Thesis Title: **Design, Development and Evaluation of a Training Method to Improve Firing Skills on Moving Targets**"

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Abstract

The basis for any country's sustained overall growth in a long term, is it's ability to ensure fulfilment of minimum basic essentials to all its populace, create a healthy & competitive atmosphere and provide equal opportunities for all, so as to ensure overall prosperity in the long run. The underlying foundation for all this to happen is an assured stable and peaceful atmosphere, which is the responsibility of the security forces. Conventionally, world over, external threats are taken care by security (defence) forces and internal security is handled by police forces. In the modern history of security threats, especially in the last 3-5 decades, terrorism has gradually gained gigantic proportions to the tune of becoming a global phenomenon which seriously & significantly affects/ impacts many nations across the world. Of the many ways in which terrorism affects, suicide styled surprise terror-attacks, is a major global challenge that security forces (police included) of many countries are coping up with. These attacks can be divided into two broad categories. First, attacks which target the civilian population, who are generally unarmed and hence such attacks cannot be resisted. Second, attacks which are specifically targeted on security personnel (soldiers as well as police), on those who are deployed on patrol duties or guarding a check-post, i.e., those deployed as the first line of defence. While there are many multi-pronged measures in place to control/ curb the terror-menace, one common step/ feature i.r.o. many countries is Special Forces (SF), who are highly capable to handle & neutralise such terror threats. These indomitable forces are considered, every country's most potent force, capable to handle any kind of risk/ threat situations. From the observations based on various terror attacks that have been unleashed in the past on security personnel (police or security forces), it has been observed that, SF do take/ need some time – atleast a few hours, to reach the scene of attack, before they can take control over the situation and neutralise the terror threat. So, it is evident that, when ever a terror attack occurs, it is the security forces of the first line of defence, i.e., those deployed on patrol duties or on check-post duties, who are inevitably the 'first to bear the brunt' of such attacks. In this context, the ability of these security personnel (soldiers as well as police) to fire accurately at those attacking terrorists is highly significant, to nail them down or chase them away or atleast give stiff resistance, till the time additional/ SF arrive. From the training perspective, ability to fire at moving targets during training stage can be considered as equivalent to, or a reasonable measure of the ability to fire at moving attackers in real situations. In this context, imparting firing skill on moving targets at training stage is considered important

Conventionally, weapon firing training is imparted in standard open firing ranges, by actual firing of bullets on static targets. Moving target firing can be imparted in two distinct methods. One, by means of physical firing in firing ranges, in which different target movements are generated using independent/ specific mechanisms. Second, by simulation / virtual means, i.e., target movement is generated with the help of hi-tech simulation softwares and associated infrastructure. For Physical method, it is pertinent to note that, generating different types of target movements physically in an open firing range has considerable practical constraints and

incurs substantial cost. Simulation method of training has an advantage that it can virtually generate any type of target movement and even a battle environment. However, all this is possible only at a corresponding high price. Since both the methods are expensive, only affluent and technologically advanced countries have used these methods to impart moving target training to their soldiers. However, the under-developed and developing countries, by virtue of affordability constraints, have limited themselves largely to conventional methods of training, on static targets only. In this context, it can be logically construed that, their security forces (soldiers & police), are not adequately experienced/ exposed to the much-needed moving target firing. Whereas, it is known that firing skills on moving targets plays a significant role in any offensive or counter-offensive operations, while encountering terror attacks. This research study attempts to explore the feasibility of a cost-effective method to impart moving target training using conventional infrastructure, i.e., through standard open firing range, and thus improve the firing skills on moving targets. The research work includes field trails to validate the proposed method.

Initially, as a first step, the content of moving target training (syllabus) has been designed (formulated) based on a thorough analysis of the movements of attackers in various terror attacks unleashed in the past. Accordingly, Moving Target Training (MTT) has been planned to be imparted on four distinct target motions – Horizontal, Slant, Random motions and on Flash Appearance & Disappearance of target. Designs (2D-drawings) of mechanisms to generate different types of target motions for conceived method of training have been finalised. Designed mechanisms constitute a chassis that can be tracted, and four independent modules, each capable to generate one specific type of motion. Working model (electro-mechanical) is fabricated, based on these designs. Further, the existing method for static firing skill assessment has been studied in detail. Improvised method has been proposed, considered more suitable for MTT. Elaborate field trials have been planned/ conducted to evaluate the effectiveness of proposed model to generate various types of target movements as conceived, as well as to evaluate the effectiveness of proposed training method to enhance firing skills/ accuracy on moving targets. Experiment results are satisfactory, and validate the effectiveness of proposed model to definitely improve firing skills on moving targets. Significant features of this proposed training model (method) are:

(i) It is a pioneering work in the field of moving target training, and is considered a unique model of its kind, for the intended purpose, i.e., to impart moving target training in an open firing range in a cost-effective way.

(ii) Each type of target motion has been generated using specially designed mechanisms (SDMs), through innovative ways to achieve the said target motions. Working model is fabricated without dependence on any complex/ costly or custom-made spares.

(iii) The proposed design utilises existing infrastructure to impart MTT. Hence it is considered an affordable & cost-effective method, thus ensuring ‘reachability to all’.

(iv) From the evaluation of results of field trails, it evolved that the quantum of learning of moving target skills by trainees is significantly dependent on two distinct factors:
   (a) Previous skill grade of firer in Static firing
   (b) Degree of difficulty to predict target motion

The scope of this research work is limited to explore and identify a suitable training method to impart moving target training using conventional infrastructure, i.e., open firing range, and in turn enhance firing efficiency/ accuracy on moving targets. Further scope exists for futuristic research work, to measure the exact impact of various training related factors on rate and quantum of learning.