

Original article

## Using tanks for indirect fire – an attempt to reactivate training

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### INFORMATIONS

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### ABSTRACT

*Indirect fire is a domain of artillery. Tanks due to their combat capabilities (mobility, hit resistance and accuracy of fire) were hardly used for such type of tasks, although being prepared from constructional point of view. Nevertheless, evaluation of a concept of tanks utilization in a battlefield frequently oscillated around a support of infantry or just operation support. Closing down and ceasing development of artillery units as a result of the Polish Armed Forces' transformation led to a situation under which the lack of an adequately intensive artillery fire significantly affecting support of first echelon units can be faced during real operations. For this reason, the General Command of Branches of Armed Forces bearing in mind tanks' capability of fulfilling the aforementioned task decided to reactivate the competence of indirect fire by tanks' crews, especially because the execution of this task was terminated at the beginning of the 1990s. The article presents the analysis of documents in force related to conducting indirect fire by a tank subunit and characteristics of individual undertakings required for preparation of a subunit to fulfil above-mentioned tasks based on the experience gained by a tank battalion of the 15<sup>th</sup> Mechanized Brigade in Gizycko, as well as realization of numerous organizational projects necessary for shooting preparation and fire control execution during fulfillment of this type of fire tasks. Results of practical indirect fire execution by tanks lead to constructive observations referred to achieving high results of an accurate indirect fire by tanks and implementing changes in documents which normalize training and shooting processes, adjusting an organizational portion of the project to the current organizational structures of tank and artillery subunits and to correlations resulting from this fact. The article also inclines to discussion regarding the direction of changes indispensable for conducting the indirect fire by tanks and the rationale of the execution of these tasks in a contemporary battlefield.*

### KEYWORDS

*shooting, tanks, indirect fire, covert fire position*



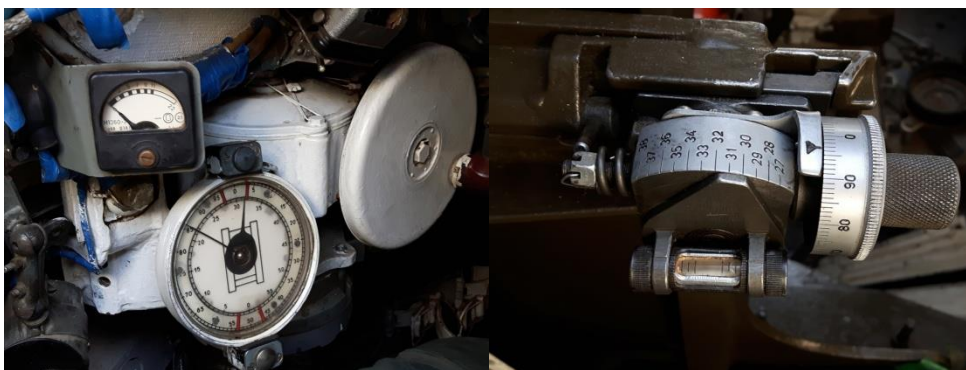
## Introduction

Tanks are one of the most important combat assets of a contemporary battlefield. Effectiveness of armed forces' operations depends both on their quality and methods of utilization. A tank, as a tracked combat vehicle is characterized by a powerful armament, a solid armor and high mobility, therefore, fighting an enemy's armored targets by the direct fire is considered to be its primary task. Nevertheless, applying capabilities of tank guns, characterized by the significant range and rate of fire, destructive impacts of fragmentation-demolition projectiles and optical sights provides capacity of fulfilment fire tasks by tanks in a manner different from the standard one, that is the indirect fire from covert fire positions.

In December 2015, the Commander of the 16th Mechanized Division issued the order to prepare a tank subunit from the 15<sup>th</sup> Mechanized Brigade in Gizycko for the such unconventional task and present the entire process of the subunit preparation together with possibility of execution of the task with live ammunition during a training-methodical course for high-level staff of the 16<sup>th</sup> Mechanized Division in 2016. Due to the fact that it was the reactivation of the long-suspended practice, the whole project commenced with the analysis of legislative acts in force permitting execution of the task, available specialized literature, correspondence of the task fulfilment with capacities of flied training areas as well as technical preparation of T-72M1 tanks for the task which had not been conducted for more than twenty years, and probably never, by this particular type of the tank.

### 1. Basic principles

In basic terms, the indirect fire can be described as shooting to targets which are not directly observed by a gunner (the shooting direction is determined with the use of a turret protractor and through determination of a gun elevation angle with the use of an elevation level, the range is set – Fig. 1).



**Fig. 1.** Sights instruments of T-72M1 tank  
*Source: [15<sup>th</sup> Mechanized Brigade library].*

A covert fire position is a place in a terrain or an area occupied or prepared to be occupied by tanks to execute fire, which provides concealment against an enemy's visual observation of equipment, a flash, a smoke and a dust generated during shooting (Fig. 2).

Currently valid in the Polish Armed Forces training and shooting programs for combat vehicles of tank subunits neither include the scope of the program covering preparation of subunits for indirect fire nor organizational and shooting conditions of this type of fire. It was caused by the fact that since the end of the 1990s this type of the training has not been conducted in practice which resulted from the change of the concept of using tanks in combat operations and consequently led to suspension of the training.



**Fig. 2.** T-72M1 tank at firing position during shooting  
*Source: [15<sup>th</sup> Mechanized Brigade library].*

The only available and valid literature regarding the tank indirect fire is the manual by Zbigniew Muszomanski and Wieslaw Wieleba 'Indirect fire by tanks', a limited number of articles from the 1990s printed in *Polska Zbrojna*, mainly written by the same authors and an auxiliary document necessary for conducting aforementioned shootings that is 'Tables of fire for 125 mm tank gun'.

By analyzing the above-mentioned documents several characteristic constatations can be drawn, which should be observed while assigning tank subunits for conducting indirect fire:

- decision about engagement of a tank subunit should be taken by a tactical formation's commander (a unit's commander is authorized to make such the decision) after consulting an artillery chief's recommendation,
- shooting should be regarded as a special task (lower number of fragmentary-demolition rounds per gun, lower rate of fire in comparison to artillery fire),
- tank subunits not directly engaged in combat against an enemy should be used for shooting, thus, basically second echelon or tactical formations (seldom units) reserves,
- company (sometimes battalion – however a unit weakened to a such extent is hardly to be imagined) constitutes a basic tank subunit which should be used for execution of indirect fire,
- tank subunits used for indirect fire should be assigned to an artillery subunit, due to their better situational awareness regarding artillery fire limitations, better organization of information flow system and possessed computing as-

- sets for artillery fire coordination and control. Independent execution of fire by a tank subunit with support of forward observers section (platoon) is feasible but less efficient. This arises from an objective complication which can be faced by tankers (organization of second echelon targets observation, conducting manual computation of fire corrections applying formulas, lack of devices which serve for meteorological preparation, lack of habits and limited experience related to the subject,
- ammunition for this task should be allocated aside the tank's unit of fire and delivered to a firing position by a severally assigned for this task group of soldiers which in case of tank subunits requires additional manpower,
  - due to the prolonged occupying of a fire position by a tank unit only one fire task can be executed, after which the position is to be left immediately. Should this not be the case, it can lead to the self-annihilation of the subunit through its quick detection by an enemy (the artillery radar system Liwec requires 1 min. to locate a tank company).

The reactivation of capacities necessary for executing the indirect fire was related to the adequate preparation of functional post holders in a tank subunit. One of the preparatory proposals included a time layout divided according to a place where the training was supposed to be conducted and duty posts of soldiers who required undergoing of the training and obtaining certificates allowing in a later stage for carrying out the training event in adequate role (shooting supervisor, control group checking correctness of settings determination to planned targets and fire readiness of a company of officer and crews executing fire) – see Table 1.

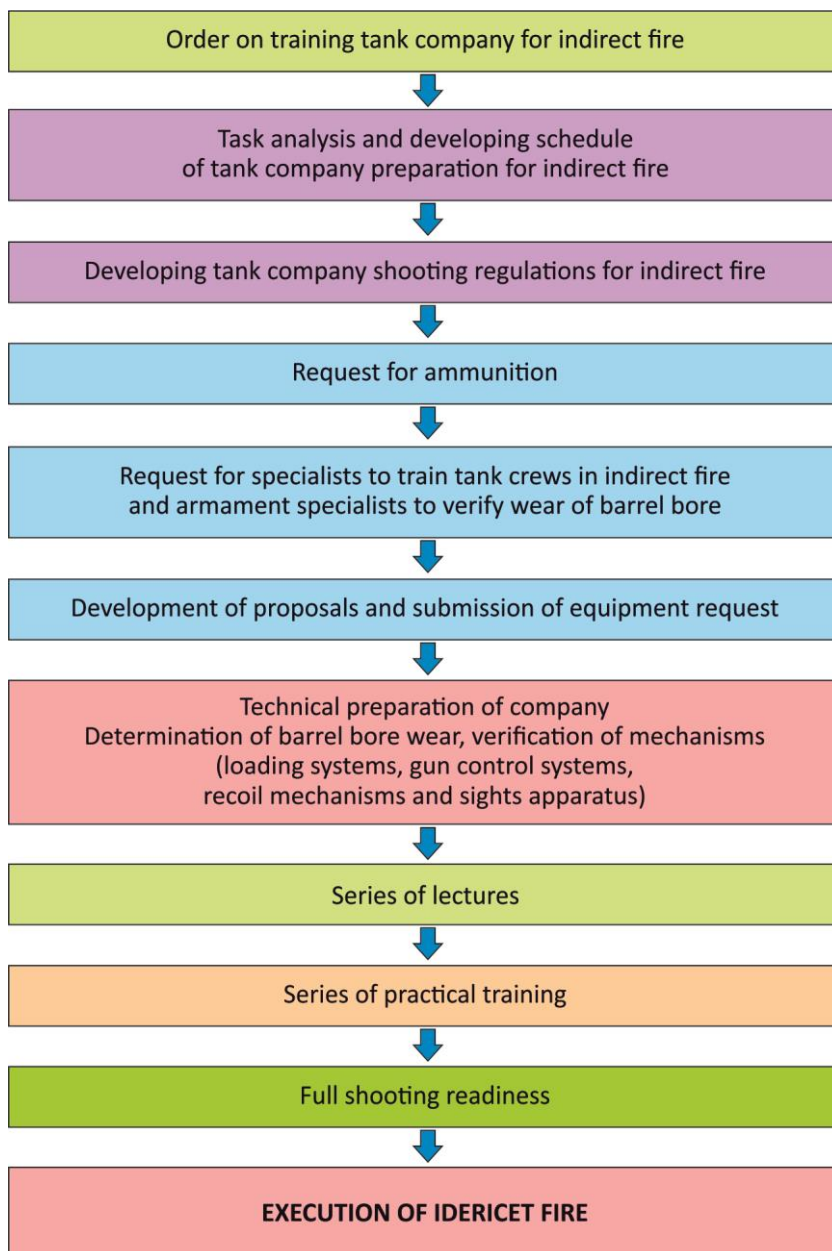
**Table 1.** Time layout of preparation cycle of a subunit for indirect fire execution

<b>Position, location and duration of training</b>	<b>Training center</b>	<b>Military unit Tactical lane</b>	<b>Military unit Field exercise</b>
<b>Battalion commander staff</b> (designated personnel)	2 weeks (certificate)	2 weeks	3-4 days
<b>Company commanders</b>	2 weeks (certificate)	2 weeks	3-4 days
<b>Platoon leaders</b>	2 weeks (certificate)	2 weeks	3-4 days
<b>Crew leaders</b>	1 week (certificate)	2 weeks	3-4 days
<b>Gunners</b>	1 week (certificate)	2 weeks	3-4 days
<b>Drivers</b>	1 week (certificate)	2 weeks	3-4 days

*Source: [Own study].*

As for the location of preparation of tank subunits for the non-standard task, it was proposed to carry out the training by specialists from a selected training center who after completion of the cycle would authorize independent execution of the indirect fire (at the later stage, when such shootings will be included to training and shooting programs they will be carried out within the frameworks of educational programs of training centers, officers studies or military academies – thus, the trainings organized in military units will be sufficient). Unfortunately, none of the training centers agreed

to conduct the subject matter training and the only support in a form of a week-lecture sessions were provided by a lecturer from the Military University of Land Forces in Wroclaw. The practical part of the training was based on the only available and prevailing manual 'Indirect fire by tanks' and the experience of officers from a self-propelled artillery battalion of the 15<sup>th</sup> Mechanized Brigade regarding not only the issues covering duties of an artillery reconnaissance group, principles related to directing a tank subunit, calculation of meteorological and ballistic data and implementation of corrections but also an organizational side of shooting execution.



**Fig. 3.** Algorithm of preparation a tank company for indirect shooting  
*Source: [Own study].*

A schedule of a subunit preparation for indirect fire constituted particularly important document normalizing shooting preparatory undertakings, which contained the detailed description of organizational-planning measures required to be fulfilled by particular functional departments and subunits of the brigade and a resulting algorithm of preparation (Fig. 3) became a clearly defined guideline facilitating conducting the project and overcoming implications arising from it in the future.

The criteria for preparation exercise for shooting were developed in accordance with 'Land Forces' Missile and Artillery Forces shooting program', Dowodstwo Wojsk Lądowych, Szefostwo Wojsk Rakietowych i Artylerii, DWLad Wewn. 87/2006, Warszawa 2006, based on shooting task No 3 'Striking static, observed or not observed target from covert firing positions'.

125 mm OF-19 ammunition with W-429Je fuse is used for shooting, for which firing tables for 125 mm tank gun are developed. Owing to this type of the fuse the fragmentary, fragmentary-demolition or demolition results can be obtained through rightly turning a safety cap and appropriate arming of the fuse.



**The fuse armed for direct action (safety cap detached, setting '0':**

- Time since hit to burst – approx. 0.001 s,
- Speed of fractions – 700-1200 m/s,
- Fall angles do not exceed 25°:  
the larger hit angle, the bigger computing striking zone.

Target – enemy's uncovered infantry and combat as-sets.

**The fuse armed for short delay (safety cap attached, setting '0':**

- Time since hit to burst – approx. 0.005-0.01 s,
- Target – infantry in covered trenches,
- Projectile has to pierce cover and burst.

**The fuse armed for long delay (safety cap attached, setting 'Z':**

- Time since hit to burst – approx. 0.-0.15 s,
- Target – destruction of defense and wooded-ground constructions,

Striking angles should be large to a possible extent

**Fig. 4.** Characteristics of W-429Je fuse

Source: [Land Forces ammunition].

During a preparation phase of a tank subunit for the indirect fire, it is essential to have it equipped with the accessories for directing a tank company; that is two poles with 2-3 cm diameter and length of 2 m which serve for setting primary direction of shooting with the use of a protractor-compass; dowels with 5-8 cm diameter and length of 40-50 cm for marking positions of individual tanks, two-meter location rod for determining the distance with the use of the protractor-compass. Remaining accessories required to

conduct tasks by a reconnaissance group detached from an artillery reconnaissance group such as a mine detector, a mine marking kit, a radiation detector, a chemical contamination detection device PCHR-54M, torches, topographical maps and tables of fire are at disposal as they constitute the integral part of a subunit's equipment.

The last element which necessitates to be conducted prior commencing the shooting is checking the tear bore of tank guns which is required to determine the deviation of projectiles initial velocity from tabular one as well difference of ranges of tank company guns and a gun of a fire direction tank. The necessity of differences' determination comes from the fact that during the process of operation (depending on the number of shots, intensity of shooting etc.) barrels change their ballistic characteristics individually, mainly as far as wear of barrel bore is concerned. Usually, such verifications are performed with the use of PKI-26 device which measures the value of difference between the actual and nominal diameter of the barrel bore at the distance of 850 mm from a muzzle attachment. Due to the fact that the more advanced methods of the wear of the barrel bore exist, owing to specialists from a Regional Technical Workshop, it was possible to carry out the verification with the use of the modern RIB 2000 apparatus which enabled for conducting visual inspection by a camera and measuring diameters at various distances. Simultaneously the digital photographic documentation showing the state of the bores of tank guns was obtained. Owing to professional verification which certified the lack of breaches of permissible enlargements of the barrels diameters as well as their straightness, the guns with the smallest wear of bores, staying in the limits of 2A category (the barrel diameter measured at the distance of 5050 mm from the muzzle not exceeding 125.9 mm) were chosen for shooting.

## **2. Shooting and fire control preparation**

In order to maintain a tank subunit in constant readiness for the most efficient execution of fire tasks from covert fire positions, conducting a series of organizational undertakings aimed at preparing shooting and fire control are at the utmost importance. They are characterized by:

### **a) reconnaissance and settings determination**

The data regarding targets are forwarded to a tank subunit's commander by a higher echelon or they can be determined by him through reconnaissance conducted from a command post. The data include: number and type of targets, coordinates and an altitude of a target center, target dimensions, character of a target's activities, time of a target's detection and measures used for detection. Position of targets are determined applying Cartesian or polar coordinates with the use of devices (a range finder, a protractor-compass, a scissor telescope), based on a topographical map, air pictures or by sight. The altitude of a target is established based on a topographical map or by computing a position angle.

### **b) topographical fixing**

The topographical fixing of fire positions (command posts, command-observation posts) covers determining Cartesian coordinates and altitudes of

fire direction tanks positions (command posts and command-observation posts) as well as topographical azimuths of approximate directions necessary for aiming tanks' guns and devices at a required direction.

#### **c) meteorological preparation**

The meteorological preparation is carried out in order to determinate deviations of meteorological conditions from tabular ones, which are taken into account while computing settings for shooting. They include: an atmospheric pressure deviation in a ground layer at the altitude of a fire position, mean air temperature and wind deviations within an altitude of a projectile trajectory. Meteorological preparation tasks are executed by meteorological subunits and artillery meteorological posts in a form of a ballistic MET report. In case of the lack of the report and the requirement to open rapid fire, a speed and wind direction as well as air temperature deviation from tabular are determined by a tank subunit's commander. The temperature is measured by TB-15 battery thermometer, a deviations nomogram can also be used.

#### **d) ballistic preparation**

The ballistic preparation in a tank subunit is performed by soldiers under a supervision of specialists of the armament and electronic branch. It aims at determining ballistic deviations of shooting conditions from tabular ones. It covers determining of:

- deviation of projectiles' initial velocity from the tabular one caused by the wear of tank guns bores,
- difference in ranges of tank company guns and a fire direction tank's gun,
- aggregate deviation of projectiles' initial velocity caused by the wear of tank guns bores and characteristics of charges batches (a battalion control tank and company fire direction tanks),
- temperature of charges,
- ballistic properties of projectiles and charges (deviation of a projectile mass from tabular one and paint coating and as for charges – characteristics of a given batch),
- distribution of ammunition – between tanks and its segregation.

#### **e) technical preparation**

It covers:

- preparing tanks, ammunition, optical and measurement devices and fire control devices – for shooting,
- determining individual corrections of tank guns and optical and measurement devices and fire control devices.

Preparation tanks for shooting include: a general verification of tanks (mainly guns), an inspection of operability of mechanisms (both electric and manual drives) such as: a loading system, locks, a circuit of the electric trigger mechanism and electronic devices, recoil mechanism (level of liquid and value of



pressure in a recoil mechanism), sights devices (checking of an elevation level and a line of sight).

#### **f) shooting and fire control organization**

It covers organization of work at a command post or a command-observation post and at fire positions, communication as well as determination of settings for shooting.

A battalion (company) commander and a fire officer are required to:

- establish a method of positioning functional personnel and fire control devices at a command post and at a fire position,
- specify responsibilities of functional post holders during fire control and sequence of their work during execution of fire tasks,
- set fire control signals and a method of forwarding commands and reports.

#### **g) organization of settings determination**

It covers following aspects:

- determining a primary direction of shooting,
- selecting a method of settings determination for shooting during various periods of combat operations,
- collecting data about fire subunits and shooting conditions, necessary for settings determination,
- computing corrections for deviations of shooting conditions from tabular ones and preparing charts of computed corrections and forwarding completed corrections to subunits if required,
- preparing fire control devices and verifying the correctness of devices readiness and determined settings for shooting.

### **3. Indirect fire**

The 3rd tank company from Orzysz was the subunit which completed the full scope of theoretical and practical trainings and then double-executed the shooting from covert positions. This is the subunit which after having been theoretically trained by a specialist from the Military Academy of Land Forces in Wroclaw, then through the practical training supported by the full engagement of a self-propelled artillery battalion reactivated the capacity of conducting indirect fire tasks. During the first shooting with live ammunition the tank company was subordinated to the self-propelled artillery battalion and an artillery battalion's commander was assigned as a shooting supervisor and simultaneously as an organizer of fire control. Due to the fact that this type of shooting had not been conducted on premises of the Land Forces Training Field (OSPWL Orzysz), the certification of this installation for tank shooting from covert positions took place at the same time. The first fire task was executed in accordance with the developed criteria of the preparation exercise for shooting No 1aWB without time regime, with registration fire of each tank and after registering the fire, the company commenced

conducting the fire for effect with the converged sheaf. As the execution of the first shooting underwent with accordance to the expectations, complying with safety regulations both coming from the organization of the shooting and maintaining the safety of the training field premises, the next shooting was organized in a distinctive way. The tank battalion commander was the organizer and the supervisor of shooting, having and his disposal the subordinated forward observers platoon for shooting support (reconnaissance tasks, determination of coordinates, meteorological preparation, settings determination, assessment of fire effects and determination settings for fire for effect) which in principle is executed in practice pursuant with standard operating procedures. Also, this shooting was carried out in the way which allowed for achieving the set objectives.

A commander of the 3<sup>rd</sup> tank company and a specially trained for such type of tasks the so-called 'fire officer' (the supernumerary shooting functional position enforced by instructional provisions), the role which was played by a platoon leader from the shooting company, were responsible for topographical, ballistic and technical preparation as well as for the tasks covering the organization of setting determination and execution of shooting. Entire calculations were conducted by them manually with special sheets and formulas facilitating the process at a company command post. Data required for fire correction, calculated for the fire direction tank were received from a leader of forward observers platoon, who when assigned to the tank subunit plays the role of a fire support coordinator. Both of the shootings were also coordinated by a self-propelled artillery battalion commander and a tank battalion commander who played the role of shootings supervisors and advisors having the maximum specialized knowledge related to their subunits.

The tactical UAV ORBITER from the UAVs Base in Miroslawiec and the artillery radar LIVIEC from the Artillery Regiment in Wegorzewo served for supporting the image visualization and increasing tactical awareness of the shooting supervisors (subunits commanders).

The shooting was realized based on the customized preparation exercise 'Striking a stationary, observed target from covert positions' with targets established as follows: a radiolocation station, an observation post, personnel and combat assets, tanks and carriers, anti-tank and anti-aircraft assets, defense positions located at the range of the own equipment and safety boundaries. The registration fire was declared as the method of settings determination for the fire for effect. The shooting was evaluated on the basis of time norms and fire accuracy by the shooting supervisor. The assessment of the fire for effect accuracy was performed by the section of forward observers with the use of rang finding and reconnaissance equipment (APDR, DAK-1, LPR-1, PAB-2) – the shooting provisions for indirect fire are presented in Table 2.

During the first shooting, a radiolocation station at the distance of 4500 m constituted the target to destroy. At first, the settings for the fire for effect were determined with the use of a laser range finder which afterwards was change into the more accurate bilateral observation eliminating errors occurred during projectiles' ricocheting, which sporadically appeared during the registration fire. The whole shooting consumed 24

projectiles (6 for registration fire and 3 salvos – 6 projectiles each for the fire for effect) with extended time regimes resulting from the work of the fire controllers who were responsible for verification of the accuracy of the corrections applied to the sights, prolonging the fire execution time due to constructional dissimilarities of the artillery and armored combat vehicles.

**Table 2.** Provisions of preparation exercise for indirect shooting No 1aWB

<b>Preparation exercise No 1aWB</b>					
(Conducting indirect fire by a tank subunit Striking a stationary, observed target from covert positions)					
<b>Targets:</b> a radiolocation station, an observation post, personnel and combat assets, tanks and carriers, antitank and anti-aircraft assets, defense positions etc.					
<b>Distance:</b> at the range of the own equipment and safety boundaries					
<b>Number of rounds:</b> for registration fire – 6, for verification of the accuracy of settings determination for the fire for effect – 1-3 rounds per company (platoon, tank)					
<b>Time:</b>					
Description of the executed fire task	Time norms (in min) for the marks (night/day)				
	Very good	Good	Satisfactory		
Striking stationary target with the arbitrary registration fire	12	14	16		
	15	18	21		
<b>Remarks:</b>					
1) The time norms were extended of 50% according to the norms included in the Missile and Artillery Forces' shooting program for fire support companies					
<b>Execution:</b> shooting with fragmentation-demolition projectiles with the fuse armed for the direct action, with short or long delay:					
1) The fire task executed by:					
– during destruction and incapacitation – a tank company or platoon,					
– during demolition – a company, a platoon, a tank.					
2) During execution of the combat task with an assigned supernumerary reconnaissance subunit (asset) – the coordination with them is established in advance.					
3) Observation angle – arbitrary, during demolition – up to 3-00.					
<b>Mark:</b>					
	MARK				
Method of settings determination for the fire for effect	in range [in% D <sub>cT</sub> ]:			in azimuth [in mil]:	
	Very good	Good	Satisfactory	Very good	Good
Fire registration with the use of a laser range finder, a bilateral observation or based on a deviation mark	1,5	2	2,5	7	10

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**Remarks:**

- 1) The norms of accuracy were presented:
  - for single targets in relations to the center of the target,
  - for surface targets in relations to the position which a given subunit should shoot at within the determined method of striking.
- 2) During the tank shooting at the distance not exceeding 4 km – the deviation norms are extended by 50%.

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**Shooting conditions:** day, night

**Instructions:**

The shooting supervisor introduced the tactical situation to trainees and issues the tasks. The fire officer of the tank company and the commander of forward observers section report reaching readiness for shooting and shooting support. The registration fire is carried applying each existing methods provided in the manual 'Indirect fire by tanks' – sygn. Szkol. 637/85. As soon as the target has been indicated, the company commences execution of shooting by the fire direction tank. Once the conditions are established (determination of setting calculated for the fire for effect) the company (platoon, tank) switches into the fire for effect. The shooting supervisor evaluates shooting based on the time norms and the accuracy of fire. The assessment of the accuracy of the fire for effect is conducted by the forward observers section with the use of the range finding and reconnaissance devices (APDR, DAK-1, LPR-1, PAB-2). The lower mark obtained according to the aforementioned norms constitutes the shooting total mark.

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*Source: [Study by the Training Section of the 15<sup>th</sup> Mechanized Brigade].*

During the second shooting of the 3<sup>rd</sup> tank company (Fig. 5), tanks and armored carriers at the same distance of 4500 m constituted the targets, the company shot with 9 combat assets and consumed 26 rounds to complete the task with one direct hit at the target. Unfortunately, maintaining the time regimes described in the shooting conditions and stemming from the lack of practical skills and experience in conducting the above-mentioned task by tank crews constituted the shortcoming which could not have been overcome. What is more, the time required for fire controllers' verification of entered corrections calculated for each tank was affected by the tanks construction, distinct from the artillery's assets, which at the current stage could not be avoided as the safety measures are to be complied with. The aforementioned changes should be implemented in relevant organizational-training documentation.



**Fig. 5.** Salvo of the 3<sup>rd</sup> tank company during execution of the preparation exercise No 1aWB

*Source: [15<sup>th</sup> Mechanized Brigade library]*

Summing up, in both cases the results of the execution of fire tasks related to the accuracy norms remained within the good and very good marks which confirmed the capabilities of conducting the indirect fire with the use of T-72M1 tanks, allowed for achieving the set training objectives, either those related to the preparation of a tank company for the non-standard shooting or the presentation of the methodic aspects of a subunit's preparation during the training-methodological course of the commander of the 16<sup>th</sup> Mechanized Division and consequently, through overlapping methodical activities of a higher supervisor, to the high-level staff of the General Command of Branches of Armed Forces.

## Conclusions

The execution of the undertakings associated with the preparation of a tank subunit for the indirect fire highlighted the range of organizational-juridical, training and logistic activities which ought to be normalized by appropriate institutions and organizational units:

- a) normalizing the provisions contained in the armored and mechanized forces' training program, activities related to the indirect fire carried out by military academies and providing a specialized course by a relevant training center (in Poznan, Wroclaw or Torun) for soldiers of subunits assigned to conduct shooting from covert positions (a battalion commander, and executive officer, a company commander, platoon leaders, crews – gunners and drivers). The training of the above-mentioned personnel results from responsibilities and task which are to be performed by them during the shooting organization and the fire control. Currently, neither 'The training program of the armored and mechanized forces' (sygn. DWLad Wewn. 203/2013) nor 'The Armored and Mechanized Forces Manual of Fire Control in Combat' (sygn. Szkol. 798/97) contain the topics related to the aforementioned subject nor indicate soldiers authorized to carry out the subject matter training;
- b) developing the issues related to execution of the indirect fire and incorporating them into the combat vehicles' shooting program within the frameworks of the fire control, as 'The combat vehicles' shooting program' in force (sygn. Szkol. 856/2012) lacks any provisions that enable conducting the above-mentioned project in combat terms. Development of the stated conditions is to happen on the 'central' level in order to oblige authorization and certification of field training premises or artillery shooting ranges for this type of the shooting. The implemented by the 15<sup>th</sup> Mechanized Brigade preparation exercise was developed on the basis of the artillery units' shooting program – inadequate in the light of the provisions of the armored forces' shooting program and frequently incomprehensible for tankers due to their unique trade;
- c) subordination of a tank company, command correlations with an artillery battalion's commander and a forward observers section assigned to the tank company during the execution of the indirect fire requires to be specified. The function of a shooting supervisor during execution of the fire part comes from

the above-mentioned relations and consequently preparation of the artillery and armored battalions' commanders for the execution of the task;

- d) such the specific task that is the use of a tank subunit for the indirect fire at present is not predicted by the tactical operations regulations of the land forces. This task could be enforced by the tactical situation that is the lack of adequately intensive or entire artillery fire, adequate assets and equipment not directly engaged in combat operations on hand and time required for the rapid organization of the subunit in an appropriate area resulting also from technical capabilities of a tank. However, this eventuality cannot be excluded due to the fact that a tank meets these criteria and calculations would solely come from a decision made by a relevant superior based on a cost-effect calculation.

Having analyzed contemporary armed conflicts one cannot draw a conclusion that the indirect fire has ever been executed under combat conditions. It seems that its application concerns rather far-past wars. The systematic development of the artillery and the precision-guided ammunition would deny a tendency of the usage of tank subunits for this type of the tasks on the contemporary battlefield. Development of tanks' day sights and thermal cameras as well as stabilizers of tank guns would stimulate a reflection on effective striking of targets by the direct fire at long distances. It was also confirmed by high consumption of artillery ammunition required for destruction or incapacitation of targets which would necessitate highly efficient logistic support to fulfil the aforementioned tasks.

On the other hand, the equipment currently in service of the Polish Armed Forces is capable of conducting the tasks in the above-described manner. Declining these abilities can appear to be a negligence in taking full advantage of technical capabilities of the combat equipment. It is difficult to state if possibilities to confirm it will appear on battlefield, bearing in mind that this type of the tanks were developed according to technical and tactical criteria at the given time and knowledge adjusting to doctrines and analyses the prior period. Let the issue whether or not we go in the right direction and if the reactivation of capacities which were fully executed twenty years ago and may disappear in the future can be declared as their development or just as skills maintenance be the beginning of the discussion on training activities of the armored forces. Nonetheless, the fact remains that the 3<sup>rd</sup> tank company of the 15<sup>th</sup> Mechanized Brigade as the only one in the Polish Armed Forces has reactivated and maintained the capabilities of conducting the indirect fire with T-72M1 tanks. True to its motto 'SEMPER PARATUS – Always Prepared'.

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#### **Conflict of interests**

The author declared no conflict of interests.

#### **Author contributions**

Author contributed to the interpretation of results and writing of the paper. Author read and approved the final manuscript.

### Ethical statement

The research complies with all national and international ethical requirements.

### ORCID

Adam Koniuk – The author declared that he has no ORCID ID's

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