Enhancing Training Through Use of Simulations

Sameer Chauhan

India's defence budget for 2013-14 has been allocated Rs. 2,03,672.1 crore (US $ 37.4 billion), a humble increase of 5.3 percent, compared to 17 percent in the year before.[1] It means that India's defence expenditure for 2013-14 will be the lowest in three decades and would be just enough to meet the expenditure for pay and allowances and maintenance of the weapon systems, directly impacting the Indian defence modernisation programme and planned future acquisitions. Therefore, the need to optimise utility for every rupee allotted could never have been more significant than today.

Under the prevailing realities of numerous and complex security challenges, the Indian Army has to be meticulously trained as a wholly networked fighting force so as to be fully effective to undertake its dominant role for preserving peace and ensuring the security of the nation. While almost one-third of the Army is operationally committed in guarding the frontiers and in counter-terrorism operations, the balance two-third is full-time and comprehensively involved in training of its rank and file on all facets of soldiering, which remains its *sine qua non*, reductions in budgets notwithstanding.

The Indian Army's well established, globally acclaimed training practices have been the backbone of the Indian Army's high professional

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standards. However, these very training practices stand today at a crossroads facing acute challenges in a form which necessitates the need to adopt radically new training techniques and methodology to keep abreast with the training requirements of a fast modernising Army. These challenges include:

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- Rapidly shrinking training areas and firing ranges due to exponential urbanisation and population increase;
- The advent of expensive high technology driven weapons and equipment which need to be preserved to ensure their longevity in operational service, thereby depriving any force of their easy availability for training;
- Growing complexity in the nature of warfare in a joint environment; and
- Ever reducing time for training due to escalating operational commitments.

One of the ways to achieve a balance would be by giving further impetus to simulations-based training, which is more imperative now than ever before. The rapid technological advances in the field of Modelling and Simulations (M&S) have thrown up a plethora of opportunities to leverage technology to fulfill the training aspirations of any modern-day Army. While simulators and war-gaming solutions have been in the Indian Army for some time, contributing towards enhancing battle skills at the tactical level, the current challenges to our live training methodologies have necessitated the overwhelming need to broaden the scope of adopting computerised simulation techniques to hone not only the weapon and equipment handling as well as maintenance skills of our soldiers but also the operational planning and decision-making acumen

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of our field commanders. A computer aided simulation system enhances the training utility multifold with greater realism and objectivity. The modern simulation techniques actually help in developing reality-based training applications which can also help in psychological tuning up of the soldiers and officers towards elements of combat stress – fear, anger, shock, etc.

Thus, it is an established need of the hour to explore the appropriate and efficient utilisation of simulation technology which will not only enhance the training standards of the Indian Army but also prove cost-effective in the contemporary resource crunch scenario. But, at the outset, it should be well understood that simulations comprise essentially a cost-effective and objective *supplement* to existing methods of training; and can never be an absolute replacement. Even with all the advances that technology has to offer the newer generation of soldiers, the value of training and experience on ranges or a vehicle convoy cannot be replaced. Hands-on training is the best way to teach, but if and when that is not feasible, training on simulations is the next best thing.

Simulations and Simulators

Often, in our Army, *simulation* and *simulator* are loosely considered synonyms and used interchangeably. Nonetheless, for the technologists, they hold essential differences, which are important to understand if the case for their proliferation in the Army is to be reinforced.

Simulation is the imitation of the operation of a real-world process or system over time.[2] To simulate is to mimic a real system so that we can explore it, perform experiments on it, and understand it before implementing it in the real world. *Simulations* are used in many contexts. When used in the context of simulation of *technology*, it is essentially for performance optimisation. When used in the context of simulation

of *design engineering,* it is actually for testing, training and education. Primarily, simulation is used with scientific modelling of natural or human systems to gain an insight into their functioning, to show the eventual real effects of alternative conditions and courses of action. This becomes extremely important, especially when the real system cannot be engaged, because it may not be accessible, or it may be dangerous or unacceptable to engage, or it is being designed but not yet built, or it may simply not exist. When we simulate, we are first required to develop a model of the original entity (weapon, equipment or process) wherein the model so developed represents the key characteristics or behaviours of the selected physical or abstract system or process. The model represents the system itself, whereas the simulation represents the repetitive operation of the processes of the system, over a period of time. This could be to simulate the behaviour of a weapon/equipment or a group of entities (platoon/company/combat team) in a particular scenario.

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A *simulator*, on the other hand, represents the final product which essentially is a 'skills training device', developed after incorporating the process of *simulation*. It is essentially a machine with a similar set of controls (as in the original piece), using any combination of sound, sight, motion and smell to make the user experience an actual situation, designed to provide a realistic imitation of the operation of a vehicle, aircraft, or other such weapon or equipment platform or system. For example, for a vehicle simulator, 'driving' in a booth along the track and through changing scenery displayed on the monitor, the trainee must hear the engine rumble, the brakes squeal and the metal crunch if he crashes. Some such booths use movement to create sensations of

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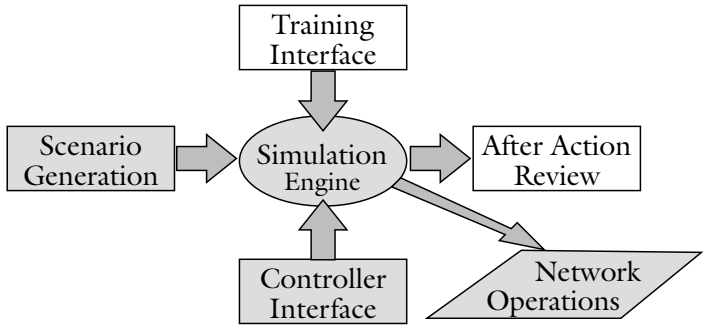
acceleration, deceleration and turning. The sights, sounds and feel of the 'driver's cabin booth' combine to create, or simulate, the experience of driving a vehicle. Therefore, *simulations* are the genesis and *simulators* are its species.

The use of simulations, especially in training is manifold. Simulations compress time and remove extraneous details; provide a learning experience, whereby skills, process, and knowledge can all be enhanced; and, they afford a luxury to explore, experiment, and repeatedly apply this knowledge to unlimited model situations. Arriving as the most versatile form of learning available, computerised simulations make training more effective than ever. Finally, while aiming at improving the skills, knowledge, and experience of the individual handler/decision-maker dramatically, they, at the same time, permit mistakes during training for a safety-critical system. In addition, simulations are also useful in trial evaluation of new generation weapons/equipment and help in truly depicting their worth in all modelled condition, thus, enabling smart acquisitions.

Architecture of Military Simulations

Before understanding the types of simulations, it is imperative to get a glimpse of the architecture of a typical military simulation (Fig 1).

Fig 1: Architecture of Military Simulations



Architecture: The architecture of any military simulation focusses on the functional nature of the missions to which the simulation is to be put to use. Essential components of the same can be summarised as:

Simulation Engine: The heart of the architecture and essentially application software, a simulation engine is the collection of components, features and support functions which are crucial to the implementation of an efficient discrete event simulation model. The entire simulation activity is centred on a *simulation engine* that performs both *execution* management and *modelling* functions.

Scenario Generator: Input data for simulation is created by the software termed as the *scenario generator*. It depends on the type of equipment/process being trained upon as also the training objectives for which the simulation is being run.

Training Interface: It supports the interactive participation by users.

Controller Interface: It is used by the control (either as pre-fed/ programmed rules or by an active on-line controller) to manage the starting, execution, and stopping of the simulation.

After Action Review: Simulation output data is analysed by the *after action review* system. Data is analysed to arrive at the standards achieved by the trainee or with respect to the degree of consistency of the simulation *per se*.

Network Interface: This software allows interactivity and interoperability between simulations operating on different computers, thus, networking between *heterogeneous simulations* and the distributed execution of *a single simulation system*.

Types

Simulations exist in many different forms, with varying degrees of realism. It is extremely important for a military planner to understand the types of simulations because only then can he plan correct and optimum development and deployment of the same. The simulations have been universally identified to be of three types: *live, virtual* and *constructive.*

Live Simulations: These are simulations where actual real life players use original systems in a real and physical environment, and only the effect of the activities is simulated. These typically involve humans and/or equipment activity in a setting where they would operate for real. The running time is continuous, as in the real world. An example is the Infantry Weapons Effectiveness Simulation System (IWESS), which is used in a two- sided collective training exercise, where the real small arms are fitted with soft, eye safe laser guns and the participants wear a jacket with laser sensors. During the exercise, the opposing forces engage each other and their hits are depicted by a sensor alarm.

Virtual Simulations: These are simulations involving humans and/or equipment where actual players use simulation systems in a computer generated synthetic or virtual environment. The running time can be real or in discrete steps, allowing users to concentrate on the key training objective. These represent a specific category of devices that utilise simulation equipment (which exactly replicates the controls of the original equipment) to create a simulated world for the user. In this manner, the system can accept input from the user (e.g., body tracking, voice/sound recognition, physical controllers) and produce output to the user (e.g., visual display, aural display). Simulations use the aforementioned modes

of interaction to produce a sense of immersion for the user, for instance, a tank, vehicle and flight simulator.

Constructive Simulations: These are simulations where virtual players are constructed in the simulation system in a synthetic environment, primarily used for training the decision-makers. The term is derived from the fact that, from a commander's perspective, the pieces operating on the battlefield are not individual soldiers/tanks/vehicles/aircraft but a construction of the combination of a group of equipment/personnel and their capabilities and behaviours into a single aggregated entity/ unit like an infantry company, artillery battery, etc pitted against similarly '*constructed*' entities representing the opposing side. The opposition reactions can be played *live* (by a player as the enemy) or as a pre-fed programme. Simulation enables multiple echelons of command and staff to execute their normal war-fighting tasks in an unconstrained exercise environment. This simulation allows commanders to face situations and make decisions under the stress of time and limited resources just as they will during actual combat by immersing them in a situation where the enemy is highly trained, experienced and unpredictable, who does not always operate as per the book but is just as determined to win the war. These result in helping the trainees develop confidence in their ability to take decisions under time/space/ resource constraints.

As can be made out, the *Live* and *Virtual* (L-V) simulations primarily aim at perfecting the 'weapon/equipment/systems handling skills' of the trainee; whereas, the *Constructive Simulations* (ConSim) aim at improving and refining the decision-making competence of the commanders and staff officers.

The advanced Armies are working towards integrating these three types of simulations. Their combination (referred to as *Live Virtual Constructive–Integration Architecture (LVC-IA*) enables entities to interact with one another and conduct a coordinated fight as though they were physically together on the same battleground. It involves adopting an integrated and fully

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interoperable federation of training equipment that includes live training [exercise with troops albeit instrumented (laser and wifi enabled)] or live firing, etc, training on simulators (virtual) and war-games (constructive) playing the same or complementary scenarios.

Benefits

The benefits of adopting simulations as second nature in training are manifold. They are safe, save time, money, fuel and the environment, and optimise original equipment utilisation. These benefits include:

- Compresses time required to develop skills in training, thus, accruing value for time for training.
- Increases and improves performance and overall training efficiency and effectiveness and shortens the training cycle.
- Helps create realistic training conditions that can either not be physically attained, or are considered too dangerous or economically not viable to be created. Training for reactions to physical loss of a tail rotor or complete engine failure cannot be replicated on an actual helicopter. A vehicle rollover training cannot be replicated on an actual vehicle; or the condition of an actual accident victim needing urgent CPR cannot be replicated on a normal human being, but on a simulator.
- Saves original equipment and weapon from use/abuse during training (aimed at skill development usage or training for repair/recovery), thus, prolonging the life of first line weapon or equipment. A validation exercise done by the South African Army showed that students going through a gunnery training simulator achieved 30 to 40 percent quicker reaction time and scored 14 percent better on their first hits than those who did not use a simulator.[3]

- Affords an opportunity for simultaneous training by a group, thus, optimising instructor and instructional resources. It enables instructors to control training content and to monitor student performance more objectively, based on unbiased report generation.
- Can help in achieving quantification of capabilities of individuals, crews/groups and commanders/staff, based on objective analysis of After Action Reports.
- Environmental protection. The environmental impact of training is limited as no air or noise pollution or terrain damage results from these skill developers. Units and individuals can train at their permanent locations without the need for actually travelling to other areas located many miles away, and can train to 'fire' weaponry without causing damage to the environment.
- Helps overcome constraints like availability of ranges or areas for training with troops. Databases replicating operational areas which might be encountered during future deployments can be created once and, thus, enable training despite limitations of time and space. Special benefits of training on ConSim applications are as follows:
- Decision-makers at every echelon are increasingly expected to consistently make the right decisions, at the right time, in highly ambiguous, pressure-laden situations. Their decisions must be timely, well-reasoned, and capable of withstanding harsh scrutiny. Individual decision-making competence increasingly influences far more than the outcome of the immediate tactical situation.
- An important benefit, which has not been lost sight of by those who have trained on it, is the simultaneity and concurrency of training of tactical as well as logistics staff officers and commanders on these systems. The manual training of decision-makers almost always presumes that the ideal logistics plans will invariably always keep pace with the unfolding tactical situation. But it is on the ConSim trainers that these *paper-logistician tigers* get exercised truly when

they need to actually apply principles of administration (*foresight, economy of effort, etc)* in a real-time, dynamic environment and, thus, get to review and train their skills in the 'simulated real combat scenarios'.

Scope for Enhanced Usage of Simulations for Training in Indian Army

The Indian Army has evolved for itself a thoroughly proficient training process based on an efficient individual training methodology and thereafter graduating to the collective and joint training mechanism. These range from squad post training on individual weapons and equipment, honing individual field craft and battle drills to field firing, sand model discussions, formation operational discussions and war-games. All these culminate in operational rehearsals and large scale military training exercises. Our training requirement encompasses terrain from mountains and high altitude to plains and deserts and the levels of desired simulations range from individual, sub-group and group levels, through the tactical, operational and strategic levels, to the joint and national. Besides, our involvement in sub-conventional operations demands that we have a vibrant simulation-based training solution for counter- terrorism operations, with an inbuilt component for limited war scenarios.

A close scrutiny of the above would reveal that the scope for usage of simulations in training is actually either in sharpening individual skills, or in collective usage of a system (i.e. crew training) or for training of the decision-makers. Please refer to Table 1 for individual or crew training requirements.

Table 1: Training for Specialised Individual/Crew Skills: Specific Arms/Services

Category	Types	Arms/ Services	Remarks
Weapons	Small arms (personal weapons)	All arms	All personnel of all arms need to be proficient in handling their personal weapons
	Heavy, crew served weapons	Specific to each arm	Examples: Training of • 7.62 mm MMG or 81 mm mortors for infantry. • Anti-aircraft guns in the Corps of Air Defence.
Equipment	All types	Specific to each arm.	Examples: Training of • Mine laying and recovering parties. • Bridge launching parties in Bridging Engineers Regiments. • Vehicle/equipment repairing on its assembly line for Electrical and Mechanical Engineers (EME).
Driving	Light vehicles	All arms	
	Specialist vehicles (including classification A vehicles)	Specific arms	Each arm and Service (e.g. armoured corps, mechanised infantry, artillery, signals, engineers, air defence, EME, etc) has its specialised vehicles, having a requirement for its crew to operate the vehicle in synchronisation.

Maintenance of Weapons, Equipment and Vehicles.	Basic	For all arms,	Important for learning the same on simulations so as to limit the rigours of wear and tear during training for maintenance on original weapons, equipment and vehicles.
	Advanced	Predominantly EME.	
Medical	First aid	All arms	• Currently battlefield nursing assistants trained in combat arms. • Ideal requirement to train each soldier, sailor and airman in this most important life-saving skill. • The US Army claims to have documented evidence that medical simulations have saved an estimated 1,000 lives in their Army.
	Surgery	Army Medical Corps (AMC), Army Dental Corps, Removal Veterinary Corps (RVC)	
Aviation	Helicopters (all types)	Army aviation	Requirement to train on simulations in flying as well as repair and maintenance of these precious platforms.

Current Status: Development and Exploitation of Simulations in Indian Army

The three types of simulations have been in the Indian Army for some time and have contributed in a large measure towards enhancing the battle skills at the tactical level. The time has come to carry out a dispassionate introspection of their status and explore the scope for improvement in the process of development and exploitation related to Modelling and Simulations (M&S) in the Indian Army.

The Simulations Development Division (SDD) located at Secundrabad and War-gaming Development Centre (WARDEC) located at New Delhi, under the aegis of the Army Training Command (ARTRAC),

are the nodal agencies coordinating the development of simulations for the Indian Army. The SDD primarily dwells on the development of L-V simulations. WARDEC coordinates development of ConSims in association with the Institute of Systems Studies and Analyses (ISSA) of the Defence Research and Development Organisation (DRDO), which in itself is the prime nodal agency for R&D purposes in this field, catering for the requirements of not only the Army but also the Indian Navy and the Indian Air Force (IAF) as well.

Besides, certain independent development of simulations has also been pursued by the directorates of the respective arms and services at the Army Headquarters as well as training schools and establishments, as per their peculiar individual requirements. Further, the Operations Research and Systems Analysis Team (ORSAT) of Headquarters Integrated Defence Staff (HQ IDS) has outsourced the development of war-gaming solutions for the Defence Services Staff College (DSSC), and the IAF and Indian Navy have their own systems of simulations development.

The SDD[4], established in 1991, has developed about 30 different types of L-V simulators and over 100 training scenarios. These simulators have generally been offshoots of the major projects/technologies which can easily be made available to users at a lower cost in a shorter timeframe. Once the requirement for a particular simulator has been identified from the environment and approved by HQ ARTRAC, SDD *suo moto* develops a prototype and tests it in-house. During the development, it may seek technical guidance from academia/industry/experts/DRDO. Once the prototype is developed and approved by HQ ARTRAC, the technological knowhow is transferred to one of the Army Base Workshops which then manufactures these simulators as per demand placed by units/formations/establishments.

WARDEC has been coordinating the development of ConSims since 1993, primarily through the ISSA of DRDO. Besides, it is also responsible for exploitation of the software in its initial phase of stabilisation. The

process of development of these complex simulations is long and intricate, involving preparation of user requirements by WARDEC/ISSA jointly, leading to project approval, preparation of initial functionality and design documents, software requirements specifications and then commencement of development of modules, its initial testing, deployment, exploitation by users and support during its life-cycle, etc. Of late, WARDEC has attempted to outsource development of some of this software beyond DRDO in order to harness the simulations developing capability and the capacity of indigenous industry in this field. Live Virtual Constructive – Integration Architecture (LVC-IA) is yet to be attempted in the Indian Army.

Development of L-V Simulations

Lack of Synergy Amongst the Defence Forces: There is a perceived lack of synergy amongst the defence agencies [i.e. HQ IDS, HQ ARTRAC, Directorate General of Military Training (DGMT), Director General Information System (DGIS) and the respective Line Directorates within the Army; and other services and Central Armed Police Organisations (CAPOs)] with respect to identification of requirements and subsequent development of L-V simulations. There is no central coordinating agency for orchestrating the ideal simulations development process benefitting the nation as a whole. Even where the same or similar type of usage is required, the Services are pursuing independent water-tight compartmentalised Development/Acquisitions/Procurements (DAP) processes. This is resulting in duplication as well as voids in certain developments. There is a strong requirement to address these obfuscations and overlaps in responsibilities in developing L-V simulations. Further, the simulations already developed are on different software platforms/protocols which are very difficult to be integrated or made interoperable. For instance, the technology for the M&S radar, based on doppler effect, is similar in the three Services. But all three work independently in getting this

application modelled and developed by separate vendors for meeting similar requirements.

Lack of Roll-on Plan: Currently, the DAP of an L-V simulation is '*product driven'* based purely on preparation of the Request For Proposal (RFP), with no scope for developing or harnessing the *technology*. There is no integrated roll-on plan or zeal to harness augmentative technology. Thus, each project is a fresh project, with a fresh RFP, fresh statement of requirement, fresh costing and fresh development timeline, rather than improving the earlier generation simulation because there is total lack of foresight for keeping the option of forward compatibility alive while drafting the RFP or while negotiating the terms for development. Obviously, the global standards and protocols during their development become the first casualty and future interoperability of the simulation with legacy systems suffers.

Lack of Financial Foresight: During the procurement of a high technology weapon system (e.g. heavy gun/tank/helicopter/missile launcher/aircraft, etc) or equipment (e.g. radar/bridging equipment, etc) or vehicle, customised L-V simulations are invariably developed as an integral part of the package and offered as such by the Original Equipment Manufacturer (OEM). But owing to assumed misplaced priority for reducing the cost of procurement so as to bring it within the budget, without reducing the number of items being procured, the axe invariably falls on the simulation systems being offered. The reason given is that the simulation can, and should be, developed 'in-house' (through 'reverse engineering' or ingenuity) rather than wasting money on its procurement. It is a proven fact that developing a L-V simulation is a long drawn R&D process yet the final product so developed may seldom be a credible "imitation of the behaviour and functions" of the original item and definitely not an exact comparison of the original L-V simulation which was being offered by the OEM. This up-front cost-cutting, appears economical to begin with, but proves counter to its

objective, because, in the absence of the OEM provided simulations, the user is left with no choice but to exploit his first-line weapon/equipment to meet the training requirement (including live firing), etc during the period of 'in-house' development of simulations, thus, causing a fair amount of wear and tear, cannibalisation, etc of the item, and, thereby, reducing the overall benefit which ought to have accrued. Further, the 'in-house developed poor cousins' seldom prove their equivalence viz the original OEM provisioned simulation. If the upfront cost-cutting becomes inescapable, it is better that a few pieces of the item itself be reduced from the overall demand rather than dropping the outright purchase of its simulations.

Comments: Exploitation of L-V Simulations

Lack of Institutionalised Approach in Promotion of Exploitation: As per the policy, once an L-V simulation is developed by SDD, it is the user who is supposed to demand this innovation, by following a certain process. There is no institutionalised motivation/ obligation for its automatic introduction in the Army. The current policy of *procuring* the same by the user from the Army Base Workshops out of its Annual Training Grant (based on certain approval procedures) is actually proving counter-productive. This is a typical personality driven *pull* method, So, all those commanders (unit upwards), who are technologically inclined resort to the procurement, even to the extent of immersing themselves in the 'so-called bureaucratic procurement process', but those who do not wish to *pull* the device into their system are not bound to do so and, thus, create an overall void in its usage in the organisation. But if the same process is reversed and the device is authorised and scaled on the Weapon Equipment Table (WET) of the unit/formation with associated changes in the provisioning process, its introduction to the user will be simplified.

Lack of Integrating the Simulation in the Overall Training Curriculum: Its benefits notwithstanding, currently, the training on

simulation devices has not been integrated with the overall training and testing process of the trainees. There is no accountability for 'non-usage'; rather, it is only taken to have been done as an 'add on'. It is strongly felt that once the training on these devices gets 'institutionalised recognition' and due integration in the overall training curriculum, it will promote the 'simulation culture' in our Army because then, there will be no alternative for the '*technologically disinclined'* but to submit to its usage and proliferation. Of course, the technical capabilities of the simulations will have to be of the optimum standards to generate and retain the faith of the trainers, and the same can be achieved by regular feedback from the users, which, in turn, can be achieved only by regular use of the devices. So it is a vicious cycle. An example comprises the small arms firing trainers that have been procured by a number of Regimental Training Centres and Stations for augmenting the small arms firing training of recruits/soldiers. Similarly, B vehicle driving simulators have been procured by a number of units/establishments. But, there is no integration of the same into the Annual Classification Range Course (for firing) or in the Training and Testing Schedule for new entrant drivers. Therefore, though the trainees are taken through the training process on these devices, very few have actually integrated their use as part of the overall training philosophy.

Even if there is an iota of lack of faith in the devices, the promotion of their usage will lead to generation of credible feedback about these systems, which, in turn, will lead to better R&D for its improvement.

Perceived Lack of Absolute Faith in the Devices: Even if there is an iota of lack of faith in the devices, the promotion of their usage will lead to generation of credible feedback about these systems, which, in turn, will lead to better R&D for its improvement. After all, Rome was not built in a day. Such technical devices have to go through the

grind of a number of improved versions, and the product refinement is an ongoing process. But, in the wait for an ideal system, we cannot shun the use of whatever we already have.

Development of Constructive Simulations (ConSim)

Long Gestation Period: The R&D of any simulation takes time which contributes to the user's impatience. Development of ConSim is a complex, long drawn process. In our Army, development and maturing of a ConSim system takes about 8-10 years. Moreover, till now, due to the twin reasons of security and erstwhile limited software development competency, the development was primarily undertaken by the ISSA of DRDO.

Synergy Through Industry Participation: It must be acknowledged that the ISSA, having mutually developed all the past ConSim systems for the Army with WARDEC, has the best domain knowledge and has acquired a rich understanding base in the past two decades in this field. However, with the ever expanding and improving software industry, in the country, the 'make Indian' approach, as enunciated in the Defence Procurement Policy (DPP), must also be explored where feasible. The indigenous simulation industry, owing to the competitive environment, has been espousing contemporary tools and techniques. While these at present are in disjointed and disconnected enterprises, with suitable initiatives from the Army and the government, they could be harnessed and consolidated towards development of high end ConSim systems. WARDEC has initiated the first steps in this direction by proposing the development of a few such types of software through industry participation, which would also attempt to keep abreast with high end technology. Such an initiative, in addition to improving the quality of the systems developed, would also result in faster fructification of projects processed through multiple agencies, '*bureaucratic processes'* of the financial advisers notwithstanding. The utility of ConSims as an objective tool for augmenting tactical

training is indisputable. In order to ensure that maximum realism is imparted in these systems, it is imperative that the underlying tactical logic is flawless, if not perfect, and the technology, at both the front and back ends, is capable of providing an easy to operate and exploit interface. To this end, the technology base available within the country must be fully explored and harnessed for potent development.

From a credible and effective training perspective, the Army will have to opt between using actual platforms to conduct some aspects of training or training on simulation-based training devices.

Exploitation of ConSims

The author has been questioned on the utility of conducting training on constructive simulations many a times, and that too by very senior levels of command. Their argument has been that the erstwhile staff officers and commanders of our Army have always been training and training well, even without such simulations, so why the big deal about them? Their perception is that we are not yet ready for a 'simulations augmented training culture'. To discuss the same, let us analyse the method of training of our commanders (especially from platoon and equivalent to division/ corps level). Do we have any quantified measurement of mission readiness amongst our Army today? When we say that a particular sub-unit/unit /formation is 'fit for war', do we say the same based on any quantitative evaluation? This quantification of mission readiness is possible by the use of simulations. Training on simulations is measurable.

A Strong Future

In July 2007, the United States House Resolution 487 officially recognised M&S as a national critical technology. This was official acknowledgement of nearly seven decades of contributions by M&S to varied areas such as nuclear testing and disarmament, space exploration, homeland security, and

economic development. Estimates range from $4 billion to $7.5 billion spent each year by the US Department of Defence (DoD) on M&S tools, processes, and products. We may accept it or not but, globally it has been well recognised that the future for training with simulations remains very strong. Thus, from a credible and effective training perspective, the Army will have to opt between using actual platforms to conduct some aspects of training – which can cost thousands of rupees an hour – or elect to undertake training on simulation-based training devices that generally cost only hundreds of rupees an hour to operate. Further, there is a strong need to:

- **Recognise all the Major Players' Users** [Army, Indian Navy, IAF, Ministry of Home Affairs (CAPOs)]and developers (in-house competence plus DRDO plus private indigenous industry as equal partners) under one national interface.
- **Profess a National Simulation Policy,** establish a national simulation complex and have long-term technology requirements identified and updated periodically, with primacy to establish continuity in development and upgradation teams. It is strongly recommended that an objective assessment be made with respect to current development and exploitation aspects of all types of simulations which have been raised in this paper, and suitable corrections and initiations be resorted to by those who are in the decision-making capacity. Let the relentless use of simulations become second nature with all aspects of training in the Indian Army, and, thus, '*train as you fight and fight as you had trained*'.

Notes

1. Laxman K Behera, "India's Defence Budget 2013-14: A Bumpy Road Ahead," *IDSA Comment*, March 4, 2013, available at http://www.idsa.in/idsacomments/IndiasDefenceBudget2013-14_lkbehera_040313
2. J Banks, J S Carson, B L Nelson and D M Nicol, *Discrete-Event System Simulation* (London: Pearson Prentice Hall Inc., 2005), p. 3.
3. Helmoed-Romer Heitman, "Core Element of SA Army Simulation," *Jane's Defence Weekly*, January 1997, p. 9.
4. For more details, see http://mod.nic.in/samachar/oct16-04/body.html, March 13, 2013.