



International Civil Aviation Organization

**The Third Meeting of the APANPIRG ATM Sub-Group  
(ATM /SG/3)**

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**Agenda Item 4: ATM Systems (Modernization, Seamless ATM, CNS, ATFM)**

**TEM – EXPLOITING THE CAPABILITIES OF AIR TRAFFIC SIMULATORS**

(Presented by Airports Authority of India)

**SUMMARY**

To align the Station Level Simulator Training of controllers with concepts of ICAO Circular on Threat and Error Management (TEM), Airports Authority of India has decided to focus the curriculum of training in Air Traffic Simulators, to Enhance the Skills of Controllers in dealing with Threats and Errors Identified in Station Level TEM Manual. Airports Authority of India had implemented Air Traffic Simulators at Kolkata, Chennai, Mumbai and Delhi ATS Centres. This paper is presented to share the experience gained at Delhi.

**1. INTRODUCTION**

1.1 ICAO Circular 314/AN178, *Threat and Error Management (TEM) in Air Traffic Control* Chapter 1, paragraphs 1.1 to 1.3, 2.2.3 and 2.2.4 state:

*...that TEM framework is a conceptual model that assists in understanding, from an operational perspective, the interrelationship between safety and human performance in dynamic and challenging operational contexts.. **The main objective of introducing the TEM framework to the Air Traffic Services (ATS) community in general and the Air Traffic Control (ATC) community in particular, is to enhance aviation safety and operating efficiency.** The TEM model focuses simultaneously on the operational context and the people discharging operational duties in such context. The model is descriptive and diagnostic of both human and system performance. It is descriptive because it captures human and system performance in the normal operational context, resulting in realistic descriptions. It is diagnostic because it allows quantifying the complexities of the operational context in relation to the description of human performance in that context, and vice-versa.... **The TEM model can be used as a training tool, helping an organization improve the effectiveness of its training interventions, and consequently of its organizational safeguards.** Some threats can occur unexpectedly, such as pilots carrying out instructions that were intended for another aircraft as a result of call sign confusion. In this case, air traffic controllers must apply skills and knowledge acquired through training and operational experience to manage the situation. Regardless of whether threats are expected or unexpected, one measure of the effectiveness of an air traffic controller's ability to manage threats is whether threats are detected with the necessary anticipation to enable the air traffic controller to respond to them through deployment of appropriate countermeasures.*

1.2 It is with such references from ICAO Circular 314/AN178 that the training activities at Regional Training Centers at Kolkata, Chennai, Mumbai and Delhi have been aligned with TEM framework the following three stages.

- **Stage I.** Threats and Possible Errors were listed;
- **Stage II.** ATCOs were sensitized to respond to these threats and errors during classroom sessions and sensitization programme. In the class room sessions minor threats/errors, for example – common errors in flight data entry, ATIS broadcasts, readback/hearback issues, weather phenomena affecting airspace and airport operations, cross FIR Boundary coordination issues are discussed; and
- **Stage III.** Simulator training was imparted for major threats, for example – simultaneous go-around and a departing flight from same runway, aircraft skidding off the runway, releasing the departing or arriving flights on incorrect frequency in multi runway/multi approach control radar environment, non/delayed RT contact by incoming flight, complete avionics failures, handling fuel emergencies of diverted/diverting flights, etc.

1.4 Identification and listing of threats in Air Traffic Management environment is a continuous process. While preparing the TEM Manual for concerned airport, attempt is made to include as many threats as possible pertaining to ATM environment of each metro airport. However, it is also recognized that such a list can never be complete and with the development of new airspace structure, operationalization of new automation system, implementation of new procedures, and changes in flows of traffic pattern, new threats may emerge that may require immediate redressing. Thus the Station Level TEM Manual essentially remains a living document.

1.5 The pre-On-the-Job training for the ATC ratings or refresher training ON SIMULATOR for enhancing the skills of controller not only for increasing the proficiency of controllers in general but also for keeping them in touch with “**how to respond to unusual occurrences and emergencies**” becomes integral part of ATM Training System. Air traffic Simulators are used as very effective training tools with LIBERTY for trainee officer to commit as many mistakes as possible and learn the valuable lessons to deal with real traffic more confidently to provide error free service in ATC.

1.6 Air Traffic Simulators at Delhi , Mumbai, Chennai and Kolkata are used to impart training to controllers in following thrust areas :

- Pre On-the Job-Training - that is - Initial training before On-the-Job-Training at active channel is started by the double banking officer.
- Refresher Training – in dealing with Emergencies, Unusual Circumstances, Radar Failure, System Failure
- Skill Enhancement – in refining the Final Approach Spacing for individual runways and interlacing spacing for approaches in approaches to adjacent runways, Bad Weather Training, Traffic Overload Training , Performance Evaluation.
- Change Management – New PBN Procedures, Route Changes , Reduced Separation etc.

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## 2. DISCUSSION

### Application of Threat and Error Management in Training

2.1 The 'Standards Quality Management and Safety' section of ATM Directorate at Corporate headquarters of AAI receives reports of ATC incidents occurring anywhere in India. The SQMS section analyses the reports along with the regulator and tries to identify possible threats and errors and the associated trend if any. If the analysis brings out any threat or errors an advisory is issued to a particular ATS centre or to all the ATS centers with guidelines to prepare exercise that will help controllers to counter threats and weed out errors. Therefore, as mentioned above the concepts of Threat and error Management have been applied in the controllers' training/refreshers training at metro airports.

2.2 For example - the major Threats and errors identified at IGI Airport, Delhi, inter alia, are as follows:

- Weather deviations in Two/ Three runway mixed mode of operations;
- Similar Call sign/ Call sign confusion;
- Readback - hearback errors;
- Runway incursion by aircraft/ vehicle;
- Alignment on wrong runway;
- Departure followed by missed approach of arrival on the same runway;
- Radio Communication Failures/ VHF failure;
- Failure of Automation System/ Radar;
- Hotspots on ground and in the air;
- Taxiway incursion by aircraft/ vehicle;
- Level burst/ Aircraft climbing or descending to a level different from cleared level;
- Special Use Airspace infringements;
- Head down time in radar due to keyboard operations for profile update;
- Emergency descent by aircraft;
- Coordination failure;
- Activation of Danger Areas;
- Conflict at converging/ crossing points of routes;
- Resolution of conflict when the two conflicting aircraft operate in adjacent sectors and
- Inadvertent activation of Special Condition Codes 7500/7600/7700 by pilots in air /technicians on ground.

2.3 For minor threats and errors emerging out of changes say "temporary closure of a taxiway leading to a complex taxi routing", controllers are being sensitized by the Quality Improvement Teams in their daily/weekly sensitization sessions.

2.4 For changes leading to major impact on ATC functioning like implementation of Data Link Clearance Delivery, classroom training programmes are conducted. Refresher training programs are undertaken for all ATC officers to sensitize them for major threats, particularly Pre-Monsoon, Pre-Fog Low Visibility Procedures. Special training for handling of traffic after major closure of airspace at Delhi is planned during January 2016 onwards.

2.5 In the third stage, targeted skill enhancement exercises were created in Air Traffic Simulator with an objective to enhance Controller Performance to respond to identified threats and to eliminate the errors highlighted in the TEM Manual of Delhi Airport.

2.6 At Delhi Airport, the Air Traffic Simulator was operationalized on 12th December, 2014. Since then, classroom Training of 167 officers in unusual occurrences and 570 Simulator exercises on various aspects have been imparted to Air Traffic Controllers of Delhi in Aerodrome Control, Area Control, Approach Control, Terminal Radar and Enroute Radar. The System Description of Air Traffic Simulator operationalized at Delhi is at Appendix A.

2.7 First phase of Skill Enhancement exercise was conducted from 23rd February, 2015 to 20th March, 2015. Total 107 ATC officers from Aerodrome Control, Approach Radar Control, Enroute/ Area Radar Control and Procedural Area Control were given specific simulator training in the identified TEM framework at the ATS Centre, New Delhi.

#### Training for Unusual Circumstances and Emergencies (TRUCE)

2.8 Similar to the mandatory simulator training of flight crew, it is very important to regularly train Air Traffic Controllers for Unusual Circumstances and Emergencies. These conditions occur less frequently, but for a controller it is very important to act swiftly, accurately and in a logical manner to handle these contingencies. Contingency plans are prepared and discussed in monthly sensitization programmes. Nevertheless, in case of sudden developments in traffic scenario the controller handling the emergency or unusual occurrence may still miss vital action, as the skill which has not been practised is likely to be forgotten. Airports Authority of India has adopted the policy of imparting refresher training to the controllers with focus on the situations mentioned in 2.1 and 2.2. above. To keep the controllers always prepared to handle unusual occurrences/emergencies the following methodology is adopted in Simulated training:-

2.9 Preparation of Checklists: Single page checklists are prepared for every unit/ section to deal with different contingencies. These checklists include all tasks sequentially to address the responsibility of a particular unit; as mentioned in the concerned Contingency Plan. For example, the Check List to handle Aircraft Accident at airport is attached at Appendix B.

2.10 Classroom Training: Classroom training of all Controllers have been initiated in a phased manner to address following unusual conditions and emergencies:

- Aircraft Local Standby – Priority;
- Aircraft Full Emergency;
- Aircraft Accident – inside/ outside airport;
- Bomb Threat;
- Aircraft Hijack;
- Weather Emergencies including deviations, wind shear, heavy rain, turbulence, aquaplaning and change of runway direction;
- In Flight Medical Emergency needing priority handling;
- Radio Communication Failure;

- Emergency descent; and
- Failure of on board avionics.

2.11 Simulator Training: A group of 6 Controllers are called for simulator exercises every day. The simulator exercises begin with a short briefing session followed by simulated exercises. Six different scenarios are created and a controller performs one scenario and monitors 5 different exercises performed by others.

2.12 As a major benefit of the simulator training, it was recently observed that many controllers of Delhi are followed the actions listed in Contingency Plans/ Airport Emergency Plans, exactly as required ( and practiced on simulator), in real life aircraft priorities, emergencies and unusual conditions.

### **3. ACTION BY THE MEETING**

3.1 The meeting is invited to:

- a) note the information contained in this paper; and
- b) discuss any relevant matters as appropriate.

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**Appendix A**

**System description:**

**Composition:** Each Integrated Air Traffic Simulator has following sub-systems:

- Controller Working Position: 8 Nos. (FDD, SDD and VCS)
- Ground Controller Position: 2 Nos. (ASMGCS and VCS)
- Pilot Positions: 16 Nos. (2 Pilots per Controller)
- Session Manager: 1 No.
- Control & Monitoring Display: 2 Nos.
- EPP and DBMS: 1 No. (DBMS is combined with EPP)
- DRF
- ATG with FDP , SDP and DLS
- VCCS

**Capabilities:** Each IATS lab has following capabilities:

- Eight Student trainees at a time with 16 Pseudo Pilots
- Four Independent Exercises at a time OR One Integrated Exercise with up to four pilots
- TWR with 2-D Ground ( ASMGCS ) map scenario
- Ground Control , TWR Control with Electronic Flight Progress Strips
- ACC Procedural with Electronic Flight Progress Strips
- OCC procedural with ADS-CPDLC ( data link )
- Radar Training
- Alerts ( STCA, MSAW , MTCD )
- VCCS with multiple role function (different fictitious roles such as Fire Station, AOCC, MET, MLU for communication ) capabilities

**GLOSSARY:**

<b>ADS</b>	Automatic Dependent Surveillance
<b>AOCC</b>	Airport Operation Control Centre
<b>ASMGCS</b>	Advanced Surface Movement Guidance and Control system
<b>ATG</b>	Air traffic Generator
<b>CPDLC</b>	Controller Pilot Data Link Communications

<b>DBMS</b>	Database Management System
<b>DRF</b>	Data Recording Facility
<b>EPP</b>	Exercise Planning and Preparation System
<b>FDD</b>	Flight Data Display
<b>MLU</b>	Military Liaison Unit
<b>MSAW</b>	Minimum Safe Altitude Warning
<b>MTCDD</b>	Medium Term Conflict Detection
<b>OCC</b>	Oceanic Control Centre
<b>SDD</b>	Situation Data Display
<b>STCA</b>	Short Term Conflict Alert
<b>VCS</b>	Voice Communication System
<b>VCCS</b>	Voice Communication Control System

**Appendix B**

**Actions by Tower Controller – AIRCRAFT ACCIDENT (Inside Airport)**

**1. Activate Crash Alarm at least for 1 minute**

*(Alarm at TWR-S (Tower South) sounds at Fire Station 1: in case of crash on RWY29/11, Approach areas or Associated TWYs*

*Alarm at TWR-M (Tower Middle) or TWR-N (Tower North ) sounds at Fire Station3 : in case of crash on RWY28/10 or 27/09, Approach areas or Associated TWYs)*

**2. Broadcast Crash Message over Crash Alarm System**

- **CRASH, CRASH, CRASH**
- **Aircraft Type, Flight Number**
- **Location of Accident**
- **Grid Map Location**
- **Time of Accident**
- **POB**
- **Endurance (Fuel on Board)**
- **Aircraft Operator**
- **Any Dangerous Goods on Board, including quantity & location, if known**

**3. Inform Approach about Aircraft Accident and Request to Re-vector Aircraft on Another**

**Runway:***(Keep the coordination as short as possible)*

**4. Inform SMC about aircraft accident and Request to take necessary action**

**5. Inform Tower Supervisor**

**6. Approve Immediate Runway Entry to Fire & Rescue Vehicles**

**7. Clear Runway Entry to External Agencies Approaching via Rendezvous Point 1 or Rendezvous Point 2**

**8. Make Proper Log Entries**

*Note1: Tower will resume Normal Operations on affected Runway only when cleared by the TWR Supervisor in coordination with CMC & WSO.*

*Note 2: In case of Aircraft on Fire while on Ground; amend crash message with “Aircraft on Fire”, all other actions remaining same.*