ACCEPTABLE COMPENTENCY BASED TRAINING AND ASSESSMENT/ EVIDENCE BASE TRAINING PROGRAM AND APPROVAL

SECTION 1 GENERAL

1.1 PURPOSE

This Advisory Circular (AC) provides general guidance to AOC holders and ATO organizations regarding the policies that are applicable to CBTA/EBT programe that may be acceptable to CAAV.

This Advisory Circular (AC) contains guidance concerning CBTA/EBT programs for VAR 12 certificate holders and ATO certificate holders. This AC also addresses the roles and purposes of CBTA/EBT instructors.

This AC is providing guidance to Vietnam Approved Training Organisations (ATOs) and Vietnam Air operators for the development and implementation of competency-based training and assessment programmes.

This AC contains procedures for the development and implementation flight crew training programmes developed under the EBT concept, which provides an alternative means of satisfying the recurrent training requirements of Annex 6- Operation of Aircraft, Part I - International Commercial Air Transport – Aeroplane

1.2 STATUS OF THIS ADVISORY CIRCULAR

This is an original issuance of this AC.

1.3 BACKGROUND

The Procedures for Air Navigation Services — Training (PANS-TRG) are the result of the evolution of the work initiated by the Flight Crew licensing and Training Panel (FCLTP) on the implementation of the training required for the pilot licences and ratings found in Annex 1 — Personnel licensing, including the multi-crew pilot licence (MPL)

The FCLTP, identified a clear need for licensing and training material that, although too detailed to take the form of Standards, was of sufficient importance to provide universal benefit to States. The need called for material that had to be harmonized and subjected to a formal consultation and approval process and that called for a higher level of adherence on the part of States than that required of guidance material. The FCLTP determined that the establishment of the PANS-TRG would be the appropriate document for use by all States.

In 2011, following the work undertaken by the IATA Training and Qualifications Initiative on the

development of a competency-based approach to the training and assessment of aircraft maintenance mechanics/technicians/engineers (AMMTEs), including those personnel with licensed or authorized privileges.

There is industry-wide consensus that, in order to reduce aircraft hull loss and fatal accident rates, a strategic review of recurrent training for airline pilots is necessary. Consequently, procedures for evidence-based training (EBT), developed by the IATA Training and Qualifications Initiative, were introduced to the PANS-TRG issued in 2013 and are intended as a means of assessing and training key areas of flight crew performance in a recurrent training system. In addition, qualifications of the instructor were expanded.

In 2015, the Next Generation of Aviation Professionals Task Force developed competency frameworks for air traffic controllers (ATCOs) and air traffic safety electronics personnel (ATSEP) to support the progressive implementation of competency-based training practices for air traffic management (ATM) personnel. This second edition of the PANS-TRG has been restructured and divided into different parts dealing with each category of personnel.

The Competencies Task Force which was established in 2014 to review and clarify the existing competency-related definitions and concepts in provisions and organize them in a conceptual framework that would illustrate the relationships between the concepts.

1.4 APPLICABILITY

This AC is applicable to both Vietnam AOC and ATO holders and the service providers they may use to administer their approved training.

This AC applies to Vietnam ATOs providing training leading to endorsement of a type rating, and This AC also applies to Vietnam AOC holders conducting in their Flight crew recurrent training programme for type-rated pilots and Air operators for the development and implementation of competency-based training and assessment programmes.

1.5 RELATED REGULATIONS

The following regulations are directly applicable to the guidance contained in this advisory circular-

- VAR Part 9, ATO Approval,
- VAR Part 12 AOC Administration,
- VAR Part 14, AOC Personnel Qualification.

1.6 RELATED PUBLICATIONS

For further information on this topic, individuals, instructors and examiners are invited to consult the following publications—

1) International Civil Aviation Organization (ICAO)
    - ICAO Annex 1- Personnel Licensing,
    - ICAO Annex 6- Operations of Aircraft, Parts 1 & 3 - International Commercial Air

Transport,
- Document 9868, PANS Training,
- Document 9941, Competency Based Training Methodology,
- Document 9995, Manual of Evidence-Based Training.

2) EASA Regulations
   - The EASA ED Decision 2015/027/R and associated documents.

3) International Air Transport Associated (IATA)
   - Guidance Material for CBTA/EBT.
   - The EBT IMPLEMENTATION GUIDE – 1st Edition July 2013
   - DATA REPORT FOR EBT – 1st Edition July 2013

1.7 DEFINITIONS & ACRONYMS

A. The following definitions are used in this advisory circular—

Adapted competency model. A group of competencies with their associated description and performance criteria adapted from an ICAO competency framework that an organization uses to develop competency-based training and assessment for a given role.

Air operator certificate (AOC). A certificate authorizing an operator to carry out specified commercial air transport operations.

Aircraft operating manual. A manual, acceptable to the State of the Operator, containing normal, abnormal and emergency procedures, checklists, limitations, performance information, details of the aircraft systems and other material relevant to the operation of the aircraft.

Note - The aircraft operating manual is part of the operations manual.

Approved Training Organisation **(ATO)** Means an organisation which is entitled to provide training to pilots on the basis of an approval issued in accordance with the VAR Part (

Assessment (evidence) guide. A guide that provides detailed information (e.g. tolerances) in the form of evidence that an instructor or an evaluator can use to determine whether a candidate meets the requirements of the competency standard.

ATA chapters. A common industry referencing standard for aircraft technical documentation.

Behaviour. The way a person responds, either overtly or covertly, to a specific set of conditions, and which is capable of being measured.

Behavioural indicator. An overt action performed or statement made by any flight crew member that indicates how the crew is handling the event.

Competency. A dimension of human performance that is used to reliably predict successful

performance on the job. A competency is manifested and observed through behaviours that mobilize the relevant knowledge, skills and attitudes to carry out activities or tasks under specified conditions.

Competency-based training and assessment. Training and assessment that are characterized by a performance orientation, emphasis on standards of performance and their measurement, and the development of training to the specified performance standards.

Competency standard. A level of performance that is defined as acceptable when assessing whether or not competency has been achieved.

Conditions. Anything that may qualify a specific environment in which performance will be demonstrated.

Core competencies. A group of related behaviours, based on job requirements, which describe how to effectively perform a job and what proficient performance looks like. They include the name of the competency, a description, and a list of behavioural indicators.

Configuration deviation list (CDL). A list established by the organization responsible for the type design with the approval of the State of Design which identifies any external parts of an aircraft type which may be missing at the commencement of a flight, and which contains, where necessary, any information on associated operating limitations and performance correction

Critical flight manoeuvres. Manoeuvres that place significant demand on a proficient crew.

Criterion-referenced test. A test, the measurement of which is compared with an objective standard (and not against another measurement).

Dispatch deviation procedures guide (DDPG). Manual to identify any procedure to dispatch an aircraft with allowable systems/components inoperative or missing.

Note - Large aircraft manufacturers may choose to produce operating and maintenance procedures in documents such as dispatch deviation procedure guides, for use by operators.

Error. An action or inaction by an operational person that leads to deviations from organizational or the operational person's intentions or expectations.

Note - See Chapter 1 of Annex 19 —Safety Management for a description of operational personnel.

Error management. The process of detecting and responding to errors with countermeasures that reduce or eliminate the consequences of errors and mitigate the probability of further errors or undesired states.

Note.— See Attachment C to Part II, Section 1, Chapter 1 and Circular 314 — Threat and Error Management (TEM) in Air Traffic Control for a description of undesired states.

Event. A combination of a task or a sub-task and the conditions under which the task or sub-task is to be performed.

Evidence-based training (EBT). Training and assessment based on operational data that is characterized by developing and assessing the overall capability of a trainee across a range of core competencies rather than by measuring the performance in individual events or manoeuvres.

Evidence based training (EBT) operator. means an organisation that is holding an air operator certificate (AOC) in accordance with Var Part 12 and that has implemented an EBT programme approved by the CAAV, in accordance with the provisions of that Regulation.

EBT instructor. A person who has undergone a screening and selection process, successfully completed an approved course in delivering competency-based training and is subsequently authorized to conduct recurrent assessment and training within an approved EBT programme.
EBT practical assessment means a method for assessing performance that serves to verify the integrated performance of competencies. It takes place in either a simulated or an operational environment.

EBT programme. means a pilot assessment and training programme in accordance with Var part 14

Facilitation technique. An active training method, which uses effective questioning, listening and a non-judgemental approach and is particularly effective in developing skills and attitudes, assisting trainees to develop insight and their own solutions and resulting in better understanding, retention and commitment.

Human factors principles. Principles which apply to aeronautical design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance.

***Human performance*.** Human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations.

ICAO competency framework. A competency framework, developed by ICAO, is a selected group of competencies for a given aviation discipline. Each competency has an associated description and observable behaviors.

***Adapted competency model*.** A group of competencies with their associated description and performance criteria adapted from an ICAO competency framework that an organization uses to develop competency-based training and assessment for a given role.

Competency. A dimension of human performance that is used to reliably predict successful performance on the job. A competency is manifested and observed through behaviors that mobilize the relevant knowledge, skills and attitudes to carry out activities or tasks under specified conditions.

Note: ICAO describes knowledge, skills and attitude as:

- **Knowledge** is specific information required to enable a learner to develop and apply the skills and attitudes to recall facts, identify concepts, apply rules or principles, solve problems, and think creatively in the context of work. Knowledge is an outcome of the learning process, whether learning occurs in formal or informal settings. There are different types of knowledge: declarative (e.g. facts and raw data), procedural (e.g. categorized/ contextualized and application of conditional if-then rules), strategic (e.g.

synthesis, inference to guide resource allocation for decision making, problem solving and behavioural action), and adaptive (e.g. generalization, innovation and invention).

- **A skill** is an ability to perform an activity or action. It is often divided into three types: motor, cognitive and metacognitive skills. **A motor skill** is an intentional movement, involving a motor or muscular component, that must be learned and voluntarily produced to proficiently perform a goal-oriented task; **A cognitive skill** is any mental skill used in the process of acquiring knowledge, such as reasoning, perception and intuition; **A metacognitive skill** relates to the ability of learners to monitor and direct their own learning processes ("thinking about thinking"); for example, planning how to approach a given learning task, monitoring comprehension and evaluating progress toward the completion of a task.
- **Attitude** is a persistent internal mental state or disposition that influences an individual's choice of personal action toward some object, person or event and that can be learned. Attitudes have affective components, cognitive aspects and behavioral consequences. To demonstrate the "right" attitude, a learner needs to "know how to be" in a given context.

This manual distinguishes between "Pilot competencies" and "Instructor and Evaluator competencies".

Pilot competencies. An ICAO competency framework for aeroplane pilots.

Inter-rater reliability. The consistency or stability of scores between different raters.

Instructor and Evaluator competencies. A competency framework for instructors and evaluators as described in this manual.

Instructional systems design (ISD). A formal process for designing training which includes analysis, design and production, and evaluation.

Line-oriented flight scenario. Training and assessment involving a realistic, "real time", full mission simulation of scenarios that are representative of line operations.

Note- Special emphasis should be given to scenarios which involve a broad set of core competencies. It simulates the total line operational environment for the purpose of training and assessment of flight crew members.

Master minimum equipment list (MMEL). A list established for a particular aircraft type by the organization responsible for the type design with the approval of the State of Design containing items, one or more of which is permitted to be unserviceable at the commencement of a flight. The MMEL may be associated with special operating conditions, limitations or procedures.

Manoeuvres. A sequence of deliberate actions to achieve a desired flight path. Flight path control may be accomplished by a variety of means including manual aircraft control and the use of auto flight systems.

Minimum equipment list (MEL). A list which provides for the operation of aircraft, subject to specified conditions, with particular equipment inoperative, prepared by an operator in conformity with, or more restrictive than, the MMEL established for the aircraft type.

Mixed EBT programme Means an operator's recurrent training and checking programme provided for in point VAR 14, a portion of which is dedicated to the application of EBT but which does not replace proficiency checks provided for in VAR 7.

Monitoring. A cognitive process to compare an actual to an expected state. It requires knowledge, skills and attitudes to create a mental model and to take appropriate action when deviations are recognized.

Observable behaviour (OB). A single role-related behaviour that can be observed and may or may not be measurable.

Operations manual. A manual containing procedures, instructions and guidance for use by operational personnel in the execution of their duties.

Performance criteria. Statements used to assess whether the required levels of performance have been achieved for a competency. A performance criterion consists of an observable behavior, condition(s) and a competency standard.

Phase of flight. A defined period within a flight.

Practical assessment (or EBT practical assessment) Refers to a method for assessing performance that serves to verify the integrated performance of competencies. It takes place in either a simulated or an operational environment. An EBT assessment is equivalent to a proficiency check and is performed under the instructor privilege in the context of proficiency check in accordance with VAR 14. More information can be found in ICAO Doc 9868 "PANS-TRG".

Scenario (event-set). Relatively independent segment of training made up of several events.

Scenario-based training phase (SBT) Refers to the largest phase in the EBT programme. It is designed to maximise crew's exposure to a variety of situations that develop and sustain a high level of competency and resilience. The scenario for this phase should include critical external and environmental threats, to build effective crew interaction to identify and manage errors. A portion of the phase will also be directed towards the management of critical system malfunctions. Scenario elements address the training topic and detail the threat and/or error that the crew are exposed to.

Threat. Events or errors that occur beyond the influence of an operational person, increase operational complexity and must be managed to maintain the margin of safety.
Note - See Chapter 1 of Annex 19 — Safety Management for a description of operational personnel.

Threat management. The process of detecting and responding to threats with countermeasures that reduce or eliminate the consequences of threats and mitigate the probability of errors or undesired states.
Note – See Attachment C to Part II, Section 1, Chapter 1 and Circular 314 - Threat and Error Management (TEM) in Air Traffic Control for a description of undesired states.

Training objective. A clear statement that is comprised of three parts, i.e. the desired performance or what the trainee is expected to be able to do at the end of training (or at the end of particular stages of training), the performance standard that must be attained to confirm the trainee's level of competence, and the conditions under which the trainee will demonstrate competence.

Unsafe situation. A situation, which has led to an unacceptable reduction in safety margin.

B. The following acronyms are used in this advisory circular -

AC	Advisory Circular
ACAS	Airborne collision avoidance system
APP	Approach
AOC	Air Operator Certificate
ATC	Air traffic control
ATO	Approved training organization
CAAV	Civil aviation authority of Vietnam
CBTA	Competency-based training and assessment
CRM	Crew resource management
EBT	Evidence-based training
EVAL	Evaluation phase
FSTD	Flight simulation training device
FPA	Flight path management - automation
FPM	Flight path management - manual control
ICAO	International Civil Aviation Organisation
IOB	Instructor observable behaviour
KNO	Application of knowledge
KSA	Knowledge, skills and attitudes
LOC-I	Loss of control in flight
LOSA	Line operations safety audit
LTW	Leadership and teamwork
MEL	Minimum equipment list
MPL	Multi-crew pilot licence
OB	Observable behaviour
OEM	Original equipment manufacturer(s)
PRO	Application of procedures
PSD	Problem-solving & decision-making
SARPs	Standards and Recommended Practices
SAW	Situation awareness
SBT	Scenario-based training
SMS	Safety management system
SOP	Standard operating procedure
TA	Traffic advisory
TCAS	Traffic collision avoidance system
TEM	Threat and error management
UPRT	Upset prevention and recovery training
VAR	Vietnam Aviation Regulations
WLM	Workload management

SECTION 2 COMPETENCY BASED TRAINING AND ASSESSMENT (CBTA)

2.1. Principles of Competency Based Training

The main benefit of a competency-based approach to training and assessment is its potential to encourage and enable individual aviation professionals to reach their highest level of operational capability while ensuring a basic level of competence as a minimum standard.

When developing the assessment and training plans, it is important to consider the principles of Competency related to training and assessment:

(1) Relevant competencies are clearly defined for a particular role within an aviation discipline.
(2) There is an explicit link between competencies and training, required performance on the job, and assessment.
(3) Competencies are formulated in a way that ensures they can be trained for, observed and assessed consistently in a wide variety of work contexts for a given aviation profession or role.
(4) Trainees successfully demonstrate competency by meeting the associated competency standard.
(5) Each stakeholder in the process including the trainee, instructor, training organization, operator, service provider and regulator has a common understanding of the competency standards.
(6) Clear performance criteria are established for assessing competence.
(7) Evidence of competent performance is valid and reliable.
(8) Instructors' and assessors' judgements are calibrated to achieve a high degree of inter-rater reliability.
(9) Assessment of competencies is based on multiple observations across multiple contexts.
(10) To be considered competent, an individual demonstrates an integrated performance of all the required competencies to a specified standard.

2.2 Best Practices That Support Competency Based Approaches to Training and Assessment

To gain the maximum value and achieve efficiencies, competency-based approaches should incorporate training best practices as follows:

1) organizations encourage and support learning in formal and informal settings at different stages in an aviation professional's work life;
2) training programmes focus on the quality of what trainees do and achieve during training rather than on the prescribed amount of time aviation professionals spend training;
3) training focuses on accommodating an individual trainee's needs and provides flexibility; and
4) the highest quality and level of consistency of instruction is provided and particular attention is given to coaching, facilitation and mentoring.

SECTION 3 EVIDENCE BASED TRAINING (EBT)

3.1 Why EBT?

The EBT development project arose from an industry-wide consensus that, in order to reduce the aircraft hull loss and fatal accident rates, a strategic review of recurrent training for airline pilots was necessary. Existing airline pilot training regulation is largely based on the evidence of hull losses from early generation jets and a simple view that in order to mitigate a risk, simply repeating an event in a training programme was sufficient. Over time, many new events occurred, and the subsequent addition of these events saturated recurrent training programmes and created an inventory or "tick box" approach to training.

It is impossible to foresee all accident scenarios, especially in today's aviation system where the system's complexity and high reliability mean that the next accident may be something completely unexpected. EBT addresses this by moving from pure scenario-based training to prioritizing the development and assessment of key competencies, leading to a better training outcome. The scenarios recommended in EBT are merely a vehicle and a means to develop and evaluate competence. Mastering a finite number of key competencies should allow a pilot to manage unforeseen situations in flight.

The key competencies identified in EBT encompass what were previously termed both technical and nontechnical KSA, aligning the training content with the actual competencies necessary in contemporary aviation context. These competencies are embedded in the threat and error management (TEM) concept.

The availability of useful data covering both flight operations and the training activity has improved substantially over the last 20 years. Data sources like flight data analysis, flight observation (e.g. line operations safety audit (LOSA)) and air safety reports give a detailed insight into the threats, errors and risks in flight operations and their relation to unwanted consequences. An enhanced monitoring of training results demonstrates important differences in training needs between different manoeuvres and aircraft generations. Availability of such data has both established the need for the EBT effort and supported the definition of the resulting training concept and curriculum.

3.2 EBT Philosophy

EBT recognizes the need to develop and evaluate crew performance according to a set of competencies and the related KSA without necessarily distinguishing between the "non-technical" (e.g. CRM) and the technical competencies needed in order to operate safely. Any area of competence assessed not to meet the required level of performance shall also be associated with an observable behaviour that could lead to an unacceptable reduction in safety margin.

The aim of EBT is to identify, develop and evaluate the competencies and the related KSA required to operate safely, effectively and efficiently in a commercial air transport environment, while addressing the most relevant threats according to evidence collected in accidents, incidents, flight operations and training.

Representing the essences of TEM is a set of competencies, competency descriptions, corresponding taxonomy and behavioural indicators encompassing the technical and non-technical KSA to operate safely, effectively and efficiently in a commercial air transport environment. To this set of competencies must be added a statement (developed by the operator or relevant training provider) to define the standard of competencies and related KSA to achieve the task to the required level of proficiency. The

competencies and the related KSA should be used as a means to guide and develop competency levels appropriate to the type of operation and aircraft, within the training syllabus.
The EBT programme proposes a paradigm shift, not simply to replace a sometimes outdated set of critical events by a new set, but to use the events as a vehicle to develop and assess crew performance across a range of necessary competencies (and related KSA). In addition, EBT refocuses instructors on the analysis of root causes of errors in order to correct inappropriate actions, rather than simply asking a pilot to repeat a manoeuvre without really understanding why it was not successfully flown at first.

EBT addresses two elements (prepare the pilot for the unexpected and mitigate operational risks) by moving from task-based training to prioritising the development and assessment of key competencies, leading to a better training outcome.

Finally, it is recognized that in today's very high-fidelity simulator environment, there are very powerful training tools and yet regulation is much more biased towards testing and checking. EBT seeks to redress the balance between training and checking, recognizing that an assessment of competence is necessary, but once completed, pilots learn most effectively when not under pure test conditions. Appropriate input by competent instructors will enable pilots to be trained to a given set of performance criteria for performing tasks and managing events effectively.

3.3 Training and Assessment According to CBTA/EBT Principles

The first stage of CBTA/EBT implementation is training and assessment according to CBTA principles, which requires providing the instructors with CBTA curriculum that teaches them how to train and assess pilot competencies. Training to respond to and recover from surprise events forms a key part of the curriculum.

Training and assessment according to CBTA principles also means augmenting existing recurrent and type rating courses with CBTA principles without significant restructuring. This [overlay] concept serves as an interim solution for incorporating CBTA/EBT.

3.4 Mixed Implementation CBTA/EBT

Currently, CAAV permit a mixed-CBTA/EBT implementation for recurrent training only. This implementation serves as a stepping-stone to further developments such as baseline and enhanced CBTA/EBT with more training and the use of alternative training media, and less checking.

Each recurrent module contains three phases:

- **Phase 1 is the evaluation phase**, which features scenarios designed to enable instructors to make assessments of pilot competencies for insight into training needs.

- **Phase 2 is The manoeuvres validation phase** The purpose of the manoeuvres validation phase is to check the handling skills necessary to fly critical flight manoeuvres so that they are maintained to a defined level of proficiency. This replaces the MT described in ICAO Doc 9995 Chapter 7.5. Manoeuvres in this context are not part of the line-orientated flight scenario; they are a sequence of deliberate actions to achieve a prescribed flight path or to perform a prescribed event to a prescribed outcome. Features maneuvers that place a significant demand on a flight crew. Prescribed maneuvers

are defined by the aircraft generation and specified by recommended frequencies on a recurrent calendar basis.

Note : See Appendix 1 for the aircraft generation and specified by recommended frequencies on a recurrent calendar basis

- Phase 3, Scenario-based training phase: The purpose of the SBT is to further develop pilot core competencies in a learning environment. This does not form part of any LPC or OPC requirement. the largest phase, focuses on development of competencies and competencies as countermeasures to threats in line-oriented scenarios.

The mixed CBTA/EBT maintains the current operator proficiency check (OPC) and license proficiency check (LPC). Mixed implementation prescribes a defined CBTA/EBT grading framework.

3.5 Baseline CBTA/EBT

Baseline CBTA/EBT is an airplane generation-specific implementation that relies on industry evidence and data that is gathered and analyzed by ICAO to define industry-universal recommendations for improvement of safety in recurrent and type rating training. The industry evidence is reviewed and updated on a continual basis. Since baseline CBTA/EBT recommendations are ICAO-defined, the baseline program does not specify a detailed operator-conducted analysis or program design (ICAO 2013). In short, baseline CBTA/EBT offers/requires:

- An off-the-shelf solution
- Development of a set of competencies
- An assessment system
- Training of instructors for standardization and inter-rater reliability. Instructor training programs should enable the instructor to train and assess the competencies
- Pilot access to information regarding EBT principles, methods, and demonstrable competencies with performance criteria
- Measurement of training system effectiveness to inform changes and improvements
- No analysis by the operator.

Operators and ATOs endorse the concept of baseline EBT program and address all the topics identified for generation aircraft, at the recommended frequency (A, B, C). See appendix 2

Topics listed under:

• Frequency A: should be trained at every EBT module
• Frequency B: should be trained at half frequency of "A"
• Frequency C: should be trained at least one time during the three-year period.

3.6 Enhanced CBTA/EBT

Enhanced CBTA/EBT builds on baseline CBTA/EBT. Enhanced CBTA/EBT takes into account operational relevance to the individual operator. Since it is operator-specific, it has high potential for increasing the effectiveness of pilot training and improving aviation safety, but is a complex process (ICAO 2013).

Therefore, a baseline program and an enhanced program differ in optimization. Data analysis bridges the baseline CBTA/EBT program to the enhanced CBTA/EBT training program using the operator's

own fleet or operation-specific data. An enhanced program improves efficiency and effectiveness of training, but requires the collection of a substantial amount of operator data, including:

- Aircraft type analysis
- Risk and training analysis
- Guidance development

3.7. Implementation Stages and Timeline

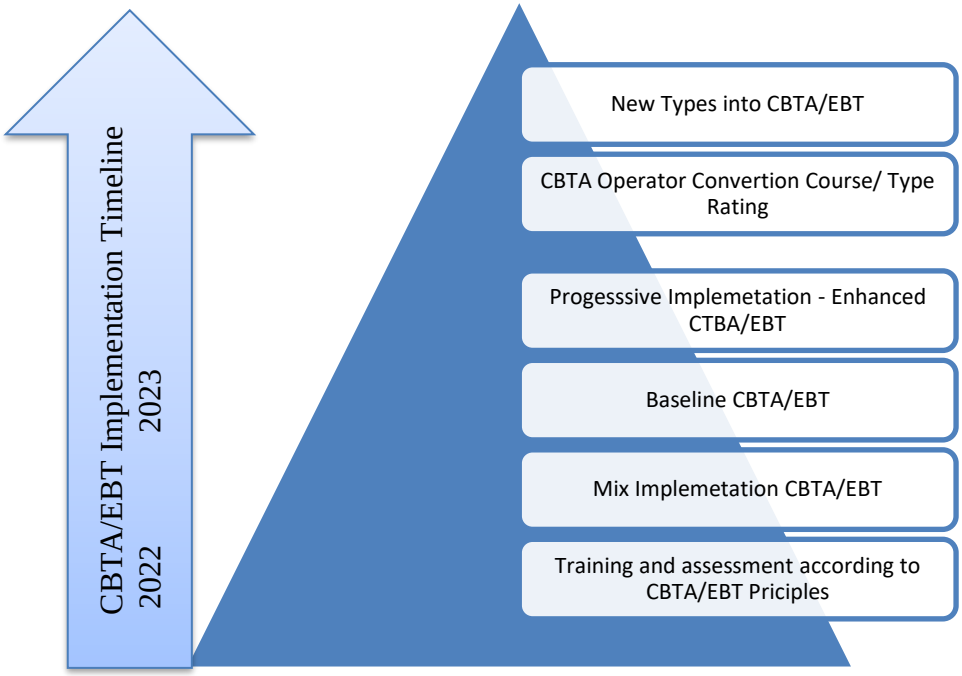


Figure 1: CBTA Stages and Implementation Timeline

Refer to the ICAO Manual of Evidence-Based Training (ICAO 2013) and the IATA Evidence-Based Training Implementation Guide (IATA 2013) for additional information about implementing CBTA/EBT.

SECTION 4 CORE COMPETENCIES AND BEHAVIORAL INDICATORS

Core competencies are group of related behaviours, based on job requirements, which describe how to effectively perform a job and what proficient performance looks like. They include the name of the competency, a description, and a list of behavioural indicators also named as observable behaviour or performance indicators.

CAAV Core Competencies and Behavioural Indicators has been developed in accordance with the recommendations, methodologies and criteria described in ICAO Doc. 9995 as well for the Evidence-based Training.

It shall be used for the evaluation of pilot training courses and progressive evaluation.

Application of knowledge (KNO)	
Objective: Knowledge and understanding of relevant information, operating instructions, aircraft systems and the operating environment	
OB 0.1	Demonstrates practical and applicable knowledge of limitations and systems and their interaction
OB 0.2	Demonstrates the required knowledge of published operating instructions
OB 0.3	Demonstrates knowledge of the physical environment, the air traffic environment and the operational infrastructure (including air traffic routings, weather, airports)
OB 0.4	Demonstrates appropriate knowledge of applicable legislation
OB 0.5	Knows where to source required information
OB 0.6	Demonstrates a positive interest in acquiring knowledge
OB 0.7	Is able to apply knowledge effectively

Application of procedures and compliance with regulations (PRO)	
Objective: Identifies and applies appropriate procedures in accordance with published operating instructions and applicable regulations	
OB 1.1	Identifies where to find procedures and regulations
OB 1.2	Applies relevant operating instructions, procedures and techniques in a timely manner
OB 1.3	Follows SOPs unless a higher degree of safety dictates an appropriate deviation
OB 1.4	Operates aircraft systems and associated equipment correctly
OB 1.5	Monitors aircraft systems status
OB 1.6	Complies with applicable regulations
OB 1.7	Applies relevant procedural knowledge

Communication (COM)	
Objective: Communicates through appropriate means in the operational environment, in both normal and non-normal situations	
OB 2.1	Determines that the recipient is ready and able to receive information
OB 2.2	Selects appropriately what, when, how and with whom to communicate
OB 2.3	Conveys messages clearly, accurately and concisely
OB 2.4	Confirms that the recipient demonstrates understanding of important information
OB 2.5	Listens actively and demonstrates understanding when receiving information
OB 2.6	Asks relevant and effective questions
OB 2.7	Uses appropriate escalation in communication to resolve identified deviations
OB 2.8	Uses and interprets non-verbal communication in a manner appropriate to the organisational and social culture
OB 2.9	Adheres to standard radiotelephone phraseology and procedures
OB 2.10	Accurately reads, interprets, constructs and responds to datalink messages in English

Aeroplane Flight Path Management – Automation (FPA)
Objective:

Controls the flight path through automation	
OB 3.1	Uses appropriate flight management, guidance systems and automation, as installed and applicable to the conditions
OB 3.2	Monitors and detects deviations from the intended flight path and takes appropriate action
OB 3.3	Manages the flight path to achieve optimum operational performance
OB 3.4	Maintains the intended flight path during flight using automation whilst managing other tasks and distractions
OB 3.5	Selects appropriate level and mode of automation in a timely manner considering phase of flight and workload
OB 3.6	Effectively monitors automation, including engagement and automatic mode transitions

Aeroplane Flight Path Management – Manual Control (FPM)	
Objective: Controls the flight path through manual control	
OB 4.1	Controls the aircraft manually with accuracy and smoothness as appropriate to the situation
OB 4.2	Monitors and detects deviations from the intended flight path and takes appropriate action
OB 4.3	Manually controls the aeroplane using the relationship between aeroplane attitude, speed and thrust, and navigation signals or visual information
OB 4.4	Manages the flight path to achieve optimum operational performance
OB 4.5	Maintains the intended flight path during manual flight whilst managing other tasks and distractions
OB 4.6	Uses appropriate flight management and guidance systems, as installed and applicable to the conditions
OB 4.7	Effectively monitors flight guidance systems including engagement and automatic mode transitions

Leadership & teamwork (LTW)	
Objective: Influences others to contribute to a shared purpose. Collaborates to accomplish the goals of the team	
OB 5.1	Encourages team participation and open communication
OB 5.2	Demonstrates initiative and provides direction when required
OB 5.3	Engages others in planning
OB 5.4	Considers inputs from others
OB 5.5	Gives and receives feedback constructively
OB 5.6	Addresses and resolves conflicts and disagreements in a constructive manner
OB 5.7	Exercises decisive leadership when required
OB 5.8	Accepts responsibility for decisions and actions
OB 5.9	Carries out instructions when directed
OB 5.10	Applies effective intervention strategies to resolve identified deviations
OB 5.11	Manages cultural and language challenges, as applicable

Problem solving decision making (PSD)	
Objective: Identifies precursors, mitigates problems, and makes decisions	
OB 6.1	Identifies, assesses and manages threats and errors in a timely manner
OB 6.2	Seeks accurate and adequate information from appropriate sources
OB 6.3	Identifies and verifies what and why things have gone wrong, if appropriate
OB 6.4	Perseveres in working through problems whilst prioritising safety
OB 6.5	Identifies and considers appropriate options
OB 6.6	Applies appropriate and timely decision-making techniques
OB 6.7	Monitors, reviews and adapts decisions as required
OB 6.8	Adapts when faced with situations where no guidance or procedure exists
OB 6.9	Applies effective intervention strategies to resolve identified deviations

Situation awareness and management of information (SAW)	
Objective: Perceives, comprehends and manages information and anticipates its effect on the operation	
OB 7.1	Monitors and assesses the state of the aeroplane and its systems
OB 7.2	Monitors and assesses the aeroplane's energy state, and its anticipated flight path
OB 7.3	Monitors and assesses the general environment as it may affect the operation
OB 7.4	Validates the accuracy of information and checks for gross errors
OB 7.5	Maintains awareness of the people involved in or affected by the operation and their capacity to perform as expected
OB 7.6	Develops effective contingency plans based upon potential risks associated with threats and errors
OB 7.7	Responds to indications of reduced situation awareness

Workload management (WLM)	
Objective: Maintains available workload capacity by prioritising and distributing tasks using appropriate resources	
OB 8.1	Exercises self-control in all situations
OB 8.2	Plans, prioritises and schedules appropriate tasks effectively
OB 8.3	Manages time efficiently when carrying out tasks
OB 8.4	Offers and gives assistance
OB 8.5	Delegates tasks
OB 8.6	Seeks and accepts assistance, when appropriate
OB 8.7	Monitors, reviews and cross-checks actions conscientiously
OB 8.8	Verifies that tasks are completed to the expected outcome
OB 8.9	Manages and recovers from interruptions, distractions, variations and failures effectively while performing tasks

Table-1 Core Competencies

SECTION 5 COMPETENCY BASED GRAIDING SYSTEM

5.1 Principles of Assessment in a Competency-Based Environment

In a competency-based environment the following principles applies:

a) Clear performance criteria are used to assess competence. The adapted competency model establishes these performance criteria.

b) An integrated performance of the competencies is observed. The trainee undergoing assessment must demonstrate all competencies and their seamless interaction with each other.

c) Multiple observations are undertaken. To determine whether or not a trainee has achieved the interim and/or final competency standard, multiple observations must be carried out.

d) Assessments are valid. All of the competencies that comprise the adapted competency model must be assessed.

There must be sufficient evidence to ensure that the trainee achieves the competency and meets the interim competency standards and/or the final competency standard. The trainee must not be asked to provide evidence for or be assessed against activities that are outside the scope of the adapted competency model.

e) Assessments are reliable. All assessors should reach the same conclusion when performing an assessment. All assessors should be trained and monitored to achieve and maintain an acceptable level of inter-rater reliability.

5.2 Grading System

The organisations to define the best grading system applicable to the specific organisation or operation, to be approved by the CAAV in the applicable manuals.

The bellow five grades of a possible Grading System provide an example to classify the competences. This grading for Evidence-based Training for Operators and CBTA for ATOs

The grading scale should be 1 to 5, where:

Grade 1	**NOT COMPETENT**	Determines that the minimum acceptable level of performance was not achieved for the conduct of line operations. An outcome of ADDITIONAL TRAINING IS REQUIRED before conduct line operations. **The pilot does not have adequate knowledge, by** rarely demonstrating **any of the performance indicators when required, which results in an unsafe situation**
Grade 2	**MINIMUM ACCEPTABLE LEVEL**	Determines that the minimum acceptable level was achieved for the conduct of line operations. **The pilot has knowledge of a minimum acceptable level, by only** occasionally demonstrating **some of the performance indicators when required, but overall did not result in an unsafe situation**
Grade 3	**ADEQUATE (average)**	The pilot has an adequate knowledge, by **frequently demonstrating** many of the performance indicators when required, which results in a safe operation
Grade 4	**EFFECTIVE (above average)**	Determines that the pilot is above the average. **The pilot has effective knowledge, by** regularly demonstrating **most of the performance indicators when required, which enhances safety**

Grade 5	**EXEMPLARY**	Determines that the pilot is above the average and the outcome is enhanced safety, effectiveness and efficiency. **The pilot** always demonstrates **all performance indicators when required, which significantly enhances safety effectiveness and efficiency**

Table-2 Grading System

5.3 Pilot Core Competencies and Grading System

5.3.1 Introduction

This part describes the five grades of the Grading system (using word pictures) in reference to each of the 9 pilot competencies.

The ICAO (Doc 9995) definition of an "unsafe situation" is "a situation which has led to an unacceptable reduction in safety margin".

Example how to describe the pilot competencies in relation the grading:

5.3.2 Communications

1. The pilot did not communicate effectively, by rarely demonstrating few of the performance indicators when required, which resulted in an unacceptable reduction in safety margin.
2. The pilot communicated at a marginal level, by only occasionally demonstrating some of the performance indicators when required, which resulted in a reduction of safety margin or effectiveness.
3. The pilot communicated adequately, by regularly demonstrating many of the performance indicators when required, which resulted in a safe operation.
4. The pilot communicated effectively, by regularly demonstrating most of the performance indicators when required, which enhanced safety and effectiveness.
5. The pilot communicated in an exemplary manner, by always demonstrating all the performance indicators when required, which significantly enhanced safety effectiveness, and efficiency.

5.3.3 Leadership and Teamworking

1. The pilot did not lead or work as a team member effectively, by rarely demonstrating few of the performance indicators when required, which resulted in an unacceptable reduction in safety margin.
2. The pilot led and worked as a team member at a marginal level, by only occasionally demonstrating some of the performance indicators when required, which resulted in a reduction of safety margin or effectiveness.
3. The pilot led and worked as a team member adequately, by regularly demonstrating many of the performance indicators when required, which resulted in a safe operation.
4. The pilot led and worked as a team member effectively, by regularly demonstrating most of the performance indicators when required, which enhanced safety and effectiveness.
5. The pilot led and worked as a team member in an exemplary manner, by always demonstrating all the performance indicators when required, which significantly enhanced safety effectiveness and efficiency.

5.3.4 Workload Management

1. The pilot did not manage the workload appropriately, by rarely demonstrating few of the performance indicators when required, which resulted in an unacceptable reduction in safety margin.
2. The pilot managed the workload at a marginal level, by only occasionally demonstrating some of the performance indicators when required, which resulted in a reduction of safety margin or effectiveness.
3. The pilot managed the workload adequately, by regularly demonstrating many of the performance indicators when required, which resulted in a safe operation.
4. The pilot managed the workload effectively, by regularly demonstrating most of the performance indicators when required, which enhanced safety and effectiveness.
5. The pilot managed the workload in an exemplary manner, by always demonstrating all of the performance indicators when required, which significantly enhanced safety effectiveness and efficiency.

5.3.5 Situation Awareness

1. The pilot's situation awareness was not adequate, by rarely demonstrating few of the performance indicators when required, which resulted in an unacceptable reduction in safety margin.
2. The pilot's situation awareness was at a marginal level, by only occasionally demonstrating some of the performance indicators when required, which resulted in a reduction of safety margin or effectiveness.
3. The pilot's situation awareness was adequate, by regularly demonstrating many of the performance indicators when required, which resulted in a safe operation.
4. The pilot's situation awareness was effective, by regularly demonstrating most of the performance indicators when required, which enhanced safety and effectiveness.
5. The pilot's situation awareness was exemplary; all performance indicators were always demonstrated when required, which significantly enhanced safety, effectiveness and efficiency.

5.3.6 Problem Solving and Decision Making

1. The pilot did not solve problems or make decisions effectively, by rarely demonstrating few of the performance indicators when required, which resulted in an unacceptable reduction in safety margin.
2. The pilot solved problems and made decisions at a marginal level, by only occasionally demonstrating some of the performance indicators when required, which resulted in a reduction of safety margin or effectiveness.
3. The pilot solved problems and made decisions adequately, by regularly demonstrating many of the performance indicators when required, which resulted in a safe operation.
4. The pilot solved problems and made decisions effectively, by regularly demonstrating most of the performance indicators when required, which enhanced safety and effectiveness.
5. The pilot solved problems and made decisions in an exemplary manner, by always demonstrating all of the performance indicators when required, which significantly enhanced safety effectiveness and efficiency.

5.3.7 Application of Procedures

1. The pilot did not apply procedures correctly, by rarely demonstrating few of the performance indicators when required, which resulted in an unacceptable reduction in

safety margin.
2. The pilot applied procedures at a marginal level, by only occasionally demonstrating some of the performance indicators when required, which resulted in a reduction of safety margin or effectiveness.
3. The pilot applied procedures adequately, by regularly demonstrating many of the performance indicators when required, which resulted in a safe operation.
4. The pilot applied procedures effectively, by regularly demonstrating most of the performance indicators when required, which enhanced safety and effectiveness.
5. The pilot applied procedures in an exemplary manner, by always demonstrating all of the performance indicators when required, which significantly enhanced safety effectiveness and efficiency.

5.3.8 Aircraft Flight Path Management, Automation

1. The pilot did not manage the automation effectively, by rarely demonstrating few of the performance indicators when required, which resulted in an unacceptable reduction in safety margin.
2. The pilot managed the automation at a marginal level, by only occasionally demonstrating some of the performance indicators when required, which resulted in a reduction of safety margin or effectiveness.
3. The pilot managed the automation adequately, by regularly demonstrating many of the performance indicators when required, which resulted in a safe operation.
4. The pilot managed the automation effectively, by regularly demonstrating most of the performance indicators when required, which enhanced safety and effectiveness.
5. The pilot managed the automation in an exemplary manner, by always demonstrating all of the performance indicators when required, which significantly enhanced safety effectiveness and efficiency.

5.3.9 Aircraft Flight Path Management, Manual Control

1. The pilot did not control the aircraft effectively, by rarely demonstrating few of the performance indicators when required, which resulted in an unacceptable reduction in safety margin.
2. The pilot controlled the aircraft at a marginal level, by only occasionally demonstrating some of the performance indicators when required, which resulted in a reduction of safety margin or effectiveness.
3. The pilot controlled the aircraft adequately, by regularly demonstrating many of the performance indicators when required, which resulted in a safe operation.
4. The pilot controlled the aircraft effectively, by regularly demonstrating most of the performance indicators when required, which enhanced safety and effectiveness.
5. The pilot controlled the aircraft in an exemplary manner, by always demonstrating all of the performance indicators when required, which significantly enhanced safety effectiveness and efficiency.

5.3.10 Knowledge

1. The pilot did not have adequate knowledge, by rarely demonstrating few of the performance indicators when required, which resulted in an unacceptable reduction in safety margin.
2. The pilot had knowledge of a marginal level, by only occasionally demonstrating some of the performance indicators when required, which resulted in a reduction of safety margin or effectiveness.

3. The pilot had adequate knowledge, by regularly demonstrating many of the performance indicators when required, which resulted in a safe operation.
4. The pilot had good knowledge, by regularly demonstrating most of the performance indicators when required, which enhanced safety and effectiveness.
5. The pilot had exemplary knowledge, by always demonstrating all of the performance indicators when required, which significantly enhanced safety, effectiveness and efficiency.

SECTION 6 ROLES OF PILOT AND INSTRUCTOR

6.1 Pilots

Pilots undergoing assessment and training as part of an EBT programme / Competence based should understand the means by which they will be assessed and trained.

Prior to the implementation of an EBT programme all pilots should be fully briefed and provided with information on the following:

a) competencies and related behaviour indicators,
b) purpose of each phase of EBT,
c) assessment methods and performance criteria, and
d) operator or ATO grading system.

6.2 Instructors - General

Competency-based training programmes, such as EBT and ab-initio MPL courses, are highly dependent upon the analytical and assessment skills of the instructor cadre. Furthermore, it is important that only those individuals who possess a good understanding of the learning process and how to positively influence human behaviour are considered for instructor positions.

6.3 Instructors - EBT

For ground instructors, some competencies may not apply. For the instructor assessment of competence, these competencies may not be observed. A review of the records of the instructor may be sufficient.

For flight instructors the privileges of a SFI / TRI for multi-pilot aeroplanes includes privileges to conduct EBT practical assessment at an EBT operator. The instructor must comply with the requirements of VAR7 for EBT instructor standardisation at that EBT operator VAR 14, namely the initial and recurrent standardisation programme.

The training of instructors conducting CBTA courses is at the core of successful implementation. Effective trainee learning requires alignment of instructor paradigms and clear standards that are consistently applied. And, with industry demand for safety and accountability, it is critical to set an instructor standard in pilot training program. To help reach this goal, holds instructor calibration training.

The initial calibration course includes two days of theoretical training and one day of observing and running competency-based simulator sessions to set standards and reliability between instructors. The course focuses on the researched, industry-aligned (IATA and ICAO) competencies' standards. After the initial calibration, reliability between instructors is managed through a regular process of concordance/inter-rater reliability checks.

As noted, while traditional instructor training considered TEM, there is now considerable emphasis on how competencies serve to manage threats, errors, upsets, and UAS and promote resiliency to black swan events. It is essential for instructors to be familiar with CBTA/EBT, what the competencies are, how to enhance them, and how to assess them.

6.3 Instructors – EBT Training initial

(a) Before delivering the operator's EBT programme, the instructor should complete an EBT instructor initial standardisation programme composed of:

(1) EBT instructor training; and

(2) EBT assessment of competence.

(b) The EBT instructor training course should be delivered by at least one pilot who is or has been an EBT instructor, and who has demonstrated proficiency to train the elements specified in point (c) below.

(c) The EBT instructor training course should comprise theoretical and practical training. At the completion of EBT instructor training, the instructor should:

(1) have knowledge of EBT, including the following underlying principles: (i) competency-based training;

(ii) learning from positive performance;

(iii) building resilience; and

(iv) data-driven training;

(2) demonstrate knowledge of the structure of an EBT module;

(3) demonstrate knowledge of the method of training delivery for each phase of an EBT module;

(4) demonstrate knowledge of the principles of adult learning and how they relate to EBT;

(5) conduct objective observations based on a competency framework, and document evidence of observed performance;

(6) relate specific performance observations of competencies;

(7) analyse trainee performance to determine competency-based training needs and recognise strengths;

(8) evaluate performance using a competency-based grading system;

(9) apply appropriate teaching styles during simulator training to accommodate trainee learning needs;

(10) facilitate trainee learning, focusing on specific competency-based training needs; and

(11) conduct a debrief using facilitation techniques.

(d) An instructor may be given credits for parts of point (c) if the instructor has demonstrated competencies in those topics.

(e) The recommended competency assessment grading system methodology for instructor competencies should be the same as the one used for pilots. This is the Venn model.

Management of the learning environment	
Objective: Ensures that the instruction, assessment and evaluation are conducted in a suitable and safe environment	
iOB 2.1	Applies TEM in the context of instruction/evaluation
iOB 2.2	Briefs on safety procedures for situations that are likely to develop during instruction/evaluation

iOB 2.3	Intervenes appropriately, at the correct time and level (e.g. progresses from verbal assistance to taking over control)
iOB 2.4	Resumes instruction/evaluation as practicable after any intervention
iOB 2.5	Plans and prepares training media, equipment and resources
iOB 2.6	Briefs on training devices or aircraft limitations that may influence training, when applicable
iOB 2.7	Creates and manages conditions (e.g. airspace, ATC, weather, time, etc.) to be suitable for the training objectives
iOB 2.8	Adapts to changes in the environment whilst minimising training disruptions
iOB 2.9	Manages time, training media and equipment to ensure that training objectives are met

Instruction	
Objective: Conducts training to develop the trainee's competencies	
iOB 3.1	References approved sources (operations, technical and training manuals, standards and regulations)
iOB 3.2	States clearly the objectives and clarifies roles for the training
iOB 3.3	Follows the approved training programme
iOB 3.4	Applies instructional methods as appropriate (e.g. explanation, demonstration, learning by discovery, facilitation, in-seat instruction)
iOB 3.5	Sustains operational relevance and realism
iOB 3.6	Adapts the amount of instructor inputs to ensure that the training objectives are met
iOB 3.7	Adapts to situations that might disrupt a planned sequence of events
iOB 3.8	Continuously assesses the trainee's competencies (e.g. by including the root cause(s) of the deficiency(-ies) observed according to the competency framework)
iOB 3.9	Encourages the trainee to self-assess
iOB 3.10	Allows the trainee to self-correct in a timely manner
iOB 3.11	Applies trainee-centred feedback techniques (e.g. facilitation, etc.)
iOB 3.12	Provides positive reinforcement

Interaction with the trainees	
Objective: Supports the trainees' learning and development and demonstrates exemplary behaviour (role model)	
iOB 4.1	Shows respect for the trainee (e.g. for culture, language and experience)
iOB 4.2	Shows patience and empathy (e.g. by actively listening, reading non-verbal messages and encouraging dialogue)
iOB 4.3	Manages trainees' barriers to learning
iOB 4.4	Encourages engagement and mutual support between the trainees
iOB 4.5	Coaches the trainees
iOB 4.6	Supports the goal and training policies of the operator/ATO and authority
iOB 4.7	Shows integrity (e.g. honesty and professional principles)

iOB 4.8	Demonstrates acceptable personal conduct, acceptable social practices, content expertise, a model for professional and interpersonal behaviour
iOB 4.9	Actively seeks and accepts feedback to improve own performance

Assessment and evaluation	
Objective: Assesses the competencies of the trainee and contributes to continuous training system improvement	
iOB 5.1	Complies with operator/ATO and authority requirements
iOB 5.2	Ensures that the trainee understands the assessment process
iOB 5.3	Applies the competency standards and condition
iOB 5.4	Assesses trainee's competency (-ies)
iOB 5.5	Performs grading
iOB 5.6	Provides recommendations based on the outcome of the assessment
iOB 5.7	Makes decisions based on the outcome of assessments
iOB 5.8	Provides clear feedback to the trainee
iOB 5.9	Reports strengths and weaknesses of the training system (e.g. training environment, curriculum, assessment/evaluation) including feedback from trainees
iOB 5.10	Suggests improvements for the training system
iOB 5.11	Produces reports using appropriate forms and media

Table 2 Instructor Competencies

6.4 Instructors – EBT Training Recurrent

The EBT instructor should:

(a) conduct six EVAL or SBT phases of an EBT module (or a combination of both) every 36 months. One of the EVAL or SBT should take place in the period of 12 months immediately preceding the expiry date. The 36-month period should be counted from the end of the month the module was taken. If this has not been fulfilled, the EBT instructor should complete an EBT assessment of competence.

When the module is undertaken within the last 12 months of the validity period, the new period should be counted from the original expiry date;

(b) receive annual recurrent standardisation. The recurrent standardisation should include:
- (1) refresher EBT training; and
- (2) concordance training; and

(c) complete an assessment of competence every 3 years. When the assessment of competence is conducted within the 12 months preceding the expiry date, the next assessment of competence should be completed within 36 calendar months of the original expiry date of the previous assessment of competence.

SECTION 7 CONDUCT OF EBT

The aim of an EBT program is to identify, develop and evaluate the competencies required by pilots to operate safely, effectively and efficiently in a commercial air transport environment, by managing the most relevant threats and errors, based on evidence collected in operations and training.

Competency-based training is the approach used to deliver the content of EBT programmes. The facilitation technique is the primary technique (see 7.8) that should be used for competency-based training. Other techniques, such as showing and telling, complement facilitation if the trainees do not have the knowledge and/or experience to conduct the required task.

The first step to implement the EBT is with the publication of guidance material to allow the implementation of a 'mixed EBT' which maintains the current operator proficiency check (OPC) and licence proficiency check (LPC). The second step is starting to allow CAAV to approve the baseline EBT, which replaces OPC and LPC. This will allow a single philosophy of recurrent training within the airline.

7.1 Preparation

a) Creation of lesson plans. Lesson plans should be created in accordance with the respective appendix.

b) Standardization of instructors. Before delivering instruction or conducting assessment within the EBT programme all instructors should be trained and standardized.

c) Information to pilots. Prior to the implementation of an EBT programme all pilots should be made familiar with the EBT principles, philosophy, phases of the training programme and the means by which they will be assessed and trained.

7.2 Briefing

Session Briefings should contain at least the elements set out below.

a) Objectives:

1) demonstrate at least the minimum required standard in all the competencies;
2) enhance handling skills; and
3) enhance the trainee's ability to prevent, mitigate and manage most relevant threats and errors.

b) Structure of the session:

1) evaluation phase;
2) manoeuvres training phase; and
3) scenario-based training phase.

7.3 Evaluation Phase

Qualified and authorized instructors should be assigned to carry out assessments to determine that all required performance standards have been satisfactorily achieved.

a) The purpose of the evaluation phase is to:

1) observe and assess flight crew competency;
2) collect data to further develop and validate the effectiveness of the training system; and
3) identify individual training needs.

b) During the evaluation phase of the session the instructor will not normally give any instruction to the pilots or interrupt. Instead he or she will focus on observation, run the scenario and play the role of external parties (ATC, cabin crew, etc.) where necessary. All deficiencies in flight crew competence should be noted in order that they may be addressed during the subsequent phases of the session.

c) In the event the instructor is obliged to intervene, the effect of this intervention on the flight crew's performance should be taken into account.

d) Evaluation phase should includes check scenarios referred to in VAR 14 within an approved mixed EBT programme. In order to facilitate the provision of simple and realistic scenarios in accordance with ICAO Doc 9995 Chapters 3.8 and 7.4, the EVAL is not intended to be a comprehensive assessment of all VAR 14 items; nevertheless, the list below includes the items that should be included in the EVAL only:

(i) Aeroplanes

Where applicable, the EVAL should include the following manoeuvres as pilot flying:

(A) rejected take-off when an FSTD is available to represent that specific aeroplane, otherwise touch drills only;

(B) take-off with engine failure between V1 and V2 (take-off safety speed) or, if carried out in an aeroplane, at a safe speed above V2;

(C) 3D approach operation to minima with, in the case of multi-engine aeroplanes, one-engine-inoperative;

(D) 2D approach operation to minima;

(E) at least one of the 3D or 2D approach operations should be an RNP APCH or RNP AR APCH operation;

(F) missed approach on instruments from minima with, in the case of multi-engined aeroplanes, one-engine-inoperative;

(G) landing with one-engine-inoperative. For single-engine aeroplanes a practice forced landing is required.

(ii) Helicopters

(A) Where applicable, operator proficiency checks should include the following abnormal/emergency procedures:

— engine fire;
— fuselage fire;
— emergency operation of under carriage;
— fuel dumping;
— engine failure and relight;
— hydraulic failure;
— electrical failure;
— engine failure during take-off before decision point;
— engine failure during take-off after decision point;
— engine failure during landing before decision point;
— engine failure during landing after decision point;
— flight and engine control system malfunctions;
— recovery from unusual attitudes;
— landing with one or more engine(s) inoperative;
— instrument meteorological conditions (IMC) autorotation techniques;
— autorotation to a designated area;
— pilot incapacitation;

— directional control failures and malfunctions.

(B) For pilots required to engage in IFR operations, EVAL include the following additional abnormal/emergency procedures:

— 3D approach operation to minima;

— go-around on instruments from minima with, in the case of multi-engined helicopters, a simulated failure of one engine;

— 2D approach operation to minima;

— at least one of the 3D or 2D approach operations should be an RNP APCH or RNP AR APCH operation;

— in the case of multi-engined helicopters, a simulated failure of one engine to be included in either the 3D or 2D approach operation to minima;

— landing with a simulated failure of one or more engines;

— where appropriate to the helicopter type, approach with flight control system/flight director system malfunctions, flight instrument and navigation equipment failures.

(C) Before a flight crew member without a valid instrument rating is allowed to operate in VMC at night, he/she should be required to undergo a EVAL at night. Thereafter, each second EVAL should be conducted at night.

e) The evaluation phase should consist of a line-oriented flight scenario during which there are one or more occurrences for the purpose of evaluating one or more key elements of the required competencies. The root cause rather than the symptoms in any deficiency should be identified.

f) This is not intended to be a comprehensive assessment of all areas of competency, nor a demonstration of all critical flight manoeuvres.

7.4 Manoeuvres Training Phase

The purpose of the manoeuvres training phase is to practise and develop the handling skills necessary to fly critical flight manoeuvres, in order that they are maintained to a defined level of proficiency, according to predetermined performance criteria as established by the operator or training organization.

During the manoeuvres training phase, the focus is on the handling skills required to perform critical flight manoeuvres and associated procedures. This is not part of the line-oriented flight scenario training, and can be accomplished with greater efficiency, focusing as appropriate on the critical elements of manoeuvres to enhance skill levels.

The instructor should behave as an active trainer, utilizing learning opportunities whilst ensuring that the desired level of competency is achieved.

7.5 Scenario-Based Training Phase

The purpose of the scenario-based training phase is to develop, retain and practice the competencies for effective management of threats and errors to enhance the crew’s ability to cope with both predictable and unforeseen situations.

The focus of the scenario-based training phase is to develop the flight crew's capability to manage relevant threats and errors. In contrast to the evaluation phase, the instructor should intervene or interrupt where necessary to enable the development of the crew's competence or enhance the learning experience.

This training should consist of line-oriented flight scenarios during which one or more threats may be introduced. The contents of this training should be adapted to develop the weaker competencies identified during the evaluation phase.

7.6 Assessment

The purpose of the evaluation phase is to assess competence, determine training system effectiveness and indicate individual training needs. On completion of the evaluation phase any areas that do not meet the minimum competency standard will become the focus of subsequent training. If, at the conclusion of this training, competency has not been achieved in all areas, the pilot should be removed from line flying duty and should only resume line flying after additional training and assessment confirming that minimum competency standards have been achieved. Any area of competence assessed not to meet the required standard shall also be associated with an observable behaviour that could lead to an unacceptable reduction in safety margin. Any subsequent retraining and assessment needs to focus on the root cause of the deficiency and not simply be the repetition of a manoeuvre.

Assessment is a continuous process throughout all phases. It is the process of observing, recording, analyzing and determining crew performance against a defined standard in the context of overall performance. It includes the concept of self-critique and feedback, which can be given during training, or in summary thereafter.

Assessment should be accomplished by relating the observed crew behaviour to the competencies. The competencies should not be used as a checklist. The determination of crew competence should be made solely with reference to defined standards established by the operator or training organization.

Instructors assigned to carry out evaluations should be knowledgeable of the competencies or equivalent system in order to allow valid assessments and constructive debriefings. A successful assessment includes giving guidance to flight crew members to improve future performance, and also making recommendations for additional training where this is necessary.

7.7 Debriefing

The debriefing should comprise a fair and unbiased review based on observed actions and facts. A debriefing is successful if the trainees have a clear understanding of their performance, particularly in areas that can be improved.

The debriefing should commence with a statement of the outcome, so that the flight crew members know immediately whether the module has been completed successfully, or if additional training is required. The instructor should state the reason for additional training required and the effect on licences or ratings held.

Where appropriate and once the outcome has been announced the debriefing should be a facilitated discussion where flight crew members should be encouraged to critique themselves. The Instructor

should provide feedback to the crew to encourage the changes needed and also to provide specific recommendations to improve individual flight crew member's performance.

With the consent and knowledge of the crew, animated playback systems and video can be used to target and to develop competencies and understand individual and crew performance. Once the debriefing is completed, the video or playback system data should be deleted unless the participants agree on the contrary.

7.8 Facilitation Technique:

The following aims to explain what the facilitation technique is, why it is needed, some of the skills required to use this training technique and some general guidelines.

To be competent in any job, a person requires a certain amount of knowledge, an adequate level of skills, and a particular set of attitudes. This is true for doctors, hotel receptionists, lawyers, footballers, soldiers, artists and of course flight crew members. The role of a trainer in any discipline is to help people develop their knowledge, skills and attitudes so that they are able to do their job well. In many professions the formal training emphasis is often on developing knowledge and skills, with the examination of competence almost exclusively concerned with measuring knowledge and skills against a set of standards.

Facilitation means that trainees are given the opportunity to discover what they are doing and the effect it has on others and on the task, so that they can make the decision to alter their behaviour or reinforce any positive behaviour.

The facilitation technique is more effective than the showing and telling technique because the participant's involvement and experiences are actually part of the learning process.

To be competent, a pilot requires capabilities across a range of knowledge, skills and attitudes (KSA). The role of the instructor is to help trainees develop their KSA using appropriate techniques including facilitation. The facilitation technique is not just for the poor performer or for the development of attitude but can be equally used to reinforce effective behaviour because it gives trainees an understanding of why they are good, which encourages their continued development.

The differences between instruction and facilitation techniques are highlighted in Table-3.

	Instruction Technique	**Facilitation Technique**
What do the words instructing/facilitating imply?	Telling, showing	Enabling the trainee to find the answer by himself/herself
What is the aim?	Transfer knowledge and develop skills	Gain insight/self-analysis to enable an attitude change
Who knows the subject?	Instructor	Both instructor and trainee
Who has the experience?	Instructor	Both instructor and trainee
What is the relationship?	Authoritarian	Equal
Who sets the agenda?	Instructor	Both instructor and trainee
Who talks the most?	Instructor	Trainee
What is the timescale?	Finite	Infinite

Where is the focus?	Instructor-task	Trainee-performance and behaviour
What is the workload?	Moderate	High
Whate are instructor's thoughts?	Judgmental	Non-judgmental
How is progress evaluated?	Observation	Guided self-assessment

Table-3 Instruction and Facilitation Techniques

SECTION 8 THREAT AND ERROR MANAGEMENT

8.1 General

Threat and error management (TEM) is an overarching safety concept regarding aviation operations and human performance. TEM is not a revolutionary concept; it evolved gradually, as a consequence of the constant drive to improve the margins of safety in aviation operations through the practical integration of human factors knowledge.

TEM developed as a product of the collective industry experience. Such experience fostered the recognition that past studies and, most importantly, operational consideration of human performance in aviation had largely overlooked the most important factor influencing human performance in dynamic work environments: the interaction between people and the operational context (i.e. organizational, regulatory and environmental) within which they discharge their operational duties.

The recognition of the influence of the operational context in human performance led to the conclusion that study and consideration of human performance in aviation operations must not be an end in itself. In regard to the improvement of margins of safety in aviation operations, the study and consideration of human performance without context address only part of a larger issue. TEM therefore aims to provide a principled approach to the broad examination of the dynamic and challenging complexities of the operational context in human performance, for it is the influence of these complexities that generates consequences directly affecting safety.

8.2 The threat and error management (TEM) model

The threat and error management (TEM) model is a conceptual framework that assists in understanding, from an operational perspective, the interrelationship between safety and human performance in dynamic and challenging operational contexts.

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 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 in several ways:

a) safety analysis tool — can focus on a single event, as is the case with accident/incident analysis, or can be used to understand systemic patterns within a large set of events, as is the case with operational audits.
b) licensing tool — helps clarify human performance needs, strengths and vulnerabilities, allowing the definition of competencies from a broader safety management perspective.
c) training tool — helps an organization improve the effectiveness of its training interventions and, consequently, of its organizational safeguards.

From a training perspective, the broadest application to date of the TEM model is in flight crew human performance training, especially in crew resource management (CRM) training, a widely implemented human factors based training intervention. This may lead to questions about the relationship between TEM and CRM, and it is therefore essential to clarify potential confusions from the outset.

TEM is an overarching safety concept with multiple applications in aviation, while CRM is exclusively a training intervention. The basic concepts underlying TEM (threats, errors and undesired aircraft states) have been integrated into existing CRM programmes because TEM countermeasures build in large measure — although not exclusively — upon CRM skills. The combination of TEM concepts with CRM skills thus introduces the opportunity to present the utilization of CRM skills by flight crews anchored in the operational environment and from a purely operational perspective. It is emphasized that TEM training does not replace CRM training but rather complements and enhances it.

8.3 The components of the TEM model

There are three basic components in the TEM model, from the perspective of flight crews: threats, errors and undesired aircraft states. The model proposes that threats and errors are part of everyday aviation operations that must be managed by flight crews, since both threats and errors carry the potential to generate undesired aircraft states. Flight crews must also manage undesired aircraft states, since they carry the potential for unsafe outcomes. Undesired state management is an essential component of the TEM model, as important as threat and error management, because it largely represents the last opportunity to avoid an unsafe outcome and thus maintain safety margins in flight operations.

8.4 Threats

Threats are defined as events or errors that occur beyond the influence of the flight crew, increase operational complexity, and must be managed to maintain the margins of safety. During typical flight operations, flight crews have to manage various contextual complexities, for example, adverse meteorological conditions, airports surrounded by high mountains, congested airspace, aircraft malfunctions, and errors committed by other people outside of the cockpit, such as air traffic controllers, flight attendants or maintenance workers. The TEM model considers these complexities as threats because they all have the potential to negatively affect flight operations by reducing margins of safety. Some threats can be anticipated, since they are expected or known to the flight crew. For example, flight crews can anticipate the consequences of a thunderstorm by briefing their response in advance or can prepare for a congested airport, as they execute the approach, by making sure they keep a watchful eye out for other aircraft.

Some threats can occur unexpectedly and without warning, such as an in-flight aircraft malfunction. In this case, flight crews must apply skills and knowledge acquired through training and operational experience.

Some threats may not be directly obvious to, or observable by, flight crews immersed in the operational context and may need to be uncovered by safety analysis. These are considered latent threats. Examples include equipment design issues, optical illusions, or shortened turn-around schedules.
Regardless of whether threats are expected, unexpected, or latent, one measure of the effectiveness of a flight crew's ability to manage threats is whether threats can be anticipated so as to enable the flight crew to respond to them through deployment of appropriate countermeasures.

Threat management is a building block to error management and undesired aircraft state management. Although the threat-error linkage is not necessarily straightforward (i.e. it may not always be possible to establish a linear relationship or one-to-one mapping between threats, errors and undesired states), archival data demonstrate that mismanaged threats are normally linked to flight crew errors, which in turn are oftentimes linked to undesired aircraft states. Threat management provides the most proactive option to maintain margins of safety in flight operation, by avoiding safety-compromising situations at their roots. As threat managers, flight crews are the last line of defense to keep threats from impacting flight operations.

Table-4 presents examples of threats, grouped under two basic categories derived from the TEM model. Some environmental threats can be planned for and some will arise spontaneously, but they all have to be managed by flight crews in real time. Organizational threats, on the other hand, can be controlled (i.e. removed or, at least, minimized) at source by aviation organizations and are usually latent in nature. Flight crews still remain the last line of defence, but there are earlier opportunities for these threats to be mitigated by aviation organizations themselves.

Environmental threats	Organizational threats
- **Weather:** thunderstorms, turbulence, icing, wind shear, cross/tailwind, very low/high temperatures. - **ATC:** traffic congestion, TCAS RA/TA, ATC command, ATC error, ATC language difficulty, ATC non-standard phraseology, ATC runway change, ATIS communication, units of measurement (QFE/meters). - **Airport:** contaminated/short runway; contaminated taxiway, lack of/confusing/faded signage/markings, birds, aids U/S, complex surface navigation procedures, airport constructions. - **Terrain:** High ground, slope, lack of references, "black hole". - **Other:** similar call signs.	- **Operational pressure:** delays, late arrivals, equipment changes. - **Aircraft:** aircraft malfunction, automation event/anomaly, MEL/CDL. - **Cabin:** flight attendant error, cabin event distraction, interruption, cabin door security. - **Maintenance:** maintenance event/error. - **Ground:** ground-handling event, de-icing, ground crew error. - **Dispatch:** dispatch paperwork event/error. - **Documentation:** manual error, chart error.

Table 4 Examples of Threats

8.5 Errors

Errors are defined actions or inactions by the flight crew that lead to deviations from organizational or flight crew intentions or expectations. Unmanaged and/or mismanaged errors frequently lead to undesired aircraft states. Errors in the operational context thus tend to reduce the margins of safety and increase the probability of adverse events.

Errors can be spontaneous (i.e. without direct linkage to specific, obvious threats), linked to threats, or part of an error chain. Examples of errors would include the inability to maintain stabilized approach parameters, executing a wrong automation mode, failing to give a required call-out, or misinterpreting an ATC clearance.

Regardless of the type of error, an error's effect on safety depends on whether the flight crew detects and responds to the error before it leads to an undesired aircraft state and to a potential unsafe outcome. This is why one of the objectives of TEM is to understand error management (i.e. detection and response), rather than solely focusing on error causality (i.e. causation and commission). From a safety perspective, operational errors that are detected in a timely manner and promptly responded to (i.e. properly managed) do not lead to undesired aircraft states and do not reduce margins of safety in flight operations, thus becoming operationally inconsequential. In addition to its safety value, proper error management is an example of successful human performance, having both learning and training value.

Capturing how errors are managed is then as important as, if not more important than, capturing the prevalence of different types of error. It is of interest to capture if and when errors are detected and by whom, the response(s) upon detecting errors, and the outcome of errors. Some errors are quickly detected and resolved, thus becoming operationally inconsequential, while others go undetected or are mismanaged. A mismanaged error is defined as an error that is linked to or induces an additional error or undesired aircraft state.

Table-5 presents examples of errors, grouped under three basic categories derived from the TEM model. In the TEM concept, errors have to be "observable"; therefore, the TEM model uses the "primary interaction" as the point of reference for defining the error categories.

Aircraft-handling errors	- Manual handling/flight controls: vertical/lateral and/or speed deviations, incorrect flaps/speed brakes, thrust reverser or power settings. - Automation: incorrect altitude, speed, heading, auto throttle settings, incorrect mode executed, or incorrect entries. - Systems/radio/instruments: incorrect packs, incorrect anti-icing, incorrect altimeter, incorrect fuel switches settings, incorrect speed bug, incorrect radio frequency dialled. - Ground navigation: attempting to turn down wrong taxiway/runway, taxi too fast, failure to hold short, missed taxiway/runway.
Procedural errors	- SOPs: failure to cross-verify automation inputs. - Checklists: wrong challenge and response; items missed, checklist performed late or at the wrong time. - Call-outs: omitted/incorrect call-outs. - Briefings: omitted briefings; items missed. - Documentation: wrong weight and balance, fuel information, ATIS, or clearance information recorded, misinterpreted items on paperwork; incorrect logbook entries, incorrect application of MEL procedures.

Communication errors	- Crew to external: missed calls, misinterpretations of instructions, incorrect read back, wrong clearance, taxiway, gate or runway communicated. - Pilot to pilot: within crew miscommunication or misinterpretation.

The TEM model classifies errors based upon the primary interaction of the pilot or flight crew at the moment the error is committed. Thus, in order to be classified as an aircraft-handling error, the pilot or flight crew must be interacting with the aircraft (e.g. through its controls, automation or systems). In order to be classified as a procedural error, the pilot or flight crew must be interacting with a procedure (e.g. checklists and SOPs). In order to be classified as a communication error, the pilot or flight crew must be interacting with people (e.g. ATC, ground crew, and other crew members).

Aircraft-handling errors, procedural errors and communication errors may be unintentional or may involve intentional non-compliance. Similarly, proficiency considerations (i.e. skill or knowledge deficiencies and training system deficiencies) may underlie all three categories of error. In order to keep the approach simple and avoid confusion, the TEM model does not consider intentional non-compliance and proficiency as separate categories of error but rather as subsets of the three major categories of error.

8.6 Undesired aircraft states

Undesired aircraft states are flight crew-induced aircraft position or speed deviations, misapplication of flight controls, or incorrect systems configuration, associated with a reduction in margins of safety. Undesired aircraft states that result from ineffective threat and/or error management may lead to compromising situations and reduce margins of safety in flight operations. Often considered at the cusp of becoming an incident or accident, undesired aircraft states must be managed by flight crews.

Examples of undesired aircraft states would include lining up for the incorrect runway during approach to landing, exceeding ATC speed restrictions during an approach, or landing long on a short runway requiring maximum braking. Events such as equipment malfunctions or ATC controller errors can also reduce margins of safety in flight operations, but these would be considered threats.
Undesired states can be managed effectively, restoring margins of safety, or flight crew response(s) can induce an additional error, incident, or accident.

Table-6 presents examples of undesired aircraft states, grouped under three basic categories derived from the TEM model.

Aircraft handling	— Aircraft control (attitude). — Vertical, lateral or speed deviations. — Unnecessary weather penetration. — Unauthorized airspace penetration. — Operation outside aircraft limitations. — Unstable approach. — Continued landing after unstable approach. — Long, floated, firm or off-centre line landing.
Ground navigation	— Proceeding towards wrong taxiway/runway. — Wrong taxiway, ramp, gate or hold spot.
Incorrect aircraft configurations	— Incorrect systems configuration.

	— Incorrect flight controls configuration. — Incorrect automation configuration. — Incorrect engine configuration. — Incorrect weight and balance configuration.

Table-6 Examples of undesired aircraft states

An important learning and training point for flight crews is the timely switching from error management to undesired aircraft state management. An example would be as follows: a flight crew selects a wrong approach in the flight management computer. The flight crew subsequently identifies the error during a cross-check prior to the final approach fix (FAF). However, instead of using a basic mode (e.g. heading) or manually flying the desired track, both flight crew members become involved in attempting to reprogramme the correct approach prior to reaching the FAF.

As a result, the aircraft "stitches" through the localizer, descends late, and goes into an unstable approach. This would be an example of the flight crew getting "locked in" to error management, rather than switching to undesired aircraft state management. The use of the TEM model assists in educating flight crews that, when the aircraft is in an undesired state, their basic task is undesired aircraft state management instead of error management. It also illustrates how easy it is to get locked in to the error management phase.

Also from a learning and training perspective, it is important to establish a clear differentiation between undesired aircraft states and outcomes. Undesired aircraft states are transitional states between a normal operational state (i.e. a stabilized approach) and an outcome. Outcomes, on the other hand, are end states, most notably reportable occurrences (i.e. incidents and accidents). An example would be as follows: a stabilized approach (normal operational state) turns into an unstabilized approach (undesired aircraft state) that results in a runway excursion (outcome).

The training and remedial implications of this differentiation are significant. While at the undesired aircraft state stage, the flight crew has the possibility, through appropriate TEM, of recovering the situation and returning to a normal operational state, thus restoring margins of safety. Once the undesired aircraft state becomes an outcome, recovery of the situation, return to a normal operational state, and restoration of margins of safety are not possible.

8.7 Countermeasures

As part of the normal discharge of their operational duties, flight crews must employ countermeasures to keep threats, errors and undesired aircraft states from reducing margins of safety in flight operations. Examples of countermeasures would include checklists, briefings, call-outs and SOPs, as well as personal strategies and tactics.

Flight crews dedicate significant amounts of time and energy to the application of counter-measures to ensure margins of safety during flight operations. Empirical observations during training and checking suggest that as much as 70 percent of flight crew activities may be countermeasure-related activities.

All countermeasures are necessarily flight crew actions. However, some counter-measures to threats, errors and undesired aircraft states that flight crews employ build upon "hard" resources provided by the aviation system.

These resources are already in place in the system before flight crews report for duty and are therefore considered as systemic-based countermeasures. These include:

— airborne collision avoidance system (ACAS);
— ground proximity warning system (GPWS),
— standard operating procedures (SOPs);
— checklists;
— briefings; and
— training.

Other countermeasures are more directly related to the human contribution to the safety of flight operations.

These are personal strategies and tactics, and individual and team countermeasures, which typically include canvassed knowledge, skills and attitudes developed by human performance training, most notably, by crew resource management (CRM) training. There are basically three categories of individual and team countermeasures:

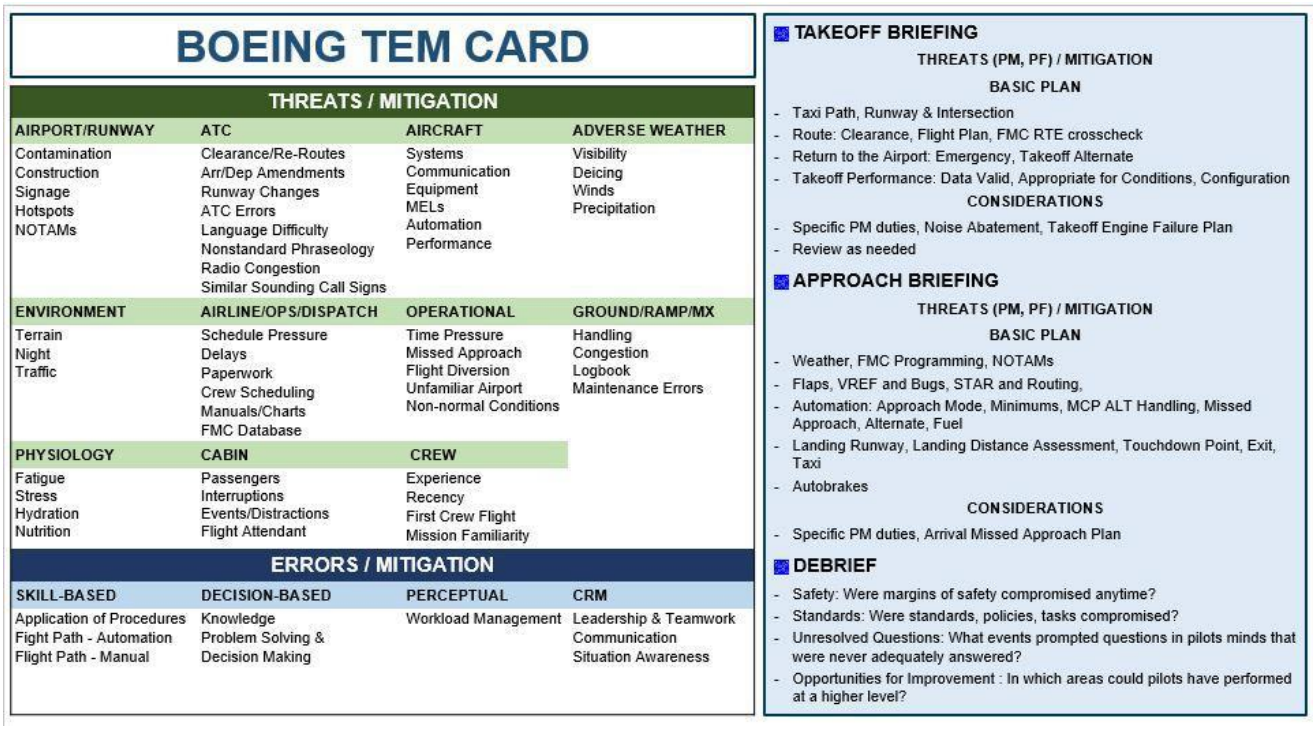
— planning countermeasures: essential for managing anticipated and unexpected threats;
— execution countermeasures: essential for error detection and error response; and
— review countermeasures: essential for managing the changing conditions of a flight.

Enhanced TEM is the product of the combined use of systemic-based and individual and team countermeasures. Table-7 presents detailed examples of individual and team countermeasures

Planning countermeasures		
SOP briefing	The required briefing was interactive and operationally thorough	— Concise, not rushed, and met SOP requirements — Bottom lines were established
Plans stated	Operational plans and decisions were communicated and acknowledged	— Shared understanding about plans – "Everybody on the same page"
Workload assignment	Roles and responsibilities were defined for normal and non-normal situations	— Workload assignments were communicated and acknowledged
Contingency management	Crew members developed effective strategies to manage threats to safety	— Threats and their consequences were anticipated — Used all available resources to manage threats
Execution countermeasures		
Monitor/ cross-check	Crew members actively monitored and cross-checked systems and other crew members	— Aircraft position, settings, and crew actions were verified
Workload management	Operational tasks were prioritized and properly managed to handle primary flight duties	— Avoided task fixation — Did not allow work overload
Automation management	Automation was properly managed to balance situational and/or workload requirements	— Automation setup was briefed to other members — Effective recovery techniques from

		automation anomalies
Review countermeasures		
Evaluation/ modification of plans	Existing plans were reviewed and modified when necessary	— Crew decisions and actions were openly analysed to make sure the existing plan was the best plan
Inquiry	Crew members asked questions to investigate and/or clarify current plans of action	— Crew members not afraid to express a lack of knowledge – "Nothing taken for granted" attitude
Assertiveness	Crew members stated critical information and/or solutions with appropriate persistence	— Crew members spoke up without hesitation

Table-7 Examples of individual and team countermeasures



BOEING TEM CARD

THREATS / MITIGATION

AIRPORT/RUNWAY	ATC	AIRCRAFT	ADVERSE WEATHER
Contamination Construction Signage Hotspots NOTAMs	Clearance/Re-Routes Arr/Dep Amendments Runway Changes ATC Errors Language Difficulty Nonstandard Phraseology Radio Congestion Similar Sounding Call Signs	Systems Communication Equipment MELs Automation Performance	Visibility Deicing Winds Precipitation
ENVIRONMENT	**AIRLINE/OPS/DISPATCH**	**OPERATIONAL**	**GROUND/RAMP/MX**
Terrain Night Traffic	Schedule Pressure Delays Paperwork Crew Scheduling Manuals/Charts FMC Database	Time Pressure Missed Approach Flight Diversion Unfamiliar Airport Non-normal Conditions	Handling Congestion Logbook Maintenance Errors
PHYSIOLOGY	**CABIN**	**CREW**	
Fatigue Stress Hydration Nutrition	Passengers Interruptions Events/Distractions Flight Attendant	Experience Recency First Crew Flight Mission Familiarity	

ERRORS / MITIGATION

SKILL-BASED	DECISION-BASED	PERCEPTUAL	CRM
Application of Procedures Fight Path - Automation Flight Path - Manual	Knowledge Problem Solving & Decision Making	Workload Management	Leadership & Teamwork Communication Situation Awareness

TAKEOFF BRIEFING

THREATS (PM, PF) / MITIGATION

BASIC PLAN

- Taxi Path, Runway & Intersection
- Route: Clearance, Flight Plan, FMC RTE crosscheck
- Return to the Airport: Emergency, Takeoff Alternate
- Takeoff Performance: Data Valid, Appropriate for Conditions, Configuration

CONSIDERATIONS

- Specific PM duties, Noise Abatement, Takeoff Engine Failure Plan
- Review as needed

APPROACH BRIEFING

THREATS (PM, PF) / MITIGATION

BASIC PLAN

- Weather, FMC Programming, NOTAMs
- Flaps, VREF and Bugs, STAR and Routing,
- Automation: Approach Mode, Minimums, MCP ALT Handling, Missed Approach, Alternate, Fuel
- Landing Runway, Landing Distance Assessment, Touchdown Point, Exit, Taxi
- Autobrakes

CONSIDERATIONS

- Specific PM duties, Arrival Missed Approach Plan

DEBRIEF

- Safety: Were margins of safety compromised anytime?
- Standards: Were standards, policies, tasks compromised?
- Unresolved Questions: What events prompted questions in pilots minds that were never adequately answered?
- Opportunities for Improvement : In which areas could pilots have performed at a higher level?

Figures -2 Examples of Boeing TEM Card