

# METHODOLOGY OF SHOOTING TRAINING USING MODERN IT TECHNIQUES

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## ABSTRACT

Mastering, improvement, shaping and preservation of skills of safe, efficient and effective use of the firearm requires the use of relevant methodology of conducting the shooting training. However reality of police trainings does not usually allow for intensive training shooting with the use of ammunition. An alternative solution is the use of modern training technologies. Example of this is the "Virtual system of improvement tactics of intervention services responsible for security and shooting training. "Introduction of stimulator to police trainings will enable complete staff preparation to achieve its tasks, creating potential of knowledge and experience in many areas, far exceeding the capabilities of conventional training.

Keywords: training, weapon, security, Police, simulator

## 1. INTRODUCTION

Protection of life, health and property of citizens are constitutionally protected values. Their protection creates the conditions for the safe functioning and development of society, the country and its institutions. For the effective protection of these values, in addition to good law, it is necessary to have well-functioning system of administrative bodies equipped with the appropriate legal, material and technical approaches and technology for the prevention and countering the dangers [1]. Within this entire system the Police plays special role, bearing the greatest responsibility for the state of public order and security [2].

The police is equipped with a power competence realized in specific forms of actions, ensuring a fast and efficient elimination of risk associated with different manifestations of behaviors violating the legal order of social co-existence. This privilege provides the ability to take emergency action, including the use of the means of direct coercion by the police. The aim is to submit to the recipients issued under the law commands, prohibitions or orders. The choice of the means of direct coercion must comply with the needs of the situation, which are necessary to achieve this goal. In case, where these means have proved insufficient or their use, due to the circumstances of the incident is not possible, a police officer is allowed to use firearms. It is used primarily

against persons directly threatening life and health and the perpetrators of physical aggression, often with the use of dangerous objects. As the mean of direct coercion of extraordinary nature, firearm is considered as the mean of extremity.

The effectiveness of interventions and conducting them in accordance with police procedures and rules require from the officers a continuous improvement of their skills. Regulations, techniques and tactics of intervention with the use of force and firearms are the parts of vocational trainings and vocational training courses. Only systematic improvement allows to master the ability to make the right decisions and make them effectively, and most importantly – to safely carry out intervention.

## 2. SHOOTING TRAINING

Development of police officers trainings includes: central improvement- organized by police schools and the Higher Police School in Szczytno, local development - organized by the Police organizational units or cells of these units and the development of external ones- organized by entities outside the police.

Basic forms and purposes of conducting the training in shooting, including shooting training realized in the Police determines the Instruction on the organization and the police shooting from firearms and shoots (throws) of chemical agents incapacitating agents appended to annex No. 1 to Decision No 713 of the Chief of Police of 30 December 2005 on the shooting training of police officers [3].

The aim of the shooting training of police officers is:

- mastering and improving the skills of safe, efficient and effective use of firearms in different situations and conditions by the police officers;
- the formation and preserving compliant with law policeman's behavior in similar situations to the actual realities of the use of firearms;
- develop a skill of proper assessment of the situation, identification and selection of goal, the decision to use or abandon the use of firearms.

On the other hand, shooting range training includes:

- theoretical instruction (lectures on topics of firearms safety, basic knowledge of weapons and

ammunition, basic marksmanship, shot theory, jams of firearms);

- practical instruction (non-shooting training, shooting training and programming shootings);
- exams and tests of knowledge and skills.

All forms of the training are subject to a specific methodology. Methodology of teaching is referred to as "the discipline dealing with the practical teaching methods of selected contents, most of various school subjects. Methodology of teaching comes down to the search for ways (methods) of rational action possible by a thorough analysis of the subject content and experience-based teaching methods and means of diagnosis enabling students to master the content "[4]. Such an understanding of the methodology used in the control process, improvement, forming and preservation of skills of safe, effective and efficient use of firearms allows to isolate and create the following types of shooting scenarios:

- from short firearms - preparatory, static, fast, dynamic, situational; it is realized for a variety of targets, for a different distance, the distance (5, 10, 15, 20, 25 m), with different shooting postures (standing, kneeling, lying, out from the curtain), for different purposes;
- with submachine guns - static, fast, dynamic, situational;
- with smoothbore weapon - static, fast, dynamic, situational.

For the purpose of training technical measures are used, including targets which depending on the specificity of shooting can be rotating mechanisms showing the goal in a specified period of time or hanger that gives the possibility to suspend the blade at a certain height and distance convenient for the shooter. The most common targets used in shooting paper targets are designed for a specific type of shooting. They can also be annular discs for learning shooting and precision shooting, as well as shields physique primarily designed for combat shooting. Lecturers shooting may use other purposes, for example. Poppers, figures silhouettes of people or animals [5]. Element to ensure the safety of participants in training shooting are sight and hearing protection. No such protection can lead to permanent hearing or vision.

Each form of training requires applying very strict rules of safe use of weapon which, among others, specify in detail the obligations of all participants, that is the shooting instructor and the shooters.

The process of shooting training of police officers covers several stages and the effect itself- the use of ammunition- ought to be proceeded by systematic and correctly organized and realized non-shooting training[6], which is the basic element of realizing shooting training regardless of the degree of advancement of the shooter. It covers elements which will be used during the training as well as remembering and consolidating ones which have already been learnt by the participants.

The objective of the non-shooting training is to educate a police officer as far as skills guaranteeing safe and efficient use of firearms is concerned, as well as elaborating adequate habits and response reactions and acquiring the skills enabling reaching precision of a shot. Consolidating the string of adequate actions which the trainee must execute requires imposing them on him as instructor's command. Due to the fact that the basic weapon of a police officer is short firearms, during the training one must place special emphasis on actions related to reaching this type of gun (taking the gun out of the holster), reloading, assuming shooting postures as well as actions related to correct keeping the finger off the trigger connected to observation of gunpoint devices and combining these activities with breathing.

The key element of shooting training is to learn the correct shooting posture. This is such placing of the body which ensures good statics of a gun, efficiency of directed fire and own safety. Shooting posture is the most variable element of shooting technique, mostly determined by situation in which a given police officer finds themselves and depending on the type of shooting (static, dynamic, situational), used gun (short, long) and distance of shooting. Another element of training is ranging, which consists of placing gun barrel in such a location on vertical and horizontal plane, so that the flight path of bullet passed through the designated target. These actions are realized through the so called syncing sights, that is notch and gunpoint. Also the skill of keeping the finger off the trigger has a significant impact on the quality of shot, since wrong move of an index finger during this activity results in a missed shot. The last stage of shooting technique is not shooting but withstanding it. This consists in maintaining the state of all elements of body and gun in location prior to the shot. The key reason for the necessity to maintain full concentration of attention and muscle tension for 1-2 seconds after the shot is to avoid, already before or during the shot, psychological and physical relaxation. In the context of shooting training it is very important to regulate breathing which corresponds to the accuracy of a shot. Not holding one's breath during control of synced sights and keeping finger off the trigger decreases the results of shooting.

Well-elaborated and correctly realized shooting training facilitates controlling the entire set of elements which form a single shot, leading to acquiring and maintaining correct habits and automating technical actions and, consequently, reaching among others high results in shooting.

Shooting training may be enhanced by situations which the police officer may encounter during his or her work with firearms. For this reason, for the purposes of this type of training scenarios of shootings have been elaborated. They assume realization of conditions of a specific variant of static, fast, dynamic or situational shooting. Reaching the assumed minimum in the form of number of points or shooting holes in shield point field in a specified time marks a given variant as done in formal terms.

Static shooting is a shooting at a distance up to 25 meters, to shields TS – 2, TS – 3 and TS – 9 without specifying time of shooting. First shootings are conducted from the distance from 5m and once a police officer passes them, the distance gradually increases up to 25m.

Fast shooting is characterized by a specified and short period of duration. Depending on the stage of fast shootings, the use of methods impacting the swaying of homeostasis of the officer's organism using the firearms is also possible. It is also possible to use stimuli, situations, simulated atmospheric phenomena or behaviours of third persons towards whom actions are taken and which are unpredictable for the trainee. Shooting may be conducted in conditions of limited visibility, with lightening of targets by means of for example a torch, headlamps of cars, with the use of equipment simulating the battle field (smoke grenades, stun grenades) [7].

Dynamic shooting is conducted after physical effort. It is characterized by one or several targets placed in various distances, with the use of various shooting postures and change of shooting positions. During the shooting the police officer moves in line with the principles of tactics. It is advisable that during shooting natural and artificial covers are used. Shootings of this type may be conducted in conditions of limited visibility, with lighting of targets by means of for instance a torch, headlamps of cars. Dynamic shootings in the initial period of training are conducted individually, then in pairs, ending with shift shooting.

Situational shootings are characterized by the necessity to identify the target and take decision regarding shooting. During shooting the police officer moves with a gun ready for shooting, in line with the rules of tactics. It is advisable that during shooting natural and artificial covers are used. Shootings of this type may be conducted after physical effort, in conditions of limited visibility, with lighting of targets by means of for instance a torch, headlamps of cars etc. Situational shooting is conducted individually or in a team.

The most advanced form of shooting training is training with the use of warfare in objects in which for instance persons performing the function of helpers may be placed. During such training elements of tactics and technics of detention of persons, hostage situations or taking over objects in situations of terrorist attacks are realized. This training is realized mostly on tactical ranges through officers who present very high level of intervention skills, as well as who use firearms on a perfect level.

The moment in which safe situation turns into a deadly dangerous is many times difficult to capture and almost unnoticeable and it so happens that it might be tragic as a result. The skill of correct and safe use of firearms is based mostly on habitual behaviours. In psychological terminology, an automated activity, way of behaving or reacting which is shaped as a result of practising, mainly by repetition, is called in this way. In the course of time, these skills become instinctive to the

point, where they really stop being controllable on an ongoing basis. However, the reality of police trainings does not allow for intense shooting training with the use of ammunition. This is of course dictated by economic reasons.

### **3. VIRTUAL SYSTEM TO IMPROVE TACTICS OF INTERVENTION ACTIONS OF SERVICES RESPONSIBLE FOR SAFETY AND SHOOTING TRAINING**

In the effort to meet these needs, one must search for new, alternative training solutions, also thanks to the use of modern IT technologies. An example of this is "Virtual system to improve tactics of intervention actions of services responsible for safety and shooting training." The proposed system, due to high level of detail and very wide scope of scenarios and variants adjusted to the specificity of actions of the Police, tactics and provisions of law in place in Poland as well as police internal procedures will be able to properly support the process of improvement training of officers. Complementary, mobile training tool will enable exercising realized in real time events, which might occur during realization of tasks with participation of officers in real places of undertaken interventions. The purpose of conducted trainings on this simulator will be efficient increasing and maintaining of high level of training provided for officers in elaboration by them of correct reactions in the process of taking decisions during realization of a specific task. Such solutions allow to reflect in virtual world of computer training system some real scenarios of actions undertaken by one or several (intervention patrol) police officers and other services responsible for safety. Conduct of trainings in the scope of interventions will be enriched with the possibility of improving technique and shooting tactics. Improving the tactics is shaping of the skills in correct selection of the moment of shooting and a place of the strike, whilst the shooting technique refers to fast and accurate shooting to specific target. A significant element of such a solution are not only the novelty technical solutions, but also appropriately selected scenarios and variants of the course of situation stemming from many years of experiences of police officers of all types of services.

The simulation system consists of subsystem of psychophysical parameter measurement, projection subsystems, guns, assessment of trainees and system which integrates the subsystems (simulation management subsystem), enabling management of the simulation process and creation of new scenarios.

For the purposes of the system, film material has been elaborated in line with the elaborated scenarios and variants stemming from the practice of intervention actions of the Police and stemming from the methodology of shooting training. A full list of possible for occurrence in reality crisis situations with which a police officer may meet during conduct of his or her professional duties will be applied, with the option of its expansion by applying a combination of elaborated

variants and creating new ones. Under the project, 50 scenarios and variants of actions for training of tactic of intervention actions and shooting training will be elaborated. The variants of actions are the ways of proceeding targeted at obtaining the assumed goal, which are made on the basis of anticipated scenarios of threats. They may be elaborated at each phase of police actions and their number ought to be adequate to the number of assumed threats to safety during a given event. The variant should indicate a police officer, measures anticipated for restoring the breached public order, and pursuant to the alleged description of events also method-tactics and technique of conduct of actions[8].

Virtual training system for tactics of intervention actions and conduct of shootings with firearms is targeted at placing the trainee officer before a decision of choosing adequate measure of restraint and its adequate use. Proper assessment of the undertaken decisions of the officers and selection of adequate evaluation of subsequent exercises, is possible thanks to the use of monitoring tools of biometric parameters.

In the frames of the system, a subsystem of measurement of psychophysical parameters of the trainee persons (POC) was planned as well as automatic/ semi-automatic assessment of exercises- in line with the so far model of assessment of the way of acting of the officers. This subsystem allows for testing in real time the level of focus of attention and stress level. It enables assessment of mental burdens, accompanying the completion of tasks by the trainees, such as taking decision of the use of firearms or use of other measure of restraint towards an aggressive person and individual research of the usefulness for their realization. This ensures the possibility of immediate verification of actions of the officer and modification of the course of scenario so that the efficiency of training was optimized, considering at the same time individual aptitude of the trainees. Gathering information ought to commence already in the phase of preparation and waiting for the training, as well as after its completion.

In order to test biometric and environmental parameters, one must apply the solution in the form of modules placed on the trainee, which then will be wirelessly sent to the position of operator with adequate diagnostic software at disposal. Sensor modules are used for measuring body temperature, blood rate, breathing activities, physical activity, ECG and blood pressure. For this purpose a probe for measurement of blood and pulse was used (installed on the wrist of a persons who was tested, who was located right next to the glove placed on one's hand, in which measuring electrodes will be located) and sensor of saturation located on the ear top. Obtained measurements are saved and enable observing the results of measurements in real time. Sensor may be connected with adequate electric cables to the main ECG module which will be placed on the main strip of the trainee officer. Its tasks will be to monitor ECG of two independent outflows during the conducted test.

The training system, through displaying the registered picture of places of real interventions, will provide the trainee officer with sight stimuli. It is, among others, on the basis of sight observations that decisions are made as to the use of most adequate to situation measure of restraint.

The key elements which form part of the measurement system are oculometer and scene camera. Oculometer is a device using the source of infra-red light and in-built camera for defining the position of eyes in motion and defining the direction of looking. Light emitted by oculometer in infra-red moves outwards from the cornea of an eye of the trainee, causing obtaining in this way information used for its further processing and making available in the form suitable for interpretation. The second element of measurement system is scene camera the task of which is to record the plan of image seen by the trainee on which points and areas of so called heat maps will be depicted. In combination with adequate software, one may view how a trainee observes for instance the course of intervention or in which way he or she synchronizes sights when shooting from a gun to shooting shield displayed on projection screen. Quite often the enclosed software provides the results in graphic form of heat maps, view paths, statistical data, for instance, how long the trainee looked at a dangerous tool held by a criminal displayed on the projection screen.

The applied measurement tools enable conduct of measurement and gathering of measurement material. This might significantly impact evaluation process of education in tactical and technical application of means of direct restraint located in individual equipment of the officer during intervention.

An integral part of training computer system will be the equipment in elements refine measures applied during service means of direct restraint being on individual disposal of an intervening police officer, and in particular, training replica of firearms.

For the purposes of simulator the following were adopted: short gun "Glock 17", smooth-bore weapon „Mossberg" or gas pitcher and electric stun gun, as well as, to increase realistic nature of exercises- police baton and handcuffs. The process of adaptation was conducted with the use of the existing on the market replicas of firearms, the look of which and the method of use is very similar to original guns.

Replicas of these means of restraint were equipped in infrared emitters enabling the mapping of place of strike which will be recorded by a detection camera. These solutions reflect the most realistic way of acting of standard gun and its functions. Therefore, the key aspect of selected solutions is tactical efficiency, mobility of set (gun plus power supply), way of energy supply (gas, combustion, electric, air) with the least harmful exit emission and the cost of use of the set. An important element of acting of the gun is verification in terms of impact of objects within the interaction with operator,

that is police officer. Mapping of behaviour of a gun during shooting is possible through applying the so called gunshot recoil, causing after pressing the trigger a move of the lock into the back, extreme location and its return to the front, closing the bullet chamber, making a specific rumble during shooting. The movement of the lock is caused by applying compressed gas of blow-back system specified with GBB abbreviation (Gas Blow Back), the container of which is placed in gun magazine. Gas container may be very simply loaded with gas from the external, larger bottle, through using an adequate disjunctive power connector.

Elaborated and adequately adjusted components are integrated in such a way, so as to enable correct functioning of the gun modified in the frames of the monitoring system shooting efficiency.

Another element of the system is a subsystem of video projection, enabling display on the projection screen of registered earlier scenario and identification of activity conducted by trained persons and elaboration of the system of positioning of point of shooting. In this scope a module of projection was elaborated, equipped in short-throw projectors with high resolution (minimum of 2K) and screens, on which a screen will be displayed, showing real events. The element of subsystem is projection screen ensuring optimum display of elaborated image, registered in real conditions, furthermore it thoroughly maps the size of postures of persons and objects which occur. The module will be integrated with a camera, tracking the screen and enabling receipt of signal (shot) on a specific spot on the screen. The information of the point of signal is relocated to the displayed at that time image, thanks to which the instructor obtains information on whether and how an object on the screen has been shot. The system of video projection enables display of elaborated earlier scenarios of exercises, on the basis of which trainees, equipped in modified gun and measures of direct restraint, take adequate actions.

In the system, elements enabling recreating without the use of live ammunition of shooting from firearms and in particular, generating and indicating a place of shot on the displayed projection screen were placed. For this purpose the detection camera covering with its scope entire area of projection screen will be used, whilst the bullet from firearms will be replaced by light emitter in IR infra-red placed inside the replica of firearms of gun barrel. The infra-red emitter must be placed also in the replica of electric stun gun, replacing shot out probes with emitter light. The system enables registration of the fact of selection of a given means of direct restraint depending on the type of practiced scenario.

During conduct of dynamic shooting training the laser of applied emitter, should be launched only for the time and at the time of giving the shot, mapping thoroughly the moment of shooting. Whilst, during realization of static training focused on increasing competencies of accurate targeting, laser ought to generate constant bundle,

enabling registering and mapping the technique of targeting. During mapping by means of emitters the places of striking a target, parameters of the pathway of bullet flight should be considered, which vary depending on distance, as well as the applied ammunition and changeable atmospheric condition.

Apart from the displayed on the projection screen video image of prototype of the created training system must provide should elements. During recording in real places of undertaken interventions, sound material will be registered, enabling recreation during realization of future shooting trainings, sound elements occurring at the time of conduct of real tasks by officers. For accurate recreation of sound applying adequate digital multi-channel sound system is required as well as applying and placing devices emitting the sound.

Managing entire process of simulation is possible thanks to the platform integrating the subsystems. It was equipped in a number of elements, enabling gathering of information on behaviours of trainees. Data obtained from the system are subjected to analysis and reporting to the instructor who conducts the training.

#### **4. CONCLUSIONS**

Introduction to the system of police trainings Virtual system to improve the tactics of intervention actions of services responsible for safety and shooting training will allow for full preparation of staff for realization of tasks standing before them, creating the potential of knowledge and experience in many areas, significantly exceeding the possibilities of conventional training. Replacing real exercises with a training on simulator will contribute to decreasing their costs and a simultaneous increase of its scope. Interactive training will eliminate material losses, risk of loss of life and health, caused by an error stemming from lack of adequate high level of skills of the trainee. Furthermore, it will limit the volume of negative factors impacting instructors and trainees which occur, i.e. during shooting training. Additional feature of the system will be the possibility of finding application while elaborating universal, pattern profile of police officer, realizing the tasks at intervention level. It will facilitate the selection of candidates for specific types of police services, increasing through this the level of realization of tasks by entire formation.

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#### **REFERENCES**

- Pieprzny S., 2012. Administracja bezpieczeństwa i porządku publicznego, Rzeszów.
- Pieprzny S., 2011. Policja. Organizacja i funkcjonowanie, wyd. 3, Warszawa.
- Decyzja nr 713 komendanta głównego Policji z 30 grudnia 2005 r. w sprawie szkolenia strzeleckiego policjantów, Dz. Urz. KGP z 2006 r., nr 3, poz. 9 ze zm.
- Okoń W., 2003. Wprowadzenie do dydaktyki ogólnej, Warszawa.
- Idzikowski A., 2014. Szkolenie strzeleckie. Bezpieczeństwo – charakterystyka zagadnienia, Legionowo.
- Stechnij T., Grzebieluch M., Kukuła A., 2011. Trening techniczny bezstrzałowy jako podstawa szkolenia strzeleckiego policjantów, Katowice.
- Decyzja nr 143 komendanta głównego Policji z 2 maja 2016 r., w sprawie programu nauczania na kursie specjalistycznym w zakresie posługiwania się bronią palną podczas pełnienia służby w ubraniu cywilnym, Dz. Urz. KGP z 2016 r., poz. 23.
- Struniawski J., 2014. Dowodzenie w trakcie operacji policyjnych w zakresie imprez masowych i zgromadzeń publicznych, Szczytno.