:

- The tool coordinating the efforts of employees to achieve organizational goals,
- Allows objective evaluation of the effectiveness,
- Supports motivation to improve the individual performance,
- Allows identifying problem areas in relation to achieving goals.
- The new system of budgeting – disadvantages:
- Time–consuming,
- A lot of "paperwork",
- Problems in goal–setting,

- Risk of inflexibility,
- Emphasis on short–term goals,
- Inadequate or irrelevant information provided by the authors of goals.

Conclusion

Based on the abovementioned fact, it is clear that the issues of the new system–of–budgeting implementation are very difficult. The changes that have occurred in the process of budgeting and planning should lead to a more rational management of budgetary resources within the Ministry of Defence. When assessing the current state of the examined questions, I must state that the options offered for the accomplishment of goals and the mission of military units have not been utilized efficiently, so that they could lead to a more rational management of resources (factual, financial, human).

At the present, when the Czech economy is facing the economic crisis, the basic task of the management will be to support effective, efficient and economical use of resources. The resource management should include the entire cycle of planning, budgeting (programming) and resource utilization for individual goals from accounting up to their analysis.

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The infocommunication system requirements of the deployable rapid diagnostic laboratory support "sampling group" I.

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The purpose of the authors of this article is to present the abilities and the requirements of the infocommunication sub–system of a sampling group which supports the professional activity of a deployable rapid diagnostic laboratory. In addtion, the article determines the infocommunication demands and the contact system of the group. Considering the above, the authors of the article investigate the applicable technologies, the possible technical devices and give suggestions for their implementation.
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Introduction

The rapid diagnostic laboratory, implementable in a standard 22–foot container, is a tool system which is capable of eliminating the consequences of bio–terrorism and answering issues of health and food, and increasing the efficiency of biological risk management.

In the case of an occurred biological risk or infection it may be necessary to deploy a mobile biological analysis laboratory which would be installed near the location of the infection to process the samples from the pathogens and detect the presence of the pathogens in order to enforce the management decisions in relation to the risk management procedures and protocols.

In order to support all of these, a mobile sampling group strengthens the bio–laboratory. Its task is sampling from a specified area. The purchase taking of the samples from the possibly contaminated area forms the basis of the laboratory work, as the main task and basic purpose of the bio–laboratory is to process and analyse them.

It is necessary to establish a communication link between the sampling group and the bio–laboratory in order to facilitate the appropriate amount and quality of information exchange. One of the subfields of the communication sector of the bio–laboratory is keeping contact with the sampling group which helps the professional management. Providing all kinds of information exchange promotes exact task–execution.

Another element of the communication system of the bio–laboratory is an internal communication system and a network which ensures the contact development with the lead and command management. All of these should be established taking into account the above mentioned requirements.

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The sampling unit is a group equipped with special sampling devices and other additional components (see on Figure 1.). It moves via motor vehicles, possibly by aircraft (helicopter). Its members carry out various sub–tasks during the sampling which are an important influence factor in the planning of the establishment of the communication system. Beyond the sampling they perform the appropriate (temporary and safe) storage of samples and the reliable delivery of them to the deployable laboratory.

Figure 1. Sampling Group [1]

The communication link between the sampling group and the bio–laboratory

The factors which affect the establishment of the infocommunication system of the sampling group are greatly narrowed by the usable systems and devices. Accordingly, we need to examine the communication basics and the physical location of the group and its members during the performance of the tasks.

To properly ensure the system of communication services it is necessary to specify the communication needs before we determine the system requirements. Considering the links and connections of the sampling group, it has to serve two directions according to the determined requirements:

- the relation between the sampling group and the bio–laboratory (external communication);
- the internal communication of the sampling group.

There is a significant difference between the two directions in terms of the distance and the service requirements. According to the previous examinations and the communication needs it is necessary to ensure a long distance connection between the group and the bio–laboratory as the distance between the location of the sampling and the place of the processing of the sample can be tens of kilometres. The communication tools and systems need to be chosen correspondingly.

The essential criterion of rapid and precise task execution is a quick and simple connection because the installation and operation of complicated communication tools is not practical as the bio–laboratory is not reinforced by infocommunication professionals. The large space requirement of a big and complex communication system is a negative factor as well, since the size of the bio–laboratory is limited and the placement of a large number of laboratory and mechanical equipment is a priority.

In accordance with all of these, a communication tool should be provided — for the sampling group — which is easy to use, small sized and offers a proper connection with the bio–laboratory and with the sampling group as well. The communication channel between the sapling group and the bio–laboratory should provide a voice based communication. Voice connection is an important element of the communication between the two parties because professional governance and support can be done through it. Besides the transmission of issued orders for the sampling group, it is important that the group leader report and send information to management for defining further tasks.

Another important possibility is the realization of data communication. Besides the oral tasking and reporting, the transformation of certain data may be necessary to help to process the samples in the future. A datasheet — filled out by the leader of the sampling group — concerning the sample and sampling can be an example of data recording. After acquisition the determined samples must be examined for data for the easier start-up of a later investigation. It can be recorded in a pre–defined datasheet. (see on Figure 2.) One of these datum can be the amount of samples, the sampling location, the sampling date, the type of samples etc.

Asbestos Air Sampling Data Sheet

Sampler: _______________________ Date:_______________ Location:_______________________________ Project No.: ________

Sample Number	Date	Sample Time	Air Flow	Type of Sample	Employee Name (If personal sample)	Pump Type and Pump ID number	Sampling Protocol	Comments
		ON ______ OFF ______ Total (min) ________	Start _____ Stop _____ Avg _____	☐ Personal ☐ Area ☐ Pre-Abatement ☐ Clearance		☐ Gast ______ ☐ Gilian _____ ☐ Other: ___________	☐ ID-160 ☐ NIOSH 7400 ☐ NIOSH 7402 ☐ Other: ___________	
Sample Number	Date	Sample Time	Air Flow	Type of Sample	Employee Name (If personal sample)	Pump Type and Pump ID number	Sampling Protocol	Comments
		ON ______ OFF ______ Total (min) ________	Start _____ Stop _____ Avg _____	☐ Personal ☐ Area ☐ Pre-Abatement ☐ Clearance		☐ Gast ______ ☐ Gilian _____ ☐ Other: ___________	☐ ID-160 ☐ NIOSH 7400 ☐ NIOSH 7402 ☐ Other: ___________	
Sample Number	Date	Sample Time	Air Flow	Type of Sample	Employee Name (If personal sample)	Pump Type and Pump ID number	Sampling Protocol	Comments
		ON ______ OFF ______ Total (min) ________	Start_____ Stop_____ Avg _____	☐ Personal ☐ Area ☐ Pre-Abatement ☐ Clearance		☐ Gast ______ ☐ Gilian _____ ☐ Other: ___________	☐ ID-160 ☐ NIOSH 7400 ☐ NIOSH 7402 ☐ Other: ___________	
Sample Number	Date	Sample Time	Air Flow	Type of Sample	Employee Name (If personal sample)	Pump Type and Pump ID number	Sampling Protocol	Comments
		ON ______ OFF ______ Total (min) ________	Start_____ Stop_____ Avg _____	☐ Personal ☐ Area ☐ Pre-Abatement ☐ Clearance		☐ Gast ______ ☐ Gilian _____ ☐ Other: ___________	☐ ID-160 ☐ NIOSH 7400 ☐ NIOSH 7402 ☐ Other: ___________	
Sample Number	Date	Sample Time	Air Flow	Type of Sample	Employee Name (If personal sample)	Pump Type and Pump ID number	Sampling Protocol	Comments
		ON ______ OFF ______ Total (min) ________	Start_____ Stop_____ Avg _____	☐ Personal ☐ Area ☐ Pre-Abatement ☐ Clearance		☐ Gast ______ ☐ Gilian _____ ☐ Other: ___________	☐ ID-160 ☐ NIOSH 7400 ☐ NIOSH 7402 ☐ Other: ___________	

Chemistry Water Sampling Data Sheet

Date:_____ Time:_____

Weather Conditions:_____

Wind Direction:_____ Wind Speed:_____ Air Temp (°C)_____

Station/ Site:_____

Sampling Location	Depth (m)	Temp, °C	Specific Gravity	Salinity & Hydrometer Chart	Refractometer	pH	D.O.	Chloride	CO_2
Top									
Bottom									

Observations:_____

_____

_____

Date:_____ Time:_____

Weather Conditions:_____

Wind Direction:_____ Wind Speed:_____ Air Temp (°C)_____

Station/ Site:_____

Sampling Location	Depth (m)	Temp, °C	Specific Gravity	Salinity & Hydrometer Chart	Refractometer	pH	D.O.	Chloride	CO_2
Top									
Bottom									

Observations:_____

_____

_____

Figure 2. Sampling data sheet [2]

In addtion, pictures or videos can be taken of the samples or of the location, this helps the preparation of the processing of samples, the action of processing, archiving, or makes possible inspections, investigations. The personal equipment of the members of sampling unit should be installed with a camera which is able to take photos or record moving pictures of the process (see on Figures 3.). Naturally it helps the professional ordinance of the sampling group if the group leader is able to control the workflow from the background.

Figure 3. Sampling method [3]

It is a significant factor that it has to be able to communicate in an area without communication infrastructure. The satellite link is one of the most suitable solutions for establishing a connection. Its advantage is that it is less sensitive to the terrain conditions and it has a high capacity of availability, but its major disadvantage is the huge traffic charge. Satellite communication has a great importance both in civilian and in military (defence) signal areas. The currently applicable satellite phones can provide all requirements which are necessary nowadays in a modern infocommunication society and also suitable for serving the bio–laboratory. Therefore the satellite data transfer allows continuous, highly reliable voice and data traffic between the users and the remote endpoints.

Over all, in terms of the communication among the bio–laboratory and the sampling unit, based on the existing needs and expectations, an integrated voice and data connection providing technology should be selected from among wireless connection types. As described above, *microwave connection* provides opportunities beyond the satellite connection forms. Microwave connection can be workable on Ethernet interface so the long distance microwave connection can be established between information technology (communication) devices which are used in civilian life. *"Ethernet is the most widely used local area network protocol (LAN). Its defined standard is 802.3. Ethernet was originally developed by Xerox, its initial form called Aloha net […] Nowadays the most commonly used Ethernet protocols are the 10 Mbps and 100 Mbps versions. […] Recently the 1000 Mbps, gigabit versions are widely spread." [4]* It always provides the connection between the endpoints, allowing a fast and secure voice, data and image transmission. With the VPN[3] service which is based on MPLS[4] protocol the secure connection form is available which is allowed by developed virtual circuits which exclude unauthorized access to data and information. In our view, the secure exchange of data and the exclusion of unauthorized persons are highly important requirements at all levels and in all directions of connection. Secure and protected communication is the basic condition of the successful operation, even if the laboratory carries out non-military but civilian tasks. A good example of a leak is when a civilian "captures" a message which contains information about the samples, it can create a panic among the public, forwarding

3 Virtual Private Network
4 Multiprotocol Label Switching

misunderstood information. In our opinion, its use in this project is not the most appropriate way because a direct line of sight (LOS) is necessary between the microwave antennas and it needs complex visibility testing and an antenna (mast) kit and it significantly affects the place of the operation. Therefore a professional specialist with complex knowledge is necessary during the planning, installation and operation, something not available in the capapcity of the bio–laboratory. In our view, the high–speed, high–throughput microwave link can be definitely useful as a second connection.

The *wireless connection form with radios* can also be achieved between the two parties. In this case, considering the large distance, the short–wave (HF) radio connection can be implemented. The radio equipment is excellent for voice communication, but only slightly suitable for data transmission because the transfer speed is not sufficient to transfer images and moving pictures. The modern, currently applied antenna types can easily be used because of their small size but the bridging of the large distances mostly can be achieved only with complex antennas. It is important that these radios generally should be easy to handle (user level), with highly efficient and fast tuning. During the application of radio links the frequencies to be used should be taken into account in every case as their use requires authorization. *("Appointing frequency is possible according to the government regulation about the national allocation of frequency bands within the using rules established in a regulation by the Minister. The allocation of frequency bands is determined by government regulation in accordance with international agreements and EU sources of law." [5]).* Accordingly, the radio signal is very well applicable during military use of the bio–laboratory, when the nation uses its own operational radio devices and the corresponding antenna kit. We need the safety factors to take into account the case of radio connections (applying all wireless connections),- to insure that the information will be only accessed by the specified persons. The security issue is naturally a particular field in the world of infocommunication but a kind of information defence base can be realized with the decrease of spreading radio waves. The spread of radio waves can be limited by using controlled antennas. The radiation area is decreased with the right force and control, and therefore the covered area can be optimized.

Those devices which work on unlicensed frequency[5] ranges are easily accessed by civilians. This may be appropriate but there is a risk of mutual interference with other devices but it can be minimalized with careful planning thereby making it very applicable.

It is important to highlight — from the other forms of connection — the use of a GSM network which is one of the most widely used communication ways nowadays. The mobile network is a continuous developing area of modern telecommunication which provides various services after classic phone calls. Besides voice calling, advanced devices are capable of data transforming, video calls and establishing Wi–Fi contact. Its big advantage is that the mobile network is available almost everywhere (because of high national coverage). Nowadays, the devices can establish a high–speed data connection (3G; 4G) which provides smooth data transfer. The new technology supports mainly data contact and data communication because it requires a higher speed and higher throughput.

The 3G (4G) cellular systems can complement each other well with the local networks (for example: LAN). The 3G can allow services and applications such as playing high–defini-

5 ISM: Industrial — Science — Medical band: The 2,4 GHz band usable for establishing radio frequency connections without any official permit. Several common devices radiate in this band, so we must account for the interference.

tion videos, video conferencing, or fast internet access. The 4G services provide a 326 Mbit/s theoretical maximum transfer rate — with high mobility — for the users. It supports the internet connection and online television, in addtion to the "classic" phone calls. According to these, we have to analyze the modern GSM services as a corresponding communication solution. The usability across national borders is guaranteed as the roaming service insures passing across the mobile networks of several nations. However, the channel is opened, the encryption and the covering of the transmission of the data is not appropriate. Apart from this, it can be an excellent duplication of a given communication channel, of a satellite contact for example.

In summary, satellite communication which is capable of large distances, is mainly used for voice but also data connection, it is usable in every circumstance and its geographical capability is the best choice with reserved radio or GSM connection. In case of military applications using their own tactical radios is expedient.

The external satellite communication of the sampling group

As previously mentioned, it is necessary to establish voice communication between the mobile sampling group and the deployable rapid diagnostic laboratory. Therefore, the bio–laboratory should have satellite communication, so it is best to realize the connection between the group and the laboratory by using this method.

The satellite systems provide two–way communication data transfer between the satellite and the terrestrial user. We need a system formed with telecommunication satellites for establish the satellite communication. Their aim is to ensure telecommunication. The majority of telecommunication satellites are in geosynchronous orbit[6] which has the big advantage that it is orbiting with the same orbital speed of the Earth and it seems always to be at the same point from the Earth. It greatly facilitates the establishment of a satellite connection. It is enough to set the terrestrial antenna to the satellite and the established connection remains constant. The GEO orbit means an approximately 35 800 km altitude above sea level. The other satellites which are orbiting in the same altitude are the geostationary satellites[7] but the difference is that those move at the level of the Equator. For the implementation of satellite communication, transmitter and receiver stations and terrestrial observation stations are necessary which carry out the monitoring of the system and the satellites. A relatively large area of the territory of the Earth (approximately 40–45 %) can be covered by the satellites which operate at this altitude. This allows the communication system to operate with a small number of satellites.

The satellites installed by the company Thuraya operate at this altitude and are capable of establishing contact between the sampling group and the bio–laboratory. "*The Thuraya -3 satellite was built by the company Boeing Satellite System and began a geosynchronous orbit on 15 January 2008 at 154° west longitude. The Thuraya mobile satellite system was built by the Boeing Satellite System (formerly: Hughes Space and Communication International, Inc, or HSCI) for about 1 billion USD worth. Its planned life is 12–15 years. The Thuraya–1 and 2 satellites are at 44° to the east in geostationary orbit." [6]* The hand–held satellite phones are ideal for information exchange based on our recommendation and taking the primary voice communication needs into account.

6 GEO: Geosynchronous Earth Orbit
7 GSO: Geostationary Earth Orbit

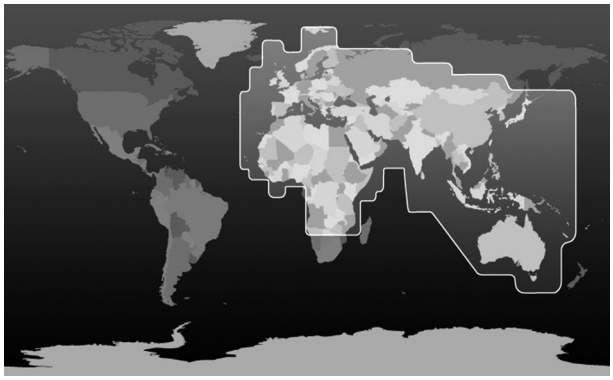

Figure 4. Thuraya coverage map [7]

It is necessary to provide a kit of Thuraya XT–Dual phone for the mobile sampling group which is water–, shock– and dust resistant and suitable for application at a GSM band (900/1800/1900 MHz) besides satellite connection. This is an excellent option in the case of the mobile network coverage appropriate in the region. In this case the satellite communication can be omitted which carries out a cost–effective connectivity. Naturally, in those areas where the terrestrial infrastructure is not available, the satellite connection is realizable. The Thuraya XT–dual device is usable for communication while moving without significant loss of satellite signal, thanks to the advanced technology, its special antenna and the extremely strong system. It is also possible to use in-vehicle by a connect to the car kit. It has high talk and stand–by time and is suitable for data transfer along with voice communication. It has Bluetooth and message sending functions (SMS, MMS, e–mail, Fax), and emergency SMS function. The great advantage of the device is that it can receive satellite calls with a covered antenna so the significance of this device is portability.

The fitting of the other station (bio–laboratory) with Thuraya XT–Dual devices maintain the satellite or GSM connection between the two parties. The bio–laboratory needs a device which ensures the connectivity in indoor space (inside the container). An indoor transceiver has to be installed inside the container which can establish contact with the help of an antenna installed on the outside of the container. This could be the FDU XT–Dual device which is a fix established docking station, with which the telephone device becomes capable of communication. With the use of FDU we can realize full–featured fax, voice and data communication and the loading of the device is also solvable.

Figure 5. Thuraya FDU and XT–Dual [8]

The above described device is excellent for serving the sampling group's communication needs. Although there are many devices to choose from, in our opinion the devices made by Thuraya, in the present case, have several positive characteristics. [9]

The external microwave communication of the sampling group

A possibility for an installed contact between the sampling group and the bio–laboratory as a duplicate of the satellite (and GSM) contact is microwave link. Microwave is an electromagnetic wave which is between 1 meter and 1 millimetre and its frequency is higher than 300 MHz and lower than 300 GHz. Nowadays, the increasing spread of devices for information exchange mainly use the lower part of the range of frequency for communication and telecommunication. Today, companies and individuals often use such tools which have mainly been characterized by telecommunication service providers.

The microwave link provides all the requirements which must be supported by the communication system of the bio–laboratory. It provides a constant, reliable connection for long distances between the endpoints and its high–speed data connection allows the voice, image, video and videoconferencing communication. The GSM phones, the Bluetooth devices, the devices for wireless data transmission (WLAN), the television and radio systems and the satellite stations also use microwave transmission.

The disadvantage of the microwaves is that a line of sight is needed for the installation of connection. Landmarks in their way can obstruct, absorb or force their deflexion. Of course, the deflected signals can reach the destination between the transmitter and the receiver antenna in another way. This phenomenon exists because the microwave tufts spread in the air not by point so the extent of the tufts should be taken into account during the planning. We also have to take into account that there are different zones in which the deflected signals are in phase, that is to say, are not in phase with the central signal. These are called Fresnel–zones. (see on Figure 6).

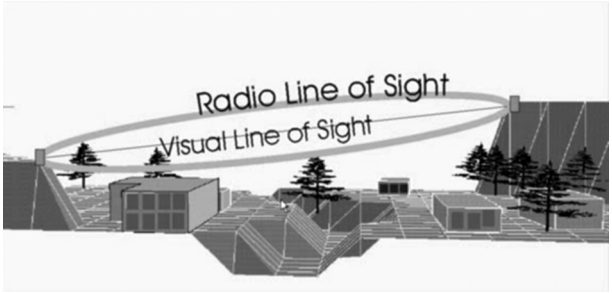

Figure 6. Line of Sight [10]

The secure establishing of the connection is realizable with encrypted, closed–channel microwave management. This type of connection has the same characteristics as the wire networks so it is very well able to establish temporary connections which can replace a wire network. The range is extendible by using higher gain antennas and a Point to Point or a PMP[8] connection is also established. The Point to Point connections are suitable for bridging distances more than tens of kilometres with high–speed data transmission speed. Besides the use of 5GHz ISM bands, we can use the frequency bands designated by the National Media and Communications Authority. Most of the small sized, deployable antennas have IDU–ODU[9] systems, which include indoor and outdoor units. It operates on the principles of SNMP[10] and support Qos services and bandwidth management in order to be effective.

The implementation of the communication between the bio–laboratory and the sampling group can be executed by establishing a Point to Point contact. A reliable and secure connection can be achieved in any environment, field and weather conditions. The contact established by Ethernet microwave antenna can operate as a wireless bridge. The *alvarion microwave (Ethernet) antenna* can be tools which can appropriately serve the requirements. The connection is also realizable with different organizing principles. If possible, we can connect to public networks[11] with the antenna and these might provide a wider range of connection.

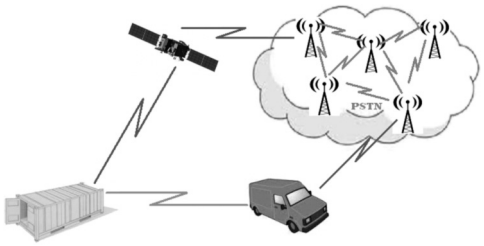

Figure 7. Two microwave links between sampling group and laboratory (source: own)

8 Point Multi–Point
9 Indoor Unit – Outdoor Unit
10 Simple Network Management Protocol
11 PSTN: Public Switched Telephone Network

The alvarion antenna operates in a time–division duplex mode which allows separated two–way communication (uplink/downlink) in a same frequency using different time slots. The antenna uses ODFM[12] channel access methods with error correction coding.[13]

Thanks to the advanced multipath contact of the ODFM, the system does not need a direct line of sight between the antennas. The system supports other adaptive modulation methods such as the BPSK[14] the QSK, or the quadrature amplitude modulation (16, 64 QAM).

Figure 8. IDU and ODU units of alvarion Ethernet antenna [11]

The antenna can be configured with encrypted/authenticated channels, with WEP[15], or AES[16] algorithm and with 128–bit key. Basic protection can be achieved with these methods, but it is only the configuration of antennas used transmission path that can be supplemented with other security solutions.

The system supports the virtual networks with the service IEEE 802.11Q VPN[17]. This is a so–called tunnelling–technic and it ensures that the information forwarding will be hidden. We call VPN that network in which the transmission of data is made through a public infrastructure while the data remain confidential.

Conclusion

The first step of the tasks of the rapid diagnostic laboratory is sampling. The sampling process has to be started after the relocation of the bio–laboratory, which is a long and complex process and which needs professional support.

The sampling team collects the samples from the specified field section or the contaminated area; brings them to the laboratory where the analysis is executed. If they have more information it helps the biological examinations. The communication system of the bio–laboratory should forward this information.

12 Orthogonal Frequency Division Multiplexing
13 FEC: Forward Error Correction
14 Binary Phase–shift Keying
15 Wired Equivalent Privacy
16 Advanced Encryption Standard
17 Virtual Private Network

The information link of the sampling group defines two main directions. One of them is the direction of the bio–laboratory which is implemented mainly with satellite connection. The satellite connection ensures the voice– and data connection between the two endpoints which can be implemented by Thuraya XT–Dual device. If possible, the device is able to connect to GSM networks. The microwave Ethernet connection is able to duplicate the link established by satellite phone device, which allows a long–distance voice and data connection with the help of the connected computer or telephone.

The overall conclusion is that the infocommunication system of the sampling group which operates as a part of the deployable rapid diagnostic laboratory is a complex system which applies various technology and technical devices.

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War Grave Excavation Methods: Survey, Results and Suggestions

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War graves, or war heroes' graves, are burial places for soldiers who fell in battle while serving their homeland, or as a result of fighting for their country. War graves around the world are, from time to time, excavated — either by chance or by design — and the earthly remains of the warriors resting within may be exhumed. The following study primarily seeks answers to the questions of who should, in such cases, carry out the excavation of a war grave? Which areas of science may be affected by the excavation? What types of experts can be involved in such instances? And what methods exist for this purpose? A further objective of the study is to make recommendations on the optimal methodology that may be applied by experts in Hungary.

Introduction — Definition of the Problem

As a Hungarian researcher I have faced the problem in my homeland that there is not a unified methodology for excavating war graves. I assume the reason for this may be traced to events in the past.

After the Second World War, due to Soviet influence, unlike the period between the two World Wars, Hungary could not operate its own war graves research and maintenance organisation. The legislative rules stated that the only graves that could be preserved were those of "friendly" soldiers from the Soviet Union and from forces fighting on their side. [1] It is a sad fact how this affected the nation's own war heroes and their relatives. It was forbidden even to visit the final resting places of the "enemy Germans and their henchmen". In the 1990s, after the change of the socialist state mechanism, the first research could begin on the graves of fallen Hungarian soldiers, both within the country's borders and outside of them. In parallel, data began to be compiled on those foreign soldiers who were buried in Hungary. In the last two decades we have seen a large amount of research related to war graves and a large number of excavations in Hungary. Most frequently these have been carried out by funeral services, without the involvement of experts, and without any type of documentation.

The first step in the process of introducing professional war graves excavation in Hungary was to gain an awareness of the international literature on the subject. It is sufficient to quote one example of the Western European literature on war grave research [2] for us to see how essential it is for excavations to be carried out professionally. One exemplary

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precedent in military archaeology is the excavation of the grave of a First World War German soldier, found in 2003.[2]

Studies of the foreign professional literature on war graves research led us to the conclusion that future excavations in Hungary need to be carried out within a framework of scientific research, which makes it necessary to develop a method which is appropriate for local circumstances. In order to achieve this, we set the objectives of learning about and analysing the research procedures of experienced foreign partner organisations, of comparing the different practices, and of evaluating their applicability in Hungary. The most important element was to conduct a survey by sending questionnaires to the competent bodies abroad.

Questionnaire–based survey about war grave excavation methods

The questionnaire[3] was sent out to a total of 12 organisations in 11 countries[4] in the summer of 2011, through the Hungarian office for the preservation of war graves. [22] The survey had a response rate of 50%, because 6 organisations answered the questionnaire. Based on the responses from the war graves research bodies in the Netherlands, Poland, Romania, Germany, Austria and the USA, and in the relevant professional literature,[5] our analysis could begin.

Existance of competent organisations

The first question of the questionnaire sent out to the war graves organisations looked for separate focuses on war grave issues. (*Is there a separate body or research team in your country which deals with the excavation of war graves? If yes: What is the name of the body and their specific function? If no: Who deals with the exhumation of the remains of war heroes in your country?)*

In Austria, war grave excavations may only be conducted with the permission of the Ministry of the Interior, and if necessary, the permission from the country concerned. [3] In justified cases, when permission is granted, Department IV/7 of the Ministry of the Interior notifies the regional office of the Austrian Black Cross foundation in the State concerned,

2 The soldier was buried in his uniform. The crowned Prussian buttons on his jacket were revealing enough in themselves, but the military archaeologists observed that they were arranged on the remains in a twin column. With this fact, it could be established that the jacket was of type "1910 M". The Brandenburg single–column jacket was the one most generally used in the army, but the twin–column Swedish type was only used by the guards regiment. This finding led the researchers to the outcome of this professional excavation: almost a hundred years after the soldier died, he was positively identified as Jakob Hones. If the buttons had been disturbed at the site of the excavation before the military archaeologists could make their observation, it would not have been possible to identify the body.

3 Consisting of 7 sections on the institutes of individual countries which deal with war graves research, and on the work they do.

4 Austria: Österreichisches Schwarzes Kreuz; France: Pôle d'Entretien des Nécropoles Nationales et des Hauts Lieux de Mémoire; Netherlands: Oorlogsgravenstichting; Poland: Rada Ochrony Pamięci Walk i Męczeństwa; Great Britain: The Commonwealth War Graves Commission; Germany: Volksbund Deutsche Kriegsgräberfürsorge e. V. and Deutsche Dienststelle; Italy: Commissariato Generale per le Onoranze ai Caduti in Guerra; Russia: Vojennije Memoriali; Romania: Oficiul Naţional pentru Cultul Eroilor; Ukraine: State Interdepartmental Commission for Perpetuating the Memory of the Victims of War and Political Repressions at the Cabinet of Ministers of Ukraine; USA: Laboratory Director and Forensic Anthropologist The Joint POW/MIA Accounting Command.

5 Example: РУКОВОДСТВО ПО ПОИСКОВЫМ И ЭКСГУМАЦИОННЫМ РАБОТАМ. Москва ТОО "Люкс-арт" 1997. http://may1945bibliotek.narod.ru/eksgumacion01-0.htm (downloaded: 14 05 2013)

which is responsible for coordinating the exhumation. This non–profit organisation has been responsible for war graves throughout Austria, as well as the war graves of Austrian citizens abroad, for more than 80 years. [23]

Since 1919, the German War Graves Agency (in German: Volksbund Deutsche Kriegsgräberfürsorge e. V — VDK) [24] has had the task of researching and preserving the war graves of German soldiers, and in the event of reburial, of exhuming the soldiers' remains. With a staff of 560 people, this is probably the largest war graves preservation body, with the task of maintaining the final resting places of 2.5 million fallen heroes. In order to simplify access to and care of war graves, and the execution of commemorations, one of the principles of the VDK is to re–inter, in central cemeteries, the bodies of German soldiers who were buried in different places. Each region, and each country, employs local experts who are charged with researching and exhuming German soldiers' earthly remains, and with organising their reburial. In the last few decades, 55 mass cemeteries have been built in Eastern, Central and Southern Europe, and 716 000 soldiers have been reburied.

The responses gave the following answers: in the Netherlands, the Recovery and Identification Unit of the Royal Netherlands Army (RIU/RNLDA) has the task of researching and excavating the graves of civilian and military war victims, and of identifying the dead. The unit employs three specialists, who work in the laboratory of Camp Soesterberg.

The central body for the preservation of war graves in Poland[6] does not have a separate research team. The task of the Council for the Protection of Struggle and Martyrdom Sites is, first and foremost, to preserve the memory of war events, sites and role players, which manifests itself mainly in the maintenance and care of war graves and military burial sites. Research into the human remains of war and their excavation falls within the competence of the regional provinces, the Voivodeships. Although there is no central apparatus in Poland for war graves research, investigations are still carried out using scientific procedures. The district attorney of the relevant Voivodeship involves various local scientific bodies in the work. Site research using geo–radar and excavations are carried out by specialist research teams[7] or by archaeologists from the local universities[8], anthropological and DNA tests on the remains are conducted by employees of the institutes of forensic medicine in the Voivodeships[9], and any artefacts or documents found in the graves are examined by museum historians.

In Romania, the National Office for Heroes Memory (ONCE) [25] is the institution which supervises and has the authority to approve the exhumation of the earthly remains of heroes who fell in the Romanian War of Independence, the Balkan Wars and the World Wars. There is, however, no specialist agency to carry out research, excavation and investigations, so this work is done on a case–by–case basis.

The USA has the largest war graves research organisation, not just among the respondents to the questionnaire, but also in the world. The Joint Prisoners of War, Missing in Action Accounting Command (JPAC) [26] is an organisation of more than 400 people, whose main aim is to locate, repatriate and identify the bodies of 83,000 American soldiers around the world, those who never returned from the Second World War, the Korean War, the Vietnam War

6 The Ministry for Cultural and National Heritage oversees the work of the Council for the Protection of Struggle and Martyrdom Sites (Rada Ochrony Pamięci Walk i Męczeństwa, http://www.radaopwim.gov.pl/).
7 Example: Pomorze1945 (http://www.pomorze1945.com/); "Pomost" Society (http://www.pomost.net.pl/)
8 Example: Uniwersytet Mikołaja Kopernika; Kazimierz Wielki University In Bydgoszcz.
9 Example: Department of Forensic Medicine, Pomeranian Medical University, Szczecin.

and the Cold War. The institution came about in 2003 through the union of several former research institutes with similar missions, and the Command centre is located on the Hawaiian island of Oahu. The organisation operates the Central Identification Laboratory (CIL), which is the largest anthropological laboratory in the world. JPAC has four permanent contingents, located in Thailand, Vietnam, Laos and Hawaii, as well as logistical support teams stationed around the world from Europe to Papua New Guinea. A separate file is opened for each individual case, and a research team is set up to investigate it. In addition to the permanent contingents, JPAC has the capacity to operate 6 research teams at a time, with a staff of 4–9 people. More than 1300 successful identifications have been made so far, and there are currently over 1000 cases in progress.

Affected scientific areas

The second question focuses on special methods and scientific areas used in identification and reconstruction.

The Austrian war graves foundation involves anthropologists and museologists during exhumations.

In the German agency, the emphasis during war graves research and identification of victims is placed on the historical sciences. The VDK has a database containing biographical data on approximately 860 000 war dead, as well as information about their military careers. Additionally, roles in German research may be played by anthropology, odontology and museology.

In order to identify unknown victims, the experts of the Dutch organisation use the scientific methods of a variety of archaeology, anthropology and military history known as battlefield research. The archaeologists and military historians have a thorough knowledge of the military events that took place in Dutch territory, as well as the military uniforms worn and equipment used, and this plays an important role in the research. The anthropologists mainly uses osteological (determining the age and height of victims, and investigating any bone anomalies or traumatic alterations) and odontological (examining the teeth and making odontological maps) methods. The odontological examination can lead to a positive identification if the research team has access to the soldier's dental records.[10]

With regard to the areas of science affected, the leader of one of the Polish research institutes which deals with war graves research, dr. Andrzej Ossowski, professor at the Pomeranian Medical University, Szczecin (Pomorski Uniwersytet Medyczny w Szczecinie), and an expert in judicial genetics and personal identification, gave his response to our question. He informed us that war grave research in Poland combines the methods of the historical sciences, forensic medicine, (military) archaeology and criminology. Probably the most important condition in achieving a successful outcome of the research is the research team itself, which needs to include the following experts: 1. anthropologist, 2. forensic geneticist (these two positions are often filled by a single person), 3. military historian, 4. military uniform and equipment specialist, 5. criminologist, 6. expert in electronic devices. The professor also adds that other essential qualities are a passion for this type of activity and commitment. Some members of research teams in Poland are often volunteers.

10 During the World Wars of the 20th century, American and German forces, for example, made dental records of their soldiers. Unfortunately this was not the practice everywhere, and so this method cannot be applied in the case of research into Hungarian soldiers.

Colleagues at the Romanian institute conduct excavations using historiological, archaeological, anthropological and — as indicated in their letter to us — military and health procedures. There are no anthropological experts within the Romanian war graves organisation, but those taking part in the excavations examine bones in situ, in search for traumatic alterations.

The scientific work process of JPAC commences with the activities of historians. These are the people who constantly are collating data from veterans, families, special reports, archives and other documentary sources. Archive photographs are examined by a special photographic historian. If the historians uncover enough data to investigate a case, with the possibility of finding the earthly remains of a missing soldier, JPAC sets up a research team depending on the nature of the task, with members that may include a historian, an anthropologist (or taphonomist), a bomb disposal expert, a geologist, a spatial informatics specialist, a linguist, a forensic photographer and a technician. Technicians are involved in special situations, for example when excavating a crashed aircraft. If required, underwater archaeologists may also be called on to participate in the work. Any "material evidence" found in the vicinity of the earthly remains is examined by the archaeologists of JPAC in an attempt at making an identification.

Methodologies, auxiliary materials, publications

Three questions in the survey were about the written support materials, methodology descriptions and publications that the partner organisations are aware of in connection with the field of war graves research.

From the response received from Austria, we learnt that exhumations conducted there basically begin with the excavation of the skeleton's legs. Austrian experts also place a high priority on the material relics recovered from war graves.

In Germany, the VDK conduct excavations of war graves on the basis of methodological instructions which are issued centrally. Work proceeds in line with the following main stages:

- acquisition of all the permits required for the excavation;
- notification of the local authorities;
- review of the historical documents and lists of losses for the area concerned;
- estimation of the number of dead located there;
- determination of burial site numbers (if they exist);
- determination of the direction in which the bodies lie;
- involvement of employees; survey of the burial site;
- estimation of the depth at which the bodies are buried;
- construction of a fence around the excavation site;
- start of documentation; photographs before work starts;
- removal of plants and the topsoil; manual recovery of bones, continuously photographed;
- placing the bones in exhumation coffins;
- full excavation of the graves;
- filling the holes and restoring the environment;
- photography after work is completed; handing back the area;
- writing reports;
- placing the coffins in a temporary location at the end of each working day.

The reburial registers completed during the excavation and the objects used for identification are sent, when the work is completed, to the central office of the organisation in Berlin. The information received there is analysed and compared with historical documents and reports on losses. After the objects have been examined, identification can be made using identification markings and personal effects (such as rings with engravings) if any are found, or on the basis of individual physical characteristics (such as bone deformities or dental imprints).

The Dutch researchers recommended the publication titled *Battlefield Archaeology* [4], as well as a few works within the body of literature on anthropology, which are described as essential. [5] In addition to traditional anthropological and odontological examinations, the RIU/RNLDA also uses DNA analysis and three–dimensional facial reconstructions. The Dutch experts also belong to a vast system of connections, with members consisting of war graves preservation partner organisations, military corps, museums, justice organisations and historians. The work of war graves research is often carried out with the involvement of this circle of professionals.

Professor Dr. Andrzej Ossowski informed us that in Poland, the field work is prepared by historical research. This includes a review of the documents in the local archives and the parish registries, and in some cases also consists of interviews with surviving eyewitnesses of wartime events. Obtaining maps from the time of the events and from the present day, and making aerial and satellite photographs, are also part of the preparatory phase, and this contributes greatly to the success of the research. When all the documents and maps are available to the researcher, these are analysed and interpreted. The next stage of the process, which is the start of field work to locate war burial sites, is conducted on the basis of the analysis. The fieldwork is conducted with the use of GPS devices, metal detectors and magnetometers. After a burial site is identified, the dimensions of the grave are recorded, and then the human remains are excavated using archaeological methods. When excavating a war grave, however, it is important to uncover the bones as quickly as possible, so the process could be called "quasi–archaeological". During the careful excavation, special attention must be paid to any relics which could help in identifying the people concerned, such as identification markings ("dogtags"), documents and personal effects. Every such find must be carefully rescued and recorded. Following the excavation of the skeleton, the in–situ anthropological tests take place, and a sample is taken for later DNA tests. In Poland there is an increasing number of scientific articles being published on the subject of war graves research. [6] One of the most important publications on this subject, also published in the English language [7], presents the research methods used during the excavation of the land around a former concentration camp. More than 600 000 Jewish prisoners were killed in the death camp at Belzec. One of the main objectives of the research was to find human remains. The work was complicated by the fact that the majority of victims' bodies had been burnt in crematoria. Excavations at the approximately 6 hectare site were prepared for by making a thorough study of written documents and site plans, as well as a summary of witness testimonies. Ground–penetrating radar[11] and pilot digs were used to locate relics during the research. In 1997–1998 a total of 2227 soil samples were taken at five–metre intervals over a network which covered the whole area, with their precise locations meticulously recorded on a site plan at a scale of 1:100. The samples were submitted to archaeological analysis, and the structure of the soil could then

11 Pürckhauer type sampling auger. It is 65mm in diameter, and can be used for depths of 6–8m.

be accurately determined. A total of 225 samples contained evidence of a grave — such as human teeth, hair or bone fragments, traces of mortuary wax[12] or ashes of cremated bodies — at depths ranging from 1.7m to 5 m. [8: 73] By tracing the origins of these samples back to their positions on the map, the locations of mass graves were identified. Following this, archaeological methods were used to pinpoint the limits of the graves and to excavate them. With this method, a total of 33 mass graves were identified in Belzec.

In Romania, ONCE has formulated a methodology which is followed when carrying out excavations, research and reburials. [9] It distinguishes between three different types of war grave.

The precise location of human remains is known. In type 1, the methodology starts from the premise that based on the grave markings; an attempt will be made to identify the location of the pelvic bone of the war dead. This bone is large enough to be found relatively easily, and is therefore the simplest from with which to determine the position in which the skeleton is lying. During excavations, archaeopedology, that is the archaeological study of soils, is also applied.

Only the approximate area of burial is known, and the war grave is unmarked. In type 2 war graves, pilot digs are recorded on a site map, with the aim of finding the first grave, which can later be used as the basis for comparisons.

There is no knowledge about the location of the war grave. A different procedure is used for each of the above cases. In type 3 war graves, pilot digs are also carried out, similarly to those in type 2, with the aim of finding graves in the supposed area of burial by progressing along two opposed diagonals. The methodology extends particularly to phenomena which can be used by the researcher to determine the presence of multiple graves or mass graves. The description covers traces of traumatic alterations that may be observed on the bone, which can be used to determine the cause of death. It also issues a warning that at this stage of the excavation; the grave may only be excavated by hand, using small tools, such as a small rake, to reduce the chance of damage to any relics. The grave must be thoroughly examined until all artefacts have been found by the researchers. Following this, the bone fragments may be raised one by one, and placed in plastic bags, with the place and time of the exhumation clearly indicated on them. Those taking part in the excavation must make an accurate record of the bones. Because of the risk of oxidation, the material remains are quickly placed in an environment which is protected from air and sunlight, and are transferred to the museum of military history for examination. The methodology also describes how bones and teeth can be used to work out the age of the victim at the time of their death, and other anthropological methods for determining their gender. It also contains a basic description of craniometrical techniques. Later it describes the methods of making an inventory of bones and the rules for storing and reburying the remains, in line with the principles of criminalistics.

The American research teams conduct their work using a variety of rules and supplementary materials. JPAC operates in accordance with defined political principles and with high expectations for ethics, professionalism and conduct. For example, according to principle no.

12 Grave wax or mortuary wax (adipocere) is a fatty substance derived essentially from the saponification of a mixture of ammonium, potassium and limestone salts with fatty acids (especially palmic acid). It is formed particularly in environments where the muscles and soft tissues of corpses have lain for many years in moist clay soils or water. All the soft part are transformed into this wax-like mass, which usually preserves the form of the tissues and organs. Source: Pallas Nagylexikon (http://www.kislexikon.hu/hullaviasz.html (downloaded: 02 02 2013)

4, colleagues must carry out the highest level of scientific work to provide forensic service of exceptional quality. This requires the following conditions: competency, continuous training, acquiring experience, familiarity with laboratory procedures, professional development and the application of known scientific protocols and methodologies. The tasks of JPAC and their implementation are described in detail in their operating rules. [10] These define the mission of the institution, and the operations relating to research and investigation, laboratory procedures and identification. The operations and working methods of the CIL are regulated separately [11], and the methodologies are defined in supplementary laboratory manuals. [12] Additionally, the employees of the Command also have at their disposal a range of scientific publications and auxiliary materials [13], and databases for example, on the places where American troops served and missing persons. Due to restrictions of space, this study cannot make a thorough exploration of the American methods for every branch of science, but it is nevertheless useful to highlight at least one basic procedure. During in situ examinations, the historian and the linguist have the important function of garnering as much information as possible about past events from the local population. A good example of the importance of the method of questioning is shown by the research carried out by JPAC and their predecessor organisation in Yeong San, Korea.[13] The bodies of American soldiers killed in fighting in the area — during battles fought by Manchu troops — were not all found by researchers. Research carried out half a century later, however, led to success, when members of JPAC learnt from an elderly local person that after the fighting, the local residents had buried the bodies themselves. As the researchers in the 1950s had not used the method of questioning — merely searching for victims on the battlefield, when locals had taken them elsewhere for burial — it was impossible for them to be successful. [14]

Bone remains after excavation

The next question in the survey was concerned with the fate of the remains after exhumation.

German soldiers are reburied with honours, with the cooperation of the local representative of the VDK, in the closest German military cemetery to the scene of the excavation, generally during a special commemoration. Reburials are governed by strict rules. [15]

The Dutch team informed us that the bone remains of war victims are always subjected to anthropological tests. When the victims were soldiers, they are reinterred in a heroes' burial garden with military honours.[14]

The war graves research team in the Voivodeship of Pomerania in Poland has already excavated a huge number of soldiers' graves from World War II, numbering some 3000. As a result of professional excavations and the anthropological and genetic tests that are carried out on the bodies, around 1000 of the war dead have been identified.

In Romania, the reburial of excavated war heroes is governed by law. [16] The bone remains are reburied in exhumation coffins, measuring 60x40x20 cm, and made of cardboard or wood. If the religion of the victim is known, they are accorded the appropriate funeral ceremony, and if not, they are laid to rest in accordance with the rites of the Romanian Orthodox

13 AGRS — American Graves Registration Service

14 Dutch soldiers are reburied in the Grebbeberg or Loenen Military Cemeteries, British soldiers in one of the burial gardens maintained by the GWGC, such as the Military Cemetery in Arnhem–Oosterberg, and German soldiers are buried in the Military Cemetery in Ysselsteyn.

Church. If more than one soldier is reburied, their coffins are not placed in separate graves, but side by side in a common grave. The soldier is finally given a new war grave marking, in accordance with their religion. [17]

The slogan "Leave no man behind", used by the US military forces, also extends to fallen American soldiers. In various parts of the world, JPAC not only researches the earthly remains of American soldiers, but repatriates them in every case. When members of the research team find the bones of a missing soldier, they are sent for examination, along with any relics found nearby, to the CIL, where thorough forensic tests are carried out by the laboratory's scientists. In the laboratory, forensic anthropologists and odontologists attempt to reconstruct the skeleton, and to determine the origin of the victim, their gender, their age at the time of death, the cause of death and any traumatic alterations or illnesses, from all this the victim's biological profile is put together. The main aim is to establish the identity of the soldier. The laboratory is equipped with a high level of technology, and is capable of conducting DNA sampling, nuclear and mitochondrial DNA analysis, scanning electron–microscopic and radiological tests, and thin–section bone histological examinations. Personal identification is assisted by computer programs which have been specially developed by JPAC. One such program compares the dental records of soldiers with the dental finds from the burial site. A further aid to personal identification may be provided by a database containing the results of optical tests, which is particularly useful if eyewear is recovered from the grave. When the laboratory tests have been carried out, JPAC hands over the remains of every American soldier to the American Battle Monuments Commission [27], which has the responsibility for re–interment of the soldier. Unless the relatives specify differently, the USA reburies their war dead with military honours in the central military garden of rest at the Arlington National Cemetery near Washington DC.

Documentation/ Record methods

The final question in the survey concerned the types of documentation produced during war graves research.

In Austria a separate file is created for collecting the documents generated during the excavation of a war grave: lists of the bones and the soldier's objects (uniform remnants, indications of rank, medals and insignia).

The VDK makes a record of all the information uncovered during a war grave excavation, and register visual phenomena and artefacts. As far as documentation is concerned, it is probably the German agency which makes the most complete set of documents. This is also indicated by the remarkable amount of material which is attached to the reburial documentation that is prepared during every excavation. The documentation contains the following:

- a printed registration form;
- a list of the artefacts found;
- data on the property where the excavation took place;
- map and site plan;
- plan of the grave(s);
- photographic documentation of the condition before, during and after the excavation;
- certificate verifying the restoration of the site after the end of the work;
- archive and other relevant documentation.

Data uncovered during the excavation are recorded on a form, known as the reburial register. The compilers of the form have provided space for recording all the important information — such as the site of the exhumation, details of the victim, objects found in the grave, data about the people taking part in the excavation — but it is also possible to mark the recovered bone and tooth remains on anthropological and odontological maps.

The Dutch researchers exhume human remains using archaeological methods, during which the stages of the process are photographed. The GPS coordinates are also recorded, along with the compass points of the grave and its dimensions. An investigative report is made for every excavation, which is sent, in the case of foreign soldiers, to the competent partner organisation and the relevant embassy.

Generalising from the example of the research team named Pomorze 1945[15], it can be stated that the process of excavation work in Poland is documented by photographing the work, making an identification report, and preparing a site map and a list of relics found.

In Romania, ONCE workers complete a form during every excavation, which records the following details: the location of the exhumation, the location of the new grave, lists of the bones and objects that were recovered, the place where they are stored, and other observations, and if it is possible to establish any of them the form also records the gender and height of the victim, and their name and the regiment they were in.

The experts at JPAC open a separate "missing in action" file for every individual case. Scientists from the different fields summarise the data, and document in detail the observed phenomena and the results of the test they have carried out. In order to remain objective, however, the persons carrying out the tests have no knowledge of the other details of the case. All the data and documents generated during the work process are placed in the file, including reports by historians, archaeologists, forensic experts and all other experts involved in the case. After all the test results have been included in the file, the scientific director of JPAC evaluates the case before closing it.

Summary and comparison of the presented procedures

Based on the above, we will attempt first to summarise the types of war grave research bodies according to the way they are organised. This concerns the principles under which they operate, the types of experts they employ, the particular methods that the experts apply, the way they record their results, the places where the personal identification of the war dead is carried out and where the soldiers are reburied. In order to simplify the analysis of the knowledge received so far the table below summarises a few important elements of the data presented.

15 The excavations carried out by the Pomorze 1945 research team can be traced back on their homepage: http://pomorze1945.com/?co=117&lang=PL (downloaded: 12 05 2013)

	War graves research body	Mission	Experts	Special method elements	Documentation	Non-field research sites
Netherlands	central state research team (3 persons)	Researching and identifying war dead, and reburial in a central cemetery	archaeologist, anthropologist (osteological and odontological), military historian (battlefield researcher!)	battlefield research, DNA analysis, facial reconstruction, odontological mapping, system of contacts	photos, data about location (GPS co-ordinates) and the grave	own laboratory
Poland	no dedicated research team - local researchers and institutes are commissioned for each case	case work - identification and reburial of war dead	historian, archaeologist, geneticist, museologist, criminologist, technician	thorough preparation, "almost archaeological excavation", in-situ anthropological tests, DNA samples, soil samples	photos, records, site plans, list of finds	universities, justice research institutes
Romania	no dedicated research team - experts commissioned for each case	case work - reburial of war dead	specially trained experts who perform multidisciplinary tasks	special procedures for identifying grave sites, excavation begins with pelvis	records with data on sites and graves, list of finds with place of storage, data on war dead	no data available
Austria	non-profit regional body employees and commissioned experts	no data available	anthropologist, museologist	excavation begins with leg bones	records, list of finds	no data available
Germany	non-profit regional body research team and commissioned experts	reburial of fallen German soldiers in national central burial grounds for each region	historian, anthropologist, odontologist, museologist, specially trained expert who perform multidisciplinary tasks	comprehensive documentation, mainly subsequent examinations, great emphasis on historiological methods	documents: records, list of finds, site data, maps, site plans, photos, certificates, permits, historical documents; in the reburial records data on the victim, the site, the grave, the circumstances, participants in the exhumation; includes anthropological and odontological mapping	own laboratory
USA	central, state research commission, permanent divisions and research teams (400 people)	to repatriate every fallen soldier to the USA, carry out identification in the USA and then rebury them in the central national cemetery	historian, archaeologist, anthropologist (or taphonomist), odontologist, bomb disposal expert, geologist, spatial informatics specialist, linguist, forensic photographer, technician	extremely broad multidisciplinary methods, thorough preparatory work, extremely thorough lab tests: e.g. modern DNA analysis, radiological and osteological tests; dental and optical records databases	"missing in action" files: all potentially related data is recorded, along with expert opinions and research results	own laboratory

The presentation of the 6 war grave research bodies that submitted responses and their methods builds up a comparative picture from which we can draw some general conclusions. Countries with larger populations and with stronger economic potential not only maintain organisations which deal with the preservation of war graves, but are also able to operate separate war grave research and excavation teams and identification laboratories. The best example of this is the United States of America, whose JPAC organisation embodies the most professional variant of institutional war grave research. Outside the closed set of countries that participated in the survey, we can also state that, in addition to the USA and Germany, Great Britain and Russia also maintain war grave preservation and research organisations with large numbers of employees, which supports this general conclusion. Other countries in a favourable economic position, or which do not have significant numbers of unknown war heroes, or war heroes whose final resting places are unknown, have organisations operating with a smaller apparatus, but still with high level technical conditions. In these cases, however, the application of scientific methods cannot be described as fully comprehensive. In states which do not have the material resources to operate a separate research institute for their war dead, the excavation of war graves and the identification of soldiers are carried out in different ways, but these states are also capable of dealing with these issues in a professional manner. Preconditions for this, however, are political will and well considered and prepared organisational work. Based on the above, countries may be classified into three categories depending on their war grave research organisations:

1. those with permanent war grave research institutions (e.g.: USA–JPAC; Germany — VDK);
2. those with permanent war grave research offices (e.g.: Netherlands — RIU/RNLDA);
3. those which engage war grave research teams on a case–by–case basis (e.g.: Poland, Romania, Austria).

The efforts individual countries make related to war graves research is also closely linked to economic factors. The principle taken by the USA, whereby every single fallen soldier is researched and repatriated, is something that only a few countries can afford. It is also possible to classify the procedures into three categories, depending on the principles they operate under:

1. *the "No one left behind" model:* The aim is to research and excavate the graves of all fallen soldiers, and to repatriate and rebury their earthly remains (e.g.: USA);
2. *the "We care for everybody" model:* The aim is to research and excavate the graves of fallen soldiers, and to rebury their earthly remains in the closest national military cemetery (e.g.: Germany);
3. *the "We won't let it be destroyed" model:* There is no planned permanent research, and the aim is not to centralise war graves, but to rebury the earthly remains of soldiers whose graves are in danger, or are uncovered by chance, in the closest military cemetery or in the local cemetery (e.g.: Romania).

From the preceding chapters and the table we can see the types of experts used by the competent bodies during the work processes carried out in different countries. It is possible to refer to a type of institution that employs specially trained staff who are capable of carrying out work in more than one branch of science at the same time. This type includes the example of ONCE in Romania, which has an employee who is both a historian and an anthropologist. On the other hand, there is a type of institution that employs a separate expert for every branch of science involved in the procedure. Common denominators here are the historian, the archaeologist and the anthropologist. In addition to these, there are numerous independent sciences or branches of science which may be represented by experts in the field of war graves research.

The particular methods of each field of the sciences are applied, if not identically, then at least similarly by the different organisations. There may be differences when, in addition to the basic fields of science in war graves research, namely historical science, archaeology and anthropology, additional branches of science are also applied in the research. With regard to the conduct of the procedures, however, a definite division may be drawn. A distinction must be made between the work processes used during well–prepared research work and those followed subsequently when a war grave is excavated by chance. These can be summarised according to the components set forth below, and the order in which they occur.

1. prepared war graves research: military historical examination → field research → excavation → museological, anthropological and genetic tests → summary and analysis of results → military historical examination (e.g.: USA, Germany);
2. unprepared war graves research: excavation → museological, anthropological and genetic tests → military historical examination → summary and analysis of results → military historical examination (e.g.: Austria, Romania).

The second procedure omits the field research, and its first military historical examination is carried out not as a precondition to the work process, but as a consequence of it.

Concerning the documentation of research work there are no differences of principle between the different states, and all of them consider it important. There are, though, some differences regarding the amount of data recorded and the different formulas.

Exhumed soldiers — regardless of whether they are successfully identified or not — must be laid in their final resting place. As regards the location of the reburial, there are also three categories into which the organisations may be classified: the reburials may be described as central, regional or local:

1. *central:* In this case the earthly remains of soldiers are reburied in a central national military cemetery (e.g.: USA, Netherlands);
2. *regional:* In this case the earthly remains of the fallen are reburied in the closest national military mass cemetery (e.g.: Germany);
3. *local:* In this case, soldiers are laid to rest in the same place, or in the nearest cemetery (e.g.: Romania).

This all presents us with an overall picture of the nature and operations of war grave research organisations. With this knowledge in mind, we can venture at an adaptation of the organisations and methods to the circumstances in Hungary.

Recommendation for a new method — a potential model for Hungary

Although Hungary does not yet have a regulated formula for carrying out war graves research, several attempts have already been made to implement one which is based on science. The Hungarian body with responsibility for preservation of war graves, which has changed its name on several occasions, operated in the early 2000s in the Institute and Museum of Military History. In the bastion of Hungarian military historical research, the first professional work came about as a co–production of the office for war graves preservation and the department of military archaeology, and following some reorganisation the work was continued from the Ministry of Defence. Representatives from the two departments travelled to many locations, during excavations, to try out the methods borrowed from other branches of science or read about in foreign professional literature, and to formulate new methods with the aim of reconstructing historical military events and identifying the war heroes. At the same time, the civil sphere also recognised the importance of researching and preserving war graves, and an abundance of societies, foundations and scientific groups were formed and are working hard for the common goal. [18] Following the initial attempts made with the knowledge of the major English language textbooks and publications on the subject [19], a new method needs to be developed, based on a knowledge of the methods used by foreign partner organisations, and adapted to be suitable for local conditions, and after it has been successfully tested, the new method needs to be launched.

Due to the fact that, even today, it is not uncommon for human remains of soldiers to turn up in Hungarian soil, it would be extremely useful to operate a permanent war graves research institute or office, functioning either as a separate organisation working closely with the Ministry of Defence Institute and Museum of Military History and the Ministry of Defence Department for the Preservation of Military Traditions and War Graves, or as a part of one of them. As for the composition of the research team, I consider it essential, on the basis of international experience, to use the “triumvirate” of a military historian, an archaeologist and

an anthropologist when war graves are excavated. A three–person team of this kind would be an engine driving war graves research in Hungary, and would carry out both the prepared and the occasional (unprepared) types of work. During the process, every single excavation site would be accorded a collection of documents, containing the following attachments:

- exhumation register;
- list of material artefacts;
- site plan;
- photographs of the excavation;
- expert opinions by the museologist and the anthropologist;
- related military historical descriptions and sources;
- maps;
- reburial data sheet;
- photographs of the reburial.

These tasks could also be carried out without the presence of one or other experts, but in such an event the research would fail to include numerous investigative reports, and this could encumber the realisation of certain goals, such as personal identification. The Hungarian Army would provide a bomb disposal expert to join the research team if the circumstances require. The principle of war graves research, based on the economic clout of the country, would only stretch as far as the "We care for everybody" model. It would have the aim of researching and excavating the graves of fallen war heroes, and of reburying them in the closest national military cemetery. It would be possible to introduce and provide a central military cemetery in Hungary for Hungarian soldiers (and for those of unknown origin), as well as other central Hungarian military cemeteries in individual foreign countries.[16] If and when a central military cemetery is established, the research team would also assume responsibility for transferring human remains there, but until this situation arises, it will be necessary to involve local funeral services in carrying out reburials locally. The three–person research team would represent only the core of the organisation, and the headcount would need to be expanded, either for functional tasks or for professional tasks. As a temporary measure, until it is possible to set up a professional research team, we recommend the creation of an internet website, based on the Dutch model, which experts from the different fields (historians, archaeologists, anthropologists, archivists, amateur researchers, etc.) in Hungary would be invited to participate in. This would provide an opportunity for information to be shared and processed, for contacts to be made, and, if the situation arises, for "locally competent" experts to undertake excavation and investigation work, under the coordination of the Ministry of Defence. In my experience, the involvement and cooperation of enthusiastic researchers would throw up plenty of opportunities.

Afterword

The recommended method described above, which is based on the international professional literature and on the survey, is currently undergoing testing. In recent years the Ministry of Defence and other independent researchers have made efforts to implement scientifically based research in this area. Most recently, the method was used during an excavation that

16 For example, based on the model of the Hungarian central cemeteries in Russia (in Boldirjevka and Rudkino).

took place close to the city of Szolnok on 26th July 2012, which is presumed to be a mass war grave from the autumn of 1944. A positive sign for the future is given by the fact that scientific issues [20] and articles [21] on this subject are now being written by Hungarians. One of the main objectives of the research carried out by the author of these lines is to develop a Hungarian step–by–step methodology for war graves research – an article with greater detail than this study – which could lay the groundwork for future requirements in this field of research. It is our hope that the establishment of a Hungarian research team and the application of a unified methodology will produce great results in a variety of scientific branches. Furthermore by setting up central cemeteries, a contribution may be made towards bringing a final closure to the destructive World Wars of the Twentieth Century, as "the war is only over when the last war hero has been buried."

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Capabilities and application possibilities of the intelligence functional sub–system of "HUTOPCCIS"[1] computer–aided command system operating on a geospatial information systems basis

FURJÁN Attila[2]

Operational command is to be implemented always in the area of operations, or area of responsibility, using command assets that have a direct effect on the operational activities, and are able to quickly and operatively react to changes in the situation, and to make available the necessary forces and equipment in due time corresponding to the current situation in order to support the combat activity. These requirements are met by field command systems.

This study is aimed at presenting the development results, capabilities, and application possibilities of the computer–aided intelligence planning and command and data processing functional sub–system operating on a geospatial information systems basis.

Head words: "HUTOPCCIS" command system, target intelligence, target reporting, target analysis, target data processing, digital map, geospatial information systems, intelligence planning on digital maps, visibility examination, detected targets, monitoring of the fire for effect.

Introduction

Operational, tactical leadership is a command and control system that is different from ordinary peacetime command, and its main purpose is to plan the economic and focused usage of the available capabilities, to define tasks and missions on the operational or tactical level, and to control the processes of employment.

The modern armed forces can fulfil the tasks determined at the so–called levels of ambition, the forecast tasks — in employment either under Article 5 of the North Atlantic Treaty or not — and meet the requirements of today and those set by the alliance only if they possess and apply a "Tactical Command and Control Information System" which — as an element of the automated command system of future land units — ensures the employment planning as well as the command of combat (manoeuvre), combat support, and combat service units, sub–units, forces as an element of the automated command system of future land units.

The sub–systems of the battlefield system are led on the forces level but must be independent to an appropriate extent on each independent intermediary level. Access to the

1 HUTOPCCIS — Hungarian Tactical Operational Command and Control Information System — Magyar Harcászati Hadműveleti Vezetési és Irányítási Információs Rendszer

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data and information is controlled at every employment and command level; a lower–level command element, its office staff, departments have access only to those superior–level data and information which have been permitted and made available by the superior level for the accomplishment of the mission.

Already developed sub–systems of the "HUTOPCCIS" command system:

1. Manpower and technical establishment registry and maintenance functional sub–system;
2. Intelligence planning & command and data processing functional sub–system;
3. All–arms (operational) functional sub–system;
4. Fire support functional sub–system;
5. Route planning and march command functional sub–system;

Developers of the computer–aided tactical command system:

- Furján Attila,
- Chief Programmer: Lepesi Györgyné.

The subject of this study is the essence and the capabilities of one of the most important sub–systems of the command system: the intelligence functional sub–system.

Combat support sub–systems — intelligence functional sub–system

The purpose of the intelligence functional sub–system

The intelligence and data processing sub–system ensures the planning and allocation of intelligence tasks, the determination of combat missions, the creation of the data base of the expected enemy and non–friendly forces, and the planning of grouping, deployment, and activities of the intelligence/reconnaissance elements in the phase of operations, combat activity, and employment of the combat (manoeuvre), combat support, and combat service units, sub–units. Through supporting all these tasks, it ensures the professional elaboration and preparation of plans, orders, sketches, documents, registries which are necessary for the commanding of operations, battles.

The sub–system allows for the collection, accurate recording, operational and tactical elaboration of the data and information gathered and reported by the elements of the unified intelligence system (combat recce, long–range recce, artillery, engineering, chemical protection, etc). On the basis of the data bases and plans created during the preparation of operations and combats, it develops comprehensive information and enables the information to be transmitted to command posts, working groups, departments.

The sub–system supports and ensures the creation and continuous maintenance of the "Intelligence Log" in both paper– and digital format.

Capabilities and application possibilities of the intelligence functional sub–system:

- it can be used in tactical and operational situations as well as in crisis management;
- to use it, professional knowledge and intermediate level PC skills are necessary;
- in processing intelligence data, matches NATO STANAG requirements;

- the DTA[3]–50 digital map and digital elevation model created by the Hungarian Defence Forces Geo–information Office are used as the base platform;
- provides the possibility to set different scales on the digital map and to adjust the UTM grid;
- UTM, MGRS and geographical coordinates used by NATO may be entered into and acquired from the digital maps;
- coordinate transformation for the adjacent zones in the UTM projection system is fully supported;
- distance measurement is possible on the digital map;
- height data can be acquired (through a digital elevation model);
- a raster (scanned) map can be used as a base platform;
- digital orthophoto can be used as a base platform;
- stationary and mobile target intelligence data can be entered, intelligence information can be gathered, processed, and displayed on a digital map with NATO standard symbols (in accordance with APP–6C);
- the value of the intelligence information can be defined in accordance with NATO STANAG;
- the intelligence information can be queried by selecting the symbol of the detected targets on the digital map;
- the positions, posts of the intelligence/recce forces and assets can be planned using the digital map;
- the reconnaissance capabilities and visibility can be displayed and examined from the intelligence/recce positions and posts;
- the capabilities and overall visibility of all intelligence sources can be examined;
- target zones can be displayed on the digital map (zones A, B1, B2, C, and D);
- the detected targets can be grouped by priority, listed, and printed;
- the manoeuvres and movements of the intelligence/recce forces and assets can be managed, manoeuvre estimations and calculations can be carried out;

The intelligence process

1. *"The intelligence cycle is an activity during which information is acquired, gathered, and turned into intelligence data, to make those available for users."* [1: 51]

The intelligence process (cycle) includes four parts:
- control (tasking);
- acquisition of data (data gathering);
- processing;
- distribution (reporting).

Control (tasking)

The first phase of the intelligence process involves the definition of requirements by the Commander and the intelligence and operations staff. The Commander defines the basic

3 Digitális Térképészeti Adatbázis — Digital Cartographic Database

intelligence mission and guidance, and together with the staff, carries out the planning, command and control and decision–making tasks to define the assessment of intelligence data and to ensure continuous implementation.

Intelligence data are mainly required by G2 or S2 as well as G3 or S3 officers, and the fire support coordinator officer (FSCOORD). The G2 or S2 controls intelligence data gathering and the assessment work for all data sources, and ensures that battlefield information and intelligence data are quickly distributed.

The Commander defines the so–called "Primary Intelligence Requirements" on the basis of proposals by the G2 or S2. They investigate the assigned task, the status of the enemy, terrain conditions, Commander's guidance and concept of operations (combat) so as to define the intelligence data– and information needs. The tasking so developed will contribute to the completion of the common primary goal of intelligence carried out through all intelligence/recce forces and assets, that is: to provide the necessary intelligence data about the enemy and the terrain for ensuring foresight, drawing correct conclusions, and destroying the enemy by fire.

Content and preparation of data bases

The necessary data are prepared and refined during computer processing. The expected enemy targets are entered into the data base of "Expected and Detected Targets", taking into account their structure. (Figures 1, 2). They indicate destruction of targets in the destruction field in order of their priority, consistent with NATO requirements. As follows:

I immediately, interrupting an on–going strike if necessary;
A upon acquisition, as soon as the assets are available;
P as per the plan.

They clarify the enemy High Value Targets (HVT's) in the "System of Targets" data base (Figures 3, 4). The HVT's represent high value from the standpoint of the enemy, that is the forces and assets most necessary for the accomplishment of their mission. For example: if the enemy forces are preparing an attack operation (battle) in an area where several river crossings are located then those engineering assets ensuring the crossing of rivers will qualify as high value targets.

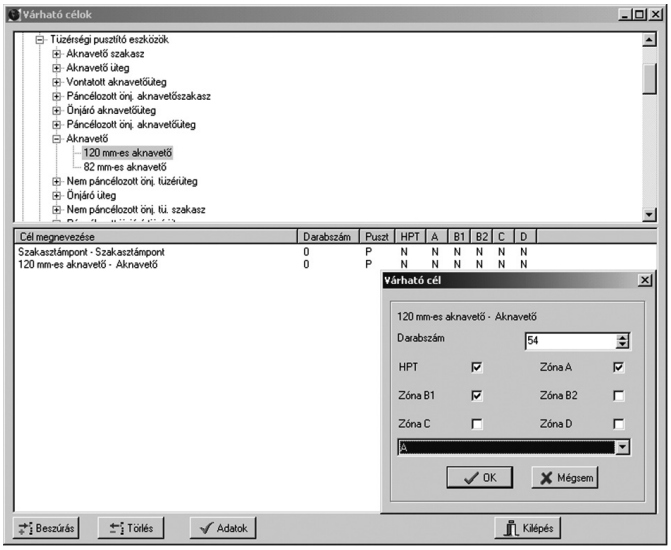

Figure 1. Data base of expected and detected targets (own resources)

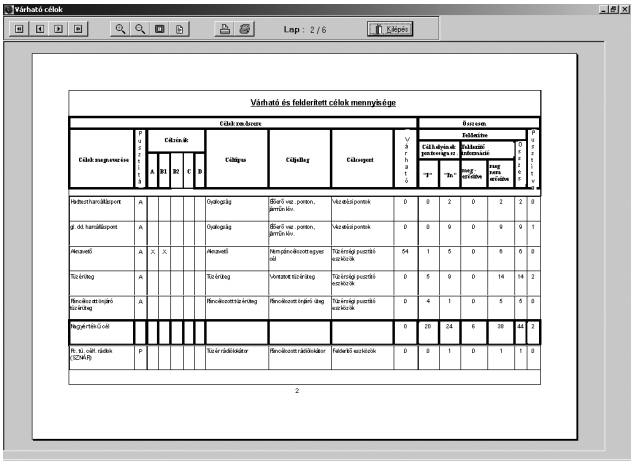

Figure 2. List of expected and detected targets (own resources)

High Value Targets (HVT's) — from which High Pay–off Targets are to be selected — include the following groups of targets:

- Weapons of mass destruction (e.g. missile platforms suitable for the delivery of weapons of mass destruction);
- Artillery weapons (artillery, multiple–barrelled launcher, and mortar batteries and platoons);
- Antiaircraft artillery (antiaircraft missile and artillery batteries and platoons);
- Command posts (observation posts of fire support and observers, automated fire and strike control centres of the artillery, command observation posts, forward command posts, communications centres, up to the first echelon brigades, command, guidance,

control, and warning centres and posts of air forces, up to brigade level);
- Intelligence and target intelligence assets, data processing centres;
- Electronic warfare (EW) assets (means of electronic recce, command posts of radio jammer battalions);
- Combat (attack) troops, reserves;
- Logistics units, logistics centres;
- Airports.

The Commander shall identify the so–called High Pay–off Targets (HPT's). High Pay–off Targets (HPT's) are High Value Targets (HVT's), and attacking them will highly contribute to the completion of operational (tactical) aims. The G2 or S2 branch, in cooperation with the fire support officer (FSO) and other staff branches, proposes which HVTs shall be qualified as HPTs. In my opinion, the proper interpretation of these two is of utmost importance, as the so–called FM publications include translation inaccuracies, e.g. both HV and HP targets are called "high value targets" in the translation several times, which is wrong, since their English denominations are different, and their definitions are substantially different, too. The literal Hungarian translation of "High Value Target" expresses the sense of the expression. The literal Hungarian translation of "High Pay–off Target" (HPT) would mean targets that pay off, that is their destruction is of priority from the point of view of one's own forces for the completion of operational (tactical) aims. (Figure 3)

Its literal translation into Hungarian does not fit the language; therefore, it is better to nominate them "targets of high priority" in Hungarian. So, high pay–off targets (HPTs) are selected from high value targets (HVTs), that is, every high pay–off target (HPT) is also a high value target (HVT), but not every high value target (HVT) will be a high pay–off target (HPT). The decision to qualify a HVT as HPT demands careful coordination work within the staff. Only those HVTs will be qualified as HPTs, which are to be reconnoitred and struck in order to accomplish the tasks specified by the Commander.

HPTs, because of their importance, have priority in the course of specifying intelligence tasks. HPTs are to be identified both in the data base of expected and detected targets (Figure 1) and in the system of target data base (Figure 4). Thereby, the software will group HPTs separately from the rest of the reported targets during data gathering.

The needed initial data shall be entered in the first phase of the intelligence process, such as:

Name, call sign and coordinates of own intelligence/recce sub–units; — coordinates are UTM, as in NATO. The list of own forces can be printed in the form of a chart.

The data base includes the standardized symbols of all intelligence/recce assets, so they can be displayed on the digital map.

The exercise maintenance data base shall be prepared during planning, and the following data shall be entered:

- the number of target data processes; — which means the set of intelligence data to be processed in a tactical (operational) time interval. A new target data processing can be opened at any time — in accordance with the tactical situation — and the old target data processing can be saved and recalled at any time;
- the basic direction;
- the coordinates of the battlefield (width and depth);
- the beginning of the exercise.

The targets are grouped in a logical order (main group of targets, group of targets, name of the target, type and nature of the target) in the system of target data base. The default target properties are indicated, such as coverage, size, whether it qualifies as a HPT, when its destruction is planned. Furthermore, the database can store images of the targets (installations, equipment) and their most important battle and technical data. Thereby these image and text data can be recalled and examined at any time during assessment of the targets (Figure 11). The system of targets presently includes the data of 203 targets but it can be augmented — also during a battle. The data base includes the NATO standard symbols of the targets, so they can be displayed on the digital map.

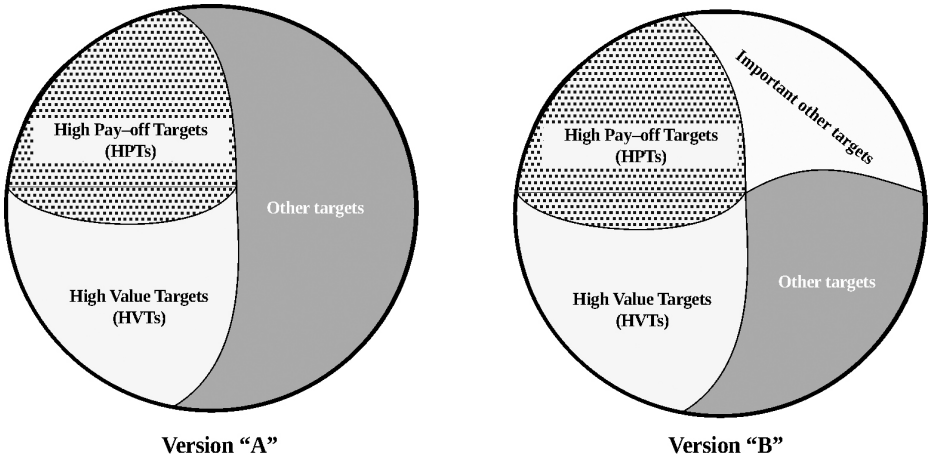

Figure 3. Composition of targets (own resources)

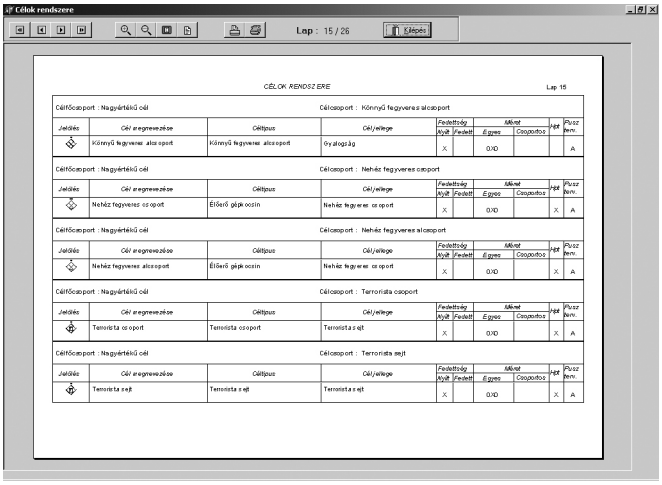

Figure 4. System of the targets data base (own resources)

Besides these, the following data bases are available:

- the actual target no. file; — from which the software provides a target no. for the targets; — The numbering of targets includes two letters and four numbers, consistent

with NATO STANAG. The first letter stands for the country, the second for the military unit (e.g. QB0801).

- maintenance of equipment; — includes the intelligence/recce assets and their properties (accuracy– and reliability properties and reconnaissance capabilities of intelligence sources and assets). The list of intelligence/recce assets can be printed in form of a chart.

The front edge is designated on the digital map in the combat preparation phase. There are two ways of its designation:

- Designing it directly on the digital map during planning;
- After assuming battle formation, artillery intelligence sub–units report the accurate coordinates of the front edge by polar or Cartesian coordinates along the front edge, with 50–100 m gaps.

The forward artillery intelligence sub–units have the obligation to continuously observe the front edge, so that in case the front edge is displaced by 500 m the artillery intelligence troops (fire support and fire observation groups) located at front can instantly report and submit the new front edge in form of map data, which will then be refined by the software and be visible on the digital map accordingly.

The NATO concept on target intelligence prescribes the division of the enemy's operational (tactical) areas into zones. These zones in practice include adjacent target zones. As such, the HVTs are located in these zones during the operations (battles). In the course of assessing the enemy targets, they shall find out in which zone the HVTs are expected to be located, and indicate that in the "target zones" column of the data base of expected and detected targets.

Location of HPTs within the target zones

The first zone is zone "A", in a distance of 0–5 km from the line of contact. The enemy's combat troops, field and anti-aircraft artillery, reconnaissance, ranging and target intelligence assets, command posts, communications centres are located in this zone.

The primary task of visual reconnaissance is to specify the HPTs in zone "A". 100 mm armour–piercing guns, which are usually used for direct laying but usually also capable of indirect laying, are located in this zone. The equipment of the division artillery group is situated 3–6 km deeper towards the end of zone "A". These assets include 130 mm guns suitable for the delivery of nuclear warheads, 152 mm gun–howitzers, self–propelled and motorized howitzers, 122 mm and 220 mm multiple–barrelled launchers.

These weapon systems have great destruction capabilities, posing direct danger and threat to one's own troops.

Destruction of command posts in due time is very important in the fight against the enemy's artillery. War experience has shown that a bigger part of the enemy's artillery is not able to conduct a return fire due to the neutralization and suppression of command posts, communications centres and lines. In modern circumstances, this task can be carried out more efficiently by radio electronic suppression, which does not exclude the necessity of destroying command posts by artillery means. The intelligence/recce organization types of the Hungarian Defence Forces have different forces and assets for the reconnaissance and graphic intersection of targets in zone "A".

The company fire support and fire observation groups and combat reconnaissance troops possessing laser range–finders are able to detect targets to the full depth of zone "A" — dependent on the line and range of sight — and to specify the coordinates accurately (to 75 m accuracy). Besides the above–mentioned visual reconnaissance sub–units, the SNAR radio locator stations of the combat reconnaissance and artillery intelligence troops are also able to detect and accurately specify the position of mobile enemy targets – depending on visibility.

However, a sufficient amount of this equipment is not available, so they are not able to cover zone "A" of the combat area in full width without gaps. The reconnaissance of artillery and mortar batteries can be carried out in that depth by the sound–ranging battery in a reconnaissance width of 12 km and up to 20 km depth. It is advisable that the sound–ranging battery be employed in the area of main efforts of reconnaissance.

In night–time conditions, only those flash ranging sub–units are able conduct reconnaissance — up to 2 km — which are equipped with night vision devices. As for the future, it is necessary that flash ranging sub–units shall be equipped with night vision devices.

Also the combat (manoeuvre) forces located at the front edge can provide useful information on this zone, although the positioning may be inaccurate and shall be refined by additional intelligence.

It must be noted that in a situation at the threshold of war and during crisis management, the border guard patrols serving alongside the border of the country can provide the first information up to a depth of about 3 km from the border, with inaccurate positioning.

The second zone, zone "B1" is the strip between 5–20 km from the line of contact. Most of the high pay–off enemy targets, that is the artillery–, anti–aircraft artillery, mortar, multiple–barrelled launcher batteries and platoons, intelligence, ranging, target reconnaissance assets, command posts and communications centres, radio electronic devices are expected to be located here. The division artillery group is situated at the edge of zone "A" or at the front end of zone "B", usually at 3–6 km from the line of contact. These means include 130 mm guns and 152 mm gun–howitzers, howitzers, and multiple–barrelled launchers. The multiple–barrelled launchers stay at a covered (hidden) place until they receive fire order. Upon receiving the fire order, they will take their prepared firing position areas, deliver fire, and immediately make manoeuvers. The firing position area will be abandoned within 5–15 minutes. This system of employment is applied by tactical missiles, too.

Today, the basis of the artillery group is made up of self–propelled artillery systems, most of which (about 80 %) are armoured. These have a great manoeuvring capability, which enables them to stay in the firing positions only for the time of firing. This actually takes about 10 minutes, and even less for multiple–barrelled systems. However, there are even stricter requirements for future fire systems. The duration of stay of the sub–unit in the firing position area shall not exceed 5 minutes. Foreign military experts argue that by decreasing the duration of stay of artillery sub–units in the firing positions, a higher invulnerability can be ensured than by a technically furnished firing position.

An effective destruction of targets with great manoeuvring capability, such as self–propelled artillery sub–units, can be successful only by destroying them immediately after detection. This in turn tightens the requirements regarding intelligence/recce assets, data gathering, and data processing. These shall supply comprehensive target information including data about – besides the coordinates – the calibre and number of the guns and the size of the

area taken by the sub–unit. These data will facilitate the selection of the forces and equipment to be involved in destroying the targets, ensure the choosing of the proper firing method, and exclude unnecessary use of forces and equipment when destroying individual (roving) guns.

Therefore, the application of long–range and accurate target detection assets is of utmost importance. Even the flash ranging sub–units that are equipped with laser rangefinders are able to support reconnaissance and firing only up to 10 km from the front edge, 5 km deep from the edge of zone "B1", that is to 1/3rd of the zone. The sound–ranging battery is able to locate the position of the enemy's mortars by graphic intersection up to — depending on calibre — 5–8 km and the artillery batteries up to 18–20 km from the deployment area. As the sound–ranging sub–unit is deployed at 3 km depth from one's own front edge and in a width of 8–10 km, this complex is capable of carrying out reconnaissance only to the middle of zone "B1".

The SNAR–10 radio locator station can detect mobile targets (columns) to the depth of 23 km with an accuracy of 20 m. Therefore, this asset can be used for the full depth of zone "B1". But it has its limitations. Its reconnaissance sector is limited to: 4–40 mils, and they are able to reconnoitre high pay–off targets (artillery batteries) only when they are moving or carrying out a manoeuvre.

In favourable visibility conditions, visual aerial reconnaissance is possible up to 15–20 km. The coordinates of the target shall be specified through map–terrain synchronization, which will result in approximate accuracy or inaccuracy. In the development process of artillery systems, there is a strong tendency of further increasing the range of fire, to higher than 40 km. That enables the location of fire positions outside the range of ground radio locators, which increases the significance of aerial reconnaissance.

It must be stated that Hungarian Defence Forces do not possess such reliable reconnaissance assets that would be able to locate the high pay–off targets, especially artillery equipment by graphic intersection in that zone. Mortars are high pay–off targets with great destruction capability and are especially difficult to detect, since they usually take firing positions in ravines, on the opposite side of mountains, in pits or gullies, on steep riverbanks, behind installations, in ruined buildings and basements, bushy areas, forest clearings, and other places where their camouflage is easy and reconnaissance is difficult. Mortar fire does not give such easily detectable signals as guns. Therefore, detecting enemy mortars is extremely difficult due to the small number of detectable signals and the great manoeuvring and camouflaging capabilities. As for artillery sub–units, their destruction is hindered due to their staying in the firing positions for an insignificant duration of time.

Guns, multiple–barrelled launchers, and mortars are most likely to be reconnoitred while they are firing. NATO reconnaissance sub–units use AN/TPQ–36 locators (up to 20 km) and AN/TPQ–37, 47, ARTHUR and COBRA locators (up to 35–50 km). These locators can range the enemy artillery– and mortar batteries (platoons) very fast and accurately, and allow immediate destruction after detection. The locators work with computer processing. They detect and follow artillery– and mortar shells in flight. The data acquired by following the shell path is used to determine the trajectory, which allows for the estimation of the position of the weapon or the impact point. The locator operator can send the data in the required form, digitized to the supported fire control centre, and store them in the locator's memory, or delete them if the situation demands. These assets are radiation emitters and therefore exposed to electronic warfare.

The equipment of the army artillery group is also situated in zone "B1", at a distance of about 4–12 km from the line of contact. The army artillery group involves tube fire means and heavy mortars.

Zone "B2" is situated 20–40 km from the line of contact. This zone is probably taken by enemy tactical– and antiaircraft missiles, the division command post, anti-aircraft defence centres, supply and logistics centres and the second echelon of combat troops (reserves). Targets in this zone represent very high value, and — mainly the tactical missiles — pose significant danger to own troops.

The reconnaissance sub–units of the Hungarian Defence Forces presently do not possess such intelligence/recce assets that would enable them to detect high pay–off targets in this zone. Similarly, — due to the firing range — our artillery is not capable of destroying targets in that zone, therefore, this mission would devolve upon the air force if the reconnaissance issue was solved. It is highly necessary to introduce long–range artillery — primarily multiple–barrelled — equipment.

Promising is the fact that the HDF are developing an unmanned reconnaissance aircraft, which would ensure continuous reconnaissance and fire support in full tactical depth. The advantage of the system lies in the fact that the data processing centre would receive information about enemy targets simultaneously with reconnoitring, and also the results of destruction by fire could be directly and reliably specified. It is also very important that radio locators for the detection of artillery equipment be introduced within the artillery organization, which would provide the capability to reconnoitre high pay–off targets in zones "B1" and "B2" and support firing at these targets.

Zone "C" is at 40–60 km from the line of contact, and this is where the reserve (2nd echelon) of the enemy is situated in their quartering area. Information about these targets can be gathered mainly from intelligence sources, and their destruction would only be possible by the air force.

Zone "D" is the area 60–150 km from the line of contact, and expectably the enemy operational–, antiaircraft missiles, command posts and communications centres, airports, logistics units, supply centres and storehouses are located there. Any target information about this zone can be obtained through intelligence channels, and their destruction would only be possible by the air force.

Scientific investigations by Western and Russian military scientists have shown that fighting high pay–off targets, especially artillery equipment of great destruction in the modern circumstances can only bring success if the time elapsed between the detection of the target and firing is less than 1 minute. This can be achieved only by the comprehensive integration of intelligence/reconnaissance and destruction assets; full automation of intelligence data gathering, processing, and transmitting to firing means; and rational allocation of zones of reconnaissance, zones of destroying by artillery, and zones of radio electronic suppression.

These target zones are also indicated on the digital map, paving the way for professional tasking with regards to high pay–off targets.

Acquisition of data (data collection)

As per the NATO definition, data collection is defined as: "In the sense of intelligence, it is a step of the processing phase of the intelligence cycle, during which the registry of events is

developed by grouping the correlated pieces of information and intelligence data, facilitating further processing." [2: 47]

In accordance with NATO principles, the intelligence data are collected from different sources. This information is immediately processed in order to provide the target data necessary for tactical decisions. In order that the Commander can make full use of the fire power under his command, an efficient intelligence data collection shall be developed. The primary conditions of successful collection of intelligence data are continuous planning and systematic coordination of the collection activity.

So to use the intelligence sources, forces, and assets involved in the data collection as effectively as possible, their employment possibilities, capabilities, and limitations shall be well known to the people controlling target intelligence.

Through computer processing, users can enter the accurate coordinates and intelligence/recce capabilities of the intelligence forces (assets) of any units (brigade, division) into the data base. The application of the digital map facilitates proper data gathering.

"The digital map is the product of a map production technology fully based on computer support — source analysis, data collection, editing, updating, storage, electronic and reproduction outputs — which will be closely connected with a topologically uniform digital data base, and therefore will be able to convey all cartographic elements and property data necessary for the production of paper, film, and digital products which can be assigned to the 2D or 3D digital information." [3: 223]

The "digital elevation model" (DDM) facilitates the proper planning of intelligence forces and assets on the digital map. The digital elevation model of Hungary is stored on 3 CDs. With the DDM, the terrain can be modelled, and visibility can be quickly and properly implemented by placing a vector or raster digital map on the map model, and so the location of intelligence assets can be properly and quickly planned in the phase of operation (combat activity) preparation and implementation (Figure 5). With the DDM, the uncovered areas can be quickly and accurately specified and assigned to those reconnaissance forces that are able to reconnoitre them (e.g. aerial reconnaissance).

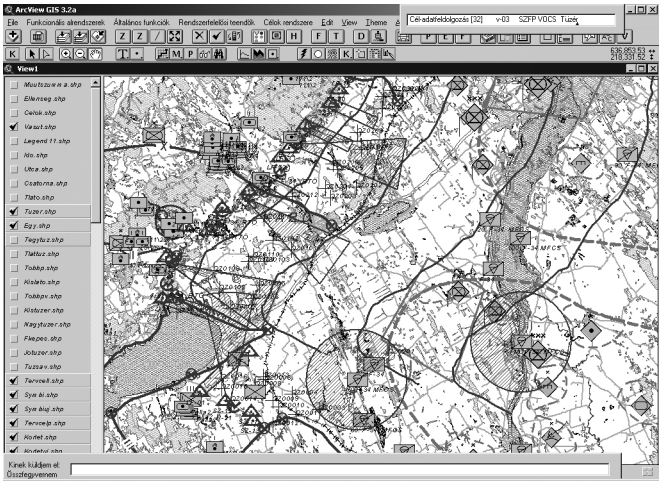

Figure 5: Reconnaissance capabilities and visibility examination of reconnaissance assets on a digital map (own resources)

Conclusion

The strategic direction specified by the General Staff and the National Public Service University has priority in the scientific and educational activities of our institute, for the work of the teachers and researchers of the faculty. The Faculty carries out its education– and scientific tasks in that spirit. One of our priorities is to research the employment possibilities of military forces engaged in combat, in asymmetric warfare, and the supporting of command and control by means of computer networks and systems.

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Mali: a new challenge for peacekeeping

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In the past few years many conflicts have intensified in Africa, one of which have caused a new peacekeeping mission to be deployed to Mali, and already existing operations to be strengthened. Mali was the first victim of the chaos caused by the Arab Spring and the international intervention in Libya. The heavily armed Tuareg returned to Mali after the Libyan intervention, and their separatist aspirations caused an interior conflict that escalated when terrorist groups got involved. A democratically functioning country collapsed from one day to another. The crisis in Mali is a difficult challenge for the international community because it has to organize a multidimensional peacekeeping mission, while having to fight against terrorism. Moreover, the global economic crisis forced these nations to reduce their military spending without compromising effectiveness. The present paper deals with the complexity of the conflict in Mali and examines whether the United Nations Multidimensional Integrated Stabilization Mission in Mali (MINUSMA), the peacekeeping mission in Mali, is able to comply with the expected requirements.
Keywords: Mali, terrorism, international intervention, peacekeeping mission, cooperation

Introduction

The international community has a long history in peacekeeping. In the past 20 years peacekeeping missions have rapidly developed. The African Continent had a leading role in this development. [1] After the Cold War many countries in Africa sequentially collapsed. The financial assistance from the super powers dried up, economic problems came to the surface in addition to other historical conflicts that led sometimes to bloody clashes or even worse events. Then international peacekeeping operations with limited mandates were deployed into the countries most affected by the conflicts. Mostly these missions were unsuccessful in peacekeeping. The massacre in Rwanda made the international community reconsider the framework and possibilities of peacekeeping. [2]

The past few years saw similar crises triggered by revolutions in the Middle–East, which then spread to Africa. The conflicts in the African countries have some common features rooted in their historical background but every conflict has its own specific character. In this article I try to examine the new challenges of peacekeeping in Africa through the crisis in Mali. The short history of Mali could explain the roots of the conflict not just in Mali but in Africa. Economic and ethnic conflicts are common in the African countries. The global economic crises and the aftermaths of the revolutions in the Arabic world created new challenges for states in the African region and changed the security environment in the region. [3] Mali

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was one of the most democratic countries in Africa but it collapsed in a short time as Mali's interior crises increased into an international problem when the radical Islamists infiltrated the country. The escalation in Mali was the first sign of the vulnerability of African states and of the fragility of international peace.

MINUSMA was the latest peacekeeping mission deployed in Mali after an international intervention but when it started its operation Mali was too far from peace. The new trends in the African conflicts resulted in some changes in the peacekeeping missions.

An introduction to Mali

The Republic of Mali is located in West Africa. It is bordered by Algeria, Niger, Burkina Faso, Cote d'Ivoire, Guinea, Senegal and Mauritania. Its territory is 1 240 192 square kilometers, making it the 24th largest country on Earth and the 8th in Africa. Its capital city is Bamako. Mali is a landlocked country with two rivers: the Niger and the Senegal. The climate is subtropical in the south and arid in the north. Mali is mostly flat and the northern area lies in the Sahara Desert. Its highest point is Hombori Tondo. Mali's population is slightly below 16 million and is ethnically divided: 50% of the population is Mande, 17% Peul, 12% Voltaic, 10% Tuareg and Moor, 6% Songhai. The official language is French. More than 94% of the people are Muslim. The majority of the inhabitants live in the southern regions of the country near the rivers. [4]

Mali's northern and southern parts are so different in many aspects that it has caused conflicts through its history. Northern Mali is covered by sand and neither the land nor the climate is suitable for agriculture. The northern population is characterized by ethnic and cultural diversity, there are sedentary and nomadic groups living together. The main minority in the northern area is Tuareg, traditionally connected to North Africa with their Berber Arab origin, while the majority of Malian people are Black African with African traditions. [5]

Mali is the 25th poorest country in the World, agriculture, cotton and a gold mining sector have the main role in its economy and the country has some uranium deposits too. [4] In the past few years the region suffered from droughts that increased its economic problems.

Mali was a French colony in the 19th century as part of French Sudan. In 1959 Senegal and Mali got its autonomy as the part of the French Community and they formed the Mali Federation. One year later both countries became independent.

The first president of Mali was Modibo Keita, who stabilized his own power in a dictatorship and built a single–party system. In 1968, just like in Egypt and Libya, there was a military coup d'état against Keita, whom had returned to the Franc Zone due to economic reasons. After a bloodless revolution Lieutenant Moussa Traoré seized power but the democratic transition was not completed until 1992. Traoré declared a new constitution in 1974 and at the same time he established a political party, called the Democratic Union of the Malian People. Mali held its first election in 1979. Traoré won it and consolidated his single–party regime in the framework of civil legislation. In the 1980s students organized an uprising against the anti–democratic regime. The riot did not reach its aims but did mark the beginning of those changes which led to a real democratic transition in 1992. Traoré recognized that the system needed liberalization in the economy and allowed independent press and political association. These reforms established the background of a democratic change. In 1991 students led a riot again, with the support of military officers. Traoré was arrested. Mali became

a democratic country with a semi–presidential multiparty system. Alpha Oumar Konoré was the first democratically elected president of Mali for two terms, then in 2002 Amadou Toumani Touré, who had been the leader of the military group in the 1991 revolution, won the election. Touré was the president until March 2012 when a military coup removed him from power and a transitional government, led by Dioncounda Traoré, was established. [6]

The background of the crisis in Mali

Mali was the most democratic country in Africa in the past 20 years. Although Mali was the first victim of the North African unrest, there are many other fragile states in its neighbourhood. There were three main reasons for the crises in Mali. Firstly, there was a historical conflict in society. The Tuareg minority, who lives in the northern part of the country, wanted autonomy in the Azawad region. Moreover, Mali had to face deeper economic problems worsened by drought and increased by the global economic crisis. Slavery further escalated the social and political conflicts. Secondly, there was a revolutionary wave in the Arabic countries, which started in North Africa. Finally, radical Islamist groups joined the rebels thus the Mali crisis presented a threat to the regional and the international security.

We shall try to describe the connection of these three main reasons and explain how they escalate a crisis which necessitated an international intervention in the end. As we mentioned above, Mali is ethnically divided. Tuareg are nomadic Berber people wandering in the desert of the Sahara.[2] They live in northern Mali, Niger, Algeria, and Mauritania. After the French colonization the western powers established borders without regard for the ethnic groups. The newly drawn borders are the reason for many conflicts all over Africa because they fragmented the tribes and ethnic groups. When Mali gained independence in 1960 Tuareg wanted autonomy but the government forces were better equipped so they repressed the Tuareg rebellion then they established strong military control over the three northern regions. Socialism and nationalism effected Keitha's governing method and he took the land from the Tuareg, so they fled to the neighbouring countries: Algeria, Niger, Mauritania and Libya. While Mali went on to a democratic transition in 1992 the Tuareg started an insurgency again. The transitional government was ready for negotiations with two Tuareg factions: the Azawad Popular Movement and the Arabic Islamic Front of Azawad, but not all the Tuareg community got involved. [7] At the end of this process the National Pact was signed. The Tuareg people got political rights, the government granted their local representation and their combatants were allowed to join the Malian Armed Forces. These agreements were not able to put an end to the violence as the Islamic Front of Azawad did not sign the National Pact and continued the attacks.

The final moment which led to the Malian crisis was the Libyan regime change. After Gaddafi's return in Africa in the 1970s he welcomed the Tuareg migrants. Gaddafi integrated them into the Libyan Forces. They played an active role in the civil war on both sides. After Gaddafi's death these experienced and heavily armed fighters had to leave Libya. They returned into Mali and that triggered the Mali crisis.

2 Tuareg: In the past Tuareg people connected East and West Africa, they had the main role in the trans–Saharan–trade.

The main actors of the conflict

This conflict was more complicated than it seemed. The rebel Tuareg groups were fragmented, with different objectives and the turmoil in Mali attracted terrorist groups that established their bases in the country.

In October 2011 Tuareg fighters founded an organization called National Movement of Liberation of Azawad (MNLA, in French: Mouvement National pour la Libération de l'Azawad). This was the moderate wing of the rebellion because it was a nationalist movement not an Islamist formation. Their aim was to establish an independent and secular country in the territory of Azawad. During the escalation the MNLA became fragmented and some smaller groups broke off.

Ansar al–Dine is another group founded by a Touareg fighter Iyad Ag Ghali. This group is an Islamist group but it is not part of an international terrorist network. Ansar al–Dine aims at creating an Islamic country in Mali, to be governed by Sharia law. At the beginning of the conflict the MNLA and Ansar al–Dine co–operated, but after Northern Mali fell Ansar al–Dine took control from the MNLA and started to reach its own goals. [8]

Al–Qaida in the Islamic Maghreb (AQIM) is a regional jihadist group in the Sahel, a branch of al–Qaida. It is not clear if Ansar al–Dine and AQIM are connected to each other but both have similar objectives. Their members were not only Malian or Tuareg but there were well trained fighters who had come from Afghanistan and Somalia, and young people from the neighbouring countries. [9] The movement of Unity and Jihad in West Africa (MUJWA) is another terrorist organization which split off from AQIM. Their goal is the same but MUJWA operates in West Africa and its leaders are black African. [10] This group was formed in Mauritania in mid-2011. The objectives of the MNLA and Ansar al–Dine do not meet: the MNLA wants autonomy for the Tuareg while Ansar al–Dine envisions an Islamic Mali. The real danger for regional stability is AQIM and MUJWA. [8]

The escalation of the conflict and the international military intervention

The Tuareg rebellion started in January 2012. In response, government troops were deployed but the Malian Forces were not able to isolate the riot in the north. While the Tuareg aspiration for autonomy were rising the government of Mali had to face internal political problems. The MNLA leaders stated that the autonomy of Azawad is off the negotiation agenda and they started the occupation of the northern cities. On 22nd March in 2012 a group of Malian officers overthrew the civilian government having seen its inability in managing the northern conflict. The leader of the coup d'état, officer Amadou Sanogo, was trained by the US military while fighting against terrorism. [3] [11]

By the end of March the MNLA had taken control over Kidal, Gao and Timbuktu: the main cities in the northern part of the country. At the beginning of the insurgency the MNLA and Ansar al–Dine fought together with the Malian army, until they occupied the whole northern region. On 6th April the MNLA declared the separation of the North as an inde-

3 US AFRICOM was founded in 2008 as part of counter terrorism in cooperation with the countries in the region. In this frame US troops were deployed and organized training for the national armed forces.

pendent state: Azawad. After the separation the Islamists seized power from the MNLA, implemented Sharia laws and by the autumn of 2012 most cities were in Islamist hands. As the northern conflict widened there was a fear that it could further extend in the southern part of the country and spread in the region. The government of Mali and Economic Community of West African States (ECOWAS) requested an international military intervention. On 12th October 2012 the United Nations Security Council passed Resolution 2071, which was an action plan for military intervention in Mali. According to this plan ECOWAS and the African Union were to lead the forces which had a limited timeframe of 45 days. [6] This resolution did not authorize the deployment of the international forces. One month later the United Nations Security Council adopted Resolution 2085, which gave a mandate for the intervention of African–led troops and the French forces to take all the necessary measures. [12]

Operation Serval

France supported the intervention from the beginning of the crisis not only because of the historical background but also for political reasons: the uranium from neighbouring Niger ensures a large part of the French energy supply and the escalation of the conflict could threaten its access. [13] The French forces started their operation on 11th January 2013. The intervention was urgent because the radical groups captured the city of Konna, with a military airport nearby which had real importance in logistical terms for foreign troops. [14] At the beginning of the operation France did not deploy land forces except the Special Forces and as in Libya they attacked the Islamist targets with air strikes launched from armed Gazelle helicopters, Mirage and Rafale fighter jets. The French operations quickly suppressed the Islamist militias. The African–led mission had been deployed sooner than planned with the first troops arriving on 17th January. Due to international actions in Mali the Algerian wing of AQIM attacked a gas field in Algeria and took the foreigner workers hostage. The Algerian Security Forces acted quickly but seven hostages became victims of this incident. [15]

France continued its operation assisting the Malian army. By the end of January the main cities in the north were cleared of the Islamist forces but it did not mean the end of the crisis. The Islamist groups retreated into the Adrar des Ifoghas Mountains and continued their attacks. French forces were planned to be withdrawn in the end of March 2013, but the situation in Mali forced them to stay longer as the Malian army would have been too weak to fight with the Islamist units alone. The Chadian troops played an important role in resolving the conflict in Mali. When the French forces pushed back the Islamist groups in the Arder des Ifoghas and Tighargar the experienced Chadian troops followed them and destroyed their bases and killed the terrorist leaders. [16] Until then the terrorist groups presented a real threat to Mali, they made their presence felt by constant terrorist attacks. France started the withdrawal of half of its troops but approximately 1000 French troops stayed in Mali in cooperation with the international peacekeeping mission. [17]

African-led International Support Mission in Mali (AFISMA)

The French forces did not fight alone with the Islamists in the military intervention; well organized and coordinated cooperation with the troops of AFISMA was witnessed. As I have mentioned above, the African–led International Support Mission was established by

the United Nations Security Council Resolution with a one–year mandate to restore peace and security in Mali. The European Union created a support mission beside the French and African troops. It was a training mission for developing the Malian Armed Forces.[4] [18] The French intervention and the forces of AFISMA worked in cooperation, but their motivation to intervene was far different. France wanted to defend its political interests in the region while AFISMA came to put an end to the humanitarian crisis in Mali and prevent the escalation of the conflict in the region. Despite the French participation the mission of AFISMA did not alter the well–tried method in peacekeeping with the western countries and international organizations providing the financial background and the equipment for the military operations while 3rd world countries deployed their soldiers. [19] The main financial contributors to AFISMA were: Japan with 120 million USD, the United States 96 million USD and the EU 75 million USD. [20] The member states of the African Union and ECOWAST sent the troops for AFISMA.[5] [20] The initial plan was to deploy 3000 troops in Mali but when the operations started their strength increased to over 6000. Chadian, Nigerian and ECOWAS troops were over–represented in the forces of AFISMA.

As the objectives of the peacekeeping missions were to achieve a longstanding solution, AFISMA had to act in wider dimensions of security during the military actions and further on. [21] AFISMA took part in political solutions, ECOWAS mentored the process of negotiations between the transitional government and MNLA leaders. As a result of the mediation they signed a peace deal on 18th June 2013. [22] Experiencing the incapacity of the Malian security forces the mission had to assist with rebuilding the army of Mali. AFISMA took part in legal reforms with a special regard for minority rights. After the intervention reached its main goal to stop the extremists and stabilize the northern region AFISMA transformed into a multidimensional peace–building mission supporting the stabilization of peace and security.

MINUSMA

In the end of February 2012 the transitional government took back control in the northern cities, as a result of the international intervention, and started peace talks with the MNLA.[6] [23] Thanks to these successful military actions the Islamist groups were displaced from their bases in the mountains. It seemed that the crisis in Mali subsided but it did not mean the end of the conflict. The extremists did not give up their aims and their countless attacks remained, marking their presence. The Malian government was urged to take steps in the transition with the assistance of MINUSMA, European Union Training Mission (EUTM) Mali and the French troops. [24]

On 25th April 2013 the United Nations Security Council passed resolution 2100. AFISMA was transformed into a peacekeeping mission called Multidimensional Integrated Stabilization Mission in Mali. On 1st July 2013 MINUSMA took the authority from AFISMA. MINUSMA started its operation with 12 640 uniformed personnel and civil staff. The mandate of this mission is wide enough. Although the northern territory came under the control of the Malian government the country was far from stability yet. MINUSMA got a large mandate

4 Hungary also participated in the mission of EUTM Mali

5 The African countries that contributed to AFISMA with troops: Nigeria, Ghana, Chad, Niger, Benin, Burundi, Senegal, Cote d'Ivoire, Liberia, Togo, Burkina Faso, and Sierra Leone.

6 18 June 2013 MNLA and the government of Mali signed a peace deal in Burkina Faso

regarding the complexity of the situation in Mali. The mission was established as a peacekeeping mission but it has some specifications, namely: its mandate did not authorize the use of force just the limited use of weapons for self–defence and protecting civilians, which means they can take military action at tactical level only. MINUSMA stands on the line of a traditional peacekeeping mission and peace–enforcement. [25] The most important aim of this mission is to guarantee the peace and the security in Mali. To achieve this goal the government troops have to stabilize the key centers while they are assisting with rebuilding the security sector. The re–establishment of state authority in the country had to be provided support. This mission was called to promote the reconciliation process, support the national dialogue and take part in the implementation of the transition in Mali. The mission had elements to develop human rights and programs for disarmament and reintegration. [26]

Until now the mission has achieved little success but there have been small steps made, such as elections held in the summer, which could be the first step to rebuilding the political body of the country. There was a backward step too when the MNLA ended the ceasefire after the security forces had clashed with protesters. MINUSMA peacekeepers have to face many challenges and that makes the solution more difficult. On the one hand there are the interior problems in the country like the diversity of ethnicities and the deep economic problems. On the other hand there is regional instability with increasing extremism. Having regarded the circumstances I do not think MINUSMA will succeed in its mission in the near future. The success of the MINUSMA mission is largely inhibited by the strengthening terrorist groups in the region. Some participant African states, like Nigeria, were forced to recall their troops from the peacekeeping mission due to the radical escalation of the interior conflict.

Conclusion

The Northern–Mali crisis started as an interior conflict based on three main problems: the ethnic diversity in society, the cultural differences between the eastern and northern parts of the country and economic reasons. [6]

Due to external factors the interior problems escalated and this turnaround endangered international peace and security. The aftermath of the Arab spring and the international intervention in Libya exacerbated the existing ethnic conflict when armed Tuareg returned from Libya complemented with terrorist elements. A military coup d'état overthrew the government when the separatist Tuareg rebels captured cities in the north and the Islamist groups took control from the Tuareg fighters. The transitional government of Mali requested international intervention. This request and the spread of terrorism gave the mandate to the international community to intervene. The regional instability and the collapsed security sector of Mali predicted the necessity of a peacekeeping operation after international intervention. The French forces and the troops of AFISMA in cooperation with the security forces of Mali had taken rapid military actions, recaptured the main cities in the north and driven out the Islamist groups.

After the intervention AFISMA was transformed into a peacekeeping mission. MINUSMA functioned as the new generation of peacekeeping. It was authorized to complete multidimensional operations in security, political, economic, social and cultural dimensions. This mission works in close cooperation with the French troops as regards the fragile security in the country. The French forces continued their military actions against the Islamists. MINUS-

MA have to face a complex conflict in Mali and asymmetric challenges. The mission has not succeeded yet. The unrest is escalating in the region and the terrorist elements are gaining strength. That and the fact that some participating countries had to withdraw their troops because of their own security, threatened by the terrorist rebels, hampered the effectiveness of the mission. There are old conflicts intensifying in South–Sudan, the Democratic Republic in Congo and the Central African Republic. The international community has to divide its troops and financial resources. At present it seems that the stabilization of Mali will be a longer process.

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Place and role of cultural anthropology in the Military

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Action–anthropology is one branch of cultural anthropology that as an interdiscipline can promote the more effective functioning of the system of the Hungarian Defence Force's mission operations planning, training, and task implementation. Cultural anthropology — and the sub–discipline action–anthropology — is a branch of social science utilizing methods of theory and knowledge to solve practical social problems; therefore, it is suitable for special research in mission areas.
Keywords: Anthropology, Action anthropology, cooperation, Hungarian Defence Forces (HDF)

Cultural Anthropology

Cultural anthropology is a branch of anthropology. In the UK it is called social anthropology or socio–cultural anthropology. Cultural anthropology researches the culture and social organization of various nations and ethnic groups primarily on empirical basis and upon empirical facts. As the main method of gathering material, participant observation is considered, which distinguishes it from all other sciences that study culture and society. The methods and scientific thesis make anthropology suitable for studying any small, closed community or subculture. Learning about other cultures and the development of cultural sensitivity towards other societies — ethnic, religious, political, etc. — in addition to teaching tolerance, is extremely important to learn both in domestic academic life and in military science and the military missions of the future.

In this current work we do not wish to elaborate the relationship of ethnology, ethnography and cultural anthropology because it is not the subject of this article, but it is worth knowing that folklore is a science that inspects the life of groups who live in a traditional way of life and which are mainly peasant, nomad and gatherer groups. Ethnology deals with the comparison of these phenomena and the discovery of structure and context.

So what exactly is cultural anthropology?

Definitions: The Dictionary of Foreign Words in 1983, defined anthropology as the science of the human that deals with the natural endowments of the human and his organizational structure. According to the Encyclopaedia of Folk [6: 104] in Hungary the biological sciences include anthropology, and it only refers to the use of economic, cultural and social anthropology. We could learn Ethnography from the Ethnography Encyclopaedia [6: 743] as the internationally recognized and used name for ethnography, which is a part of ethnological

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research. Although from the definition of the Encyclopaedia of Ethnology it is clear that in the British areas the science dealing with cultural and social anthropology is known as a synonym of ethnography. One should not be surprised that a professional anthropologist perceives himself an ethnographer, or an ethnography researcher, this problem is present in anthropology society to this day. One thing is certain, that anthropology is an inter–disciplinary science that utilizes both ethnography and ethnographic methods and experience.

Cultural anthropology in the higher education of Hungary

The first Hungarian anthropological work titled "Anthropology is the description of humanity" was published by Fejér György in 1807. In 1878 the National Archaeological and Anthropological Society was founded, and the world's fourth anthropological institute was established in 1881. Zoologist Professor Méhely Lajos (1862–1953) with his appointment in 1920 slightly "misled" the Hungarian scientific approach to anthropology, which lasted until his retirement in 1930. The return to anthropological aspects of real habits was due to Bartucz Lajos, who dealt with truly scientific anthropology. Following the war, the status of the institute in Budapest and Szeged changed to department. In 1959 Bartucz was appointed to lead the Budapest Institute, which he led till his death in 1966. In the academic year 1990–91, with the leadership of Boglár Lajos three instructors separated from the Department of Ethnology of Eötvös Loránd University, and with the support of the Soros Foundation and of the Tempus program, cultural anthropology education was first launched in Hungary. Kunt Ernő founded the Cultural and Visual Anthropology Department in 1992 at the University of Miskolc. In 1995, after Kunt's death, the academic chair was been taken over by Borsányi László from Budapest. At the University of Pécs and its predecessor, the Janus Pannonius University regular training has been conducted since September 1991, which was launched in 1989 by Professor Andrásfalvy Bertalan.

The action anthropology

Action anthropology unfolded during the colonial period and was rejected by the anthropologist society, just as military anthropology, which surfaced in the 21st century as a new trend. This scientific approach has been called "colonial anthropology" within anthropology. In Great Britain the army got in direct contact with trained social scientists during the colonial period. As a result of sudden development, anthropology was deeply linked to colonial politics. Already in 1908, anthropology courses started among the people of the Sudan Civil Service. This relationship was quickly institutionalized in 1921 when, the International African Institute was founded to learn more about foreign cultures and languages, its leader was the former governor of Nigeria.[1]

Bronislaw Malinowski — one of the most respected people in the history of anthropology — said that action anthropology is nothing more than a means to increase the efficiency of colonial policy. It is a fact, that the appearance of this new direction of applied anthropology resulted in a significant difference of opinion, with which governments lived during the blooming of the colonial period. Many anthropologists and government officials had the intention of using the methods of anthropology to help the development of a colonial square alignment of foreign cultural environment, but under the control of the west. Many anthro-

pologists admitted to — those who took part in the work — really using their skills to serve the European expansion and dissemination of ideas. Many mention the name of Radcliffe–Brown, a very well known researcher in anthropology, and debate the use of his skills and knowledge as the instrument of colonialism. He wrote his study at the University of Cape Town, which was designated to help to reduce the conflict between the white and the black population, and was used to strengthen the British colonial rule in individual colonies. The American Anthropologist Association, of course, disfavoured this level of anthropological support of governments, so it has repeatedly condemned those anthropologists who openly or covertly were involved in such activities So it happened that both Margaret Mead and Ruth Benedict also became the target of the organization, having done scientific research at the request of the U.S. government in World War II about Japanese culture. To date this is the best and most detailed work on Japanese society and Japanese social scientists acknowledge it. It deserves even more respect that all of this descriptive research was carried out without even having spent time in the country.

The status and importance of applied anthropology is acknowledged by the social scientists dealing with anthropology, despite the slight fear that can be felt from people engaged in this science nowadays. Of course, this science has no spotless history, as research carried out during the wars supported the political views of a given government to the detriment of the studied culture. This was the case with World War II, Vietnam, Burma, the Gulf War and today anthropologists are also employed in Iraq and Afghanistan.

Action Anthropology in the Hungarian Armed Forces

In the Hungarian Armed Forces, I look at three different levels and tasks of action anthropology:

1. At the operational level, in the planning phase;
2. Tactical levels, the appearance in the mission areas;
3. During the training for missions and in higher education.

The toolbar of cultural anthropology is best suited to design the obstacles ahead of us and prepare for expected events. In this case, the local cultural differences, local language recognition, building and exploring a network of contacts, tracing political units, these all can provide such information to the operational planning level that can make the evacuation and the start of workflow more efficient, economical and faster. Inclusion of first contact with the local population can only be executed by a qualified specialist, but a time of keeping in touch is also helpful when an already known specialist negotiates in a foreign country with foreign leaders. On a tactical level, the military anthropologist has to appear on the spot, operate locally with the military units and continuously collect information about the state between the military and the civilian sector, and communicate with local leaders and the local population. Without this knowledge, the relocation and work of military units is more dangerous, more expensive and takes more time. Thanks to a social scientist's research, more detailed and multidirectional information can be collected about the culture and the troops are more sensitive to changes. The disclosed information will not only be used for command and reconnaissance elements, but it can be integrated into the next shift's training, not to mention its role in military higher education, with which we will be able to train multi–dimensional thinking military leaders, who will be able to meet the challenges of the future.

The building of this program requires no real huge extra cost, since neither a technical nor a developmental cost would be needed for the establishment of such a group, whether on campus or in one of the corps. The only cost is the application and recruitment of professionals who would apply their expertise to the task of national defence. More and more young anthropologists deal with the idea of military anthropology and the scientific and military potential in this science. However no step has been taken to create the ability for truly modern future military operations in the HDF. My previous articles have dealt with the American Human Terrain System's (HTS) work, but the British Defence Cultural Specialist Unit (DCSU) is also responsible for, among other things, social science methods assisting in military operations. [2]

In the U.S. national and international policy, it is not surprising that U.S. intelligence agencies are the main funders of the various secret social science projects in the world. [3] The United States and Great Britain launched two programs, which examined the possibility of social science application; these were the Intelligence Scholars Program and the Combating Terrorism Countering Radicalisation program. In the United States since April 2004, many intelligence agency analyst staff had to re–enroll in American universities to expand their expertise and knowledge of cultural anthropological knowledge, which has become necessary to carry out their work more accurately. In July 2006, the British Foreign and Commonwealth Office (FCO) and the Economic and Social Research Council (ESRC) jointly launched a 1.3 million pound initiative aimed at analyzing the extremist Islamic groups in five countries and six regions . The program's aim was to better understand the operation of terrorist groups and to develop an effective action against them. The fact is that the research program was not openly advertised, but MI5's Joint Terrorism Analysis Centre was involved in the planning. [4] The behaviour of smaller or larger communities can help or deeply impede military efforts. The understanding of local people's responses and their effects on our military operations are the keys for success. [5]

In Hungary, at several scientific conferences since 2007 (National University of Public Service, and University of Miskolc) examined the potential and indispensability of cultural anthropology in military exercises. NATO and the EU have continuously engaged in how this kind of methodology could effectively be applied in military planning and exercises, which is the most important tool of anthropology. Now only the opinion of the Hungarian Defence Forces is missing as to how this capacity could be built in and applied to the task force system.

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Analysis and assessment of targets on a digital map and Computer processing of Intelligence data

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The Tactical Operational Command and Control Information System shall have sub–systems that are capable of covering, ensuring, and servicing — in summary supporting — the battlefield systems operated by the combat (manoeuvre) forces and combat support units and sub–units during planning and commanding, on the land forces, brigade, battalion and company level.

One of the most important such sub–systems is the intelligence planning, command and data processing functional sub–system. It allows for a quick and professional processing of target intelligence data, displaying them with the standard symbols on digital maps, and promptly grouping them by priority; thereby it greatly facilitates the manoeuvre commander's foresight, provides assistance for decision–making, and provides accurate target data to the fire support groups for target planning.

Head words: "HUTOPCCIS" command system, target intelligence, target reporting, target analysis, target data processing, digital map, geospatial information systems, intelligence planning on digital maps, visibility examination, detected targets, monitoring of fire for effect.

Intelligence data reporting and entering into the computer

The collection and processing of intelligence data would be carried out by the intelligence data processing– and command post, which is to be established at the command posts of combat troops (brigade, land force); and by the intelligence data processing sections (FAR) to be established at the fire control posts of the artillery. Thus, the data necessary for fire control would be immediately available through the information network, and close cooperation would be established between the two groups.

The units directly carrying out reconnaissance, belonging to different intelligence organization types, report the intelligence data using a standard intelligence–reporting form, the "Intelligence Log", to the intelligence data processing– and command post (FAVP) and to the intelligence data processing section (FAR) via radio or a line telecommunications device if the means of entering digital data into the computer has not yet been provided (Fig. 6).

The recce sub–units would make reports in the "Intelligence Log" in the columns marked black. The numbering of these columns is in line with the computer data entry (Fig. 1–2).

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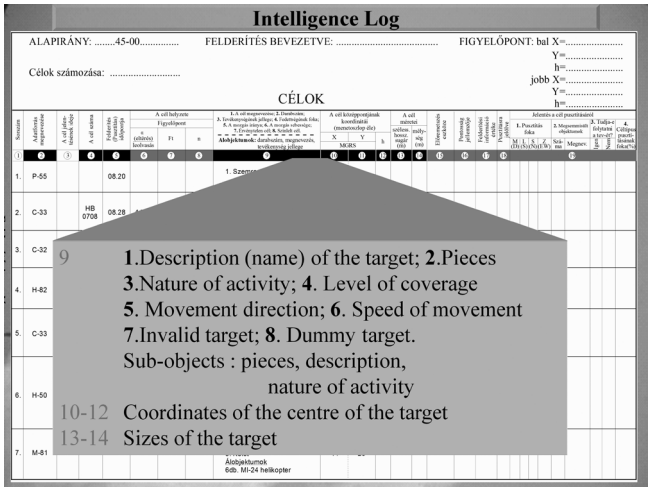

Figure 1. Standard intelligence log (own resources)

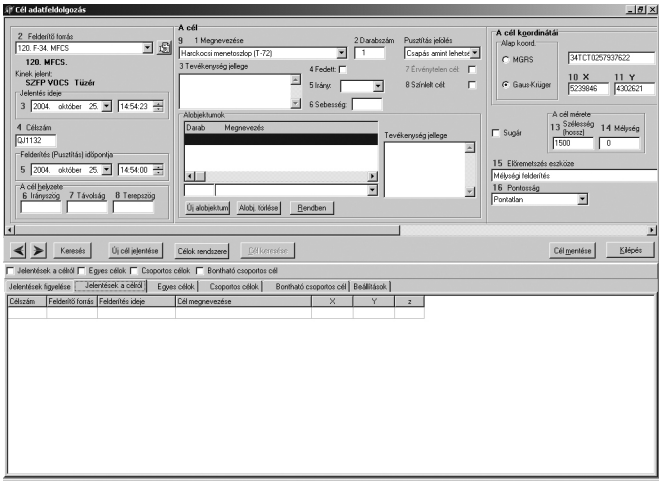

Figure 2. The developed digital log (own resource)

Polar coordinates (direction and distance) can also be reported, in which case columns 6, 7, and 8 shall be filled. For columns 15–18, only those reconnaissance units shall report which have no data in the data base.

The operator of the intelligence and data processing centre takes up the report via radio or a line device, and enters the data into the computer, following the order of the report.

The software automatically displays and records the time of report when the reported intelligence data are entered. In column 9 of the "Intelligence Log", text input is also possible. All sub–objects of a grouped target can be entered and these targets will also be summarized by type and nature of target. Of course, besides the type of target, they can report here other important enemy information found in a visual way with map–terrain synchronization or estimation. Example: "Muhi populated settlement D–1500, enemy has activated infantry–,

armour–piercing gun and mortar firing, probably preparing for an assault". Such and similar reports can be made by border guards and different reconnaissance patrols, who inspect enemy forces visually, possibly using binoculars. These groups usually do not have any apparatuses, probably only maps, so they will specify the location of the target through estimations, in relation to an object or a survey point that can be identified on the map.

Further information can be reported about a previously indicated target (target no.), and the software will record the report for that same target with the actual time of reconnaissance.

For reporting in columns 10–11, coordinates can be entered using the UTM–system, consistent with NATO requirements (Military Grid Reference System — MGRS coordinates). If a target is reported with shorter coordinates, the software will take up the middle of the specified square as the location of the target.

For no. 16, the accuracy indicator of positioning by the intelligence data can be one of the following:

"P" — accurate, "Pn" — inaccurate.

Accuracy is a basic requirement for the specification of the coordinates, height above sea level, and size of detected targets; which ensures the efficiency of destruction by fire.

Accuracy requirements:

- the error of accuracy of specifying the coordinates of the targets shall not be more than 75 m (Hungarian artillery guidelines of Tü/1, Tü/50);
- the width and depth error of accuracy when specifying the size of groups of targets shall not be more than 100 m (Hungarian artillery guidelines of Tü/1, Tü/50);
- the error of accuracy of specifying the height of the targets shall not be more than 5 m;

Accurate ("P"): if the above accuracy requirements are met.

Inaccurate ("Pn"): if the error of accuracy of specifying the coordinates of the targets is more than 75 m.

Every reconnaissance asset or method has its characteristic accuracy of specifying coordinates, which is symbolized by the average error (Ek). As the average error is a component of the cumulative error of fire aiming, the result of firing directly depends on it. Therefore, the effect of this average error can be assessed through the probability of accomplishment of the firing mission.

Colonel S. Zajcev, Academy Counsellor, Csc (PhD) of Military Sciences, Colonel V. G. Ramicün, Csc (PhD) of Military Sciences, and Major A.N. Sautin conducted research about the dependence of the probability of the destruction of different targets on the average error of specifying their coordinates. (Chart 2).

Description	Sizes (m)		Average error of specifying coordinates (m)	Probability of accomplishment of the firing mission
	width (m)	length (m)		
Firing line of a self–propelled battery incl. 6 guns situated in firing position	250	150	30 50 70 100	0.82 0.62 0.39 0.08
Division Command Post	320	320	30 50 70 100	0.96 0.89 0.76 0.48

Chart 1. Relation between the probability of accomplishing the firing mission and the average error of specifying their coordinates

The chart shows that with the increase of the average error of specifying coordinates (Ek), the possibility of accomplishing the firing mission decreases significantly, especially if the average error increases to or over 70 m. The estimations made by scientists have shown that such dependence applies to other types of objects, too.

Column 17 of the "Intelligence Log" shall be filled and submitted in case the information value reported by the intelligence source differs from the data already included in the data base, and they can properly affirm that fact.

The value of information shall be indicated using the NATO standard system

Indications of reliability of the data source and the data collection organ:

- "A — completely reliable;
- B — usually reliable;
- C — sufficiently reliable;
- D — usually not reliable;
- E — not reliable;
- F — reliability cannot be assessed."

"Rating 'A' occurs very rarely. This rating can be used if the source is known to have broad experience and background with regards to the reported type of information. Rating 'B' means an information source whose integrity is known. Rating 'F' means there is no basis for assessing the reliability of the source. Data collection organs are usually rated A, B, or C. ... if judgements about the data source and the reporting organ differ, the lower indication shall be applied." [1] The reliability of the intelligence source is collected from the reporting organ and entered into the data base.

The other component of assessing information value is accuracy, which is indicated by a number. The assessment shall be done by the lowest possible level. The classification of the information by accuracy for actual (real) targets is shown in Figure 8.

The accuracy indicators for data collection organs are also entered into the data base in the combat preparation phase. This shall be known by data collection and reporting organs, too. If the judgement regarding the value of information corresponds to the data included in

the data base, no report shall be submitted in column 17 of the "Intelligence Log". Otherwise the value of information shall be reported.

Information confirmed by other sources is defined as information established (detected) through several intelligence methods independently. These data will have rating "1", and they shall be — beyond any doubt whatsoever — correspondent to the situation and to the location of the target.

The information is considered obviously correct if it is correspondent to the situation and to the expected enemy activity and has been established through only one intelligence method and on one occasion. Also in cases where the essential parts of the report are confirmed based on already available information. Information of such qualification will be rated "2", and in this case additional intelligence will be needed.

"If a reported fact, regarding which no further information is available, is assessed as conforming to the previously observed activities of the target, then it will be qualified 'probably' correct and rated '3'." [1: 28]

In this case, additional intelligence is necessary.

Unconfirmed information that does not conform to the observations regarding the activities of the target, will be qualified "highly doubtful" and rated "4".

Information deemed "unlikely", that is not confirmed by the available data, is consistent with the actual situation but not with other data previously gathered from different sources and processed. The information which is inconsistent with already available data having a rating of "1" or "2"will have this qualification, too.

These data need clarification, additional intelligence, and confirmation by preferably more than one intelligence methods.

"Verity cannot be assessed" qualification applies to those intelligence data which have no evidences for a classification on the 1–5 assessment scale due to lack of data regarding the target. In this case, additional intelligence is necessary.

It must be noted that a fully reliable data collection organ may gather and report from fully reliable sources such data that will in turn be assessed as unlikely when compared to other information. Such information will be rated "A–5". A source assessed as unreliable may also report information that proves to be accurate when compared to other sources. In that case, the value of the information is E–1.

Information with rating "2–6" will be automatically appointed for additional intelligence.

All the intelligence information rated "1–6" belongs to the group of actual (real) targets. (Fig. 3)

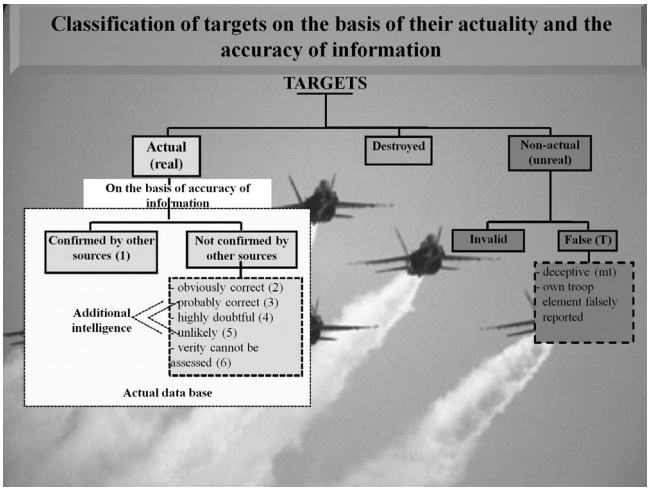

Figure 3. Classification of targets after processing, on the basis of their actuality and the accuracy of information (own resources)

However, some targets are deployed by the enemy in order to deceive our troops. These dummy targets, belonging to the group of false targets within the category of non–actual (unreal) targets, are all deceptive targets. (Fig. 3)

Deceptive intelligence data are those which do not conform with the actual situation, are inconsistent with data collected from other sources, and undoubtedly proven to be false. These data are taken into account with the aim of investigating the deception methods of the enemy and collecting intelligence about their misinformation system (Fig. 3).

"In the univocal opinion of foreign military experts, the extent to which the expected losses of the artillery sub–units can be decreased is practically equal to the number of dummy targets. If the amount of dummy firing positions is 20–30 % of the amount of real ones, the losses will decrease by 32–34%. This has been proved in the Persian Gulf War, too." [2] Therefore, a thorough analysis and synthesis of all data shall be carried out during the analysis, assessment, and processing of intelligence data.

The reports on "targets" also belong to the group of false targets where the location of own troop elements has been specified by graphic intersection and reported by mistake.

If a target (information) loses actuality, which the intelligence source reports, then it will be invalidated and therefore moved from the actual data base to the group of invalid targets (Fig. 3).

Destroyed targets will also be taken out of the actual data base and moved to a separate group of targets. Both the destroyed and deceptive (dummy) targets have distinct symbols on the digital map.

Experience from intelligence exercises show that reported intelligence data rarely comply with the requirements of actuality and accuracy of specification of coordinates, and with the strict requirements of information assessment. Even intelligence data representing high information value and accuracy (of positioning) often do not ensure the timely accomplishment of firing missions, primarily due to the slow processing of intelligence data, and also reversely: the timely submitted reports may have low value due to the inaccuracy of coordinates.

With the reporting process, data entry is finished and computer processing starts.

Processing of intelligence data

"Processing — the development of intelligence results through collection , definition of value, analysis, and integration of information and/or other intelligence data." [3: 53]

Data processing is carried out on different levels, including the assessment done by the data collection organ, and up to the highest level. The lowest–level data processing is called pre–assessment, and it usually only involves the conversion of raw data into a comprehensible form (e.g. interpreting the symbols of the locator screen or editing patrol reports). On this level, the gathered data can still be compared to the data formerly collected by the data source.

Data processing actions include three parts:

"1. Recording: the depiction of the collected information in a written or other graphic form, and the allocation of pieces of information to the associated groups.
2. Defining the value: the clarification of the relation between the intelligence data and the operations, the reliability of the data source or data collection organ, and the accuracy of information.
3. Analysis: defining the importance of the information — in relation to the already known data and intelligence information — and drawing conclusions regarding the anticipated meaning of the assessed information." [1: 18]

Data processing is a continuous activity.

Computer processing

When a target is reported, it is instantly entered into the system of targets, that is, the target type, target subtype, nature of target, and group of targets will be specified. The software classifies the targets into four priority groups:

- Group I: High Pay–off Targets (HPTs);
- Group II: High Value Targets (HVTs);
- Group III: Important Other Targets;
- Group IV: Other Targets (Fig. 9).

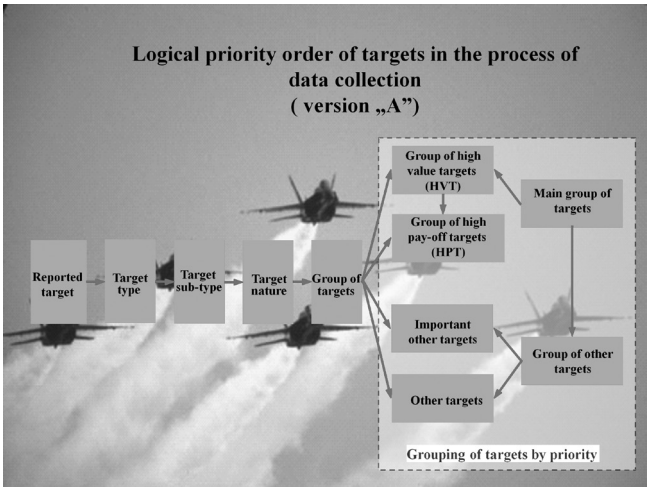

Figure 4. Computer processing of the reported targets (own resources)

The priority of intelligence data determines their value and is directly related to their urgency.

High Pay–off Targets are selected from High Value Targets. These targets can have essential (critical) impact on one's own troops in the course of the operation (combat), therefore, they must be destroyed immediately.

The present literature focuses on the high value targets and the high pay–off targets, and does not address the analysis of "other" targets. The group of high value targets is very broad. The armed forces of a small country have a limited number of intelligence assets and firing means of combat. In our research, we have come to the conclusion that the wide scale of other targets should be divided into two parts. One of these groups would include the category of "important other targets" and the other group "other targets". That would facilitate the prioritization of targets for the destruction by fire.

The important other targets are the ones which can have an impact on the own troops soon, that is why their destruction is desirable as soon as possible. Such are the enemy's near reserves, march columns, heavy means of fire in an open position, groupings manoeuvring close to own troops, helicopters on landing ground, armour–piercing equipment, etc. Based on the tactical situation, some of the important other targets may be re–qualified as high value or high pay–off targets (HPTs). Similarly, targets having been assigned to the group of high value targets can be re–assigned to a lower priority group of targets. For example, if no air strikes are planned to be conducted in one of the defence phases of defence combat, then anti-aircraft artillery means will not be high value or high pay–off targets. On the other hand, in the course of counterattack by own forces, armour–piercing missiles will be high value or high pay–off targets.

Other targets are: those that have (or may have) an impact on own troops but cannot have decisive effects soon, and they can be destroyed by other equipment (e.g. all–arms), and/or destroying them soon is not the most important task. These include e.g.: personnel and means of fire in an open position.

False targets include those own troop elements whose location has been specified by graphic intersection and reported by mistake, as well as the dummy and deceptive enemy targets.

During assessment, the target coordinates shall be subjected to a safety filtering.

This means that the software compares the target coordinates with the coordinates of own troop elements, and in case they match (there is no more than 200 m difference between the x y coordinates of the target and the own troop element), the software will indicate that and highlight these targets, grouping them separately as "False targets", and prompt to delete them. The front edge is also regarded as an own troop element (it is included in the data base), that is why the software will block the targets at the front edge, those whose location has been specified by graphic intersection and reported by mistake. Both groups of false targets can be printed in form of a chart.

In my opinion, this safety analysis and assessment phase is very important. I have directly experienced this problem at a corps–level intelligence exercise, where, during direct engagement with the enemy, our own reconnaissance sub–unit (artillery observation post) specified the location of own forward observation posts and reported them as targets several times, which we could discover through conventional data processing.

In the next phase of analysis and assessment work, the value of the targets (intelligence information) is defined, that is: the target data will be compared with the previously reported target data.

Single targets with single targets, single targets with groups of targets, and groups of targets with groups of targets will be compared to nature, type, coordinates, accuracy indicator of location (accurate or inaccurate), reliability indicator of the intelligence source, and the value of the intelligence information, among targets located in a circle with a certain (default: 200 m) radius.

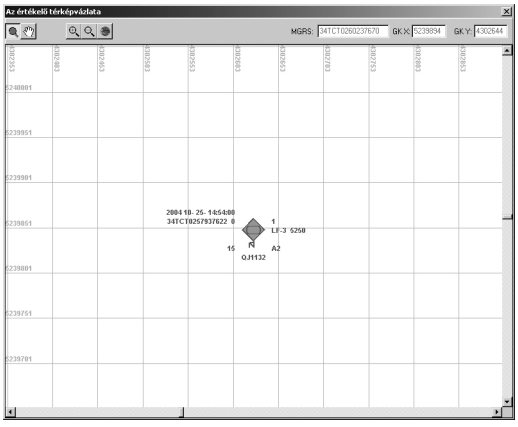

Figure 5. Analysis and assessment of targets on a digital map (own resources)

The requirements of the analysis and evaluation work:

- the software shall be able to investigate targets detected within a specified time period (e.g. 1 hour);
- every previously reported target located within a circle with 200 m radius from the currently reported target shall be displayed, indicating also the distance. These targets shall also be displayed on the monitor with the standard symbols, the most recent one in a different colour — for distinction — (Fig. 10).
- if there is less than 75 m distance between the coordinates of one or more single targets of the same type, they shall be considered as one target, and the no. and coordinates of the target shall be those of the target located by the more accurate means. The other target(s) shall be invalidated and allocated to the data base of invalid targets.
- if the graphic intersection has been carried out by assets of the same type, and the difference is less than 75 m, a mean coordinate (E, N) value shall be taken. The no. of the new target will be the no. of the target first reported.
- if the coordinates of a single target are compared with the coordinates of the centre of a group of targets, and the distance of x and y is less than 200 m, the single target will be considered as part (sub–object) of the group of targets (confirmation of group of targets);
- if a single target is compared by coordinates with one or more targets of different or same nature, e.g. a tank, an armoured personnel carrier, a machine gun, an armour–piercing gun, etc., and the difference between the coordinates (E, N) is less than 400 m, it shall be considered as part of a new group of targets.
- the new group of targets will have a new target no. (the software will issue a target no. from the target no. file), and the components (single targets) of the group of targets will also be recorded (stored) as sub–objects. The coordinates of the group of targets will be the mean value of the E and N coordinates of the single target components, its height will be the mean height values of the single target components. The software also calculates the width and depth of the generated group of targets, — in accordance with professional requirements — perpendicular to the basic direction.
- if the coordinates of a group of targets are compared with those of another group of targets, and the difference between the coordinates is less than 75 m, then it is the confirmation of one group of targets. The no. and coordinates of the group of targets shall be those of the target located by the more accurate means. If the graphic intersection has been done by means having similar accuracy, a mean coordinate value shall be taken, and the no. of the new target will be the no. of the target first reported.

As such, groups of targets can be created during assessment:

1. Based on the report from the original intelligence source — an original group of targets;
2. If the original group of targets has been confirmed by separate reports on single targets — a group of targets confirmed through single target(s);
3. Creation of a group on the basis of single targets through analysis — new group of targets;
4. Confirmation of a group of targets by another group of targets.

The assessed targets will be displayed on the analyser's digital map with NATO standard symbols (Fig. 10).

Assessment of the value of the target (intelligence information):

- The software will consider the targets (intelligence information) as confirmed by other sources if:
- "1" is reported in column 17 of the "Intelligence Log" for the accuracy indicator of the information,
- two or more targets of the same nature and with a difference between the coordinates (x, y) of less than 75 m, reported with information accuracy indicators "obviously correct" ("2"), "probably correct" ("3"), "highly doubtful" ("4"), "unlikely" ("5"), or "verity cannot be assessed" ("6"), – "not confirmed by other sources", shall be considered as one target and will be rated as "confirmed by other sources" ("1"). The no. and coordinates of the new target shall be those of the target located by more accurate means. If the graphic intersections have been done by similar means, the no. of the new target will be the no. of the target first reported, and a mean coordinate value shall be taken.
- if the nature and coordinates (E, N) of a target "not confirmed by other sources" ("2", "3", "4", "5", "6") are the same (within 75 m) as those of the target "confirmed by other sources" ("1"), then the data of the target "confirmed by other sources" ("1") shall apply;

The software groups the targets "confirmed by other sources" also by priority, group of targets, and size: The targets are sorted in a chart, which can also be printed.

The evaluated targets are fed back to the data base of expected and detected targets, where they will be summarized by type and nature (Figure 2).

The software moves the reported dummy targets to a separate group (file) and displays them on the digital map with their NATO standard symbols.

By size of target, there are:

- groups of targets,
- single targets.

The targets "confirmed by other sources" need additional intelligence based on the cumulative assessment of their priority (threat), timeliness of intelligence data, and other aspects, usually immediately before destroying them, and this intelligence is to be carried out by the reconnaissance sub–unit that is going to support fire.

The software carries out the necessary visibility estimation regarding the target for the positions of all reconnaissance assets, taking into account their intelligence/reconnaissance capabilities — which can also be displayed on the digital map — and proposes what reconnaissance assets should be involved in additional intelligence. The polar coordinates and elevation of the target viewed from the position of the chosen reconnaissance asset will be displayed.

After destroying the target, the data bases "Amount of expectable and detected targets" and "List of destroyed targets" will be updated, and the symbol of destroyed target will show up on the digital map.

The reconnaissance sub–unit supporting fire will report data consistent with NATO requirements in column 19 of the "Intelligence Log", as follows:

- the extent of destruction:

- annihilation,
- neutralization,
- suppression,
- jamming;
- the no. and description (name) of destroyed objects;
- whether they can continue the activities: yes or no;
- the extent of destruction of the type of target (%).

These data are recorded in the data base.

The target is to be considered as "not confirmed by other sources" if:

- nothing, or any of the following has been reported in column 17 of the "Intelligence Log":
- obviously correct ("2")
- probably correct ("3"),
- highly doubtful ("4"),
- unlikely ("5"),
- verity cannot be assessed ("6"),

or if:

- a target "confirmed by other sources" ("1") and a deceptive ("Mt") target have the same nature, and the difference between their coordinates (E, N) is less than 75 m. (In that case "verity cannot be assessed" (6))

The targets "not confirmed by other sources" are allocated to a separate group, similarly to the confirmed targets. Every unconfirmed target needs additional intelligence, since the data about them do not allow their immediate destruction. These targets are sorted in a chart, which can also be printed.

The software proposes what reconnaissance assets should be involved in additional intelligence based on the visibility examination and the reconnaissance capabilities of reconnaissance assets.

After the additional intelligence, the targets can be allocated to different groups depending on the assessment and processing, such as to the:

- group of targets "confirmed by other sources" ("1");
- group of targets classified as "verity cannot be assessed" ("6"),
- group of deceptive ("Mt") targets.

The targets, owing to their high manoeuvrability, change their positions quickly in the course of intelligence. Therefore, the reconnaissance personnel are obliged to report to the data processing centre if targets leave the previously reported positions. In that case, the target will be moved from the actual data base to the group of "invalid targets". This group of targets can be printed in form of a chart.

The digital map also allows target planning using the software. The planned targets will be drawn on the analyser's digital map with NATO standard symbols.

A reconnaissance–observation source has to be assigned to the planned targets. This is easy by the visibility examination carried out by the software. The software will examine which reconnaissance source (included in the data base) has sight of the target, taking into account the reconnaissance capabilities. It will display the visibility list, after which the analyser–evaluator shall choose the intelligence sources. When they are chosen, the software

displays the polar coordinates and elevation of the target viewed from the position of the reconnaissance asset. The data will be transmitted to the designated reconnaissance asset through digital transmission or conventional telecommunications, and, using those data, they will carry out aiming at the target in the field. The data about the planned target, together with the data of the chosen intelligence source will be recorded in the chart "planned and real targets", and can be printed.

During the analysis and assessment work, all intelligence data about the target can be recalled — by selecting the standard symbol of the target — on the digital map.

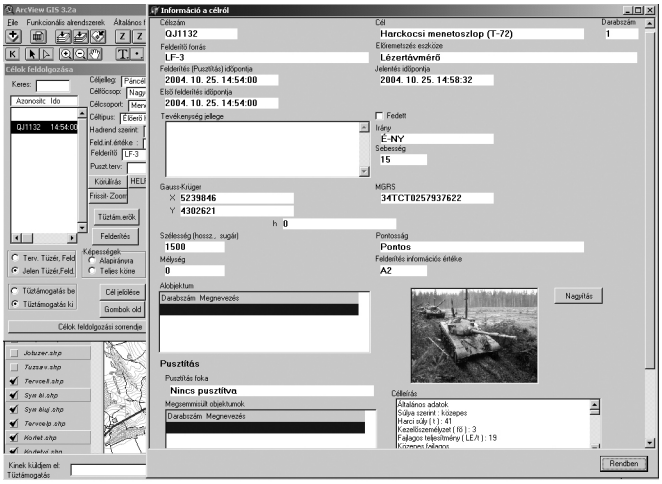

Figure 6. Recalling data about detected targets from the data base (own resources)

Drawing conclusions is the last step of information analysis. During drawing conclusions, we will find out what significance the intelligence data has in the combat area. They might be helpful for the anticipation of the future activities of the enemy.

Usage, distribution

The last step of the intelligence process is usage or distribution. The information shall immediately be made available to the user. Access to the intelligence data shall be granted to all concerned command levels and work groups. In my opinion, the intelligence data processing group and the fire support section (who allocate targets among forces and fire means) shall work in close cooperation, and they should be located next to each other, in accordance with NATO principles.

The examination of "important other" and "other" targets is carried out by the software analogously.

Basic requirements for the digital map software:

- display the intelligence data (targets) assessed by the computer with NATO standard symbols on the map;

- during the analysis of the displayed targets, all of their intelligence data shall be recallable (e.g. time of reconnaissance, nature of target, UTM (MGRS) coordinates, height, width (length), depth, description of the intelligence source, accuracy and reliability indicators, combat properties, parameters, and imagery of the target, the value of the intelligence information);
- a distinctive symbolization of destroyed targets, and all the information regarding the target and the destruction shall be recallable (e.g. by which sub–unit and when it was destroyed, the result of destruction — damage in %, no. and description/name of destroyed objects);
- display own reconnaissance forces and assets with the standard symbols;
- drawing up the reconnaissance capabilities for all positions of reconnaissance assets;
- visibility examination and drawing up the visible (and invisible) area for both the own and enemy reconnaissance assets and targets (this is of great help in planning intelligence and proper and fast designation of the location of reconnaissance assets);
- drawing up the Brigade combat area (Division defence zone) with NATO standard symbols;
- drawing up the front zone with standard symbols using the reports by reconnaissance sub–units including polar coordinates, as well as by putting directly into the digital map;

The front edge can be quickly and properly modified on the digital map during combat, and the map information can be immediately forwarded to addressees via digital data transmission.

Conclusion

The experience of the exercises conducted with "HUTOPCCIS" has been promising and demonstrates that, taking conventional planning and combat command and control into account, computer–aided tactical control can provide faster and more reliable information to headquarters and staff. The conventional telecommunications methods and tactical control, and the information flowing through an IT system complement and reinforce each other, making command and control more reliable.

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Origin and development of the thoughts on military keynesianism during 1936–2012

Luboš ŠTANCL[1], Vendula HYNKOVÁ[2]

The aim of the paper is to show how the thoughts of military Keynesianism have been developed and to define the role of military Keynesianism. First, the term 'military Keynesianism' will be introduced and its birth in the history of economic development will be dated and explained. Second, the development of the thoughts of military Keynesianism and also the development of the military–industrial complex will be described and the main different views on the application of military Keynesianism policy will be included. Finally, the authors will try to interpret opinions on the application of military Keynesianism during the economic recession, 2008–2012.

Key words: military Keynesianism, militarization, military Keynesianism policy, military–industrial complex
JEL classification: E6, B5, H5

Introduction

The term "Military Keynesianism" is related to increasing military expenditures in order to improve economic situation, more exactly to enhance the real gross domestic product (GDP). Firstly, let us have a look at the situation of military spending in the world, regardless of whether there is a state of war in a region or just increased military spending for a certain purpose(s). According to the *Stockholm International Peace Research Institute* (SIPRI), world military expenditure in 2012 was estimated to have been $1.756 billion, that represents 2.5 percent of world gross domestic product and it is about $249 for each person on our planet. [1] What we can observe nowadays is that there is a shift in global spending, in particular, from the West to Eastern Europe and the developing world (mainly North Africa). As we shall see in Table 1, due to continuing economic recession and rising government debt, states in North America, Western and Central Europe have tried to reduce government spending, including military expenditures (North America -5.5%, Western and Central Europe -1.6%). In contrast, there are regions in the world where the rate of growth is relatively high and accelerated (bolded in Table 1): North Africa (7.8%), Central America and the Caribbean (8.1%), East Asia (5%), South East Asia (6.0%), Eastern Europe (15%) and the Middle East (8.3%). The 15% rise in Eastern Europe is mostly the result of the Russia´s State Armaments Program started in 2011 and a further rise is expected to fullfil the program completely in 2020.

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Table 1. World military spending, 2012

Region	Spending ($ b.)	Change %
Africa	39.2	1.2
North Africa	**16.4**	**7.8**
Sub-Saharan Africa	22.7	-3.2
Americas	782	-4.7
Central America and the Caribbean	**8.6**	**8.1**
North America	708	-5.5
South America	65.9	3.8
Asia and Oceania	390	3.3
Central and South Asia	59.8	-1.6
East Asia	**268**	**5.0**
Oceania	28.2	-3.7
East and South East Asia	**33.7**	**6.0**
Europe	407	2.0
Eastern Europe	**100**	**15**
Western and Central	307	-1.6
Middle East	**138**	**8.3**
World total	1756	**-0.4**

The figures are in current (2012) US dollars. [1]

East and South Asia also showed a rise of 5 and 6%. We have to stress China and its rapid military build–up that seems to be disconcerting mainly for Japan, such as when China took actions allegedly to back its claims to Japanese–held islands in the East China Sea. Japan started to enhance its military spending and to build up offensive military power. According to SIPRI Yearbook 2013 statistics, China is the second highest military spender and Japan the fifth highest spender in 2012.

If we consider reasons for increasing military expenditures, there are several arguments — the state of war, defense security policy or deterrent policy, and there is a reason where increasing military power is considered a "stimulant" for economic growth. This argument in favor of military expenditures has become well–known as "Keynesian Militarism" or "Military Keynesianism", when military expenditures serve as an effective instrument of fiscal macroeconomic policy. Nowadays we usually understand military Keynesianism as an economic policy that uses massive military expenditures to attain economic growth. And there are, of course, positive and negative evaluations and many intense discussions are held about the influence of massive military spending. Now we take a look into the roots or origins of military Keynesianism.

Roots of military Keynesianism

The roots of military Keynesianism are included in Keynesian thought when English economist Sir J. M. Keynes was solving the causes of the "Great Depression" and suggested enhancing government spending. J. M. Keynes was aware of military expenditures place within the additional effective demand stimulating economic growth. He understood military spending as a public demand impulse helping the economy, but was not able to generate a sufficient level of private investment and consumption and encourage full employment.

While in 1936 J. M. Keynes talked about military spending as a theoretic example of how to increase aggregate demand, four years later, after a less than effective "New Deal" policy, he pointed out the war could improve the economy and enhance employment: *"It appears to be politically impossible for a capitalistic democracy to organize expenditure on a scale necessary to make the grand experiment which would prove my case except in war conditions"*. [2:159] [3: 129–130] As well he added that military spending had to be enormous. [4] Preparing for unavoidable war without casualties and damage can positively influence the economy.

Economist Michal Kalecki was the first who was concerned more deeply with military expenditures influence on economic growth. In 1943 he demonstrated his military spending model using the situation of Nazi Germany. He considered tremendous military expenditures more effective than other government expenditures because of the danger of labor unions and employee empowerment. In his version the government should accentuate nationalism and create a need for defense. Massive military expenditures helped to recover the German economy and overcome global recession, although the economic growth was a "secondary product". Thus the Kalecki concept became inspirational for US right–wing politicians.

The United States engaged in World War II at the end of the "Great Depression". Many economists and politicians believed that it was no "New Deal", but the war that dug the US economy out of recession. Economist Robert Lekachman noticed: *"The war pointed at a sharp Keynesian moral. As a public works project, all wars (before the nuclear era) are ideal. Since all war production is sheer economic waste, there is never a danger of producing too much"*. [5]

Table 2. U. S. military expenditures during World War II (mil. dollars, at constant prices of 1940) [6]

Year	Nominal GDP		Government Expenditures			Military Expenditures			
	(USD)	Change (%)	(USD)	Change (%)	Share of GDP (%)	(USD)	Change (%)	Share of GDP (%)	Share of GE (%)
1940	101.4		9.47		9.34	1.66		1.64	17.53
1941	120.67	19.00	13.00	37.28	10.77	6.13	269.28	5.08	47.15
1942	139.06	15.24	30.18	132.15	21.70	22.05	259.71	15.86	73.06
1943	136.44	-1.88	63.57	110.64	46.59	43.98	99.46	32.23	69.18
1944	174.84	28.14	72.62	14.24	41.54	62.95	43.13	36.00	86.68
1945	173.52	-0.75	72.11	-0.70	41.56	64.35	2.51	37.19	89.49

The US economy had expanded during 1941–1945. Gross domestic product increased markedly from 88.6 Mld USD in 1939 to 135 Mld USD in 1944 (measured at constant prices of 1939). Military production as a percent of GDP intensified rapidly from 2% in 1939 to 40% in 1943. [7]

World War II not only helped the U.S. economy overcome economic crisis, but also improved the partnership among the government, private sector and labor unions. This was a positive influence in the following years and enhanced production. The U.S. economy was propelled by military industry expansion and provided the U.S. immense economic advantage in comparison with the allies and rest of the world. The U.S. government became an administrator of the strongest economy in the world and gradually a center of the after–war world economy.

States preparing for war have to carry out the economic conversion of civilian production to military production, extend armament industry capacities and other production capacities and services. The economy is experiencing recovery, but enormous military expenditures create or deepen state budget deficits. J. M. Keynes considered wars extraordinary situations that enabled reaching almost full employment. Thus he supported increasing armament production and militarizing the economy and he thought that the militarization process would not necessarily invoke serious negative consequences, including war. However, many economists disagree and believe military expenditures are the least effective way to allocate budget resources, because they do not invest in profitable infrastructure building.

Military Keynesianism and military–industrial complex

Since 1944 attention has been paid to the conversion of military production to civilian production. At the end of World War II economists and politicians were afraid of the "Great Depression" continuing. So they hoped the Cold War would start providing the expansion of military prosperity, because disarmament and peace could have caused economic and political problems.[3] In 1950 The U. S. National Security Council submitted a secret report to the president of the U.S. This document designated NSC–68 [8] was unclassified in 1977.

The military Keynesianism Policy supporting the Korean and Vietnam War encouraged rapid military spending, not only in the U.S., but also in the rest of the world. *Table 3* demonstrates military expenditures during the period 1949–1968. The U.S. military spending increased very sharply during this time and the U.S. government made efforts to hold the strong position and confirm investor's and consumer's confidence.

3 Chester Bowles added: „ *One of the first things we must realize is that in the 1930´s we never really did find the answer to full employment. Only the defense program in 1940 put our people to work and only the war and the cold war that followed have kept them at work*". In [4]

Table 3. Military expenditures trend during the period 1949–1968 (mil. USD, at constant prices of 1960) [9: 200]

	1949	**1951**	**1953**	**1955**	**1957**	**1961**	**1962**	**1966**	**1968**
United States	16 629	37 781	54 409	44 428	46 843	47 335	51 203	57 951	68 213
NATO	23 905	50 231	70 287	58 985	62 382	63 689	69 101	76 776	87 755
Soviet Union	8 800	10 709	11 978	11 888	10 747	12 889	14 111	14 889	18 556
Warsaw Pact	13 600	15 509	16 778	16 688	16 235	20 712	22 651	25 148	31 156
World	43 659	74 094	95 291	84 013	87 848	95 623	104 311	119 492	138 851

Moreover, U.S. Keynesian macroeconomic policy was supported by industrial corporations and labor unions. Major industrial corporations got very lucrative government contracts and strengthened their position. Strong labor unions agreed to a high level of military expenditures in order to keep the social contract and minimize the number of strikes.

Increasing volumes of military expenditures deepened the militarization of economies and military–industrial complex expansion.[4] US President Dwight D. Eisenhower warned against this effect in 1961. He also started to use the term "military–industrial complex". He pointed out the danger of the militarization of the economy and potential threats. [10] The main idea is that military production should comport with the need of the defense of the country.

At present we distinguish two types of military Keynesianism. The first type, according to P. Custers, [11] was implemented during the R. Reagan and George W. Bush administrations. Military spending is perceived as the main factor of economic growth. The second type was carried out during the B. Clinton administration. The second type is characterized by government contracts stimulating investment in defense and the civilian sector. In this second instance military spending is not the main factor of economic growth.

Military Keynesianism and its criticism

The critics point out the negative social consequences of military Keynesianism policy. Excessive armament during peace can provoke nations to enter war. Moreover, there is the danger of militarization and nationalism. Enormous military expenditures speed up the increasing influence of the military–industrial complex. For instance, the contracts with the Pentagon enabled the formation and development of new industries and supporting corporations. One of the biggest suppliers for the U.S. Government Lockheed Martin profits mainly from government contracts and exporting weapons. [12]

4 The term "Military-industrial complex" was firstly described by American Philosopher Ch. W. Mills in 1956. The main idea is that there are elites in the industrial state, including cooperative (economic), political and military bureaucracy unified by the collective interest of the public policy. The phrase "Military–industrial complex" was firstly used by Dwight D. Eisenhower.

Table 4. Top 10 Armament Corporations, excluding China (2011) [13]

	Corporation (State)	Selling weapons (mil. USD)	Profit (mil. USD)
1.	Lockheed Martin (U.S.)	36 270	2 655
2.	Boeing (U.S.)	31 830	4 018
3.	BAE Systems (GB)	29 150	2 349
4.	General Dynamics (U.S.)	23 760	2 526
5.	Raytheon (U.S.)	22 470	1 896
6.	Northrop Grumman (U.S.)	21 390	2 118
7.	EADS (Europe)	16 390	1 442
8.	Finmeccanica (Italy)	14 560	-3 206
9.	L–3 Communications (U.S.)	12 520	956
10.	United Technologies (U.S.)	11 640	5 347

The military–industrial complex represents interest and personal connections with state bureaucracy, political elite and military–industrial corporations. Thus it is very hard for the government to decrease military spending or eliminate state budget deficits. As a result, there may be a continual cycle of war and peace changing and related to government spending.

There is a discussion about the contribution of investment in military research and development. Some economists suppose that military R&D is less effective than civilian R&D and use the examples of the Japanese and German economy. H. Garrett–Peltier and R. Pollin point out that a one dollar investment in the civilian sector brings more jobs than one dollar investment in defence. [14]

The critics of military Keynesianism usually use the concept created by Frédéric Bastiat called “The parable of the broken window”. In the theory he describes a shopkeeper whose window is broken by his young son, and who has to pay for a glazier to fix his window. It brings some transactions into the economy and increases money circulation. Sir M. Keynes saw that it was worth building, for example, totally useless pyramids in order to stimulate the economy, raise aggregate demand, and encourage full employment. But the main idea is that society loses the value of things which are uselessly destroyed and that we must take into account the opportunity cost. It means that the shopkeeper could have spent money on something else, but he was forced to spend his money on a new window. So military Keynesianism also ignores the opportunity cost.

Independent economists usually oppose the idea that high level military spending invokes high percentage tax rate cuts for the disposable incomes of householders and profits of corporations. By this they emphasize the long–run effects of military Keynesianism policy.

World military spending during 2008–2012

According to SIPRI, global military expenditure in 2008 showed an increase of about 4 per cent in real terms compared to 2007. US military expenditure increased, mostly due to the wars in Afghanistan and Iraq, but at the expense of expanding stat budget deficit, and also the mortgage crisis started in the United States. Military spending in Western and Central Europe

was an almost constant average, but Russia continued to enhance its military expenditures to fulfil plans in the future, despite economic problems. States, such as China, India, South Korea, Taiwan and Brazil, increased military spending, but military spending in the Middle East fell slightly, excluding Iraq where there was a large rise. At the low point of the world economic recession we could observe some efforts to help the U.S. economy and avoid the crises via the policy of military Keynesianism. Here is a citation concerning the RAND Corporation´s proposal, presented to the Pentagon in October 30, 2008.

"…the RAND Corporation recently presented a shocking proposal to the Pentagon in which it lobbied for a war to be started with a major power in an attempt to stimulate the American economy and prevent a recession."

"…RAND suggested that the $700 billion dollars that has been earmarked to bailout Wall Street and failing banks instead be used to finance a new war which would in turn re–invigorate the flagging stock markets." [15]

The RAND Corporation (www.rand.org) is a nonprofit institution that helps improve policy and decision–making through research and analysis. One of its core research areas is national security. According to the article, the Corporation is allegedly connected with the U.S. military–industrial complex and this tie could be a useful reason to start a policy of military Keynesianism. The thought consequently caused alarming debates, mainly in China, Japan, Russia and North Korea.

In 2009 despite the world recession, almost all regions registered an increase in military spending, except the Middle East. According to SIPRI, the global military expenditures increased by 6% in real terms compared to the previous year. Now we can speculate whether the idea of military Keynesianism was integrated to counteract the classical recession (i.e. decreasing aggregate demand in the economy, inducing deflation and lower output). Notwithstanding, smaller economies cut military spending, nine of the top ten spenders in the world increased their military budget. The world economic recession caused a fall in resource revenues (mainly from oil production) in some countries, but not so much on average.

The continuing recession in developed countries did not allow spending much on the defense sector in 2010. Economic growth is a key enabler; military spending is not in many cases able to grow faster than gross domestic product (GDP). In countries, such as China, Brazil, India, Russia or South Korea, the GDP grew almost rapidly and military powers were developed. The causes can be current or potential conflicts, as well as a perception of military power. Some countries had to change the budget priorities in favour of or against military spending. This is a very controversial topic under conditions of increasing social needs in a country.

In 2011 there was no increase in world military expenditures and it was the first fall since 1998. Compared with 2010, in real terms military spending remained almost unchanged. Mainly the continuing economic and financial crises in developed countries influenced government spending. Avoiding budget deficits the governments in Western and Central Europe, particularly, decided to cut military spending. In the U. S. the decade–long rise in military spending appeared to be ending (a result of the end of the Iraq War, the winding down of the Afghanistan War and also budget deficit–reduction measures), however the fall in US military spending in real terms was not as substantive as in Europe.

World military expenditure in 2012 fell by 0.4 per cent in real terms versus in 2011. That was the first fall since 1998. US military spending declined by 5.6 per cent in real terms in

2012, together with the year 2011, which might be a consequence of a post–war situation. The trend and future level of US military spending was a main topic for political debates. Under conditions of rising government debt it was an unwanted situation for the military. In Western and Central Europe, states continued to cut military spending. In contrast, the rise in military spending followed in Eastern Europe and the developing world (higher rates of growth in the Middle East and North Africa, as expected). And Russia´s military expenditures accelerated, because Russia has tried to fulfil its ambitious State Armaments Programme.

Conclusion

This paper has dealt with an introduction to military Keynesianism as an instrument of fiscal policy, the birth of this idea in Keynesian though when the positive effect of massive military expenditures on economic growth was expected. The authors explained two types of military Keynesianism and the role of the military industrial complex. The criticism of military Keynesianism was mentioned to point out the negative consequences for society. In the last part, main trends in military spending were described and also macroeconomic problems influencing the military expenditures in many countries.

Mainly during the post–war era, most advanced countries made efforts to use the military Keynesianism policy and build military power and develop an armament industry. The main goal was to stabilize the economy and enhance production. Thereby the militarization of economies became stronger and stronger. But we can observe these days that some countries increase their military expenditures to build up their army to compete with foreign military powers, and there is still a danger of militarizing economies.

Contrary to the civilian sector, the motion of military industrial development lies in the political sphere. As the analyses of the military–industrial complex shows the military–industrial complexes existence is based on a continuing symbiosis between the government (political elites) and armament corporations. The symbiosis is also an instrument for strengthening government power and re–election. The empowered political elites improved the opportunities for allocation of resources in the defense sector and increased their abilities of putting through their interests, including a combination of military and civilian Keynesianism.

There is a need to continuously examine the consequences of military Keynesianism policy and explore the relationship between military expenditures and economic growth (including the long–run effects). In addition, we should examine not only economic aspects, but also political, social and other aspects concerning the militarization of the economy.

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Hazardous Activities in Hungary — in terms of Industrial Safety

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Storage, processing and use of dangerous substances which are present in hazardous activities involve the risk of major accidents. The experience of recent history shows that industrial accidents can cause catastrophic effects to the environment of dangerous industrial establishments and citizens living nearby. The aim of the authors of this article is to categories the Hungarian hazardous activities and provide the readers with a general overview of their vulnerability.
Keywords: disaster management, industrial safety, vulnerability, Hungary, hazardous activities.

Preface

The Hungarian Parliament, in order to improve the safety of the public and of the environment and the efficiency of the prevention of manmade disasters, to strengthen the system of disaster management organizations and to improve the results of emergency actions, by the adoption of Act CXXVIII/2011 on disaster management and on the amendment of individual, related acts (Dis. Man. Act), created on January 1st 2012, a standardized system of authority tasks, organizations and procedures for industrial safety. [1]

The newly enacted industrial safety regulations (the third individual sector beside civil protection and fire prevention) cover the prevention of major accidents involving dangerous substances, and the protection of shipments containing dangerous goods, protection of critical systems and installations and the disaster management tasks of nuclear safety. [2]

In the present article the objective of the authors is to identify the hazard sources relevant for the occurrence of manmade disasters. Their objective is furthermore to typify such hazard sources and then to evaluate the exposure to major dangers in terms of industrial safety. The article is dedicated exclusively to sources of danger (hazardous activities) that are relevant in terms of the application of the law by the disaster management authority and we prepared only a general status report about the present status (June 30, 2013) of the implementation of the legal regulations.

We have used basically the public data (prepared for the general information of the public) provided by the National Directorate General for Disaster Management of the Ministry of the Interior (MI NDGDM), National Chief Inspectorate for Industrial Safety. Furthermore we have used also the specialist literature that is rather limited in this field.

In this article, in a way not yet examined by others, we propose a hazard source classification system based on the industrial safety aspects of manmade disasters. In addition we provide a comprehensive overview about the exposure to hazardous activities in Hungary.

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General classification of activities posing disaster risks

There are several versions of grouping disasters (hazard sources) known by professionals and scientists. In the legal provisions it is only the implementing regulation of the disaster management act, [3] where there is a split related to effects posing hazards, applied in risk assessment procedures. From the scientific point of view several grouping systems can be identified, however it is common in those systems that disasters are basically assigned to two groups: natural and a manmade group.

In terms of industrial safety, we shall evaluate manmade disasters, major accidents and other events endangering human health and life, the environment and critical assets affecting them. This will be done from the point of view of the disaster management act, "critical system components" covered by the regulations about critical systems and installations or related to "dangerous activities", or the "transportation of dangerous goods".

Dangerous activities are, in the application of the disaster management act, art. 3 §. clause 31 *"is an activity carried out by using industrial, biological (agricultural), chemical procedures, which, if it becomes uncontrolled, can endanger massively human health, the environment and the safety of life and security."* [4]

Hazardous activities (stationary sites) can be classified in terms of industrial safety basically as follows:

- activities related to dangerous substances and goods;
- activities related to hazardous wastes;
- activities related to radioactive materials;
- and hazardous mining activities.

The transportation of hazardous goods (mobile hazard sources) are differentiated in almost all technical literature in Hungary by transportation on public road, by railway, inland waterways and air transport.

Critical systems are defined in Act CLXVI/2012 on the identification, selection and protection of critical systems and installations (hereinafter: Lrtv.) in the explanatory provisions (Lrtv. 1. § clause g) are as follows: *"a system component of systems, assets, installation belonging to one of the sectors defined in the annexes 1–3, that are essential for the completion of social tasks, thus in particular for healthcare, for the personal safety and security of the public, for economic and social public services, which, in case of their unavailability, due to the lack of the continuous completion of these tasks would result in major consequences."* [5]

Critical system elements can be assigned according to the law to 10 main groups: energy, transportation, agriculture, healthcare, finances, industry, information and communication technologies, water, law and order, government and public safety and defense.

Following the aforementioned concept, on figure No. 1 the principal summarized results of the classification of activities (based on aspects of industrial safety) that pose risks of manmade disasters are illustrated.

Hereinafter we will cover only the general evaluation of the hazards posed by hazardous activities in Hungary. In the present article the transportation of hazardous goods and critical systems and installations are not analyzed.

Production, storage and processing of hazardous goods

In the course of major accidents happening during the production, storage, processing of dangerous substances (goods) there can be a fire or explosion and substances harmful to the health and environment might be released into the air or watercourses, thus endangering the public and the environment. The harmful effects of fire and explosions will most probably cause damage in the direct vicinity of dangerous establishments only, harming human health or the environment, within a very short time after the accident. The release of dangerous substances into the air, depending on the type, quantity, physical properties, the meteorological, surface and other conditions, can cause danger several or, in extreme cases, several tens of kilometers far away from the location of the accident. This takes, according to my experience, several tens of minutes, maybe hours. In case of substances with a permanent effect the effects can be long–lasting, occasionally even for decades. [6]

In Hungary, because of the hydrography of the country, dangerous substances can get into watercourses because of incidents, a low technological level of operation or human mistake. The effects of the catastrophic contamination of living waters can last for several days, maybe even several weeks, and the danger can emerge even several hundreds of kilometers far away. As 95% of the water catchment area of Hungarian rivers is located outside of our borders, in the course of the preparation it is not enough to consider only dangerous industrial establishments located in Hungary.

Explosions happening in the course of major accidents, radiating heat, or burning materials emitted can trigger, within or outside of the establishment, further major accidents (domino effect) and can cause massive panic resulting in major consequences.

From the four main groups of dangerous activities, I have checked the activities involving dangerous substances and dangerous goods in terms of industrial safety first.

In the field of the production (manufacturing) storage and processing of dangerous substances and goods, activities designated as installed establishments can be divided into two main groups.

a) Establishments involving dangerous substances and below tier establishments

Establishments involving dangerous substances covered by the rules regulating major accident prevention, and so called below tier establishments belong to the first group.

The establishments involving dangerous substances, the so–called "Seveso establishments" mean dangerous activities identified in line with the rules of the Seveso II. Directive.

Based on the definition of the disaster management act, § 3, clause 28, the establishment involving dangerous substances *"is the complete area under the management of an operator, where, in one or more installations involving dangerous substances, common or related infrastructure included, there are dangerous substances present in quantities reaching the tier value specified in the legal regulation issued for the implementation of the present act."*

Establishments involving dangerous substances can be assigned on the basis of the methodology listed in the implementing regulation, annex 1, to lower and upper tier categories. The basis of categorization is the quantity of dangerous substances at the sites (including also

materials that will expectedly be produced because of the runaway reaction of the process) and their danger categories [6]. Dangerous substances (chemical agents and formulations) are assigned to danger categories in line with Ac XXV/2000 on chemical safety and the related implementing regulation.

In the implementing regulation, annex 1, table 1 the most frequent dangerous substances and the related lower and upper tier quantities are listed. In table No. 2 the danger categories of dangerous substances and the related lower and upper tier quantities are listed. Dangerous substance is the substance included in table 1 or belonging to any danger class of table 2, and being present in the establishment as raw material, product, semi–finished product, by-product or wastes. The threshold quantities specified in the tables apply to one establishment.

In case the quantity of the dangerous substances being present in the establishment reaches or exceeds the value specified in column 2, then the establishment is a lower tier establishment, if it reaches or exceeds the values specified in column 3, the establishment is an upper tier establishment.

As of January 1, 2012, in addition to the lower and upper tier establishments involving dangerous substances covered by the Seveso II Directive, the procedures and obligations applying to the operators of below tier establishments have been added. [6].

The new regulation (Dis. man. Act Chapter IV. and its implementing regulations) impose, in addition to the existing regulations, obligations on operators as well, at whose sites there are dangerous substances in quantities exceeding one fourth of the lower tier quantity specified in the regulation but not reaching the lower tier level and on operators of installations that shall be handled with priority.

The sites, where chlorine or ammonia is present in quantities of at least 1,000 kg, where hazardous wastes are neutralized by incineration, and installations used for the transportation of hazardous wastes, dangerous substances beyond the battery limits are also included in this group.

Installations used for the transportation of hazardous goods that are, as a main rule, not covered by the Seveso II. Directive belong to the second group. When regulations were amended in Hungary in the year 2012, the codifier extended the effect of the regulations over establishments involved in the temporary storage of hazardous goods and installations used for the transportation of hazardous goods by pipeline.

However in the practice of the application of law in Hungary switching yards and ports are an exception. As the authority regards switching yards and ports to be part of transportation activity, they are not yet deemed establishments involving dangerous substances. In connection with the modification of disaster management regulations the codifier subjected these activities to authority inspection. However the licensing and supervising activity at dangerous establishments and the application of emergency plans are still missing.

The dangers resulting from the dangerous establishments installed can be most simply demonstrated by the application of a GIS tool (danger map or hazard map).

The Major Accident Hazard Bureau working at the Joint Research Center of the European Commission has prepared, in line with the Seveso II. Directive, Art. 13 on trans–boundary effects, the Seveso Plants Information Retrieval System (SPIRS). “Seveso establishments” can most simply be typed on the basis of the SPIRS system. In the SPIRS system — irrespective of the actual dangers of the dangerous establishment, the danger resulting from lower tier establishments is demonstrated by a circle with a diameter of 2 km, and in case of upper tier establishments by a circle with a diameter of 5 km. [7]

In the practice of the application of the law in Hungary the elements of SPIRS are integrated into the Industrial Accident Information System (IAIS) of the disaster management authority. IAIS includes, in addition to the Seveso establishments, also the basic data of below tier establishments, like their geographic location (address of the site), their status (lower, upper tier and below tier) or the industrial classification of the dangerous establishment.

Based on the IAIS the establishments producing, processing and storing dangerous substances can be assigned to a total of 17 groups (activities). The activities of the IAIS, because of the characteristics of below tier establishments, are not fully in conformity with the SPIRS classification. The disaster management authority sends a list, address, status and activities of the establishments to the Joint Research Centre of the European Commission every year.

The classification of below tier establishments is identical with that of Seveso establishments, with the difference, that among below tier establishments there are "installations to be handled with priority". In these hazardous activities the 25% threshold of the lower tier is not considered. The establishments where there is at least 1,000 kg of chlorine or ammonia present, if these establishments are not establishments dealing with dangerous substances, belong to the group of below tier establishments. The installations used for the transportation of dangerous substances by pipeline are registered as installations used for the transportation of hazardous goods, while installations used for the neutralization of hazardous wastes by incineration are recorded among establishments involving hazardous wastes.

Based on the data of MI NDGDM the number of 169 lower and upper tier establishments covered by the regulations before 2012 increased by 37% because of the new regulation taking effect. In Hungary, as of July 2013, there are 129 lower tier, 97 upper tier and 509 below tier establishments and 3 more establishments are being constructed. There are further 537 below tier establishments under the effect of the new regulation, and accordingly there are already 758 dangerous establishments covered by the dis. man. act and by its implementing regulation.

The upper tier establishments covered by the agreement of the UN Economic Commission for Europe (UN ECE) about the trans–boundary effects of industrial accidents are located along the Slovakian and Ukrainian border. The number of dangerous activities identified within a 15 km zone of the state boundary is 9, whereas the number of activities identified in the water catchment areas and endangering Croatia and Serbia is 14 [8] The Hungarian Disaster Management authority is responsible for the implementation of the technical, bilateral and multilateral provisions of the UN ECE international piece of legislation. The technical information provided for the purposes of the bilateral cooperation is written in safety documentation handled in by the operator of the upper tier establishments dealing with dangerous substances. [9]

The next figure illustrates on the basis of the authority records of MI NDGDM the geographical location of establishments involving dangerous substances in Hungary.

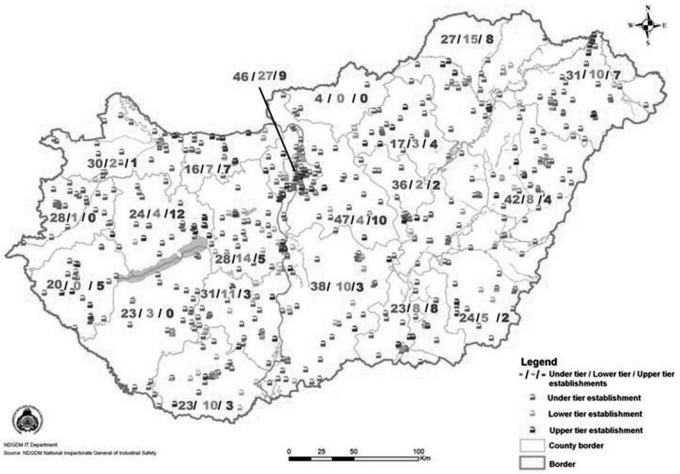

Figure 1. Location of establishments involving dangerous substances and below tier establishments in Hungary (source: MI NDGDM National Chief Inspectorate for Industrial Safety, July 1, 2013.)

b) Installations used for the transportation of hazardous goods

Installations used for the transportation of hazardous goods can be divided into five groups, in line with the transportation methods, as follows:

- Installations used for the road transportation of hazardous goods
- Installations used for railway transportation;
- Installations used for the transportation over inland waterways;
- installations used for the preparation of air transport;
- Installations used for transportation by pipeline.

Installations used for the road transportation of hazardous goods, that is warehouses used for the storage of hazardous goods in ADR (the European Agreement concerning the International Carriage of Dangerous Goods by Road) packaging, are recorded. Almost all warehouse halls that are of great significance in terms of logistics are located in the agglomeration of Budapest. This is otherwise also logical, as most of the consumption and business life is concentrated in Budapest and in its direct surroundings. From this region the products desired can be transported to any point of the country within 2–3 hours. [10]

Installations used for railway transportation are first of all switching yards that do not belong to the group of establishments involving dangerous substances. These installations shall prepare an internal emergency management plan in line with RID 1.10 and this plan regulates basically the consequence mitigation and prevention rules of the Seveso Directive applied to safety reports. On the basis of the data of MI NDGDM MÁV Zrt. identified a total of 14 yards in the area of Hungary, the most significant ones are the yards in Ferencváros, Miskolc, Szolnok and Záhony. [11]

Another major type of the installation of rail transport is the switching yard and sidings of establishments producing, processing and storing dangerous substances. Switching yards located in the area of establishments involving dangerous substances or in the area of below tier

establishments or sidings closely related to the sites pose major hazards. Sidings connected to sites can cause individual and significant dangers, as there is a high number of wagons there without any physical protection, without the supervision of the operator and of the authority.

Railway, public road, and trans-shipment facilities can be established dealing with dangerous substances or establishments not classified. The most significant operating establishment is in Budapest (Bilk Kombiterminál Zrt.). During the trans-shipment of containers the fact that the safety of containers arriving at the terminal depends on the variable quality of dispatch in Hungary or abroad and on the technical condition of the wagons is a frequent problem.

Loading and unloading facilities of establishments involving dangerous substances and ports dealing with dangerous substances are registered as installations used for inland waterway transportation. In Hungary there are loading and unloading installations at the petroleum port in Csepel (MOL Csepel base site, and Oil Tanking Kft.), at MOL Plc. Danube Refinery in Százhalombatta and at the site of Lukoil in Dunaföldvár. [12]

In case of the facilities used for the preparation of air transport the warehouses used for the storage of dangerous goods at the airport (Liszt Ferenc Airport) are registered, which cause, due to the relatively low material quantities, no significant danger compared to other transportation methods.

The implementing regulation includes the definition of the transportation of hazardous substances by pipeline (as establishments to be handled with special attention). Transportation pipelines, pump, compressor and distribution stations belong to this group, with the exception of the distribution pipelines used for natural gas supply to the public, and the collection pipelines with a nominal diameter below 400 mm used for hydrocarbon mining.

Activities dealing with hazardous wastes

Activities involving hazardous substance temporary storage facilities, used for the storage of hazardous wastes produced at establishments involving hazardous wastes, are listed. There might be hazardous wastes produced in below tier establishments, and in low quantities at a high number of non–classified sites.

The hazardous wastes accumulated in these facilities are assigned to hazardous waste categories on the basis of the environmental regulations and are transported to neutralization plants or to other sites specializing in the preparation and collection of hazardous wastes. The classification of hazardous wastes according to the European Waste Catalogue (EWC) is, based on the KöM (Ministry of Environment) regulation No. 16/2001 (VII. 18.), and is the task and duty of the producer. Classification is influenced also by other objective aspects and interests. If a waste is hazardous or not is determined by the aforementioned KöM regulation, according to the presence of components expressed in % and characterized by R–phrases. New hazardous wastes or hazardous wastes with unknown composition can be classified on the basis of the composition and hazard parameters. Based on the production technology of wastes (statistical approach), the EWC systemizes wastes in predefined groups. In the technical content of these groups some of the exact physical, chemical and other parameters applied in ADR can be found in exceptional cases only.

Among the neutralization activities, from the point of view of hazards, establishments neutralizing hazardous wastes by incineration are regarded as the most dangerous.

There is just a low number of hazardous waste incineration plants in Hungary, the most significant ones are in Dorog, Győr, Sajóbábony, Balatonfüred, Tiszaújváros and Tiszavasvár.

Among the activities involving hazardous wastes the ones that are most significant from the point of view of hazards are subject to the regulations about the prevention of major accidents.

One of the unresolved questions of the last decades is environmental safety, and within this the handling of hazardous wastes as independent hazard sources. In Hungary several million of hazardous waste are generated every year. The quantity of industrial wastes and liquid and sludge–like hazardous wastes is decreasing, while the quantity of solid hazardous wastes is increasing.

Some 30% of the hazardous wastes recorded (based on the calorific value) can be combusted. Other wastes need further treatment, first of all physical, chemical, biological decontamination, whereas unavoidable residues require professional disposal. Some 0.5–0.7 % of domestic solid wastes are hazardous wastes.

In my opinion hazardous wastes are first of all an environmental and health problem and jeopardize mainly the environment, human health is only indirectly endangered. The risk of danger occurs in case of the various environmental elements, usually as permanent environmental pollution.

Activities involving radioactive substances

Activities dealing with radioactive substances can be divided in terms of industrial safety into two main groups: nuclear installations and isotope laboratories.

a) Nuclear installations

With regard to the potential risks, among the nuclear installations in Hungary Paksi Atomerőmű Zrt. with its 4 pieces of VVER–440 (Voda Voda Energo Reactor — Water–Water Power Reactor) power generation blocks ranks first. The blocks are arranged in two pairs, in a “hermetic space” protected by a localization tower preventing/delaying release in case of minor/major accidents, respectively.

Next to the reactors, but outside of the hermetic space there are the spent nuclear fuel pools, where the spent fuel is cooled for 5 years before outbound shipment. There are 70 settlements within the 30 km radius of the power plant. The settlements belong to Tolna, Bács–Kiskun and Fejér County in terms of public administration. Depending on the emissions and weather conditions, a smaller or larger part of this region might require emergency response. The probability of exposure of regions farther off to danger is low but not nil [12].

The research reactor of the Central Research Institute of Physics (Központi Fizikai Kutatóintézet — KFKI) and the teaching reactor of the Nuclear Technical Institute of the Technical University of Budapest (BME Nukleáris Technikai Intézet) are less significant from the point of view of accidents.

The Temporary Storage of Spent Fuel (Kiégett Kazetták Átmeneti Tárolója — KKÁT) is a separate organization, but it is physically located within the battery limits of the Paks Nuclear Power Plant. The danger of KKÁT is that of accidents during transportation and loading.

Spent fuel is transported since the commissioning of KKÁT, in exceptional cases only, thus the related risk is also low. At the same time the activity of spent fuel is significantly higher and it is harder to localize due to its gamma radiation and requires more expertise.

Accidents happening during the transportation of highly active isotopes is also similar, where the restoration of the protection of the isotope is the most urgent task. The effect of transportation between the spent fuel pools and KKÁT and of accidents happening here beyond the battery limits is not probable.

The risks resulting from nuclear installations in Hungary can be characterized on the basis of the planning zones applied in response activities following nuclear accidents, as shown in the next table. The individual installations are assigned to hazard planning categories (category I–V), where

- *Zone of Preventive Precautionary Actions* (Megelőző Óvintézkedések Zónája — MÓZ) in case of installations belonging to the 1st planning category this is a pre–selected area, for which urgent precautionary actions are planned in advance, and the implementation of such actions are ordered immediately after the identification of a General Emergency Situation.
- *Zone of Urgent Precautionary Actions* (Sürgős Óvintézkedések Zónája — SÓZ) in case of installations belonging to planning category I or II this is a pre–selected area, for which urgent precautionary actions are planned in advance.
- *Zone of Foodstuff Consumption Restrictions* (Élelmiszerfogyasztási Korlátozások Óvintézkedési Zónája — ÉÓZ) is the area, within which the restriction of the foodstuff consumption of the population, the checking of agricultural producers and of the food processing industry, the strict regulation or restriction of their activities by legal regulations (as needed) becomes necessary. [13].

Table 1. Designation and area of planning zones [13]

	MÓZ	**SÓZ**	**ÉÓZ**
I. VTK			
Paks Nuclear Power Plant	3 km	30 km	300 km
II. VTK			
KKÁT	–	–	3 km
Budapest Research Reactor	–	KFKI site	1 km
Izotópintézet Kft.	–	KFKI site	1 km
III. VTK			
BME Teaching Reactor	–	–	–
RHFT	–	–	3 km
NRHT	–	–	3 km
V. VTK			
Bohunice	3 km	30 km	300 km
Mohovce	3 km	30 km	300 km
Krsko	3 km	30 km	300 km
Dukovany	3 km	30 km	300 km
Temelin	3 km	30 km	300 km

The data of the table above expressed in figures are visualized on the following figure also as a map.

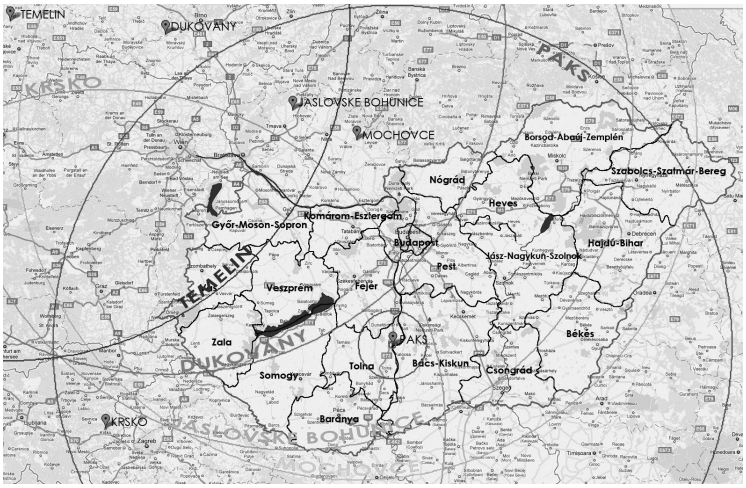

Figure No 2. Nuclear hazards in Hungary [13]

There is a Preventive Precautionary Zone marked in Hungary around the Paks Nuclear Power Plant only, this is an area with a radius of 3 km. There is also an Urgent Precautionary Zone marked in Hungary around the Paks Nuclear Power Plant only, this is an area with a radius of 30 km and the KFKI site that includes the Budapest Research Reactor.

The circles with a radius of 300 km around the Paks Nuclear Power Plant and around foreign nuclear power plants, that is the Precautionary Zone of Food Consumption Restrictions cover practically the whole area of Hungary, only small areas east from the line Vásárosnamény–Mátészalka are not affected by this zone.

Due to the location of nuclear power plants abroad their marked Preventive and Precautionary Zones do not reach Hungary [13].

b) Facilities producing radioactive materials (isotopes)

Based on the data of MI NDGDM 3 of the facilities producing radioactive substances (isotopes) are in Budapest and two are in Debrecen. Radioisotope is being produced in the experimental nuclear reactor of the Nuclear Energy Research Institute (Atomenergia Kutató Intézet), while the Institute of Isotopes Co., Ltd. (Izotóp Intézet Kft.) produces iodine radiation source. PET (Positron emission tomography) radioisotope is being produced in a medical cyclotron by the University of Debrecen (Debreceni Egyetem) Medical and Health Science Centre (OEC — Orvos– és Egészségtudományi Centrum) Nuclear Medicine Institute (Nukleáris Medicina Intézet) in Debrecen and by Pozitron Diagnosztikai Kft. in Budapest. Medical and industrial radioisotope is being produced by MTA ATOMKI (Atommagkutató Intézet — Institute for Nuclear Research) (MGC–20E cyclotron) at their site in Debrecen.

Based on the data of MI NDGDM there are a total of 33 pieces of “B” and “C” category isotope laboratories with no patients working in the country, which pose only limited danger to their environment in terms of disaster management.

The aspects used for the civil defense classification of isotope laboratories depend mainly on the classification of the laboratory (A, B, C levels), and on the category of importance of

the installation (priority, I., II., III. category). In addition to the aforementioned aspects the factors of the activities of laboratories dealing with radioactive substances posing a risk to the public influence the classification as well. The EüM (Ministry of Health) regulation No. 16/2000 (VI. 8.) on the implementation of the Nuclear Energy Act No. 1996/CXVI. includes detailed provisions about the aforementioned point.

With regard to the civil defense classification, the establishment of adequate safety systems in laboratories that frequently work with volatile, gas– and steam phase radioactive isotopes with long half–life period, and with toxic radioactive isotopes with long half–time period, and the regular inspection of such laboratories, combined with environmental sampling is highly important.

In addition to radioactivity measurements, in justified cases, the inspection shall be carried out by sampling and by radioactivity analytics, chemical, biological measurement carried out in special laboratories. The frequency of the authority inspections at isotope laboratories is properly described in the regulation 16/2000 (VI.8.) EüM, Annex 7.

Hazardous mining activities

a) Mining activities

We have anticipated that in the field of hydrocarbon production, the mining of crude oil and natural gas, the primary processing of the raw material takes place still within the battery limits of the mine. In the course of the processing of the produced and imported hydrocarbons intermediate products; fuels and lubricants; and the byproducts of processing (e.g.: bitumen) are produced. Most of the substances are highly flammable and explosive, and can cause major industrial accidents, disasters and environmental disasters.

In the course of the extraction and processing of hydrocarbons the following dangerous situations might arise:

- danger and environmental damage caused by unexpected bursts during the extraction of crude oil and natural gas, and exploratory drills;
- fire or explosion, environmental damage during the storage or primary processing of the extracted crude oil and natural gas in the area of the mine;
- fire or explosion, or environmental damage caused during the processing and storage of imported and extracted crude oil (crude oil refining, production of secondary products (PB gas);
- fire and explosion, environmental damage during storing and logistic activities (product pipeline).

Major crude oil fields are in Algyő and the oil field in North and South Zala.

There are major natural gas fields in Jász–Nagykun–Szolnok, Hajdú–Bihar and Zala County.

There are some 700 exploratory and extraction wells, MOL Plc. carries out crude oil and natural gas extraction activities at 5 mining plants, and six business organizations specialize in crude oil exploration. In Zala, in the course of crude oil extraction the danger of fire and explosion, and the potential release of carbon dioxide used in high quantities can be anticipated. Toxic gases that are harmful to human health (H2S) that are heavier than air and that are released in a mixed condition, can jeopardize several settlements and several thousands of

people for several days due to the local relief conditions and in case of unfavorable weather conditions. The extracted crude oil and natural gas and significant quantities of the PB gas produced are stored in 5 underground gas storage containers (e.g. gas storage in Pusztaedecser in Zala) at 8 PB gas filling sites and in above–ground facilities (e.g. PB gas storage in Algyő — 30,000 m^3). Among the industrial plants processing crude oil the white and black storage capacities of the Danube, Tisza and Zalaegerszeg refineries are significant.

The danger related to hydrocarbon transportation pipelines is covered in the subchapter "Transportation of hazardous goods", but due to its nature it shall be mentioned here. In case of transportation pipelines the starting and relay stations and process installations used for operation (e.g. pressure booster, loading, unloading etc. stations) pose major hazards. The exposure to dangers results mainly from above–ground installations, where the accidents and disasters described in the chapter about dangerous industrial installations might happen.

Coal and lignite mining pose no special hazard in terms of industrial safety. The facilities used for the storage of crude oil drilling mud considered hazardous waste can pose a danger to the environment [13].

b) Facilities used for the storage of mining wastes

According to the records of the NDGDM there are 400 facilities for the storage of mining wastes in Hungary and most of them are not classified. The total number of qualified "A" type facilities is 12 pieces. Some storage sites e.g.: the red sludge storage in Ajka are split into several cassettes. The disaster management authority pays special attention to the safety of facilities used for the storage of mining wastes following the industrial disaster in Kolontár.

In connection with the dam break of the red sludge reservoir on October 4, 2010 in Kolontár the Environmental Chief Inspectorate of the European Commission (EiB) sent an official notice on October 22, 2010 regarding the disaster at the site of MAL Zrt. in Ajka.

EiB asked for information among others on the classification under 96/82/EC Council Directive (Seveso II.) about the inspection of hazards of major accidents related to dangerous substances.

With regard to the applicability of the Seveso II. Directive the European Commission accepted in its reply the standpoint of MI NDGDM, as Hungarian authority, namely that the red sludge and sodium hydrate do not qualify as dangerous substances under the Seveso II, thus the installation is not covered by the Directive.

The first step in Hungary in the elimination of deficiencies affecting environmental and mining law identified and complained about by the European Commission was the amendment of regulations in Hungary regarding mining wastes. In the topic of mining wastes the Hungarian Parliament has adopted Act CLXXXI/2010 on the amendment of individual energy acts and of Act LXXVIII/1997 on the alteration and protection of the built–in environment. According to the law, the Mining Act No. XLVIII/1993 was amended as of January 1, 2011. Certain parts of the amendments were aimed at the conformity with the Directive No. 2006/21/EC (March 15, 2006), namely the treatment of wastes produced in the mining of minerals.

Accordingly the effect of Act No. XLVIII/1993 covers mining wastes (wastes produced during mining and red sludge produced during the processing of bauxite).

The competence of the Mine Inspectorate was extended by authority procedures related to the management of mining wastes and to the construction, commissioning and operation,

closing and aftercare of related facilities and installations. Resulting from the change of the legal regulations, the regulation No. 267/2006 (XII. 20.) on the Hungarian Office for Mining and Geology has been amended, and this allows the disaster management authority to participate, as specialized authority, in the construction and occupancy licensing procedure to check the internal emergency management plan. With the amendment of the GKM (Ministry of Economy and Transport) regulation No. 14/2008 (IV. 3.) GKM the regional organizations of MI NDGDM will prepare, revise, along with the mayors of the settlements concerned, the external emergency plans serving for the protection of the settlements and have them drilled.

With the modification of the regulation of mining rights, with the introduction of external emergency response actions, there is a possibility to manage the coordinated activities of disaster management, and of the state and municipal organizations involved in the rescue and emergency response.

Facilities used for the storage of mining wastes can be divided into two main groups: (1) sludge reservoirs and sludge settlement ponds and (2) pit–heaps and soil depots.

Sludge reservoirs are divided into four main groups according to the raw material extracted: (1) red sludge reservoirs (2) spent nuclear fuel storages (3) non–ferrous sludge reservoirs and (4) iron ore sludge reservoirs. The wastes produced in the course of coal and lignite mining are stored on pit–heaps and on soil depots.

Conclusions

In the article the dangers resulting from hazardous activities in Hungary covered by industrial safety regulations, being part of disaster management have been generally analyzed.

The evaluation of the activities in Hungary that pose risks of disaster, based on the aspects of industrial safety can essentially be found in case of establishments involving dangerous substances only, where dangerous establishments have maps illustrating the individual risk of fatalities and the hazard zones of establishments will be integrated into the land–use plans.

The data base of MI NDGDM (IBIR — Információ Biztonsági Irányítási Rendszer; Information Security Management System) offers adequate possibilities for the extraction of statistical data. The data of authority work are included in the so called Authority Data Base (Hatósági Adatbázis, HADAR) not connected to the IBIR. The hazard sources are visualized as a map in the GIS data base of the NDGDM, however there is no direct data base connection. The results of the hazard analyses are available for each establishment in the safety documentation, however the maps applied there are not standardized. The data of events related to industrial safety are also separately recorded, and these records shall continuously be updated to prepare executive summaries and reports.

With regard to sludge reservoirs and isotope laboratories there is a separate registration not linked to central data bases.

In terms of nuclear hazards we are aware of precautionary action zones established empirically. These zones are visualized on maps as well.

All in all it can be established that most of the activities covered by industrial safety regulations in Hungary are visualized on so–called hazard maps, where data can be analyzed as to the main parameters and location of the hazard source. The danger maps corresponding to the quantitative risk criteria are available for the establishments involving dangerous substances, but at the present they are not visualized on the GIS platform.

The identification of activities that pose risks of manmade disasters (hazard identification), the creation of standardized data bases, the completion of hazard analyses, the visualization of the results on maps are the continuous task of disaster management organizations. It is possible to develop mainly by bundling the authority and professional data bases and by standardized data handling. The use of GIS shall be given priority in this activity.

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International Public Sector Accounting Standard (IPSAS) 12–Inventories: Determining exemplary requirements for military logistics systems

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In this paper the author shows that it is conceptually possible to derive from International Public Sector Accounting Standard (IPSAS) 12–Inventories exemplary requirements that can be used as a basis to assess in principle the compliance of military logistics systems with IPSAS 12. However, the utility of isolated requirements for compliance with IPSAS 12 is limited, since these requirements certainly need to be integrated with requirements derived from other IPSASs and with requirements related to the accounting system used to prepare IPSAS annual financial statements. As a result of such a requirement's integration process it is very likely that noticeable changes and/or augmentations of the proposed exemplary requirements for compliance with IPSAS 12 will turn out to be necessary.

Introduction

The intention of this paper is to contribute to closing the existing gap in the current literature with regard to practical issues typically encountered in real world implementations of International Public Sector Accounting Standards (IPSAS). While in an earlier paper [1] the question how and to what extent existing military logistics data can be reused for IPSAS financial reporting has been discussed, this paper intends to focus on the necessary capabilities military logistics system need to have in order to store and process financial data, which meet the requirements of IPSAS 12–Inventories.

Chan [2] pointed out in his analysis of the institutional and conceptual issues related to IPSAS that IPSAS neglect the system capability, i.e. the "infrastructure for collecting, recording, and summarizing financial data", which implies, in his view, the necessity of using (for IPSAS compliant annual financial statements) an accounting (information) system that has as necessary capabilities:

> "(1) the accounting equation, assets = liabilities + net assets, as its conceptual foundation;
> (2) a detailed chart of accounts for the elements of the accounting equation, as well as revenues and expenses as changes in net assets;
> (3) a double–entry recording system; and
> (4) the ability to translate standards (such as IPSAS) into specific policies and procedures applicable to the organization concerned" [2],

which "have to be incorporated in the hardware and software of the accounting system, (...)".[2]

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The intention of this paper is therefore to determine the requirements for military logistics systems that need to comply with IPSAS in order to support the preparation of IPSAS financial statements of a NATO–led or UN–led International Military Headquarters. For current and future International Military Headquarters (HQs) the compliance of their military logistics systems with IPSAS has become relevant, since both organizations decided in 2002 and 2006, respectively, to use IPSAS as the standards for the preparation of their annual financial statements.

Determining a set of exemplary IPSAS 12 requirements allows HQs to assess the degree to which their currently operated military logistics systems comply with IPSAS 12 and can also provide a basis for determining the requirements of planned future military logistics systems. The discussion in this paper is therefore applicable to a broad range of logistics systems from manual paper–based logistics systems to fully automated logistics systems that may be part of an Enterprise Resource Planning (ERP) system.

Scope of requirements

IPSAS requirements can be grouped in two major categories: requirements for IPSAS financial statements as a whole, such as qualitative characteristics like relevance, faithful representation, understandability, timeliness, comparability, verifiability, materiality, cost–benefit, the fundamental principles of completeness [3], and requirements mandated by a specific IPSAS standard, such as e.g. IPSAS 12–Inventories or IPSAS 17–Property, Plant and Equipment. From an IPSAS point of view the scope of this paper is therefore limited to those requirements that can be directly derived from IPSAS 12. [4]

Likewise, a discussion of the more generic requirements for software applications used to process information to be used in the preparation of IPSAS financial statements will be considered to be outside of the scope of this paper. Examples for such generic requirements include e.g. controls to ensure the completeness of processed data or the realisation of segregation of incompatible duties through roles–and–responsibility concepts as can be seen from the ISACA IT Auditing Guideline G21 Enterprise Resource Planning (ERP) Systems Review [5] or from the ISACA Switzerland Chapter's Guide to Auditing IT Applications [6]. The United States Government Accounting Office's Inventory Systems Checklist provides guidance for assessing the inventory management capabilities of an inventory system and its compliance with the applicable United States statutory requirements. [7]

Possible bases for IPSAS requirements analysis

International Public Sector Accounting Standards (IPSAS) are conceptually derived from International Financial Reporting Standards (IFRS) or the earlier International Accounting Standards (IAS), respectively. A future goal of the International Public Sector Accounting Standards Board (IPSASB) is the convergence of IAS/IFRS and IPSAS. [8] [9] Guidance on the IFRS requirements for private sector inventory systems could therefore in principle form *mutatis mutandis* the basis for IPSAS requirements of public sector (including military) logistics systems.

While an Exposure Draft is foreseen for September 2013 [10], to date there is no IPSAS on the first–time adoption of IPSAS. In addition IFRS 1 First–Time Adoption of IFRS [11]

does not discuss any practical implementation issues related to the first–time adoption of IFRS or, by extension, IPSAS. Likewise, the IPSASB Recommended Practice Guidelines [12] [13], and the official SIC–Interpretations (for IAS) [14], and IFRIC–Interpretations (for IFRS) [15] all focus exclusively on accounting issues in the narrower sense.

While noticeably more practically oriented than the above authoritative guidance, the IPSASB Study 14 Transition to the Accrual Basis of Accounting: Guidance for Governments and Government Entities [16] includes nonetheless only a rather limited discussion of the role logistics systems play in the implementation of IPSAS, despite the fact that traditional governmental accounting standards, such as cash–based accounting usually do not mandate that all assets – including in particular items of inventory and items of property, plant and equipment have to be reported in the annual financial statements, as Bergmann emphasizes in his criticism of cash–based accounting. [17]

Although there is already substantial literature on the major issues typically encountered in IAS/IFRS implementations, only very few authors, such as e.g. Bastos [18], or Brown [19] give at least some high–level indications of the areas, where financial information systems have to be reviewed *in concreto* in order to ascertain that they are capable of providing the financial information necessary for the preparation of IAS/IFRS compliant financial statements.

The comparative study of Christiaens and Reyniers [20] on the impact of IPSAS on reforming governmental financial information systems concentrates on conceptual issues at the central government or local government level rather than on requirements for systems to be used in real–world implementations of IPSAS.

The compliance of information systems with laws, rules, regulations or standards is only implicitly discussed in the existing literature. One possible explanation could be that compliance of information systems are seen largely as one of many requirements an existing or planned system has to fulfill. Additionally, for most systems the documentation made available by the software vendors will be limited to user documentation and to a certain extent of technical documentation, leaving systems essentially as black boxes with limited possibilities to actually test them for compliance. This is particularly problematic with regard to most ERP systems, where as a consequence of the numerous configuration possibilities through parametrisations two real–world ERP implementations can almost never be considered identical. The example of the compliance certification of the Oracle 12 E–Business Suite for compliance, German Generally Accepted Accounting Principles (Grundsätze ordnungsmässiger Buchführung), shows that a statement of compliance is directly linked to a certain, well defined set of parameters used for the configuration of the ERP–System. [21]

From the above overview of the existing literature it can therefore be seen that there is indeed a need to determine the requirements for both existing and planned military logistics systems that need to comply with IPSAS 12 Inventories.

The concept of systems requirements analysis

Grady defines a requirement as “an essential attribute or characteristic for a system or an element of a system” [22] and the analysis of system requirements is, as Boehm notes in his discussion of the historical development of software engineering in the 20th and 21st century, always an early, if not the first, activity in the various software development life cycle models that emerged in the recent decades. [23]

The challenge in requirements analysis is to determine and document the system requirements in such a way that they are unambiguous and can be objectively validated and verified (V&V) or – in short – that they are testable. [24]

For developing requirement documents for large–scale systems Grady [22] recommends following the guidance from United States Military Standards (MIL–STD) 961D/E [25] and the successor standards of MIL–STD–490A, which define inter alia the structure, language style, and format of such requirements documents. MIL–STD–961E specifies that "(…) 'shall' (...) shall be used (...) whenever a requirement is intended to express a provision that is binding.", which – together with the expression "in accordance with" for citing references is considered to be a straightforward approach for documenting IPSAS requirements. [25]

Exemplary IPSAS 12 requirements for military logistics systems

While all items typically managed with a military logistics systems can be classified through a NATO Supply Classification Code, not all items will necessarily be items of inventories in accordance with IPSAS 12 *Inventories*, since some items may require reporting according to IPSAS *17 Property, Plant and Equipment* or — in the case of Group 87 Agricultural Supplies and Group 88 Live Animals — in accordance with IPSAS 27. Agriculture is outside the scope of this paper, since it should be reported in accordance with IPSAS 27 Agriculture. [1]

Recapitulating that IPSAS does not consider system capabilities — as pointed out by Chan [2] — a real–world implementation of IPSAS inevitably encounters the question, which actual capabilities of a system used – alone, or together with other systems – are needed in order to support the preparation of IPSAS compliant financial statements. Depending on the nature of the entity, the system concerned will need to comply with a larger or smaller number of other IPSAS standards in addition to IPSAS 12.

For deriving the requirements from the IPSAS 12 standard the following approach has been used: The text of the standard has been analysed and the intended result of an individual provision of the standard has to be worded in such a way that the result is a requirements statement that is unambiguous and can be verified and validated, but is at the same time neutrally worded, so that the requirements can be used to both analyse a broad range of comparable systems, such as e.g. paper–based logistics systems, Government–Off–The–Shelf (GOTS) logistics systems as well as Commercial–Off–The–Shelf (COTS) logistics systems and to provide, at the same time, requirements for the development and implementation of new systems.

Based on the above discussion the following exemplary requirements are proposed as basic requirements for compliance of a military inventory logistics system with IPSAS 12:

1. **Minimum item properties in accordance with IPSAS 12**
   a. The system shall for each item that meets the definition of IPSAS 12 and can be classified with a NATO Supply Classification Code (except Groups 87 and 88) provide at least the following item properties (different methods for realisation of the requirement are possible, the property names and property values are provided below for illustration of the concepts only) [26]:

Property Name	Proposed Property Values
ItemType	Inventory, PPE
ItemTransactionType	ExchangeTransaction, NonExchangeTransaction
ItemInterchangeable	OrdinarilyInterchangeable, NotOrdinarilyInterchangeable
ItemCost	Monetary amount
ItemFairValue	Monetary amount
ItemCarryingAmount	ItemCost, ItemFairValue
ItemDeferredSettlement	Yes, No
ItemFinancingElement	Monetary amount
ItemFinancingElementApportioning	List of monetary amounts
ItemDistribution	Yes, No
ItemCurrentReplacementCost	Monetary amount
ItemCostFormula	FirstInFirstOut, WeightedAverageCost
ItemWeightedAverageCost	Monetary amount
ItemWritedownAmount	Monetary amount
ItemReversedWritedownAmount	Monetary amount
ItemExpense	Monetary amount
ItemQuantity	nteger number (0, 1, ...N)
ItemDescription	Text in accordance with nomenclature
ItemFairValueLessCostsToSell	Yes, No
ItemTransactionHistory	List of transactions related to the item
ItemNATOStocknumber	4–digit number (Group/Class)
ItemBudgetAccount	Integer number or string
ItemAssetAccount	Integer number or string
ItemExpenseAccount	Integer number or string

2. **Item categories in accordance with IPSAS 12,2–9 and 11, and IPSAS 17**
   a. The system shall be capable of grouping items of inventory in accordance with IPSAS 12 (IPSAS 12,2–9 and 11) on the one hand and items of property, plant and equipment in accordance with IPSAS 17 on the other hand. [27]
   b. The system shall query the user at the time an item is created in the system to select the appropriate item category in accordance with IPSAS 12 and IPSAS 17 and shall record the selected item category by setting the *ItemType* to *Inventory* in the case of an item of inventory and to *PPE* in the case of an item of property, plant and equipment. [27]
   c. In the case the *ItemType* is set to *PPE* the system shall process the item in accordance with IPSAS 17 Property, Plant and Equipment, which is described in a separate requirements document. [27]
3. **Exchange Transactions and Non–Exchange Transactions in accordance with IPSAS 12.9 and 17 and IPSAS 9**
   a. The system shall be capable of grouping items of inventory that have been obtained by the entity as the result of an exchange transaction on the one hand and items of inventory that have been obtained by the entity as the result of a non–exchange transaction on the other hand. [28]
   b. The system shall query the user at the time an item is created in the system to select the appropriate item property and shall record the selected item category by setting *ItemTransactionType* to *ExchangeTransaction* in the case of an item of inventory obtained by the entity as the result of an exchange transaction and to *NonExchangeTransaction* in the case of an item of inventory obtained by the entity as the result of a non–exchange transaction. [28]

4. **Ordinarily interchangeable items and non–ordinarily interchangeable items in accordance with IPSAS 12.9**
   a. The system shall be capable of grouping items of inventory that are ordinarily interchangeable on the one hand and items of inventory that are non–ordinarily interchangeable on the other hand. [29]
   b. The system shall query the user at the time an item is created in the system to select the appropriate item property and shall record the selected item property by setting *ItemInterchangeable* to *OrdinarilyInterchangeable* in the case of an item of inventory that is ordinarily interchangeable and to *NotOrdinarilyInterchangeable* in the case of an item of inventory that is not ordinarily interchangeable. [29]
5. **Measurement of inventory items resulting from exchange transactions in accordance with IPSAS 12.18–27**
   a. The system shall query the user to enter the monetary amount for the item of inventory's cost of purchase and any other applicable costs. [30]
   b. The system shall set the value of the item of inventory's *ItemCost* property to the sum of the monetary amount for the cost of purchase and of all other costs entered by the user. [30]
   c. The system shall set the initial value of *ItemCarryingAmount* to the value of the *ItemCost* calculated in the preceding step. [30]
6. **Measurement of inventory items purchased on deferred settlement terms in accordance with IPSAS 12.27**
   a. The system shall be capable of grouping items of inventory that have been purchased on deferred settlement terms on the one hand and items of inventory that have not been purchased on deferred settlement terms on the other hand. [31]
   b. The system shall query the user at the time the purchased item of inventory is recorded in the system to select the appropriate item property and shall record the selected item property by setting *ItemDeferredSettlement* to *Yes* in the case of an item of inventory that has been purchased on deferred settlement terms and to *No* in the case of an item of inventory that has not been purchased on deferred settlement terms. [31]
   c. If *ItemDeferredSettlement* has the value *Yes*, the system shall query the user to enter the financing element of the purchase of the inventory item and shall record the amount of the financing element in *ItemFinancingElement.* Then the system shall query the user for the apportioning of the financing element over the period of the financing and shall record the apportioning in *ItemFinancingElementApportioning*. [31]
7. **Measurement of inventory items resulting from non–exchange transactions in accordance with IPSAS 12.18–27**
   a. The system shall query the user to enter the monetary amount for the item of inventory's fair value cost and shall record this amount in *ItemFairValue*. [30]
   b. The system shall set the value of *ItemCarryingAmount* to the value of the *ItemFairValue* entered in the preceding step. [30]
8. **Items of inventory held for distribution at no charge or for a nominal charge in accordance with IPSAS 12.18–27**
   a. The system shall be capable of grouping items of inventory held for distribution at no charge or for a nominal charge on the one hand and items of inventory not held for distribution at no charge or for a nominal charge on the other hand. [30]
   b. The system shall query the user at the time an item is created in the system to select the appropriate item category and shall record the selected item category by setting *ItemDistribution* to *Yes* in the case of an item of inventory held for distribution at no charge or for a nominal charge and to *No* in the case of an item of inventory not held for distribution at no charge or for a nominal charge. [30]
   c. The system shall allow the user to change the value of *ItemDistribution* at a later point in time after the item has been created in the system. [30]

9. **Measurement of inventory items held for distribution at no charge or for a nominal charge in accordance with IPSAS 12.18–27**
   a. In the case that *ItemDistribution* has the value *Yes*, the system shall query the user to enter the monetary amount for the item of inventory's current replacement cost and shall set *ItemCurrentReplacementCost* to the monetary amount entered in the preceding step from the amounts entered by the user. [30]
   b. Then the system shall set *ItemCarryingAmount* to the lower of *ItemCost* and *ItemCurrentReplacementCost* of the item of inventory. [30]
10. **Measurement of non–ordinarily interchangeable inventories resulting from exchange transactions in accordance with IPSAS 12.32–37**
   a. If *ItemInterchangeable* has the value *OrdinarilyInterchangeable* the system shall apply the procedure listed below under 11. [32]
   b. If *ItemInterchangeable* has the value *NotOrdinarilyInterchangeable* the system shall query the user to enter the monetary amount for the cost of purchase and any other applicable costs. [32]
   c. The system shall set the value of the item of inventory's *ItemCost* property to the sum of monetary amount for the cost of purchase and of all other costs entered by the user. [32]
   d. The system shall set the initial value of *ItemCarryingAmount* to the value of the *ItemCost* calculated in the preceding step. [32]
11. **Cost formulas for ordinarily interchangeable items of inventory in accordance with IPSAS 12.35–37**
   a. The system shall be capable of grouping items of inventory for which the first–in–first–out cost formula is used on the one hand and items of inventory for which the weighted average cost formula is used on the other hand. [32]
   b. The system shall query the user at the time an item is created in the system to select the cost formula for an item of inventory and shall record the selected item property by setting *ItemCostFormula* to *FirstInFirstOut* in the case of an item of inventory for which the first–in–first–out cost formula is used and to *WeightedAverageCost* in the case of an item of inventory for which the weighted average cost formula is used. [32]
   c. The system shall allow the user to change the value of *ItemCostFormula* at a later point in time after the item has been created in the system. [32]
12. **Measurement of ordinarily interchangeable inventories resulting from exchange transactions in accordance with IPSAS 12.32–37**
   a. If *ItemInterchangeable* has the value *NotOrdinarilyInterchangeable* the system shall apply the procedure listed above under 10. [32]
   b. If *ItemInterchangeable* has the value *OrdinarilyInterchangeable* the system shall query the user to enter the monetary amount for the cost of purchase and any other applicable costs. [32]
   c. If *ItemCostFormula* has the value of *FirstInFirstOut* the system shall recalculate *ItemCarryingAmount* in accordance with the first–in–first–out cost formula with the monetary amounts entered by the user in above step b. [32]
   d. If *ItemCostFormula* has the value of *WeightedAverageCost* the system shall recalculate *ItemWeightedAverageCost* in accordance with the weighted average cost formula and shall then recalculate *ItemCarryingAmount* in accordance with the weighted average cost formula with the monetary amounts entered by the user in above step b. [33]
13. **Wrtiting down inventory items to net realisable value in accordance with IPSAS 12.38–42**
   a. The system shall query the user if an item of inventory has become wholly or partially obsolete and let the user select this item from the items of inventory stored in the system. [33]
   b. Then the system shall query the user for the monetary value equivalent to the full or partial obsolescence of the inventory item in accordance and shall set *ItemWriteDownAmount* to this monetary amount. [33]
   c. Then the system shall reduce the item of inventory's *ItemCarryingAmount* by *ItemWriteDownAmout.* [33]

14. **Reversing the previous write down of inventory items to net realisable value in accordance with IPSAS 12.38–42**
    a. The system shall query the user for which inventory item the reason for the prior period write–down no longer exists and let the user select this item from items of inventory stored in the system. [33]
    b. Then the system shall query the user for the monetary amount equivalent to the degree to which the full or partial obsolescence no longer exists and shall set the item of inventory's *ItemReversedWriteDownAmount* to this monetary amount. [33]
    c. Then the system shall add the value of *ItemReversedWriteDownAmount* to the item of inventory's *ItemCarryingAmount*. [33]
15. **Recording the asset account of an item of inventory**
    a. The system shall be capable of recording the asset account to be used for an item of inventory. [26]
    b. The system shall query the user at the time an item is created in the system to enter the asset account to be used for the item and shall record the selected asset account by setting *ItemAssetAccount* to the selected asset account. [26]
    c. The system shall allow the user to change the value of *ItemAssetAccount* at a later point in time after the item has been created in the system. [26]
16. **Recording the expense account of an item of inventory**
    a. The system shall be capable of recording the expense account to be used for an item of inventory. [26]
    b. The system shall query the user at the time an item is created in the system to enter the expense account to be used for the item and shall record the selected expense account by setting *ItemExpenseAccount* to the selected expense account. [26]
    c. The system shall allow the user to change the value of *ItemExpenseAccount* at a later point in time after the item has been created in the system. [26]
17. **Recognising the sale, exchange or distribution of non–ordinarily interchangeable inventory items as an expense, when there is related revenue in accordance with IPSAS 12.44–46**
    a. The system shall query the user which inventory item is being sold, exchanged, or distributed. [34]
    b. If the value of ItemInterchangeable is NonOrdinarilyInterchangeable the system shall record the value of *ItemCarryingAmount* in the expense account specified in *ItemExpenseAccount* and in the asset account specified in *ItemAssetAccount* together with the date when the related revenue is realised. [34]
    c. Then the system shall set the value of the *ItemCarryingAmount* property of the inventory item to zero. [34]
18. **Recognising the sale, exchange or distribution of an ordinarily interchangeable inventory item as an expense, when there is related revenue in accordance with IPSAS 12.44–46**
    a. The system shall query the user which inventory item is being sold, exchanged, or distributed. [34]
    b. If the value of *ItemInterchangeable* is *OrdinarilyInterchangeable* the system shall query the user for the quantity of items to be sold, exchanged or distributed. [34]
    c. If the quantity of items to be sold, exchanged or distributed is less or equal than *ItemQuantity*, the system shall calculate the expense amount in accordance with the first–in–first–out formula in the case *ItemCostFormula* has the value *FirstInFirstOut* or with the weighted–average–cost–formula in the case *ItemCostFormula* has the value *WeightedAverageCost*. [34]
    d. Then the system shall record the expense amount calculated in the preceding step c in the expense account specified in *ItemExpenseAccount* and in the asset account specified in *ItemAssetAccount* together with the date when the related revenue is realised. [34]
    e. Then the system shall reduce ItemQuantity by the quantity entered and reduce the value of the *ItemCarryingAmount* property by the expense amount calculated in the preceding step c. [83]

19. **Recognising the sale, exchange or distribution of non–ordinarily interchangeable inventory item as an expense, when there is no related revenue in accordance with IPSAS 12.44–46**
    a. If the value of *ItemInterchangeable* is *NonOrdinarilyInterchangeable* the system shall record the value of *ItemCarryingAmount* in the expense account specified in *ItemExpenseAccount* and in the asset account specified in *ItemAssetAccount* together with the date when the related revenue is realised. [34]
    b. Then the system shall set the value of the *ItemCarryingAmount* property of the inventory item to zero. [34]
20. **Recognising the sale, exchange or distribution of an ordinarily interchangeable inventory item as an expense, when there is no related revenue in accordance with IPSAS 12.44–46**
    a. The system shall query the user which inventory item is being sold, exchanged, or distributed. [34]
    b. If the value of *ItemInterchangeable* is *OrdinarilyInterchangeable* the system shall query the user for the quantity of items to be sold, exchanged or distributed. [34]
    c. If the quantity of item to be sold, exchanged or distributed is less or equal than *ItemQuantity*, the system shall calculate the expense amount in accordance with the first–in–first–out formula in the case *ItemCostFormula* has the value *FirstInFirstOut* or with the weighted–average–cost–formula in the case *ItemCostFormula* has the value *WeightedAverageCost*. [34]
    d. Then the system shall record the expense amount calculated in the preceding step c in the expense account specified in *ItemExpenseAccount* and in the asset account specified in *ItemAssetAccount* together with the date when the related revenue is realised. [34]
    e. Then the system shall reduce *ItemQuantity* by the quantity entered and reduce the value of the *ItemCarryingAmount* property by the expense amount calculated in the preceding step c. [34]
21. **Calculation of the total carrying amount of all inventory items in accordance with IPSAS 12.47–50**
    a. The system shall calculate the total carrying amount of all items of inventory as the sum of the *ItemCarryingAmount* properties of the individual inventory items. [35]
    b. The system shall output the total carrying amount of all item of inventory. [35]
22. **Calculation of the carrying amount of inventory items in classifications in accordance with IPSAS 12.47–50**
    a. The system shall be capable of reporting the carrying amounts of inventory items by the common classifications of inventories, merchandise, production supplies, materials, work in progress, finished goods or by user–defined classifications. [35]
    b. The system shall calculate and output for each classification of inventories the sum of the respective inventory items. [35]
23. **Calculation and output of the carrying amount of inventory items carried at fair value less costs to sell in accordance with IPSAS 12.47–50**
    a. The system shall query the user which inventory items are carried at fair value less costs to sell (i.e. at residual value). [35]
    b. The system shall calculate and output the sum of those inventory items carried at fair value less costs to sell. [35]
24. **Calculation and output of the amount of inventories recognised as an expense during the accounting period in accordance with IPSAS 12.47–50**
    a. The system shall calculate and output for each expense account the amount of inventories recognised as an expense during the accounting period. [35]
25. **Calculation and output of the amount of write–downs of inventories recognised as an expense during the accounting period in accordance with IPSAS 12.47–50**
    a. The system shall calculate and output for each classification of inventories the sum of the respective inventory items. [35]

26. **Calculation and output of the amount of reversals of write–downs of inventories recognised as an expense during this accounting period or prior accounting periods in accordance with IPSAS 12.47–50**
    a. The system shall calculate and output for each classification of inventories the sum of the *ItemReversedWriteDownAmounts.* [35]
27. **Calculation of the carrying amount of inventories pledged as security in accordance with IPSAS 12.47–50**
    a. The system shall query the user which items of inventory have been pledged as security. [35]
    b. The system shall calculate and output the sum of the *ItemCarryingAmount*s of all items of inventory items that have been pledged as security. [35]

Conclusion and outlook

The above discussion has shown that — in principle — exemplary requirements for the compliance of military logistics systems can be derived from IPSAS 12–Inventories.

However, several of the found requirements such as e.g. requirement 16 Recording the expense account of an item of inventory directly confirm the opinion of Chan that IPSAS implicitly take for granted that an "accounting system with sophisticated features" has already been implemented and that such an accounting system is based both on double–entry book–keeping and on the IPSAS accounting equation and has *inter alia* a sufficiently detailed chart of accounts [2]. The wide–ranging requirements that hide behind these "sophisticated features" can be seen e.g. in the Generally Accepted Principles for IT–based Accounting Systems (Grundsätze ordnungsmäßiger DV–gestützter Buchführungssysteme) issued by the German Federal Ministry of Finance [36].

Following Grady the process of requirements integration ensures that all requirements of a system taken together, i.e. "the complete set of requirements" [22: 395] are reduced to the minimum number of requirements, complete and balanced, and are mutually consistent. [22: 395] IPSAS 12 requirements therefore would need to be integrated with regard to requirements derived from other IPSASs and with requirements related to the link of the military logistics system with the accounting system used to prepare IPSAS annual financial statements.

More likely than not the exemplary IPSAS 12 requirements proposed above need to be noticeably changed and/or augmented depending on the characteristics of the accounting system used and other factors external to the military logistics system.

From the text of IPSAS 12 it is not a straightforward move to derive concrete requirements for the historical data that have to be stored for an item, such as transaction history, which is of high relevance, e.g. for writing down the carrying amount of an item and possibly reversing fully or partially this write down in later accounting periods. Additionally, the practical effort for storing large amounts of historical data for items with a high turnover but small individual carrying amount can be expected to be considerable

Another issue in which further research would be desirable would be to explore, if other ways of documenting requirements, such as using models, graphics or tables are better suitable for documenting IPSAS requirements than the written (narrative) requirements proposed in this paper. [22: 395]

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(Specialized) Technical and medical reconnaissance of disaster–affected areas

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Following a disaster in the affected area secondary impacts also prevail besides primary ones. It is important to know these impacts because rescue operations should be based on them. The implementation of the activities with the aim of managing the consequences is commanded and controlled by the onsite commander in all cases. As a leader, he makes decisions based on assessment. This method is appropriate if it is built on the reconnaissance information and data of the affected zone. Depending on the features of disasters, the most frequent reconnaissance methods of the disaster area are the technical and medical reconnaissance. In this article, the authors review the purposes, functions and correlations of these scopes of tasks with the decisions of the onsite commander. On the other hand, they systematize the types of technical reconnaissance and the applicable reconnaissance methods and tools. Furthermore, they examine the main tasks, requirements and elements of medical reconnaissance.
Keywords: disaster area, specialized reconnaissance, building diagnostics, cable search, public utilities, specialized medical reconnaissance

Introduction

In natural and man–made disasters, it is crucial to identify the appropriate rescue tasks from the aspect of intervention and rescue activities, and the outcome of disasters.

The adequate reconnaissance of the disaster–affected area is essential for the thorough and safe response and efficient damage control.

The former requires special expertise and tools and relates to the entire territory of the affected area. Following the occurrence of a disaster, response and recovery units need abundant information on the needs of the disaster response forces. [13: 1]

The primary and secondary assessment of the situation is based on the data provided by the reconnaissance of the disaster area; thus, it is a fundamental element of rescue operations. Following a widespread catastrophic incident, onsite commanders must make decisions based on the incoming data and information. The consequences of “hasty” or improvised decisions, regardless of the information collected, may be the use of an inefficient and unduly expensive technique, thus causing unprecedented damages in human lives and property. Therefore, we may say that reconnaissance and its special type called specialized reconnaissance is essential in the course of recovery following a disaster.

Due to the unexpected occurrence of disasters and the urgency of intervention, it is necessary to get prepared for the reconnaissance of the areas potentially prone to disasters already

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in the prevention period. The question arises as to how we can define disaster assessment (reconnaissance); which are its special forms; what the differences between technical and medical reconnaissance are; and how they can be related to the decisions made during the response activities. Hence, the functions, types, possible tools or instruments and the techniques of reconnaissance procedures must be defined. In this article, the authors answer these questions and systematize the theoretical and practical issues of the two main forms of reconnaissance.

1. Definition and types of reconnaissance of disaster–affected areas

The meaning of reconnaissance of areas damaged by natural or human–related disasters is collecting information, which delivers data on the features of the disaster area, the possible ways of protection, the probable consequences of the phenomenon and the possibilities of preventing the disaster's escalation. The evaluation of data gained in the course of reconnaissance takes place according to the following:

- the evaluation of the general conditions of the disaster areas,
- the viability of the terrain and roads, assessment of the level of damages,
- the assessment of the location, the condition of shelters and the number and vulnerability of persons located outdoors,
- the assessment of the condition of public utilities, and the potential consequences of damages occurring in the systems,
- the exploration of the sectors of the terrain contaminated by radioactive, biological or chemical substances,
- the determination and definition of the location of the facilities and buildings, which are needed to accomplish the rescue, decontamination and supply tasks,
- the assessment and forecast of the present and the expected changes in the weather conditions. [1]

Following the assessment and verification of the information collected, the data is systematized and prioritized by its features and importance in order to ensure the immediate provisions. In the past, reconnaissance had to fulfill the requirements of continuity, up–to–dateness, being purposeful, timeliness, credibility flexibility and adequate detailedness. These requirements are valid nowadays as well, although they are supplemented by the rule of complexity and systems approach.

As we can see, the efficient assessment process is an indispensable element of thorough planning and response. Its main functions are to help the government and defense forces in treating the effects of disasters. On the other hand information originated from disaster assessment facilitates the interoperability of the response teams. Overall, therefore results are intended to measure the extent and the impacts of the disaster, and the government can make a decision about the necessary level and requirements of response and about the needs of international assistance, as humanitarian intervention with urban search and rescue teams (USAR teams) or humanitarian aid. Internationally, the efficiency of disaster assessment often based on the combination of two components; observation and semi–structured interviews taking into account that representative data or information can be useful as well. There is a close connection between observation and visual reconnaissance, since both of them

are based on visual impressions besides smells and sounds. This type of disaster assessment often starts with a walk around the affected zone. Semi–structured interviews — held with local inhabitants, survivors, casualties, representatives of survivors or key officials — have no rigorous framework and specific protocol or order. Questions are not decided preliminary, thus interviewers have freedom to vary their questions to the interview context and to the people they are interviewing. [2]

In international interventions onsite reconnaissance inspectors usually use assessment checklists which help them in planning and implementing the assessment. These checklists include the major sectors of humanitarian activity consisting of questions that need to be observed and answered in the course of reconnaissance activity. In many cases, some of the questions require specialized reconnaissance. Checklists provide data in the following fields: [2]

- nature of disaster (Table 1),
- urban search and rescue (USAR),
- shelter and personal/household items,
- health,
- water and sanitation,
- food and nutrition,
- and logistics.

Subject	Indicative information
Main event.	Date and time (local and UTC). Duration. Strength.
Subsequent events and expected developments.	Aftershocks. Weather forecast. Water level rising/falling. Flooding expected to rise/recede.
Affected area.	Name of region, province, and/or district (be aware of conflicting local names). Provide GPS or other map coordinates. Major cities/urban centres/villages. Approximate size of affected area in square km. Topography.
Population.	Estimate total population in affected area. Estimate percentage of affected population. Socio–economic characteristics (rural, urban agricultural, industrial, nomadic, low–income).

Table 1. Assessment checklist of nature of disaster
(Edited by the authors) [2]

The reconnaissance of disaster–affected areas can be grouped by its types and methods (Figure 1). By type we can distinguish general, specialized and particular reconnaissance. According to the methods of reconnaissance there are terrestrial and particular reconnaissance. The latter includes aquatic and aerial reconnaissance.

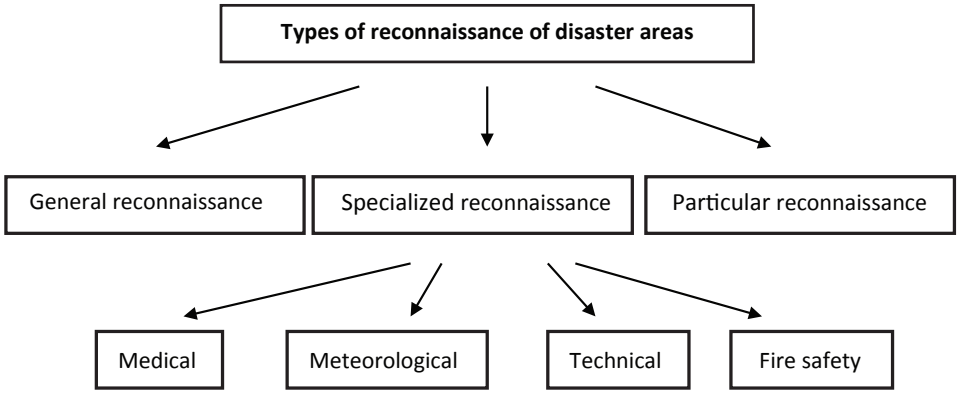

Figure 1. Types of reconnaissance of disaster areas
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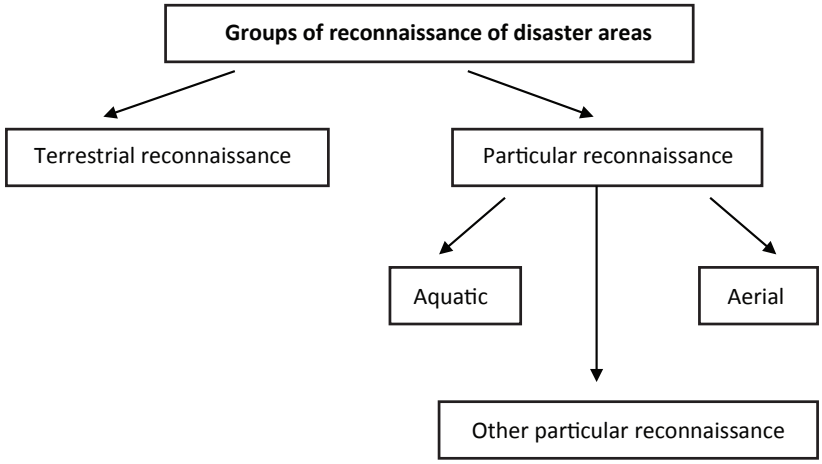

Figure 2. Grouping of reconnaissance of disaster areas
Edited by the authors [3: 82]

The type of assessment of disaster areas highly influences the method of reconnaissance. With regard to the methods, we distinguish terrestrial, aquatic, aerial and other reconnaissance (Figure 2). Aquatic and aerial reconnaissance are often called particular reconnaissance. In the following, let us examine the features of general and specialized reconnaissance.

General reconnaissance

During general reconnaissance the main objective is to collect basic information and data on the stricken area. Before this, the selection of the reconnaissance area and forces as well as the determination of safety regulations are necessary. The information gathered (i.e. reconnaissance data) is evaluated, reconnaissance inspectors make conclusions and forward it to

the so–called head of protection and the response control persons, who can make their decisions on the further steps and actions necessary based on these raw data and results.

During the process of collecting information, the objective is to search for a source of information (a person, a facility or an object) irrelevant of the incident area. [3]

General reconnaissance is the first phase of situation assessment. In justified cases, search continues with the help of specialized reconnaissance.

Specialized reconnaissance

Specialized reconnaissance becomes necessary when the results of the general reconnaissance are not sufficient for the performance of tasks related to mitigation and recovery of damages. As obtaining important information is necessary, it requires the use of special forces and devices. Furthermore, specialized reconnaissance has to cover the entire territory of the disaster–affected area; for example, in case of damage to a chemical plant, the measurement of the concentration of poisonous substances is not only carried out in the immediate vicinity but also extended to the vulnerable area surrounding the plant.

The special monitoring of mission areas is carried out by specialized forces using special vehicles and devices. [4] The authors would like to call the attention to the fact that these actions or interventions are system–based activities and not independent ones.

The types of specialized reconnaissance are as follows:

- radiological, biological, chemical,
- meteorological,
- medical,
- animal welfare and phytosanitary,
- technical,
- and fire safety reconnaissance.

In many cases, the activities listed above are implemented simultaneously, since, depending on the characteristics of a given mission area, several specialized reconnaissance processes may become necessary in order to be able to make right decisions later. In case of terrestrial reconnaissance, gathering information and the reconnaissance of the danger source can be performed from a fix point, by vehicle, in form of patrolling or scouting. Aquatic reconnaissance is usually performed by reconnaissance platoons with tools and devices capable of working under and on water. Generally speaking, their activities are as follows: examination of the hydrological parameters and the identification of the phenomena and objects that endanger the operation of facilities. In case of aerial reconnaissance, the main objective is to determine the extent and the expected directions of the spread of the disaster with the help of aircraft.

The use of this technique is significantly effective in non–approachable or hardly approachable areas and during the escalation of disasters; the information on the escalation is immediately needed in order to prevent secondary impacts and to protect human lives. Examining the specialized forms of reconnaissance, besides aquatic and aerial reconnaissance, we may also mention some other special reconnaissance techniques needed to adapt to the special environmental conditions of the danger source. Such activities are, for instance, cave, mountain or satellite reconnaissance. They can be coordinated by specially trained and prepared specialists. [5]

After the presentation of the general features, types and methods of reconnaissance of disaster areas, let us examine what kind of tasks have to be done during the process of reconnaissance.

2. The scope of tasks of reconnaissance of disaster areas

The efficient and productive process of reconnaissance of disaster–affected areas consists of strongly correlated activities. Regarding chronology, reconnaissance operations have the following elements:

1. planning, identification of the affected areas;
2. designation of the reconnaissance observers/patrols/squads/groups;
3. the reconnaissance itself, collecting information, measuring and recording data;
4. the evaluation, aggregation and — if needed — verification of the information and data gathered. [3]

Regarding the sudden occurrence of disasters, usually there is not enough time for planning of the reconnaissance activities immediately before the response, thus these activities must be performed during the preparatory period. Recon forces and commanders can best rely on reconnaissance maps of the disaster area, because they provide extensive information on the location of recce squads, rescue forces and significant buildings or facilities, the allocation of the necessary technical equipment and the possible routes of relocation in order to be able to determine the reconnaissance directions and routes in the most precise and effective way. [3]

To gather information — which is considered the main target of reconnaissance — specialists apply the methods and techniques of identification, observation, assessment and search. The implementation of these tasks can be done through target spotting or patrolling with the use of equipment suitable for the given circumstances. The objective of this process is to map and ensure the requirements of the effective, successful and safe activity of the response teams besides protecting human lives and property. Furthermore, an absolutely relevant role of reconnaissance is to be able to detect the changes in the movement of the response forces in time in order to be prepared for rapid decisions. In case of changes suddenly occurring, an escalation or a new hazard, the former conditions are basic requirements for a fast and adequate realignment of implementation. [5]

Assessing the areas damaged by disasters, it is obvious that all involve damages of medical or technical nature. We can state that it is not possible to make reasonable decisions without collecting information on them. Therefore, in the following chapter we will analyze specialized technical and medical reconnaissance tasks and activities.

3. Specialized technical reconnaissance

The objectives of specialized technical reconnaissance are to provide analyzable data on the status, the conditions and the extent of sustained damages of buildings, infrastructural elements and the public utility system, the required number of forces to be involved, rescue and reconstruction efforts and the equipment needed during the response. Furthermore, during the process of specialized technical reconnaissance, experts analyze the ways in which buildings become ruined and the possibility of rescuing civilians from under the ruins, on the

other hand, they also estimate the possible number of people trapped under the debris and the chance of being alive. Prior to technical rescue and intervention, by evaluating assessment information, it is important to find out if life–threatening conditions exist, the dimensions of the disaster zone and the features of hazards. Furthermore, it is necessary to prioritize response tasks, and — if it is reasonable — to carry out simultaneous activities.

Additionally, the experts must determine the method of supporting the response forces and ensuring the required equipment, and they also have to confine the incident sites by designating safety boundaries and prepare for a possible evacuation.

According to the above mentioned and based on disaster descriptions or reports, we may say that the two main elements of specialized technical reconnaissance are the assessment of the condition of buildings (generally called building diagnostics) and the localization of damages to the public utility system and the identification of the probable future consequences. The following chapter discusses the suitable methods.

3.1 Processes and methods of building diagnostics

Basically, the purpose of the diagnostic processes is to estimate the level of ruin of buildings and other structures. The aim of building diagnostics (implemented after the onsite assessment), is to determine the extent of damages. During damage assessment, the correlations and the priority of damage phenomena can be identified. During the specialized examination of the building conditions, it is highly important to scrutinize the load–bearing structures and support beams of buildings, as these elements strongly influence the extent of damages, the vulnerability of human lives and the possibility of collapse. Depending on the circumstances and the extent of damages, the examination of structures consists of the following activities:

- visual inspection,
- detection of structural faults (damage–free or non–damaged environment),
- examination of edges and joints,
- thermo–dynamical calculations and onsite measurements in case of the shift of support structures,
- examination of ceiling and roof structures. [6]

Following disaster incidents (e.g., earthquakes, gas explosions, terrorist acts, etc.), building structures are frequently distorted due to strain, sinking, cracking, heat convection and tear and wear of materials. To measure these changes inspectors use calipers, plumb lines, straight laths, and water level meters or bullets in order to determine the slope conditions. In case of minor mechanical damages, it is sufficient to use a wire brush, a chisel or a knife to diagnose damages. In case of covered structure elements, exploration procedures involving building demolition are carried out or thermal cameras are used.

In the following, we examine how the assessment of the conditions of the individual structural elements (foundations, subtractions, load–bearing structures, ceilings, etc.) can be carried out. [6]

Foundation assessment

During building diagnostics, foundation assessment basically includes the creation of a crack image and the examination of sinking. Speaking of damages resulting from disasters, the above–mentioned two cases are closely related to each other, since, as we can see in the drawing below [Figure 3], cracks increasing the vulnerability of the building are created as a result of sinking. The position and the rate of sinking can be assessed by visual inspection. Plumb lines (in case of vertical shifts), or a strung cord, a lath, a bullet or a water level meter can be used for the measurements of deformations. [7: 45]

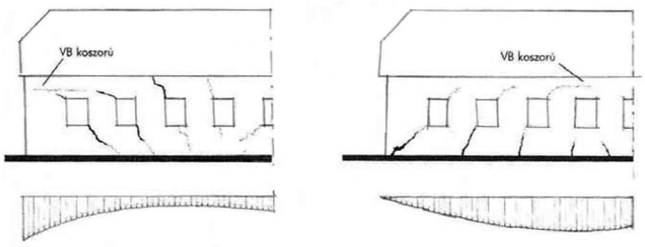

Figure 3. Rate of sinking depending on cracks [6]

If the rate of sinking and the damages of the foundation can only be determined by ground exploration, creating a maximum one–meter wide search pit up to the foundation plain might be required.

Examination of the insulation of the subtraction

The examination of the insulation of the subtraction can be implemented by the access to the insulation's endings or by opening them on a short segment. Therefore, inspectors can ascertain the materials and the layers of the insulation and they can make conclusions on the leak spots and the expected harmful impacts of the moisture on the building's structure. In case of mortar plasters or cladding, the separated cover surface can be explored with a rubber mallet or by hand. The damage to the water insulation rarely causes direct danger to life, though in medium or long term they can directly contribute to the decreasing of the load–carrying capacity of the wall structures and to the collapse of the buildings.

The examination of the vertical load–carrying and outer wall structures

During specialized technical reconnaissance the most important element of building diagnostics is the examination of the damages to the load–carrying and other wall structures that directly threaten the stability of the building's structure and can cause a direct danger to life. In case of the compression of the wall–parts, the reduction in size is relevant, on the other hand, during the examination of cracks, their lengths, directions, depths and spaciousness are relevant. These parameters have to be determined by measuring instruments. Based on crack–spaciousness categories, spaciousness exceeding 15 mm can cause the slanting and deformation of the walls or the distortion of the structure of the ceiling. The examination of

vertical wall structures can be carried out using the following methods:

- *examination of deformation*, whereby the changes of the wall structures are measured using the earlier mentioned tools: plumb lines, straight laths, strings or measuring tapes. The danger of collapse of the building prevails if the projection of the wall's center of gravity approaches the contour of the baseline,
- *examination of the damages caused by moisture*, whereby the dampening of the walls can be measured (e.g. by tapping),
- through *thermal examination*, heat bridges and condensation damage caused by precipitation can be measured,
- using *thermal cameras* the heat radiation of surfaces can be examined by thermal maps.

The examination of ceilings

During the first phase of examination of ceilings, by virtue of visual inspection it is necessary to determine if the damages on the structure of the ceiling are superficial or spread over the load–bearing structures as well. During the examination it is absolutely important to take into consideration that the cracks in the monolithic reinforced concrete ceilings must not move deeper than the reinforcing bars. In case of structures made from wood, steel or reinforced concrete, small damage is enough to cause fatal damage.

The examination of ceilings can be performed the following ways:

- *examination of cracks*, during which it is necessary to ascertain if the direction of the cracks corresponds to the direction of the bridging, or is it perpendicular to it. The latter incurs a real danger, especially with wooden and steel beam supports, since it exponentially increases the risk of fractures and collapse. In reinforced concrete structures, when the thickness of cracks exceeds 0.6 mm, further examination is needed.
- *examination of stability*, which primarily means the checking of the joints of the support structures,
- *examination of rigidness*, whereby the permanent stoops of the structural elements are measured with respect to the limit values provided by standards,
- *examination of damage caused by moisture*, whereby primarily the surface damages caused by dampening can be measured,
- *thermal examination*, during which the insulation of ceilings can be tested.

Examination of facade balconies and hanging corridors

Collapse of facade balconies and hanging corridors is extremely dangerous to people who are located inside or next to the buildings, besides the rescue forces. Subsequently, in the course of building diagnostics, these structural elements must be approached with extreme precautions. Primarily, we have to examine the method and the level of how the walls and the ceilings are joined, afterwards, the examination of damage, corrosion, cracks, moisture and stability (which ensures the verification of the joints of support structures) can be completed in the way already mentioned above. In order to check the fixation of the bars and putlogs, it is necessary to examine the fastener elements.

Examination of flat roofs

It is necessary to examine the flat roofs to avoid accidents. It should be done by uncovering the ceiling layers. This process implicates:

- checking the condition of moisture insulation,
- examination of deflection in the case of the deformation of insulation layers,
- measurement of slopes,
- examination of cavities formed during the loosening of the connections of support structures and surface layers.

The visual inspection of flat roofs should be extended to the lower plain of the ceiling, since obvious signs indicate leaks, (which highly influences stability); it can be discovered using this method.

After the examination of building structures, we should focus on the methods and protocols of the examination of public utility systems, which is another important activity of technical reconnaissance.

3.2 Augmented Situational Visualization

In many cases damage occurring in the structure of facilities can be evaluated by observing key differences between the augmented baseline image and the real view of the building. This modern way of assessment is based on Interstory Drift Ratio (IDR), which is a global measure that can be calculated from external building dimensions and conveniently used to quantify the sustained damages. Generally speaking IDR is the relative horizontal displacement of two adjacent floors which can be measured by using special equipment called Augmented Reality (AR) see–through displays (glasses) (Figure 4) connected to a portable computer device. [8]

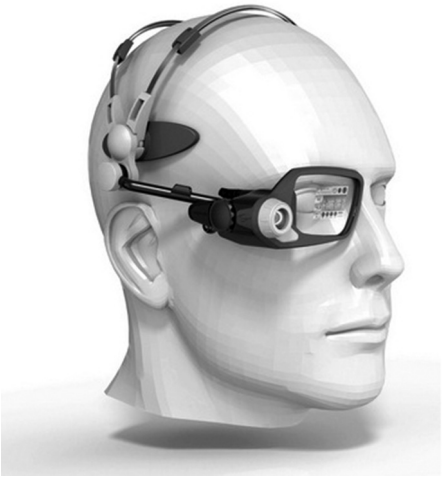

Figure 4. Augmented Reality (AR) see–through displays [15]

3.3 The special technical reconnaissance of public utility systems

Before mentioning the examination of reconnaissance procedures related to public utilities, we have to explain the elements of public utility systems. Public utilities are the collective concepts of pipe and lead systems that satisfy certain service providing demands of the population, industry, the economy or law enforcement, etc. Amongst public utility systems we distinguish the following branches:

- energy supply,
- telecommunication,
- water supply,
- sewage and rainwater drainage,
- gas supply,
- distant heating supply,
- and crude oil transport. [9]

The work aiming at the mitigation of damages to the public utility systems can be classified as a top priority response pre–task, since these can directly inhibit rescue activities and can create further harmful incidents. In the course of specialized reconnaissance, the evaluation of the location and conditions of public utilities takes place along with the assessment of the consequences of damages. Furthermore, the secondary impacts, damages and characteristics or the spread of the emergency can also be calculated. Following reconnaissance, the reconstruction of the public utility system is performed by technical rescue and special utility recovery units. Maps, data and site maps collected from the official registration of public utilities provide relevant assistance to the search activities. In order to assess and identify the damages to the utility system, localization and exploration of the pipelines are necessary with the help of instrumental observation and by opening research pits. [10]

In the following, we review the tools and equipment needed to perform the instrumental positioning of the underground pipeline system. [10]

Instrumental search of underground utility systems

The materials of cables and pipelines (which have been damaged or are needed to be examined), basically determine the applied protocol used during the instrumental search. The ultrasonic, electromagnetic or thermal camera technology can be either used in case of metallic or non–metallic pipelines. In practice, the most frequently used method is the induction pipeline search, whereby non–metallic pipeline need to be converted into an electrical conductor, (since the very basic requirement of this method is that electricity have to flow along the pipelines). The method for inducting pipelines is to fix a kind of metallic wire or string onto the body of pipeline in order to make it a conductor.

In the following, we discuss what technical devices are needed to perform the search, mapping and damage localization of the pipeline system. [10]

The radio frequency wire locators are suitable to perform both localization and depth measurement activities. Besides identifying the location of pipeline, they can also be used for examining the insulation, the condition of the pipelines and the damage to the cladding. We distinguish active sweep devices (which are in direct contact with the metallic pipelines) and passive sweep devices (which can be used in case of long pipelines with high performance signal emitters).

Magnetic wire locators are suitable for searching facilities containing metallic components, since these tools sense the magnetic field of ferromagnetic substances. Magnetic locators are generally lightweight, tractable instruments equipped with LCD monitors, on which the signal intensity can be permanently monitored. The maximum sweep depth of a device depends on the type and performance, but this value is generally approximately 8 to10 meters.

Ground Penetrating Radars (GPR) consist of the following three components: a sensor, a built–in hard disc and an antenna suitable for the reception of the signals and for the transmission of the received signals on a specific frequency into the ground following amplification. Regarding the functionality of GPR, they transmit short impulses to the tested facilities and detect the frequency and the run–time of the reflected signals.

During *reconnaissance by probe*, search is carried out by moving the transmitter cable on the ground surface. Both the receiver and the transmitter have to be calibrated to the same frequency. Before searching with digital probe, the presence of interfering signals (emitted by nearby computers, electric devices or other electric cables, etc.) has to be checked. This method is also suitable for the identification of the pipelines' location and their accurate depth, besides localizing the damages.

In case of *non–metallic pipelines*, searching is more difficult, as these public utility units do not conduct electrical signals used in the search process. Thus, a kind of an emitter must be transferred into the pipeline. The solution is a 50–meter–long search cable made of glass fiber (Figure 5), which is led into the pipelines by the searchers. After generating radio frequency into it, the pipelines can be located with the help of suitable receivers.

Figure 5. Glass fiber research cable suitable for searching non–metallic cables [16]

Based on the above, we can say that the range of devices used for searching pipelines is very wide. During the design of these devices, manufacturers focus on multifunctionality and multiple applicability. Instrumental reconnaissance can be accomplished successfully in

a very short period of time by using site plans or utility system maps. Therefore, the damages occurring as a result of disasters can be assessed, besides locating the endangered pipelines. Generally, some tools and portable measuring devices are sufficient to carry out onsite inspections during the survey of buildings and public utility systems. Nevertheless, the use of many large and special instruments is reasonable in many cases to perform the targeted inspection.

4. Specialized medical reconnaissance

The unfortunate impact of disasters are damage, deaths, and human health impairment. The identification of tasks in these mission areas cannot be implemented without thorough assessment. In the following, we examine the definition, purpose, types, functions and the methods of implementation of specialized medical reconnaissance.

4.1 The definition, purpose and function of specialized medical reconnaissance

Specialized medical reconnaissance is an activity that has the function to complement data and information (collected from the damage areas caused by disasters or other emergencies) with additional special and medico–epidemiological information and details.

Its function is to support the head of rescue in the identification and implementation of tasks related to the disaster zones. Specialized medical reconnaissance is different from general disaster assessment, since it is more comprehensive and complex. Therefore, due to its feature, this activity can only be performed by experts and groups having basic medical qualification. Regarding the implementation of specialized medical reconnaissance, we distinguish two basic types of activities:

- specialized medical reconnaissance performed during medico–epidemiological disasters,
- specialized medical reconnaissance performed during non–medico–epidemiological disasters.

Assessment should give answers to the following questions:

- What is the root cause and what are the consequences and the primary and secondary impacts?
- What is the number of casualties and the diseased, what are the features of their injuries and the expected tendencies?
- What spontaneous or organized actions have already been taken? What kind of further medical consequences can be predicted?
- What kind of medical supply system is operating during normal conditions in the area and how can it be transformed into a disaster management medical organization?
- To what an extent did the disaster affect the given system, and how can the reserves be activated? Furthermore, what other forces can be involved in the implementation of rescue activities?

The subsidiary objective of specialized medical reconnaissance is that the head of rescue operations must identify the range, boundaries, zones and dimensions of response activities with a high level of professionalism and prudence, based on the incoming data and information. Another important role is to provide detailed information on the damage to the

infrastructure in order to identify how they obstruct the implementation of the medical tasks (damages to roads or houses, etc.).

4.2 Phases and implementation of specialized medical reconnaissance

Specialized medical reconnaissance is performed by observers, scouts, patrols or recon squads. They perform their tasks by observing, patrolling, searching, sampling etc.

The main phases of the activities are:

- planning reconnaissance,
- implementing reconnaissance (collecting data and information),
- evaluating, aggregating and systemizing data,
- continuously rechecking data and processes.

The most important elements of disaster–medical specialized reconnaissance are:

- the estimated number and location of casualties,
- the identification of the types of injuries according to the following:
- by root cause (mechanical, thermal, radiation, chemical, etc.),
- by their complexity (mono–complex, poly–complex or combined),
- in case of complex injuries, the identification of the main injury,
- distribution of the severity of casualties, the proportion of children and the elderly who suffered injuries,
- circumstances that refer to further dangers of damage to health (e.g. the lack of hygiene, food and water shortage, climatic circumstances, epidemics, the condition and losses of local health care),
- the existence and condition of medical resources, pharmacies, storage, etc.,
- the direction of the mass flow of casualties, the possibilities of triage and collection of casualties,
- the possible ways of evacuation, the number of refugees, the direction of their movement,
- the condition of communal systems, the perspective hazard of undernourishment due to the lack of calories or protein. [11: Slide 23]

4.3 The relationship between medical reconnaissance, protection and rescue in the affected area

Protection and rescue are based on medical reconnaissance, as the fundamental goals of protection are saving human lives and property. Rescue activities are based on a series of decisions made by the head of rescue operations. These decisions cover the following:

- What has to be done in order to avoid the escalation of the situation?
- Which are the basic and important actions and which are the less important tasks that can be postponed for a short time, and finally, which are the tasks that can be delayed.
- What is the size of the affected area, where are the work sites situated and what kind of workplaces have to be established for the recovery of damage.
- How can the undisturbed conditions for rescue be ensured and what are the technical–medical and civil protection tasks that are needed to be carried out?
- What will be the direction of rescue and which are the forces and equipment that are needed to be put in action, furthermore, what is their location?
- How often should the shifts take place?

The answers to these questions are based on the data, information, evaluations and partial assessments provided and carried out by the assessment teams. On the other hand, according to this information, an overall view can be obtained of the tasks, the necessary forces and equipment, and other units that can be deployed. Considering these facts, the responsible persons can make decisions on the form, extent and elements that are needed to be activated and involved in medical disaster issues respecting the valid laws and hierarchy.

The main objective of specialized medical reconnaissance is to deliver information for risk analysis of the affected territory before a temporary medical relief camp can be built on the mission area. These assessment processes require professional skills in medical and humanitarian affairs including international humanitarian methodologies and laws, epidemiology, public health infrastructures, diseases, logistical needs etc. Furthermore, during international interventions, especially in developing countries, understanding of psychosocial and cross–cultural issues are absolutely relevant. Besides risk analysis, resource matrix — containing human resource assignments for the medical activities — and effective cooperation with the local forces are important elements of medical reconnaissance. [12]

Summary

The essential conditions for efficient response in the disaster–affected areas following disasters are obtaining information and collecting data, which can be performed by general or specialized reconnaissance units. In the latter case, the use of special recon units, equipment, and procedures become reasonable and have to be extended to the entire disaster area. One of the specific versions of specialized reconnaissance is specialized technical reconnaissance, whereby the survey of the condition of buildings and the survey of damage to public utility systems take place. Regarding civilians and rescue forces situated in the disaster–affected zone, the examination of the essential building structures is very important. It can be performed by visual inspection or building diagnostics carried out by measuring devices.

In the course of the former method, a general status assessment can be implemented for a rapid situation awareness. This method does not require the detailed examination of root causes. To accurately identify building diagnostic data, meticulous instrumental analysis is needed. In this article, we have systematized these tools.

One of the most frequently occurring secondary impacts of disaster are the losses resulting from the damage to public utility systems. Therefore, prevention is very important, besides the timely localization of damage occurring to the pipelines, which can also be provided for in the course of specialized technical reconnaissance. It can be concluded that without specialized technical reconnaissance, the vulnerability of the rescue forces is significant, besides civilians, since it is indispensable that the response forces must have adequate knowledge of the condition of the buildings and public utilities situated in the given area.

In the mission areas (occurring as a result of disasters and other hazards), technical damages must also be taken into account besides injuries, diseases or epidemics.

As a result of medical disasters, the features of the disaster zone are identified by the diseases, epidemics, injuries etc. Therefore, the necessary equipment, devices, forces and measures can only be identified by knowing these issues. Also based on the above, it is obvious that nowadays and even in the future, heads of rescue operations cannot avoid specialized medical reconnaissance in order to be able to make the right decisions. In the orga-

nizations responsible for protection, the number and the alert capability of experts, who are able to carry out this type of specialized reconnaissance highly influences the outcome of the disaster and the success or failure of the intervention. In this way, the importance of the reconnaissance of losses — especially medical and specialized reconnaissance — should be taken into account more seriously as one of the most significant tasks to be performed in the disaster areas.

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Support to insurgency and counter insurgency operations[1]

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Introduction

Since the end of the 20th Century the role and ultimate power of states have been diminishing. Once, states were considered untouchable no matter what happened within their borders and no matter who ruled them, but nowadays, international intervention into intra–state affairs has become quite common. Ungoverned, undergoverned, misgoverned and contested areas offer fertile ground for insurgents, extremists, organized crime and warlords to flourish and consequently endanger not only local civilian populations but also the political, security, economic or ideological interests of western powers. Consequently, two separate approaches to intra–state interventions have been developed: backing the government in their fight against the insurgency, such as in Afghanistan, and backing the insurgents in their fight against the government such as in Libya.

First, this article will analyze the changed role of the states in the New World Order and define parameters that guide international interventions into the intra–state affairs. Secondly, it will analyze western approaches to insurgency and counter insurgency operations through a case study of NATO operations in Afghanistan and Libya.

Role and status of states in the new world order

Until two decades ago, intervention in intra–state questions and crisis would have been unimaginable. This was established by the 1648 Treaty of Westphalia, which upheld the right of sovereign states to act freely within their own borders. Additionally, it was backed up by 1945 Charter of the United Nations article 2/7: *"Nothing contained in the present Charter shall authorize the United Nations to intervene in matters which are essentially within the domestic jurisdiction of any state or shall require the Members to submit such matters to settlement under the present Charter."*[1] Despite this, and in the light of the bloody and brutal conflicts of the 1990s, tension rose between principles of sovereignty and intervention. This article will answer what has changed that gives evermore authority to the international community to intervene and support one of the opposing sides in intra–state conflicts.

The end of the Cold War and the bipolar division of the world ended the support of the powerful allies to the weaker African and Asian states, many of these plummeted into civil wars for power, justice, human rights or for resources, both deficient and abundant ones.

1 This article is the written form of the presentation that was shown on the Central European Forum on Higher Military Education (CEFME) International Young Scientists Conference on December 2013, NUPS, Budapest

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Nathan Lauri states that intra–state crises most often rose from four structural reasons: authoritarian rule, the marginalization of minorities, relative socio–economic deprivation or weak states. [2]

The changes that led to these circumstances did not occur overnight. They resulted from the versatile political and apolitical factors that happened not only in the states themselves, but also in their surroundings. Most analyses indicate that instability springs from the weak dynamics of the political processes in which expectations from state and citizens are not in balance. When states cannot fulfill their societies' demands, it leads to peoples' dissatisfaction and lowering of the states' legitimacy. The fact that the state has been dragged into crisis, war or a conflict means that the crucial institutions of pre–conflict power failed in the state management, monopoly of the use of force, sustained stable social relations, protection of its citizens and, in most cases, in the protection of a functional market. In order to maintain a stable state capable of dealing with constant changes, governments need to conduct constant adjustments and alignments in: [3: 6–10]

1. *Political settlements.* They are used to emphasize centralization of state management and persuade political, industrial and military elites of the benefits of coexisting. Hobbes critically observed that *"unity among people is not natural; it comes out of a contract that is artificial."*[4: 122] Political settlements fulfill needs and interests of individuals and groups, but the ability to form and focus them towards the greater good is of crucial importance for sustainability and stability of the states.
2. *Survival functions.* States must develop capacity in relation to: security (ability to control, if not monopolize, the use of violence); revenue (the ability to raise funds sustainably, particularly through taxation) and law (the capability to rule through laws).
3. *Expected functions.* They are used to prove and verify legitimacy of state structures. They represent the minimum capacity needed for the state to exert its power over people by satisfying their basic needs.

Being involved in conflict or war additionally impedes the functioning of the states and in many cases gives room for development of new organizational forms on a sub-state level, new economies and new relations, loyalties and spheres of interests. According to Claire McIoughlin the relationship between conflict and fragility is circular: conflict is both cause and consequence of weak authority and state legitimacy. [5]

In attempts to deal with crisis, most states lose institutional capacity to fulfill their duties within executive, parliamentary or judiciary spheres. They become fragile and unresponsive. Fragility is not something that can be clearly defined; it varies in its content, intensity and capacity. Fragility has many causes — chronic and acute ones, and it leads to many consequences such as poverty, vulnerability to inter and intra state conflicts, inability to deal with humanitarian disasters and a high risk of states' political collapse. Governments that lack resources and expertise to resolve disputes and grievances and to protect their legitimacy to manage competition and protect the rights of citizens, enable individuals and groups to disrupt their governance even more and seize power by all means available and deemed necessary. [2]

Bloody and ruthless clashes stemming from the aforementioned fragility raise multiple concerns: those for human security, state and regional stability and development and economic growth as well as a strong belief that instability and underdevelopment are mutually interlinked and supported. Nathan stated that "*Large–scale domestic violence prevents the*

attainment of security communities because it renders people and states insecure, generates uncertainty, tension and mistrust among states, and creates the risk of cross–border violence." [6] In other words, weak and fragile states can no longer "keep" their insecurity within their borders, uncontrolled terrain becomes the training ground for terrorists, extremists and criminal groups as weapons, drugs, people and other contraband flow through the regions unchecked and enters rich countries of the West. This raises alarm within the international community and it rises to arms and gets involved in the fight.

Insurgency vs Counterinsurgency

As stated in the previous chapter, main threats, insecurities and instabilities for the western powers come from weak, fragile and dysfunctional states. They are most often involved in some type of inner struggle, crisis or conflict. Before we can explain foreign involvement in the support of insurgents or the governments fighting against them, this article will define main principles of insurgency and counterinsurgency.

Insurgency

NATO defines insurgency as "*the actions of an organized, often ideologically motivated, group or movement that seeks to effect or prevent political change of a governing authority within a region, focused on persuading or coercing the population through the use of violence and subversion*." [8: 1–2] Insurgents attempt to achieve their goals through the use of various political and military means, applying tactics such as violence, subversion and propaganda.

Insurgencies normally seek to achieve one of three objectives:

1. to overthrow the existing government in order to reallocate power,
2. to expel whom they perceive to be "outsiders" or "occupiers" or,
3. to seek to create or maintain a region where there is little or no governmental control that they can exploit. [8: 2–7]

Need, will, and motivation to rebel come out of core grievances stated previously in the text: feelings of suppressed socio–cultural identity that is conflicting (such as the black majority against apartheid in South Africa in 1980s); religion (as was the cause of 30–years of rebellion of Christian blacks in the south Sudan against the ruling Arab Muslims of the north Sudan ending in 2010); economy; corruption and lack of essential services (such as in Egypt during the Arab spring movements of 2010); repression (such was in Libya under Gaddafi's rule); foreign exploitation and occupation (as was the case in Vietnam during 1960–70s) etc.

Both NATO and US counterinsurgency doctrines recognize that for both insurgents and governments they fight, population vulnerability is a key prize. Under the right leadership and ideological cloak, the population may bring prevailing victory to one side or the other. Thus, one of the main steps for insurgents is to convince and prove to the population that the ruling government is incapable of providing and securing them. In order to do this, insurgent organizations must create good "management" structure that is most often made up of five elements: leaders, guerrillas, underground, auxiliaries and mass base. [8: 3–12, 13]

Leaders provide vision, direction, guidance, coordination and organization for an insurgent movement. They have force of personality, the power of revolutionary ideas and personal charisma. There are generally three categories of leadership: single person, single group

or party and group of groups. One person leadership structure has one person who provides cohesion, motivation and direction for the insurgency. Such was Osama Bin Laden for Al–Qaida. The insurgency may be headed by a ruling council that makes and executes policy. The lead group contains many leaders with different concepts of how the movement should be conducted or lead.

A guerrilla does the actual fighting for the insurgency. The RAND study on trends in outside support for insurgency concludes that *"In ideological, religious and nationalist insurgencies, militants risk their lives, and possibly those of their friends and families, to further the set of beliefs. Thus self-reliance, dedication to the struggle and self–denial are extremely useful qualities in rebel groups."*[9: 83] They are usually the faceless masses that execute the leader's visions and ideas.

The support can be external, internal or an underground one. It gathers active supporters who usually must operate secretly, especially during the preparation of the insurgency. The underground may spread propaganda, support sabotage, assassination and subversion, support intelligence and counterintelligence operations, run safe houses, provide transportation and manufacture and maintain arms and explosives. [8: 2–4] In its' study of outside support for insurgent movements RAND diversified three main forms of support to rebels: *critical* ones (such as providing safe haven, transit, finances, political support and propaganda, and sometimes even direct military support); *valuable* ones (such as training, weapons and materiel); and *minor* forms of support (such as fighters, intelligence, organizational aid and inspiration). [9: 84–102]

An auxiliary is the support element of the insurgency (usually they are children and women). They provide important logistical services safer than the underground does, and they do not directly participate in operations. Examples of support that auxiliaries provide include: storing weapons and supplies, performing courier operations, providing passive intelligence collection, giving early warnings of counterinsurgent movements, acquiring funds from lawful and unlawful sources, providing forged or stolen documents, promoting and facilitating desertion of security forces, recruiting and screening new members, creating and spreading propaganda, providing medical support and manufacturing and maintaining equipment. [8: 3–16]

The mass base consists of the population of the true silent supporters of the insurgent movement. Leaders often recruit members of the mass base, who are actively oriented, to serve as auxiliaries, underground or guerrillas.

NATO COIN doctrine identified main insurgents' vulnerabilities that become exposed during their fight. [7] First among these is security. As the insurgency expands, it becomes harder to keep their activities, locations and key personnel a secret, which exposes their "flanks" to government COIN ops. There is an inherent tension between the need to grow popular support and the need to maintain organizational security. It directly influences where they wish to establish their bases of operations – further away from center would be safer but harder to act; however, placing them close by would increase the risk of getting discovered.

If insurgents decide to decentralize their organization to increase safety, they face another set of challenges: the flow of information, resources, encouragement or directions become much harder. Having longer and more exposed lines of supply make them more vulnerable and fragile. But decreasing support could make their members feel secluded and isolated, which could lead to development of their own narrative, path or direction that can indicate a split in the insurgents' unity of effort, leading to factionalism within the leadership.

NATO experts conclude that "*nothing is more demoralizing for insurgents than to realize that people inside their movement or trusted supporters are deserting the insurgency or providing information to government authorities*" [8: 3–17] and this is the moment when counterinsurgency starts its major operations.

Counterinsurgency

Counterinsurgency (COIN) encompasses all "*those military, paramilitary, economic, psychological and civil actions which government takes for defeating an insurgency.*" [8: 3–1] It can be conducted by the very government facing insurgency alone or in union with the international community and foreign assistance. Because it needs to disrupt the operational tempo of the insurgents, the government needs to develop a strategic–political, operational and tactical dimension. Since political considerations are of much greater importance than military considerations in a struggle for the consent of the population, every COIN action should support a political resolution to the problem.

While insurgents aim to expose government's inadequacies and falsehoods, ruling governments need to recognize and understand the full range of insurgent actors, their motivations, aspirations, interests and relationships. As stated before, both sides fight for the inclination of the population. Insurgents most often hide among the civilians: they do not carry visible insignia or uniforms, and can often be taken for the innocent and impartial bystanders, so NATO COIN doctrine stresses "*it is a struggle for the population, not against the population*" even when the population turns against ruling elites. [8: 3–20] If this principle is not obeyed, the situation may lead to the one similar to Afghanistan where "*Afghan people hate the Taliban, but they equally despise the government.*" [10: 11]

Additionally, NATO defines some other attributes of COIN, such as: political primacy (need to have a clearly–defined political objective) and relevancy of the full legitimacy of government as well as the need to provide security under the rule of law. It also warns that insurgencies are often long lasting. Some reports state that the average duration of successful insurgencies was 14 and unsuccessful ones 11 years, and this could not be possible without the ability to learn and adapt to new techniques, tactics and procedures. In order to do this, all operations need to be intelligence driven with a clear unity of effort, goals, visions and strategies. In the military spectrum of operations the first and crucial goal is to neutralize the insurgency by isolating them from their support. As their backing system breaks, so will the ability to wage operations.

Another important military factor in COIN is the terrain. [10: 2] The nature and size of urban population increasingly hamper a counterinsurgent's ability to detect and identify insurgents. In urban centers insurgents easily hide in masses and have increased freedom of movement in observing and approaching their targets. This is the reason why the two most deadly and violent attacks in Afghanistan during 2012–2013 were in fact in Kabul, its capital city, despite the extensive net of police, military and intelligence agencies available. In fact, the attacks were at the intelligence base and main city traffic police headquarters, the very institutions meant to protect the people. [5] COIN forces may have to emphasize intelligence and police operations to counter covert organizational, intelligence, logistic and terrorist ac-

5 From personal experience of Maj. Zekulić, serving in Afghanistan, Kabul as the member of NATO forces at the time of attacks.

tivities, and carefully plan and coordinate all operations, particularly those involving use of deadly force, as there is a high risk of collateral damages.

Militaries sometimes call COIN a *"clear–hold–built"* operation. In its full spectrum they combine *offense* operations (*"Clear"* meaning finding and eliminating the insurgent), *defense* (*"Hold"* meaning establishing the presence and protecting the local populace) and *stability* operations (*"Build"* meaning rebuilding the infrastructure, increasing the legitimacy of the local government and bringing the rule of law to the area). [8: 3–17]

When foreign states step in the intra–state crisis they consequently became legitimate targets as well. According to the Law of armed conflict, theatre of war is any space where military operations are prepared and executed, making the confrontation much more comparable to full spectrum war, then civil conflict. We saw examples of this when Islamist extremist conducted attacks on Madrid, London and attempted to do them in Germany and Denmark, as a response to their engagement in Afghanistan. On the other side, the US justified their raids in Pakistan by claiming that the Pakistan government was shielding and protecting the Taliban insurgents and Al–Qaida operatives.

International responses to insurgency and counterinsurgency

Whether the western powers get involved in intra–state conflicts to support insurgents, or to support governments in their struggle against insurgency, depends on multiple factors. Countries that are ruled in opposition to democratic principles, who brutally suppress human and minority rights or who prevent fair access to natural and mineral resources, could be a potential target for international intervention. According to Nathan, following causes may trigger international intervention into intra state matters[6]: [11]

- *Proximity*, the risk of cross border violence and instability is greatest among adjacent countries. In case of Africa and Europe, the Mediterranean Sea is considered not as a buffer zone of separation, but as the mitigating and hard to control medium through which insecurity factors and actors may easily enter. This was one of the reasons for French led EU intervention in Mali in 2013.
- *Military balance of power*, as the likelihood of military intervention would be smaller if the opposing party had significant military might that could significantly jeopardize lives of NATO/EU troops. Such was the case of operation "Allied Force" against Serbia in 1999, when the decision was made to conduct operations only through air strikes, estimating that putting troops on the ground would be too risky.
- *Regional organization and norms* that guide foreign policies towards protection of their national or international interests. In support of this aspect, we can observe extensive EU interest in security situations in Africa and the Near East, whilst NATO is more oriented towards controlling security and stability in Asian and Caucasus region. Depending on whether the preferred security status is provided by the governments in power (such as in Afghanistan) or by the insurgents (such as in Syria) foreign intervention may occur in support of one party or the other.
- *Structural instability* is the precondition for the worsening of the favorable industrial and economic culture in the region of interest. Intervention by EU and NATO into

6 Other factors include: strategic culture, defensive versus offensive motivations. [11]

Somalia and the Gulf of Aden to fight Somali pirates was predominantly guided by the need to protect merchant and cargo ships, thus enabling continuation of trade and business.

US National Defense Strategy, published in June 2008 clearly states that *"violent extremist ideology adherents reject state sovereignty, ignore borders, and attempt to deny self–determination and human dignity wherever they gain power… Combating these violent groups will require long–term, innovative approaches."* [12: 2]

That is why the attention of the international community returned to Somalia after it was left to plummet into civil war in 1993. Although it has not had a stable central government since 1991, the situation in 2005 became so dire due to an increase of piracy and increase of terrorist attacks planned and prepared in an Al–Qaida base stationed on the Somali island of Eas Komoboni, that something had to be done. US, NATO and EU troops sailed the seas, while AU sent 1,700 Sudanese and Ugandan troops to protect the regime's limited presence at Baidoa and Johwar and assisted them in fighting the Islamic extremists' and warlords' rebellions. [13: 24]

On the other hand there are many instances when states provide direct military support to the insurgents, sometimes even using their own armies to fight alongside them. Without them, they would remain marginalized and struggle merely to survive. Such was the case in Congo during the first and second Congo War, or the "Great African war". Before Laurent Kabila obtained the support of Rwanda and Uganda, he was a murky guerrilla leader who posed little danger to the regime. With their political and military support, he eventually overthrew it and became the president. As his "friendship" with Rwanda and Uganda cooled, they attempted to overthrow him, and would probably have succeeded if it were not for assistance from seven other states: Zimbabwe, Angola, Chad, Sudan and Namibia. [14]

We discussed earlier general concepts behind the term insurgency and counterinsurgency, but different nations and organizations use different terms to explain and justify their engagement in intra–state conflicts. For example, the US military doctrines use the term *Foreign Internal Defense* (FID) and *Internal Defense and Development* (IDAD). Both concepts encompass actions by *"civilian and military agencies of one government in programs taken by another government to free and protect its society from subversion, lawlessness and insurgency."* [15] FID can also be defined as an effort that involves numerous US Government agencies where they are all working together to eliminate the root causes of an insurgency in certain areas. The US Special Forces' doctrine also states that "*FID also supports stability operations designed to promote and protect US national interests by influencing adversarial, political, and information operational variables in a region or country…"* [16]

Nevertheless, international intervention will most likely occur where there is a case of grave violation of human rights or threat of massive violence overflow in the region. In such circumstances, western powers might initiate humanitarian intervention operations.

Humanitarian intervention

UN Charter and Law of War emphasize the principle of nonintervention and forbid aggression, in case of crises and conflicts that can occur within a State. But the 1990s brought the so-called, "CNN effect" that forced people to face humanitarian catastrophes and killing of civilians from the comforts of their own homes. These images activated the collective con-

science of the population that pressed their political leaders to react. On the eve of the NATO campaign in Kosovo in 1999, Tony Blair became one of the first world leaders to assert a moral right to *"get actively involved in other people's conflicts"* even without the mandating resolution of the UN Security Council. He stated the need to wage a *"just war, based not on territorial ambitions, but on values."* [17]

Slowly, a concept was forming that it is a moral duty of the international community to intervene and protect civilians from governments that cannot or will not do it themselves, implying that saving human lives could in some circumstances override sovereignty of the states. That is why humanitarian intervention at its core carries the UN principle of "*The responsibility to protect – R2P*."[7] By 2005, the UN World Summit confirmed the final "Outcome Document" that legalized the possibility to conduct humanitarian intervention in cases of proven genocide, war crimes, ethnic cleansing or crimes against humanity.

Some politicians believe that to *"Accept the doctrine of humanitarian intervention would mean the endangerment of the concept of independence and nonintervention in a world that reached no agreement on which moral postulates should actually guide humanitarian intervention."* [18: 21] Any intervention, even the humanitarian one, contains in its nature forceful interaction in the affairs placed within the authority of another state. They claim that each state has a right to their own political independence, organization, traditional and cultural principles that can be different from American or West European, and that there are small chances for success of such operations when meddling into inner relations they know little or nothing about. Reasons against also include: questionable motives for intervention, resistance of different groups including the leading one in the area of intervention and also the simple fact that foreign actors cannot secure long term stability for any state unless there is motivation for change within. [19]

The positive side to this concept is that interference is focused on protection and well-being of the civilians. Supporters of the humanitarian intervention often emphasize the moral need to protect interests of all people, the right to fight for universal human good, for basic freedoms in each country and obligation to respect the interests and needs of civilians. If governments refuse or are incapable of doing this, then the foreign actors (international community) are forced to act.

Humanitarian intervention bases its legitimacy on the obligation to protect basic human rights, but it can only be validated if this action in not unilateral but authorized by a multilateral, internationally validated body and that action, as such, should be transparent, controlled and clearly focused on the main aim of the intervention.

Case studies

Crises most often arise when states lack popular legitimacy, either because they are wholly authoritarian (case of Libya in 2010), are under minority rule (case of Rwanda in 1994) or because they exclude ethnic minorities from full participation in a democratic political sys-

7 In 2001 Canada had set up an International Commission on Intervention and State Sovereignty, under the chairmanship of Gareth Evans, a former Australian foreign minister, and Mohamed Sahnoun, a former Algerian diplomat. In their report, published in 2001, it was they who first suggested changing the discretionary "right to intervene" into a more muscular "responsibility to protect". Available at http://www.economist.com/node/11376531

tem (case of Mali in 2011). Similarly, Nathan says: "*Put differently, the absence of justice is frequently the principal reason for the absence of peace.*" [2] Oppressed and marginalized communities may seek to resolve the crisis through armed rebellion. Hostilities are likely to be intense and sustained because the stakes are so high.

Insurgents may prize freedom and justice more than peace. They may consequently be prepared to provoke and endure prolonged physical and political violence in order to achieve their goals. Quick peace settlements predominantly serve the interests of the ruling elite and its foreign sponsors, who wish to prove that they can maintain control over the country and that they possess the ability to suppress any violence or upheaval. In these circumstances, the cessation of hostilities is not in the interests of rebels as they need time to prove their strength, ability to challenge and disrupt ruling governance.

This article analyzes reasons and two different approaches of the international community to intra–state conflicts: support for the Afghan Government in its struggle against the Taliban insurgency, and on the opposite spectrum, support for Libyan insurgents in their fight against the regime of Muammar Gaddafi.

Support for counterinsurgency: Case study Afghanistan

To be able to fully understand the counterinsurgency strategy in Afghanistan, it is vital to be acquainted with the history of insurgency itself in this particular area. After the "Saur revolution" in 1978, a communist party named the "People's Democratic Party of Afghanistan — PDPA" formed a new government with Nur Muhammad Taraki as the Head of the State. However, the deeply conservative and religious population did not respond favorably to the implementing of the socialist agenda by the PDPA, and by the spring of 1979 large parts of the country started an open rebellion against the government. After a year, it became clear that the government was not able to regain control and territorial integrity. Therefore, after he assassinated president Taraki, Deputy Prime Minister Hafizullah Amin requested Soviet military assistance. Although the USSR at first declined military intervention, it could not allow such an insecure environment at its border, and on Christmas Eve the Soviets launched the invasion, seizing key airfields and key government and communications sites in Kabul, occupying main cities and installing a puppet regime.[8]

The Soviets expected the resistance and war to end here but it was only the beginning. The Soviet army was not prepared for this kind of warfare as they were trained to wage wars on European plains, not in the mountains. They were forced to employ new techniques and strategies for fighting the Mujahedeen, the Afghan freedom fighters who came from a traditional warrior society and proved highly resourceful in fighting the Soviets. Although the Soviets were winning the battles, they were losing the war because the Mujahedeen were not willing to confront them on the open battlefield. They would simply come back and reestablish control over the area when the Soviet forces left. It was a stalemate where insurgents controlled the countryside and the Soviets controlled the cities.

Mujahedeen morale was higher, and with the help of foreign aid in weaponry, estimated to be worth $66 billion from 1978–1992 [20: 238], they had significant efficiency. Another

8 New president was Babrak Kamal, former diplomat in exile, as the President. In the process they killed Hafizullah Amin, accusing him of being a brutal power–hungry leader who betrayed the Saur revolution and accusing him of being an American sympathizer or even a CIA agent.

advantage was the support of Afghan Islamists by Pakistan, where the Mujahedeen could find new recruits and shelter. The new "Gorbachev foreign policy",[9] along with the inability to control the Afghan countryside, was one of the many reasons for the Soviets' withdrawal. The plan was to prepare the Afghan army to fight without Soviet help and the withdrawal was finished by the beginning of 1989.

The Soviet withdrawal left Afghanistan in a collapsed state, which resulted in civil war. In 1992 major Afghan political parties agreed on power–sharing and establishing an interim government for a transitional period until the general elections. However, a significant group made of mostly ethnic Pashtu was regrouping in Kandahar. They were calling themselves the Taliban, which meant "students" or "seekers". They started to attract fresh recruits from religious seminaries with excessive funding by Pakistan's Inter–Services Intelligence in Federally Administered Tribal Areas in Pakistan – FATA and Waziristan, which was an effort to expand Pakistan's sphere of influence into Afghanistan with the help of the so–called proxy warriors.[10] After a few years of sporadic fighting, the Taliban entered Kabul in 1996, and established the Islamic Emirate of Afghanistan. [21] By the end of 2000, the Taliban seized control of 90% of the country, imposing a strict interpretation of Sharia law. The only opposition, named Northern Alliance, was formed in the north of the country under the leadership of later assassinated Ahmad Shah Massoud. The assassination was conducted by the Al–Qaida operatives in return for allowing Afghanistan to become safe haven for shelter and training camps of Al–Qaida operations.

On 11th September 2001, Al–Qaida members attacked the United States on their own territory killing more than 5,000 people. This was a turning point in NATO strategy toward insurgents and global terrorism, for the first time in history Article 5 of the North Atlantic Treaty was activated and Operation Enduring Freedom was launched. A wartime–like coalition was put together with over thirty countries which provided logistical, financial, diplomatic and political support. Military operations began on October 7, 2001 and within 75 days American coalition and anti–Taliban Afghan forces defeated and chased the Taliban, Al–Qaida and Pakistani insurgents into Pakistan. US officials claimed that "*The Taliban is out of business, permanently*"[11] but they were deceived.

Again, the same scenario as with the Soviets happened. The coalition had achieved a military victory but an effective long term policy was not present. Taliban found sanctuaries in Pakistan and in the vast lands of their hometown, Kandahar, where they could retrain new recruits and prepare for a new phase of war. The Pakistani government could also wage another proxy war, this time against Coalition troops and president Karzai, who was in a way installed by the US.[12] [22: 288] On the other side, Afghanistan Transitional Authority (ATA) was facing the task of rebuilding the country from ashes and almost no security forces at all to rely on.

9 Easing of Cold War tensions

10 proxy war n. — a war instigated by a major power which does not itself become involved — Oxford dictionary

11 Taliban destroyed, says Cheney (18.11.2013) accessed at http://hindu.com/2002/03/14/stories/2002031406201400.htm

12 Fight against the Taliban could not be waged in Pakistan. Exceptions are isolated and covert operations that target individuals, like the assassination of Osama bin Laden, which crippled the Al–Qaida leadership, but also in a way embarrassed the Pakistani Government, weakened the Coalition capacity for negotiation, which is an extremely important issue, simply because Pakistan still sees the Taliban as a valuable asset in bringing Afghanistan into its sphere of influence, and the US–led Coalition's primary goal in this matter should be to cut all links between the Taliban and Pakistani army. Estimates are that between 1994 and 1999, 80,000 to 100,000 Pakistanis trained and fought in Afghanistan. [22]

To assist them with this challenge and assure that the Taliban regime did not return to power, the international community stepped in, and at the beginning of 2002, in accordance with UN Security Council Resolution 1386 established the International Security Assistant Force — ISAF. While troops assigned to operation "Enduring Freedom" were still fighting the pockets of Taliban resistance, ISAF's main role was securing Kabul and the surrounding areas, acting as military support for the Government and the creation of Afghan National Security Forces.

By 2006, it became obvious that the NATO strategy for securing and stabilizing Afghanistan was not working. As the attacks on NATO and Afghan Security Forces (AFS) troops drastically increased, it became obvious that the Taliban were not defeated, they had regrouped, rearmed and were ready to fight for power and territory once again.[13] This time they were backed up by allies from Hezb–i–Islami, the Haqqani network, foreign fighters from Pakistan, local tribes that had rejected the Karzai rule and criminal organizations involved in opium production and trade. Counterinsurgency operations had to be initiated.

As the local Security Forces and Government were still too weak, US forces assumed the leading role in COIN.

The first COIN strategy was not as effective as the international community hoped it to be. One of the main reasons was that the majority of the Afghan population live in the countryside, where central governance from Kabul has a weak and almost invisible reach. The occasional flood of foreign soldiers, concentrated in small *Provincial Reconstruction Teams* (PRTs), into neighboring villages, just to pull back behind walls hours or days later, triggered additional dissatisfaction, frustration and unrest among the population. Any aid or help brought to them in attempts to "win hearts and minds" just triggered the insurgents' rage, and they would reappear as soon as foreign troops left. These troops and efforts were seen as occupying, exploiting and hostile. Thus, the number of Alliance casualties constantly increased and by 2009 doubled in numbers. COIN strategy had to be changed.

Based on the analysis of 90 insurgencies since 1945, Seth Jones wrote in his study "Counterinsurgency in Afghanistan" that there are *"three variables correlated with the success (and failure) of counterinsurgency efforts: capability of indigenous security forces (especially police), local governance and external support for insurgents including sanctuary."* [23] This and the arrival of former US Special Forces General Stanley A. McChrystal and Iraq Veteran General David H. Petraeus, as consecutive ISAF commanders, changed the operational design and dynamics of the second Afghanistan COIN. Foreign military troops pulled back and local Security Forces and Government officials pushed front, still backed and supported by ISAF.

Their plan was to activate COIN in two separate directions. The first, "population–centric" strategy emphasized the need to satisfy economic, social and political grievances through three COIN "lines of operations" — security project, governance, and development. Security and governance could be improved by short–term projects, even without any long–term policy. The idea assumes that development aid will promote local stability and win political support.

The second strategy was to continue training and equipping ASF, but now through a concept called "embedded partnership". In its core was the idea to rapidly bring ASF to a phase where they would conduct their tasks, missions and operations independently, but according

13 http://icasualties.org/oef/ accessed on 15 November 2013

to western standards. This was to be done by embedding NATO troops into Afghan Security Forces. They were not just training together, but also living, sleeping, eating and fighting together. Slowly, NATO troops pulled out leaving COIN with a fully "Afghan face" and full local ownership.

However, 4 years into second COIN, billions of dollars invested in the country have done little to increase the population's support for the Afghan Government or support against the Taliban, and the fact is that the most stable areas are the ones that have not received any aid or received a small share of it. The main reason is the flourishing corruption in the Afghan Government in certain areas, combined with opium production and involvement in local power struggles, which is a sign of inefficient Government apparatus.

On the military end, two problems occurred: The ASF troops started acting and fighting as the NATO troops, they were no longer deemed local, but seen as an extended hand of the "occupying force". Constant home searches were viewed as attacks on family honor, and some incidents by Coalition soldiers have damaged the relations between the domicile population and Coalition forces and/or Afghan officials. Another gap opened as the exit strategy of Coalition forces was developed. After the 2014 transition, Afghan military and police, although well trained and impressively equipped may have problems effectively fighting the Taliban, and even more sustaining and maintaining the complex bases, facilities and equipment they were given. In these circumstances, the withdrawal of Western forces could lead to a collapse of the entire security sector.

As an answer to that, president Karzai attempted reconciliation with the Taliban, and negotiations are still in progress. The Taliban are not fighting to be accommodated but to bring the State down or at least gain their own autonomy in the south and east of the country. [24] The coalition has started its military withdrawal, but without any doubt, for the past 11 years it has actively supported and backed the Afghan Government in its fight against insurgency.

Support for insurgency: Case study Libya

When, on 15 February 2011, Muammar Gaddafi's security forces opened fire on protesters inspired by uprisings in Tunisia and Egypt, a seed, which would eventually end Colonel's forty year long career as an autocrat in Libya, was planted. Protests began in the eastern city of Benghazi, controlled by the Gaddafi opposition and some defected military units, and slowly spread across the country. In the area where the fighting was intense, reports claimed that the Government was using firearms and even heavy artillery and cluster bombs against protesters in civilian areas. The international community condemned that kind of action and responded accordingly.

The first international measure came on 26 February 2011, when the UN Security Council adopted resolution no. 1970 that imposed an arms embargo, travel ban for members of the Gaddafi regime and an asset freeze. It also referred the actions of the Government to the International Criminal Court (ICC) for investigation. However, Gaddafi ignored the measures and launched a counterattack pushing the rebels back and approached Benghazi and Misrata, which, on 17th March 2011, triggered the second UN resolution no. 1973 imposing a no–fly zone over Libya and authorizing "*to take all necessary measures… to protect civilians and civilian populated areas under threat of attack in the Libyan Arab Jamahiriya, including Benghazi, while excluding a foreign occupation force of any form on any part of Libyan*

territory." [25] Immediately, the Libyan Government announced a ceasefire, but nevertheless continued with the shelling of rebel–controlled cities and regime soldiers continued approaching Benghazi.

Because of that, some of the European members of NATO, backed by partner countries of the Arab League,[14] decided to launch operations in support of UN SC resolutions. The United Kingdom initiated operation "Ellamy", France operation "Harmattan" and the US launched the military operation "Odyssey Dawn". At the same time, NATO was preparing for its mission, and on 23rd March 2011, operation "Unified Protector" absorbed all other international operations in Libya. After the command transfer, three tasks were initiated:

Policing the arms embargo. Even before the uprisings, Gaddafi feared a military coup so he kept regular military units poorly armed, with just four brigades of highly equipped and trained soldiers. Therefore, NATO ships performed a maritime blockade with the mission to monitor, report and interdict vessels suspected of carrying arms or mercenaries, however, NATO ships did not enter Libyan territorial waters.

Patrolling the no fly–zone. It was successfully conducted after initial strikes had destroyed all Government air defense capabilities. The few Ally losses were mainly due to mechanical malfunctions.

Protecting the civilians. The only way to protect civilians was through air strikes on Gaddafi's ground forces, but the problem was the proximity of the regime's forces and other assets to civilian infrastructures with reported use of human shields by forces loyal to the regime.[15] Similarly, insurgents also used civilians for refuge, resupply and shield.

By August 2011 rebels rallied under the National Transitional Council of Libya (NTC) became internationally recognized as the legitimate governing authority in Libya. The ICC issued an arrest warrant for Gaddafi and his closest associates for war crimes and crimes against humanity. After a certain stalemate, with the help of NATO–led aerial intervention, opposition launched attacks on Tripoli and Gaddafi's hometown Sirt, and eventually overpowered forces loyal to the regime and captured these cities. Two months later, NTC secured control over the whole of Libya and Operation Unified Protector ended on October 31, 222 days after it had begun.

It can be concluded that NATO's involvement in the conflict was in fact in support of the rebels as it played a crucial role in the rebels' campaign to overthrow the regime.[16] The fact that the rebels were recognized as the legitimate representative of Libya and the fact the NATO bombed Gaddafi's residence only corroborated that NATO and the West would settle for a regime change. Because of that, some claim NATO went beyond its limits, as provision of military assets to the rebels was not part of adopted UN resolutions. Nevertheless, NATO stayed within the limits of the mandate, as the mission was solely airborne and many civilian lives were saved.[17]

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14 Qatar, Jordan, Morocco and UAE

15 Mission aborted on orders of SAS: RAF attack is halted after troops spot human shields (20 11 2013) from http://www.dailymail.co.uk/news/article-1368626/Libya-RAF-abort-attack-SAS-spot-Gaddafi-using-human-shields.html

16 NATO has "played a decisive role" in Libya (20 11 2013) from http://www.dw.de/nato-has-played-a-decisive-role-in-libya/a-15346089-1

17 French Air Force itself launched over 4,500 flying missions and hit around 2 500 military targets. The French airmen continue their mission in Tripoli (20 11 2013) from http://www.lepoint.fr/editos-du-point/jean-guisnel/les-aviateurs-francais-poursuivent-leurs-missions-sur-tripoli-22-08-2011-1365090_53.php

Conclusion

Internal conflicts, whether instigated by the government or the insurgents, generate tension and mistrust between states and in the region, in ways that prevent them from attaining mutual confidence, stability and security needed to create and maintain a healthy, functioning and prospering community. Cross–border violence, hostilities, rebel attacks from neighboring countries, military action by governments against rebel movements, or collective enforcement action intended to restore domestic order are just some of the consequences of uncontained conflicts.

Weak and fragile states are incapable of restraining instabilities and crisis within, thus forcing the international community to "step in" and take charge in separating opposing sides, negotiating peace settlements and reestablishing a stable environment. Whether this is done with or without support of the ruling elites is far less important than the international security, safety of the local population and regional political and economic stability.

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Military symbology and schemes of battalion task force in selected tactical activities (Learning tool)[1]

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This paper deals with the use of military symbology in accordance with the current standard of the North Atlantic Treaty Organization (NATO) APP–6C from 2012. It analyses the current state of the topic, especially the available resources dedicated to military symbology and schemes of tactical activities of units. The paper defines the procedures and principles in creating tactical symbols and principles for their use in tactical situations. One of the annexes of is an overview of the most common tactical symbols, which provides a standardized, structured set of graphic symbols identifying the most common units, equipment, lines, areas and maneuvers with respect to the current state of the Army of the Czech Republic. This examination also provides the user, through the presentation of MS Office, a comprehensive overview of tactical symbols, as well as short instructions for their use. These symbols can also be removed from the presentation and can be used by the user as the necessary basis for creating one's own diagrams of tactical situations. The next part of this thesis deals with the design of new variants of schemes selected for use in tactical operations of a battalion task force. This schema set is available to the user as well in a presentation of MS Office. Individual schemes are drawn to ensure the required clarity and so this presentation can be used for teaching and by students. This work is a learning tool which can be used by students of The University of Defense especially in subjects like Tactics of Units and Tactics of Formations and, other fields of study as well as in military practices of the units of the Army of the Czech Republic (ACR).
Keywords: Military symbology, schemes, battalion task force, schema set, principles in creating tactical symbols, use of tactical symbols, NATO joint symbology, APP–6C, learning tool.

Introduction

The basic purpose of this paper is to highlight the importance of the knowledge of creation and use of military symbology in the current operating environment.

It is not intended to provide an exhaustive treatise on the issue of military symbology. The aim is primarily to acquaint the reader with the issue of military symbology under a general framework and with available documents dealing with military symbology.

1 This article is the written form of the presentation that was shown on the Central European Forum on Higher Military Education (CEFME) International Young Scientists Conference on December 2013, NUPS, Budapest

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The most important part of this work is to create a file of the most common site of military symbols, which will serve both for teaching, as well as a database usable when creating custom schemas of tactical situations. The other part is an album of schemas of battalion task forces in selected tactical activities.

The work itself and its annexes should serve students and teachers as support for teaching at the University of Defense and also as an aid for the improvement of individual training in the ACR.

Definition of basic terminology

Interoperability is the ability to act in a coordinated way, to effectively and efficiently achieve Allied tactical, operational and strategic objectives. [3]

Unit is a military element whose structure provides for the responsibility of the parent folder. [1]

Maneuver is the evolution of the troops on the battlefield with the use of movement in conjunction with fire or firepower to achieve the advantages over the enemy in order to meet the stated purpose. [1]

Maneuver defense is a way of keeping the defense consisting of a combination of active offensive operations for troops with a temporary obstruction prepared status (favorable lines). [1]

Multinational operation is an operation carried out by the forces of two or more cooperating States. [1]

The defense is a basic, but not the decisive nature of the struggle led, in order to repel or thwart the attack of the enemy in a specified area and time, inflicting losses, maintain important premises, preserve strength and resources, and thus create the conditions for its own activity. [1]

Operation represents the military activity or the implementation of the military strategic, tactical, training, administrative task or the provision of assistance, the process of warfare, including movement, supply, attack, defense, and maneuver, which are necessary for the achievement of the objectives of any battle or campaign. [1]

Operating procedures are detailed methods, with the help of which the headquarters and units perform their operational tasks. [3]

Operating environment consists of a summary of the conditions, circumstances and influences that have an impact on the use of skills and decision–making. [4]

Positional defense is the kind of defense that most defense forces deploy in a selected policy area where there will be a decisive battle. It relies mainly on the ability of the forces in the defensive area to keep biased position and checks the terrain between them. Backups are used to increase the depth, to block, or for the renewal of fighting position to counterattack. [1]

Graphical symbol is a graphical shape that is used to display the operational and tactical situations, the stationing of troops, equipment, weapons, and objects on a map, the schema (sketch), screen or projection devices, and is complemented by numerical and text description. [5]

Task force is a temporary grouping of units under the command of the designated Commander, created for the purpose of carrying out certain operations or to meet a specific task. [1]

Attack is a kind of battle, which is crucial in order to achieve victory. The attack consists in the destruction of the enemy, in his report, the breakdown of the procedure in their own troops into its depth with the use of fire and maneuver. [1]

Attack from direct contact normally starts after the rearrangement or replacement of units in contact with the enemy. Usually requires the implementation of realignment and rotation, including ensuring confidentiality of the activities before the enemy. [1]

Attack after moving from a depth usually takes place from the default, or other area, generally outside the range of the artillery of the enemy. The default space for an attack battalion occupies in the report of the Brigade (the parent). [1]

Analysis of current situation

The first chapter is devoted to the definition of the basic concepts contained in this work, and describes the current state of the solved problems in the environment of the ACR. In particular, it deals with the analysis of the available literature and its timeliness in comparison with the latest NATO standard *APP-6c (Joint Symbology)*. In addition, this section deals with the analysis of the specific graphical symbols and principles for their use. The last part of the first chapter is an analytical description of the use and nature of graphical symbols.

Analysis of the available literature

As has already been mentioned above, this section deals with the analysis of the available NATO and national military documents, especially the literature dedicated to the issue of graphical symbols. The basic and fundamental document for the design issue is the Alliance document *APP–6* published in May 2011. This publication provides the user with all the military vital information about graphical symbols. In the introduction it describes the dividing of graphical symbols on land, air, maritime (surface, beneath the surface) and the space units. Furthermore, there is a defined division of the graphical symbols that are used to display weapons, material, vehicles and equipment. Graphical symbols show friendly units, units of the enemy, neutral and unknown forces.

After this initial division into individual categories, this Alliance publication also deals with their creation and use, in particular the principle of locating and describing each of the symbols with the appropriate default defined fields. This publication is not trying to create a database of all graphical symbols, as in the case of the previous document *APP–6A* (1999). There are more displayed individual icons forming the symbol and it is always shown as an example, the description of their location.

The following figure shows an example: Here is the icon depicting the mortar, it also shows the fields in the frame of its own symbol, where you can place this icon, and last but not least there is a specific example of use, in this case the unit towed mortars.

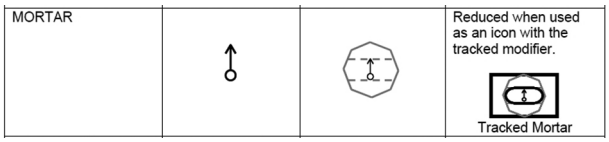

Figure 1. Example of icon and default fields (APP–6C)

A custom document is very easy to understand, thanks to this structure, and at the same time very versatile and usable. The user does not have to pick a symbol from a prebuilt database, it presents individual icons from which the symbol consists and introduces the principles of their placement to the user.

The publication also describes the symbols for the coordination of the activities of the units, such as: lines and interfaces, maneuvers, command and control, fires ... etc. The last part the document also contains meteorological symbols. *The document is currently not available in Czech translation.*

Literature, dedicated to the military symbology in the ACR is mainly the publication *Pub–53–01–4 Štábní práce v operacích – 3. část* of the year 2009, which is based on document *APP–6B*, from 2008. This publication also provides instructions on how to form graphical symbols and how to work with them. Symbols are represented, rather, in the form of a database, and as already mentioned, the publication is based on an old document *APP–6B*, and therefore some of the symbols are no longer valid.

The last comprehensive document, which deals with the principles of military symbology, is a handbook *Situační značky* (2005) and is based on the original document *APP–6A*. This handbook offers a very brief form on the principles of making and use of the symbols. Again, these are rather a small database of specific symbols and a description of the basic principles. As has been already mentioned, the publication is based on the original standard *APP–6A*, and thus most symbols do not agree with the current guidelines for creating them.

In the environment of the ACR, there are also other documents devoted to military symbology but these do not address the complex issues, but rather deal with them only marginally depending on the specialization of the publication. These are for example the three publications: *Tactics of the Squad* (*Platoon*, *Company*).

Use and creation of military symbology

In the current multinational operational environment, the emphasis is placed primarily on the interoperability in the area of command and control. This means accurate and unambiguous representation of an operational (tactical) situation, which is an important decisive factor in the process of command and control in the operation. In the common operating environment it is then absolutely necessary to find a common language that will be easy to understand by all actors in an operating environment. An essential part of this language is a graphical representation of the markup and symbols, which can transmit information faster and more efficiently than a lengthy verbal description. In this, the analysis confirmed opinion is the nature of military symbology existence. As mentioned above, the present document, which deals with the issue of military symbology, is APP–6C. This document is currently used by all members of NATO.

Graphical symbols represent the units, equipment, vehicles and other elements related to activities in the operating environment. The symbol is formed from the frame, the main character (icon), color fill, and other ancillary data and symbols are placed in the appropriate fields.

Using the frame, we define the identification of a unit, or an object that is represented by the symbol. Using the shape of the frame we also divide units on land, air, maritime (surface, beneath the surface) and the space units, equipment, facilities, and activities. The main icon

is placed in the middle of the brand and represents the image of the unit, equipment, facility, or activity. Some of the icons, for example, technique, or weapons may be used without the frame, these are further defined in the APP–6C. Sectorial icons 1 and 2 are located above and below the main icon in the area, its Octagon, which is used for the layout of the individual icons within frame signs.[4]

Full–frame icons are a special kind of main icon, which go beyond the boundary of the octagon and occupy the entire frame of the symbol. For example, the symbol for recognisance unit. (Figure 2)

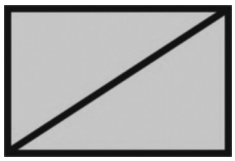

Figure 2.
Recognisance unit (own source)

Additional information is located outside the frame in the appropriate fields. (Figure 3)

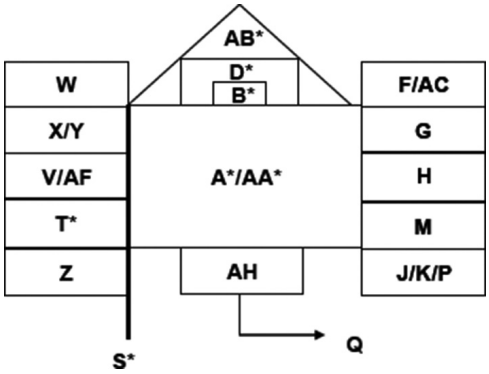

Figure 3. The label field of the symbol (APP-6c)

The symbols indicating the points, lines, areas, and tactical activities is governed by its own rules for label placement and display fields that vary according to the type and purpose of the symbol. As regards the displaying, you can draw the following symbols in either black or white (depending on the background), or color. Color can be used for own forces – blue, red for enemy, green for the obstacles, and yellow for the chemically contaminated areas.

The following illustration shows the fill and border colors that are used for creating graphical symbols. The use of color varies according to the method of view. The 3 number sequence shows the designation of the appropriate color in the RGB–model. (Figure 4)

4 A detailed description of the purpose of each of the icons, including the so–called, Full–frame icons are part of the annex to this work — presentation Tactical symbols. The use of color, display options, and also the detailed description of all label fields is also clarified.

Description	Hand-Drawn	Computer Generated ICON (RGB Value)	FILL (RGB Value)
Friend, Assumed Friend	Blue	Cyan (0, 255, 255)	Crystal Blue (128, 224, 255)
Unknown, Pending	Yellow	Yellow (255, 255, 0)	Light Yellow (255, 255, 128)
Neutral	Green	Neon Green (0, 255, 0)	Bamboo Green (170, 255, 170)
Hostile, Suspect, Joker, Faker	Red	Red (255, 0, 0)	Salmon (255, 128, 128)
Boundaries, lines, areas, text, icons, and frames	Black	Black (0, 0, 0)	Black (0, 0, 0)
(See note)	White	White (255, 255, 255)	Off-White (6% Grey) (239, 239, 239)
Note: A high contrast colour should be used as the default colour depending on the background for boundaries, lines, areas, text, icons, and frames.			

Figure 4. RGB model (APP–6C)

Partial conclusion

In the part of analysis, dedicated to the available resources on the field of military symbology, this work came to the conclusion that at the present time in the environment of the ACR there is only one current document — APP–6C, which, however, is still not available in Czech translation.

The objectives

Analyze the current situation of the use of military symbology in the environment of ACR, in regards to the available documents, evaluate the importance of the use of military symbology in the current operating environment, create the database of most used graphical symbols, which will also be a description of the principles for their use,

Create an album of schemes for the battalion task force in the selected tactical activities.

Restrictions

In this work I restrict, on the basis of interviews with educators from the Faculty of Economics and Management (FEM) (K–110 K–108 and K–107), to the development of the most frequented graphical symbols at the University of Defense.

Used methods of examination

In this work the following methods have been used to explore:

- *Analysis* — the basic method that was used in the analysis of available materials in ACR and Alliance materials dedicated to military symbology.

- *Synthesis* — through the combination of individual knowledge, which has been obtained by analyzing the available resources in a coherent framework, comes the idea of the content of the work.
- *Comparison* — this method was used, especially in the parts of the description of the differences between the documents dedicated to the subject.
- *Induction* — induction was achieved by the transfer of knowledge within the general framework.
- *Deduction* — method, which helped in the application of general knowledge.

Introduction to military symbology

As mentioned in the introduction to this work, we can characterize the direction of contemporary operations. We talk about joint multinational operations carried out within the framework of NATO (North Atlantic Treaty Organization) and in the framework of the European Union Battle–groups (EUBG). For the successful conduct of such operations, it is essential to establish a common operational language, as a means of communication, which is used by all interested nations. It is necessary to the established uniform standards for all NATO joint actions. In contemporary operations interoperability plays an important role — that is the required knowledge of common operating procedures and symbolism. This symbolism, also known as military symbology, provides us a universal tool for description of tactical situations and operating tasks without the need for lengthy verbal description. Also there are no more language barriers. Knowledge of tactical symbols is in a contemporary operating environment is absolutely necessary. Consequently, it is necessary to reflect these claims into the preparation of the individual in the ACR, and also into the preparation of students in the University of Defense.

The key objective of this work is creation of the study material that will provide the user an overview of the most commonly used symbols, with regard to the current state of the Army of the Czech Republic. In the next section is an album of schemes of selected tactical activities for battalion task force.

Selected tactical symbols

As mentioned above, this file provides the user with a form of presentation of MS Office a comprehensive overview of most commonly used symbols, as well as a brief guide to using them. These symbols can be removed from the presentation and can be used by the user as needed, for example for creating custom schemas of tactical situations. Symbols are placed in MS PowerPoint presentation and are also supplemented by the description of fields and represented by a variant of use of the individual symbols.

Album of schemes for battalion task force in selected tactical activities

Another objective of this work was to create a scheme for battalion task force in the selected tactical activities. This objective constitutes of creation of a PowerPoint presentation, which represents this album of schemes. One of the main requirements, which the author set by the creation of these schemes was their lucidity and clearness. It ensures the fact that the individ-

ual schemas are drawn according to the steps. In some schemes it was appropriate to split the layers, where each layer represents the terrain, units, maneuvers and obstacles. These layers then, when displayed in a single image, create the schema of tactical activity. (Figure 5 and 6)

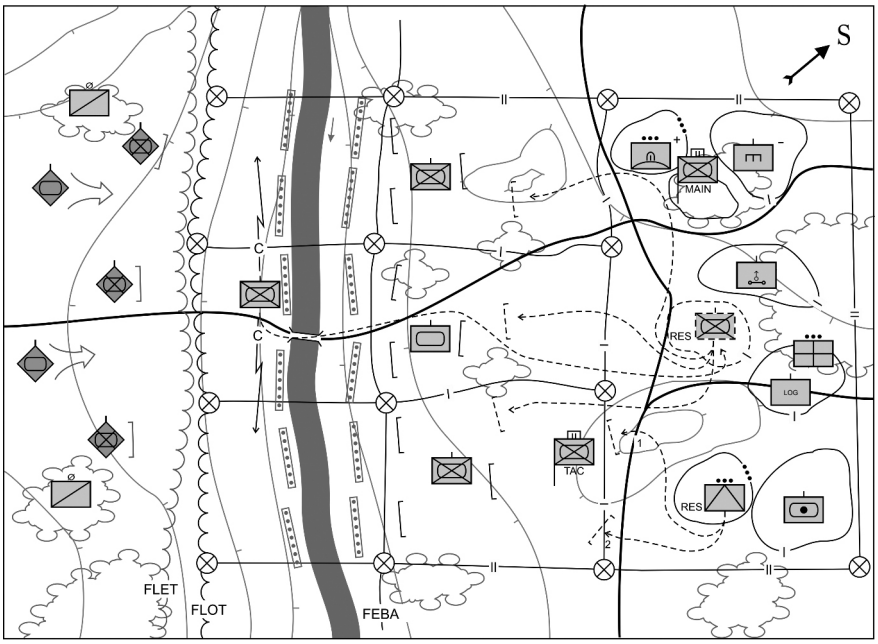

Figure 5. Defense of water obstacle (own source)

The album contains the schemas for the following activities:

- The structure of battalion task force
- Battalion task force in the first echelon of brigade
- The defense of battalion task force
- Fires of battalion task force in defense
- Defense of water obstacle
- Positional defense
- Maneuver defense
- Attack of battalion task force
- Battalion task force in encirclement
- Relieving battalion task force in defense
- Variants of attack of battalion task force
- Attack of battalion task force from the direct contact
- Attack of battalion task force after moving from the depth

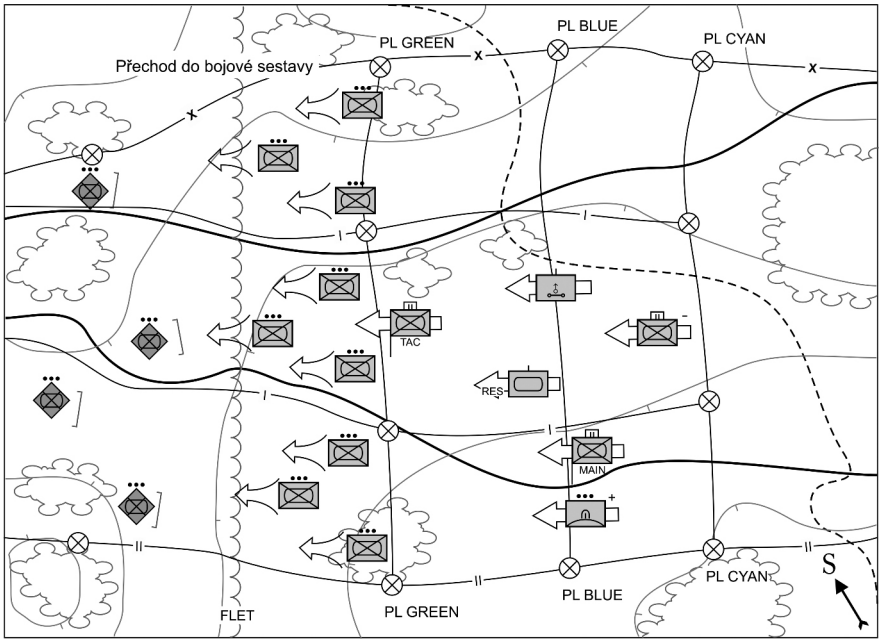

Figure 6. Attack of battalion task force after moving from a depth (own source)

The conclusion

The analysis found:

In contemporary operations it is necessary to introduce common standards for all joint activities. Knowledge of tactical symbols in a contemporary operating environment is absolutely necessary.

In the contemporary environment of ACR there is only one current document — APP–6C, which, however, is still not available in Czech translation.

On this basis, one can argue that:

It is necessary to incorporate the demands of knowledge of tactical symbols into individual training in ACR, and also in the preparation of students at the University of Defense.

It is necessary to create a handbook dedicated to the issue of military symbology.

This work can be used in military practice as a basis for improvement of training in the area of military symbology. It may also be used by students of the University of Defense for the study of military symbology. This work may also be a teaching tool, available to the teachers of University of Defense, in subjects like tactics of the units and formations.

The final conclusion

The purpose of this work was to point out the importance of knowledge of military symbology in a contemporary operating environment. The work concludes that in contemporary

operations it is necessary to introduce common standards for all joint activities. Knowledge of military symbology is absolutely necessary in a contemporary operating environment. In the current ACR environment there is only one document dedicated to military symbology — APP-6c, which, however, is still not available in Czech translation, therefore it is necessary to create the handbook dedicated to the issue of military symbology in the Czech language.

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Military Captcha[1]

Jiří SZTUKA[2], Ladislav HAGARA[3]

Captcha description

Captcha is a tool that protects websites from internet bot attacks. A detailed description of Captcha will be mentioned below.

What is Captcha

Captcha is an acronym based on the word "capture" and standing for "Completely Automated Public Turning test to tell Computers and Humans Apart". Captchas are mostly developed for systems which are vulnerable to e–mail spambots, for example Yahoo! Mail or Gmail. They are also developed for systems that provide posting, such as most blogs, forums, chats, etc. Captcha can be designed and made in various ways. Many companies make their Captchas in .Net, PHP or JavaScript. We had chosen JavaScript for our Captcha development.

Purpose of Captcha

The main purpose of Captcha is to distinguish whether you are human being or "bot". It simply asks you a question that is easy for a human to answer, but impossible for computer to solve. The first Captcha was used on Yahoo! webpages.

Picture 1. Example of Captcha

It was a picture of a curved text where one had to type in some kind of label underneath the Captcha picture. If one succeeded, the webpage sent you on to the desired content, or allowed the completion of the new account.

Development of Captcha

Impossible Captcha

At first people started to make Captchas that were really hard or nearly impossible for computers to solve, but they were almost impossible to solve even by humans.

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1 This article is the written form of the presentation that was shown on the Central European Forum on Higher Military Education (CEFME) International Young Scientists Conference on December 2013, NUPS, Budapest

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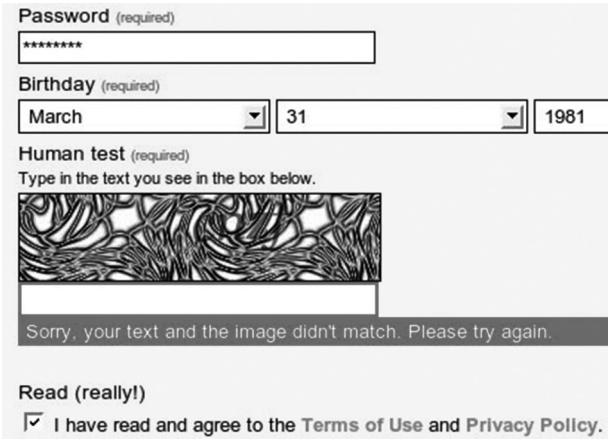
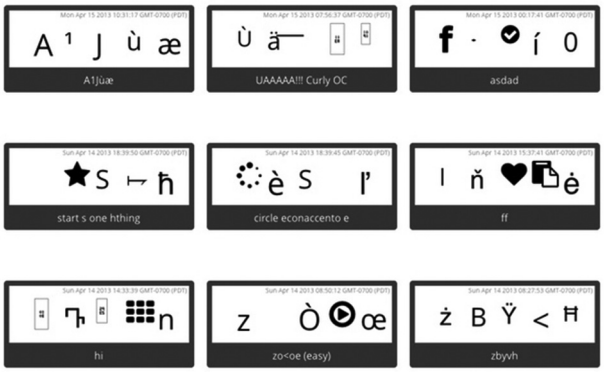


Picture 2. Impossible Captcha

The illustration above displays an impossible Captcha, one where the main intent is not to make the question that hard. Although there is one kind of Captcha that is specialized at making the task impossible to solve. It is called Crapcha (Completely Ridiculous and Phony Captcha that Hassles for Amusement).



Picture 3. Example of Crapcha

Picture 4. Math Captcha

Pix Captcha

Many different kinds of Captcha were invented. The main goal is to make the easiest question for a human, but that a computer cannot solve. That was when picture Captcha were created, it is called Pix–Captcha. It is short form for Picture Captcha.

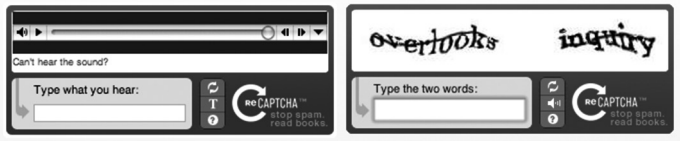
Picture 5. Picatcha—Pix—Captcha

This Captcha asks you to mark a specific picture, or specific group of pictures. Pictures are generated randomly and do not look the same. For example you have to mark all clocks, pix–captcha generated 8 pictures two of them are clocks one is digital and the second is an-

alog, the rest of the pictures can be anything. The computer does not know how these clocks that you have to mark should look like, but you can easily mark the two pictures that display clocks.

More accessible Captcha

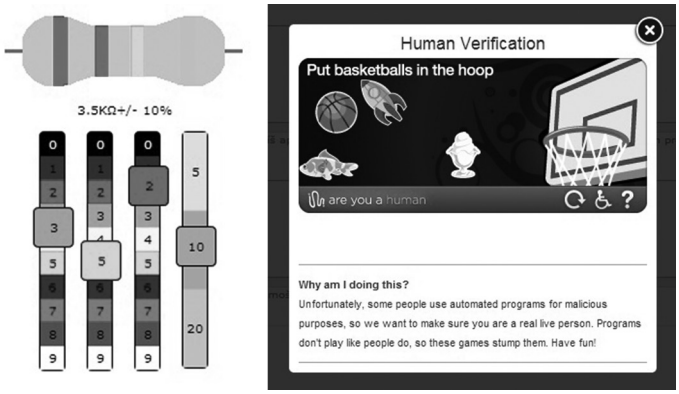
There were many attempts for more accessible Captchas. First people tried to do some kind of Captcha for people with disabilities, mostly visual. More accessible Captcha involved questions like: “How much is 1+2”, or “What color is the sky?”. Questions that are impossible for computers to solve. But these kinds of Captcha may worsen accessibility for people with intellectual and mental disabilities, for instance dyscalculia. The biggest effort is on making a central server which is shared with many sites.



Picture 6. Sound Captcha(left), Original Captcha(right)

This server provides Captchas on websites, all of them generated randomly, and not only the text–based Captchas, but also visual, motor, cognitive and hearing kinds of Captcha. This could eliminate problems for people with mental, intellectual, visual, etc. disorders. The picture above displays the sound and the original, mostly used Captcha. The displayed text could be unreadable for some, and impossible to type correctly.

Picture 7. 3D Captcha before test and after test



Picture 8. Rezistor Captcha and Game Captcha

Kinds of attacks

Attackers usually try to get attention somehow. And there are various ways to accomplish that. There are various forms of getting attention done by attackers such as:

- Seeing something that has not been seen yet,
- Showing funny and interesting or even shocking content,
- Possibility of getting something for free,
- Declaring the reader a winner of some kind of competition,
- Showing any kind of nudity.

People are easily manipulated and usually do not recognize this kind of thread. The main groups of interest for attackers are elderly people or young people. Groups that are not educated enough in Information Technologies.

"Bots"

But there are also other forms of attacks that can cause server overload. This can be caused by robots. A robot is a computer program that does some cycling processes over and over again, till the goal is reached. It usually collects data or fulfills requirements until accomplished and it is necessary to continue. And even within this branch there are many variations of these robots (they are called "bots"). There are few examples of bots:

- Spambots,
- Gatherers,
- Chatterbot,
- Botnet.

Spambots: this bot will send unwanted emails to your email address. Spambots can simply get your email address anywhere you type it, they register a string with a "@", and after "harvesting" your email they just save your address and send spam to you.

Gatherers: they come through web pages and collect links of new web pages. These collected links can be used for consecutive exploration.

Chatterbot: It is a kind of spambot, the difference is that this bot sends you unwanted messages, not emails. This bot spams users in chat applications.

Botnet: It is a network of interconnected bots on virus–infected computers. Bots are waiting for commands from owners who own this kind of virus–infected computer. They simply do what the owner tells them to do.

Characteristics of the solution

Military Pix–Captcha — Military means that this kind of Captcha is primarily designed for people who work in military branches. But it can also be used by users who are not educated in knowledge of military ranks. Military Pix–Captcha has many utilizations. For example at forums, specifically in situations when you want to create, edit or delete new posts. Whenever you want to do such actions, Captcha will occur and wait for its solution. In another way you will be unable to proceed with such action. It can be also used at a contact form, where it appears right before successfully sending your contact information.

For whom is Military Captcha intended

Although Pix–Captcha is modern and an easily solved kind of Captcha it is not commonly used. Problems appear in situations when blind people would want to access pages that use this kind of Captcha. It is designed for military personnel and even for people that are not familiar with military ranks, but not for handicapped or injured people, or who have visual disorders or disabilities.

Military Captcha development

Randomly generated pictures

Simple image array is used in which are inserted all pictures of military ranks concerning one national type of ranks. One image array means only one image is generated randomly. We have chosen three randomly generated pictures so we have three arrays. Pictures containing military ranks are saved in a specific folder. This must be mentioned, because functions that generate these pictures randomly need the exact paths of these pictures. The path is saved into a variable called “imlocation”. So there are three functions which generate pictures randomly, each for one array. Functions are refreshed every time you refresh your web page, so each time you refresh your web page, you will get three different pictures. Before pictures are shown to the user, there is an “If else” statement that oversees this problem. It simply says: “Generate pictures as long as all of them are different from each other and until that, do not show me the pictures”.

```
if(((image1[image1_number])!=(image2[image2_number]))

&&((image1[image1_number])!=(image3[image3_number]))

&&((image2[image2_number])!=(image3[image3_number]))
)
```

Picture 9. Condition for different picture appearance

Randomly generated text

We used simple labels in which there is shown which one you have to mark for passing Captcha. We solved this similarly to the problem with the pictures. I have chosen a function that involves array of text. In this case military ranks are in the form of a text. Again, titles are randomly generated.

Mutual comparison

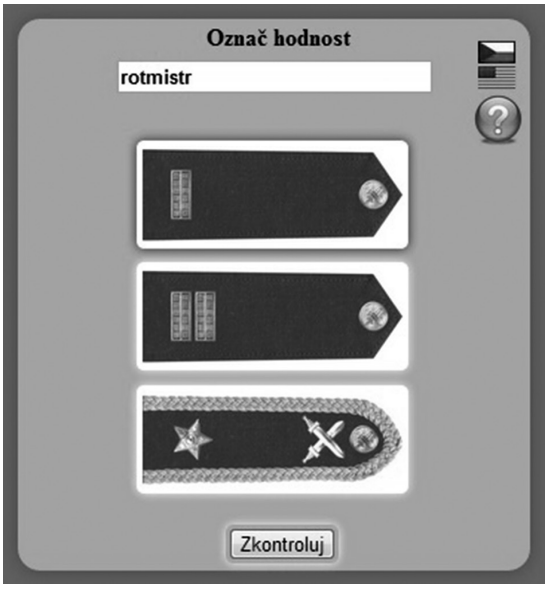
We decided on mutual comparison. This means that it is necessary to have a simple algorithm that compares text and name of the picture, to see whether one's indication is correct. All of the pictures have their own names based on ranks that they show. We made a function that cut out a specific part of the file name. This specific part involves the whole title of the rank, but does not involve filename extension, but how to ensure cutting out the filename dynamically? It can be easily made by saving the length of text that has been randomly generated into a variable, followed by putting this variable as a number into a function that cut out a wanted string. Now the function knows in what range it has to cut.

```
var label1 = document.getElementById("Match").value;
var delka = label1.length;
var label2 = label1.substring(0,delka);
```

Picture 10. Function for finding proper length of picture title

Now we know the exact length of string that we are looking for.

Picture marking



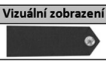
Picture 11. Military Captcha

At first we wanted to make the indication animated. But it would only complicate the structure of source code and worsen the functionality of Captcha. Also, there are various problems with different appearances of the same code in different browsers. So we decided to solve this problem by showing a border around the picture that one has to click on. We solved this exact part by involving jQuery in the source code. The picture is shown in div of dedicated scale, position, color and name. After clicking on the picture the border is shown around the div, not the picture. This action made the picture move. From a visual side, there was no problem, but it did not have a good aesthetic appearance. We wanted to make all the divs immobile and not influenced by changing scale after marking them with a border. We changed markings by border, by marking the picture with shadows after a click. That is the way to make div immobile after marking it. We chose a scale of fifteen pixels for the shadow. The color of the shadow is red, so it is easy to recognize which picture is the one marked. A few problems were solved, but many others showed up.

After marking a picture one can change one's mind and want to mark another one. It does not sound like a big deal, but after marking a new picture one needs to unmark the old one. The solution we have described above made the pictures marked, not unmarked when one selected another picture. We had to upgrade click function with variables which indicate whether the other div is selected or not.

Help button

Military Captcha is supposed to be accessible even for people that are not familiar with military ranks. Due to this problem it was necessary to add a help button that shows all ranks of the chosen nationality. The button is situated underneath the national flags. The new window displaying military ranks will open after clicking on this button.

NATO	Hodnost	Vizuální zobrazení
OR-1	Vojín	
	Svobodník	
OR-2	Desátník	
OR-3	Četař	
OR-4	Rotný	
OR-5	Rotmistr	
OR-6	Nadrotmistr	
OR-7	Praporčík	
OR-8	Nadpraporčík	
OR-9	Štábní praporčík	
OF-1	Poručík	
	Nadporučík	
OF-2	Kapitán	
OF-3	Major	
OF-4	Podplukovník	
OF-5	Plukovník	
OF-6	Brigádní generál	
OF-7	Generálmajor	
OF-8	Generálporučík	
OF-9	Armádní generál	

Picture 12. Military ranks — Czech Republic

NATO	Rank	View
OR-1	Private	
OR-2	Private	
OR-3	Private First Class	
OR-4	Specialist	
	Corporal	
OR-5	Sergeant	
OR-6	Staff Sergeant	
OR-7	Sergeant First Class	
OR-8	Master Sergeant	
	First Sergeant	
OR-9	Sergeant Major	
	Command Sergeant Major	
	Sergeant Major of the Army	

NATO	Rank	View
OF-1	Second Lieutenant	
	First Lieutenant	
OF-2	Captain	
OF-3	Major	
OF-4	Lieutenant Colonel	
OF-5	Colonel	
OF-6	Brigadier General	
OF-7	Major General	
OF-8	Lieutenant General	
OF-9	Colonel General	
OF-10	General of the Army	

Picture13. Military ranks — United States

NATO	Hodnosť	Vizuálne zobrazenie
OR-1	Vojak 1. stupňa	
	Vojak 2. stupňa	
	Slobodník	
OR-2	Desiatnik	
OR-3	Čatár	
OR-4	Rotný	
OR-5	Rotmajster	
OR-6	Nadrotmajster	
OR-7	Podpráporčík	
OR-8	Práporčík	
OR-9	Nadpráporčík	
OF-1	Poručík	
	Nadporučík	
OF-2	Kapitán	
OF-3	Major	
OF-4	Podplukovník	
OF-5	Plukovník	
OF-6	Brigádny generál	
OF-7	Generálmajor	
OF-8	Generálporučík	
OF-9	Generál	

Picture14. Military ranks — Slovak Republic

NATO	Ranksorban	Vizuális megjelenítés
OR-1	Honvéd	
OR-2	Őrvezető	
OR-3	Tizedes	
OR-4	Szakaszvezető	
OR-5	Őrmester	
OR-6	Törzsőrmester	
OR-7	Főtörzsőrmester	
OR-8	Zászlós	
OR-8	Törzszászlós	
OR-9	Főtörzszászlós	
OF-1	Hadnagy	
OF-1	Főhadnagy	
OF-2	Százados	
OF-3	Őrnagy	
OF-4	Alezredes	
OF-5	Ezredes	
OF-6	Dandártábornok	
OF-7	Vezérőrnagy	
OF-8	Altábornagy	
OF-9	Vezérezredes	

Picture15. Military ranks — Hungary

Web implementation

As you can see, there are flag icons representing each state individually. It is there only for testing purposes and it is not going to be in the web version. The implemented version is supposed to appear right after one wants to send post or information where one has filled in a contact form. These are two main but not exclusive domains where Captcha could be used. Unlike the testing version, the implemented version will not let you change nationality while answering a question. There will be an option that will let you choose from the list of nationalities. Nationality selection will be presented by a selection file containing all nationalities.

Posting

One of many domains where Captcha could be implemented is at forums, mainly due to a higher possibility of bot attacks. Problems occur right before the successful posting of a contribution. That is the weakest part in forum security, and Captcha helps strengthen this weakness by implementing itself.

The program should be used in situations such as sending your post to a forum, just after clocking the submit button. Your post is held right after clicking and Captcha pops up, the rest of the screen is blacked out and the only accessible part of the screen is Captcha. The content of the webpage is accessible and you or the robot has to answer the question that Captcha wants solved. The only thing that allows continuation is solving the question.

Sending

Sending has similar principles as posting has, but with the difference that sending is not viewed on the webpage. This applies to contact forms that allow admins and also robots to get personal information. As mentioned before, sending has a principle which is similar to posting. It includes a button, but its main purpose is calling, the function that shows Captcha and hides the website content.

Web browser and nationality support

Captcha was developed and tested on Google Chrome, on which it is fully functional. Also it is working properly in other browsers like Mozilla and Firefox. The only problematic browser is Internet Explorer, which does not support a svg file format. In the current situation Military Captcha supports three nationalities: Czech, American, Slovak and Hungarian. These involve ranks and Captchas in the native language for each state individually.

Implementation possibilities

Military Captcha could be used on websites of the Czech army: http://www.army.cz/. Implementation at school intranet is also possible.

Other possible ways of Captcha usage

On the other hand, despite security purposes there is an option to use Captcha as educating material.

Security elements

Right–clicking is not allowed after Captcha appearance. This represents a simple prevention against potential abuse. The main reason is to limit a robot's options of abuse to the maximum. After wrong indication, followed by unsuccessful checking, the Captcha will reload itself.

Possibilities of future development

Expansion

Due to multinational influence, national expansion is necessary. The number of French soldiers in our institution has risen, due to this French Captcha is needed.

Education

Captcha could be also used for educating. The program should be accessible for every student at university webpages. Upgraded by an option menu where you can select difficulty and number of questions, plus nationality selection.

Resources

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The Analysis of the U.S. Financial Year (FY) 2014 Defense Budget[1]

SZABÓ Albert[2]

Introduction

The analysis examines the governmental decisions that tried to provide alternatives and offer a realistic response to the current U.S. debt crisis, severely undermining those defense budget provisions that had previously been planned. First, the impact of the 2011 Budget Control Act and the 'sequestration' process will be examined within the context of U.S. defense planning, giving a comprehensive overview of the U.S. budget debate with regard to U.S defense policy. Then the analysis compares and contrasts the current 2013 financial year data to the 2014 financial plan proposal based on President Obama's statement in the White House on April 10, 2013, in which he presented the key points of the 2014 financial year budget. There the President put an emphasis on his sustained effort to improve the situation of American people through social benefit programs. These will have a determining effect to the United States armed forces in the future, which operate under heavy pressure and at times financial austerity. Expenses of social welfare and medical care are important for our analysis, as these belong to more steady mandatory items of the federal budget, while the defense budget relies mostly on discretionary funding, and is subject to major fluctuations. Finally the assessment will reflect on the Obama administration's FY 2014 proposals with regard to the US defense policy review process in order to highlight the practical effects of sequestration.

Keywords: United States, strategy, defense policy, sequestration, financing

1. The essence of the Budget Control Act and the sequestration process

President Barack Obama approved the Budget Control Act (BCA) [1] on August 2 2011. In several aspects this was a milestone in the history of the United States, as one of the worst budget crises ever was postponed by the Act. Enacting the BCA was the only way for the United States to maintain financial liquidity in the short term. Even though it has never happened in U.S. history that the financial year has closed with a budget surplus, but this particular situation was extremely hard: enduring fiscal deficit and the continuously high stock of government debt was to continue increasing the debt accumulation in the U.S., paralyzing financial policy. Therefore, significant fiscal spending cuts were enacted to regulate the growth of debt and maintain financial viability.

1 This article is the written form of the presentation that was shown on the Central European Forum on Higher Military Education (CEFME) International Young Scientists Conference on December 2013, NUPS, Budapest

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The BCA created the so called Joint Select Committee on Deficit Reduction, publicly referred to as the Super Committee, whose primary task was finding a suitable solution to reduce the estimated $ 1.2 trillion deficit over the next ten years. However, in the selected ten–year period, the BCA will be followed much more by rebalancing the rate of debt accumulation, raising again long–disputed questions within U.S. politics, like how these cuts would be distributed among the different departments and functional fields.

As the next step, the budget sequestration process was initiated as an inevitable measure, unless a negotiated solution to executing budget reductions was found. The budget sequestration in 2013 referred to the automatic spending cuts of U.S. federal government spending in different categories of outlays that were initially set to go into effect on January 1, 2013. Both parties in Congress, the President, and the secretary of defense insisted that sequestration would not be allowed to go into effect, and no contingency plans were developed to mitigate the effects. Despite being under serious pressure, sequestration was also postponed by a further two months by the American Taxpayer Relief Act of 2012, until March 1st 2013 to create further opportunity for a bipartisan negotiated solution. However, still lacking consensus the sequestration finally went into effect. The sequestration became a major topic of the fiscal cliff debate. The debate's resolution, the American Taxpayer Relief Act of 2012 (ATRA), [2] eliminated much of the taxation issues of the dispute but only delayed budget sequestrations for two months, thus reducing the original $110 billion to be saved per fiscal year to $85 billion in 2013. [3] The reductions in spending authority are approximately $85.4 billion during fiscal year 2013, with similar cuts for years 2014 through 2021. [4] However, the Congressional Budget Office estimated that the total federal outlays will continue to increase even with the sequester by an average of $238.6 billion per year during the next decade, although at a somewhat lesser rate.

2. Historical perspectives

Putting the uneasy situation of the U.S federal budget crisis into historical perspective and contrasting the Department of Defense (DoD) budget within, we can observe unprecedented levels of DoD expenditure in real terms, explaining a lot about the current crisis. On February 1st 2011, the Obama administration released its FY 2011 budget. That fiscal year was seeking 549 billion dollars for the Department of Defense base budget, which also included war costs. This represents a nominal increase of 2.8 percent in real terms, or 1.4 percent over the FY 2010 request.

Since 2001, the base budget has grown by an average of four percent per year above inflation. Overall funding for overseas contingency operations (OCO) has declined by just over 50 percent since 2008 when the war in Iraq ended. [5]

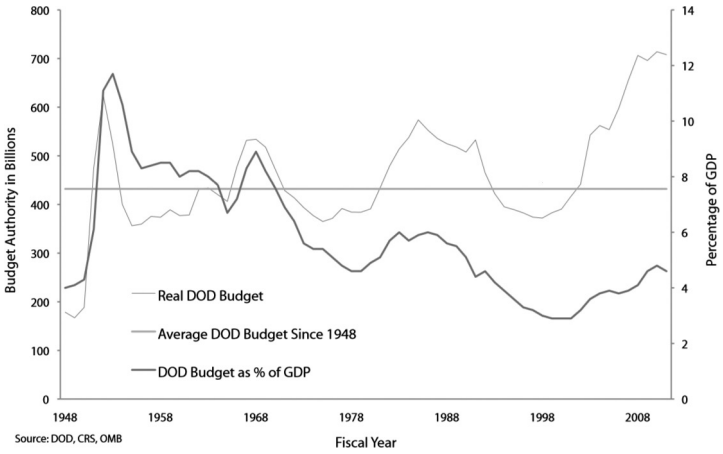

Chart 1. Pentagon Budget Since 1948 [6]
(in constant FY 2011 dollars – includes war costs)

As Chart 1 shows, defense spending since World War II has risen and fallen in cycles. In inflation–adjusted dollars and including war costs, the FY 2011 Pentagon budget request was 13 percent higher than the Korea War peak, summing up to 624 billion dollars; and it was 33 percent higher than the Vietnam War peak (534 billion dollars), 23 percent higher than the Reagan–era 1980s peak (574 billion dollars), and 64 percent higher than the Cold War average (432 billion dollars), and also 15 percent higher than the post–9/11 average which was 618 billion dollars. The latter symbolized the historic DoD budget record in the United States.

3. Effects on the FY 2014 defense budget

Our intention is to compare the FY 2013 defense budget to the FY 2014 defense budget request and to examine the main fracture points which influence U.S defense policy planning. The Obama Administration requested $525.4 billion in discretionary funding and $6.3 billion in mandatory funding in the base Department of Defense budget for FY 2013. Initially the budget did not include a request for Overseas Contingency Operations (OCO) funding and instead used a placeholder of $88.5 billion, which was similar to the level of war funding in FY 2012. In May, the DoD released its FY 2014 OCO budget request, which totaled $88.5 billion. With this change, the total DoD request for FY 2013 — including the base budget and OCO — was set to $620.2 billion USD.

Account	FY 2013 Request *(in billions)*
DoD Base Discretionary	$525.4
DoD Base Mandatory	$6.3
DoD Overseas Contingency Operations	$88.5
DoD Total (051)	***$620.2***
Department of Energy	$17.8
Department of Labor	$1.4
Other Agencies	$0.2
Atomic Energy Total (053)	***$19.4***
Department of Justice	$4.8
Department of Homeland Security	$1.6
Other Agencies	$1.4
Defense-Related Activities Total (054)	***$7.7***
Department of Veterans Affairs	$137.4
Other Agencies	$0.4
Veterans Total (700)	***$137.7***
Payment to Military Retirement Fund	**$67.2**
Total Defense-Related Funding	***$852.2***

Chart 2. Summary of defense–related funding in the FY 2013 Budget Request [7]

Chart 2 presents the total defense–related budget that includes more than the DoD budget alone. The budget request also includes $19.4 billion for defense–related atomic energy programs, $7.7 billion for defense–related activities in other agencies, and $137.7 billion for veterans' benefits and services. The treasury must also make an annual payment of $67.2 billion to the Military Retirement Trust Fund which was $15.2 billion. Together these expenses total $852.2 billion, or 23 percent of the total federal budget.

The FY 2014 budget request was released by the Obama administration on April 10 and this request — similarly to the FY 2013 defense request — does not comply with the Budget Control Act budget caps currently in effect for FY 2014, exceeding the caps by $52 billion. The FY 2014 budget requests a total of $612.5 billion for the Department of Defense (DoD). The base budget for the Department includes $526.6 billion in discretionary funding and $6.5 billion in mandatory funding. An additional $79.4 billion is requested for ongoing military operations, primarily in Afghanistan.

Account	FY 2014 Request *(in billions)*
DoD Base (discretionary)	$526.6
DoD Base (mandatory)	$6.5
DoD Overseas Contingency Operations	$79.4
DoD Total (051)	***$612.5***
Department of Energy	$17.8
Department of Labor	$1.3
Other Agencies	$0.2
Atomic Energy Total (053)	***$19.3***
Department of Justice	$5.0
Department of Homeland Security	$1.6
Other Agencies	$1.4
Defense-Related Activities Total (054)	***$8.0***
Department of Veterans Affairs (discretionary)	$63.5
Department of Veterans Affairs (mandatory)	$86.1
Other Agencies	$0.4
Veterans Total (700)	***$150.0***
Treasury Payment to the Military Retirement Trust	$70.3
Tax Exemptions for Military Personnel	$15.2
Other Total	***$85.4***
Total Defense-Related Spending	***$875.2***

Chart 3. Summary of Defense–related Funding in the FY 2013 Budget Request [8]

The total defense–related budget request also includes $19.3 billion for defense–related atomic energy programs; $7.7 billion for defense–related activities in other agencies; $137.7 billion for veterans' benefits and services; $70.3 billion to the Military Retirement Trust Fund to cover unfunded obligations from prior years, as well as tax exemptions for military personnel that resulted in $15.2 billion in lost revenue. Altogether these expenses total $875.2 billion, which is nearly a quarter of the total federal budget.

Nonetheless, when comparing the total FY 2014 department of defense base budget request with the previous year we find that it had been reduced by $7.7 billion on the one hand, but on the other the total defense related spending had been increased by 23 billion dollars. The reason for this increase in spending is veterans' benefits and services, plus the costs of the military retirement trust fund. If we add up all these extra costs the result is $ 235.4 billion which is nearly half of the base DoD budget, or 'it could cover the costs of three Afghanistan wars'.

The 2012 Defense Strategic Guidance [9] calls for rebalancing to the Pacific region and the Middle East. The U.S. military is not likely to emerge from this drawdown with the capacity or capability to both increase its presence in the Asia–Pacific region and maintain its current level of presence in the Middle East. As the FY 2014 budget request also shows, U.S. forces can be redeployed from one theater to another as needed in the event of a conflict, but the military may not be able to address successfully two major overlapping conflicts in different theaters.

Conclusion

Basically, the fiscal uncertainty that began in 2011 with the federal statute of the BCA has only grown worse over time with the throw–back of the Super Committee, sequestration going into effect, and the government shutdown. Now that sequestration has indeed begun and the sharpest decrease from FY 2012 to FY 2013 has already taken place, the BCA budget caps may be more of a ceiling than floor in the coming years. Moreover, a significant reduction in the defense budget means that the United States will have to make a number of critical strategic choices in defense planning and management for the future. [8] The sequestration process or the BCA do not relieve defense planners from making these difficult choices because future funding levels are never certain—Congress only appropriates one year at a time. [10]

Finally, the current budget impasse may not be resolved until the Afghanistan drawdown is effectively over, at which point many of the critical decisions will have already been made for the Defense Department by incremental reductions that chip away at programs year–by–year or, worse, by the blunt and indiscriminant mechanism of sequestration. The 2014 Quadrennial Defense Review (QDR) and the FY 2015 budget request will provide an opportunity for the Defense Department to address the rapidly evolving budgetary pressure. If the Department plans for the reduced budget caps in its FY 2015 request and uses the QDR as an opportunity to alter its strategic guidance according to these more realistic budget constraints, it will give DoD greater say in how cuts are implemented in the future but on the other hand this approach is not without risks. [11] The Department now has an opportunity to revise its budget and strategic guidance to fit within more realistic resource constraints.

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Thoughts on the Book Nuclear Reactor Safety

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In 2013 December, the SOMOS Environmental Protection Ltd. and the ELTE Eötvös Publishing Company published a new book dedicated to the safety of nuclear reactors and having analogous title ("Nuclear reactor safety"). For the readers of Academic and Applied Research in Military Science we want to present some considerations for reviewing the book.
Keywords: nuclear reactor safety, operation and construction of nuclear reactors, safe operation, safety assessment, legal regulation of the reactor safety

Introduction

Nuclear weapons, defense against them and the non-proliferation issues have priorities in military science and the science of military engineering. Military tasks of nuclear emergency response and the research with contemporary scientific tools are especially important to meet the challenge of the renaissance of CBRN weapons.

The book on Safety of Nuclear Reactors is closely connected to the previously mentioned military and defensive tasks. It provides complete theoretical and practical knowledge of nuclear safety, one of the most essential parts of military engineering, i.e. the safety of nuclear reactors and nuclear power plants, including response tasks of a nuclear emergency.

The book Nuclear Reactor Safety covers the issues of the peaceful use of nuclear energy, and of the safe construction and operation of nuclear power plants. [1] The following goals of the book were declared by the editors: to complement missing basic knowledge, knowledge transfer, to awaken interest and support experts.

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Volume I. of Nuclear Reactor Safety

The Book has 750 pages in two volumes. The 378 pages of the first volume are separated into Chapters I-III. The contents of the chapters are shortly summarized below.

Picture 1. The cover of Volume I.

Chapter I. The most important processes of nuclear reactors

The first chapter reviews the basic nuclear processes facilitating the understanding of the following chapters: fission, chain-reaction, neutron physics, critical systems, research reactors, nuclear power plants, the basic physics of the pressurized water reactors, and the basics of thermo hydraulics, fuel cycle, the behaviour of fuel elements, activity transport and environmental effects.

Chapter II. The construction of nuclear power plants

This chapter reviews the basic operation of a nuclear power plant, the function of a nuclear power plant, the features of the power plant cycle, the main characteristics of systems and equipment.

Chapter III. The basics of reactor design safety

The subjects of the chapter are the normal and emergency operational conditions, and the design basis of them; incidents, accidents, safety functions and systems; design basis and deterministic design principles, risks and characteristics and criteria of risk.

Volume II. of Nuclear Reactor Safety

The 372 pages of the second volume are separated into Chapters IV-VI.

Picture 2. The cover of Volume II.

Chapter IV. The operational safety of the reactors

Beside the technical requirements, the safety culture and the operational norms, for the consistency and coherence for the construction and the safe operation of a nuclear reactor there must be established instructions and procedures described in the actual chapter. The chapter shows how these norms, instructions and procedures must be complied with in any circumstances during normal and emergency operation. The aging treatments, maintenance, monitoring and testing listed in the chapter are also important elements of safe operation as long as possible.

Chapter V. The basics of safety assessments

The chapter depicts how safety assessment demonstrates the acceptability of safety level resulting from control measurements and tests directed at serious accident assessments, Level 1 and Level 2 PSA, assessments of external hazards and the evaluation of source term, activity transport and health effects.

Chapter VI. The legislation for the safety of nuclear reactors

The acceptance of the use of nuclear reactors in society is - as usual - based on legal regulations.

The relevant legislation is mostly based on international standards and other norms accepted by international organizations. Among these are the safety standards of the IAEA[3] [3] and the European Union regulations, directives and recommendations. Safety is guaranteed by the international organizations and a system of international conventions.

The chapter describes the legislative background, the responsibilities, safety reports, and the activity of international organizations (IAEA, OECD[4] NEA[5], ENSREG[6], WENRA[7]) and the system of international conventions.

Final conclusions

The Hungarian authors of the book have published such a complex work on the topic, a first in the world. Besides the theoretical questions the book provides an overview of the process how the issues of nuclear reactors' safety are handled by professionals in practice. It can be stated that the book is a new and bright lighthouse in the sea of domestic nuclear safety. It directs and guides the reader through the safety issues of the electricity-producing nuclear power plants, which make up the dominant part of the peaceful use of nuclear energy.

Besides the importance, the actuality of the book is also acknowledged, because the MVM[8] Paks Nuclear Power Plant (NPP) has a leading position in energy production in Hungary, generating more than 40% of the domestic electric energy. However, the increase in energy production has become a necessity recently, and one of the important and environmentally friendly ways is the extension of the Paks Nuclear Power Plant with a new block or blocks. Young specialists, as well as students, teachers and workers in their field of work can find knowledge and experience in the book necessary for the NPP's extension. A well of experience and several decades of practical knowledge from the writers were also incorporated into this masterpiece.

Holló Előd, one of the editors of the book mentioned the possibility of a shorter English edition of the book.

The book has 24 authors, who are not teachers, but experts in their own fields, acknowledged both at a domestic and international level. The diversity results in the occasional struc-

3 International Atomic Energy Agency
4 The Organisation for Economic Co-operation and Development
5 Nuclear Energy Agency
6 European Nuclear Safety Regulators Group
7 Western European Nuclear Regulators Association
8 MVM — Magyar Villamos Művek (Hungarian Electric Energy Corporation)

tural problems of the book. It is not a lack of teaching approach, rather the missing unified approach and style that might be objected to.

The editors sought homogeneity with the main objectives, that the principles must be reviewed generally and the practical implementations with examples from the Paks NPP should also be referred to. The four-member editorial board had a difficult task to ensure a homogeneity of visions of 24 individual authors. It is appreciated that their effort was mostly successful, but not in every case, unfortunately.

We hope that these imperfections of the Hungarian edition will be eliminated in the planned English edition and the readers will receive a great handbook.

Based on all these, we highly recommend this book for the specialists of both the civil and the defense sectors.

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