FRAMEWORK FOR SIMULATORS IN ARMED FORCES

INTRODUCTION

"Fight as you train - Train as you fight".

1. Effective military training can be the difference between success and failure in all military missions. With its wide-reaching benefits, synthetic/ virtual training is revolutionising the training in the defence sector, especially when Armed Forces are challenged with limited resources and ever tightening of defence budget. Simulation and modelling technologies, apart from supporting training, can also exert a positive influence on all domains of the military affairs.

2. Indian Armed Forces have been utilising flight simulators as an effective training tool for pilots since 1970s which got a fresh impetus through '*Rathore Committee on Flight Safety'* (Jun 1994) and '*Committee on Fighter Aircraft Accidents (COFFA)'* chaired by Dr APJ Abdul Kalam (Sep 1997). However, exploitation and availability of simulators eventually got a major boost in the aftermath of strong recommendations of *60th Report of Public Accounts Committee 2003-04*.

3. The significance of simulators is well understood by the Armed Forces in terms of cost reduction, safety, training in near realistic setting by replicating variable combat scenarios, quicker training and conserving the critical operational equipment from wear and tear. However, a need exists to optimise exploitation of Simulators in the Armed Forces and Indian Coast Guard. Hence, a comprehensive framework has been formulated.

VISION

4. To implement simulation based training across all military domains and train combatants, leaders, maintainers, administrators, life science experts, procurement and financial agencies and thus achieve cost effective, efficient, safe, fast-paced and smart training.

AIM

5. To lay down the framework for synergised and enhanced exploitation of simulators by the three Services and the ICG.

GOALS AND OBJECTIVE

6. The framework has the following goals and objectives: -

   (a) To reduce live equipment utilisation with enhanced utilisation of simulators.

   (b) To ensure Capability Plans cater for phased induction of simulators.

   (c) To duly factor requirement of simulators at the planning stage of procurement, as applicable.

   (d) To coordinate and factor combined requirements of simulators during procurement and utilisation.

(e) To promote Services interaction with Indian industry to enhance indigenization.

APPLICABILITY

7. The policy will be applicable to all types of simulators in use/ to be procured in the future by the Armed Forces. The policy would be applicable to but not restricted to entities listed below: -

(a) Aerial vehicles (Manned and Unmanned).
(b) Land Vehicles (Specialist and Common User Vehicles).
(c) Maritime vehicles.
(d) Specialist Eqpt (Including earthmoving and works services related eqpt).
(e) Weapon and Sensors system.
(f) EW Trainers for Air and Ground Systems.
(g) Cyber operational Architecture Training System (COATS).
(h) Small Arms and Marksmanship.
(i) Firefighting.
(j) Damage control.
(k) Maritime Systems/ Underwater escape.
(l) Battlefield, Tactical, Air Combat & Squad/ Soldier multi domain Virtual Trainer.
(m) Virtual Boot camp.
(n) Air traffic and aircraft control simulators.
(o) Strategic Systems.
(p) War Gaming.
(q) Medical and life sciences (including High G, Disorientation simulator etc).
(r) System Maintenance and fault finding.
(s) Simulation, Forecasting and Project Management tools (for Acquisition and Budgeting).
(t) Design development and System Integration rigs.
(u) Testing and Certification simulation tools.
(v) Mission Planning/ Briefing/ Debriefing.

8. Types of Simulation and a broad classification of Simulators in use by the Armed Forces is placed at **Annexure I**.

NODAL AGENCIES

9. The following Department/ formations will function as nodal agencies for responsibilities indicated below : -

(a) **Service Headquarters (SHQs)**. The Services through designated Directorates would identify new areas of application of simulators and enhance exploitation of simulation in all facets of operations, maintenance, administration, medical science and work services resulting in optimization of live training efforts. To achieve this, Services will formulate appropriate policies, syllabus, acquisition plans and monitoring mechanisms. SHQs and HQ Indian Coast Guard (ICG) to provide

comprehensive data on availability of simulators, capacity for training, spare capacity and utilization data to HQ Integrated Defence Staff.

(b) **HQ Integrated Defence Staff (HQ IDS).** HQ IDS will be the nodal agency for formulation of overarching policy to optimise utilization of simulators in Armed Forces. The broad responsibilities would include the following: -

(i) Maintain the data of simulator availability.

(ii) Undertake annual appraisal to synergize and optimise simulator requirements and its exploitation.

(iii) Coordinate simulator requirements with other civil organisations including Central Armed Police Forces (CAPF) for Friendly Foreign Countries (FFC).

(iv) Responsible for approvals of JSQRs and coordinate for indigenization of simulators. Providing information to the industry on new areas of application of simulators envisaged by the three services and ICG through Department of Defence Production (DDP) and Society of Indian Defence Manufactures (SIDM).

(v) A six monthly feedback from the industry about the capability and capacity to develop simulators indigenously will also be maintained and disseminated to the Services.

(vi) Ensure Capability Plans cater for phased induction of simulators.

(vii) Factor simulator for/ of FFCs in the Staff Talks for mutual exploitation and instruct all DAs to forward a compilation of annual data of action taken in regard to simulator requirement and fulfillment thereof for the FFCs

(c) **DDP/ MoD.** The Department would encourage and nurture indigenous development and production of existing and future simulators through both public and private defence industries. The Department would task SIDM to liaise with all stakeholders to prepare six-monthly report on industries' capability and capacity.

(d) **DRDO**. Centre for Artificial Intelligence and Robotics (CAIR)/ DRDO will act as the nodal agency for coordinating efforts in the Public and Private sector for research and development of future technologies related to simulation in defence

(e) **Acq Wing/ MoD.** DAP-2020 would be suitably modified to ensure that simulators are procured along with the associated operational equipment/ systems.

GUIDELINES FOR IMPLEMENTATION

10. **Scaling and Acquisition**. The following guidelines will be referred to regarding scaling and Acquisition of Simulators: -

(a) SHQs would identify areas for simulator utilisation and include the same in their acquisition Plans.

(b) Sponsoring directorates to embed the requirement of sister services and other organisations, as applicable, while formulating SoC for procurement of a simulator along with weapon platform, system and equipment.

(c) For simulators having potential of exploitation by any other agencies apart from the sponsoring service, identified spare capacity will be kept in reserve for use by other organisations/ FFCs. Monetisation of the spare capacity to defray acquisition and running costs must be explored and instituted, if possible. Product support, Comprehensive Annual Maintenance Contract and spares requirement will be accordingly formulated and catered. For supporting and training, suitably qualified retired armed forces personnel could be examined for hiring.

(d) Simulators for legacy systems will be procured on requirement basis.

(e) All new simulators must be state-of-the-art with open architecture to ensure realistic and immersive training with capability to upgrade without major changes of hardware. Special Effect (SFX), computer generated visual effects (VFX), and Artificial Intelligence when required must create realistic mix of smoke, light, sound and smell.

(f) Efforts would be made to maximise indigenisation.

(g) To cater to different variants of same type, OEM should be asked for plug and play/ roll on-roll off reconfigurable simulator to maximize gain.

(j) Hindustan Aeronautics Limited (HAL), Defence Public Sector Undertakings (DPSU) and private Indian Industries to evolve suitable methodology for development of simulators alongside the main weapon platform, system and equipment. MSME and civil industry shall be promoted in development, production and Maintenance, Repair and Overhaul (MRO)/Repair and Overhaul (ROH)/ Sustenance of simulator for such training systems.

(k) The Technology Perspective and Capability Roadmap (TPCR) must reflect envisaged procurement plan for simulators by the Services for guidance to the industry. SHQs will also interact with Indian industry through SIDM, FICCI, ASSOCHAM and CII regularly to ascertain indigenous capabilities.

(l) Build, Operate and Maintain model by civil vendor, where possible, should be adopted.

(m) Where required, infrastructure for simulator may be created on turnkey basis. Functional Requirements Document (FRD) for simulator infrastructure from OEM must be obtained during contract finalization stage so that by the time equipment is being delivered, infrastructure is ready to house the simulator.

(n) Weapon system performance parameters and operational scenarios during development of Simulator by an Indian entity will be shared on as required basis. During simulator development, warfighter would participate for timely production of a realistic simulator.

11. **Utilisation of Simulators**. The following will be ensured to enhance utilisation of Simulators: -

(a) SHQs would formulate comprehensive roadmap (along with training syllabus) and issue suitable guidelines on induction and utilisation of simulators to enhance training standards and reduce live efforts.

(b) For gainful training and evaluation of warfighter's capabilities, simulators shall be manned by the specialised manpower including retired personnel.

Services will assess and, if possible, increase the hours of operation of simulators at their disposal by increasing the manning for optimally utilising the spare technical capacity.

(c) The spare simulator training capacity will be offered to civil operators, Central Armed Police Forces (CAPF) and Armed Forces of FFCs, etc under the Indian Technical and Economic Cooperation Program (ITEC) and/ or the Self Financing Scheme (SFS).

(d) High end expensive simulators in civil sector, where feasible, could be utilised through a '*Pay as you use'*.

(e) To ensure high degree of simulator availability, procurement must cater for adequate years of warranty, followed by comprehensive AMC. This should be followed by holistic follow-on maintenance support. Obsolescence Mitigation Plan and adequacy of Manufacturer's Recommended List of Spares (MRLS) must be catered.

(f) An annual appraisal of availability and utilisation will be carried out by the respective SHQs and HQ IDS to optimise the utilisation.

(g) Annual Stock taking on simulators procurement, usage as well as cross service utilisation (depending on spare capacity) to be made as mandatory agenda points in all Annual Tri Services Training Commander Conferences.

(h) Cyber security on account of its system, personnel and team capabilities would have to be of the highest level. Greater the realism in mission rehearsal and fidelity, greater would be need for data protection.

DEFENCE SIMULATION FUTURE TRENDS

12. Next generation synthetic trainers should bring to bear many of the latest training solutions and technology under development and consideration globally i.e. Cyber safe networking of simulators; wearable technologies; field deployable simulation; blended multi domain large force training solutions; mission rehearsal tools with personalized and adaptive learning; augmented and virtual reality based simulators; embedding of AI to generate and predict newer tactics/ concept to train in variable combat environment, etc. In view of the core competency, Centre for Artificial Intelligence and Robotics (CAIR)/ DRDO as nodal agency in consultation with SHQ and HQ IDS would formulate a roadmap for future technology development/ acquisition plan.

INDIGENISATION

13. The strong Defence eco-system and MSME base in India provide the potential for India to be a hub for production, operation and MRO for simulators, for both domestic and global markets. The DDP and the Industry may get into long term partnership with an implementable action plan for development and production of Simulators.

CONCLUSION

14. All efforts will be made to achieve maximum proliferation of simulators in the operational, maintenance and administration domains of military affairs. Avenues of application of simulation technology must be constantly explored to achieve a high level of op preparedness while reducing expenditure on training and preserving the life of equipment.

15. Finally, the Indian development, production and maintenance industries must be engaged by the Services to ensure highest level of indigenisation for production, deployment and maintenance of military simulators.

16. The Effectiveness of the Framework will be reviewed at an interval of every three years and revision if required would be promulgated accordingly.

Annexure I
(Refers to Para 8
of the Directive)

TYPES OF SIMULATION

1. Globally military simulators are broadly classified based on its utilisation i.e. Land, flight, maritime and joint forces simulators. These could be rudimentary desktop computer based trainer to high fidelity full motion full-mission flight simulator to the blended LVC trainer embedded with augmented and virtual reality solutions. Simulation devices in defence training can be broadly categorised into five types: -

(a) **Live Simulation**. A simulation involving real people operating real systems. These are considered simulations because they are not conducted against actual enemy.

(b) **Virtual Simulation**. A simulation involving real people operating simulated systems.

(c) **Constructive Simulation**. A simulation involving simulated people operating simulated systems. Real people simulate scenarios, but are not involved in determining the outcomes.

(d) **Blended Simulation**. A good mix of all of the above simulators for optimum training and cost saving.

(e) **Simulation, Forecasting and Testing Tools.** These are simulation software/ tools used for forecasting, prediction, testing and evaluation of operational plans, system designs, entities' performance, acquisition processes, etc i.e. War gaming simulator, FlexSim for Logistics and acquisition, adaptive models for price forecasting, multitude of decision support tools, etc.

SIMULATOR LEVELS

2. For flight devices categorisation, guidelines stipulated by USA and European Aviation regulatory bodies are widely used. Based on the fidelity and level of utility, the virtual flight training devices are categorized either as Flight Training Device (FTD) which are rated from 1 to 7 with 7 being the most sophisticated or Full Flight Simulator (FFS) which are classified with letters A through D.

3. **FTD**. These are full size replica of a specific aircraft type's instruments, equipment, panels and controls in an open flight deck/ cockpit area or in a cockpit mockup. It includes the equipment and computer programs necessary to represent aircraft (or set of aircraft) operations in ground and flight conditions to extent of the system installed in the device. These do not have motion.

(a) **FTD 1 to 3**. These are no more manufactured; only existing one are under usages. These were Computer Based Training (CBT) devices i.e. Desktop computer device, grandfathered Kiran aircraft simulators, etc.

(b) **FTD 4**. These have accurate system modeling but have generic aerodynamic model. These are Basic Cockpit Procedure Trainer or the Avionics Part Task Trainer i.e. Bison APTT. These are sometimes loosely referred as Basic Instrument Training Device (BITD).

(c) **FTD 5**. These have specific models of aircraft system and aerodynamics and are suitable for all variants of a type of aircraft.

(d) **FTD 6**. These are highest fidelity simulators with very accurate aircraft performance data, physical cockpit, specific control feels, hi-fi visuals, etc. These emulate actual functionalities of aircraft along with spatial presentations.

(d) **FTD 7**. These are only for helicopters. These always have variant specific aircraft performance and are equipped with environmental and vibration simulation.

4. **FFS**. These are a replica of aircraft instruments, equipment, panels and controls in an open flight deck area or cockpit mockup. It includes the equipment and computer programs necessary to represent aircraft (or set of aircraft) operations in ground and flight conditions having the full range of capabilities of system installed in the device. These have motion.

(a) **Level A**. These are simulators with 3 axis motion and night visuals.

(b) **Level B**. These are simulators with 3 axis motion, night visuals and ground simulation. This is lowest level for helicopter simulator.

(c) **Level C**. These are 6-axis motion simulators with night and dusk visuals, dynamic control loading and high degree of fidelity.

(d) **Level D**. These are 6 Degree-of-Freedom (DoF) simulators with day, dusk and night visuals. These have dynamic control loading and extreme high fidelity. With Level D simulator, one can perform all maneuvers and can achieve full type rating as these emulate actual aircraft. These have outside visuals upto minimum of 150°. These are also referred as ‘zero hour’ simulators i.e. all type flying can be carried out on these including landing and emergencies.

5. **Aviation Training Devices (ATD)**. FTDs are now sometimes also categorized simply as Basic ATD (BATD) or Advanced ATD (AATD).

6. Insofar as Land, Maritime and Joint simulators are concerned, no specific classifications exist. However, sometimes categories used for flight simulators are loosely used for such devices.

7. To maximize gains from such devices, efforts would be made to scale and acquire simulators categorized as FTD Levels 4 to 6 for fighter aircraft, while for helicopters, it would be either FTD Level 7 or minimum of FFS Level C. For transport class of aircraft, it would be FFS Level C or D. Additionally, to embed simulator training in the daily curriculum, it should desirably be located at the same base where troops/crew are stationed. Therefore, scaling and procurement should be accordingly done.