Logistics, combat service support,
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THE BATTLEFIELD MAINTENANCE IN ALLIED COMBAT OPERATIONS WITH REFERENCE TO BATTLE DAMAGE REPAIR OF WEAPON SYSTEMS

The paper presents battlefield maintenance system during allied combat operations with particular emphasis on evacuation and repair of weapon systems. The mentioned processes are described on the basis of allied policies, doctrines and regulations. The special role of expedient (improvised) repairs was underlined as a system which allow to sustain technical efficiency of military equipment during dynamic combat operations and far from sources of supply.

SYSTEM ZABEZPIECZENIA TECHNICZNEGO OPERACJI SOJUSZNICZYCH W KONTEKŚCIE NAPRAW USZKODZEŃ BOJOWYCH SYSTEMÓW UZBROJENIA

W artykule przedstawiono system zabezpieczenia technicznego podczas operacji sojuszniczych ze szczególnym uwzględnieniem zadań ratownictwa technicznego, tj. ewakuacji i napraw uszkodzeń bojowych systemów uzbrojenia realizowanych w warunkach polowych. Przedstawione procesy zostały scharakteryzowane na podstawie sojuszniczych regulacji i doktryn. W pracy podkreślono szczególną rolę ratownictwa technicznego, a zwłaszcza doraźnych (improwizowanych) napraw, realizowanych w rejonie działań, które mogą mieć kluczową rolę w zakresie utrzymania zdatności technicznej systemów uzbrojenia w czasie dynamicznych operacji wojskowych realizowanych na odległych teatrach działań.

1. INTRODUCTION

Operating on a future battlespace military units will relatively smaller and will characterize higher mobility and autonomy which is caused by necessity to operate far from own supply sources and lack of local support. The units will operate as expedition and joint tasks forces and will made up of land, air and navy units. As a result, the land forces must create with other sort of armed forces mobile and well equipped and trained battle units to properly conduct military tasks on the future battlefield[2] (fig. 1). To follow the mentioned requirements logistics units should aim at the same level of mobility and ability like

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[2] K. Ficoń, *Logistyka operacyjna*. BEL Studio Sp. z o.o., Warszawa 2004

supported by them fighting units[3]. One of the organizational and technical solution, developing and improving by NATO armies, which permit quickly recover fighting ability of broken weapon systems during combat operations are systems of expedient (temporary) repairs, including battle damage repairs.

Fig. 1. Maintenance of Armored Infantry Vehicle "Rosomak" during operation ISAF
Source: photo of S. Budek

2. COMBAT SERVICE SUPPORT

An efficient and effective combat service support system of military units conducting any combat operations is the principal determinant of the success. This fact is confirmed by both the historical and conducted recently armed operations[4,5,6,7,8,9,10]. Concerning functional point of view, logistics system of military units can be grouped into six subsystems (fig. 2).

[3] MC 319/1, NATO Prinicples and Policies for Logistics, Brussels 1997
[4] R. E. Dupuy, *Historia wojskowości. Starożytność – średniowiecze*, Bellona, Warszawa 1999
[5] H. N. Schwarzkopf, *Nie trzeba bohatera: autobiografia*, Ryton, Warszawa 1993
[6] W. Lester Grau, Timothy Thomas L., *Soft Log and Concrete Canyons: Russian Urban Combat Logistics in Grozny, http://fmso.leavenworth.army.mil/documents/softlog/softlog.htm*, z dnia 04.02.2009
[7] R. Bielecki, *Wielka armia Napoleona*, Bellona, Warszawa 1995
[8] *The Falklandy Campaign: The Lessons*, Londyn 1982
[9] S. Dworecki, T. Kęsoń, *Konflikty zbrojne w Europie i na Bliskim Wschodzie*, MON, Warszawa 1996
[10] T. Smal T. (red.), *Zabezpieczenie logistyczne PKW w operacjach poza granicami kraju*, Wrocław 2007

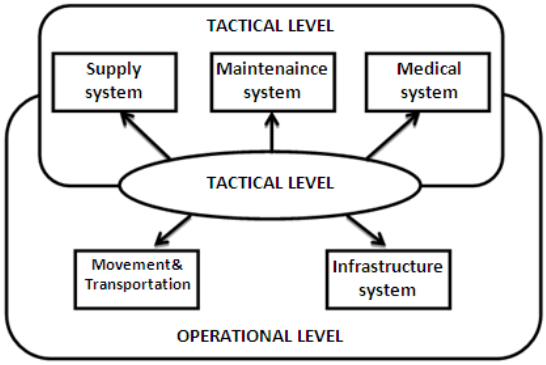

Fig. 2. Organizational structure of military units logistics system
Source: Own work on the basis of: K. Ficoń, Operational Logistics (In Polish). BEL Studio Sp. z o.o., Warsaw 2004, p. 71

Ensuring for fighting units appropriate level of materials supply and logistics service is a crucial to effectively perform combat operations and requires to implement a number of coordinated with each other processes, which include[11]: management, material supply, maintenance, medical support, movement&transportation and military infrastructure.

3. MAINTENANCE OF WEAPON SYSTEMS

The most essential is process of technical support provided by maintenance subsystem in refers to current paper[12]. According to doctrinal documents, technical support means maintenance of weapon systems to keep them ready to use and recovery of their ability to use in case of damage as well as supply military units in military equipment, spare parts and technical materials, which are crucial to conduct service and repair[13,14].

Maintenance tasks of weapon system was presented on the figure 3.

[11] DD/4, *Doktryna logistyczna Sił Zbrojnych RP*. Sztab Generalny WP, Warszawa 2004, s. 25-54
[12] S. Niziński, *Eksploatacja obiektów technicznych*. Biblioteka Problemów Eksploatacji, ITE, Warszawa-Sulejówek-Olsztyn-Radom, 2002
[13] DD/4.2, *Doktryna logistyczna wojsk lądowych*, DWL, Warszawa 2007, s. 151
[14] Stanag 2406, *Land Forces Allied Logistics* Doctrine - ALP-9(B), 1995

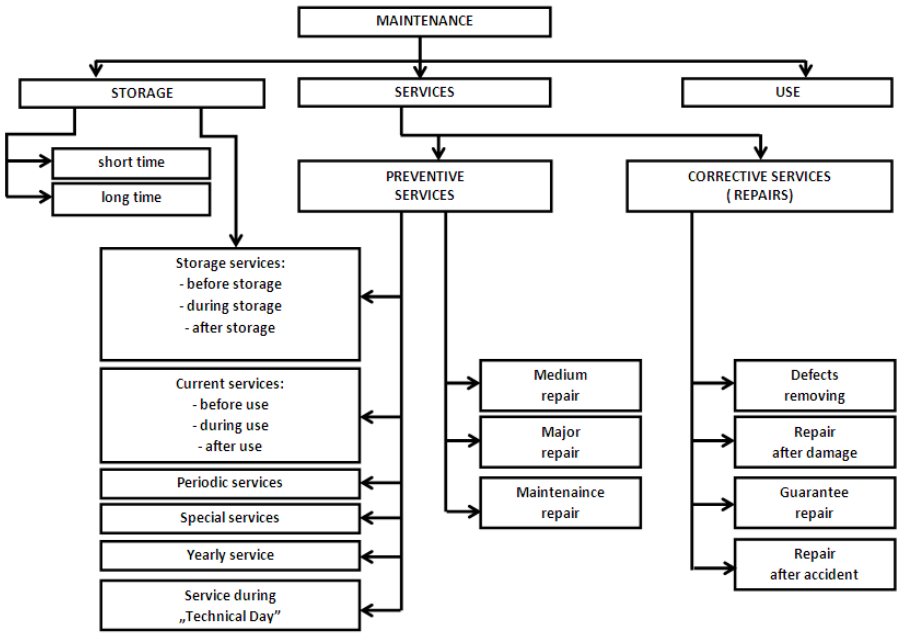

Fig. 3. Maintenance tasks of weapon systems of The Polish Land Forces
Source: A. Dryhusz, K. Kowalski, Paper in journal: The Scientist Book of The T. Kościuszko Military Academy of Land Forces 2010, no. 4(158), p. 73

Maintenance system operation can be divided into two stages[15]:

- maintenance of weapon systems to execute specific operation and training tasks,
- combat service support, including technical support to achieve sustainability and readiness of weapon systems at demanded level.

4. BATTELFIELD MAINTENANCE

According to Land Forces Logistic Doctrine of Polish Armed Forces[16], essence of technical support is maintenance of weapon systems at appropriate level of readiness to use. The mentioned process is conducted within the confines of combat service support of military units during peace, crisis and wartime by logistics units. During peace maintenance includes numerous tasks connected with keeping military equipment ready to use like servicing, repairing and maintaining during storage. Apart from that, there are modernization, retrofit or purchasing of new weapon systems executed in connection to needs.

However, combat operations are very dynamic process varying with time and space. The combat and tactics situation is changing on the battlespace instantly and random.

[15] K. Ficoń, *Logistyka operacyjna*. BEL Studio Sp. z o.o., Warszawa 2004, s. 103
[16] General Staff of Polish Armed Forces, HQ of Land Forces, *Land Forces Logistics Doctrine - (DD/4.2)* (In Polish), Warszawa 2007

Meanwhile all combat service support processes are determined and require precise planning, organization and supervising. That point of view considering, combat service support system slows down dynamic and pace of combat. Therefore, maintenance actions will often limited to recovery of weapon systems, that is: quick assessment of situation, evacuation, quick expedient repairs, cannibalization or destruction of equipment which cannot be evacuated or repaired (fig. 4).

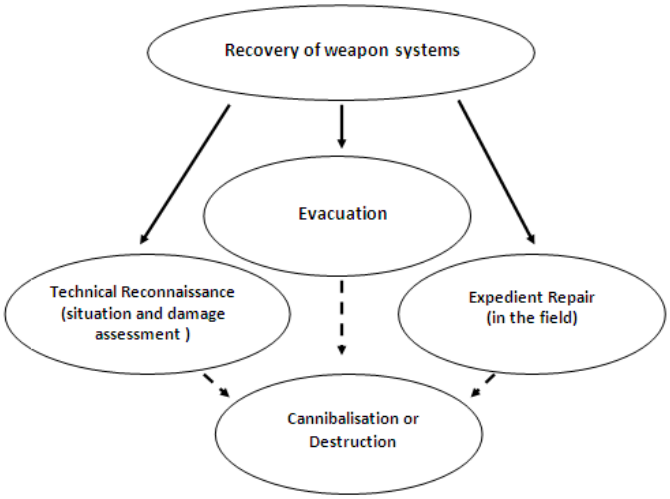

Fig. 4. Recovery tasks of weapon systems during combat operation
Source: own work

It should be underlined that weapon systems belong to group of technical object using in random mode[17] and like agricultural, city or rescue service equipment, they require specific maintenance system, which is determined to perform tasks just on time and place.

5. EVACUATION AND BATTLE DAMAGE REPAIR

The crucial processes of Battlefield Maintenance are evacuation and repair of weapon systems used to perform combat operations (fig. 5). Efficiency of that process will determine success on the current battlespace, which is connected with logistics forces and means supporting recovery tasks during operation[18,19,20]. The Yom-Kippur War conducted in 1973 was the perfect example of that thesis. The Israeli Armed Forces suffer a lot during first 18 hours of combat in refers to tanks, since 80% of them were damaged. However the Israelis had a very efficient evacuation and repair system and the small dimensions of battle area was additional advantage. The most of repairs were executed at a front line, because of that 80% of damaged tanks were recovered to operation in 24 hours. Some tanks were

[17] S. Niziński i R. Michalski (red.), *Utrzymanie pojazdów i maszyn*. Wydawnictwo Instytutu Technologii Eksploatacji, Olsztyn 2007, s.323
[18] M. Brzeziński, E. Chylak, *Eksploatacja w logistyce wojskowej*, Bellona, Warszawa 1996
[19] D. Voyls, *What is in a Name*. Aircraft Survability, Summer 2007
[20] FM 4-30.31, *BDAR and Recovery doctrine*, September 2006

many times damaged and recover. Finally, the very dangerous counterattack of the Egypt-Syria coalition was fought off thanks to 15 repaired tanks[21].

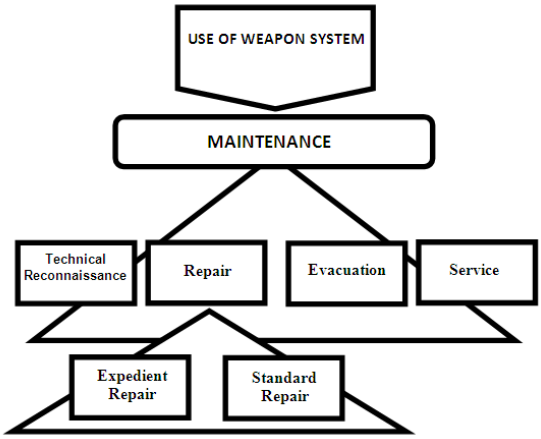

Fig. 5. Expedient repair in the maintenance system of military equipment
Source: own work on the basis of: K. Ficoń, Operational Logistics (In Polish). BEL Studio Sp. z o.o., Warsaw 2004, ISBN 83-88442-82-1

As the history and experiences of last wars show, modern and nonconventional means of fire will caused increasing losses in weapon systems[22,23]. As far as a military equipment concerned, most of damaged part of it is recovered on the battlefield and reused. It is very often basic source of supplying military units during combat operations[24,25].

The Logistics Doctrine of NATO Land Forces is basic doctrinal document, which unambiguous regulate recovery of military equipment problems[26]. It describes conditions and criteria of providing logistic support during allied operations. According to mentioned doctrine, repair includes all activities in order to recovery weapon systems as soon as possible. The special role of repair, executed in the field conditions, is underlined which can be improvise, temporary and conduct without standard methods[27]. At the same time, there is claimed in the document, that efficient field repair depends on systematic and flexible applying of following undertakings[28]:

- determining of repair priorities and urgent repair needs;
- assessment of damage range and necessary repair means;
- specifying the level and place of repair;

[21] P. Czerwiński, *Co to jest BDAR?* Przegląd Wojsk Lądowych 1999, nr 12, s. 82
[22] *Zasady zabezpieczenia tyłowego połączonych SZ NATO*, Wojskowy Przegląd Zagraniczny 1989, nr 3, s. 123
[23] S. Dworecki, T. Kęsoń, *Konflikty zbrojne w Europie i na Bliskim Wschodzie*, MON, Warszawa 1996, s. 181-182
[24] J. Godzimirski, Naprawa płatowców, WAT, Warszawa 1998
[25] K. Ficoń, *Logistyka operacyjna*. BEL Studio Sp. z o.o., Warszawa 2004, s. 103
[26] Stanag 2406: Land Forces Allied Logistics Doctrine - ALP-9(B), 1995
[27] K. Ficoń, *System eksploatacji techniki wojskowej w NATO*. Wojskowy Przegląd Logistyczny i Techniczny nr 5, 2001, s. 3 - 4
[28] J. Wójcik, *Organizacja remontów i ewakuacji technicznej wg doktryny ALP-9(B).* Poglądy i Doświadczenia 2001, nr 4, s. 61

- determining and obeying procedures of repair;
- providing supply of spare parts and repair materials;
- organizing of evacuation and repair process.

There is also stated in the mentioned doctrine that the expedient repairs, conducted on the fighting area, are crucial task of battlefield maintenance system. It should be improvised and executed as close a broken equipment as possible in order to quickly restore damaged weapon systems. The expedient repair is taken if:

- there is not enough time or lack of spare parts to provide standard repairs;
- the operational situation forces to quickly restore damaged weapon systems;
- after expedient repair and accomplishing task restored object must be repaired using standard methods.

According to Stanag 2399 „ Battle Field Recovery/Evacuation Operation", evacuation and repair of weapon system should be executed very close to fighting units with use of the newest technology, which allow to quickly recover of damaged equipment and accomplish a task. It is also permissible to restore working order of object only partially with using of improvise and temporary methods and technologies[29].

The newest NATO document that refers to battle damage repair of weapon systems is Stanag 2418, which introduce idea of expedient repair. This kind of activity was defined as repair, which can be temporary and executed with use of nonconventional (improvised) methods in barracks or in the field conditions. The expedient repair can be conducted only in accordance with the accepted procedures and instructions[30]. According to the quoted document, expedient repair includes also battle damage repair.

The analysis of battle damage repair systems in others armies of NATO[31], and especially in the U.S. Army[32,33,34,35], prove that the system is essential component of battlefield maintenance and it is being permanently improved and expanded concerning it significance and complexity. The improvement of the system is provided by numerous researches, analysis and tests of the state-of-the-art technologies, lessons&learned programs and trainings. As a result, there is no confirmation for the theory about superiority of standard repair executed with using spare parts instead of expedient repair conducted close to fighting weapon systems. As the numerous publications show, the allied armies use mobile and easy to move mobile workshops and battle damage repair technology and equipment during combat operations conducted on the remote battle theatres[36,37,38,39].

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[29] STANAG 2399, *Battle Field Recovery/Evacuation Operation*. 1992

[30] STANAG 2418, *Procedures for expedient repair, including battle damage repair*. 2009

[31] T. Smal, *Geneza, rozwój i funkcjonowanie systemu BDAR*. W: K. Kowalski (red): III Sympozjum Naukowo-Techniczne - Eksplolog 2008 nt.: Problemy eksploatacji techniki bojowej oraz kompetencje oficerów logistyki WL, ISBN-978-83-87384-18-0, Wrocław-Karłów 19-21.11.2008, s. 254-266

[32] T. Smal, G. Stankiewicz, *System napraw polowych w armii USA*. Logistyka nr 6/2000

[33] FM 4-30.31 (FM 9-43-2), *Recovery and Battle Damage Assessment and Repair*, 2006

[34] W. Tipps, *Battle Damage Assessment and Repair (BDAR) Largely Neglected*. Aircraft Survability, Summer 2007

[35] E. Nowak, W. Nowak: *Zabezpieczenie logistyczne wojsk lądowych w armii USA*. Wojskowy Przegląd Logistyczny i Techniczny 1999, nr 3

[36] Joint Support Command of HA, The Improvised and Battle Damage Repair Concept for Bundeswehr Land Systems, Cologne 2007

[37] I. Kjartan, *Presentation of the Norwegian BDR-equipment*. In Procedings: 15th NATO/PfP Battlefield Maintenance Panel meeting, 10 – 14 May 2010 at Antalya, Turkey

6. CONCLUSIONS

The weapon systems belong to group of technical objects use in random mode and they require special maintenance system, which is determine to accomplish task on time in specific place regardless of circumstances. Efficiently operating maintenance system can determine success in combat operation if it is organized on the strength of mobile and well trained and equipped maintenance units. The system can even create advantage over an enemy by quickly recovering and restoring all damaged objects with the exception of heavy combat damages. That is way, the new and diverse solutions should be searched for in order to support fighting units in capable weapon systems without necessity of evacuation to stationary workshops. The expedient repair/battle damage repair system is a solution, which can improve operation of maintenance system. Diversification of various solutions and adequate designing of equipment (repairability) will support logistics units in recovering of weapon systems and can help create advantage over an enemy.

The crucial role of efficient and effective maintenance system in the field conditions is underlined not only in the allied doctrines and rules but also in numerous publications concerning recently conducted combat operations. The appropriate documents admit execution of improvise and temporary repairs in order to fast recover of damaged weapon systems to battle area. As far as the battlefield maintenance of weapon systems at the appropriate level of task efficiency concerned it is very profitable to the weapon system would characterized by high level of survivability, vulnerability and repairability in case of any damage. Additionally, there are necessary well-trained specialists, appropriate procedures and repair instructions, which are accepted and equipment, tools and materials to quickly execute battle damage repairs during combat operations.

7. BIBLIOGRAFIA

[1] Bielecki R., *Wielka armia Napoleona*, Bellona, Warszawa 1995.
[2] Brzeziński M., Chylak E., *Eksploatacja w logistyce wojskowej*, Bellona, Warszawa 1996.
[3] Czerwiński P., *Co to jest BDAR?* Przegląd Wojsk Lądowych 1999, nr 12.
[4] DD/4, *Doktryna logistyczna Sił Zbrojnych RP*. Sztab Generalny WP, Warszawa 2004.
[5] DD/4.2, *Doktryna logistyczna wojsk lądowych*, DWL, Warszawa 2007.
[6] Dupuy R. E., *Historia wojskowości. Starożytność – średniowiecze*, Bellona, Warszawa 1999.
[7] Dworecki S., Kęsoń T., *Konflikty zbrojne w Europie i na Bliskim Wschodzie*, MON, Warszawa 1996.
[8] E. Nowak, W. Nowak: *Zabezpieczenie logistyczne wojsk lądowych w armii USA*. Wojskowy Przegląd Logistyczny i Techniczny 1999, nr 3.
[9] Ficoń K, *Logistyka operacyjna*. BEL Studio Sp. z o.o., Warszawa 2004.
[10] Ficoń K, *System eksploatacji techniki wojskowej w NATO*. Wojskowy Przegląd Logistyczny i Techniczny nr 5, 2001.
[11] FM 4-30.31 (FM 9-43-2), *Recovery and Battle Damage Assessment and Repair*, 2006.

[38] O. Reitshmied, *Battle Damage Repair (kit)*, In Procedings: 15th NATO/PfP Battlefield Maintenance Panel meeting, 10 – 14 May 2010 at Antalya, Turkey
[39] J. Furch, O. Těšík, *Temporary Repairs of Army Vehicles* (in Czech). In Proceedings of Armamant and Technics of Land Forces. Liptovský Mikuláš: Akadémia ozbrojených síl generála M. R. Štefánika, 2006, p. 260 – 267

[12] Furch J., Těšík O., *Temporary Repairs of Army Vehicles* (in Czech). In Proceedings of Armamant and Technics of Land Forces. Liptovský Mikuláš: Akadémia ozbrojených síl generála M. R. Štefánika, 2006.
[13] General Staff of Polish Armed Forces, HQ of Land Forces, *Land Forces Logistics Doctrine - (DD/4.2)* (In Polish), Warszawa 2007.
[14] Godzimirski J., Naprawa płatowców, WAT, Warszawa 1998.
[15] Grau W. L., Thomas T. L., *Soft Log and Concrete Canyons: Russian Urban Combat Logistics in Grozny, http://fmso.leavenworth.army.mil/documents/softlog/softlog.htm,* z dnia 04.02.2009.
[16] Joint Support Command of HA, The Improvised and Battle Damage Repair Concept for Bundeswehr Land Systems, Cologne 2007.
[17] Kjartan I., *Presentation of the Norwegian BDR-equipment.* In Procedings: 15th NATO/PfP Battlefield Maintenance Panel meeting, 10 – 14 May 2010 at Antalya, Turkey.
[18] MC 319/1, NATO Prinicples and Policies for Logistics, Brussels 1997.
[19] Niziński S., *Eksploatacja obiektów technicznych.* Biblioteka Problemów Eksploatacji, ITE, Warszawa-Sulejówek-Olsztyn-Radom, 2002.
[20] Niziński S., Michalski R. (red.), *Utrzymanie pojazdów i maszyn.* Wydawnictwo Instytutu Technologii Eksploatacji, Olsztyn 2007.
[21] Reitshmied O., *Battle Damage Repair (kit),* In Procedings: 15th NATO/PfP Battlefield Maintenance Panel meeting, 10 – 14 May 2010 at Antalya, Turkey.
[22] Schwarzkopf H. N., *Nie trzeba bohatera: autobiografia*, Ryton, Warszawa 1993.
[23] Smal T. (red.), *Zabezpieczenie logistyczne PKW w operacjach poza granicami kraju*, Wrocław 2007.
[24] Smal T., *Geneza, rozwój i funkcjonowanie systemu BDAR.* W: K. Kowalski (red): III Sympozjum Naukowo-Techniczne - Eksplolog 2008 nt.: Problemy eksploatacji techniki bojowej oraz kompetencje oficerów logistyki WL, ISBN-978-83-87384-18-0, Wrocław-Karłów 2008.
[25] Smal T., Stankiewicz G., *System napraw polowych w armii USA*. Logistyka 2010, nr 6.
[26] STANAG 2399, *Battle Field Recovery/Evacuation Operation.* 1992.
[27] Stanag 2406, *Land Forces Allied Logistics* Doctrine - ALP-9(B), 1995.
[28] STANAG 2418, *Procedures for expedient repair, including battle damage repair*. 2009.
[29] Tipps W., *Battle Damage Assessment and Repair (BDAR) Largely Neglected*. Aircraft Survability, Summer 2007.
[30] Voyls D., *What is in a Name*. Aircraft Survability, Summer 2007.
[31] Wójcik J., *Organizacja remontów i ewakuacji technicznej wg doktryny ALP-9(B).* Poglądy i Doświadczenia 2001, nr 4.
[32] *Zasady zabezpieczenia tyłowego połączonych SZ NATO*, Wojskowy Przegląd Zagraniczny 1989, nr 3.