Evidence-Based Training Implementation Guide

July 2013

1st Edition

Evidence-Based Training Implementation Guide

July 2013

International Air Transport Association
Montreal—Geneva

1st Edition

NOTICE

DISCLAIMER. The information contained in this publication is subject to constant review in the light of changing government requirements and regulations. No subscriber or other reader should act on the basis of any such information without referring to applicable laws and regulations and/or without taking appropriate professional advice. Although every effort has been made to ensure accuracy, the International Air Transport Association shall not be held responsible for any loss or damage caused by errors, omissions, misprints or misinterpretation of the contents hereof. Furthermore, the International Air Transport Association expressly disclaims any and all liability to any person or entity, whether a purchaser of this publication or not, in respect of anything done or omitted, and the consequences of anything done or omitted, by any such person or entity in reliance on the contents of this publication.

© International Air Transport Association. All Rights Reserved. No part of this publication may be reproduced, recast, reformatted or transmitted in any form by any means, electronic or mechanical, including photocopying, recording or any information storage and retrieval system, without the prior written permission from:

Senior Vice President
Safety and Flight Operations
International Air Transport Association
800 Place Victoria
P.O. Box 113
Montreal, Quebec
CANADA H4Z 1M1

Evidence-Based Training Implementation Guide
ISBN 978-92-9252-191-2
© 2013 International Air Transport Association. All rights reserved.
Montreal—Geneva

Table of Contents

GLOSSARY OF TERMS

A/C	Aircraft
ACAS	Airborne Collision Avoidance System
APP	Approach
AQP	Advanced Qualification Program
ATA	Air Transport Association
ATC	Air Traffic Control
ATO	Approved Training Organization
ATQP	Alternative Training and Qualification Program
CAA	Civil Aviation Authority
CLB	Climb
CRM	Crew Resource Management
CRZ	Cruise
DES	Descent
EASA	European Aviation Safety Agency
EBT	Evidence-Based Training
DA	Decision altitude
FAA	Federal Aviation Administration (United States of America)
FL	Flight level
FMS	Flight Management System
FOQA	Flight Operations Quality Assurance
FSTD	Flight Simulation Training Device
GA or G-A	Go-around
GND	Ground
IOE	Initial Operating Experience
IRR	Inter-rater reliability
LDG	Landing
LOE	Line Oriented Evaluation
LOFS	Line Orientated Flight Scenario
LOFT	Line Oriented Flight Training
LOSA	Line Operations Safety Audit
MEL	Minimum equipment list
MPL	Multi-crew pilot license
Neo	New engine option
PF	Pilot Flying
PIC	Pilot-in-Command
PM	Pilot Monitoring
PNF	Pilot Not Flying (former term for PM)
QAR	Quick Access Recorder
SOP	Standard Operating Procedure
TEM	Threat and Error Management
TO	Take-off

DEFINITIONS

Assessment. The determination as to whether a candidate meets the requirements of the competency standard.

ATA Chapters. The chapter numbering system controlled and published by the Air Transport Association, which provides a common referencing standard for all commercial aircraft documentation.

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

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

Competency. A combination of skills, knowledge and attitudes required to perform a task to the prescribed standard.

Competency-based training. 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.

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

Critical flight maneuvers. Maneuvers that place significant demand on a proficient crew.

Critical system malfunctions. Aircraft system malfunctions that place significant demand on a proficient crew. These malfunctions should be determined in isolation from any environmental or operational context.

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

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 program.

EBT module. A session or combination of sessions in a qualified FSTD as part of the 3-year cycle of recurrent assessment and training.

EBT session. A single defined period of training in a qualified FSTD that normally forms part of an EBT module.

***EBT scenario*.** Part of an EBT session encompassing one or more scenario elements, constructed to facilitate real time assessment or training

***EBT scenario element*.** Part of an EBT session designed to address a specific training topic

***Error*.** An action or inaction by the flight crew that leads to deviations from organizational or flight crew intentions or expectations.

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 aircraft states.

Facilitation technique. An active training method, which uses effective questioning, listening and a non-judgmental 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.

Factor. A reported condition affecting an accident or incident.

Flight crew member. A licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period.

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

Line orientated flight scenario (LOFS). LOFS refers to 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 involving a broad set of competencies that simulate the total line operational environment, for the purpose of training and assessing flight crew members.

Maneuvers. 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.

Outcome Grading. Assessment using a grading scale with two or more grades describing the overall outcome in relation to a defined outcome (not assessing the individual competencies in depth).

Phase of flight. A defined period within a flight.

Threat. Events or errors that occur beyond the influence of the flight crew, increase operational complexity and must be managed to maintain the margin of safety.

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 aircraft states.

Training event. Part of a training scenario that enables a set of competencies to be exercised.

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.

EXECUTIVE LETTER

Air travel continues to be the safest means of transportation. The industry's 2012 record safety performance was the best in history. However, as the volume of air traffic continues to grow, more needs to be done to maintain this impressive record.

Progress in the design and reliability of modern aircraft, a rapidly changing operational environment, and the realization that not enough has been done to address the human factors issue, prompted a strategic industry review of pilot training.

Evidence-Based Training (EBT) arose from the need to develop a new paradigm for competency-based training and assessment of airline pilots, based on evidence. The aim of an EBT program is to identify, develop and evaluate the key 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. Over the last twenty years, the availability of data covering both flight operations and training activity has improved substantially. The availability of such data has both established the need for the EBT effort and supported the definition of the resulting training concept and curriculum.

The Evidence-Based Training Implementation Guide is a significant milestone in modernizing pilot training and marks the successful collaboration between IATA, ICAO and IFALPA to jointly lead and serve the industry in the ongoing improvement of pilot training, evaluation and qualification. We are proud to introduce this manual, which will contribute to the advancement of pilot training, and to our common goal of increasing aviation safety worldwide.

Guenther Matschnigg
Senior Vice President
Safety & Flight Operations, IATA
Infrastructure, IATA

Nancy Graham
Director
Air Navigation Bureau
ICAO

Don Wykoff
President
International Federation of Air
Line Pilots' Associations

DISCLAIMER

Although every effort has been made to ensure accuracy, the International Air Transport Association (IATA), the International Civil Aviation Organization (ICAO), the International Federation of Airline Pilots' Associations (IFALPA), and other contributors to this publication shall not be held responsible for any loss or damage caused by errors, omissions, misprints or misinterpretation of the contents hereof. Furthermore, the International Air Transport Association, the International Civil Aviation Organization, the International Federation of Airline Pilots' Associations, and the contributors to this publication expressly disclaim any and all liability to any person or entity in respect of anything done or omitted, and the consequences of anything done or omitted, by any such person or entity in reliance on the contents of this publication.

Opinions expressed in this publication do not necessarily reflect the opinion of the International Air Transport Association, International Civil Aviation Organization, nor the International Federation of Airline Pilots' Associations. The mention of specific companies, products in this publication does not imply that they are endorsed or recommended by any of the above in preference to others of a similar nature which are not mentioned.

BACKGROUND

1. Manual Objective

This document sets out to consolidate EBT guidance material available to date into one manual in support of accelerating the understanding, adoption, and effective implementation of EBT. Whilst the introduction of EBT is logical rather than radical, the nature of some of the necessary change needs to be completely understood by all stakeholders.

The contents will be useful to the following entities:

1. Civil Aviation Authorities (CAA's)
2. Operators
3. Approved Training Organizations (ATOs)
4. Course Developers
5. Pilot Representative Bodies

2. Applicability

The contents of this manual are intended to provide guidance to operators in order to comply with ICAO Doc 9995, the *Manual of EBT*, which in turn defines a means of compliance with ICAO. According to ICAO Doc 9995, the manual is intended to provide guidance to Civil Aviation Authorities, operators and approved training organizations in the FSTD element of recurrent assessment and training of pilots referred to in Annex 6 to the Convention on International Civil Aviation, Operation of Aircraft, Part I, International Commercial Air Transport – Aeroplanes, paragraphs 9.3, Flight crew member training programs, and 9.4.4, Pilot proficiency checks, in addition to ICAO Annex 1 to the, Personnel Licensing, paragraph 1.2.5, Validity of licenses.

Aeroplanes considered for application of the guidance within this manual are those with a certified seating capacity of 50 or more passengers (for turbo-jet aeroplanes referred to in this manual as jets) and 30 or more passengers (for turbo-propeller aeroplanes referred to in this manual as turboprops). It may also provide guidance for training organizations engaged in the recurrent assessment and training of flight crew operating large or turbojet aeroplanes in accordance with Annex 6, Part II – International General Aviation – Aeroplanes (Section 3 refers).

The details contain guidance for the development of recurrent assessment and training programs, which are only conducted in an FSTD qualified for that purpose. This manual is not intended to address any related recurrent assessment and training, which is intended to take place in an aircraft.

3. Aircraft Generations

The following table is considered to be representative of the generations of aircraft described within this manual.

Generation 4 – Jet	A318/A319/A320/A321 (including neo), A330, A340-200/300, A340-500/600, B777, A380, B787, A350, Bombardier C Series, Embraer E170/E175/E190/E195
Generation 3 – Jet	A310/A300-600, B737-300/400/500, B737-600/700/800 (NG), B737 MAX, B757, B767, B747-400, B747-8, B717, BAE 146, MD11, MD80, MD90, F70, F100, Bombardier CRJ Series, Embraer ERJ 135/145
Generation 3 – Turboprop	ATR 42-600, ATR 72-600, Bombardier Dash 8-400, BAE ATP, Embraer 120,Saab 2000
Generation 2 – Jet	A300 (except A300-600), BAC111, B727, B737-100/200, B747-100/200/300, DC9, DC10, F28, L1011
Generation 2 – Turboprop	ATR 42, ATR 72 (all series except -600), BAE J-41, Fokker F27/50, Bombardier Dash 7 and Dash 8-100/200/300 Series, Convair 580-600 Series, Shorts 330 and 360, Saab 340
Generation 1 – Jet	DC8, B707

Manual Content

The material in this manual is based upon the following source documents

ICAO Annex 1 – Personnel Licensing

ICAO Annex 6 – Operations of Aircraft

ICAO Doc 9625 Manual of Criteria for the Qualification of Flight Simulation Training Devices, Volume 1 – Aeroplanes

ICAO Doc 9841 Manual on the Approval of Training Organizations

ICAO Doc 9868 – the Procedures for Air Navigation Services – Training (PANS-TRG), Chapters 5 & 6

ICAO Doc 9995 Manual of Evidence-based Training

IATA Data Report for Evidence-Based Training

Structure of the Manual

The manual is structured to a chronological sequence for the implementation of an operator EBT program. Sections 1 – 3 in the manual provide general introductory and explanatory background information. Sections 4 – 8 provide more specific guidance and Appendices provide more precise details of aspects of the program and its implementation, in addition to other supporting reference material. There is also an FAQ section, which may assist those seeking information quickly.

Sources of Information

EBT has been developed as a means of compliance with ICAO Annex 6 to the Convention on International Civil Aviation, Operation of Aircraft, Part I, International Commercial Air Transport – Aeroplanes, paragraphs 9.3, Flight crew member training programs, and 9.4.4, Pilot proficiency checks. Reference should also be made to ICAO Annex 1 to the Convention on International Civil Aviation, Personnel Licensing, paragraph 1.2.5, Validity of licenses. Further guidance material is provided in ICAO PANS-TRG (Doc 9868), Chapters 5 and 6. Chapter 5 details the purpose and intent of EBT, and determines that States wishing to implement EBT shall do this in accordance with ICAO Doc 9995, the *Manual of Evidence-based Training*. The *Manual of Evidence-based Training* contains detailed guidance material for States and operators, and this manual includes many of the provisions. ICAO PANS-TRG (Doc 9868), Chapter 6 contains the framework of qualification and competencies for instructors, including those conducting EBT, and this is further amplified in Chapter 6 of the *Manual of Evidence-based Training* as well as in this document. Of particular note are the appendices in ICAO's Doc 9841, the Manual on the Approval of Training Organizations, that detail the unique differences inherent in competency-based training programs, such as EBT, and the need for specialized training for those Licensing Authorities that will regulate and oversee such activities. It is especially important to realize that the EBT program specifically and only addresses training to be conducted in a qualified FSTD, and guidance on the qualification of FSTD's is contained in ICAO Doc 9625, the Manual of Criteria for the Qualification of Flight Simulation Training Devices, Volume 1 – Aeroplanes. Finally, the Data Report for Evidence-based Training, published in May 2013 contains the evidence upon which this program was developed and is a useful reference for operators implementing the baseline EBT program or developing enhanced EBT programs.

Updates to the manual

EBT requires a new training process, which evolves as a result of continuous feedback and the incorporation of new evidence as it becomes available. IATA and stakeholders commit to providing a review of this manual on a regular basis and, whenever a significant change occurs, incorporating improvements to its content. In this context it should be noted that the various structures described in the manual are likely to evolve in the light of in-service experience.

SECTION 1

1 INTRODUCTION AND RATIONALE

1.1 BACKGROUND

The evidence-based training project is a safety improvement initiative. It arose from an industry-wide consensus that, in order to reduce the airline accident rate, a strategic review of recurrent and type-rating training for airline pilots was necessary. The international Standards and national regulations for airline pilot training are largely based on the evidence of accidents involving jet aircraft of the early generations, apparently in the belief that simply repeating pilot exposure to "worst case" events in training was considered sufficient. Over time, novel events occurred that were simply added to the requirements resulting in progressively crowded training programs. This created an inventory or "tick box" approach to training.

The availability of data covering both flight operations and training activity has improved substantially over the last 20 years. Sources such as flight data analysis, flight observations (e.g. LOSA programs) and air safety reports give a detailed insight into the threats, errors and undesired aircraft states encountered in modern airline flight operations as well as their relationship to unwanted consequences. It was considered logical to review current training practices in light of evidence from these data sources.

A large-scale comprehensive analysis of a range of available data sources was conducted and important differences emerged between what can be considered as four different jet aircraft generations and two turboprop aircraft generations. The process and results of this quantitative analysis was peer-reviewed by a team of internationally recognized experts in pilot training, representing airline operators, pilot associations, regulators and original equipment manufacturers. This allowed transparency as well as bringing a qualitative perspective to the data. Results from the analysis showed convergence and it became apparent that whilst there remains an overlap in areas of risk and training needs across aircraft generations, there are also quite distinct differences in patterns of risk in aircraft of the various generations that are currently not addressed. Certain critical core pilot competencies emerged in technical and non – technical areas that clearly illustrate the need for changes to the focus of airline pilot training, both in terms of concept and curriculum across the generations.

1.2 PILOT COMPETENCIES

Aircraft design and reliability has improved steadily and significantly over time, yet accidents still occur, even though the aircraft and systems were operating without malfunction. Controlled flight into terrain (CFIT) is one example of this principle, where inadequate situation awareness on the part of the crew is almost always a contributing factor. ICAO has defined competency as "the combination of knowledge, skills and attitudes (KSAs) required to perform a task to a prescribed standard under a certain condition", yet conventional recurrent training requirements consider only the so-called "technical skills" and knowledge. A pilot's competencies in some areas, such as situation awareness, are not addressed.

It is impossible to foresee all plausible 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 defined competencies, leading to better training outcomes. Mastering a finite number of defined competencies will allow a pilot to manage previously unseen potentially dangerous situations in flight.

EBT implementation involves a paradigm shift, not simply to replace a sometimes-outdated set of critical events with a new set, but to use the scenario-based events as a vehicle and a means to develop and assess crew performance across the range of necessary defined competencies. In addition EBT refocuses the instructor onto analysis of the root causes of unsuccessfully flown maneuvers in order to correct inappropriate actions, rather than simply to ask a pilot to repeat a maneuver with no real understanding as to why it was not successfully flown in the first instance. Having the ability to accurately apply the principles of 'fault analysis' should be a major determinant in the selection process of an instructor who will be expected to conduct a competency-based training program such as EBT. The labeling of knowledge and skills into "technical" and "non-technical" is an unnecessary complication as clearly successful safe and efficient operations require an appropriate blend of both technical and non-technical areas. The key competencies identified in EBT encompass what were previously termed both technical and non-technical knowledge, skills and attitudes, aligning the training content with the actual competencies necessary in contemporary aviation context. They are embedded in the threat and error management concept.

EBT recognizes the need to develop and assess crew performance according to a set of competencies without necessarily distinguishing between those which are "technical" and "non-technical", needed in order to operate safely. Any area of competence assessed as not meeting the required level of performance should also be associated with an observable behavior that could lead to an unsafe situation.

1.3 EVIDENCE

The availability of data covering both flight operations and training activity has improved substantially over the last 20 years. Sources such as flight data analysis, flight observation (e.g. LOSA) and air safety reports give a detailed insight into the threats, errors and undesired aircraft states encountered in modern airline flight operations as well as their relationship to unwanted consequences.

A comprehensive analysis of safety data sources and training results has demonstrated important differences in training needs between different maneuvers and different 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.

1.4 OPERATOR'S EBT PROGRAMS

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. This could be extended to the large and turbojet general aviation environment. An ICAO *Manual of Evidence-based Training* (Doc 9995) was published in 2013 and this, together with updates to the *Procedures for Air Navigation Services – Training* (PANS-TRG, Doc 9868) and the guidance material in this manual, will allow commercial air transport and corporate operators to develop an effective EBT program.

Implementation of EBT should enable operators to develop more effective training programs and to improve operational safety. The guidance material herein will assist the large, better resourced operators to build their own EBT programs. Sufficient detail will also be provided in this document for smaller operators to use "off the shelf" EBT material to produce a baseline EBT program.

1.5 INSTRUCTORS AND EXAMINERS

In recognition of the criticality of competent instructor in any training program, EBT requires specific additional guidance on the required competencies and qualifications of instructor and examiners involved in EBT. This area is covered in more depth in Section 4 of this manual.

SECTION 2

2 KEY ELEMENTS

2.1 GENERAL PRINCIPLES

The aim of an EBT program is to identify, develop and assess the competencies required by pilots in order 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. While this is the objective of this manual, the EBT concept can be used by general aviation operators of large and turbojet aircraft to implement an EBT program.

Implementation of EBT is designed to result in a more effective and efficient training program with associated improvements in operational safety.

The minimum requirements considered necessary prior to implementation of EBT are as follows:

a. development of a competency framework with associated assessment and grading system;

b. training of instructors including standardization and inter-rater reliability assurance. Specialized EBT instructor training programs should stress fault-analysis techniques and the effective training and assessment of the appropriate core competencies;

c. provision of information to pilots regarding the principles and methodology of the program, the performance criteria that is being applied as well as the assessed core competencies; and

d. on-going evaluation of the training system performance.

There are various stages for the implementation of EBT, which should invariably be conducted in close consultation with the CAA and include:

a. Definition of an implementation and operations plan;

b. Adaptation of the program according to the generation of aircraft (fleet) and type of operation for the operator;

c. Staged implementation effort (an initial limited trial phase may be considered by the CAA);

d. Review of training program effectiveness upon receipt of sufficient training data; and

e. Adaptation of training program according to the training system feedback.

2.2 STAGED IMPLEMENTATION

An operator may consider the need for a staged implementation of an EBT program in defined steps working towards the goal of its full implementation. In all circumstances the minimum requirements specified in paragraph 1 of this section should be adhered to. Implementation may be accomplished in one or more of the following transitional steps:

a. Training and assessment according to EBT principles.

This means the conduct of training and assessment according to EBT principles without changing existing program syllabus elements. Instructors and pilots should be trained in the methodologies specified in Sections 4 and 5. The development and application of defined performance criteria to training events and scenarios, to which the operator standard can be applied, will enable more effective application using existing program syllabus elements.

b. Mixed implementation.

Implementation of a mixed EBT program means that some portion of a recurrent assessment and training is dedicated to the application of EBT. This is a means of achieving a phased implementation where, for example, the CAA rules permit such a program as part of operator specific training and assessment, but preclude such a program for the revalidation or renewal of pilot licenses. This phased implementation recognizes the potential for such an EBT program to be developed and implemented in advance of any future enabling rule changes, which may then permit total implementation.

c. Progressive implementation

The enhanced EBT program requires significant resources and some operators may decide to only implement the baseline EBT program. This approach is applicable to those operators implementing an enhanced EBT program. The enhanced EBT development methodology takes into account individual operational considerations and has the greatest impact on improving pilot training and ultimately aviation safety. However, operators may consider progressive implementation of EBT whereby initially a baseline EBT program is implemented for a period of time. This allows time for the operator to introduce and gradually integrate the principles of EBT and its essential elements. Enhanced EBT can be introduced at a later stage as confidence and understanding of the benefits EBT are gained. The subsequent transition to enhanced EBT can be conducted progressively, for example by fleet.

2.3 BASELINE EBT PROGRAM

In contrast to an enhanced EBT program, which provides benefits in operation-specific training, the baseline EBT program is a generation specific, ready-made program. It does not require detailed analysis or program design by the operator or the ATO. It only needs the necessary adaptation to aircraft type and to type of operation. This approach consists of the development of a competency assessment system, plus adaptation of guidance material to create scenarios relevant to the type of aircraft operated.

Each periodic EBT module should consist of a session or sessions in a suitably qualified FSTD. Each module should normally contain the following 3 phases (in certain circumstances the CAA may decide that the evaluation phase should be conducted in a different sequence to the one advocated in this manual; this is intended to enable coherence with certain existing AQP programs.

Practical training in the management of aircraft system malfunctions

The philosophy of EBT is that the qualified FSTD should be used to the maximum extent possible for assessing and developing crew competence. Crews should be exposed to a wide variety of situations that may be faced in line operations. Aircraft system malfunctions to be considered for the evaluation and scenario-based training phases are those that place a significant demand on a proficient crew. All malfunctions not covered by this characteristic continue to require review and appropriate procedural knowledge but with different means. For instance, to repeat simple malfunctions and use the FSTD environment as a 'procedure training device' is to deny the full benefit of the FSTD as a learning tool. It is for precisely this reason that the malfunction clustering system was developed (see the following sub-paragraph on equivalency of malfunctions), to reduce unnecessary requirements to "tick boxes" against each listed malfunction of the ATA chapters.

Equivalency of malfunctions

Equivalent groups of aircraft system malfunctions can be determined by reference to malfunction characteristics and the underlying elements of crew performance required to manage them. Demonstrated proficiency in the management of one malfunction is then considered equivalent to demonstrated proficiency for the other malfunctions in the same group.

Malfunctions characteristics should be considered in isolation from any environmental or operational context, as in the table below.

Characteristic	**Description of required crew performance**	**Examples**
Immediacy	*System malfunctions requiring immediate and urgent crew intervention or decision*	*Fire, smoke, loss of pressurization at high altitude, failures during take-off, brake failure during landing*
Complexity	*System malfunctions requiring complex procedures*	*Multiple hydraulic system failures, smoke and fumes procedures*
Degradation of aircraft control	*System malfunctions resulting in significant degradation of flight controls in combination with abnormal handling characteristics*	*Jammed flight controls, certain degradation of FBW control*
Loss of instrumentation	*System failures that require monitoring and management of the flight path using degraded or alternative displays*	*Unreliable primary flight path information, unreliable airspeed*
Management of consequences	*System failures that require extensive management of their consequences (independent of operation or environment)*	*Fuel leak*

For examples, see Appendix E, Malfunction Clustering, and Appendix D, Example EBT Module.

Note: The recurrent training and assessment of these malfunctions refers to training conducted in an FSTD qualified by the CAA at the appropriate level for recurrent training and assessment. Any malfunctions not covered by the characteristics above continue to require review and appropriate procedural knowledge training to support the EBT program, utilizing for example, procedure trainers or distance learning approaches which may include reference to a wide variety of media and interactive software applications.

This is intended simply as a means of offloading the need to perform such activity in a highly qualified FSTD, which has much greater potential benefit in other areas.

Equivalency of approach types

The development of a baseline EBT program requires the determination of critical training events, the development of training scenarios and the definition of appropriate flight crew performance criteria when managing these events and scenarios.

Selection of approaches for scenario-based training should be based on the underlying elements of flight crew performance to conduct them. Equivalent groups of approaches can be determined by reference to these elements. Demonstrated proficiency in the conduct of one approach type can be considered equivalent to demonstrated proficiency for the other approach types in the same group.

In order to develop the equivalency of approach types the following parameters should be considered:

a. straight in/visual alignment/circling approaches;

  b. level of automation;

  c. precision/non precision approaches and approaches with vertical guidance;

  d. internal/external guidance;

  e. visual segment;

  f. special airport approach procedures (e.g. PRM, RNP-AR);

  g. non-standard glide path angle; and

  h. low visibility operations.

Frequency of training may be reduced for types of approaches that are conducted regularly in line operations.

Go-around training from various stages of the approach should form an integral and frequent element of approach training, and is indicated by the analysis contained within the Data Report for Evidence-based Training referred to in this manual.

It is impossible to list here all possible permutations for an operation and the different approach types. It is intended that an operator wishing to benefit from the philosophy described here should examine all types of approaches flown within the operation, and make an analysis according to the characteristics detailed above. The resulting list of equivalent approach types, along with the list of equivalent malfunctions should be presented to the CAA as part of the application process for EBT.

Documentation and records

On completion of program implementation, all available measurement and tracking tools should continue to be used to chart improvements and degradations in crew and pilot performance. The data should also be utilized to facilitate further program development and customization.

Wherever possible, existing record keeping processes should be utilized and enhanced to provide for effective monitoring of program effectiveness.

2.4 ENHANCED EBT PROGRAMS

Collection and analysis of operations data

The difference between the baseline EBT and an enhanced EBT program is optimization. Data analysis makes the bridge between the baseline EBT program and the enhanced EBT program using the operator's own and/or the general fleet data, as well as operations-specific data. An enhanced program should typically result in improved effectiveness and efficiency, but requires a sufficient base of specific data. The purpose of data collection and analysis is to provide the source from which adjustments to the training program can be made with confidence that the result is indeed an improvement compared with the baseline program.

Data collection should provide for a detailed analysis of existing threats and identify potential weaknesses in the level of the operator's operational safety. This may also be indicated by flight crew performance, and should comprise the following:

a. Flight data – Analysis of recent trends across the operator's own or similar fleets, if required in conjunction with the Data Report for EBT, to identify and quantify differences and specific areas of threat or interest;

    b. Training data – Analysis of recent trends across all fleets of the operator in conjunction with the Data Report for EBT, to identify and quantify differences and specific areas of threat or interest; this requires the implementation of a training measurement system;

    c. Operator's safety reports – Analysis of operator's safety data from all sources with specific identification of those risks that can be mitigated by pilot training; and

    d. World fleet data – Analysis of available safety data from operations with similar aircraft types and similar operations; this should include OEM data.

Operational characteristics of the operator

When enhancing a baseline EBT training program it is important to first analyze the operational characteristics of the operator. This includes aircraft types, route structure and typical sector lengths, special operations, destinations requiring special attention, pilot experience levels and culture. It is very important to focus on the most critical operational risks identified and the training that can demonstrably mitigate these. There should be a close correlation between training and operations.

Competency framework

An identical competency framework is applied to both baseline and enhanced EBT programs. It is advantageous to develop, train and assess competencies utilizing scenarios that are relevant to operations. Scenarios can sometimes be identified through the data collection and analysis process. In some cases the data may highlight the criticality of certain competencies in the operation, which may lead to a focus in specific areas as part of the training program. By continuing to focus on the complete set of identified competencies, the operator's EBT program will prepare flight crews for both known and unforeseen threats and errors. Appendix A contains a set of competencies.

Data, methods and tools

The data collection and analysis process needs to cover various types of data, both from within the training activity (inner loop) and from the flight operations and safety management (outer loop). Data analysis can be as simple as analyzing the operator's mission and making sure that operator-specific threats are accounted for in the training program. Alternatively, the analysis may be carried out using sophisticated flight data analysis system software. The various data sources are discussed in detail later in this section.

Safety reporting systems

Safety reporting programs form the most basic source of safety information. Examples include air safety reports, mandatory occurrence reports and voluntary confidential safety reports. These programs can be mandatory, voluntary, confidential and, in some cases, anonymous. Successful reporting programs are built on the principle of an open reporting culture, where the focus is on safety improvement and not on the assignment of blame. A functional and effective reporting system is a rich source of information, highlighting:

a. operational threats and their approximate frequencies and demographics;

b. specificities of routes, destinations and other operational factors;

c. capability of the crew to cope with various real-life situations; and

d. errors experienced in operations.

The content of the report typically consists of a narrative and various descriptors for classifying the event. Managing a large quantity of reports and distilling useful information from them usually requires a tailored software application. An in-depth study of training-related issues may require an analysis of the narrative parts of the reports, which makes the task more challenging.

Note: It is considered that the most effective reporting systems are those that are confidential and non-punitive to ensure honest, uninhibited reporting.

Flight data analysis (FDA)

FDA is a tool intended for objective safety trend monitoring and the provision of feedback from operations. It has many potential uses in terms of influencing procedural development, evaluating operations into specific airports, as part of the monitoring process as a component of a safety management system (SMS). It has tremendous potential to determine systemic issues and provide data for remediation through training. FDA is a powerful data collection tool that allows quick access to the results. A limitation is that FDA can only detect pre-defined events based on detectable technical cues. For example, FDA detects unstable approaches, as the stable approach criteria can be pre–programmed as a defined set of quantitative parameters. However, lateral or vertical navigation errors (e.g. “altitude busts”) cannot be detected as the specifically cleared routes and altitudes vary throughout a flight and therefore cannot be pre-defined. Also, prevailing environmental conditions (e.g. runway condition or weather) or communications (e.g. intra-cockpit or with ATC) cannot be recorded on current equipment. In summary, FDA information is useful for examining what has occurred in the operation, but not why things occurred or how the situation was managed after the occurrence. However, FDA can be very powerful in highlighting important operational trends, such as:

a. the rate of unstable approaches and corresponding rate of resultant go-arounds versus landings;

b. the frequency of some threats and events, e.g. ACAS or EGPWS alerts, or rejected take-offs;

c. operation route and destinations specificities, and other operational factors; and

d. issues that relate directly to training, e.g. hard landings or rotation technique.

FDA is most effective as a trending tool to measure improvement or degradation in operational performance in terms of the risk events defined by the specific FDA program. From the trends, adjustments can be made in the training program to mitigate the risk shown by the FDA analysis. As the trending continues, the effectiveness of the adjustments can be measured and validated in a quality loop process.

There are several ways to further enhance the use of FDA for the operator. One method is to share data with other operators in existing data sharing groups enabling 'lessons learnt' to be transferred across their membership. Another way is by benchmarking the flight data analysis risk events with other operators using the same software with the same event set. The process can be anonymous while providing further insight into training needs.

Note: "State of the art" FSTDs are normally enabled for the potential collection of FSTD FDA, sometimes referred to as Simulator Operations Qualify Assurance (SOQA). This data can be useful for comparative systemic trend monitoring between training and operations, but should never be used for individual performance analysis.

Note: Where operators chose to share FDA as part of the development of EBT programs, any shared data should be fully de-identified, to avoid potential identification of crewmembers, flight specific details or date and location of airports.

Flight-deck observation

Flight-deck observation means normal operations monitoring such as LOSA and other similar methods. The philosophy is a non-intrusive observation of the flight crew activity. The focus is on threats and errors and on their management. The results are not correlated to the individual pilots but are interpreted at the level of the whole operation. LOSA is performed on a time-limited (snapshot) basis but other variations of normal operations monitoring can occur on a more continuous basis.

The insight gained from the LOSA Study provided the EBT focus group with a unique contextual perspective of flight crew performance collected from the cockpit during normal operations. Findings provided from the study complement and contextualize findings from analyses of other data sources. LOSA data is collected using the threat and error management (TEM) framework.

The power of flight-deck observation lies in its capability to combine the advantages of safety reporting systems and flight data analysis. All threats and errors seen by the observer are captured – as opposed to only the ones that the pilot elects to report. Also, and very importantly, all contextual factors (e.g. weather, time pressure, etc.) are captured, and the "why's and how's" missed by FDA are also observed. The principal disadvantage is a relatively high human resource requirement, including the need to standardize the observer's recording of data.

For the purpose of training enhancement, flight-deck observation may produce the single most valuable source of information.

Data sharing groups

There are various opportunities to share relevant operational and training data between operators. The relevance of data from other operators depends on the similarity of aircraft types, destinations, training programs and other factors. While some of such data may be valuable, care must be taken not to drive the training programs too extensively on the basis of such external data.

Aircraft manufacturers share information on fleet-wide trends and individual events of concern. Such information may be very useful to the operators of the aircraft type/family in question. Training and operational conferences organized by the manufacturers provide an important opportunity to access such data.

2.5 COLLECTION AND ANALYSIS OF TRAINING DATA

Data from EBT programs should be analyzed in a manner similar to that described within the Data Report for Evidence-based Training. For the purpose of developing this EBT program, training data was acquired and analyzed from existing programs such as the Advanced Qualification Program (AQP), which is a voluntary alternative to the traditional regulatory requirements for pilot training and checking under the Federal Aviation Regulations (United States of America). Under the AQP the FAA is authorized to approve significant departures from traditional requirements, subject to justification of an equivalent or better level of safety. In order to achieve such regulatory approvals, AQP programs are highly developed, sophisticated training programs that share many goals set by EBT. The advantages of collecting information on these programs are obvious. AQP operators are providing information on course structure and content, flight operational data as well as metrics on training system performance. Additionally all AQP programs have the capability for first-look evaluation of proficiency, which provides insight into continual proficiency and skill decay.

The “inner loop” within the training function, in other words determining the effectiveness of remediation in training and the performance of the training system, is a valuable source of data. Taking full advantage of such data requires robust and well-calibrated training metrics. Typical outputs include:

a. differences in success rates between aircraft types and training topics;

b. distribution of errors for various training scenarios and aircraft types;

c. skill retention capability versus skill type;

d. trainee’s feedback: this provides a different perspective as to the quality and effectiveness of the training product; and

e. instructor tracking system: this is important to measure the effectiveness of the instructor calibration process, but it is essential to impress on instructors that the purpose of this system is not to spy on them or to pressure individuals to change their grading.

Training metrics are an invaluable component in supporting an EBT training program but they must be placed in the context of operational data, because only the latter can justify the importance of a specific skill within the real operation.

2.6 INTEGRATION OF ANALYSIS

Any data system used will have strengths, weaknesses and bias. In order to overcome shortcomings of individual data analysis, whether it is FDA, flight-deck monitoring or safety reporting systems, analysis methods should be used in an integrated manner. For example, FDA could well identify problems without providing the reason as to why they have occurred while flight-deck monitoring and/or a confidential reporting system could well shed light on the root causes and help define the most effective remedies.

Collecting all the necessary operational data and analyzing it in combination with training data requires a close liaison between the safety and the training departments. With the exception of training data, all relevant data usually resides within the safety department, as does the expertise for analysis.

2.7 ENHANCED EBT PROGRAM DEVELOPMENT

The development of an enhanced EBT program requires the determination of critical training events, the development of training scenarios and the definition of appropriate flight crew behavioral indicators when managing these events and scenarios.

In addition to the baseline EBT program discussed earlier, the information and data used to create the training scenarios should be derived according to the principles laid out in paragraphs 4 to 6 in this section.

One method to perform the development tasks is to abide by the following key stages:

a. completion of the steps required in paragraph 1 of this section;

  b. identification of threats and errors to be considered in a risk and training analysis;

  c. execution of a risk and training analysis;

  d. development of the training guidance: this can include all threats and errors listed in the risk and training analysis; for each training maneuver or scenario, measurable performance criteria should be defined; each training maneuver and scenario should have appended to it the competencies considered most critical to its management; and

  e. definition of the Enhanced EBT program: this includes the outline guidance for the training program and the assessment of trainee performance, in addition to information for instructors conducting the training; it is assumed that the training and assessment described will be conducted in an FSTD qualified to ICAO Level VII according to Doc 9625.

Each periodic EBT module should consist of a session or sessions in a suitably qualified FSTD. Each module should normally contain the following 3 phases (in certain circumstances the CAA may decide that the evaluation phase should be conducted in a different sequence to the one advocated in this manual; this is intended to enable coherence with certain existing AQP programs:

a. Evaluation phase

   This phase consists of scenarios developed in accordance with the methodology described in Section 7 of this manual. The assessment should be realistic and the scenarios should be representative of the operator's environment.

b. Maneuvers training phase

   This phase consists of maneuvers, which place significant demand on a proficient flight crew. Maneuvers in this context mean a sequence of deliberate actions to achieve a prescribed flight path or to perform a prescribed event to a prescribed outcome. Flight path control may be accomplished by a variety of means including manual aircraft control and the use of auto flight systems. Lists of maneuvers will be specified, according to aircraft generation with indications of the required frequency of the maneuver in an EBT program.

c. Scenario-based training phase

   This phase forms the largest phase in the EBT program, and is designed to focus on the development of resilience through exposure to situations that develop and sustain a high level of competency. This includes training to mitigate the most critical risks identified for the aircraft generation. The phase will include the management of specific threats and errors in a real time line-orientated environment. The scenarios will include critical systemic and environmental threats, in addition to building effective crew interaction to identify and correct errors. A portion of the phase will also be directed towards the management of critical aircraft system malfunctions. For this program to be fully effective, it is important to recognize that these predetermined scenarios are simply a means to develop competency, and not an end, or “tick box” exercises in themselves.

Practical training in the management of aircraft system malfunctions

Aircraft system malfunctions to be considered for the evaluation and scenario-based training phases are those, which place a significant demand on a proficient crew. All malfunctions not covered by this characteristic continue to require review and appropriate procedural knowledge training with different means. The philosophy of EBT is that the qualified FSTD should be used to the maximum extent possible for assessing and developing crew competence. Crews should be exposed to a wide variety of situations that may be faced in line operations. To repeat simple malfunctions and use the FSTD environment as a procedure training device is to deny the benefit of the FSTD as a learning tool, and for this reason the malfunction clustering system was developed (see equivalency of malfunctions), to reduce unnecessary requirements to “tick boxes” against each listed malfunction of the ATA chapters.

Equivalency of malfunctions

Equivalent groups of aircraft system malfunctions can be determined by reference to malfunction characteristics and the underlying elements of crew performance required to manage them. Demonstrated proficiency in the management of one malfunction is then considered equivalent to demonstrated proficiency for the other malfunctions in the same group.

Malfunctions characteristics should be considered in isolation from any environmental or operational context, as in the table below.

Characteristic	**Description of required crew performance**	**Examples**
Immediacy	*System malfunctions requiring immediate and urgent crew intervention or decision*	*Fire, smoke, loss of pressurization at high altitude, failures during take-off, brake failure during landing*
Complexity	*System malfunctions requiring complex procedures*	*Multiple hydraulic system failures, smoke and fumes procedures*
Degradation of aircraft control	*System malfunctions resulting in significant degradation of flight controls in combination with abnormal handling characteristics*	*Jammed flight controls, certain degradation of FBW control*
Loss of instrumentation	*System failures that require monitoring and management of the flight path using degraded or alternative displays*	*Unreliable primary flight path information, unreliable airspeed*
Management of consequences	*System failures that require extensive management of their consequences (independent of operation or environment)*	*Fuel leak*

For examples, see Appendix E, Malfunction Clustering, and Appendix D, Example EBT Module.

Note: The recurrent training and assessment of these malfunctions refers to training conducted in an FSTD qualified by the CAA at the appropriate level for recurrent training and assessment. Any malfunctions not covered by the characteristics above continue to require review and appropriate procedural knowledge training to support the EBT program, utilizing for example, procedure trainers or distance learning approaches which may include reference to a wide variety of media and interactive software applications. This is intended simply as a means of offloading the need to perform such activity in a highly qualified FSTD, which has much greater potential benefit in other areas.

Equivalency of approach types

Selection of approaches for scenario-based training should be based on the underlying elements of flight crew performance to conduct them. Equivalent groups of approaches can be determined by reference to these elements. Demonstrated proficiency in the conduct of one approach type can be considered equivalent to demonstrated proficiency for the other approach types in the same group.

In order to develop the equivalency of approach types the following parameters should be considered:

a. straight in/visual alignment/circling approaches;

b. level of automation;

c. precision/non precision approaches and approaches with vertical guidance;

d. internal/external guidance;

e. visual segment;

f. special airport approach procedures (e.g. PRM, RNP-AR);

g. non-standard glide path angle; and

h. low visibility operations.

Frequency of training may be reduced for types of approaches that are conducted regularly in line operations.

Go-around training from various stages of the approach should form an integral and frequent element of approach training, and is indicated by the analysis contained within the Data Report for Evidence-based Training referred to in this manual.

It is impossible to list here all possible permutations for an operation and the different approach types. It is intended that an operator wishing to benefit from the philosophy described here should examine all types of approach flown within the operation, and make an analysis according to the characteristics detailed above. The resulting list of equivalent approach types, along with the list of equivalent malfunctions should be presented to the CAA as part of the application process for EBT.

Documentation and records

On completion of program implementation, all available measurement and tracking tools should continue to be utilized to chart enhancements and degradations in performance and the deployment of skill. These tools also can be utilized to facilitate further program development and customization. Wherever possible, existing record-keeping processes should be utilized and enhanced to provide for effective monitoring of program effectiveness.

2.8 GAINING REGULATORY APPROVAL

Civil Aviation Authorities differ significantly in size and scope depending on the specific mandate provided by their governments. As per the Convention on International Civil Aviation, all Contracting States do have a common underpinning responsibility when it comes to civil aviation i.e., '…the uniform application by Contracting States of the specifications contained in the International Standards is recognized as necessary for the safety or regularity of international air navigation...' With that focus in mind, each CAA attempts to develop rules and standards of conduct in close harmonization with ICAO Standards and Recommended Practices (SARPs) in so far as they are consistent with national interests. Recognizing the sovereignty of the State, Article 38 of the Convention makes provisions for the filing of differences when circumstances so warrant.

Another required commitment among Contracting States is the need to establish and maintain a national safety oversight system, which is designed to ensure civil aviation standards are upheld. This obligation invokes the need by each CAA to effectively manage risk in those parts of the civil aviation industry that fall within its jurisdiction. It is with the risk management process that applicants wishing to seek approval for introducing evidence-based training methodologies need to become most familiar.

Besides employing best practices in risk management, CAAs need to be assured that changes to the regulatory status quo are supported by evidence, which provides irrefutable proof that the change represents an improvement to existing practices and demonstrated outcomes. In other words, applicants must be prepared to put their proposal through a rigorous testing process, a so-called proof-of-concept trial.

Proof-of-concept trials

Many CAA's are adopting approval processes, which incorporate varyingly complex proof-of-concept trials as a means of validating potential modifications to their regulatory framework. They commence this exercise by subjecting each new idea or issue to a formal risk assessment process. This is particularly true when evaluating concepts that are relatively new, such as employing competency-based training methodologies.

In addition to the motivators described previously, another important feature of any particular proposal for change is being able to demonstrate that the end-state or outcome is in the public interest.

Note: In the case of competency-based training, provision has been made in Annex 1 – *Personnel Licensing* for some reduction in the experience requirements for the issue of certain licenses and ratings providing that the training organization has satisfied the CAA that the training delivers at least equivalent levels of competencies from those originally prescribed. In these instances, CAA's will likely require an evaluative process similar to that described in this chapter.

Logically therefore, the ability to successfully obtain an approval for a training providing a level of competency equivalent to prescribed training is dependent upon the applicant's proposal undergoing a thorough "proof- of-concept" trial, which is able to consistently demonstrate that the proposal meets all of the following objectives:

a. maintains an equivalent or reduced exposure to risk;

b. results in improvements in efficiencies or existing outcomes; and

c. continues to meet the public interest as intended in the applicable regulations and their associated standards.

As a result, the immediate challenge becomes one of convincing the CAA to dedicate the necessary resources to the evaluation process. Since many CAA's are resource-limited, it becomes incumbent upon the applicant for approval to provide every assurance that the trial is likely to meet all of the primary objectives.

Regulatory considerations

Any form of training that is designed to satisfy the initial qualification or maintenance of competency requirements of a civil aviation license, rating, or privilege is not restricted to merely an operational suitability study. As such, the notion of gaining initial approval for adopting evidence-based training methodologies will likely be subjected to many levels of scrutiny within a CAA and should be viewed as a significant challenge requiring a detailed project implementation plan.

States have differing organizational constructs in the design of their civil aviation authorities, which will greatly influence the approach necessary for gaining approval. It is probable that a proposal to adopt evidence-based training philosophies into existing airline training programs will require a carefully managed process designed to meet both licensing and operational suitability requirements. Authorities, due to their distinct specialization requirements, often manage licensing and operations independently. Both the applicant and the CAA therefore need to be mindful of these considerations in developing a plan to adequately assess the impact of the proposal on both domains.

Requirements of CAAs vary and some CAAs, for example, may require the operator to produce a comprehensive safety case. Others will not take the safety case approach but will use elements such as a comprehensive risk assessment followed by a proof-of-concept trial. In any case, operators should be prepared to demonstrate to their CAA that they have assured themselves that the EBT proposal:

a. maintains or improves safety through improved risk analysis;

b. maintains or improves safety through more effective crew training to mitigate identified risks;

c. complies with the ICAO *Manual on Evidence-based Training* (Doc 9995); and

d. meets the public interest as intended in the applicable regulations and their associated standards.

Finally the application will need to pass the test of compliance with internationally accepted standards.

Whilst operational efficiency is not of direct relevance to a CAA's safety oversight role, the maintenance of or improvements in operational efficiency will be an important consideration for the senior management of the applicant.

In summary, provided the operator is of the firm belief that its proposal will meet the objectives outlined in a) through d) above, the following steps should be undertaken prior to making a formal application for approval:

a. specify how the proposed change will continue to serve the public interest;

b. identify the end-state objectives of the proposal;

c. quantify the improvement in efficiencies/outcomes being sought;

d. determine the current regulatory impediments to achieving those desired improvements;

e. identify the overriding hazards of the intended proposal and conduct a thorough risk profile;

f. define the risk controlling measures in the form of a risk management plan that must be validated during the proof-of-concept trial; and

g. establish data collection and analysis procedures for the trial and proposed training programs.

With all these factors addressed the applicant needs to devise a detailed draft proof-of-concept plan for consideration by the CAA that has been subjected to a rigorous risk management process. The areas and activities that would need to be covered would probably involve:

a. selection and training of staff;

b. training program development, application for approval, validation, and continued review;

c. development and maintenance of training courseware;

d. administrative staff duties in support of the training program and of the instructor-evaluators;

e. delivery of training;

f. record-keeping;

g. assessment and examination processes; and

h. operator's feedback to the CAA.

2.9 PARTNERING FOR RESULTS

There is measurable added value by partnering the efforts of industry and the CAA in reaching sustainable improvements to current regulatory frameworks with respect to proposed EBT programs. The challenge is arriving at a common understanding of what it is about the proposed trial's objective that represents a valued return on investment, since both parties will be committing resources to the endeavor.

In order to promote an efficient and effective national transportation system, civil aviation authorities are constantly trying to balance this objective with the need to create a safe operating environment. Implementing best practices in risk management becomes a primary objective. Hence, an organization that methodically scopes out the proposed trial in the manner suggested has a much higher probability of realizing a common understanding of the importance to proceed.

The natural consequence of inadequate or rushed preparatory groundwork prior to submitting an application for approval should result in a denial of the application by the CAA.

SECTION 3

3 COMPETENCIES AND BEHAVIORAL INDICATORS

3.1 DEFINITION

The ICAO definition of a competency is “a combination of knowledge, skills and attitudes (KSAs) required to perform a task to the prescribed standard”.

3.2 EXAMPLE DERIVED FROM THE ICAO DEFINITION

Let us imagine a scenario for a diversion. Performing a diversion to an alternate airport is a typical complex task, which is performed by a flight crew under certain conditions (deteriorating weather, night, winter, possible time pressure because of the fuel situation, etc.).

In order to manage a diversion successfully the flight crew needs to apply a wide range of knowledge, skills and attitudes.

If this diversion is finally performed in accordance to prescribed standards, i.e., SOPs, the crew can be considered as being competent to perform a diversion.

3.3 USES OF COMPETENCIES IN EBT RECURRENT TRAINING

Recurrent assessment and training is a process of revalidation and affirmation that the pilot continues to demonstrate the level of competency required, in addition to presenting valuable opportunities for continuous improvement, beyond a defined minimum standard of performance. The performance of tasks has always been paramount and formed the basis for assessment based upon the outcomes of maneuvers, such as the “V1 cut.”

For many decades the industry has used as performance measurements the completion of maneuvers like rejected take-off, engine failure between V1 and V2, go-around from minima with the critical engine inoperative. A pilot able to demonstrate the ability to fly these often-repetitive maneuvers within prescribed quantitative performance measurements indicating an acceptable level of deviation from ideal criteria is deemed to be “competent”.

EBT is based on the premise that this concept is no longer appropriate as a simple indicator, due to the complexities of modern operations and automation systems, coupled with the significant attribution of serious incidents and accidents to human factors causes.

The paradigm shift developed by EBT is that assessments, which are necessary during all forms of training and instruction, as well as evaluation and checking, should be determined according to performance in the defined areas of competency, and not simply by the achievement of a pre-determined outcome in a specific maneuver.

The EBT concept continues to require the completion of certain tasks, but competent flight crew members should be able to complete tasks reasonably expected of them under achievable conditions. Tasks remain important, but only in so much as they establish a pre-defined norm according to the curriculum, which in the case of recurrent EBT should be achieved. The key distinction is that EBT envisages a system of competence measurement, which looks at the total performance across a wide range of activities that include some traditional tasks.

EBT also suggests a shift in balance between “checking” and “training,” recognizing that competence needs to be affirmed in a traditional sense according to present rules, but also recognizing the tremendous value and learning opportunities offered by modern FSTDs and highly capable instructors. Effective learning, away from the pure traditional “check”, facilitates improved levels of performance, to which all pilots should strive. EBT is about assisting pilots improve from a minimum standard of performance, measured across a very restricted and predictable regime of checking, to a higher standard of performance across a very wide spectrum of activities, under training that facilitates improvement and stretching of competence capability. It is in these “expert” and “beyond expert” areas that we build resilience to deal with unforeseen events, and engender the confidence in and to deal competently with challenges encountered in flight operations.

3.4 COMPONENTS OF COMPETENCIES

The predominant components of all competencies are the behavioral indicators. The behavioral indicators can be seen as the “assets” or “tools” necessary to enable a crew to operate safely, efficiently and effectively in all phases of flight. Since the introduction of human factor concepts, the industry is using various similar models to describe and relate human behavior with performance.

3.5 EXAMPLE PAST MODELS

a. Behavioral Markers (University of Texas), derived from thousands of actual flight observations, became the basis for the LOSA (Line Operations Safety Audit) program under ICAO Document 9803, *Line Operations Safety Audit*.

b. Non-technical skills developed through a trial in Europe, which eventually became JAA NOTECHS.

c. The definition of 3 areas of human performance, interpersonal, technical and procedural, the interpersonal influencing both other areas.

d. Categories of personal behavior, working and leadership behavior.

Similarities between these models are self-evident. For pilots and training managers, these models serve as important aids to observe, measure, and assess human performance.

Since 2008 the ITQI Evidence-Based Training and Instructor Qualification working groups evaluated all the systems in use, and defined an acceptable industry-wide example framework combining technical and non-technical competencies, descriptions and behavioral indicators, which are designed to be used according to the methodologies for assessment described within this manual. It is important to note that the behavioral indicators are just that, and not intended to be used as performance criteria, or as a checklist.

It is considered that there are benefits for an ATO or operator developing its own competency framework, consulting all relevant stakeholders, and enabling strong “buy-in” for the implementation of a tailored system. Such a system should always include a comprehensive list of crew behavioral indicators needed to operate safely, effectively and efficiently.

3.6 COMPETENCIES

The competencies listed in Appendix A have been developed by a large expert industry working group based upon systems tested and validated and in operational use today. The availability of a worldwide-harmonized framework of competencies is of great value, but it should be considered only as an example. Operators are encouraged to develop suitable equivalent frameworks to meet their needs. A competency framework supports operations, training, assessment and innovation, and provides feedback to initial, ab-initio programs and pilot selection programs/systems. The proper and standardized use of systems and recording of results cannot be over-emphasized in the development of a training system.

3.7 COMPARISON OF DATA

Operators applying the same competency framework can gather and share experience based on a standardized system, and design training accordingly. The competencies also serve as measuring dimensions for crew performance in both training and competency assessments. EBT grading systems measure the extent to which the flight crew is able to apply competencies with the appropriate prioritization in order to manage a flight.

3.8 DIFFERENT SYSTEMS

Pilot competencies required to operate in a commercial air transport environment should be consistent, irrespective of crew origin, culture or operation specifics. Despite this and the availability of an example competency framework in Appendix A of this manual, the benefits of developing an individual operator system include the use of language tailored to minimize ambiguity, as well as deeper understanding and “buy-in” from stakeholders engaged in the development. Whilst many operators have developed competency frameworks and are in some cases committed to tailored data collection and analysis according to the defined system, the competencies listed in Appendix A can be seen as acceptable to the airline industry overall.

3.9 ITQI – THE NEW SAFETY TOOL

Performance data collection and translation into a common format will lead to a consistent elevated standard of global training practices, linked to actual operational performance. This will be of immense value to the airline industry. Over the past decade, the IATA Operational Safety Audit (IOSA) has already demonstrated what is possible using a common approach to airline safety standards, by delivering remarkable safety dividends to IATA airline members and other air operators on the IOSA Registry, and in turn to the travelling public. By advocating this total systems approach, based upon career spanning pre-selection, training and assessment according to consistent principles, methods, and outcomes, ITQI is endeavoring to “raise the bar” once again.

3.10 EBT COMPETENCY MEASUREMENT – EXAMPLE

In the framework found in Appendix A, there are 8 competency areas to be measured. It is important to note that during recurrent assessment and training, an assumption is made that the pilot is competent at the commencement of each module, and therefore we are not building a program to develop particular areas. We are designing an immersive training module, which will both assess and further develop competence. To this end instructors will be observing and looking for learning opportunities. It is not the intention to score and grade each behavioral indicator, but the intention is for instructors to note areas of performance which both exceed and fall below the expected level, and once noted, to ensure that the root cause competencies are chosen as exemplary models, or for further development as necessary.

This requires a complete change in the focus of instructors away from simply measuring the flight path to considering the underlying factors affecting crew performance, across the range of competencies and according to defined behavioral indicators.

3.11 GUIDELINES FOR THE CONSISTENCY OF ASSESSMENTS

Instructor training should give appropriate emphasis to the reliability of assessment processes. When an instructor group shows low inter-rater reliability, in addition to more training, there may be a need for a better rating form or clearer rating standards to help the group work together on the basic parameters of the assessment process.

The instructor group should establish specific standards for elements to be rated. This is especially true for elements that may cause problems or are new to the instructors.

When making crew performance assessments there is a high probability of rater bias, and the common forms of bias that should be addressed through instructor training include the error of central tendency, halo-effect error, and leniency error.

If the airline has not already implemented some form of inter-rater reliability (IRR) training, IRR should be presented as a group process beginning with an overview of IRR, followed by the critical nature of crew assessment, the IRR measures, the grade sheet, rating scales, and examples of the criteria for each point on the scale.

3.12 GUIDELINES FOR DEVELOPING INSTRUCTOR STANDARDIZATION AND TRAINING MODULES

Consideration should be given to preparing standardization video working with real crews undertaking EBT without the benefit of coaching or preparation.

Instructors should be provided with accurate and immediate rating feedback from the start of their assessment training through standardization sessions. The first rating sessions may take place in a larger group showing individual and group data along with appropriate benchmarks that the group is trying to meet.

After individual and group feedback is provided and explained, instructors should be encouraged to discuss and develop new rating rules and strategies. This cycle of practice, feedback, and discussion allows the participants to improve their reliability, and should continue until group benchmarks have been met.

Under EBT assessment there should be on-going training and standardization to establish confidence in the crew performance data, the resulting indications about competencies and behavioral indicators, and the effects on overall crew performance.

Instructors should be encouraged to take an active team approach to standardization sessions and should see these sessions as an essential part of maintaining their assessment standards. One way to ensure team involvement is to encourage instructors to control the standardization sessions, and ultimately to determine their own schedule and length of cycle between sessions based on the rating performance of the instructor group.

It should be explained that the implementation of EBT impacts substantially on the means to assess crew performance. Operators implementing the program developed detailed measures of crew performance. These more accurate crew performance measures will help instructors provide more standard crew assessments, and crews will ultimately receive a fair and accurate assessment from all instructors.

3.13 GUIDELINES FOR DEVELOPING CREW EFFECTIVENESS MODULES

It should be emphasized that flight crews form the core of an EBT program, and crews should be encouraged to provide feedback about the training system and performance measurement. The implementation of EBT should include a detailed specification of any new policies and procedures. As part of coordinating the release of EBT procedures with document updates, a series of briefings should be undertaken.

3.14 IMPLEMENTATION GUIDELINES FOR EBT INSTRUCTORS

The grading system combined with the competencies and behavioral indicators is the focal point in establishing reliable crew assessment. Instructors should be encouraged to fully utilize the system and provide necessary feedback, in order to make refinements over time. The operator or ATO should work with the instructors to establish a specified level of inter-rater reliability prior to conducting EBT.

Individual instructors with specific assessment problems should be encouraged to work with the group in resolving the issues. Assessment should be approached as a group effort where the team, and not just one individual, needs to resolve any outstanding problems.

The operator should treat assessment standardization as a long-term development process giving the instructors the organizational support that will allow them to drive the process.

3.15 GUIDELINES FOR MAINTAINING STANDARDS AND INTER-RATER RELIABILITY

Operators should monitor flight crew performance problems in order to address even minor problems, often reported as acceptable but below the normative expectation.

Operators and ATOs alike should understand that a major payoff to establishing and maintaining a standard assessment is the ability to identify long-term trends in crew performance. Without data establishing that benchmarks have been met, operators will find it difficult to make meaningful interpretations of performance trends because of the unknown reliability and accuracy of the data.

When crew performance data show a drop in ratings, the operator should consider a range of causes from properties of the evaluation phase scenario to lack of crew training in specific areas. The IRR process allows operators to isolate probable causes with a greater degree of accuracy.

Once EBT is implemented, the data may show a pattern of lower ratings for certain competency areas with some of the instructor-group IRR benchmarks not being met. In such cases, the operator or ATO should consider the possibility that some instructors do not have the same interpretation of an event set or of the standards of performance.

3.16 GUIDELINES FOR IMPROVING COMPETENCY AND MEASUREMENT SYSTEM

Operators should recognize that the collection of reliable flight crew performance data is a minimum requirement for improving crew performance. Operators should be prepared to support the training department and instructors in their efforts to establish and maintain a reliable assessment system.

Operators should understand that EBT is strongly linked to improving overall crew effectiveness at all levels.

The operator should maintain key members of the original EBT implementation team to help with additional development by capitalizing on the members' experience gained from the initial program effort.

If a performance issue is identified, either through analysis of operational data, or from EBT training data, an operator should link it to one of the competencies and behavioral indicators. This step is necessary to determine the precise nature of the issue and to design systemic remedies, through amendments and development of the EBT program. In turn, this analysis may indicate areas for further development within the competency framework.

SECTION 4

4 INSTRUCTOR TRAINING

Briefings are an important part of a flight crew training session, and instructors should brief flight crews to act as they would in line operations dealing with other personnel, including cabin crew members, as if they are present throughout the session.

The event sets used in the implementation of the EBT program should assist instructors to identify key aspects of flight crew performance.

Instructors should be trained in the functions and use of event sets, and the related mechanisms of competency measurement.

4.1 THE EBT INSTRUCTOR

The most advanced training equipment and program will not achieve training objectives effectively without appropriate instruction, yet sub-optimal equipment used by an effective instructor, may still deliver. EBT requires a very high standard of instruction. All instructors engaged in EBT need special preparatory training to qualify for this task. This manual assumes that qualified instructors have received training to competence in accordance with the guidance material contained within Chapter 6 of ICAO Doc 9868 (PANS-TRG).

ICAO PANS-TRG requires that prior to the issue of an instructor authorization, all instructors shall hold or have held a license, rating or authorization equivalent to that for which the privilege to instruct is being sought.

Prior to an organization authorizing the provision of instruction within holistic competency-based training environments, such as multi-crew pilot license (MPL) or EBT programs, instructors should undergo a selection process designed to ensure the individual’s motivation and disposition are suitable for the instructor’s role. The EBT instructor should demonstrate the ability to accurately assess crew performance in the following areas of expected competence:

1. Application of Procedures

2. Communication

3. Aircraft Flight Path Management, automation

4. Aircraft Flight Path Management, manual control

5. Leadership and Teamwork

6. Problem Solving and Decision Making

7. Situation Awareness

8. Workload Management

This means that potential instructors should be able to demonstrate effective performance of all the aforementioned areas of competence and should be selected according to both their performance as a pilot, in addition to their suitability as a trainer. It is recognized that existing instructors may need additional training in order to effectively conduct EBT.

Prior to conducting instruction and assessment within an EBT program, all instructors should successfully complete a formal competency assessment. This assessment should be made during a practical training session supervised by a person nominated by the operator or the ATO.

Instructors should receive appropriate refresher training at defined intervals (e.g. annually) and be re-assessed in their instructor roles when providing an evidence-based training session.

The development of strong inter-rater reliability and consistency in the approach to EBT is of great importance and should not be underestimated either initially or as a focus for continuous improvement of an EBT system. Establishing robust guidelines and thorough experience strengthens inter-rater reliability, provided that suitable mechanisms are put in place. Clear and concise instructions, accurate performance indicator descriptions and peer review all increase inter-rater reliability.

During training, EBT instructors should achieve competence in the following areas:

1. Manage safety

2. Prepare the training environment

3. Manage the trainee

4. Conduct training

5. Perform trainee assessment

6. Perform program evaluation

7. Continuously improve performance

4.2 EFFECTIVE INSTRUCTION

To be competent in performing a task, an individual needs an appropriate combination of knowledge, skills and attitudes. It is accepted that the role of an instructor or trainer in any discipline is to help people develop those requisite knowledge, skills and attitudes so that they are able to do their jobs well. However, 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 prescribed minimum regulatory performance standards. These standards are traditionally derived from testing criteria established by the Licensing Authority to determine that the individual being assessed demonstrates the minimum acceptable abilities to perform an evaluated maneuver. In aviation, historically the vast majority of training resources and all formal examinations have been aimed at ensuring people have the appropriate knowledge and skills, rather than the right attitudes. The fact that attitudes and associated behaviors are fundamental to competence has only been officially recognized relatively recently. The reason for this past omission is uncertain, but a reasonable assumption may be that the ‘attitudes’ have been less precisely defined and hence more difficult to train and examine successfully.

The instructional techniques predominantly in use today often are able to transfer knowledge and skills efficiently. However, without a thorough appreciation of human behavior and the understanding of the learning process in delivering training, instructors are frequently ineffective at bringing about attitudinal or behavioral change. Fortunately, the technique of 'facilitation' has gained increasing popularity within the instructor community as of late. Its principal purpose is to encourage a change in attitude or behavior by the student gaining insight or becoming aware of what they are doing, and being self-motivated to change.

Most experts and practitioners are in agreement that the variability in the effectiveness of CRM training is largely linked to the quality of the delivery and not the content, and that training with a high degree of facilitation has been more successful. In the same way, a high level of facilitation skills is necessary for EBT instructors to develop and assess competencies across the range of required knowledge, skills, and, more importantly, attitudes in their trainees.

4.3 INSTRUCTION AND FACILITATION

Instruction is often misunderstood as being singularly a 'directed' activity, where knowledge and skills are developed in trainees through either lecturing or demonstration, followed by direct questioning primarily used to check understanding or reinforce key messages. By adding the technique of facilitation to their approach, instructors help trainees to discover for themselves what is appropriate and effective, in the context of their own experience and circumstances.

Both a directed and a facilitated approach are useful and have their place in providing effective instruction. In order to transfer knowledge and many skills, some instructional techniques are more efficient to employ than others. It would be laborious and unnecessary to teach a straightforward and precise subject such as an electrical system by exclusively using facilitation. Similarly, a lecturing approach to deliver precise information accompanied by direct questioning might be used to train larger numbers of people, and is particularly useful if only certain answers are considered acceptable. On the other hand, trying to encourage appropriate attitudes without engaging the students themselves in the understanding and evaluation process normally has limited success.

A person's behavior is based on their past experience, values and beliefs which will be different from those of others. People generally behave in a way that they think is rational, and often find it easy to justify their behavior to themselves and others. However, they may not be aware of the effects of their behavior on other people and how this may affect teamwork and hence the operation. Good facilitation will invoke a thought process, which may elicit a suggested alternative behavior from the person himself or herself, which of course does not question their values and has a more positive effect.

The technique of facilitation allows this process to occur, although it is not just for the poor performer or for the development of attitudes. Facilitation can also be used to reinforce effective behavior because it gives people an understanding of why they are good, which encourages their continued development. Furthermore, it can be used in the development of skills and knowledge, because it is an effective tool for allowing self-analysis and in depth thought, which is an easier way for people to learn, as there is less recourse to memory techniques. The skills of self-analysis are not only of benefit in the training session, but can also be continually used for self-development on the line. Table 4-1 highlights the differences between directed instruction and facilitated instruction.

Table 4-1. Directed and facilitated instructional technique differences

	Directed Instructional technique	**Facilitated Instructional 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 behavior
What is the workload?	Moderate	High
What are instructors' thoughts?	Judgmental	Non-judgmental
How is progress evaluated?	Observation	Guided self-assessment

Dr Guy Smith NWA

Although instructors have used facilitation techniques within their instruction style naturally for many years, instructors traditionally are focused on just the basics of explaining, demonstrating and, finally, checking that the task is being done in accordance with a standard. However artfully employing the technique of facilitation means that students are given the opportunity to discover what they are doing and the effect it has on others and the task, so that they can make the decision themselves to alter their behavior or even reinforce any positive behavior. This process should be made as easy as possible.

When using a more directed approach, the instructor generally knows the subject well and has experience in that area, whereas the students are likely to have significantly less experience or knowledge of the subjects being taught. Facilitating works best when both parties know the subject and have the experience, particularly when discussing aspects concerning behavior. In fact, very competent facilitators are quite capable of being effective without knowing the subject or having any experience of it. In many respects this can be a useful pointer to know when to be more of a facilitator. If you are certain that only you have the relevant knowledge and the student would find it difficult to work it out in the time available, then another approach is probably more appropriate.

Unfortunately, the relationship between instructor and student when instructing can all too often be perceived as being "top down", in that the instructor knows more than the student, whereas when facilitating it must be apparently equal. A common mistake by inexperienced instructors when facilitating is to create the impression that they are in some way superior, by implying they know more or have a better attitude.

The agenda when facilitating must be set by both parties if the process of buy-in is to get the right start. Agreeing what you are going to talk about and how you will go about it is an important first step. The instructor can greatly assist the learning outcome of the session by summarizing and giving meaning to the students' discussions. It is still the trainer's responsibility to ensure that all the training requirements are included in the facilitative session.

One of the best measures of identifying which instructional technique is in use is to note who is doing most of the talking. When facilitating, students need to be clear in their own minds and be able to self-assess what they are doing and the benefits of changing. It is difficult to do this whilst trying to listen to a trainer passing multiple messages.

The time taken to cover a subject when lecturing for instance tends to be finite and consistent, whereas with facilitation the timescale is indefinite. This does not mean that it necessarily takes longer; but that the process of facilitation must be given sufficient time to achieve its aim. The facilitator should not be worried about longer debrief or exercise times, because the student's concentration period is much longer when they are actively involved in the thinking and discussion rather than passively listening. In a limited time period such as in a debrief, the self – reflective process may need to continue afterwards. Conversely, if the aim is achieved in a few minutes, the job is done and there is no point dragging out the discussion.

The focus when managing the learning event is often on the task and the instructor: how well they are doing, did they get things in order, are they being clear, is the equipment working, are they on time? With facilitation the focus must be solely on the students, their attitudes and behavior, and whether they are learning and are comfortable with the process that is being used. The focus should also be on the students demonstrating an understanding and willingness to change, if the results could be improved upon.

Because each student is different and it is difficult to read people's minds, the workload whilst facilitating is intense, and even more so when there is more than one recipient such as in a crew or group situation. The instructor in this respect is having several conversations simultaneously, both verbally and non-verbally, and having to think quickly in reaction to what is being said. Conversely, with directed instruction, the workload is high in preparation and initial delivery, but then reduces over time as the instructor becomes more familiar with the material.

Although the trainer's observations and training objectives are inevitably judgmental, in order to prompt a student's self-analysis, the attitude of the trainer when facilitating a debrief should be non-judgmental. In other words, he/she must be prepared to accept that the opinion of the student is valid and not necessarily wrong, even though the trainer's own experience dictates otherwise. This attitude is the most difficult to genuinely achieve, particularly for trainers who have spent many years ensuring things are "right".

4.4 FACILITATION SKILLS

The various skills required to use facilitation as an effective instructional technique are as follows:

4.4.1 Questioning

Asking the right questions at the right time is a fundamental skill of facilitation and these are examples:

Type	Purpose	Response	Example
Open	To get a more accurate and fuller response.	Unknown but they will say more than a few words.	'What, when, why, where, who, how'
Closed	To check understanding and to control the discussion.	Can be 'Yes', 'No' or specific data.	'Did you, were you, had you'
Probing/building	To obtain further information	More in depth response.	'Tell me more, why was that, explain'
Summarizing	To confirm agreement	Yes	'Is what you mean, have you agreed?'

Things to avoid in questioning:

- Leading, e.g. "Would you not agree that…?"
- Multiple, e.g. "What did you say next and what was displayed on the radar...?"
- Rhetorical, e.g. "You will remember what I am saying, won't you...?"
- Ambiguous, e.g. "How long was it before the leak started...?"

4.4.2 Active listening

It has often been said that hearing is done with the ears whereas listening is done with the mind. The term active listening means that a person concentrates carefully on what is being said, in order to fully understand the other person. LISTEN, the following mnemonic, helps to capture key points:

1. **L**ook interested
2. **I**nquire with questions
3. **S**tay on target
4. **T**est understanding
5. **E**valuate the message
6. **N**eutralize your thoughts, feelings and opinions

4.4.3 Body language

Reading body language and managing one's own body language are essential skills when facilitating. A trainer should know when a student is uncomfortable, confused, interested, distracted or bored. Furthermore it is important that a trainer is able to manage his or her own body language so that it is congruent with what they are saying and so that the messages being transmitted are accurate and consistent.

4.4.4 Observation of behavior

The ability to observe and discuss behavior and attitudes rather than technical issues is an important skill that trainers need to develop to become effective at facilitation. It is not unusual for instructors who are not used to facilitation to feel a certain amount of embarrassment when first attempting this. As attitudes (as exhibited by behaviors) are a less precise competency to measure, there is no better way of demonstrating appropriate behavior than role-modeling. This is because the student can observe what this behavior is and experience the positive effects on themselves. Furthermore, in order to maintain credibility as a trainer, it is important that appropriate behavior is demonstrated as a form of role modeling.

4.4.5 Giving and receiving criticism

There may be occasions when it is appropriate and constructive to give students direct criticism and this should be carefully handled. Similarly, a trainer should be able to receive criticism well in order to develop.

4.4.6 Continuous development

In order to ensure continuous improvement in facilitation skills, the recommended method is to seek feedback from trainees. This must be done genuinely otherwise nothing useful may be gained. A measure of whether an instructor is doing this well is whether in fact any feedback is given.

4.4.7 Some advice for effective facilitation in a debrief

4.4.7.1 Do:

- Give an introduction
- Encourage self-analysis (research indicates that it is the best form of learning)
- State that participation from the trainees is needed
- Allow pilots to set the agenda order by asking:
    - Which parts of the session they want to discuss
    - What went well
- Use open questions (who, where, when, what, why, how)
- Deepen the discussion with supplementary questions – let them analyze.
- Ask what happened / why it happened / what could we improve on?

- Listen and encourage
- Use names, nods, smiles, eye contact
- Sit forward to show interest
- Use silence/pauses (sit back and allow them time to think for several seconds)
- Mix instruction with facilitation for issues on which the trainees do not have the knowledge
- Summarize the discussion to meet training aims

4.4.7.2 Don't:

- Miss the introduction – it is the most common way to spoil facilitative training
- Lecture
- Use your chronological agenda
- Short change high performing crews with a quick debrief
- Interrupt
- Answer your own questions (if they don't reply, instead reword the question)
- Just use question and answer
- Do the thinking for them

4.4.7.3 Self-check:

- Who is talking most – you or them?
- Have you used at least 2 questions per issue (to deepen discussion)?
- Are the pilots doing the analysis themselves?
- Are the training points being covered?
- Have the pilots spoken to each other?
- Has positive behavior been reinforced?

4.5 IMPORTANT CHARACTERISTICS OF EBT INSTRUCTOR TRAINING

Instructors should undergo suitable training in order to adapt to the needs of training within an EBT program. Training should provide the framework for existing instructors to develop their competence to undertake EBT training and assessment.

The training programs for the instructor's role should focus on the development of competence in the following specific areas:

1. the competency system, in particular the measuring of behaviors observed according to the defined grading system;
2. making assessments by observing behaviors; gathering objective evidence according to the competency behavioral indicators;
3. correlating between observed behavior and potential outcome in observed or similar situations;
4. development of effective instructional and facilitation skills;
5. recognizing and highlighting good performance;
6. determining root causes for deviations below the standards of performance; and
7. identifying situations that could result in unacceptable reductions in safety margins.

4.5.1 Assessment

Crew assessment techniques are an essential part of instructors training and should be based on the collection of reliable data. The IRR analysis tools (discussed in Section 3 and as part of the abbreviated course in Appendix B for an EBT instructor) are designed to increase that reliability. Computer-based IRR analysis tools can be used to inform one or a group of instructors on how they are rating crew performance in relation to the other raters. The IRR analysis tools focus on rater standardization by addressing agreement, congruency, and consistency. Agreement allows instructors to determine how close the ratings are for each item being rated. Congruency helps individual raters understand how their use of the rating scale compares with the total group of raters, and consistency shows how individual raters correlate with the group. Crew assessment is discussed in Section 3, dealing with the competencies and behavioral indicators. A crew assessment is based on clear standards and the on-going process of collecting reliable crew performance data.

4.5.2 Standardizing EBT training and assessment

There are clear benefits derived from a standardized EBT training and assessment process. EBT is intended to enable instructors to focus training in key areas of the operation and allow the instructor-evaluators to concentrate on underlying aspects of performance according to the complete competency framework. This promotes a standard training and assessment environment. One complaint about CRM training has been the lack of objective standards leading to a range of performance and, ultimately, to substantial variability in the effectiveness of CRM. The implementation of EBT needs to address this problem by enabling the development of unambiguous behavioral indicators for the assessment of crew performance.

A complaint about CRM assessment has been that instructors are provided with insufficient training and given too high a workload during FSTD-based LOFT or line oriented evaluation (LOE) sessions. EBT training should ensure that instructors are given ample practice to build up their skills in standardizing the assessment process. This can be done initially during the final part of the basic instructor training, and should be done on a regular basis thereafter under some form of standardization training. With the standard and focused approach that EBT gives to the assessment process, instructors are able to manage their workload by concentrating on the essential elements rather than trying to assess against ambiguous and variable outcomes.

4.5.3 Expanding practice

Once EBT is implemented, the flight crews are provided with focused opportunities to practice procedures under normal, non-normal and training conditions. Crews, through normal procedures, are provided with the opportunity to practice specific behaviors every time they fly. This frequent practice of learned behaviors promotes the development of competencies that an operator has identified as essential to good performance within its operational environment. In addition, crews are provided with the opportunity to practice good behaviors under emergency and abnormal conditions when undergoing EBT training in an FSTD.

4.5.4 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.

4.5.5 Methodology of debriefing

The debriefing should commence with a statement of the outcome, so that the 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 licenses or ratings held.

Where appropriate and once the outcome has been announced the debriefing should usually consist of a facilitated discussion during which trainees are encouraged to critique their performance. Trainers should provide feedback to the crew to encourage changes needed and also to provide specific recommendations to improve individual crew member’s performance.

Animated playback systems and video can be used to target and to develop competencies and understand individual and crew performance. Once debriefing is complete, the video or playback system data should be deleted unless the participants agree to the contrary.

SECTION 5

5 PILOT UNDERSTANDING OF EBT AND TRAINING

5.1 INTRODUCTION

EBT represents a significant departure from typical recurrent training programs and, without appropriate education of the pilot workforce; it is likely to be viewed with some suspicion. In particular, the concept of a proficiency assessment being conducted as the first item on the first day of an EBT module of recurrent training may raise concerns, both in individual pilots and pilot representative bodies. Appropriate education and information flow will assist in “buy-in” and allay concerns. This section provides guidance on the nature of information that should be communicated during the process of EBT development within an operator’s workplace.

5.2 PHILOSOPHY OF EBT HISTORY

It should be quite clear to all stakeholders that commercial aviation is a safety-critical industry. Safety is of paramount importance for the protection of passengers and crew members as well as for the health of this multi-billion dollar sector of the world’s economy. Despite this level of awareness, airline training has changed relatively little over recent decades.

Analysis of airline accidents and serious incident operational data over the past 30 years has led airlines, manufacturers and regulatory bodies to conclude that between 70% and 80% of accidents and serious incidents have a contributing human factor element. Various research programs have demonstrated that these types of occurrences have many common characteristics. One of the most compelling observations of these programs is that often the problems encountered by flight crews are associated with poor group decision-making, ineffective communication, inadequate leadership, and poor flight deck management. Most traditional training programs emphasize the technical aspects of flying almost exclusively, and do not deal effectively with various types of crew management strategies, techniques and broader human factors that are also essential for safe flight path management.

Crew resource management (CRM) training is often cited as a milestone in airline training progress. Although it was a watershed at the time, it is just one example of a practical application of human factors. Early CRM training set it apart as something discreet from technical training, but lessons learned over several generations of development of CRM have produced some conventional wisdom in terms of training integration. Although training can be approached in many different ways, there are some essential features. The training should focus on the functioning of the flight crew as an efficient team, not simply as a collection of technically competent individuals; it should provide opportunities for crew members to practice their skills together in the roles they normally perform in flight. Programs should teach crew members how to use their own personal and leadership styles in ways that foster crew effectiveness. A program should also teach crew members that their behavior during normal, routine circumstances could have a powerful impact on how well the crew as a whole functions during high-workload, stressful situations. During critical emergency situations, rather basic skills and knowledge often become paramount, and it is unlikely that any crew member will be able to take the time to reflect upon his or her CRM training to determine how to act. Similar situations experienced in training increase the probability that a crew will handle actual stressful situations more competently.

Research studies from the behavioral sciences strongly suggest that behavioral change in any environment cannot be accomplished in a short period of time, even if the training is very well designed. Trainees need time, awareness, practice and feedback, and continual reinforcement to learn lessons that will long endure. To be effective, training must be consistent and continuously reinforced.

Line oriented flight training (LOFT) has been a stepping-stone in this process where FSTD-based exercises are designed specifically to put knowledge, skills and attitudes into practice and improve pilot performance. Many operators now have CRM and LOFT programs to supplement technical training. Data from the Data Report for Evidence-based Training suggest that CRM has improved, probably as a result of some of these activities.

All training must be evaluated for effectiveness and to this end LOE was developed following the success of LOFT, being a logical extension. Much of the early LOE implementation was flawed. Whilst the metrics for ‘technical skills‘ were defined by performance standards such as speed, altitude and tracking accuracy, there was no common taxonomy or performance standard for the so-called ‘non–technical‘ skills. A tendency developed to look for technical outcomes as a metric of competence in ‘non–technical‘ skills. Assumptions were sometimes made on performance in areas such as communication, assertiveness and decision-making based on the premise that they must have been adequate if the technical outcomes were satisfactory. Possibly the relative novelty of CRM and LOFT programs and the absence of well-defined and widely-accepted standards of CRM and LOFT performance mitigated against the development of training standards. Despite inroads made in certain countries, on a worldwide basis the selection and training of instructors of CRM and LOFT is also a significant variable. Variations in the breadth and depth of training knowledge and skill indicate a strong need for standardization of the instructor team, with the provision of unambiguous guidelines for the conduct of assessments.

5.3 RECURRENT EBT PROGRAMS

At present, a typical recurrent training period currently comprises 2 or possibly 3 sessions of training in an FSTD qualified for the purpose, every 4 to 6 months. Typically the first session involves the practice of various scripted maneuvers by each pilot. Repeats of these or similar maneuvers are then assessed during a formal ‘check‘ during the next session, usually the following day, and involves license or rating renewal. If an individual does not meet the performance standard for one or more of the mandatory maneuvers, he or she is usually permitted to repeat the item. This session may or may not follow a LOE format; in some cases a LOFT or LOE session will follow as a third session. Whilst the airline usually collects and stores results of the assessment sessions, this is usually done at an individual level rather than a company or fleet level. Also the performance of the individual is not indicative of ‘line‘ performance, but is performance after practice in the previous session. Therefore it is not really possible for the airline to extract data on areas, which may be more generally problematical, in terms of performance across crews.

The FAA’s Advanced Qualification Program (AQP) and EASA’s Alternative Training and Qualification Program (ATQP) have attempted to address issues at both individual and broader levels within an airline but are still limited by existing mandatory items to be met. EBT takes the concepts of these programs further by structuring recurrent assessment and training according to evidence-based priorities based on a comprehensive analysis of safety and training data from a wide variety of sources. A module of EBT recurrent training generally comprises three phases: an evaluation phase, a maneuvers training phase and a scenario-based training phase for event management. The emphasis will be on training to achieve competence rather than on evaluation, although competence in all areas must be achieved by the end of the period of recurrent EBT.

The evaluation phase is conducted as the first session. This way baseline performance is measured, i.e., actual crew performance is captured in terms of day-to-day competence. This phase consists of scenarios developed to be representative of the operator’s environment. If a crew member does not meet the predetermined standard in a particular area, then a maneuver may be repeated or if necessary re-trained in this or the subsequent session(s). Importantly, any common problem areas will become apparent to airline management, which will allow further refinement of training in these areas.

The subsequent phase in a module of EBT recurrent training will comprise a maneuver proficiency training session where the emphasis will be on technique. This phase consists of maneuvers, which place significant demand on a proficient flight crew. Maneuvers in this context mean a sequence of deliberate actions to achieve a prescribed flight path or to perform a prescribed event to a specific outcome. Flight path control may be accomplished by a variety of means including manual aircraft control and the use of auto flight systems. Lists of maneuvers will be specified, according to aircraft generation with indications of the required frequency of the maneuver in an EBT program. Instructors will assist individuals in achieving competence and developing proficiency in challenging areas as well as in those areas where their performance in the evaluation session indicated that further practice was desirable.

Either separately or combined with the maneuver proficiency session, scenario-based training for event management will also be conducted in the scenario-based training phase. This will be conducted through a number of un-briefed scenarios. This phase forms the largest phase in the EBT program and is designed to focus on the development of competency, whilst training to mitigate the most critical risks identified for the aircraft generation. The phase will include the management of specific threats and errors in a real-time line orientated environment. The scenarios will include critical systemic and environmental threats, in addition to building effective crew interaction to identify and correct errors. A portion of the phase will also be directed towards the management of critical aircraft system malfunctions. It is important to recognize that these predetermined scenarios are simply a means to develop competency and not an end in themselves.

This phase requires flight crew members to effectively apply their knowledge, skills and attitudes in a process of guided self-discovery in solving problems that may only be partially reliant on standard operating procedures (SOPs), as opposed to merely training the SOPs themselves. They must understand both the learning objectives and the process under which these objectives are most likely to be achieved, insofar as these are different from other forms of training.

Overall, during the period of EBT recurrent training, the appropriate knowledge, skills and attitudes will be reinforced. The crew members will be challenged and emerge confident in their abilities to deal with known as well as previously unknown issues.

SECTION 6

6 TRAINING METRICS

6.1 INTRODUCTION

In order to determine the effectiveness of EBT, it is necessary to assess systematically the competencies of flight crew members. This is essential if performances that address major threats to safety are to be maintained and improved. However, if implemented inappropriately, assessment could be potentially damaging to increased safety in the long term. Instructors may be reluctant to explore some competency issues, and therefore need clear guidance and effective tools to make balanced and effective assessments.

In particular, some methods exist for assessment of both technical and non-technical skills, but EBT takes this a step further with the total system approach to competency.

Prior to the introduction of EBT in the operator's training program, a detailed description of the training and assessment methodology (including standard terminology to be used) acceptable to the CAA should be published in the Operations Manual. This methodology should include procedures to be applied in the event that crew members do not achieve the defined level of competence over the EBT module.

Research into means of assessment has determined that acquired competencies are reflected in recognizable behaviors, whose characteristics can be identified by simple evaluative statements.

The need for a clear and simple system focusing on general concepts and their application is fundamental, as is the need for the training of the users of the system.

Appendix A contains the example competency system developed for EBT. This system reflects the ICAO Doc 9995, the *Manual of Evidence-based Training*. A number of airlines have developed their own behavioral marker systems, and provided that these systems can be expanded to meet the needs of EBT, and demonstrate a similar level of robustness, there should be no reason why these existing systems should not be utilized.

Instructors should be familiar with the competency system in use by the operator in order to enable constructive assessments, give guidance to crews to improve future performance and to make recommendations for additional training where this is necessary. However, they should not use these indicators as a checklist when making assessments. EBT assessment should not be conducted as an activity survey for each phase of flight, but should be carried out within the overall assessment of the module.

Key to the use of any performance measurement system is the training and standardization of the instructors within the company. Regular re-standardization is necessary, as it has been shown that instructors' skills are degradable, and require regular re-evaluation and sharpening.

6.2 PROCESS

Grading systems are the cornerstone of any assessment of competency. It is extremely important that the means by which a system is selected and developed is both thorough and consultative, including all parties involved in the EBT program. The process for selecting an optimum grading system should follow a logical path. Paragraphs 3, 4 and 5 cover the development of a system, which should be considered as an example only, for the purpose of showing a methodology. The process is applied in order to create an example system, which is detailed in paragraph 5.

6.3 GENERATION OF CRITERIA

The first step is to engage with all key stakeholders, pilots, trainers and program developers, to identify expectations and objectives and to set in place a time line for the system development. The output from this is circulated for comment. At a defined point the local CAA should be involved to understand the process being followed, and to ascertain any expectations and objectives. This process should result in an exhaustive list of criteria, against which any system could be measured.

6.4 GROUPING OF CRITERIA

The second step is to consolidate the defined criteria into groups under logical titles, to enable a more efficient analysis. It is important to ensure that the criteria groups are distinct, minimizing duplication. This in turn will avoid unnecessary bias in any final weighting.

Whilst a necessary assumption is the effective training of all instructors, one criterion should address the risk of the grading system being poorly implemented.

The criteria groups used in our example are as follows with explanatory notes containing the criteria generated from the initial brainstorming session and other comments received during the development work:

1. Fairness and accuracy

   The grading system should allow the evaluation to be objective, fair, and relevant. It should be reliable, accurate, consistent and resistant to abuse, halo effects, instructor-evaluator laziness, ‘box ticking’ and bias, both positive and negative. Finally, it should ensure that pilots who are unable to fulfill competency performance expectations are not released to line service.

2. Clarity

   The grading system should allow assessments to be transparent, clear, complete, unambiguous, and not subject to interpretation or confusion. It must also address the occasions where pilots do not have the opportunity to demonstrate a particular competency.

3. Usability

   The grading system should be simple, easy to use, understandable, practical, manageable, accessible, uncomplicated, and resistant to unintentional errors. It should not dominate any debrief and should be compatible with facilitation. Finally it should be compatible with any media to be used, electronic or otherwise.

4. Ease of compliance

   The grading system should comply with both operator and CAA requirements. It should meet high-level regulations, allow auditing, and be traceable, explainable and long lasting. It should also ensure that any assessment is less liable to legal action.

5. Continuous improvement

   The grading system should provide evidence to enable improvements in both the training system and trainee performance, for the purpose of enhancing safety. It should be meaningful, deliver useful data, identify trends, aid analysis and address existing, future or potential problems in order to improve the training system. It should enable trainees to provide feedback on their assessment in order to help improve grading consistency and the grading system. It should also enable the continuous development of the trainee's performance.

6. Motivating

   The grading system should be motivating, trustworthy, respectful, and easy to 'sell', so that both trainers and trainees enjoy the experience without creating fear. It should also recognize exemplary performance and promote commitment by both trainers and trainees to the assessment process.

7. Technical data management

   The grading system should provide a manageable quantity of good data, be media compatible, easy to record and produce electronic data, compatible with analysis and presentation tools. It should also maintain data protection and assure controlled access.

8. Adaptability

   The grading system should be adaptable, flexible and able to tailor to all facets of the operation, aircraft types and training objectives.

9. Implementation risk

   The grading system should provide robust defenses against the risks of ineffective implementation. The system should be comprehensible for trainers, enable efficient trainer standardization, strong inter-rater reliability, and facilitate the identification of trainer divergence. It should be familiar to all users, cost efficient and resistant to drift and mutation.

Ranking of criteria

To enable recognition of relative importance, the criteria groups should be ranked using a score of 1 – 10, where 10 is considered the most important and then each is scored relative to this benchmark and each other. The following scores represent the importance of each group, and the resulting weighting is used in Figure 6.2:

Criteria group	Weighting
Fairness and accuracy	10
Usability	10
Clarity	9
Continuous improvement	8
Implementation risk	7
Data management	6
Adaptability	6
Ease of compliance	5
Motivation	5

Figure 6.1 Weighting of criteria groups

6.5 DEVELOPMENT OF GRADING OPTIONS

The next step is the development of appropriate grading system options measuring them against the defined criteria and their ranking. Prior to this stage it is important that widespread agreement is obtained on the criteria and their relative importance. The grading system that will be finally selected will be the one that best meets the agreed criteria.

Figure 6.2 is a summary of grading system comparisons created during a process to select the most appropriate one for use by an operator or ATO. The left hand vertical column contains the criteria described above, and the column adjoining allocates the weighting of the criteria. The uppermost horizontal axis lists abbreviated headings for each type of grading system. For this the 10 options chosen were:

1. Each competency to be graded in each scenario element of maneuver.
2. Each competency to be graded on the session.
3. Each competency to be graded on the session, in addition to the scenario element and maneuver where there is a deviation below the norm.
4. Each competency to be graded on the session, in addition to each task where there is a deviation below the norm.
5. Each task to be graded according to outcome, each competency to be graded in each scenario element or maneuver.
6. Each task to be graded according to outcome, only the critical competencies to be graded against tasks where there is deviation below the norm.
7. Each task to be graded according to outcome.
8. Each scenario element or maneuver to be graded according to outcome.
9. Each competency to be graded according to each task.
10. Each critical competency to be graded according to each task.

Grading System			5	6	7	8	1	2	3	4
Competent/Not yet competent statement			Module	Module	Module	Module	Module	Module	Module	Module
Outcome grading							Each **task**	Each **task**		
Competency grading			Each competency is graded in each **scenario/ maneouvers training**	Each competency is graded on the **session**	Each competency is graded on the session and on the **scenario/ maneouvers training** with the deviation below the norm (relevant competency)	Each competency is graded on the **session** and on the **tasks** with deviation below the norm	Each competency is graded in each **scenario/ maneuvers training**	Only the critical competencies graded against the **tasks** with deviation below the norm	All competencies are graded against each **task**	Only the **critical competencies** graded against each **task**
Free Text			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fairness & accuracy	Weighting	10	90	90	100	100	57	60	42	47
Usability		10	60	88	88	60	33	32	13	23
Clarity		9	81	81	79	63	80	68	21	21
Adaptability		6	48	59	48	42	32	26	28	36
Implementation risk		7	41	56	49	48	23	35	14	21
Continuous improvement		8	80	57	67	68	73	49	32	40
Compliance		5	35	40	43	44	49	43	20	20
Motivating		5	44	42	44	33	18	20	12	15
Data management		6	60	50	51	38	36	31	30	35
			539	**562**	**569**	495	402	364	212	258

Figure 6.2 – the 8 grading systems evaluated with scores

Grading Scales Version		A	B	C	D	E	F	G	H	I	J	K	L	M
System		unidirectional	unidirectional	unidirectional	unidirectional	unidirectional	unidirectional	unidirectional	unidirectional	unidirectional	Bidirectional	Bidirectional	Graphic Band	Plain Text
numbers (below beeing competent + above)	**weight**	**1+1**	**1+2**	**1+3**	**1+4**	**1+5**	**2+2**	**2+3**	**2+4**	**more than 6 grades**	**3**	**5**	**NIL**	**NIL**
Fairness & accuracy	**10**	4	6	7	9	10	5	9	10	7	4	6	7	2
Usability	**10**	10	5	6	9	7	5	8	7	9	4	5	8	1
Clarity	**9**	5	4	6	10	9	7	8	7	8	4	5	8	2
Adaptability	**6**	9	6	7	8	8	7	7	7	5	4	3	10	8
Implementation risk	**7**	8	5	9	10	9	5	8	7	6	2	2	6	1
Continuous improvement	**8**	1	3	6	9	10	4	7	8	10	2	4	7	5
Compliance	**5**	6	6	7	10	10	6	9	9	8	5	5	2	4
Motivating	**5**	2	4	6	9	10	3	6	7	8	2	5	7	6
Data mgt	**6**	3	4	6	7	8	6	8	9	10	3	3	4	1
		361	**315**	**438**	**597**	**590**	**353**	**519**	**522**	**524**	**223**	**287**	**449**	**199**

Figure 6.3 Example of option scoring in grading system development

Based on this analysis the decision was made to use 1 grade for unsatisfactory performance, and 4 grades detailing levels of successful performance. Grading is conducted during the Evaluation Phase, and also at the conclusion of each session, grades being allocated to each of the 8 competencies. Narrative remarks are required to detail unacceptable performance, attributing observed behaviors and circumstances. Exemplary performance should also be annotated in this way.

6.6 TECHNIQUES TO BE APPLIED IN GRADING

Assessment is a continuous process throughout all training phases. It is the process of observing, recording, analyzing and determining crew performance against defined expectations 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 behavior to the competencies by using the behavioral indicators. The behavioral indicators are not intended to be used as a checklist. The determination of crew competence should be made solely with reference to defined expectations. By this the instructor should be able to continuously assess performance, highlighting both exemplary performance and that which falls below expectations.

Instructors and trainees should be knowledgeable of the competencies in order to allow valid assessments and constructive debriefings. A successful assessment includes giving guidance to crews to improve future performance, and also making recommendations for additional training where this is necessary.

SECTION 7

7 PROGRAM DEVELOPMENT

7.1 INTRODUCTION

Appendices 2 to 6 in the *Manual of Evidence-based Training* (ICAO Doc 9995) form the basis for the construction of EBT recurrent assessment and training programs. They are also listed here in Appendices G to L. Each appendix is related to an aeroplane generation as described in paragraph 3 of the Background section of this document. In order to address all assessment and training topics at the defined frequency, a training program of 48 FSTD hours over a 3-year cycle for each flight crew member has been assumed. This EBT recurrent assessment and training should be conducted in an FSTD qualified for the purpose.

Each appendix comprises information from which a recurrent assessment and training program should be developed. For each aircraft generation, this information data is extracted from a comprehensive assessment and training matrix described in paragraph 3 and contained in the respective Appendix to ICAO Doc 9995.

The ICAO *Manual of Evidence-Based Training* is not intended to cover areas of recurrent flight crew training outside the normal scope of training conducted in an FSTD qualified for the purpose, nor is this manual intended to include additional areas of ground and refresher training. There are some threats or errors that cannot be addressed in an FSTD-based program, but these may and should become the focus of other additional types of recurrent training in order to adequately manage them.

The competency map columns in the assessment and training matrix reflect the training principle behind EBT and are linked to the competencies described in Appendix A; the defined scenarios serve as tools to assess and develop those competencies. It should be remembered that this map is simply intended as a tool for program development, to assist in evaluating the balance of a program in respect of each of the 8 competencies in Appendix A.

Data referred to in this manual has been analyzed and is contained within 2 source files, the Evidence Table and the EBT Accident and Incident Study. The Evidence Table consists of data from multiple sources and has the capability to corroborate analytical results leading to the development of assessment and training topics. It represents a robust set of evidence and it is the primary tool used in determining results. The EBT Accident and Incident Study has a substantial number of events in the analysis, and is an extremely useful tool in developing prioritization of results as well as discriminating by aircraft generation. Depending on the case, the assessment and training topics are drawn from both sources, the Evidence Table alone or the Accident and Incident Study alone.

Note.– The Evidence Table and the EBT Accident and Incident Study are contained in the Data Report for Evidence-Based Training published by IATA.

7.2 BACKGROUND FROM THE ANALYSIS

By using analysis as a tool, assumptions are made that the results will have strong predictive validity even though the environment is constantly changing. These challenges were accepted because data results have proven to be very successful. Results from data analysis should always be applied in the context of professional experience and expertise. For the creation of the EBT program defined in this manual, a cautious approach was taken, and the proposed frequency of training is always more than that suggested by the data analysis, unless the corroborating data is very strong. An example of this could be illustrated in the EBT Accident and Incident Study where the data imply different training frequency in adjacent generations. If the data is quite supportive of a higher training frequency in a generation, the training category in the adjacent generation will be upgraded.

Operational and training data from multiple sources indicate that pilots operating the more modern generation aircraft take less time to achieve competence in the performance of certain maneuvers. Modern generation aircraft are also more complex, and pilots have more to learn for achieving a defined level of competency to operate. The number of assessment and training topics is slightly fewer in early aircraft generations; the training time in the FTSD should be largely the same.

7.3 EBT RECURRENT ASSESSMENT AND TRAINING MATRIX

Appendices G to L contain generation-specific assessment and training matrices. This paragraph describes the component elements in the column headings of the matrix as follows.

Assessment and training topic

A topic or grouping derived from threats, errors or findings from data analysis, to be considered for assessment and mitigation by training. Topics marked with “ISI” are those considered only as part of a defined “in-seat instruction” exercise.

Frequency

This is the frequency of the topic to be included in an EBT program, determined according to evidence. There are three levels of frequency:

A – assessment and training topic to be included with defined scenario elements during every EBT module;

B – assessment and training topic to be included with defined scenario elements during alternate EBT modules (i.e., every other module in a series); and

C – assessment and training topic to be included with defined scenario elements at least once in the 3-year cycle of the EBT program.

Flight phase for activation

This is the flight phase for the realization of the critical threat or error in the assessment and training scenario. This simply means the flight phase of the EBT program session where the topic is considered most relevant. In brackets in the abbreviation column is the flight phase(s) related to the training criticality survey from Figure 8.1.

Abbreviation	Flight Phase	Description
ALL (Phase Φ)	All	Any or all phases of flight
GND (Phases 1 and 8)	Flight planning, pre-flight, engine start and taxi-out Taxi-in, engine shut-down, post-flight and flight closing	Ground phases up to when the crew increases thrust for the purpose of taking-off. From the speed that permits the aircraft to be maneuvered by means of taxiing for the purpose of arriving at a parking area until the crew completes post-flight and flight closing duties.
TO (Phase 2)	Take-off	This phase begins when the crew increases the thrust for the purpose of taking-off. It ends after the speed and configuration are established at a defined maneuvering altitude or to continue the climb for the purpose of cruise.
CLB (Phase 3)	Climb	This phase begins when the crew establishes the aircraft at a defined speed and configuration enabling the aircraft to increase altitude for the purpose of cruise. It ends with the aircraft established at a predetermined constant initial cruise altitude at a defined speed.
CRZ (Phase 4)	Cruise	The cruise phase begins when the crew establishes the aircraft at a defined speed and predetermined constant initial cruise altitude and proceeds in the direction of a destination. It ends with the beginning of descent for the purpose of an approach.
DES (Phase 5)	Descent	This phase begins when the crew departs the cruise altitude for the purpose of an approach at a particular destination. It ends when the crew initiates changes in aircraft configuration and/or speed to facilitate a landing on a particular runway.
APP (Phase 6)	Approach	This phase begins when the crew initiates changes in aircraft configuration and/or speeds enabling the aircraft to man oeuvre for the purpose of landing on a particular runway. It ends when the aircraft is in the landing configuration and the crew is dedicated to land on a specific runway. It also includes go-around where the crew aborts the descent to the planned landing runway during the approach phase. Go-around ends after speed and configuration are established at a defined maneuvering altitude or to continue the climb for the purpose of cruise.
LDG (Phase 7)	Landing	This phase begins when the aircraft is in the landing configuration and the crew is dedicated to touchdown on a specific runway. It ends when the speed permits the aircraft to be maneuvered by means of taxiing for the purpose of arriving at a parking area.

Description (includes type of topic, being threat, error or focus)

A description of the training topic, which can be a particular event, e.g. “Go-around,” or a more general focus area, e.g. “Manual aircraft control”.

Desired outcome (includes performance criteria or training outcome)

The statements are simple and evaluative, or based upon behavioral indicators, according to the type of training topic. This is intended to guide program developers to ensure the desired outcomes are possible according to design.

Example scenario elements

This is a list of example scenarios, which can address the training topic. This list is by no means exhaustive and contains only key elements of sample scenarios; operators are encouraged to develop alternative scenarios.

Competency map

Competencies marked are those considered critical in managing the scenario. They were determined according to the following:

a. those competencies considered most critical to the successful management of the defined threat or error; or

b. those competencies most likely to be linked to the root cause of poor performance, in the case of unsuccessful management of a defined threat or error.

The competency map can also be used to determine which scenarios or combinations of scenarios may be used in developing particular competencies.

Assessment and training topic map

The assessment and training topics that are not greyed out are grouped by weighting (refer to paragraphs *Assessment and training topic* and *Frequency* above for details), e.g. "Topic map – Group B". They constitute a series of columns, one per topic. These columns allow a mapping of where a scenario listed is also considered to be relevant to another assessment and training topic.

A summary process for end users wishing to implement the baseline EBT program is contained in the summary flowchart for users at the end of this chapter.

7.4 IMPLEMENTATION OF A BASELINE EBT PROGRAM

7.4.1 General

The purpose of the EBT program is to use events defined to be most critical, as a means of developing and assessing competencies. It is important to note that, when adapting material in these appendices to specific operator's needs, it is never the intention that all possible events or scenarios be programmed within the EBT recurrent cycle. Operators should select the scenarios most useful to their needs, but ensure that the frequency of defined topics is maintained, to minimize competence decay over time.

7.4.2 Construction of EBT modules

7.4.2.1 Evaluation phase – selection of assessment topics and scenarios

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 behavior 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 maneuver.

The ideal balance in a 3-year EBT program cycle is to balance assessment of the competencies, e.g. out of the 8 competencies ensure that there are topics and scenarios, which require particular demonstration of each competency over the period. The application of this will be subject to the frequency of evaluations to meet both licensing and operator requirements. When designing the evaluation phase, developers should endeavor to balance the focus of evaluations (typically 6 over a 3-year period) to each competency.

The first scenario in the evaluation phase may commence with a normal aircraft pre-flight set up with full operational flight plan information provided to the crew. This helps to build realism and allows the crew time to assimilate their environment. There are other possible commencement points for the evaluation phase, but great care should be exercise to ensure the crew is given time to fully prepare and assimilate the environment before the evaluation begins. It is intended that only one or two topics be selected as the assessment vehicle and that the scenario devised for each pilot should be conducted in real time. Consideration may also be given to the benefit of scenarios that are time constrained, especially when the focus is on competencies “workload management” and “leadership and teamwork”. Where aircraft malfunctions are considered for this phase, they should be drawn from a traditional determined list of the aircraft manufacturer and not from unforeseen scenarios.

7.4.2.2 Maneuvers training phase

The critical elements of each maneuver are described in the matrix of the Appendices 2 to 6 to the ICAO *Manual of Evidence-based Training* (Doc 9995) and of Appendices G to L to this manual. This is not real-time training, but allows crews the time to practice and improve performance in largely psychomotor skill-based exercises. It is important to maintain the focus on skill, and not to turn this into LOFT-style training. Once the pilot has completed the critical part of the maneuver successfully, the aim has been achieved. Repositioning of the flight simulation to focus training on the intended maneuvers will be a commonly used FSTD feature for this phase. “Every effort should be made to provide a relaxed environment free from the normal LOFT style considerations, wherein the crew can practice skills with coaching where necessary”.

7.4.2.3 Scenario-based training phase

The purpose of the scenario-based training phase is to maximize exposure to a variety of situations according to the priorities determined through analysis, for the purpose of enabling learning and developing competence and resilience. All topics should be included except those already completed in the evaluation phase, and the program developer should look carefully to minimize repositioning, maintain consistency of the environment, avoid confusion and ensure that training is as realistic as possible. Care should be taken in providing for realism, and maintaining focus on the given topic. Topics will necessarily be combined and run sequentially over the course of a scenario, which may be a short A to B flight, or a descent from cruise altitude followed by approach and landing or go-around.

Many of the topics can clearly be distinguished and described within the program, but some are necessarily considered across the spectrum of the EBT module, embedded as part of the development. In particular three embedded topics, “surprise”, “compliance” and “monitoring”, are described below:

Surprise

The data analyzed during the development of this manual and of the EBT concept indicated substantial difficulties encountered by crews when faced with a threat or error that was a surprise or an unforeseen event. The element of surprise is difficult to achieve in an FSTD-based training program and should be distinguished from what is sometimes referred to as the “startle factor”, the latter being a physiological reaction. Wherever possible, consideration should be given towards variations in the types of scenario, times of occurrences and types of occurrence, so that pilots do not become overly familiar with repetitions of the same scenarios. Variations should be the focus of EBT program design, but not left to the discretion of individual instructors in order to preserve program integrity and fairness.

Compliance

The data analyzed also indicated a strong link between intentional crew non-compliance and the occurrence of more serious errors resulting in incidents and accidents. Compliance is considered as a training topic, spanning all aspects of the EBT program. This means that instructors should ensure that observed non-compliances are taken as learning opportunities throughout the program. In all modules of the program, the FSTD should as far as possible be treated like an aircraft, and non-compliances should not be accepted unless clearly necessary in the particular circumstances to maintain or achieve a higher level of safety.

Monitoring

The pilot monitoring (PM) plays a vital role in operational safety. One of the objectives of the EBT program is to devote special attention to the development and enhancement of that role. The PM is considered to provide the following functions:

a. plays an active role;

b. maintains situation awareness, particularly regarding the tasks of other crew members;

c. supports the PF by providing input to the tactical (short term) and strategic (long term) plan for the flight;

d. monitors parameters not immediately apparent to the PF;

e. monitors activities of the PF;

f. provides back-up to the PF (ensures redundancy; takes over control when the PF does not respond to cues or fails to ensure safety);

g. makes call-outs of deviations from SOPs and/or limitations; and

h. performs tasks as defined by SOPs.

Instructors should balance their attention to both PF and PM roles and maximize learning opportunities, which are often revealed when both crew members are busy with particular tasks, sometimes to the exclusion of effective flight path monitoring.

7.4.2.4 In-seat instruction (ISI)

For the purpose of this document, in-seat instruction should follow a predetermined scripted scenario. It can be achieved by:

a. the response of one pilot to simple instructions provided confidentially by the instructor. This should be limited to the simulation of pilot incapacitation; or

b. by the instructor occupying a pilot seat and performing pre-determined exercises acting as the PF or PM for the purposes of demonstration and of intervention by the other pilot.

In-seat instruction should normally only be used in the scenario-based training phase. Where a pilot is instructed to play a role, there should be no assessment of this function. Where a pilot is expected to respond to an error induced during ISI, the response should be according to behavior expected in line operations, and additionally there should be no negative consequences to any assessment of performance for the duration of ISI. Once ISI has ceased and/or control is transferred, subsequent performance may be assessed in the normal way.

Topics marked “ISI” are intended to be the focus of instructor ISI. In these cases topics should be combined together to create an ISI scenario to be used at the determined frequency. The following training topics are considered for instructor ISI:

a. monitoring, crosschecking, error detection, mismanaged aircraft state; and

b. upset management.

7.4.2.5 Focusing on airline-critical procedures

The enhanced EBT development process is operator specific. Operators have different missions, philosophies and SOPs, and EBT development helps an airline to best adapt to meet unique operational needs. This operational focus should be used to involve training and flight operations in the process of developing competency. By addressing procedures and fundamental issues of crew performance, enhanced EBT extends involvement to the entire spectrum of flight operations, involving personnel in flight standards, training, and operations.

Guidelines for identifying own operator’s needs

The identification of competency problem areas is an on-going activity, and to ensure the long-term success of the EBT program, an airline should identify a few operationally significant competency problems at the beginning of the EBT development process.

An airline that does not have detailed crew performance data should use the *Data Report for Evidence-Based Training* to identify general problem areas, and then the airline should use specific aircraft accident and incident reports to obtain the details.

When existing airline data or reports do not point to clear competency issues, the development team should consider surveys or structured interviews as possible tools for data collection.

The needs survey should be designed primarily for instructors and should investigate at least two areas:

a. performance problems by phase or sub-phase of flight; and

b. performance problems by EBT topic.

The EBT development team should be aware of the benefits and possible liabilities of each scenario it plans to add. The team's mandate is to create an immersive training program, minimizing repositioning and maximizing realism, and the team should thus be cognizant with the need to create manageable workload and effective learning.

7.4.2.6 Summary process for end users wishing to implement the baseline EBT program

The following table is intended as a simplified guide, summarizing key steps to be followed during the implementation of a recurrent assessment and training program derived from the EBT principles and data described in this manual. Some activities are sequential, and some can run in parallel enabling the most efficient implementation of EBT. The table is not intended to be fully comprehensive detailing all possible options, but more as a ready guide towards the key steps, with appropriate references to chapters of the Manual of Evidence-based Training (ICAO Doc 9995).

Note.− Items marked with * are considered steps with no interdependency and can therefore be completed in isolation and before any formal implementation process. They are simply presented at the necessary point in the sequence. Items marked with ** are those with limited interdependency and this is referenced in the text.

Step		Doc 9995 Reference	Description	Parties involved
1	Definition of an implementation and operations plan.	4.1.2 of Part I Chapter 2 of Part II	Once a decision has been taken by the operator or ATO to implement EBT, a consultative document should be created in cooperation with the CAA, defining the objectives, time lines and any limitations based upon existing rules and the risk management processes defined in Appendix 7. This can be agreed according to the options described within the manual, for staged or total implementation, fleet-wide or operation-wide or as a program that runs in parallel to components of existing training. It is impossible to be precise about all options available, and this relies on an effective partnership between operator and CAA, described in Appendix 7. Agreement in principle should be reached before detailed program planning commences. Successful implementation of EBT depends on an effective partnership between the applicant and the CAA, in addition to the buy-in of all staff involved in the development and delivery of training and of the pilot population.	CAA, operator/ATO
1A	Implementation strategy, consideration of options.	4.2 of Part I	**Training and assessment according to EBT principles.** This means the conduct of training and assessment according to EBT principles without changing existing program syllabus elements. Instructors and pilots should be trained in the methodologies according to Chapter 6. The development and application of defined performance criteria to training events and scenarios, to which the operator's standard can be applied, will enable more effective application using existing program syllabus elements.	CAA, operator/ATO
1B		4.2 of Part I	**Mixed implementation.** Implementation of a mixed EBT program means that some portion of a recurrent assessment and training is dedicated to the application of EBT. This is a means of achieving a phased implementation where, for example, CAA rules permit such a program as part of the operator's specific training and assessment, but preclude such a program for the revalidation or renewal of pilot licenses. This phased implementation recognizes the potential for such an EBT program to be developed and implemented in advance of any future enabling rule changes, which may then permit total implementation.	CAA, operator/ATO
2*	Instructor training and standardization.	4.1.1 and 6.3 of Part I	Instructors should undergo suitable training in order to adapt to the needs of training within an EBT program. Training should provide the framework for existing instructors to develop their competence to undertake EBT assessment and training. This should be considered at the earliest possible opportunity and can be created in advance of any planned implementation of EBT.	Operator/ATO

Step		Doc 9995 Reference	Description	Parties involved
3*	Review of training effectiveness upon receipt of sufficient training system data.	4.1.2 of Part I	Existing training metrics and measurement parameters should be considered. Where possible it is desirable to establish a baseline for training system performance prior to the implementation of EBT, so that system performance in areas of focus can be effectively measured.	Operator/ATO
4*	Development of a competency framework, standards and a grading system.	4.1.1 of Part I	This should be considered at the earliest possible opportunity and can be created in advance of any planned implementation of EBT.	Operator/ATO, pilot representation, CAA as appropriate
5	Malfunction clustering.		This should be undertaken in consultation with the aircraft OEM, and is a highly desirable, though not essential component of the design process.	Operator/ATO, OEM, CAA as appropriate
6	Approach type clustering.		This should be conducted with reference to the types of approaches flown within the operation, with less attention being given to approaches which are typically flown frequently within the normal operation	Operator/ATO
7	Selection and adaptation of the scenarios defined in Appendices 1 to 6 according to the generation of aircraft (fleet) and type of operation for the operator.	4.1.2 of Part I	This involves a process of selecting scenarios and priorities according to the methods described in the Appendix preamble, combining with any additional local needs or requirements, and the development of the evaluation and training event frequency. Once determined this should then be used as the framework within which to place and adapt the scenarios listed, according to type and operation specific needs. Special attention should be given to the material created for the guidance of instructors, in addition to ensuring that pilots are provided with any necessary information with which to prepare for training, and that all necessary databases, charts, operational flight plan, etc. information is provided in the normal way.	CAA, operator/ATO
7A	Program design.		**EBT program design.** The program should be designed according to the guidance and priorities within this manual. All modules and lesson plans should be fully tested prior to use, to ensure that anticipated timings and FSTD fidelity provide for the training outcomes defined.	Program design team
8	Adaptation of training program according to the training system feedback.	4.1.2 of Part I	This may highlight areas for particular focus during the adaptation of the EBT baseline program for use. Care should be exercised if deviations from the recommended priorities or frequency are made. Data analyzed during the creation of EBT was very substantial and encompassed a wide range of types of operation. The priorities indicated in the appendices have been created with a careful analysis and should only be adjusted when there is compelling data indicating the need for a deviation.	Operator/ATO, pilot representation

Step		Doc 9995 Reference	Description	Parties involved
9**	Instructor training and standardization.	4.1.1 and 6.3 of Part I	Instructor EBT program standardization, which should be a formalized approach to ensure a consistent and standardized approach to the EBT program prior to implementation, including practical training reinforcing application of the assessment and grading system and maximizing inter-rater reliability.	CAA, operator/ATO
10	Instructor competency assessment.	6.3 of Part I	Prior to conducting instruction and assessment within an EBT program, all designated EBT instructors should successfully complete a formal competency assessment. The competency assessment should be made during a practical training supervised by a person nominated by the operator or the ATO.	CAA, operator/ATO
11	Information to pilots.	4.1.1 and 6.1.2 of Part I	Pilots should be briefed about the principles and methodology of EBT, competencies and performance criteria and the assessment methods and the grading system. It is considered essential that pilots who will be trained and assessed according to EBT principles understand all the processes involved and are given time to adjust to the new performance requirements.	CAA, operator/ATO, pilot representation
12	Implementation (an initial limited trial phase may be considered by the CAA).	4.1.2 of Part I Chapter 2 of Part II	Precise scope and limitation will be agreed in partnership with the CAA. The training and logistical difficulties of only fleet-wide versus operator-wide trials should be considered. A better solution may be to apply EBT to a proportion of the operator's assessment and training program.	Operator/ATO, CAA
13	Review of training effectiveness upon receipt of sufficient training system data.	4.1.2 of Part I	Once implemented, training metrics should be analyzed at a predetermined frequency, to establish system effectiveness and where necessary, make corrections to the program. It is also vital that a subjective feedback system be established, enabling both pilots under assessment and training, and the instructors to provide feedback. This process is part of the buy-in considered essential for safety improvement and the partnership between all parties.	Operator/ATO
14	Measurement of training system performance.	4.1.1 of Part I	Where a system for the measurement of training system performance exists it should be utilized and if necessary adapted to meet the demands of EBT, for example in measuring performance throughout the range of competencies. Any adapted or new system should be tested and adjusted before live implementation as part of the EBT program.	Operator/ATO, pilot representation

SECTION 8

8 CONTINUOUS IMPROVEMENT

8.1 INTRODUCTION

Whilst the EBT data analysis is substantial and supportive of the programs described in this manual, this does not mean that it is sufficient over a long period of time. There is a clear need for regular and where necessary, substantial update and expansion. New data will be acquired and analyzed according to the key principles established in this manual. New sources will provide a continuing and expanded review of operations, training and safety events. The training criticality survey will be developed in order to provide corroboration and correlation across multisource data results and most importantly, continual access to professional expertise. Data analyses undertaken with the rigor and spirit of the EBT data study are a key foundation to improve safety by better training.

EBT requires a new training process, which evolves as a result of continuous feedback and the incorporation of new evidence as it becomes available. It is recommended that an operator schedule a periodic formal review of its EBT program at regular scheduled intervals, e.g. annually.

8.2 DEVELOPMENT OF THE BASELINE PROGRAM

In order to develop the EBT concept, data should continue to be collected from the following sources:

1. operators;
2. original equipment manufacturers (OEM's) of aircraft;
3. accident investigation authorities;
4. international aviation organizations; and
5. Civil Aviation Authorities.

Data listed below will continue to be acquired and analyzed:

1. LOSA;
2. EBT study of accidents and incidents;
3. flight data analysis studies;
4. training data studies;
5. airline pilot surveys on training effectiveness;
6. scientific reports; and
7. training criticality survey.

This data analysis will improve the reliability and continuously update the training priorities identified in the Data Report for Evidence-Based Training, with a view to improving and updating the baseline EBT program.

8.3 ENHANCED EBT PROGRAM

The enhanced EBT development methodology takes into account individual operational considerations and has the greatest potential for improving pilot training and ultimately aviation safety.

8.3.1 Operational data monitoring

The difference between the baseline EBT program and an enhanced EBT program is optimization. Data analysis makes the bridge between the baseline EBT program and the enhanced EBT training program using the operator's own and/or the general fleet or operation-specific data. An enhanced program should typically result in improved effectiveness and efficiency, but requires a sufficient base of specific data. The purpose of data collection and analysis is to provide the source from which adjustments to the training program can be made with confidence that the result is indeed an improvement compared with the baseline program.

Data collection should provide for a detailed analysis of existing threats and identify potential weaknesses in the level of the airline's operational safety. This may also be indicated by flight crew performance. The data collection should comprise the following:

a. Flight data with an analysis of recent trends across the operator's own or similar fleets, if required, in conjunction with the Data Report for Evidence-Based Training, to identify and quantify differences and specific areas of threat or interest;

b. Training data with an analysis of recent trends across all fleets of the operator, in conjunction with the Data Report for Evidence-Based Training, to identify and quantify differences and specific areas of threat or interest; this requires the development of a training measurement system;

c. Operator's SMS data, including safety reports with an analysis of the operator's safety data from all sources with specific identification of those risks that can be mitigated by pilot training; and

d. World fleet data with an analysis of available safety data from operations with similar aircraft types and similar operations; this should include OEM data.

8.3.2 Operational characteristics

In order to develop the enhanced program, it is important to first analyze the operational characteristics of the operator. This includes aircraft types, route structure and typical sector lengths, special operations, destinations requiring special attention, pilot experience levels and culture. It is very important to focus on the most critical operational risks provided that training can demonstrably mitigate these. There should be a close correlation between training and operations.

8.3.3 Competency framework

An identical competency framework is applied to both baseline and enhanced EBT programs. It is advantageous to develop, train and assess competencies utilizing scenarios that are relevant to operations. Scenarios can sometimes be identified through the data collection and analysis process. In some cases the data may highlight certain competencies considered critical to the management of a specified threat or error in the operation, which may lead to a focus on specific areas as part of the training program. By continuing to focus on the complete set of identified competencies, the operator's EBT program will continue to prepare flight crews for both known and unforeseen threats and errors.

8.3.4 Safety Management Systems (SMS) and EBT

The data collection and analysis generally need to cover various types of data, both from within the training activity (inner loop) and from both flight operations and the operator's SMS (outer loop). Data analysis can be as simple as analyzing the operator's mission and making sure that operator-specific threats are accounted for in the training program. Alternatively, the analysis may be carried out using sophisticated flight data analysis software

8.3.5 Reporting Systems

Safety reporting programs are a classic source of safety information. These programs can be mandatory, voluntary, confidential and, in some cases, anonymous. Successful reporting programs are built on the principle of an open reporting culture, where the focus is on safety improvement and not on the assignment of blame. The content of a safety report typically consists of a narrative and various descriptors for classifying the event. Managing a large quantity of reports and distilling useful information from them usually requires a tailored software application. An in-depth study of training-related issues may require an analysis of the narrative parts of the reports, which makes the task more challenging. A functional and effective reporting system is a rich source of information, highlighting:

a. operational threats and their approximate frequencies and characteristics;

b. specificities of routes, destinations and other operational factors;

c. capability of the crew to cope with various real life situations; and

d. errors experienced in operations.

Note: The most effective reporting systems are considered to be confidential and non-punitive to ensure honest, uninhibited reporting.

8.3.6 Flight data analysis (FDA)

Flight data analysis is a powerful data collection tool that allows quick access to the results. A limitation is that FDA can only detect pre-defined events based on predetermined technical cues. For example, FDA detects unstable approaches, as the stable approach criteria can be pre-programmed as a defined set of quantitative parameters. However, lateral or vertical navigation errors e.g. "altitude busts" cannot be detected as the specifically cleared routes and altitudes vary throughout a flight and therefore cannot be pre-defined. Also, prevailing environmental conditions (e.g. runway condition or weather) or communications (e.g. intra-cockpit or with ATC) cannot be recorded on current equipment. In summary, FDA information is useful for examining what has occurred in the operation, but not why an event occurred or how the situation was managed after the event did occur. However, FDA can be very powerful in highlighting important operational trends, for example:

a. the rate of unstable approaches and corresponding rate of resultant go-arounds versus landings;

b. the frequency of some threats and events, e.g. ACAS alerts, rejected take-offs;

c. operation and route specificities, including those of destinations, and other operational factors; and

d. issues that relate directly to training, e.g. hard landings or rotation technique.

FDA is most effective as a trending tool to measure improvement or degradation in operational performance in terms of the risk events defined in the specific FDA program. From the trends, adjustments can be made in the training program to mitigate the risk shown by the FDA analysis. As the trending continues, the effectiveness of the adjustments can be measured and validated in a quality loop process.

There are several ways to further enhance the use of FDA for the operator. One method is to share data with other operators in existing data sharing groups enabling 'lessons learnt' to be transferred across their membership. Another way is by benchmarking the flight data analysis risk events with other operators using the same software with the same event set. The process can be anonymous while providing further insight into training needs.

8.3.7 Flight deck observation

Flight deck observation is intended to mean monitoring of normal operations by an observer, such as LOSA and other similar methods. The philosophy is a non-intrusive observation of the flight crew activity. The focus is on threats and errors and on their management. The results are not correlated to the individual pilots but are interpreted at the level of the whole operation. LOSA is performed on a time-limited (snapshot) basis but other variations of normal operations monitoring can occur on a more continuous basis.

The power of flight deck observation is in its capability to combine the advantages of safety reporting systems and flight data analysis. All threats and errors seen by the observer are captured – as opposed to only the ones that the pilot elects to report. Also, and very importantly, all contextual factors (e.g. weather, time pressure) are captured, and the "why's and how's" missed by FDA are also observed. The principal disadvantage is a relatively high human resource requirement.

For the purpose of training enhancement, flight deck observation may produce the single most valuable source of information.

8.3.8 Training Data

8.3.8.1 Training metrics

The "inner loop" within the training function is a valuable source of data. Taking full advantage of such data requires robust and well-calibrated training metrics. Typical outputs include:

a. differences in success rates between aircraft types and training topics;

b. distribution of errors for various training scenarios and aircraft types;

c. skill retention capability versus skill type;

d. trainee's feedback, which provides a different perspective as to the quality and effectiveness of the training product; and

e. instructor tracking system: this system is important to measure the effectiveness of the instructor calibration process. However, it is essential to impress that the purpose of this system is not to spy on instructors or to pressure individuals to change their grading.

Training metrics are an invaluable component in supporting an EBT training program but they must be placed in the context of operational data, because only the latter can justify the importance of a specific skill within the real operation.

8.3.8.2 Training criticality survey

An element of the EBT methodology is based on a training criticality survey, identifying potential threats and errors in each phase of flight. See the Data Report for Evidence-based Training for an example. Pilots experienced in operations and training completed the analysis, and an operator wishing to develop an enhanced EBT program can replicate this model.

Pilots should be asked to assess threats and errors by phase of flight according to their experiences and projections based on experience. In the original survey there are 161 3-part questions asked. Each survey included 40 threats and errors over all phases of flight. The respondents should be the largest possible number of volunteers within the operation. It is important to have sizeable samples from each fleet.

The threats and errors used in the survey were defined specific to flight phases by the EBT Project Group. In addition, potential threats and errors occurring in most if not all flight phases are listed separately in a distinct phase: Phase Φ. Figure 8.1 describes the phases used.

TCS Flight Phase Definitions

Flight Phase	Numerical Order of Flight Phase	Definition
All	Phase Φ	Potential threats/errors in any or all phases of flight Phase (1-8)
Pre-flight/taxi	Phase 1	Pre-flight and taxi - flight preparation to completion of line-up
Take-off	Phase 2	From the application of take-off thrust until the completion of flap and slat retraction
Climb	Phase 3	From the completion of flap and slat retraction until the top of climb
Cruise	Phase 4	From top of climb until top of descent
Descent	Phase 5	From top of descent until the earlier of first slat/flap extension or crossing the initial approach fix
Approach	Phase 6	From the earlier of first slat/flap extension or crossing the initial approach fix until 15 m (50 ft) AAL, including go-around
Landing	Phase 7	From 15 m (50 ft) AAL until reaching taxi speed
Taxi/post-flight	Phase 8	From reaching taxi speed until engine shutdown

Figure 8.1 – Training Criticality Survey Flight Phases

The defined threats and errors can be surveyed on a scale of 1 to 5 in 3 dimensions (likelihood, severity and training benefit), as follows:

Likelihood describes the probability that over the course of a defined period in time a pilot will experience a threat, requiring intervention. Five levels of likelihood were used:

1. Rare – once in a career or less;
2. Unlikely – a few times in a career;
3. Moderately likely – once every 3-5 years;
4. Likely – probably once a year; and
5. Almost certain – more than once a year.

Severity describes the most likely outcome based on the assumption that the pilot has not received training to manage the defined event in five levels as follows:

1. Negligible – insignificant effect not compromising safety;
2. Minor – reduction in safety margin (but not considered a significant reduction);
3. Moderate – safety compromised or significant reduction in safety margin;
4. Major – aircraft damage and/or personal injury; and
5. Catastrophic – significant damage or fatalities.

Training Benefit describes the effect of training to reduce the severity in b) by at least one level, and is assessed in a five level scale as follows:

1. Unimportant − training does not reduce severity;
2. Minor − enhances performance in managing an event;
3. Moderate − having no training compromises safety;
4. Significant − safe outcome is unlikely without effective training; and
5. Critical − essential to understanding the event and coping with it.

For the purpose of this survey, risk is defined as the product of likelihood x severity and is calculated for all threats and errors by phase of flight for each aircraft.

Originally when the survey was sorted by threats and errors according to aircraft generation, all the factors in phase ɸ went to the bottom of the sort. This is because the factors in this phase were only assessed once even though they appear in multiple phases, hence their cumulative scoring was artificially small. Since risk is a weighted probability and all the phases of flight are mutually exclusive, the risk of any given flight is the sum of the risks for each individual phase. This makes it important to assess a threat or error each time it appears. To compensate for the way the problem in the survey was structured in not always asking the questions in the same way (ɸ phase issue), a rule was made that multiplied the risk value times the number of phases where the risk was relevant in the sense that it could be a factor in an accident.

There were two other problems in the survey that needed to be corrected:

Questions unanswered by the respondents. An unanswered question automatically assigns an unwanted 0 risk. In order to correct this we calculated the average risk per factor per phase of flight and used this value to fill in for unanswered questions.

Outliers. An outlier is an observation that lies an abnormal distance from other values in a random sample from a population. This definition provides discretion for the analyst to determine the distance.

Trimming of the outliers was done only on the high side of the mean because the multiplicative effect of the risk formula exaggerated the effects of outliers. All outliers were trimmed 1.6 standard deviations greater than the mean. Trimming was done at the finest level (risk per factor per phase per generation). This is because risk varies per factor with the phase of flight; that is another reason why questions regarding each factor should be asked for each phase. Had the correlations been done using the corrected average risk per factor per generation, the results would be the same. The methodology yields the following values:

1. Average risk for each threat or error per each phase of flight per generation on a scale of 1-25

2. Cumulative risk scoring for each threat or error for a given flight per generation

3. Corrected (for unanswered questions and outliers) average risk for each threat and error in each phase of flight per generation on a scale of 1-25

4. Corrected cumulative risk scoring per threat and error by generation leading to ranking

5. Training Criticality in the same format as risk values above

6. Distribution of the risk by factor per phase

7. Distribution of the risk by factor per phase by generation

8. Standard Deviation of risk (generation factor and phase)

8.3.9 Participation in data sharing groups

There are opportunities to share relevant operational and training data between operators. The relevance of data from other operators depends on the similarity of aircraft types, destinations, training programs and other factors. While some of such data may be valuable, care must be taken not to drive the training program too extensively on the basis of such external data.

Aircraft manufacturers share information on fleet-wide trends and individual events of concern. Such information may be very useful to the operators of the aircraft type/family in question. Training and operational conferences organized by the manufacturers are an important opportunity to access such data.

8.3.10 Integration of analysis

Any data system used has its own strengths, weaknesses and bias. In order to overcome shortcomings of individual data analysis, whether it is FDA, flight deck monitoring or safety reporting systems, analysis methods should be used in an integrated manner. For example, FDA could well identify problems without providing the reason as to why they have occurred while flight deck monitoring and/or a confidential reporting system could well shed light on the root causes and help define the most effective remedies.

With the exception of training data, all relevant data usually resides within the safety department, as does the expertise for analysis. Collecting all the necessary operational data and analyzing it in combination with training data requires a close liaison between the safety and the training departments.

8.3.11 Conclusions and recommendations

It is not the intention of this manual to fully describe the means, by which an operator will combine analyses and determine variations from the EBT baseline program, but the following are indications of methods by which programs should be adjusted.

The existence of high quality robust operational data is a powerful tool with which to adjust priorities in training, in particular to provide justification for reductions in frequency of certain topics, in order to provide capacity in the training program to address operator identified issues and risks. Effectiveness of these remedies depends also on clear unbiased and effective reporting from the training system, including initial operator experience and line checks. Training data can determine the effectiveness of any remediation and validate that desired improvements and mitigations have been achieved.

APPENDIX A

Competencies and Behavioral Indicators

Note: Demonstration of the competencies can be assessed using the behavioral indicators, which should meet the required level of performance, as established by the operator for its specific operation.

Competency	**Competency Description**	**Behavioral indicator**
Application of Procedures	Identifies and applies procedures in accordance with published operating instructions and applicable regulations, using the appropriate knowledge.	Identifies the source of operating instructions Follows SOP's unless a higher degree of safety dictates an appropriate deviation Identifies and follows all operating instructions in a timely manner Correctly operates aircraft systems and associated equipment Complies with applicable regulations. Applies relevant procedural knowledge
Communication	Demonstrates effective oral, non-verbal and written communications, in normal and non-normal situations.	Ensures the recipient is ready and able to receive the information Selects appropriately what, when, how and with whom to communicate Conveys messages clearly, accurately and concisely Confirms that the recipient correctly understands important information Listens actively and demonstrates understanding when receiving information Asks relevant and effective questions Adheres to standard radiotelephone phraseology and procedures Accurately reads and interprets required company and flight documentation Accurately reads, interprets, constructs and responds to datalink messages in English Completes accurate reports as required by operating procedures Correctly interprets non-verbal communication Uses eye contact, body movement and gestures that are consistent with and support verbal messages
Aircraft Flight Path Management, automation	Controls the aircraft flight path through automation, including appropriate use of flight management system(s) and guidance.	Controls the aircraft using automation with accuracy and smoothness as appropriate to the situation Detects deviations from the desired aircraft trajectory and takes appropriate action Contains the aircraft within the normal flight envelope Manages the flight path to achieve optimum operational performance Maintains the desired flight path during flight using automation whilst managing other tasks and distractions Selects appropriate level and mode of automation in a timely manner considering phase of flight and workload Effectively monitors automation, including engagement and automatic mode transitions
Aircraft Flight Path Management, manual control	Controls the aircraft flight path through manual flight, including appropriate use of flight management system(s) and flight guidance systems.	Controls the aircraft manually with accuracy and smoothness as appropriate to the situation Detects deviations from the desired aircraft trajectory and takes appropriate action Contains the aircraft within the normal flight envelope Controls the aircraft safely using only the relationship between aircraft attitude, speed and thrust Manages the flight path to achieve optimum operational performance Maintains the desired flight path during manual flight whilst managing other tasks and distractions Selects appropriate level and mode of flight guidance systems in a timely manner considering phase of flight and workload Effectively monitors flight guidance systems including engagement and automatic mode transitions

Competency	Competency Description	Behavioral indicator
Leadership and Teamwork	Demonstrates effective leadership and team working.	Understands and agrees with the crew's roles and objectives. Creates an atmosphere of open communication and encourages team participation Uses initiative and gives directions when required Admits mistakes and takes responsibility Anticipates and responds appropriately to other crew members' needs Carries out instructions when directed Communicates relevant concerns and intentions Gives and receives feedback constructively Confidently intervenes when important for safety Demonstrates empathy and shows respect and tolerance for other people. Engages others in planning and allocates activities fairly and appropriately according to abilities Addresses and resolves conflicts and disagreements in a constructive manner Projects self-control in all situations
Problem Solving and Decision Making	Accurately identifies risks and resolves problems. Uses the appropriate decision-making processes.	Seeks accurate and adequate information from appropriate sources Identifies and verifies what and why things have gone wrong Employ(s) proper problem-solving strategies Perseveres in working through problems without reducing safety Uses appropriate and timely decision-making processes Sets priorities appropriately Identifies and considers options effectively. Monitors, reviews, and adapts decisions as required Identifies and manages risks effectively Improvises when faced with unforeseeable circumstances to achieve the safest outcome
Situation Awareness	Perceives and comprehends all of the relevant information available and anticipates what could happen that may affect the operation.	Identifies and assesses accurately the state of the aircraft and its systems Identifies and assesses accurately the aircraft's vertical and lateral position, and its anticipated flight path. Identifies and assesses accurately the general environment as it may affect the operation Keeps track of time and fuel Maintains awareness of the people involved in or affected by the operation and their capacity to perform as expected Anticipates accurately what could happen, plans and stays ahead of the situation Develops effective contingency plans based upon potential threats Identifies and manages threats to the safety of the aircraft and people. Recognizes and effectively responds to indications of reduced situation awareness.
Workload Management	Manages available resources efficiently to prioritize and perform tasks in a timely manner under all circumstances.	Maintains self-control in all situations Plans, prioritizes and schedules tasks effectively Manages time efficiently when carrying out tasks Offers and accepts assistance, delegates when necessary and asks for help early Reviews, monitors and cross-checks actions conscientiously Verifies that tasks are completed to the expected outcome Manages and recovers from interruptions, distractions, variations and failures effectively

In the context of Threat and Error Management (TEM), competencies serve as countermeasures. (Appendix C)

APPENDIX B

Instructor Training

The following is intended as an example of the integration of EBT focused training within an ab initio instructor training program. The example describes only the relevant objectives and focus areas. It is assumed that any ab-initio training course will develop the competencies described in ICAO Doc 9868 PANS-TRG Chapter 6[1].

General

The objective is to develop the ability to train aviation based knowledge and skills and attitudes, including human factors.

By the end of the course instructor trainees will be able:

- To learn how to make adequate preparation for the conduct of training.
- To use different training techniques.
- To learn how to develop effective relationships with trainees.
- To clearly define the objectives of a training session.
- To understand trainees needs & how they want to be trained.
- To transfer information and key messages effectively and efficiently.
- To manage a training session appropriately.
- To understand the subject of human factors and behavior.
- To learn how to manage CRM issues on training sessions.
- To be able to manage difficult situations and people effectively.
- To assess a trainee’s performance against a defined standard.
- To recognize the importance of making accurate and timely progress reports.
- To know how to continuously develop their own training skills.
- To understand the knowledge, skills and attitudes of an effective trainer.
- To understand learning processes and styles.

The course is intended to develop a clear but practical understanding of the learning process and the critical importance of the role of an instructor in providing an effective environment, in addition to root cause analysis, the use of facilitation techniques, and the assessment of outcomes using video role play and live debriefing.

---

[1] This refers to provisions introduced in amendment 2 of ICAO Doc 9868, PANS-TRG.

Outline Footprint

Day 1	**Day 2**
• Learning processes and styles Theory on how people learn, the process they go through and the different ways that people prefer to learn. • Training experiences Identifying the knowledge, skills and attitudes required of a trainer. • Elements of effective training Identifying and prioritizing what is important for effective training. • Communication Recognizing the difficulty of communications, and developing skills for effective communications.	• Understanding behavior Understanding principles of behavior and why people behave in various situations. • Managing behavior Developing skills for managing difficult situations and people. • Training preparation Learning what to consider and how to prepare for training. • Body language Understanding the importance of body language and techniques for improving your capability in this subject.
Day 3	**Day 4**
• Human factors Understanding what human factors are and how they can be categorized. • Crew resources management Introduction to EBT competencies and learning how to assess a crew. • Instruction Developing instructional skills.	• Facilitation Understanding the importance of facilitation and when the technique should be used. • Questioning Understanding different types of questions and when to use them. • Developing facilitation skills Exercises in facilitation. • Receiving and giving feedback. Developing skills in how to receive and give feedback.
Day 5	
• Issues specific to flight instruction Identifying the issues specific to flight instruction and how to manage them. • Common errors and problems Being prepared for common errors and problems associated with trainees and how to manage them. • Report writing and data capture Learning how to write adequate training reports. • Practical training exercises Exercises to utilize all tools learnt during the course including briefing, demonstration and training, and debriefing.	

The following abbreviated course is intended as an example for instructors already qualified, prior to the introduction of EBT. It is assumed that the instructor is already qualified and has been assessed as competent according to ICAO Doc 9868 PANS-TRG Chapter 6.

Day 1	**Day 2**
• Review of instructional techniques course Measure of understanding and refresher on learning from initial course. • Trainee learning styles Identifying the different trainee learning styles and how to adapt. • Instructional skills Developing instructional and briefing skills. • EBT Competencies Full understanding of competencies, how they are assessed and the grading process. • Competency assessment Practice in assessing competencies.	• Review of training techniques Review of the differences between directed instruction and facilitation. • Situational training Understanding how to adapt training to different training situations. • Competency assessment and debriefing. Practice in competency assessment and debriefing using facilitation of real crew activities.
Day 3	
• Competency assessment and debriefing. Continued practice in competency assessment and debriefing using facilitation. • Final exercises Briefing, instruction and developing debriefing skills including assessment of competencies.	

APPENDIX C

Threat and Error Management (TEM)

Introduction

Threat and error management (TEM) is a framework that practically integrates Human Factors into aviation operations. It is not a revolutionary concept but 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.

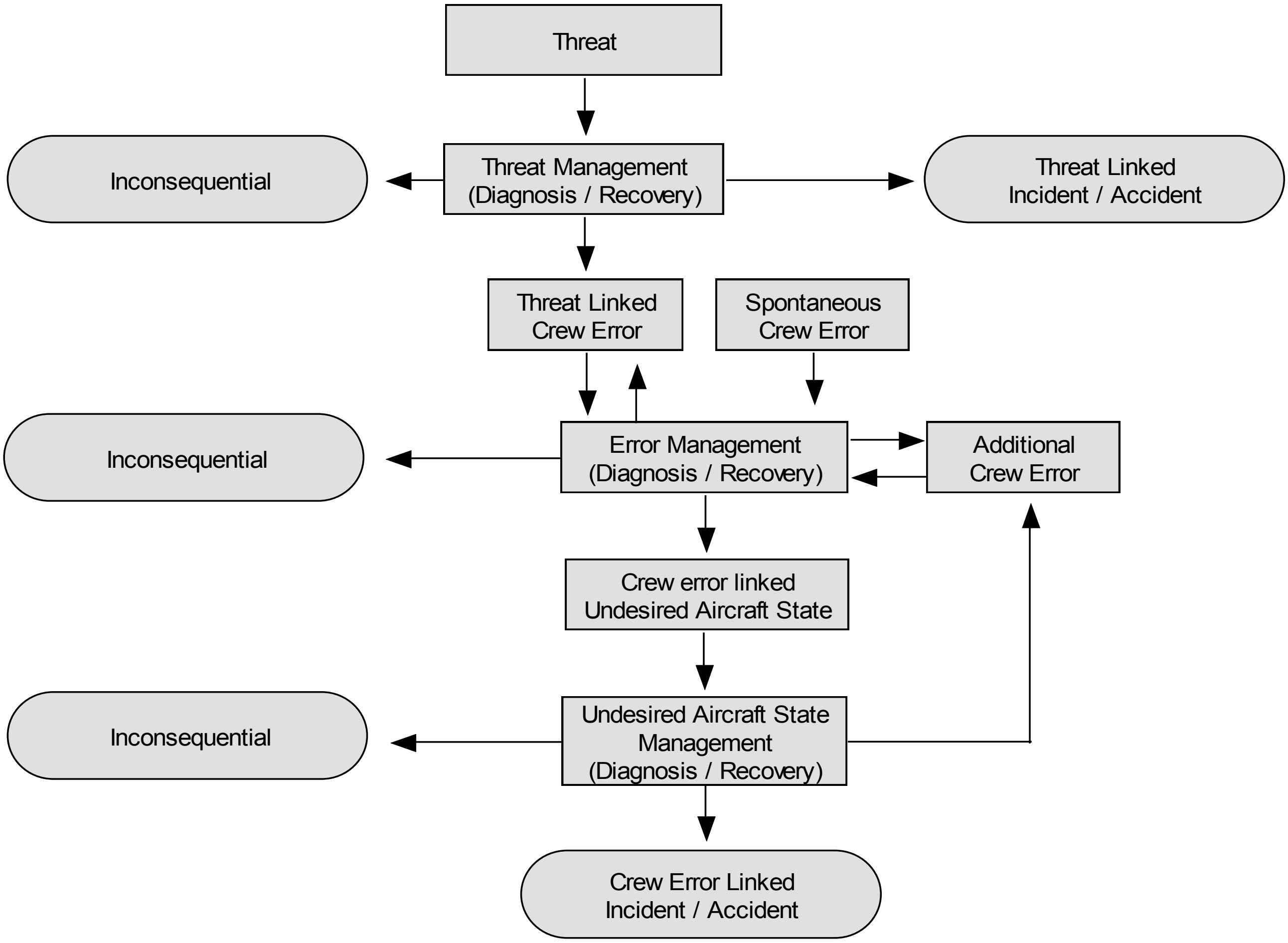
TEM developed as a product of the collective industry experience. This experience fostered the recognition that past studies and operational consideration of human performance in aviation had largely overlooked the most important factor influencing human performance in dynamic work environments. That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

The recognition of the influence of the operational context in human performance further 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. TEM training is now embedded in ICAO SARPs as an intrinsic part of Flight Crew Licensing requirements.

The TEM framework

TEM is a framework that assists in understanding, from an operational perspective, the inter-relationship between safety and human performance in dynamic and challenging operational contexts.

The TEM framework focuses simultaneously on the operational context and the people undertaking operational duties in such context. The framework is descriptive, practical 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 practical as pilots may use it intuitively and is diagnostic because it allows quantifying the complexities of the operational context in relation to the description of human performance in that context, and vice-versa.



The TEM framework can be used in several ways. As a safety analysis tool, the framework can focus on a single event, as is the case with accident/incident analysis; or it can be used to understand systemic patterns within a large set of events, as is the case with operational audits. It can be used as a licensing tool, helping clarify human performance needs, strengths and vulnerabilities, allowing the definition of competencies from a broader safety management perspective. Importantly the TEM framework can be used as a training and assessment tool, both at an individual and systemic level. It can help an organization improve the effectiveness of its training interventions, and consequently of its organizational safeguards.

The components of the TEM framework

There are three basic components in the TEM framework from the perspective of flight crews. These are threats, errors and undesired aircraft states. The framework 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 framework, as important as threat and error management. Undesired aircraft state management largely represents the last opportunity to avoid an unsafe outcome and thus maintain safety margins in flight operations.

a. Threats

Threats are defined as “events or errors that occur beyond the influence of the flight crew, increase operational complexity, and which must be managed to maintain the margins of safety”. During typical flight operations, flight crews have to manage various contextual complexities. Such complexities would include, for example, dealing with adverse meteorological conditions, airports surrounded by high mountains, congested airspace, aircraft malfunctions, errors committed by other people outside of the cockpit, such as air traffic controllers, flight attendants or maintenance workers, and so forth. The TEM framework 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 actions in advance, or prepare for a congested airport by ensuring that they keep a watchful eye for other aircraft during the approach. Some threats can occur unexpectedly, such as an in-flight aircraft malfunction that happens suddenly and without warning. In this case, flight crews must apply skills and knowledge acquired through training and operational experience. Lastly, some threats may not be directly obvious to, or observable by, flight crews immersed in the operational context, although they may be uncovered by safety analyses. These are considered latent threats. Examples of latent threats 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 are detected with the necessary anticipation 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. The threat-error linkage is not necessarily straightforward and it is not possible to establish a linear relationship, or one-to-one mapping between threats, errors and undesired states. However, archival data demonstrates that mismanaged threats are normally linked to flight crew errors, which in turn are oftentimes linked to undesired aircraft states. Threat management provides a highly proactive strategy to maintain safety margins in flight operations by mitigating safety-compromising situations. As threat managers, flight crews are the last line of defense to keep threats from impacting flight operations.

Table C-1 presents examples of threats, grouped under two basic categories derived from the TEM framework. Environmental threats occur due to the environment in which flight operations take place. 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. Organizational threats are usually latent in nature. Flight crews still remain the last line of defense, 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, inoperative aids, 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, and ground crew error. ↗ **Dispatch:** dispatch paperwork event/error. ↗ **Documentation:** manual error, chart error. ↗ **Other:** crew scheduling event

Table C-1. Examples of threats

b. 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 reduce the margins of safety and increase the probability of adverse events. They can be errors of commission or omission.

Errors can be linked to threats or be spontaneous (i.e., without direct linkage to specific, obvious threats). They can also form part of an error chain. Examples of errors would include lapses in handling, executing a wrong automation mode, failing to give a required callout, or misinterpreting an ATC clearance. Regardless of the type of error, the 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 the safety perspective, operational errors that are detected, promptly responded to (i.e., properly managed) and do not reduce margins of safety in flight operations become operationally inconsequential. In addition to its safety value, proper error management represents an example of successful human performance, presenting both learning and training value.

Capturing how errors are managed is more than capturing the prevalence of different types of error. It is important 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 C-2 presents examples of errors, grouped under three basic categories derived from the TEM framework. In the TEM concept, errors have to be "observable" and therefore, the TEM framework uses the "primary interaction" as the point of reference for defining the error categories.

The TEM framework 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 aircraft handling error, the pilot or flight crew member must be interacting with the aircraft (e.g. through its controls, automation or systems). In order to be classified as procedural error, the pilot or flight crew member must be interacting with a procedure (e.g. checklists, SOPs, etc.). In order to be classified as communication error, the pilot or flight crew member must be interacting with people (air traffic controller, ground crew, other crew members, etc.).

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

Aircraft handling errors	↗ Manual handling/flight controls: vertical/lateral and/or speed deviations, incorrect flaps/speedbrakes, thrust reverser or power settings. ↗ Automation: incorrect altitude, speed, heading, autothrottle 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 selected. ↗ 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. ↗ Callouts: omitted/incorrect callouts ↗ 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

Table C-2. Examples of errors

c. Undesired Aircraft States

Undesired aircraft states are defined as ‘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 landing distance limited runway. 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 C-3 presents examples of undesired aircraft states, grouped under three basic categories derived from the TEM framework.

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-centerline 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 C-3. Examples of undesired aircraft states

An important 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 (FMC). The flight crew subsequently identifies the error during a crosscheck prior to the Final Approach Fix (FAF). However, instead of reverting to a basic mode (e.g. heading) or manually flying the desired track, both flight crew become involved in attempting to reprogram the correct approach prior to reaching the FAF. As a result, the aircraft flies through the localizer, descends late, and the approach becomes unstable. 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 framework assists in educating flight crews that, when the aircraft is in an undesired state, the basic task of the flight crew 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 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 unstable approach (undesired aircraft state) that results in a runway excursion (outcome).

The training and remedial implications of this differentiation are of significance. While at the undesired aircraft state stage, the flight crew has the possibility, through appropriate TEM, of recovering the situation, 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 is not possible.

Countermeasures

Flight crews must, as part of their normal operational duties, 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 energies to the application of countermeasures to ensure margins of safety during flight operations. Empirical observations during training and checking suggest that, as much as 70% of flight crew activities may be countermeasures-related activities.

All countermeasures are necessarily flight crew actions. However, some countermeasures to threats, errors and undesired aircraft states that flight crew's employ builds 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. The following would be examples of "hard" resources that flight crews employ as systemic-based countermeasures:

- Airborne Collision Avoidance System (ACAS);
- Ground Proximity Warning System (GPWS),
- Standard operation procedures (SOPs);
- Checklists;
- Briefings;
- Training.

Other countermeasures are more directly related to the human contribution to the safety of flight operations. These are personal strategies and tactics, individual and team countermeasures, that typically include canvassed skills, knowledge 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;
- 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, such as the behavioral indicators listed in Appendix A. Table C-4 expands the 3 categories of countermeasures.

SOP Briefing	The required briefing was interactive and operationally thorough
Plans stated	Operational plans and decisions were communicated and acknowledged
Workload assignment	Roles and responsibilities were defined for normal and non-normal situations
Contingency management	Crew members developed effective strategies to manage threats to safety
Monitor / cross-check	Crew members actively monitored and cross-checked systems and other crew members
Workload management	Operational tasks were prioritized and properly managed to handle primary flight duties
Automation management	Automation was properly managed to balance situational and/or workload requirements
Evaluation/modification of plans	Existing plans were reviewed and modified when necessary
Inquiry	Crew members asked questions to investigate and/or clarify current plans of action
Assertiveness	Crew members stated critical information and/or solutions with appropriate persistence

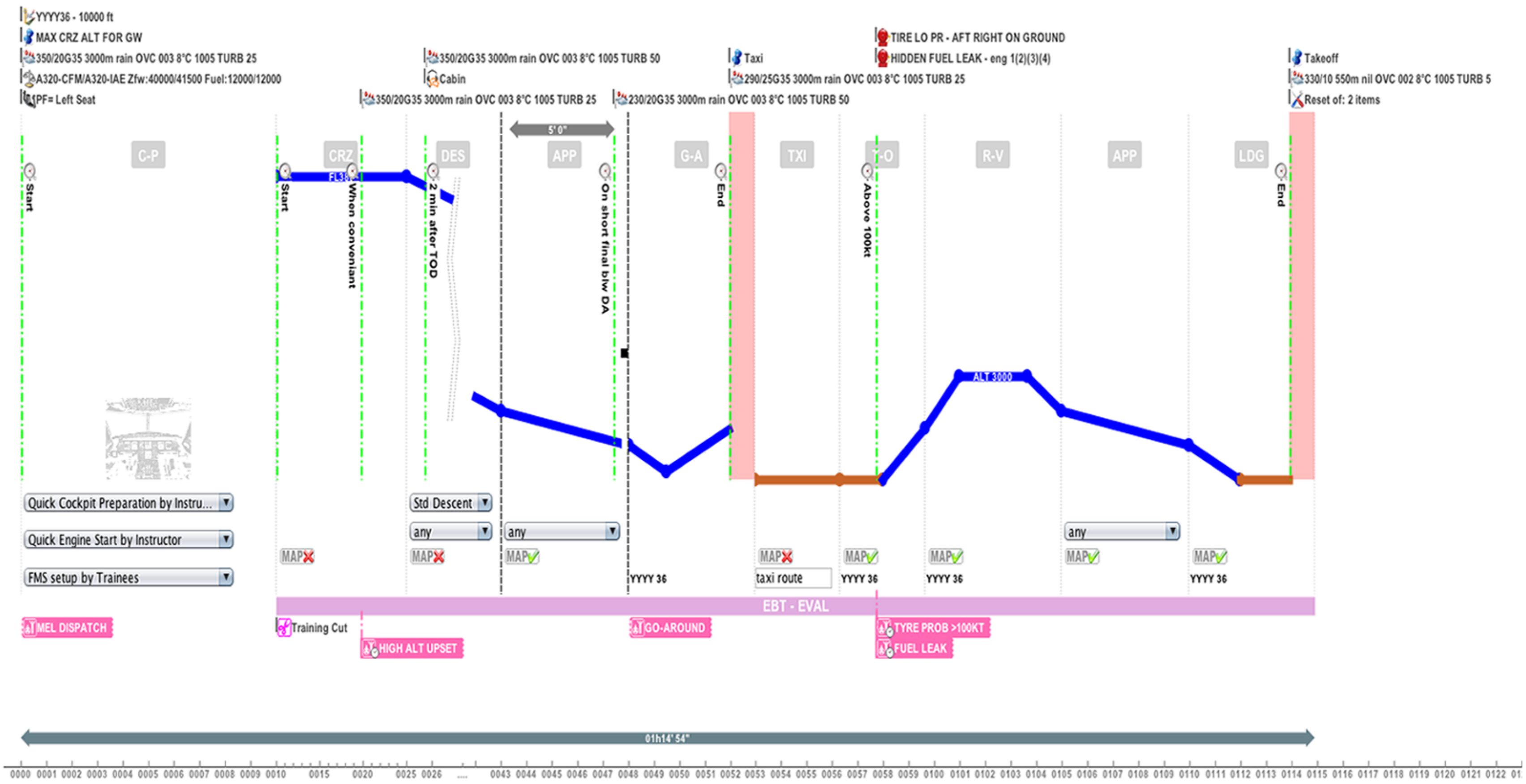
Table C-4. Examples of individual and team countermeasures

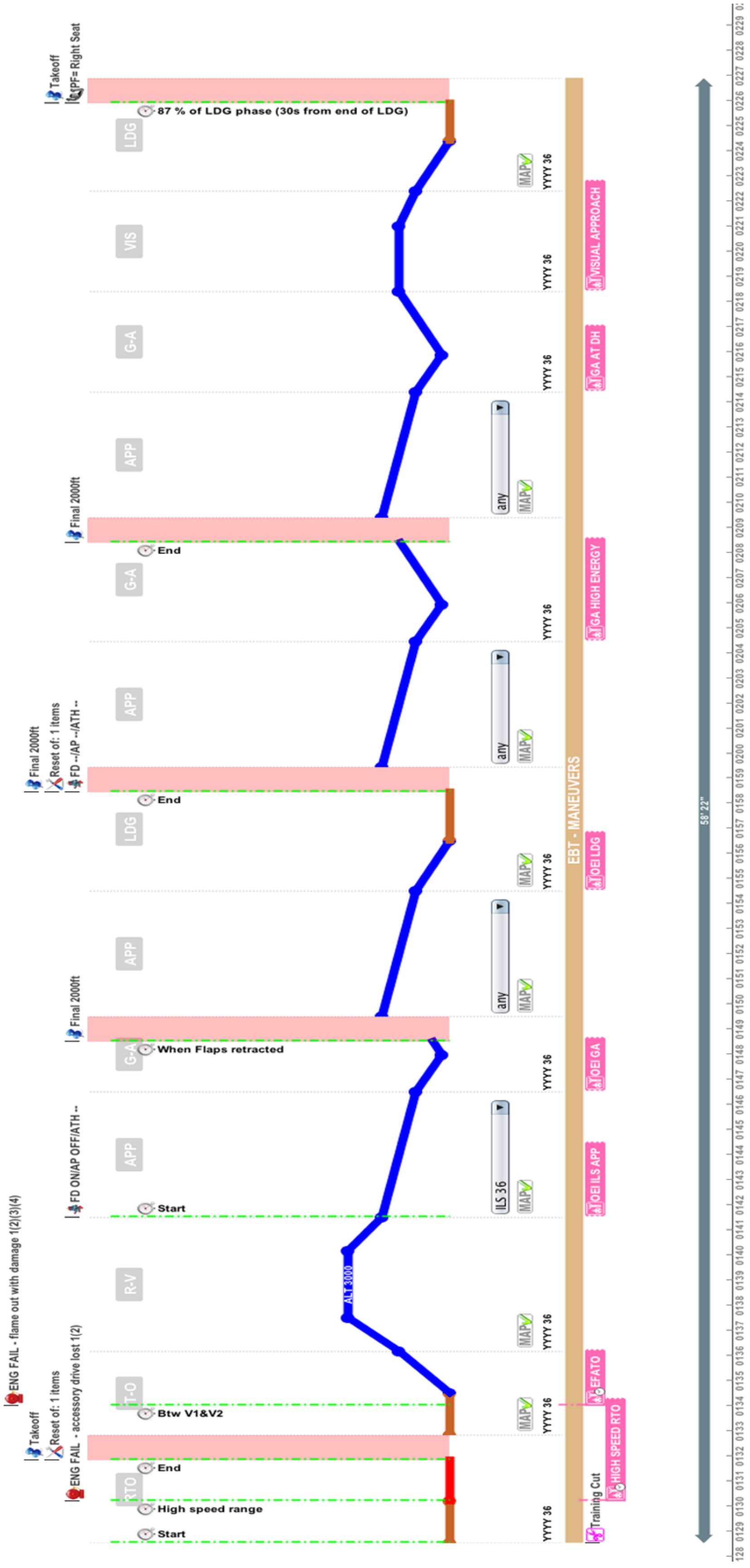
APPENDIX D

Example EBT Module

This Appendix contains an example EBT module. The following abbreviations are used exclusively in this example and are in addition to the list of abbreviations in the glossary of terms. The abbreviations used in METARs are not listed below.

AFS	Auto flight system
ALT	Altitude
AP	Autopilot
ATH	Autothrottle
BLW	Below
BRK	Break
Btw	Between
CB	Cumulonimbus
CFM/IAE	(CFM or IAE engines)
CL	Centre line
C-P	Cockpit preparation
CRZ	Cruise
DH	Decision height
EFATO	Engine failure at take-off
Eng	Engine
EVAL	Evaluation
FD	Flight director
FOB	Fuel on board
GP	Glide Path
GW	Gross weight
ILS	Instrument landing system
LHS	Left hand seat
LO PR	Low pressure
OEI	One engine inoperative
P-B	Push-back
PROB	Problem
RHS	Right hand seat
RTO	Rejected take-off
R-V	Radar Vector
SBT	Scenario-based training
SCM	Senior cabin crew member
T/L	Thrust levers
T/O, T-O	Take-off
TOD	Top of Descent
TURB	Turbulence
TXI	Taxi
VIS	Visual (approach)
Vstall	Stall speed
WV	weather
YYYY36	(designates an aerodrome and runway)
ZFW	Zero fuel weight


YYYY36 - 10000 ft
MAX CRZ ALT FOR GW
350/20G35 3000m rain OVC 003 8°C 1005 TURB 25
A320-CFM/A320-IAE Zfw:40000/41500 Fuel:12000/12000
PF= Left Seat
350/20G35 3000m rain OVC 003 8°C 1005 TURB 25
350/20G35 3000m rain OVC 003 8°C 1005 TURB 50
Cabin
230/20G35 3000m rain OVC 003 8°C 1005 TURB 50
Taxi
290/25G35 3000m rain OVC 003 8°C 1005 TURB 25
TIRE LO PR - AFT RIGHT ON GROUND
HIDDEN FUEL LEAK - eng 1(2)(3)(4)
Takeoff
330/10 550m nil OVC 002 8°C 1005 TURB 5
Reset of: 2 items
C-P
CRZ
DES
APP
G-A
TXI
T-O
R-V
APP
LDG
5' 0"
Start
Start
FL3
When conveniant
2 min after TOD
On short final blw DA
End
Above 100kt
End
ALT 3000
Quick Cockpit Preparation by Instru...
Quick Engine Start by Instructor
FMS setup by Trainees
Std Descent
any
any
any
MAP
taxi route
YYYY 36
YYYY 36
YYYY 36
YYYY 36
EBT - EVAL
MEL DISPATCH
Training Cut
HIGH ALT UPSET
GO-AROUND
TYRE PROB >100KT
FUEL LEAK
01h14' 54"
0000 0001 0002 0003 0004 0005 0006 0007 0008 0009 0010 0015 0020 0025 0026 .... 0043 0044 0045 0046 0047 0048 0049 0050 0051 0052 0053 0054 0055 0056 0057 0058 0059 0100 0101 0102 0103 0104 0105 0106 0107 0108 0109 0110 0111 0112 0113 0114 0115 0116 0117 0118 0119 0120 0121 0122 01


ENG FAIL - accessory drive lost 1(2)
Reset of: 1 items
Takeoff
ENG FAIL - flame out with damage 1(2)(3)(4)
FD ON/AP OFF/ATH --
Final 2000ft
Final 2000ft
Reset of: 1 items
FD --/AP --/ATH --
Final 2000ft
Takeoff
PF= Right Seat
RTO
T-O
R-V
APP
G-A
APP
LDG
APP
G-A
APP
G-A
VIS
LDG
Start
High speed range
End
Btw V1&V2
ALT 3000
Start
When Flaps retracted
End
End
87 % of LDG phase (30s from end of LDG)
ILS 36
any
any
any
MAP
YYYY 36
EBT - MANEUVERS
Training Cut
HIGH SPEED RTO
EFATO
OEI ILS APP
OEI GA
OEI LDG
GA HIGH ENERGY
GA AT DH
VISUAL APPROACH
58' 22"
128 0129 0130 0131 0132 0133 0134 0135 0136 0137 0138 0139 0140 0141 0142 0143 0144 0145 0146 0147 0148 0149 0150 0151 0152 0153 0154 0155 0156 0157 0158 0159 0200 0201 0202 0203 0204 0205 0206 0207 0208 0209 0210 0211 0212 0213 0214 0215 0216 0217 0218 0219 0220 0221 0222 0223 0224 0225 0226 0227 0228 0229 0:

DISPATCH WITH MEL ITEM (MEL DISPATCH)

Description:

(TODO) Description of DISPATCH WITH MEL ITEM

References:

(TODO) References of DISPATCH WITH MEL ITEM

Competencies:

- *Application of procedures*

***

HIGH ALTITUDE UPSET (HIGH ALT UPSET)

Description:

(TODO) Description of HIGH ALTITUDE UPSET

References:

(TODO) References of HIGH ALTITUDE UPSET

Competencies:

- *Application of procedures*
- *Communication*
- *Flight path management, manual control*
- *Situation awareness*

***

GO-AROUND

Description:

Go-around, all engines operative

References:

(TODO) References of GO-AROUND

Competencies:

- *Application of procedures*

***

TYRE BURST/DEFLATION ABOVE 100KT (TYRE PROB >100KT)

Description:

(TODO) Description of TYRE BURST/DEFLATION ABOVE 100KT

References:

(TODO) References of TYRE BURST/DEFLATION ABOVE 100KT

Competencies:

- *Application of procedures*
- *Situation awareness*
- *Workload management*

***

FUEL LEAK

Description:

(TODO) Description of FUEL LEAK

References:

(TODO) References of FUEL LEAK

Competencies:

- *Application of procedures*
- *Leadership and teamwork*
- *Situation awareness*

***

REJECTED TAKEOFF HIGH SPEED (HIGH SPEED RTO)

Description:

From initiation of take-off to complete stop (or as applicable to procedure)

References:

(TODO) References of REJECTED TAKEOFF HIGH SPEED

Competencies:

- *Flight path management, manual control*

***

FAILURE OF CRITICAL ENGINE BETWEEN V1 & V2 (EFATO)

Description:

Failure of a critical engine from V1 and before reaching V2 in lowest CAT I visibility conditions

The maneuver is considered to be complete at a point when aircraft is stabilized at normal engine-out climb speed with the correct pitch and lateral control, in trim condition and, as applicable, autopilot engagement

References:

(TODO) References of FAILURE OF CRITICAL ENGINE BETWEEN V1 & V2

Competencies:

- *Application of procedures*
- *Flight path management, manual control*
- *Maintains correct pitch after take-off*

***

ENGINE-OUT ILS APPROACH (OEI ILS APP)

Description:

With a critical engine failed, manually flown normal precision approach to DA without visual reference

References:

(TODO) References of ENGINE-OUT ILS APPROACH

Competencies:

- *Flight path management, manual control*

***

ENGINE OUT GO-AROUND (OEI GA)

Description:

With a critical engine failed, manually flown go-around, the whole maneuver to be flown without visual reference

The maneuver is considered to be complete at a point when aircraft is stabilized at normal engine-out climb speed with the correct pitch and lateral control, in trim condition and, as applicable, autopilot engagement (describe generally critical part of maneuver)*

References:

(TODO) References of ENGINE OUT GO-AROUND

Competences:

- *Flight path management, manual control*

***

ENGINE-OUT LANDING (OEI LDG)

Description:

With a critical engine failed, normal landing

References:

(TODO) References of ENGINE-OUT LANDING

Competences:

- *Flight path management, manual control*

***

GO AROUND HIGH ENERGY (GA HIGH ENERGY)

Description:

High energy, initiation during the approach at 150 to 300 m (500 to 1000 ft) below the missed approach level off altitude

References:

(TODO) References of GO AROUND HIGH ENERGY

Competencies:

- *Application of procedures*

***

GO-AROUND AT MINIMA (GA AT DH)

Description:

(TODO) Description of GO-AROUND AT MINIMA

References:

(TODO) References of GO-AROUND AT MINIMA

Competencies:

- *Application of procedures*
- *Flight path management, manual control*

***

VISUAL APPROACH

Description:

(TODO) Description of VISUAL APPROACH

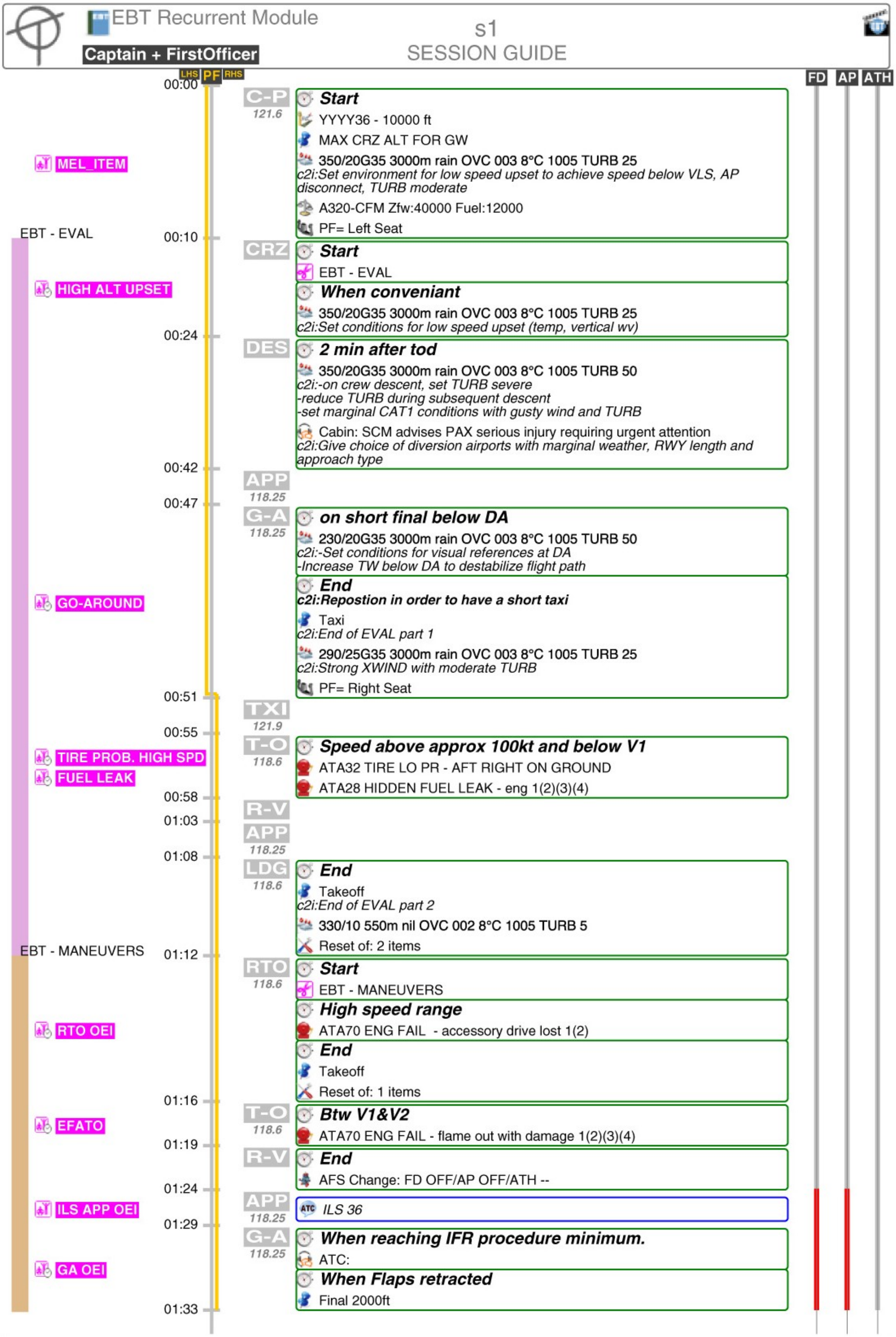
References:

(TODO) References of VISUAL APPROACH

Competences:

- *Flight path management, manual control*

***



EBT Recurrent Module

Captain + FirstOfficer

s1

SESSION GUIDE

00:00 C-P 121.6

Start
YYYY36 - 10000 ft
MAX CRZ ALT FOR GW
350/20G35 3000m rain OVC 003 8°C 1005 TURB 25
c2i:Set environment for low speed upset to achieve speed below VLS, AP disconnect, TURB moderate
A320-CFM Zfw:40000 Fuel:12000
PF= Left Seat

MEL_ITEM

EBT - EVAL

00:10 CRZ

Start
EBT - EVAL

When conveniant
350/20G35 3000m rain OVC 003 8°C 1005 TURB 25
c2i:Set conditions for low speed upset (temp, vertical wv)

HIGH ALT UPSET

00:24 DES

2 min after tod
350/20G35 3000m rain OVC 003 8°C 1005 TURB 50
c2i:-on crew descent, set TURB severe
-reduce TURB during subsequent descent
-set marginal CAT1 conditions with gusty wind and TURB
Cabin: SCM advises PAX serious injury requiring urgent attention
c2i:Give choice of diversion airports with marginal weather, RWY length and approach type

00:42 APP 118.25

00:47 G-A 118.25

on short final below DA
230/20G35 3000m rain OVC 003 8°C 1005 TURB 50
c2i:-Set conditions for visual references at DA
-Increase TW below DA to destabilize flight path

End
c2i:Repostion in order to have a short taxi
Taxi
c2i:End of EVAL part 1
290/25G35 3000m rain OVC 003 8°C 1005 TURB 25
c2i:Strong XWIND with moderate TURB
PF= Right Seat

GO-AROUND

00:51 TXI 121.9

00:55 T-O 118.6

Speed above approx 100kt and below V1
ATA32 TIRE LO PR - AFT RIGHT ON GROUND
ATA28 HIDDEN FUEL LEAK - eng 1(2)(3)(4)

TIRE PROB. HIGH SPD
FUEL LEAK

00:58 R-V

01:03 APP 118.25

01:08 LDG 118.6

End
Takeoff
c2i:End of EVAL part 2
330/10 550m nil OVC 002 8°C 1005 TURB 5
Reset of: 2 items

EBT - MANEUVERS

01:12 RTO 118.6

Start
EBT - MANEUVERS

High speed range
ATA70 ENG FAIL - accessory drive lost 1(2)

End
Takeoff
Reset of: 1 items

RTO OEI

01:16 T-O 118.6

Btw V1&V2
ATA70 ENG FAIL - flame out with damage 1(2)(3)(4)

EFATO

01:19 R-V

End
AFS Change: FD OFF/AP OFF/ATH --

01:24 APP 118.25

ILS 36

ILS APP OEI

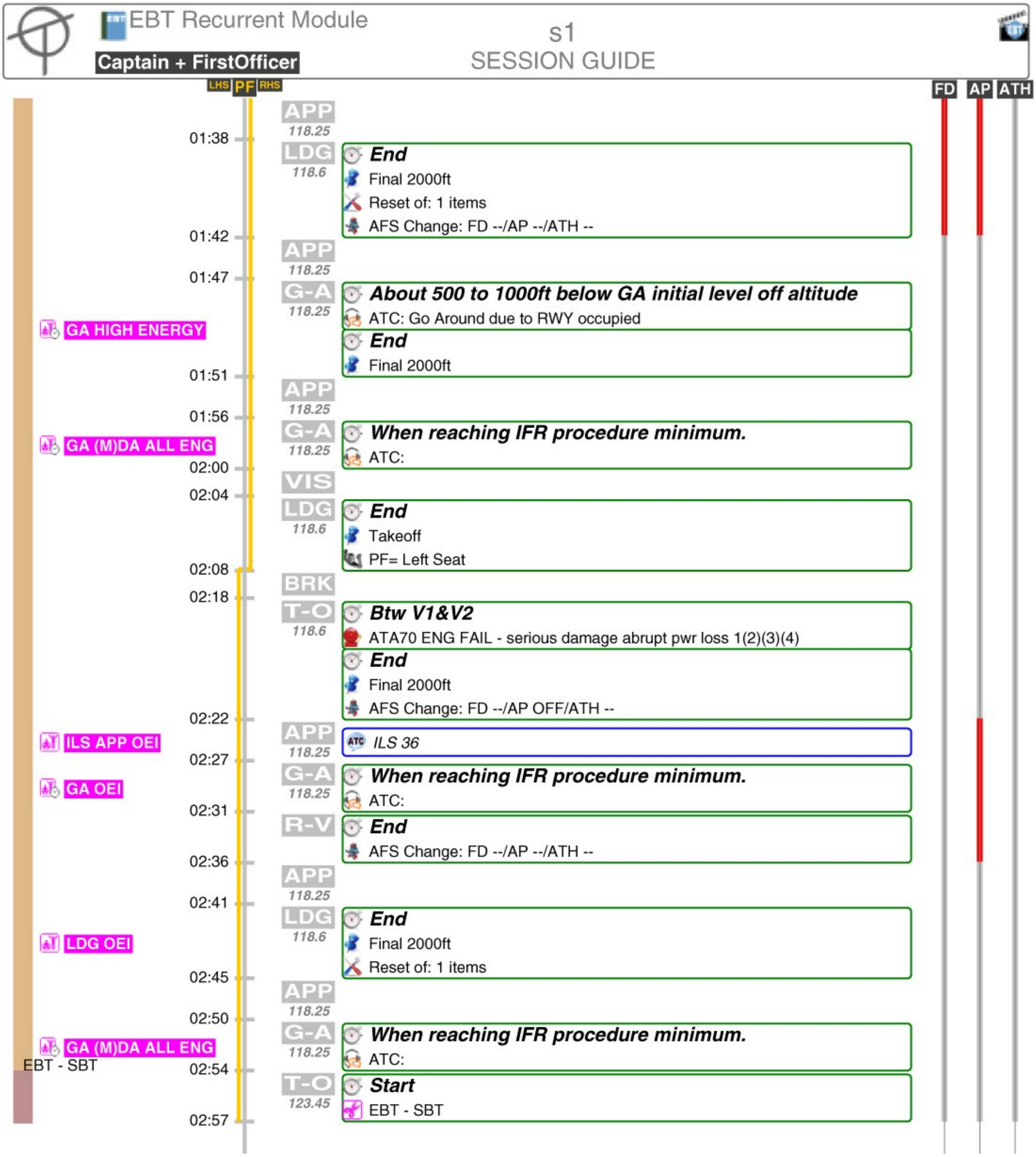
01:29 G-A 118.25

When reaching IFR procedure minimum.
ATC:

When Flaps retracted
Final 2000ft

GA OEI

01:33



EBT Recurrent Module

Captain + FirstOfficer

s1
SESSION GUIDE

01:38 APP 118.25

LDG 118.6

End
Final 2000ft
Reset of: 1 items
AFS Change: FD --/AP --/ATH --

01:42 APP 118.25

01:47 G-A 118.25

About 500 to 1000ft below GA initial level off altitude
ATC: Go Around due to RWY occupied

GA HIGH ENERGY

End
Final 2000ft

01:51 APP 118.25

01:56 G-A 118.25

When reaching IFR procedure minimum.
ATC:

GA (M)DA ALL ENG

02:00 VIS

02:04 LDG 118.6

End
Takeoff
PF= Left Seat

02:08 BRK

02:18 T-O 118.6

Btw V1&V2
ATA70 ENG FAIL - serious damage abrupt pwr loss 1(2)(3)(4)

End
Final 2000ft
AFS Change: FD --/AP OFF/ATH --

02:22 APP 118.25

ILS APP OEI

ATC *ILS 36*

02:27 G-A 118.25

When reaching IFR procedure minimum.
ATC:

GA OEI

02:31 R-V

End
AFS Change: FD --/AP --/ATH --

02:36 APP 118.25

02:41 LDG 118.6

End
Final 2000ft
Reset of: 1 items

LDG OEI

02:45 APP 118.25

02:50 G-A 118.25

When reaching IFR procedure minimum.
ATC:

GA (M)DA ALL ENG

EBT - SBT

02:54 T-O 123.45

Start
EBT - SBT

02:57

Trainee Signature: **Instructor Signature:**

Trainee_1 (Captain) Name: **Date:**

Instructor Name:

Assessment Level: Session Phase / Competency

VISUAL APPROACH

Application of procedures	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Communication	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Flight path management, manual control	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Leadership and teamwork	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Situation awareness	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Workload management	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

EBT – MANOEUVERS

Application of procedures	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Flight path management, manual control	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Trainee Signature: **Instructor Signature:**

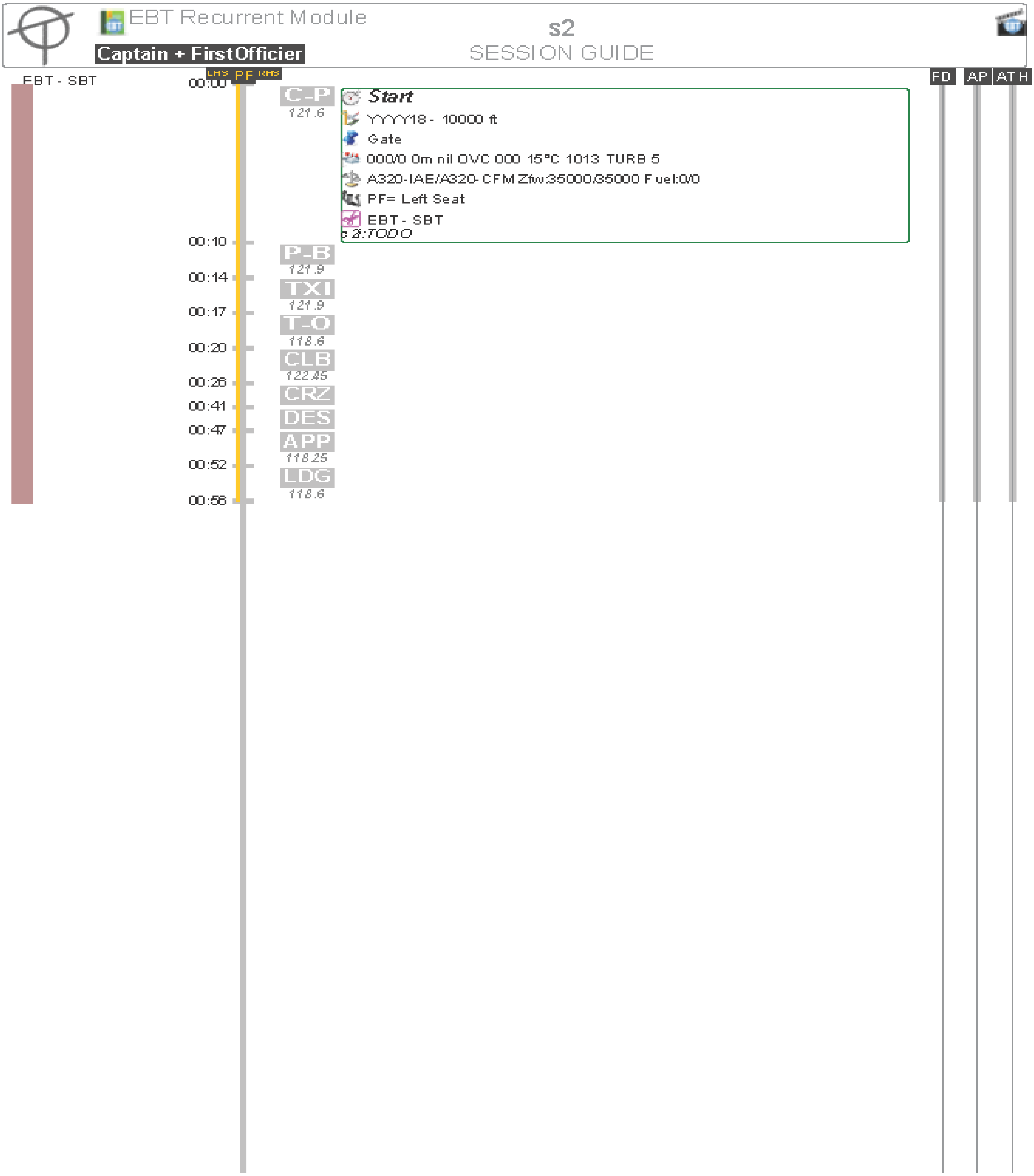
Trainee_2 (First Officer) Name: **Date:**

Instructor Name:

Assessment Level: Session Phase / Competency

VISUAL APPROACH

Application of procedures	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Communication	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Flight path management, manual control	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Leadership and teamwork	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Situation awareness	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Workload management	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5



EBT Recurrent Module

Captain + FirstOfficier

s2

SESSION GUIDE

EBT - SBT

00:00	C-P	121.6
00:10	P-B	121.9
00:14	TXI	121.9
00:17	T-O	118.6
00:20	CLB	122.45
00:26	CRZ	
00:41	DES	
00:47	APP	118.25
00:52	LDG	118.6
00:56		

Start

YYYY18 - 10000 ft

Gate

000/0 0m nil OVC 000 15°C 1013 TURB 5

A320-IAE/A320-CFM Zfw:35000/35000 Fuel:0/0

PF= Left Seat

EBT - SBT

s2:TODO

EBT Recurrent Module
Captain + FirstOfficer
s2
TOPICS LIST

IN SEAT INSTRUCTION (ISI)

Description:
Instructor as PF flies short SID and radar vectored ILS app. Instructor to fly according to a precise scripted scenario which introduces certain errors, e.g.

- *T/O removes hand from T/L at 100kts instead of V1*
- *Noise abatement dep calls for flap at thrust reduction altitude*
- *Fails to obviously take action to avoid CB ahead*
- *During radar vectors does not take up new heading*
- *Calls for flap above limiting speed*
- *Late capture of CL on approach with resulting over bank*
- *Flies marginal stable approach*
- *Deviations from CL and GP*
- *Speed excursions on approach*
- *High pitch during flare*

References:
(TODO) References of NEW EXERCISE

***

LOW ALTITUDE STALL RECOVERY IN DEGRADED FLIGHT CONTROL LAW (STALL RECOVERY)

Description:
EXERCISE DESCRIPTION
STANDARD VISUAL CIRCUIT

- *Autothrottle disarmed and and envelope protections de-activated:*
- *Establish the aircraft in a visual pattern, in downwind, abeam the runway in the first slat/flap setting to commence the standard visual circuit as per operating instructions*
- *Perform a visual pattern and configure the aircraft in accordance with the Standard Operating Procedure (SOP).*

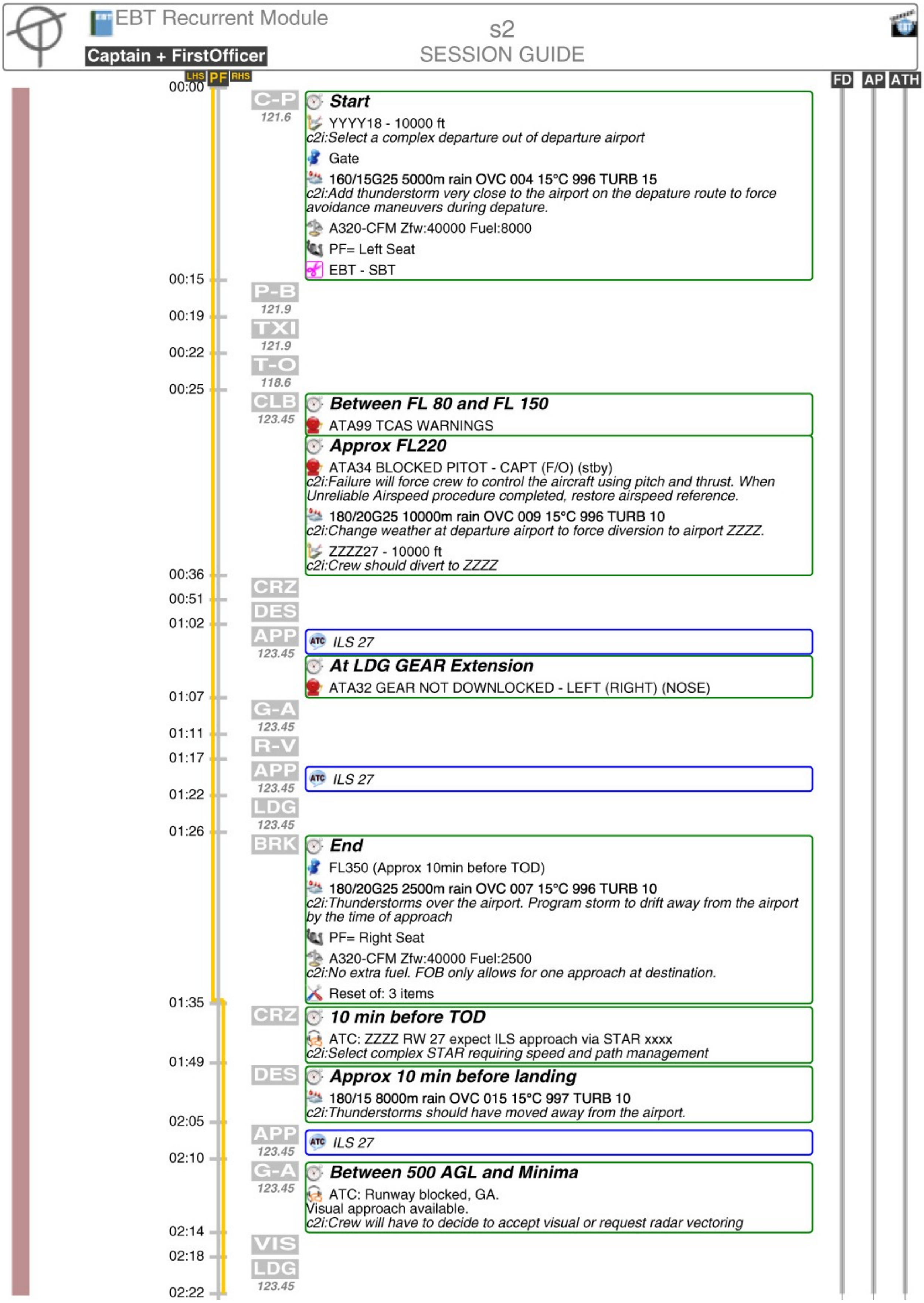
APPROACH TO STALL / STALL

- *When commencing the base turn, request the trainee to reduce thrust to idle, maintain the current altitude and continue the approach visually.*
- *Continue to configure the aircraft in accordance with the Standard Operating Procedure (SOP).*

STALL RECOVERY

- *As soon as any stall indications are recognized (e.g. stick shaker, buffet, etc.) the trainee must apply the actions as stated in operating instructions*
- *After recovery from the stall, stop the exercise.*
- *Both trainees should practice the given exercise as PF*

Note: observe FSTD limitations and unless certified, avoid flight below Vstall
References:
(TODO) References of NEW EXERCISE



EBT Recurrent Module

Captain + FirstOfficer

s2
SESSION GUIDE

00:00 C-P 121.6

Start

YYYY18 - 10000 ft
c2i:Select a complex departure out of departure airport

Gate

160/15G25 5000m rain OVC 004 15°C 996 TURB 15
c2i:Add thunderstorm very close to the airport on the depature route to force avoidance maneuvers during depature.

A320-CFM Zfw:40000 Fuel:8000

PF= Left Seat

EBT - SBT

00:15 P-B 121.9

00:19 TXI 121.9

00:22 T-O 118.6

00:25 CLB 123.45

Between FL 80 and FL 150

ATA99 TCAS WARNINGS

Approx FL220

ATA34 BLOCKED PITOT - CAPT (F/O) (stby)
c2i:Failure will force crew to control the aircraft using pitch and thrust. When Unreliable Airspeed procedure completed, restore airspeed reference.

180/20G25 10000m rain OVC 009 15°C 996 TURB 10
c2i:Change weather at departure airport to force diversion to airport ZZZZ.

ZZZZ27 - 10000 ft
c2i:Crew should divert to ZZZZ

00:36 CRZ

00:51 DES

01:02 APP 123.45

ATC *ILS 27*

At LDG GEAR Extension

ATA32 GEAR NOT DOWNLOCKED - LEFT (RIGHT) (NOSE)

01:07 G-A 123.45

01:11 R-V

01:17 APP 123.45

ATC *ILS 27*

01:22 LDG 123.45

01:26 BRK

End

FL350 (Approx 10min before TOD)

180/20G25 2500m rain OVC 007 15°C 996 TURB 10
c2i:Thunderstorms over the airport. Program storm to drift away from the airport by the time of approach

PF= Right Seat

A320-CFM Zfw:40000 Fuel:2500
c2i:No extra fuel. FOB only allows for one approach at destination.

Reset of: 3 items

01:35 CRZ

10 min before TOD

ATC: ZZZZ RW 27 expect ILS approach via STAR xxxx
c2i:Select complex STAR requiring speed and path management

01:49 DES

Approx 10 min before landing

180/15 8000m rain OVC 015 15°C 997 TURB 10
c2i:Thunderstorms should have moved away from the airport.

02:05 APP 123.45

ATC *ILS 27*

02:10 G-A 123.45

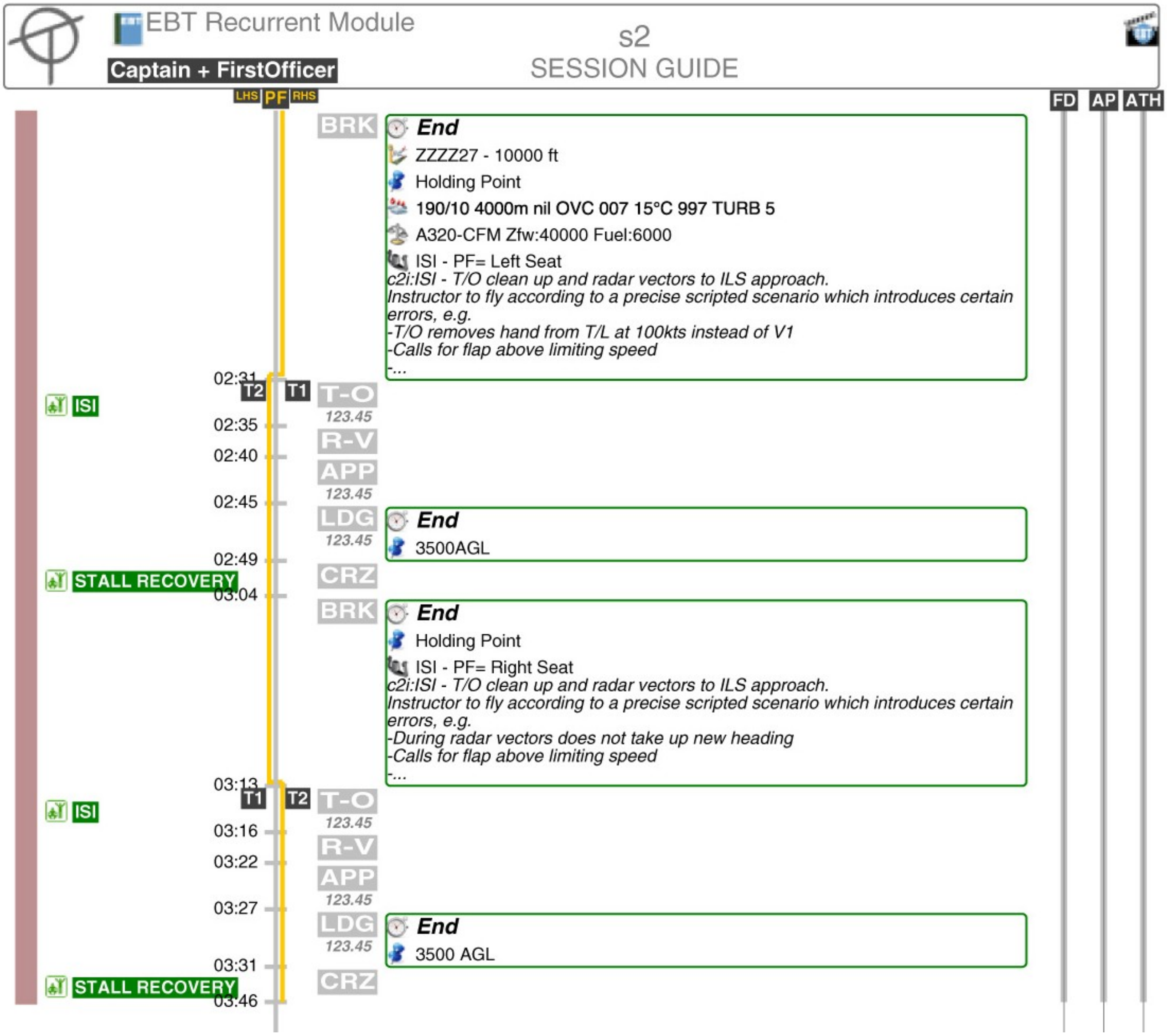
Between 500 AGL and Minima

ATC: Runway blocked, GA.
Visual approach available.
c2i:Crew will have to decide to accept visual or request radar vectoring

02:14 VIS

02:18 LDG 123.45

02:22



EBT Recurrent Module

Captain + FirstOfficer

s2
SESSION GUIDE

End

ZZZZ27 - 10000 ft

Holding Point

190/10 4000m nil OVC 007 15°C 997 TURB 5

A320-CFM Zfw:40000 Fuel:6000

ISI - PF= Left Seat

c2i:ISI - T/O clean up and radar vectors to ILS approach.
Instructor to fly according to a precise scripted scenario which introduces certain errors, e.g.
-T/O removes hand from T/L at 100kts instead of V1
-Calls for flap above limiting speed
-...

End

3500AGL

End

Holding Point

ISI - PF= Right Seat

c2i:ISI - T/O clean up and radar vectors to ILS approach.
Instructor to fly according to a precise scripted scenario which introduces certain errors, e.g.
-During radar vectors does not take up new heading
-Calls for flap above limiting speed
-...

End

3500 AGL

EBT Recurrent Module
Captain + FirstOfficer

s2
GRADESHEET

Trainee_1 (Captain) Name: **Date:**

Instructor Name:

Assessment Level: Session Phase / Competency

EBT – SBT

Application of procedures	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Communication	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Flight path management, automation	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Flight path management, manual control	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Leadership and teamwork	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Workload management	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Trainee Signature: ______________________________

Instructor Signature: ____________________________

APPENDIX E

Malfunction Clustering

Example Analyses for malfunction clustering

There are 2 examples in this Appendix demonstrating the outcome of the process described in Section 2, paragraph 3: the first for the Boeing 747-400 and the second for the Airbus A330-200. The examples are for reference and demonstration only, and not to be used. Operators should consult with their respective aircraft OEM's to determine lists to be used for their fleets.

B747-4

ATA Chapter	Non-Normal Checklist	Immediacy	Complexity	DegradesAircraft Control	Loss of Instruments	Management of Consequences
0	Ditching					X
1	Automatic Unlock	X				
1	Door Aft Cargo					X
1	Door Bulk Cargo					X
1	Door Elec Main, Ctr					X
1	Door Entry L, R 1,2,3,4,5					X
1	Door F/D Ovhd					X
1	Door Fwd Cargo					X
1	Door, L,R Upper Deck					X
1	Door Nose Cargo					X
1	Door Side Cargo					X
1	Door U/D Flt Lk					X
1	Doors Elec					X
1	Doors Entry L, R					X
1	Doors UPR Deck					X
1	Lock Fail					
1	Passenger Oxygen On					
1	Window Damage		X			X
2	Cabin Altitude Warning or Rapid Depressurization	X				X
2	Bleed Duct Leak L,C,R		X			X
2	Bld 1,2,3,4 OVHT/PRV					X
2	Bleed 1,2,3,4					X
2	Cabin Altitude Auto		X			X
2	Equipment Cooling				X	X
2	Landing Alt					
2	Outflow VLV L,R					
2	Pack 1,2,3					
2	Pack Control					X
2	Press Relief					
2	Temp Cargo Heat					X
2	Temp Zone					
3	Heat L,R, AOA					X
3	Heat L, R TAT					X
3	Heat P/S Capt, F/O					X
3	Heat P/S L,R Aux					
3	Heat Window L, R					
3	NAI Valve 1,2,3,4					X
3	WAI Valve Left, Right					X
4	Autopilot Disc					
4	Autothrottle Disc					
4	No Autoland					
4	No Land 3					
5	Radio Transmit Continuous (Stuck Microphone)					
6	Elec AC Bus 1,2,3,4		X		X	X
6	Elec Drive 1,2,3,4					
6	Elec Gen Off 1,2,3,4					
6	Elec Util bus L, R					
7	Aborted Engine Start	X				

Examples of malfunction characteristics analysis, Airbus A330-200

1					EWD WARNING COLOR (Select: R/A/G/C/W or No EWD Warning)	WARNING LVL (1/2/3)	Sound,Voice ,M/L,SD page	Specific A/C Standard or specific equipment	EBT SYSTEM MALFUNCTION CHARACTERISTICS				
ID	FWC REF - Date	NEW REVISION (Select: R/N/_)	ATA	WARNING TITLE					IMMEDIACY	COMPLEXITY	DEGRADATION OF AIRCRAFT CONTROL	LOSS OF INSTRUMENTATION	MANAGEMENT OF CONSEQUENCES
1	A330 FWC Std T3 – Nov 01/09	_	ATA 24 - ELECTRICAL POWER	ELEC EMER CONFIG	R	3	CRC WARN ELEC A		Y	Y	Y	Y	Y
2	A330 FWC Std T3 – Nov 01/09	_	ATA 26 - FIRE PROTECTION	SMOKE AVNCS VENT SMOKE	R	3	CRC WARN		Y	Y	Y	Y	Y
3	A330 FWC Std T3 – Nov 01/09	_	ATA 34 - NAVIGATION	NAV IR 1+2 FAULT	A	2	SC CAUT		Y	Y	Y	Y	Y
4	A330 FWC Std T3 – Nov 01/09	_	ATA 34 - NAVIGATION	NAV IR 1+3 FAULT	A	2	SC CAUT		Y	Y	Y	Y	Y
5	A330 FWC Std T3 – Nov 01/09	_	ATA 34 - NAVIGATION	NAV IR 2+3 FAULT	A	2	SC CAUT		Y	Y	Y	Y	Y
6	A330 FWC Std T3 – Nov 01/09	_	ATA 34 - NAVIGATION	NAV IR DISAGREE	A	2	SC CAUT		Y	Y	Y	Y	Y
7	A330 FWC Std T3 – Nov 01/09	_	ATA 34 - NAVIGATION	NAV ADR 1+2+3 FAULT	R	3	CRC WARN		Y	Y	Y	Y	Y
8	A330 FWC Std T3 – Nov 01/09	_	ATA 34 - NAVIGATION	NAV ADR DISAGREE	A	2	SC CAUT		Y	Y	Y	Y	Y
9	A330 FWC Std T3 – Nov 01/09	_	ATA 70 - POWER PLANT	ENG ALL ENG FLAME OUT	R	3	CRC WARN ENG		Y	Y	Y	Y	Y
10	A330 FWC Std T3 – Nov 01/09	_	ATA 30 - ICE AND RAIN PROTECTION	A.ICE ALL PITOT HEAT	A	2	SC CAUT		N	Y	Y	Y	Y
11	A330 FWC Std T3 – Nov 01/09	_	ATA 34 - NAVIGATION	NAV ADR 1+2 FAULT	A	2	SC CAUT		Y	N	Y	Y	Y
12	A330 FWC Std T3 – Nov 01/09	_	ATA 34 - NAVIGATION	NAV ADR 1+3 FAULT	A	2	SC CAUT		Y	N	Y	Y	Y
13	A330 FWC Std T3 – Nov 01/09	_	ATA 34 - NAVIGATION	NAV ADR 2+3 FAULT	A	2	SC CAUT		Y	N	Y	Y	Y
14	A330 FWC Std T3 – Nov 01/09	_	ATA 24 - ELECTRICAL POWER	ELEC DC ESS BUS FAULT	A	2	SC CAUT ELEC DC		N	Y	N	Y	Y
15	A330 FWC Std T3 – Nov 01/09	_	ATA 30 - ICE AND RAIN PROTECTION	A.ICE CAPT+F/O PITOT HEAT	A	2	SC CAUT		N	Y	N	Y	Y
16	A330 FWC Std T3 – Nov 01/09	_	ATA 30 - ICE AND RAIN PROTECTION	A.ICE CAPT+STBY PITOT HEAT	A	2	SC CAUT		N	Y	N	Y	Y
17	A330 FWC Std T3 – Nov 01/09	_	ATA 30 - ICE AND RAIN PROTECTION	A.ICE F/O+STBY PITOT HEAT	A	2	SC CAUT		N	Y	N	Y	Y
18	A330 FWC Std T3 – Nov 01/09	_	ATA 24 - ELECTRICAL POWER	ELEC DC ESS BUS SHED (OPER)	A	2	SC CAUT ELEC DC		N	N	N	Y	Y
19	A330 FWC Std T3 – Nov 01/09	_	ATA 27 - FLIGHT CONTROLS	F/CTL L ELEV FAULT	A	2	SC CAUT F/CTL		Y	Y	Y	N	Y
20	A330 FWC Std T3 – Nov 01/09	_	ATA 27 - FLIGHT CONTROLS	F/CTL R ELEV FAULT	A	2	SC CAUT F/CTL		Y	Y	Y	N	Y
21	A330 FWC Std T3 – Nov 01/09	_	ATA 27 - FLIGHT CONTROLS	F/CTL L+R ELEV FAULT	R	3	CRC WARN F/CTL		Y	Y	Y	N	Y
22	A330 FWC Std T3 – Nov 01/09	_	ATA 27 - FLIGHT CONTROLS	F/CTL STAB CTL FAULT	A	2	SC CAUT F/CTL		Y	Y	Y	N	Y
23	A330 FWC Std T3 – Nov 01/09	_	ATA 27 - FLIGHT CONTROLS	F/CTL FLAPS FAULT	A	2	SC CAUT		Y	Y	Y	N	Y
24	A330 FWC Std T3 – Nov 01/09	_	ATA 27 - FLIGHT CONTROLS	F/CTL SLATS FAULT	A	2	SC CAUT		Y	Y	Y	N	Y
25	A330 FWC Std T3 – Nov 01/09	_	ATA 27 - FLIGHT CONTROLS	F/CTL DIRECT LAW	A	2	SC CAUT		Y	Y	Y	N	Y
26	A330 FWC Std T3 – Nov 01/09	_	ATA 29 - HYDRAULIC POWER	HYD G + Y SYS LO PR	R	3	CRC WARN HYD		Y	Y	Y	N	Y

EBT System Malfunction Characteristics

	Total Number	≤1	≤2	≤3	4
System Failures	738	255	125	41	9
Abnormal Procedures	19	15	13	6	0

Results of the Airbus A330-200 analysis listing malfunctions with 1, 2, 3 and 4 characteristics

Characteristic	**Total Number**
Management of Consequences	**229**
Immediacy	**107**
Complexity	**68**
Degradation of Controls	**29**
Loss of Instrumentation	**18**

Airbus A330-200 total numbers of malfunctions with defined EBT characteristics

APPENDIX F

Baseline Program Priorities

Background – Prioritization

Prioritization of the training topics is probably the most important result from the EBT data analysis. It is a key part in the process for translating data into useful events and scenarios to assess and develop pilot performance in recurrent training programs. This result is the first rigorous attempt to rank parameters such as threats, errors and competencies, along with factors affecting accidents and serious incidents, from multiple data sources systematically to formulate a recurrent training program.

The exercise shows the feasibility of collecting an adequate set of operational and training data; developing the necessary methods to analyze that data, while corroborating results to produce a criticality ranking of training topics. The prioritization process occurs for each of the 6 generations of aircraft by ordering critical parameters so as to highlight differences and commonality. There is sufficient flexibility in the process to allow enhancement according to mission, culture and type of aircraft. The data in the process are also used as material to build scenarios for use in recurrent assessment and training conducted in an FSTD qualified for the purpose according to the *Manual of Criteria for the Qualification of Flight Simulation Training Devices* (Doc 9625), Volume I – Aeroplanes.

The process used is transparent and repeatable and results in a unique prioritization, according to aircraft generation. Three levels of priority A, B and C were used to determine the frequency of pilot exposure to the defined training topics within a 3-year rolling recurrent training program (see Section 7, paragraph 3).

Most of the data referred to in this report has been analyzed and are contained within the Evidence Table, and the EBT Accident and Incident Study. The Evidence Table consists of data from multiple sources and has the capability to sort as well as corroborate analytical results. It represents a robust set of evidence and it is a primary tool used in determining results. The EBT Accident and Incident Study has 3045 reports feeding the analysis, making it comprehensive as well as sensitive in developing prioritization of results and discriminating by aircraft generation. Prioritization of training topics by generation uses both of these tools. In some cases, depending on the data, the assessment and training topics are drawn from both sources, or from the Evidence Table alone or from the Accident and Incident Study alone. While the prioritization itself results from an algorithmic process, all analytical results were provided to the EBT Project Group comprising training experts and professionals in training scenario creation. Their utilization of the results served as an experiential validation.

Any set of historical data is necessarily finite. Using these data assumes a large set of experience will have strong predictive validity even though the environment is constantly changing. These challenges were accepted because statistical and quality control principles were adhered to and, more importantly, the results from data analysis were applied in the context of professional experience and expertise.

For the creation of the EBT recurrent training program defined in this manual, a cautious approach was taken, and the suggested frequency of training is higher than the results indicate unless the corroborating data is very strong. An example of this could be illustrated in the EBT Accident and Incident Study where the data imply different training frequency in adjacent generations. If the data are quite strong in the generation that demands more training, the training category in the adjacent generation is upgraded.

Operational and training data from multiple sources indicate that pilots operating the more modern generation aircraft take less time to achieve competence in the performance of certain maneuvers. Modern generation aircraft are also more complex, and pilots have more to learn for achieving a defined level of competency to operate. While the number of assessment and training topics is slightly fewer in early aircraft generations, the training time in the FTSD should be largely the same.

Summary of training topics

The following table represents the lists of training topics derived from data analysis, to which have been added topics that, despite not being indicated by significant data, were considered to be an important facet of a recurrent assessment and training program. These are highlighted in grey.

Generation 4 Jets

Gen4 Jet Training Topics	A	Adverse weather	B	Adverse wind	C	ATC
		Automation management		Aircraft system malfunction		Engine failure
		Competencies non-technical (CRM)		Aircraft System management		Fire and smoke management
		Compliance		Approach, visibility close to minimum		Loss of communications
		Error management		Landing		Managing loading, fuel, performance errors
		Go-Around management		Runway or taxiway condition		Navigation
		Manual aircraft control		Surprise		Operations or type specific
		Mismanaged aircraft state		Terrain		Pilot incapcitation
		Monitoring & cross-checking		Workload, distraction, pressure		Traffic
		Unstable approach				Upset recovery
						Windshear recovery

Generation 3 Jets

Gen3 Jet Training Topics	A	Adverse weather	B	Adverse wind	C	ATC
		Automation management		Aircraft system malfunction		Engine failure
		Competencies non-technical (CRM)		Aircraft system management		Fire and smoke management
		Compliance		Approach, visibility close to minimum		Loss of communications
		Error management		Landing		Managing loading, fuel, performance errors
		Go-Around management		Surprise		Navigation
		Manual aircraft control		Windshear recovery		Operations or type specific
		Mismanaged aircraft state		Workload, distraction, pressure		Pilot incapcitation
		Monitoring & cross-checking				Runway or taxiway condition
		Unstable approach				Terrain
						Traffic
						Upset recovery

Generation 3 Turboprops

Gen3 Turboprop Training Topics	A	Adverse weather	B	Aircraft system malfunctions	C	Adverse wind
		Automation management		Aircraft system management		Engine Failure
		Competencies non-technical (CRM)		Approach, visibility close to minimum		Fire and smoke management
		Compliance		Landing		Loss of communications
		Error management		Surprise		Managing loading, fuel, performance errors
		Go-Around management		Terrain		Navigation
		Manual aircraft control		Upset recovery		Operations or type specific
		Mismanaged aircraft state		Workload, distraction, pressure		Pilot incapacitation
		Monitoring & cross-checking				Runway or taxiway condition
		Unstable approach				Traffic
						Windshear recovery

Generation 2 Jets

Gen2 Jet Training Topics	A	Adverse weather	B	Adverse wind	C	Loss of communications
		Approach, visibility close to minimum		Aircraft system malfunction		Managing loading, fuel, performance errors
		Automation management		Compliance		Navigation
		Competencies non-technical (CRM)		Engine Failure		Operations or type specific
		Error management		Fire and smoke management		Pilot incapcitation
		Go-Around management		Landing		Runway or taxiway condition
		Manual aircraft control		Mismanaged aircraft state		Terrain
		Monitoring & cross-checking		Surprise		Traffic
		Unstable approach		Windshear recovery		Upset recovery

Generation 2 Turboprops

Gen3 Turboprop Training Topics	A	Adverse weather	B	Aircraft system malfunctions	C	Adverse wind
		Automation management		Aircraft system management		Engine Failure
		Competencies non-technical (CRM)		Approach, visibility close to minimum		Fire and smoke management
		Compliance		Landing		Loss of communications
		Error management		Surprise		Managing loading, fuel, performance errors
		Go-Around management		Terrain		Navigation
		Manual aircraft control		Upset recovery		Operations or type specific
		Mismanaged aircraft state		Workload, distraction, pressure		Pilot incapacitation
		Monitoring & cross-checking				Runway or taxiway condition
		Unstable approach				Traffic
						Windshear recovery

For a full explanation of how this information was derived please see the Data Report for Evidence-Based Training on the ITQI website: www.iata.org/itqi.

APPENDIX G

Training Program Development Guidance – Generation 4 (Jet)

1 GENERAL

This Appendix provides the recurrent assessment and training matrix for turbo-jet aeroplanes of the fourth generation. A list of such aeroplanes is in the Background section sub-paragraph 3. Aircraft Generations

Using the data of the matrix, operators can develop recurrent training programs based on the EBT concept. It is imperative that the guidance in this manual be well understood by developers of an EBT program.

2 ASSESSMENT AND TRAINING MATRIX

The assessment and training matrix for turbo-jet aeroplanes of the fourth generation is contained in the remaining pages of this Appendix.

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 4 Jet - Recurrent Assessment and Training Matrix							Competency map							
Manoeuvres Training Phase	Rejected take-Off	A	TO	Engine failure after the application of take-off thrust and before reaching V1,	Demonstrates manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detects deviations through instrument scanning Maintains spare mental capacity during manual aircraft control Maintains the aircraft within the flight envelope Applies knowledge of the relationship between aircraft attitude, speed and thrust	From initiation of take-off to complete stop (or as applicable to procedure)	x			x				
	Failure of critical engine between V1 & V2	A	TO	Failure of a critical engine from V1 and before reaching V2 in lowest CAT I visibility conditions		The manoeuvre is considered to be complete at a point when aircraft is stabilised at normal engine-out climb speed with the correct pitch and lateral control, in trim condition and, as applicable, autopilot engagement	x			x				
	Failure of critical engine between V1 & V2	B	TO	Failure of a critical engine from V1 and before reaching V2 in lowest CAT I visibility conditions		The manoeuvre is considered to be complete at a point when aircraft is stabilised in a clean configuration with engine-out procedures completed	x			x				
	Emergency descent	C	CRZ	Initiation of emergency descent from normal cruise altitude		The manoeuvre is considered to be completed once the aircraft is stabilised in emergency descent configuration (and profile)	x		x	x				
	Engine-out approach & go-around	A	APP	With a critical engine failed, manually flown normal precision approach to DA, followed by manually flown go-around, the whole manoeuvre to be flown without visual reference		This manoeuvre should be flown from intercept to centreline until acceleration after go-around. The manoeuvre is considered to be complete at a point when aircraft is stabilised at normal engine-out climb speed with the correct pitch and lateral control, in trim condition and, as applicable, autopilot engagement* (describe generally	x			x				
	Go-around	A	APP	Go-around, all engines operative		High energy, initiation during the approach at 150 to 300 m (500 to 1000 ft) below the missed approach level off	x		x	x				
	Go-around	A	APP	Go-around, all engines operative followed by visual circuit, manually flown		Initiation of go-around from DA followed by visual circuit and landing	x		x	x				
	Go-around	A	APP	Go-around, all engines operative		During flare/rejected landing	x		x	x				
	Engine-out landing	A	LDG	With a critical engine failed, normal landing		Initiation in a stablilised engine-out configuration from not less than 3 nm final approach, until completion of roll out	x			x				
Evaluation & Scenario Based Training Phases	Adverse Weather	A	GND	Thunderstorm, heavy rain, turbulence, ice build up to include de-icing issues, as well as high temperature conditions. The proper use of use of anti-ice and de-icing systems should be included generally in appropriate scenarios.	Anticipate adverse weather Prepare for suspected adverse weather Recognise adverse weather Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Predictive windshear warning before take-off, as applicable	x	x				x		
			TO			Adverse weather scenario, e.g. thunderstorm activity, precipitation, icing		x			x	x		x
			TO			Windshear encounter during take-off, not predictive	x			x			x	
			TO			Predictive windshear warning during take-off	x	x				x	x	
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			CRZ			Windshear encounter scenario during cruise	x		x			x	x	x
			APP			Reactive windshear warning during approach or go-around	x		x	x			x	
			APP			Predictive windshear warning during approach or go-around	x	x				x	x	
			APP			Thunderstorm encounter during approach or on missed approach	x					x	x	
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP			Non-precision approach in cold temperature conditions, requiring altitude compensation for temperature, as applicable to type	x	x					x	
			APP, LDG			Crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
			APP			Reduced visibility even after acquiring the necessary visual reference during approach, due to rain or fog	x	x				x		

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 4 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Automation management	A	ALL	The purpose of this topic is to encourage and develop effective flight path management through proficient and appropriate use of flight management system(s), guidance and automation including transitions between modes, monitoring, mode awareness and vigilance and flexibility needed to change from one mode to another. Included in this topic is the means of mitigating errors described as: mishandled auto flight systems, inappropriate mode selection, flight management system(s) and autopilot usage.	Knows how and when to use flight management system(s), guidance and automation Demonstrates correct methods for engagement and disengagement of auto flight system(s) Demonstrates appropriate use of flight guidance, auto thrust and other automation systems Maintains mode awareness of auto flight system(s), including engagement and automatic transitions Reverts to different modes when appropriate Detects deviations from the desired aircraft state (flight path, speed, attitude, thrust, etc.) and takes appropriate action. Anticipate mishandled auto flight system Recognise mishandled auto flight system. Take appropriate action if necessary Restore correct auto flight state Identify and manage consequences	ACAS warning, recovery and subsequent engagement of automation	x		x					
			ALL			FMS tactical programming issues, e.g. step climb, runway changes, late clearances, destination re-programming, executing diversion	x		x					
			ALL			Recoveries from TAWS, management of energy state to restore automated flight	x		x	x				
			ALL			Amendments to ATC cleared levels during altitude capture modes, to force mode awareness and intervention	x		x				x	
			TO			Late ATC clearance to an altitude below acceleration altitude	x		x				x	
			TO, APP			Engine-out special terrain procedures	x		x				x	
			CRZ			Forcing AP disconnect followed by re engagement, recovery from low or high speed events in cruise	x		x	x			x	
			CRZ			Engine failure in cruise to onset of descent using automation	x		x					
			CRZ			Emergency descent	x		x					
			DES, APP			Managing high energy descent capturing descent path from above (correlation with unstable app training)	x		x				x	
			APP			No ATC clearance received prior to commencement of approach or final descent	x		x				x	
			APP			Reactive windshear and recovery from the consequent high energy state	x		x				x	
			APP			Non precision or infrequently flown approaches using the maximum available level of automation	x		x					
			APP			Gear malfunction during approach		x				x		x
			APP			ATC clearances to waypoints beyond programmed descent point for a coded final descent point during an approach utilising a final descent that is commanded by the flight management system.	x		x				x	
	Competencies non-technical (CRM)	A	APP	This encapsulates communication; leadership and teamwork; problem solving and decision making; situation awareness; workload management. Emphasis should be placed on the development of leadership, shown by EBT data sources to be a highly effective competency in mitigating risk and improving safety through pilot performance	Communication: Demonstrates effective use of language, responsiveness to feedback and that plans are stated and ambiguities resolved. Leadership and teamwork: Uses appropriate authority to ensure focus on the task. Supports others in completing tasks. Problem solving & decision making: Detects deviations from the desired state, evaluates problems, identifies risk, considers alternatives and selects the best course of action. Continuously reviews progress and adjust plans. Situation awareness: Has an awareness of the aircraft state in its environment; projects and anticipates changes. Workload management: Prioritises, delegates and receives assistance to maximise focus on the task. Continuously monitors the flight progress.	GPS failure prior to commencement of approach associated with position drift and a terrain alert					x	x	x	
			DESC			Cabin crew report of water noise below the forward galley indicating a possible toilet pipe leak, with consequent avionics failures					x	x	x	
			CRZ			Smoke removal but combined with a diversion until landing completed.		x			x	x	x	x
			CRZ			ACAS warning immediately following a go-around, with a descent manoeuvre required.		x			x	x	x	x
	Compliance	A	ALL	Compliance failure. Consequences of not complying with operating instructions (e.g. SOP). This is not intended to list scenarios, but instructors should ensure that observed non-compliances are taken as learning opportunities throughout the programme. In all modules of the programme, the FSTD should as far as possible be treated like an aircraft, and non-compliances should not be accepted simply for expediency.	Recognise that a compliance failure has occurred Make a verbal announcement Take appropriate action if necessary Restore safe flightpath if necessary Manage consequences	The following are examples of potential compliance failures, and not intended to be developed as scenarios as part of an EBT Module: 1. Requesting flap beyond limit speed 2. Flaps or slats in the wrong position for phase of flight or approach 3. Omitting an action as part of a procedure 4. Failing to initiate or complete a checklist 5. Using the wrong checklist for the situation	Intentionally blank							

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 4 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Go-around management	A	APP	Any threat or error which can result in circumstances which require a decision to go-around, in addition to the execution of the go-around. Go-around scenarios should be fully developed to encourage effective leadership and teamwork, in addition to problem solving and decision making, plus execution using manual aircraft control or flight management system(s) and automation as applicable. Design should include the element of surprise and scenario-based go-arounds should not be predictable and anticipated. This topic is completely distinct from the go-around manoeuvre listed in the manoeuvres training section that is intended only to practice psychomotor skill and a simple application of the procedures.		Adverse weather scenario leading to a reactive windshear warning during approach	x	x					x	x
			APP			Adverse weather scenario leading to a predictive windshear warning during approach or go-around	x	x					x	x
			APP			Adverse weather scenario, e.g. thunderstorm activity, heavy precipitation or icing forcing decision at or close to DA/MDA	x					x	x	x
			APP			DA with visual reference in heavy precipitation with doubt about runway surface braking capability	x					x	x	x
			APP			Adverse wind scenario resulting in increasing tailwind below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below 15 m (50 ft) (not reported)		x		x		x		
			APP			Lost of difficult communications resulting in no approach clearance prior to commencement of approach or final descent	x		x				x	
			APP			Birds, large flocks of birds below DA once visual reference has been established				x		x	x	
			APP			System malfunction, landing gear malfunction during the approach								
	Manual aircraft control	A	ALL	The competency description is "Maintains control of the aircraft in order to assure the successful outcome of a procedure or manoeuvre."	Desired competency outcome: Demonstrates manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detects deviations through instrument scanning Maintains spare mental capacity during manual aircraft control Maintains the aircraft within the flight envelope Applies knowledge of the relationship between aircraft attitude, speed and thrust	Flight with unreliable airspeed, which may be recoverable or not recoverable	x			x			x	
			ALL			Alternate flight control modes according to malfunction characteristics	x			x				x
			ALL			ACAS RA to descend or ATC immediate descent	x	x		x				
			DES			TAWS warning when deviating from planned descent routing, requiring immediate response	x			x	x			
			TO			Scenario immediately after take-off which requires an immediate and overweight landing			x	x	x	x		
			TO			Adverse wind, crosswinds with or without strong gusts on take-off	x			x				
			TO			Adverse weather, windshear, windshear encounter during take-off, with or without reactive warnings	x			x			x	
			TO			Engine failure during initial climb, typically 30-60 m (100-200 ft)	x	x		x				x
			CRZ			Windshear encounter scenario during cruise, significant and rapid change in windspeed or down/updrafts, without windshear warning	x		x			x	x	x
			APP			Adverse weather, windshear, windshear encounter with or without warning during approach	x		x	x			x	
			APP			Adverse weather, deterioration in visibility or cloud base, or adverse wind, requiring a go-around from visual circling approach, during the visual segment	x	x	x	x		x	x	x
			APP, LDG			Adverse wind, crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
			APP, LDG			Adverse weather, adverse wind, approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP, LDG			Circling approach at night in minimum in-flight visibility to ensure ground reference, minimum environmental lighting and no glide slope guidance lights								
			APP, LDG			Runway incursion during approach, which can be triggered by ATC at various altitudes or by visual contact during the landing phase	x			x			x	
			LDG			Adverse wind, visibility, type specific, special consideration for long bodied aircraft, landing in minimum visibility for visual reference, with crosswind	x	x		x			x	
			LDG			System malfunction, auto flight failure at DA during a low visibility approach requiring a go-around flown manually.	x		x	x			x	

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 4 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	**ISI** Monitoring, cross checking, error management, mismanaged aircraft state	A	ALL	Developed scripted role-play scenarios encompassing the need to monitor flight path excursions from the instructor pilot (PF), detect errors and make appropriate interventions, either verbally or by taking control as applicable. The scenarios should be realistic and relevant, and are for the purpose of demonstration and reinforcement of effective flight path monitoring. Demonstrated role-play should contain realistic and not gross errors, leading at times to a mismanaged aircraft state, which can also be combined with upset management training.	Recognise mismanaged aircraft state. Take appropriate action if necessary Restore desired aircraft state Identify and manage consequences	Instructor role-play Deviations from the flight path, in pitch attitude, speed, altitude, bank angle		x					x	
			ALL			Instructor role-play: Simple automation errors (e.g. incorrect mode selection, attempted engagement without the necessary conditions, entering wrong altitude or speed, failure to execute the desired mode) culminating in a need for direct intervention from the PM, and where necessary taking control.		x					x	
			APP			Instructor role-play Unstable approach or speed/path/vertical rate not congruent with required state for given flight condition	x	x					x	x
			LDG			Instructor role-play Demonstration exercise - recovery from bounced landing, adverse wind, strong gusts during landing phase, resulting in a bounce and necessitating recovery action from the PM	x			x			x	
	Unstable approach	A	DES, APP	Reinforce stabilised approach philosophy and adherence to defined parameters. Encourage go-arounds when crews are outside these parameters. Develop and sustain competencies related to the management of high energy situations		ATC or terrain related environment creating a high energy descent with the need to capture the optimum profile to complete the approach in a stabilised configuration	x		x				x	
			DES, APP			ATC or terrain related environment creating a high energy descent leading to unstable conditions and requiring a go-around	x		x				x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP, LDG			Crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
	Adverse wind	B	TO	Adverse wind/crosswind. This includes tailwind but not ATC miss-reporting of the actual wind	Recognise adverse wind conditions Observe limitations Apply appropriate procedures Maintain directional control and safe flight path	Take-off with different crosswind/tailwind/gust conditions						x		x
			TO			Take-off with unreported tailwind		x			x			
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswind incl. shifting wind directions				x		x	x	
			APP			Adverse wind scenario resulting in increasing tailwind below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below 15 m (50 ft) (not reported)		x		x		x		
			APP, LDG			Crosswind with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
				Generation 4 Jet - Recurrent Assessment and Training Matrix			Competency map							
Evaluation & Scenario Based Training Phases	Aircraft system malfunctions, including operations under MEL	B	ALL	Any internal failure(s) apparent or not apparent to the crew Any item cleared by the MEL but having an impact upon flight operations. E.g. thrust reverser locked Malfunctions to be considered should have one or more of the following characteristics: Immediacy Complexity Degradation of aircraft control Loss of primary instrumentation Management of consequences	Recognise system malfunction Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences Applies crew operating procedure where necessary. Responds appropriately to additional system abnormals associated with MEL dispatch Immediacy Complexity Degradation of aircraft control Loss of primary instrumentation Loss of primary instrumentation Management of consequences	For full details see the Malfunction Clustering methodology and results. At least one malfunction with each characteristic should be included every year. Combining characteristics should not reduce the number of malfunctions below 4 for each crewmember every year according to the EBT module cycle. See Part I 3.8.3 System malfunctions requiring immediate and urgent crew intervention or decision, e.g. fire, smoke, loss of pressurisation at high altitude, failures during take-off, brake failure during landing Example: Fire System malfunctions requiring complex procedures, e.g. multiple hydraulic system failures, smoke and fumes procedures Example: Major dual system electrical or hydraulic failure System malfunctions resulting in significant degradation of flight controls in combination with abnormal handling characteristics, e.g. jammed flight controls, certain degradation of FBW control Examples: Jammed horizontal stabiliser Flaps and/or slats locked Malfunctions resulting in degraded flight controls System failures that require monitoring and management of the flight path using degraded or alternative displays Unreliable primary flight path information, unreliable airspeed Example: Flight with unreliable airspeed Example: Fuel leak	Intentionally blank							
			ALL											
			ALL											
			ALL											
			ALL											
			ALL											
			TO			MEL items with crew operating procedures applicable during take-off						x		
			TO			Response to an additional factor that is affected by MEL item (e.g. system failure, runway state)		x		x		x		
			GRD			Malfunction during pre-flight preparation and prior to departure	x					x	x	
			GRD			Malfunction after departure	x					x	x	
			GRD			Malfunctions requiring immediate attention (e.g. bleed fault during engine start, hydraulic failure during taxi)								
			TO			Take-off high speed below V1	x				x	x		
			TO			Take-off high speed above V1	x					x		
			TO			Initial climb	x					x		
			APP			On approach	x					x		x
			APP			Go-around	x					x		x
			LDG			During landing	x	x		x		x	x	
	Aircraft system management	B		Normal system operation according to defined instructions.	This is not considered as a stand alone topic. It links with the topic "compliance" Where a system is not managed according to normal or defined procedures, this is determined as a non-compliance	See "compliance" above. There are no defined scenarios, but the instructor should focus on learning opportunities when system management non-compliances manifest themselves during other scenarios. Underpinning knowldege of systems and their interactions should be develpped and challenged, and not merely the application of normal procedures.	Intentionally blank							
	Approach, visibility close to minimum	B	APP	Any situation where visibility becomes a threat	Recognise actual conditions Observe aircraft and/or procedural limitations Apply appropriate procedure if applicable Maintain directional control and safe flight path	Approach in poor visibility	x		x	x				x
			APP			Approach in poor visibility with deteriorations necessitating a decision to go-around	x		x	x				
			LDG			Landing in poor visibility				x		x	x	
	Landing	B	LDG	Pilots should have opportunities to practice landings in demanding situations at the defined frequency. Data oindicates that landing problems have their roots in a variety of factors, including appropriate decision manking, in addition to manual aircraft control skills if difficult environmental conditions. The purpose of this item is toi ensure pilots are exposed to this during the programme	Landing in demanding envornmental conditions, with malfunctions as appropriate	This topc should be combined with Adverse Weather, Aircraft System Malfunctions or any topic that can provide exposure to a landing in demanding conditions	Intentionally blank							

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
				Generation 4 Jet - Recurrent Assessment and Training Matrix			Competency map							
Evaluation & Scenario Based Training Phases	Runway or taxiway condition	B	TO	Contamination or surface quality of the runway, taxiway, or tarmac including foreign objects	Recognise hazardous runway condition Observe limitations Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Planned anticipated hazardous conditions with dispatch information provided to facilitate planning and execution of appropriate procedures						x		
			TO			Unanticipated hazardous conditions, e.g. unexpected heavy rain resulting in flooded runway surface		x			x	x		
			TO			Stop / Go decision in hazardous conditions					x	x		x
	Surprise	B	ALL	The data analysed during the development of this manual and of the EBT concept indicated substantial difficulties encountered by crews when faced with a threat or error, which was a surprise, or an unexpected event. The element of surprise should be distinguished from what is sometimes referred to as the "startle factor", the latter being a physiological reaction. Wherever possible, consideration should be given towards variations in the types of scenario, times of occurrences and types of occurrence, so that pilots do not become overly familiar with repetitions of the same scenarios. Variations should be the focus of EBT programme design, and not left to the discretion of individual instructors, in order to preserve programme integrity and fairness	Exposure to an unexpected event or sequence of events at the defined frequency	Intentionally blank	Intentionally blank							
	Terrain	B	ALL	Alert, warning, or conflict	Anticipate terrain threats Prepare for terrain threats Recognise unsafe terrain clearance Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Restore safe flight path Manage consequences	ATC clearance giving insufficient terrain clearance	x	x			x			
			ALL			Demonstration of terrain avoidance warning systems						x	x	x
			TO, CLB			Engine failure where performance is marginal leading to TAWS warning		x		x				x
			DES			"Virtual mountain" meaning the surprise element of an unexpected warning. Care should be exercised in creating a level of realism, so this can best be achieved by an unusual and unexpected change of route during the descent						x	x	x
	Workload, distraction, pressure	B	ALL	This is not considered a topic for specific attention on it's own, more as a reminder to programme develpers to ensure that pilots are exposed to immmerisive trainig scenarios which expose them to managable high workload and distractions during the course of the EBT programme, at the defined frequency	Managing available resources efficiently to prioritize and perform tasks in a timely manner under all circumstances	Intentionally blank	Intentionally blank							
	ATC	C	ALL	ATC error. Omission, mis-communication, garbled, poor quality transmission. All of these act as distractions to be managed by the crew. The scenarios should be combined where possible with others of the same or higher weighting, the principle reason being to create distractions.	Respond to communications appropriately Recognise, clarify and resolve any ambiguities. Refuse or question unsafe instructions. Use standard phraseology whenever possible	ATC role-play: the instructor provides scripted instructions, as a distraction to the crew	x	x			x			
						Controller error, provided by the instructor according to a defined scripted scenario	x	x				x	x	
						Frequency congestion, with multiple aircraft using the same frequency		x						
						Poor quality transmissions		x						
	Engine failure	C	TO	Any engine failure or malfunction, which causes loss or degradation of thrust that impacts performance. This is distinct from the engine-out manoeuvres described in the manoeuvres training section above, which are intended only for the practice of psychomotor skill and reinforcement of procedures in managing engine failures.	Recognise engine failure Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	Take-off low speed	x		x			x		x
			TO			Take-off high speed below V1	x		x			x		x
			TO			Take-off above V1	x					x	x	x
			TO			Initial climb	x					x	x	
			APP			Engine malfunction	x					x		x
			CRZ			Engine failure in cruise								
			LDG			On landing				x				
	Fire and smoke management	C	GRD	This includes engine, electric, pneumatic, cargo fire, smoke or fumes.	Recognise fire, smoke or fumes Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	Fire in cargo or cabin/cockpit at gate	x	x				x		x
			GRD			Fire during taxi	x	x				x		x
			GRD			Fire with no cockpit indication	x	x				x		x
			TO			Take-off low speed	x		x		x	x		
			TO			Take-off high speed below V1	x		x		x	x		
			TO			Take-off high speed above V1	x				x	x		
			TO			Initial climb	x				x	x		
			CRZ			Cargo fire						x	x	x
			APP			Engine fire in approach (extinguishable)		x				x		
			APP			Engine fire in approach (non-extinguishable)		x			x	x		
			APP			Flight deck or cabin fire		x			x	x		

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 4 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Loss of communications	C	GRD	Lost or difficult communications. Either through pilot miss-selection or a failure external to the aircraft. This could be for a few seconds or a total loss.	Recognise loss of communications Take appropriate action Execute appropriate procedure as applicable Use alternative ways of communications Manage consequences	Loss of communications during ground manoeuvring	x	x						
			TO			Loss of communications after take-off	x					x		
			APP			Loss of communications during approach phase, including go-around	x	x				x	x	
	Managing loading, fuel, performance errors	C		A calculation error by one or more pilots, or someone involved with the process, or the process itself, e.g. incorrect information on the load sheet.	Anticipate the potential for errors in load/fuel/performance data Recognise inconsistencies Manage/avoid distractions Make changes to paperwork/aircraft system(s) to eliminate error Identify and manage consequences	This can be a demonstrated error, in that the crew may be asked to deliberately insert incorrect data, for example to take-off from an intersection with full length performance information. The crew will be asked to intervene when acceleration is sensed to be lower than normal, and may be part of the operator procedures, especially when operating mixed fleets with considerable variations in MTOM.	x	x						x
	Navigation	C	GRD	External NAV failure. Loss of GPS satellite, ANP exceedance of RNP, loss of external NAV source(s),	Recognise a NAV degradation. Take appropriate action Execute appropriate procedure as applicable Use alternative NAV guidance Manage consequences	External failure or a combination of external failures degrading aircraft navigation performance	x		x			x	x	
			TO, CLB, APP, LDG			External failure or a combination of external failures degrading aircraft navigation performance		x			x	x	x	
	Operations or type specific	C		Intentionally blank	Intentionally blank	Intentionally blank	Intentionally blank							
	Pilot incapacitation	C	TO	Consequences for the non-incapacitated pilot.	Recognise incapacitation Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences	During take-off	x	x			x	x		
						During approach	x			x				x
	Traffic	C	CLB, CRZ, DES	Traffic conflict. ACAS RA or TA, or visual observation of conflict, which requires evasive manoeuvring	Anticipate potential loss of separation Recognise loss of separation Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	ACAS warning requiring crew intervention		x				x	x	x

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 4 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Upset recovery	C	ALL	An airplane upset is defined as an airplane in flight unintentionally exceeding the parameters normally experienced in line operations or training. 1. Pitch attitude greater than 25° nose up. 2. Pitch attitude greater than 10° nose down. 3. Bank angle greater than 45°. 4. Within pitch and bank angle normal parameters, but flying at airspeeds inappropriate for the conditions.	Recognise upset condition Take appropriate action Assure aircraft control Maintain or restore a safe flight path Assess consequential issues Manage outcomes	Upset recognition: Demonstration of the defined normal flight envelope and any associated changes in flight instruments, flight director systems, and protection systems. This should take the form of an instructor led exercise to show the crew the points beyond which an upset condition could exist.			x	x			x	x
			TO, APP			Upset recognition and recovery Severe windshear or wake turbulence during take-off or approach			x	x		x	x	
			CLB, DES			Upset recognition and recovery - as applicable and relevant to aircraft type, demonstration at a suitable intermediate level, with turbulenece as appropriate, practice steep turns and note the relationship between bank angle, pitch and stalling speed				x			x	
			CRZ			Upset recognition and recovery at the maximum cruise flight level for current aircraft weight, turbulence to trigger overspeed conditions (If FSTD capability exists, consider use of vertical wind component to add realism)			x	x		x	x	
			CRZ			Upset recognition and recovery at the maximum cruise flight level for current aircraft weight, turbulence and significant temperature rise to trigger low speed conditions (If FSTD capability exists, consider use of vertical wind component to add realism)	x			x			x	
			CRZ			Upset recognition and recovery - demonstration at a normal cruising altitude, set conditions and disable aircraft systems as necessary to enable trainee to complete stall recovery according to OEM instructions	x			x			x	
			APP			Upset recognition and recovery - demonstration at an intermediate altitude during early stages of the approach, set conditions and disable aircraft systems as necessary to enable trainee to complete stall recovery according to OEM instructions	x			x			x	
	ISI Upset recovery		CLB, DES			Recovery: Demonstration, in-seat instruction: The instructor should position the aircraft within but close to the edge of the normal flight envelope before handing control to the trainee to demonstrate the restoration of normal flight. Careful consideration should be given to flying within the normal flight envelope.				x			x	
	Windshear recovery	C	TO	With or without warnings including predictive. A windshear scenario is ideally combined into an adverse weather scenario containing other elements.	Anticipate potential for windshear Avoid known windshear or prepare for suspected windshear Recognise windshear encounter Take appropriate action Apply appropriate procedure correctly Assure aircraft control Recognise out of windshear condition Maintain or restore a safe flight path Assess consequential issues and manage outcomes	Predictive windshear warning during take-off					x	x		
			TO			Windshear encounter during take-off	x				x	x		
			TO			Windshear encounter after rotation						x		x
			TO			Predictive windshear after rotation					x	x		
			APP			Predictive windshear during approach	x				x	x		
			APP			Windshear encounter during approach	x				x	x		

APPENDIX H

Training Program Development Guidance – Generation 3 (Jet)

1 GENERAL

This Appendix provides the recurrent assessment and training matrix for turbo-jet aeroplanes of the third generation. A list of such aeroplanes is in the Background section sub-paragraph 3. Aircraft Generations

Using the data of the matrix, operators can develop recurrent training programs based on the EBT concept. It is imperative that the guidance in this manual be well understood by developers of an EBT program.

2 ASSESSMENT AND TRAINING MATRIX

The assessment and training matrix for turbo-jet aeroplanes of the third generation is contained in the remaining pages of this Appendix.

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 3 Jet - Recurrent Assessment and Training Matrix							Competency map							
Manoeuvres Training Phase	Rejected take-Off	A	TO	Engine failure after the application of take-off thrust and before reaching V1,	Demonstrates manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detects deviations through instrument scanning Maintains spare mental capacity during manual aircraft control Maintains the aircraft within the flight envelope Applies knowledge of the relationship between aircraft attitude, speed and thrust	From initiation of take-off to complete stop (or as applicable to procedure)	x			x				
	Failure of critical engine between V1 & V2	A	TO	Failure of a critical engine from V1 and before reaching V2 in lowest CAT I visibility conditions		The manoeuvre is considered to be complete at a point when aircraft is stabilised at normal engine-out climb speed with the correct pitch and lateral control, in trim condition and, as applicable, autopilot engagement	x			x				
	Failure of critical engine between V1 & V2	B	TO	Failure of a critical engine from V1 and before reaching V2 in lowest CAT I visibility conditions		The manoeuvre is considered to be complete at a point when aircraft is stabilised in a clean configuration with engine-out procedures completed	x			x				
	Emergency descent	C	CRZ	Initiation of emergency descent from normal cruise altitude		The manoeuvre is considered to be completed once the aircraft is stabilised in emergency descent configuration (and profile)	x		x	x				
	Engine-out approach & go-around	A	APP	With a critical engine failed, manually flown normal precision approach to DA, followed by manually flown go-around, the whole manoeuvre to be flown without visual reference		This manoeuvre should be flown from intercept to centreline until acceleration after go-around. The manoeuvre is considered to be complete at a point when aircraft is stabilised at normal engine-out climb speed with the correct pitch and lateral control, in trim condition and, as applicable, autopilot engagement* (describe generally critical part of manoeuvre)	x			x				
	Go-around	A	APP	Go-around, all engines operative		High energy, initiation during the approach at 150 to 300 m (500 to 1000 ft) below the missed approach level off altitude	x		x	x				
	Go-around	A	APP	Go-around, all engines operative followed by visual circuit, manually flown		Initiation of go-around from DA followed by visual circuit and landing	x		x	x				
	Go-around	A	APP	Go-around, all engines operative		During flare/rejected landing	x		x	x				
	Engine-out landing	A	LDG	With a critical engine failed, normal landing		Initiation in a stablilised engine-out configuration from not less than 3 nm final approach, until completion of roll out	x			x				
Evaluation & Scenario Based Training Phases	Adverse Weather	A	GND	Thunderstorm, heavy rain, turbulence, ice build up to include de-icing issues, as well as high temperature conditions. The proper use of use of anti-ice and de-icing systems should be included generally in appropriate scenarios.	Anticipate adverse weather Prepare for suspected adverse weather Recognise adverse weather Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Predictive windshear warning before take-off, as applicable	x	x				x		
			TO			Adverse weather scenario, e.g. thunderstorm activity, precipitation, icing		x			x	x		x
			TO			Windshear encounter during take-off, not predictive	x			x			x	
			TO			Predictive windshear warning during take-off	x	x				x	x	
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			CRZ			Windshear encounter scenario during cruise	x		x			x	x	x
			APP			Reactive windshear warning during approach or go-around	x		x	x			x	
			APP			Predictive windshear warning during approach or go-around	x	x				x	x	
			APP			Thunderstorm encounter during approach or on missed approach	x					x	x	
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP			Non-precision approach in cold temperature conditions, requiring altitude compensation for temperature, as applicable to type	x	x					x	
			APP, LDG			Crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
			APP			Reduced visibility even after acquiring the necessary visual reference during approach, due to rain or fog	x	x				x		

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 3 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Automation management	A	ALL	The purpose of this topic is to encourage and develop effective flight path management through proficient and appropriate use of flight management system(s), guidance and automation including transitions between modes, monitoring, mode awareness and vigilance and flexibility needed to change from one mode to another. Included in this topic is the means of mitigating errors described as: mishandled auto flight systems, inappropriate mode selection, flight management system(s) and autopilot usage.	Knows how and when to use flight management system(s), guidance and automation Demonstrates correct methods for engagement and disengagement of auto flight system(s) Demonstrates appropriate use of flight guidance, auto thrust and other automation systems Maintains mode awareness of auto flight system(s), including engagement and automatic transitions Reverts to different modes when appropriate Detects deviations from the desired aircraft state (flight path, speed, attitude, thrust, etc.) and takes appropriate action. Anticipate mishandled auto flight system Recognise mishandled auto flight system. Take appropriate action if necessary Restore correct auto flight state Identify and manage consequences	ACAS warning, recovery and subsequent engagement of automation	x		x					
			ALL			FMS tactical programming issues, e.g. step climb, runway changes, late clearances, destination re-programming, executing diversion	x		x					
			ALL			Recoveries from TAWS, management of energy state to restore automated flight	x		x	x				
			ALL			Amendments to ATC cleared levels during altitude capture modes, to force mode awareness and intervention	x		x				x	
			TO			Late ATC clearance to an altitude below acceleration altitude	x		x				x	
			TO, APP			Engine-out special terrain procedures	x		x				x	
			CRZ			Forcing AP disconnect followed by re engagement, recovery from low or high speed events in cruise	x		x	x			x	
			CRZ			Engine failure in cruise to onset of descent using automation	x		x					
			CRZ			Emergency descent	x		x					
			DES, APP			Managing high energy descent capturing descent path from above (correlation with unstable app training)	x		x				x	
			APP			No ATC clearance received prior to commencement of approach or final descent	x		x				x	
			APP			Reactive windshear and recovery from the consequent high energy state	x		x				x	
			APP			Non precision or infrequently flown approaches using the maximum available level of automation	x		x					
			APP			Gear malfunction during approach		x				x		x
			APP			ATC clearances to waypoints beyond programmed descent point for a coded final descent point during an approach utilising a final descent that is commanded by the flight management system.	x		x				x	
	Competencies, non-technical (CRM)	A	APP	This encapsulates communication; leadership and teamwork; problem solving and decision making; situation awareness; workload management. Emphasis should be placed on the development of leadership, shown by EBT data sources to be a highly effective competency in mitigating risk and improving safety through pilot performance	Communication: Demonstrates effective use of language, responsiveness to feedback and that plans are stated and ambiguities resolved. Leadership and teamwork: Uses appropriate authority to ensure focus on the task. Supports others in completing tasks. Problem solving & decision making: Detects deviations from the desired state, evaluates problems, identifies risk, considers alternatives and selects the best course of action. Continuously reviews progress and adjust plans. Situation awareness: Has an awareness of the aircraft state in its environment; projects and anticipates changes. Workload management: Prioritises, delegates and receives assistance to maximise focus on the task. Continuously monitors the flight progress.	GPS failure prior to commencement of approach associated with position drift and a terrain alert					x	x	x	
			DESC			Cabin crew report of water noise below the forward galley indicating a possible toilet pipe leak, with consequent avionics failures					x	x	x	
			CRZ			Smoke removal but combined with a diversion until landing completed.		x			x	x	x	x
			CRZ			ACAS warning immediately following a go-around, with a descent manoeuvre required.		x			x	x	x	x

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 3 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Compliance	A	ALL	Compliance failure. Consequences of not complying with operating instructions (e.g. SOP). This is not intended to list scenarios, but instructors should ensure that observed non-compliances are taken as learning opportunities throughout the programme. In all modules of the programme, the FSTD should as far as possible be treated like an aircraft, and non-compliances should not be accepted simply for expediency.	Recognise that a compliance failure has occurred Make a verbal announcement Take appropriate action if necessary Restore safe flightpath if necessary Manage consequences	The following are examples of potential compliance failures, and not intended to be developed as scenarios as part of an EBT Module: 1. Requesting flap beyond limit speed 2. Flaps or slats in the wrong position for phase of flight or approach 3. Omitting an action as part of a procedure 4. Failing to initiate or complete a checklist 5. Using the wrong checklist for the situation	Intentionally blank							
	Go-around management	A	APP	Any threat or error which can result in circumstances which require a decision to go-around, in addition to the execution of the go-around. Go-around scenarios should be fully developed to encourage effective leadership and teamwork, in addition to problem solving and decision making, plus execution using manual aircraft control or flight management system(s) and automation as applicable. Design should include the element of surprise and scenario-based go-arounds should not be predictable and anticipated. This topic is completely distinct from the go-around manoeuvre listed in the manoeuvres training section that is intended only to practice psychomotor skill and a simple application of the procedures.		Adverse weather scenario leading to a reactive windshear warning during approach	x	x					x	x
			APP			Adverse weather scenario leading to a predictive windshear warning during approach or go-around	x	x					x	x
			APP			Adverse weather scenario, e.g. thunderstorm activity, heavy precipitation or icing forcing decision at or close to DA/MDA	x					x	x	x
			APP			DA with visual reference in heavy precipitation with doubt about runway surface braking capability	x					x	x	x
			APP			Adverse wind scenario resulting in increasing tailwind below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below 15 m (50 ft) (not reported)		x		x		x		
			APP			Lost of difficult communications resulting in no approach clearance prior to commencement of approach or final descent	x		x				x	
			APP			Birds, large flocks of birds below DA once visual reference has been established				x		x	x	
			APP			System malfunction, landing gear malfunction during the approach								
	Manual aircraft control	A	ALL	The competency description is "Maintains control of the aircraft in order to assure the successful outcome of a procedure or manoeuvre."	Desired competency outcome: Demonstrates manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detects deviations through instrument scanning Maintains spare mental capacity during manual aircraft control Maintains the aircraft within the flight envelope Applies knowledge of the relationship between aircraft attitude, speed and thrust	Flight with unreliable airspeed, which may be recoverable or not recoverable	x			x			x	
			ALL			Alternate flight control modes according to malfunction characteristics	x			x				x
			ALL			ACAS RA to descend or ATC immediate descent	x	x		x				
			DES			TAWS warning when deviating from planned descent routing, requiring immediate response	x			x	x			
			TO			Scenario immediately after take-off which requires an immediate and overweight landing			x	x	x	x		
			TO			Adverse wind, crosswinds with or without strong gusts on take-off	x			x				
			TO			Adverse weather, windshear, windshear encounter during take-off, with or without reactive warnings	x			x			x	
			TO			Engine failure during initial climb, typically 30-60 m (100-200 ft)	x	x		x				x
			CRZ			Windshear encounter scenario during cruise, significant and rapid change in windspeed or down/updrafts, without windshear warning	x		x			x	x	x
			APP			Adverse weather, windshear, windshear encounter with or without warning during approach	x		x	x			x	
			APP			Adverse weather, deterioration in visibility or cloud base, or adverse wind, requiring a go-around from visual circling approach, during the visual segment	x	x	x	x		x	x	x
			APP, LDG			Adverse wind, crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
			APP, LDG			Adverse weather, adverse wind, approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP, LDG			Circling approach at night in minimum in-flight visibility to ensure ground reference, minimum environmental lighting and no glide slope guidance lights								
			APP, LDG			Runway incursion during approach, which can be triggered by ATC at various altitudes or by visual contact during the landing phase	x			x			x	
			LDG			Adverse wind, visibility, type specific, special consideration for long bodied aircraft, landing in minimum visibility for visual reference, with crosswind	x	x		x			x	
			LDG			System malfunction, auto flight failure at DA during a low visibility approach requiring a go-around flown manually.	x		x	x			x	

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 3 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	**ISI** Monitoring, cross checking, error management, mismanaged aircraft state	A	ALL	Developed scripted role-play scenarios encompassing the need to monitor flight path excursions from the instructor pilot (PF), detect errors and make appropriate interventions, either verbally or by taking control as applicable. The scenarios should be realistic and relevant, and are for the purpose of demonstration and reinforcement of effective flight path monitoring. Demonstrated role-play should contain realistic and not gross errors, leading at times to a mismanaged aircraft state, which can also be combined with upset management training.	Recognise mismanaged aircraft state. Take appropriate action if necessary Restore desired aircraft state Identify and manage consequences	In-seat instruction: Deviations from the flight path, in pitch attitude, speed, altitude, bank angle		x					x	
			ALL			In-seat instruction: Simple automation errors (e.g. incorrect mode selection, attempted engagement without the necessary conditions, entering wrong altitude or speed, failure to execute the desired mode) culminating in a need for direct intervention from the PM, and where necessary taking control.		x					x	
			APP			In-seat instruction: Unstable approach or speed/path/vertical rate not congruent with required state for given flight condition	x	x					x	x
			LDG			In-seat instruction: Demonstration exercise - recovery from bounced landing, adverse wind, strong gusts during landing phase, resulting in a bounce and necessitating recovery action from the PM	x			x			x	
	Unstable approach	A	DES, APP	Reinforce stabilised approach philosophy and adherence to defined parameters. Encourage go-arounds when crews are outside these parameters. Develop and sustain competencies related to the management of high energy situations		ATC or terrain related environment creating a high energy descent with the need to capture the optimum profile to complete the approach in a stabilised configuration	x		x				x	
			DES, APP			ATC or terrain related environment creating a high energy descent leading to unstable conditions and requiring a go-around	x		x				x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP, LDG			Crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
	Adverse wind	B	TO	Adverse wind/crosswind. This includes tailwind but not ATC miss-reporting of the actual wind	Recognise adverse wind conditions Observe limitations	Take-off with different crosswind/tailwind/gust conditions						x		x
			TO			Take-off with unreported tailwind		x			x			
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswind incl. shifting wind directions				x		x	x	
			APP			Adverse wind scenario resulting in increasing tailwind below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below 15 m (50 ft) (not reported)		x		x		x		
			APP, LDG			Crosswind with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
	Generation 3 Jet - Recurrent Assessment and Training Matrix						Competency map							
Evaluation & Scenario Based Training Phases	Aircraft system malfunctions, including operations under MEL	B	ALL	Any internal failure(s) apparent or not apparent to the crew Any item cleared by the MEL but having an impact upon flight operations. E.g. thrust reverser locked Malfunctions to be considered should have one or more of the following characteristics: Immediacy Complexity Degradation of aircraft control Loss of primary instrumentation Management of consequences	Recognise system malfunction Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences Applies crew operating procedure where necessary. Responds appropriately to additional system abnormals associated with MEL dispatch	For full details see the Malfunction Clustering methodology and results. At least one malfunction with each characteristic should be included every year. Combining characteristics should not reduce the number of malfunctions below 4 for each crewmember every year according to the EBT module cycle. See Part I 3.8.3	Intentionally blank							
			ALL		Immediacy	System malfunctions requiring immediate and urgent crew intervention or decision, e.g. fire, smoke, loss of pressurisation at high altitude, failures during take-off, brake failure during landing Example: Fire								
			ALL		Recognise system malfunction Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences Applies crew operating procedure where necessary. Responds appropriately to additional system abnormals associated with MEL dispatch Immediacy Complexity Degradation of aircraft control Loss of primary instrumentation Loss of primary instrumentation Management of consequences	For full details see the Malfunction Clustering methodology and results. At least one malfunction with each characteristic should be included every year. Combining characteristics should not reduce the number of malfunctions below 4 for each crewmember every year according to the EBT module cycle. See Part I 3.8.3 System malfunctions requiring immediate and urgent crew intervention or decision, e.g. fire, smoke, loss of pressurisation at high altitude, failures during take-off, brake failure during landing Example: Fire System malfunctions requiring complex procedures, e.g. multiple hydraulic system failures, smoke and fumes procedures Example: Major dual system electrical or hydraulic failure System malfunctions resulting in significant degradation of flight controls in combination with abnormal handling characteristics, e.g. jammed flight controls, certain degradation of FBW control Examples: Jammed horizontal stabiliser Flaps and/or slats locked Malfunctions resulting in degraded flight controls System failures that require monitoring and management of the flight path using degraded or alternative displays Unreliable primary flight path information, unreliable airspeed Example: Flight with unreliable airspeed Example: Fuel leak								
			ALL											
			ALL											
			ALL											
			TO			MEL items with crew operating procedures applicable during take-off						x		
			TO			Response to an additional factor that is affected by MEL item (e.g. system failure, runway state)		x		x		x		
			GRD			Malfunction during pre-flight preparation and prior to departure	x					x	x	
			GRD			Malfunction after departure	x					x	x	
			GRD			Malfunctions requiring immediate attention (e.g. bleed fault during engine start, hydraulic failure during taxi)								
			TO			Take-off high speed below V1	x				x	x		
			TO			Take-off high speed above V1	x					x		
			TO			Initial climb	x					x		
			APP			On approach	x					x		x
			APP			Go-around	x					x		x
			LDG			During landing	x	x		x		x	x	
	Aircraft system management	B		Normal system operation according to defined instructions.	This is not considered as a stand alone topic. It links with the topic "compliance" Where a system is not managed according to normal or defined procedures, this is determined as a non-compliance	See "compliance" above. There are no defined scenarios, but the instructor should focus on learning opportunities when system management non-compliances manifest themselves during other scenarios.	Intentionally blank							
	Approach, visibility close to minimum	B	APP	Any situation where visibility becomes a threat	Recognise actual conditions Observe aircraft and/or procedural limitations Apply appropriate procedure if applicable Maintain directional control and safe flight path	Approach in poor visibility	x		x	x				x
			APP			Approach in poor visibility with deteriorations necessitating a decision to go-around	x		x	x				
			LDG			Landing in poor visibility				x		x	x	

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
				Generation 3 Jet - Recurrent Assessment and Training Matrix			Competency map							
Evaluation & Scenario Based Training Phases	Landing	B	LDG	Pilots should have opportunities to practice landings in demanding situations at the defined frequency. Data indicates that landing problems have their roots in a variety of factors, including appropriate decision manking, in addition to manual aircraft control skills if difficult environmental conditions. The purpose of this item is to ensure pilots are exposed to this during the programme	Landing in demanding envornmental conditions, with malfunctions as appropriate	This topc should be combined with Adverse Weather, Aircraft System Malfunctions or any topic that can provide exposure to a landing in demanding conditions	Intentionally blank							
	Surprise	B		The data analysed during the development of this manual and of the EBT concept indicated substantial difficulties encountered by crews when faced with a threat or error, which was a surprise, or an unexpected event. The element of surprise should be distinguished from what is sometimes referred to as the "startle factor", the latter being a physiological reaction. Wherever possible, consideration should be given towards variations in the types of scenario, times of occurrences and types of occurrence, so that pilots do not become overly familiar with repetitions of the same scenarios. Variations should be the focus of EBT programme design, and not left to the discretion of individual instructors, in order to preserve programme integrity and fairness	Exposure to an unexpected event or sequence of events at the defined frequency	Intentionally blank	Intentionally blank							
	Windshear recovery	B	TO	With or without warnings including predictive. A windshear scenario is ideally combined into an adverse weather scenario containing other elements.	Anticipate potential for windshear Avoid known windshear or prepare for suspected windshear Recognise windshear encounter Take appropriate action Apply appropriate procedure correctly Assure aircraft control Recognise out of windshear condition Maintain or restore a safe flight path Assess consequential issues and manage outcomes	Predictive windshear warning during take-off					x	x		
			TO			Windshear encounter during take-off	x				x	x		
			TO			Windshear encounter after rotation						x		x
			TO			Predictive windshear after rotation					x	x		
			APP			Predictive windshear during approach	x				x	x		
			APP			Windshear encounter during approach	x				x	x		
	Workload, distraction, pressure	B		This is not considered a topic for specific attention on it's own, more as a reminder to programme develpers to ensure that pilots are exposed to immmerisive trainig scenarios which expose them to managable high workload and distractions during the course of the EBT programme, at the defined frequency	Managing available resources efficiently to prioritize and perform tasks in a timely manner under all circumstances	Intentionally blank	Intentionally blank							
	ATC	C	ALL	ATC error. Omission, mis-communication, garbled, poor quality transmission. All of these act as distractions to be managed by the crew. The scenarios should be combined where possible with others of the same or higher weighting, the principle reason being to create distractions.	Respond to communications appropriately Recognise, clarify and resolve any ambiguities. Refuse or question unsafe instructions. Use standard phraseology whenever possible	ATC role-play: the instructor provides scripted instructions, as a distraction to the crew	x	x			x			
						Controller error, provided by the instructor according to a defined scripted scenario	x	x				x	x	
						Frequency congestion, with multiple aircraft using the same frequency		x						
						Poor quality transmissions		x						
	Engine failure	C	TO	Any engine failure or malfunction, which causes loss or degradation of thrust that impacts performance. This is distinct from the engine-out manoeuvres described in the manoeuvres training section above, which are intended only for the practice of psychomotor skill and reinforcement of procedures in managing engine failures.	Recognise engine failure Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	Take-off low speed	x		x			x		x
			TO			Take-off high speed below V1	x		x			x		x
			TO			Take-off above V1	x					x	x	x
			TO			Initial climb	x					x	x	
			APP			Engine malfunction	x					x		x
			CRZ			Engine failure in cruise								
			LDG			On landing				x				

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
	Generation 3 Jet - Recurrent Assessment and Training Matrix						Competency map							
Evaluation & Scenario Based Training Phases	Fire and smoke management	C	GRD	This includes engine, electric, pneumatic, cargo fire, smoke or fumes.	Recognise fire, smoke or fumes Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	Fire in cargo or cabin/cockpit at gate	x	x				x		x
			GRD			Fire during taxi	x	x				x		x
			GRD			Fire with no cockpit indication	x	x				x		x
			TO			Take-off low speed	x		x		x	x		
			TO			Take-off high speed below V1	x		x		x	x		
			TO			Take-off high speed above V1	x				x	x		
			TO			Initial climb	x				x	x		
			CRZ			Cargo fire						x	x	x
			APP			Engine fire in approach (extinguishable)		x				x		
			APP			Engine fire in approach (non-extinguishable)		x			x	x		
			APP			Flight deck or cabin fire		x			x	x		
	Loss of communications	C	GRD	Lost or difficult communications. Either through pilot miss-selection or a failure external to the aircraft. This could be for a few seconds or a total loss.	Recognise loss of communications Take appropriate action Execute appropriate procedure as applicable Use alternative ways of communications Manage consequences	Loss of communications during ground manoeuvring	x	x						
			TO			Loss of communications after take-off	x					x		
			APP			Loss of communications during approach phase, including go-around	x	x				x	x	
	Managing loading, fuel, performance errors	C		A calculation error by one or more pilots, or someone involved with the process, or the process itself, e.g. incorrect information on the load sheet.	Anticipate the potential for errors in load/fuel/performance data Recognise inconsistencies Manage/avoid distractions Make changes to paperwork/aircraft system(s) to eliminate error Identify and manage consequences	This can be a demonstrated error, in that the crew may be asked to deliberately insert incorrect data, for example to take-off from an intersection with full length performance information. The crew will be asked to intervene when acceleration is sensed to be lower than normal, and may be part of the operator procedures, especially when operating mixed fleets with considerable variations in MTOM.	x	x						x
	Navigation	C	GRD	External NAV failure. Loss of GPS satellite, ANP exceedance of RNP, loss of external NAV source(s),	Recognise a NAV degradation. Take appropriate action Execute appropriate procedure as applicable Use alternative NAV guidance Manage consequences	External failure or a combination of external failures degrading aircraft navigation performance	x		x			x	x	
			TO, CLB, APP, LDG			External failure or a combination of external failures degrading aircraft navigation performance		x			x	x	x	
	Operations or type specific	C		InIntentioanally blank	Intentionally blank	Intentionally blank	Intentionally blank							
	Pilot incapacitation	C	TO	Consequences for the non-incapacitated pilot.	Recognise incapacitation Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences	During take-off	x	x			x	x		
						During approach	x			x				x
	Runway or taxiway condition	C	TO	Contamination or surface quality of the runway, taxiway, or tarmac including foreign objects	Recognise hazardous runway condition Observe limitations Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Planned anticipated hazardous conditions with dispatch information provided to facilitate planning and execution of appropriate procedures						x		
			TO			Unanticipated hazardous conditions, e.g. unexpected heavy rain resulting in flooded runway surface		x			x	x		
			TO			Stop / Go decision in hazardous conditions					x	x		x
	Terrain	C	ALL	Alert, warning, or conflict	Anticipate terrain threats Prepare for terrain threats Recognise unsafe terrain clearance Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Restore safe flight path Manage consequences	ATC clearance giving insufficient terrain clearance	x	x			x			
			ALL			Demonstration of terrain avoidance warning systems						x	x	x
			TO, CLB			Engine failure where performance is marginal leading to TAWS warning		x		x				x
			DES			"Virtual mountain" meaning the surprise element of an unexpected warning. Care should be exercised in creating a level of realism, so this can best be achieved by an unusual and unexpected change of route during the descent						x	x	x
	Traffic	C	CLB, CRZ, DES	Traffic conflict. ACAS RA or TA, or visual observation of conflict, which requires evasive manoeuvring	Anticipate potential loss of separation Recognise loss of separation Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	ACAS warning requiring crew intervention		x				x	x	x

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 3 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Upset recovery	C	ALL	An airplane upset is defined as an airplane in flight unintentionally exceeding the parameters normally experienced in line operations or training. 1. Pitch attitude greater than 25° nose up. 2. Pitch attitude greater than 10° nose down. 3. Bank angle greater than 45°. 4. Within pitch and bank angle normal parameters, but flying at airspeeds inappropriate for the conditions.	Recognise upset condition Take appropriate action Assure aircraft control Maintain or restore a safe flight path Assess consequential issues Manage outcomes	Upset recognition: Demonstration of the defined normal flight envelope and any associated changes in flight instruments, flight director systems, and protection systems. This should take the form of an instructor led exercise to show the crew the points beyond which an upset condition could exist.			x	x			x	x
			TO, APP			Upset recognition and recovery Severe windshear or wake turbulence during take-off or approach			x	x		x	x	
			CLB, DES			Upset recognition and recovery - as applicable and relevant to aircraft type, demonstration at a suitable intermediate level, with turbulenece as appropriate, practice steep turns and note the relationship between bank angle, pitch and stalling speed				x			x	
			CRZ			Upset recognition and recovery at the maximum cruise flight level for current aircraft weight, turbulence to trigger overspeed conditions (If FSTD capability exists, consider use of vertical wind component to add realism)			x	x		x	x	
			CRZ			Upset recognition and recovery at the maximum cruise flight level for current aircraft weight, turbulence and significant temperature rise to trigger low speed conditions (If FSTD capability exists, consider use of vertical wind component to add realism)	x			x			x	
			CRZ			Upset recognition and recovery - demonstration at a normal cruising altitude, set conditions and disable aircraft systems as necessary to enable trainee to complete stall recovery according to OEM instructions	x			x			x	
			APP			Upset recognition and recovery - demonstration at an intermediate altitude during early stages of the approach, set conditions and disable aircraft systems as necessary to enable trainee to complete stall recovery according to OEM instructions	x			x			x	
	ISI Upset recovery		CLB, DES			Recovery: Demonstration, in-seat instruction: The instructor should position the aircraft within but close to the edge of the normal flight envelope before handing control to the trainee to demonstrate the restoration of normal flight. Careful consideration should be given to flying within the normal flight envelope.				x			x	

APPENDIX I

Training Program Development Guidance – Generation 3 (Turboprop)

1 GENERAL

This Appendix provides the recurrent assessment and training matrix for turbo-propeller aeroplanes of the third generation. A list of such aeroplanes is in the Background section sub-paragraph 3. Aircraft Generations

Using the data of the matrix, operators can develop recurrent training programs based on the EBT concept. It is imperative that the guidance in this manual be well understood by developers of an EBT program.

2 ASSESSMENT AND TRAINING MATRIX

The assessment and training matrix for turbo-propeller aeroplanes of the third generation is contained in the remaining pages of this Appendix.

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 3 Jet - Recurrent Assessment and Training Matrix							Competency map							
Manoeuvres Training Phase	Rejected take-Off	A	TO	Engine failure after the application of take-off thrust and before reaching V1,	Demonstrates manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detects deviations through instrument scanning Maintains spare mental capacity during manual aircraft control Maintains the aircraft within the flight envelope Applies knowledge of the relationship between aircraft attitude, speed and thrust	From initiation of take-off to complete stop (or as applicable to procedure)	x			x				
	Failure of critical engine between V1 & V2	A	TO	Failure of a critical engine from V1 and before reaching V2 in lowest CAT I visibility conditions		The manoeuvre is considered to be complete at a point when aircraft is stabilised at normal engine-out climb speed with the correct pitch and lateral control, in trim condition and, as applicable, autopilot engagement	x			x				
	Failure of critical engine between V1 & V2	B	TO	Failure of a critical engine from V1 and before reaching V2 in lowest CAT I visibility conditions		The manoeuvre is considered to be complete at a point when aircraft is stabilised in a clean configuration with engine-out procedures completed	x			x				
	Emergency descent	C	CRZ	Initiation of emergency descent from normal cruise altitude		The manoeuvre is considered to be completed once the aircraft is stabilised in emergency descent configuration (and profile)	x		x	x				
	Engine-out approach & go-around	A	APP	With a critical engine failed, manually flown normal precision approach to DA, followed by manually flown go-around, the whole manoeuvre to be flown without visual reference		This manoeuvre should be flown from intercept to centreline until acceleration after go-around. The manoeuvre is considered to be complete at a point when aircraft is stabilised at normal engine-out climb speed with the correct pitch and lateral control, in trim condition and, as applicable, autopilot engagement* (describe generally	x			x				
	Go-around	A	APP	Go-around, all engines operative		High energy, initiation during the approach at 150 to 300 m (500 to 1000 ft) below the missed approach level off	x		x	x				
	Go-around	A	APP	Go-around, all engines operative followed by visual circuit, manually flown		Initiation of go-around from DA followed by visual circuit and landing	x		x	x				
	Go-around	A	APP	Go-around, all engines operative		During flare/rejected landing	x		x	x				
	Engine-out landing	A	LDG	With a critical engine failed, normal landing		Initiation in a stablilised engine-out configuration from not less than 3 nm final approach, until completion of roll out	x			x				
Evaluation & Scenario Based Training Phases	Adverse Weather	A	GND	Thunderstorm, heavy rain, turbulence, ice build up to include de-icing issues, as well as high temperature conditions. The proper use of use of anti-ice and de-icing systems should be included generally in appropriate scenarios.	Anticipate adverse weather Prepare for suspected adverse weather Recognise adverse weather Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Predictive windshear warning before take-off, as applicable	x	x				x		
			TO			Adverse weather scenario, e.g. thunderstorm activity, precipitation, icing		x			x	x		x
			TO			Windshear encounter during take-off, not predictive	x			x			x	
			TO			Predictive windshear warning during take-off	x	x				x	x	
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			CRZ			Windshear encounter scenario during cruise	x		x			x	x	x
			APP			Reactive windshear warning during approach or go-around	x		x	x			x	
			APP			Predictive windshear warning during approach or go-around	x	x				x	x	
			APP			Thunderstorm encounter during approach or on missed approach	x					x	x	
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP			Non-precision approach in cold temperature conditions, requiring altitude compensation for temperature, as applicable to type	x	x					x	
			APP, LDG			Crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
			APP			Reduced visibility even after acquiring the necessary visual reference during approach, due to rain or fog	x	x				x		

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
				Generation 3 Jet - Recurrent Assessment and Training Matrix			Competency map							
Evaluation & Scenario Based Training Phases	Automation management	A	ALL	The purpose of this topic is to encourage and develop effective flight path management through proficient and appropriate use of flight management system(s), guidance and automation including transitions between modes, monitoring, mode awareness and vigilance and flexibility needed to change from one mode to another. Included in this topic is the means of mitigating errors described as: mishandled auto flight systems, inappropriate mode selection, flight management system(s) and autopilot usage.	Knows how and when to use flight management system(s), guidance and automation Demonstrates correct methods for engagement and disengagement of auto flight system(s) Demonstrates appropriate use of flight guidance, auto thrust and other automation systems Maintains mode awareness of auto flight system(s), including engagement and automatic transitions Reverts to different modes when appropriate Detects deviations from the desired aircraft state (flight path, speed, attitude, thrust, etc.) and takes appropriate action. Anticipate mishandled auto flight system Recognise mishandled auto flight system. Take appropriate action if necessary Restore correct auto flight state Identify and manage consequences	ACAS warning, recovery and subsequent engagement of automation	x		x					
			ALL			FMS tactical programming issues, e.g. step climb, runway changes, late clearances, destination re-programming, executing diversion	x		x					
			ALL			Recoveries from TAWS, management of energy state to restore automated flight	x		x	x				
			ALL			Amendments to ATC cleared levels during altitude capture modes, to force mode awareness and intervention	x		x				x	
			TO			Late ATC clearance to an altitude below acceleration altitude	x		x				x	
			TO, APP			Engine-out special terrain procedures	x		x				x	
			CRZ			Forcing AP disconnect followed by re engagement, recovery from low or high speed events in cruise	x		x	x			x	
			CRZ			Engine failure in cruise to onset of descent using automation	x		x					
			CRZ			Emergency descent	x		x					
			DES, APP			Managing high energy descent capturing descent path from above (correlation with unstable app training)	x		x				x	
			APP			No ATC clearance received prior to commencement of approach or final descent	x		x				x	
			APP			Reactive windshear and recovery from the consequent high energy state	x		x				x	
			APP			Non precision or infrequently flown approaches using the maximum available level of automation	x		x					
			APP			Gear malfunction during approach		x				x		x
			APP			ATC clearances to waypoints beyond programmed descent point for a coded final descent point during an approach utilising a final descent that is commanded by the flight management system.	x		x				x	
	Competencies, non-technical (CRM)	A	APP	This encapsulates communication; leadership and teamwork; problem solving and decision making; situation awareness; workload management. Emphasis should be placed on the development of leadership, shown by EBT data sources to be a highly effective competency in mitigating risk and improving safety through pilot performance	Communication: Demonstrates effective use of language, responsiveness to feedback and that plans are stated and ambiguities resolved. Leadership and teamwork: Uses appropriate authority to ensure focus on the task. Supports others in completing tasks. Problem solving & decision making: Detects deviations from the desired state, evaluates problems, identifies risk, considers alternatives and selects the best course of action. Continuously reviews progress and adjust plans. Situation awareness: Has an awareness of the aircraft state in its environment; projects and anticipates changes. Workload management: Prioritises, delegates and receives assistance to maximise focus on the task. Continuously monitors the flight progress.	GPS failure prior to commencement of approach associated with position drift and a terrain alert					x	x	x	
			DESC			Cabin crew report of water noise below the forward galley indicating a possible toilet pipe leak, with consequent avionics failures					x	x	x	
			CRZ			Smoke removal but combined with a diversion until landing completed.		x			x	x	x	x
			CRZ			ACAS warning immediately following a go-around, with a descent manoeuvre required.		x			x	x	x	x

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 3 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Compliance	A	ALL	Compliance failure. Consequences of not complying with operating instructions (e.g. SOP). This is not intended to list scenarios, but instructors should ensure that observed non-compliances are taken as learning opportunities throughout the programme. In all modules of the programme, the FSTD should as far as possible be treated like an aircraft, and non-compliances should not be accepted simply for expediency.	Recognise that a compliance failure has occurred Make a verbal announcement Take appropriate action if necessary Restore safe flightpath if necessary Manage consequences	The following are examples of potential compliance failures, and not intended to be developed as scenarios as part of an EBT Module: 1. Requesting flap beyond limit speed 2. Flaps or slats in the wrong position for phase of flight or approach 3. Omitting an action as part of a procedure 4. Failing to initiate or complete a checklist 5. Using the wrong checklist for the situation	Intentionally blank							
	Go-around management	A	APP	Any threat or error which can result in circumstances which require a decision to go-around, in addition to the execution of the go-around. Go-around scenarios should be fully developed to encourage effective leadership and teamwork, in addition to problem solving and decision making, plus execution using manual aircraft control or flight management system(s) and automation as applicable. Design should include the element of surprise and scenario-based go-arounds should not be predictable and anticipated. This topic is completely distinct from the go-around manoeuvre listed in the manoeuvres training section that is intended only to practice psychomotor skill and a simple application of the procedures.		Adverse weather scenario leading to a reactive windshear warning during approach	x	x					x	x
			APP			Adverse weather scenario leading to a predictive windshear warning during approach or go-around	x	x					x	x
			APP			Adverse weather scenario, e.g. thunderstorm activity, heavy precipitation or icing forcing decision at or close to DA/MDA	x					x	x	x
			APP			DA with visual reference in heavy precipitation with doubt about runway surface braking capability	x					x	x	x
			APP			Adverse wind scenario resulting in increasing tailwind below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below 15 m (50 ft) (not reported)		x		x		x		
			APP			Lost of difficult communications resulting in no approach clearance prior to commencement of approach or final descent	x		x				x	
			APP			Birds, large flocks of birds below DA once visual reference has been established				x		x	x	
			APP			System malfunction, landing gear malfunction during the approach								

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 3 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Manual aircraft control	A	ALL	The competency description is "Maintains control of the aircraft in order to assure the successful outcome of a procedure or manoeuvre."	Desired competency outcome: Demonstrates manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detects deviations through instrument scanning Maintains spare mental capacity during manual aircraft control Maintains the aircraft within the flight envelope Applies knowledge of the relationship between aircraft attitude, speed and thrust	Flight with unreliable airspeed, which may be recoverable or not recoverable	x			x			x	
			ALL			Alternate flight control modes according to malfunction characteristics	x			x				x
			ALL			ACAS RA to descend or ATC immediate descent	x	x		x				
			DES			TAWS warning when deviating from planned descent routing, requiring immediate response	x			x	x			
			TO			Scenario immediately after take-off which requires an immediate and overweight landing			x	x	x	x		
			TO			Adverse wind, crosswinds with or without strong gusts on take-off	x			x				
			TO			Adverse weather, windshear, windshear encounter during take-off, with or without reactive warnings	x			x			x	
			TO			Engine failure during initial climb, typically 30-60 m (100-200 ft)	x	x		x				x
			CRZ			Windshear encounter scenario during cruise, significant and rapid change in windspeed or down/updrafts, without windshear warning	x		x			x	x	x
			APP			Adverse weather, windshear, windshear encounter with or without warning during approach	x		x	x			x	
			APP			Adverse weather, deterioration in visibility or cloud base, or adverse wind, requiring a go-around from visual circling approach, during the visual segment	x	x	x	x		x	x	x
			APP, LDG			Adverse wind, crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
			APP, LDG			Adverse weather, adverse wind, approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP, LDG			Circling approach at night in minimum in-flight visibility to ensure ground reference, minimum environmental lighting and no glide slope guidance lights								
			APP, LDG			Runway incursion during approach, which can be triggered by ATC at various altitudes or by visual contact during the landing phase	x			x			x	
			LDG			Adverse wind, visibility, type specific, special consideration for long bodied aircraft, landing in minimum visibility for visual reference, with crosswind	x	x		x			x	
			LDG			System malfunction, auto flight failure at DA during a low visibility approach requiring a go-around flown manually.	x		x	x			x	

Generation 3 Jet - Recurrent Assessment and Training Matrix — Competency map

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Evaluation & Scenario Based Training Phases	**ISI** Monitoring, cross checking, error management, mismanaged aircraft state	A	ALL	Developed scripted role-play scenarios encompassing the need to monitor flight path excursions from the instructor pilot (PF), detect errors and make appropriate interventions, either verbally or by taking control as applicable. The scenarios should be realistic and relevant, and are for the purpose of demonstration and reinforcement of effective flight path monitoring. Demonstrated role-play should contain realistic and not gross errors, leading at times to a mismanaged aircraft state, which can also be combined with upset management training.	Recognise mismanaged aircraft state. Take appropriate action if necessary Restore desired aircraft state Identify and manage consequences	In-seat instruction: Deviations from the flight path, in pitch attitude, speed, altitude, bank angle		x					x	
			ALL			In-seat instruction: Simple automation errors (e.g. incorrect mode selection, attempted engagement without the necessary conditions, entering wrong altitude or speed, failure to execute the desired mode) culminating in a need for direct intervention from the PM, and where necessary taking control.		x					x	
			APP			In-seat instruction: Unstable approach or speed/path/vertical rate not congruent with required state for given flight condition	x	x					x	x
			LDG			In-seat instruction: Demonstration exercise - recovery from bounced landing, adverse wind, strong gusts during landing phase, resulting in a bounce and necessitating recovery action from the PM	x			x			x	
	Unstable approach	A	DES, APP	Reinforce stabilised approach philosophy and adherence to defined parameters. Encourage go-arounds when crews are outside these parameters. Develop and sustain competencies related to the management of high energy situations		ATC or terrain related environment creating a high energy descent with the need to capture the optimum profile to complete the approach in a stabilised configuration	x		x				x	
			DES, APP			ATC or terrain related environment creating a high energy descent leading to unstable conditions and requiring a go-around	x		x				x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP, LDG			Crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 3 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Aircraft system malfunctions, including operations under MEL	B	ALL	Any internal failure(s) apparent or not apparent to the crew Any item cleared by the MEL but having an impact upon flight operations. E.g. thrust reverser locked Malfunctions to be considered should have one or more of the following characteristics: Immediacy Complexity Degradation of aircraft control Loss of primary instrumentation Management of consequences	Recognise system malfunction Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences Applies crew operating procedure where necessary. Responds appropriately to additional system abnormals associated with MEL dispatch	For full details see the Malfunction Clustering methodology and results. At least one malfunction with each characteristic should be included every year. Combining characteristics should not reduce the number of malfunctions below 4 for each crewmember every year according to the EBT module cycle. See Part I 3.8.3	Intentionally blank							
			ALL		Immediacy	System malfunctions requiring immediate and urgent crew intervention or decision, e.g. fire, smoke, loss of pressurisation at high altitude, failures during take-off, brake failure during landing Example: Fire								
			ALL		Recognise system malfunction Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences Applies crew operating procedure where necessary. Responds appropriately to additional system abnormals associated with MEL dispatch Immediacy Complexity Degradation of aircraft control Loss of primary instrumentation Loss of primary instrumentation Management of consequences	For full details see the Malfunction Clustering methodology and results. At least one malfunction with each characteristic should be included every year. Combining characteristics should not reduce the number of malfunctions below 4 for each crewmember every year according to the EBT module cycle. See Part I 3.8.3 System malfunctions requiring immediate and urgent crew intervention or decision, e.g. fire, smoke, loss of pressurisation at high altitude, failures during take-off, brake failure during landing Example: Fire System malfunctions requiring complex procedures, e.g. multiple hydraulic system failures, smoke and fumes procedures Example: Major dual system electrical or hydraulic failure System malfunctions resulting in significant degradation of flight controls in combination with abnormal handling characteristics, e.g. jammed flight controls, certain degradation of FBW control Examples: Jammed horizontal stabiliser Flaps and/or slats locked Malfunctions resulting in degraded flight controls System failures that require monitoring and management of the flight path using degraded or alternative displays Unreliable primary flight path information, unreliable airspeed Example: Flight with unreliable airspeed Example: Fuel leak								
			ALL											
			ALL											
			ALL											
			TO			MEL items with crew operating procedures applicable during take-off						x		
			TO			Response to an additional factor that is affected by MEL item (e.g. system failure, runway state)		x		x		x		
			GRD			Malfunction during pre-flight preparation and prior to departure	x					x	x	
			GRD			Malfunction after departure	x					x	x	
			GRD			Malfunctions requiring immediate attention (e.g. bleed fault during engine start, hydraulic failure during taxi)								
			TO			Take-off high speed below V1	x				x	x		
			TO			Take-off high speed above V1	x					x		
			TO			Initial climb	x					x		
			APP			On approach	x					x		x
			APP			Go-around	x					x		x
			LDG			During landing	x	x		x		x	x	

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 3 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Aircraft system management	B		Normal system operation according to defined instructions.	This is not considered as a stand alone topic. It links with the topic "compliance" Where a system is not managed according to normal or defined procedures, this is determined as a non-compliance	See "compliance" above. There are no defined scenarios, but the instructor should focus on learning opportunities when system management non-compliances manifest themselves during other scenarios.	Intentionally blank							
	Approach, visibility close to minimum	B	APP	Any situation where visibility becomes a threat	Recognise actual conditions Observe aircraft and/or procedural limitations Apply appropriate procedure if applicable Maintain directional control and safe flight path	Approach in poor visibility	x		x	x				x
			APP			Approach in poor visibility with deteriorations necessitating a decision to go-around	x		x	x				
			LDG			Landing in poor visibility				x		x	x	
	Landing	B	LDG	Pilots should have opportunities to practice landings in demanding situations at the defined frequency. Data indicates that landing problems have their roots in a variety of factors, including appropriate decision manking, in addition to manual aircraft control skills if difficult environmental conditions. The purpose of this item is to ensure pilots are exposed to this during the programme	Landing in demanding envornmental conditions, with malfunctions as appropriate	This topc should be combined with Adverse Weather, Aircraft System Malfunctions or any topic that can provide exposure to a landing in demanding conditions	Intentionally blank							
	Surprise	B		The data analysed during the development of this manual and of the EBT concept indicated substantial difficulties encountered by crews when faced with a threat or error, which was a surprise, or an unexpected event. The element of surprise should be distinguished from what is sometimes referred to as the "startle factor", the latter being a physiological reaction. Wherever possible, consideration should be given towards variations in the types of scenario, times of occurrences and types of occurrence, so that pilots do not become overly familiar with repetitions of the same scenarios. Variations should be the focus of EBT programme design, and not left to the discretion of individual instructors, in order to preserve programme integrity and fairness	Exposure to an unexpected event or sequence of events at the defined frequency	Intentionally blank	Intentionally blank							
	Terrain	C	ALL	Alert, warning, or conflict	Anticipate terrain threats Prepare for terrain threats Recognise unsafe terrain clearance Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Restore safe flight path Manage consequences	ATC clearance giving insufficient terrain clearance	x	x			x			
			ALL			Demonstration of terrain avoidance warning systems						x	x	x
			TO, CLB			Engine failure where performance is marginal leading to TAWS warning		x		x				x
			DES			"Virtual mountain" meaning the surprise element of an unexpected warning. Care should be exercised in creating a level of realism, so this can best be achieved by an unusual and unexpected change of route during the descent						x	x	x

Generation 3 Jet - Recurrent Assessment and Training Matrix

Competency map

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Evaluation & Scenario Based Training Phases	Upset recovery	C	ALL	An airplane upset is defined as an airplane in flight unintentionally exceeding the parameters normally experienced in line operations or training. 1. Pitch attitude greater than 25° nose up. 2. Pitch attitude greater than 10° nose down. 3. Bank angle greater than 45°. 4. Within pitch and bank angle normal parameters, but flying at airspeeds inappropriate for the conditions.	Recognise upset condition Take appropriate action Assure aircraft control Maintain or restore a safe flight path Assess consequential issues Manage outcomes	Upset recognition: Demonstration of the defined normal flight envelope and any associated changes in flight instruments, flight director systems, and protection systems. This should take the form of an instructor led exercise to show the crew the points beyond which an upset condition could exist.			x	x			x	x
			TO, APP			Upset recognition and recovery Severe windshear or wake turbulence during take-off or approach			x	x		x	x	
			CLB, DES			Upset recognition and recovery - as applicable and relevant to aircraft type, demonstration at a suitable intermediate level, with turbulenece as appropriate, practice steep turns and note the relationship between bank angle, pitch and stalling speed				x			x	
			CRZ			Upset recognition and recovery at the maximum cruise flight level for current aircraft weight, turbulence to trigger overspeed conditions (If FSTD capability exists, consider use of vertical wind component to add realism)			x	x		x	x	
			CRZ			Upset recognition and recovery at the maximum cruise flight level for current aircraft weight, turbulence and significant temperature rise to trigger low speed conditions (If FSTD capability exists, consider use of vertical wind component to add realism)	x			x			x	
			CRZ			Upset recognition and recovery - demonstration at a normal cruising altitude, set conditions and disable aircraft systems as necessary to enable trainee to complete stall recovery according to OEM instructions	x			x			x	
			APP			Upset recognition and recovery - demonstration at an intermediate altitude during early stages of the approach, set conditions and disable aircraft systems as necessary to enable trainee to complete stall recovery according to OEM instructions	x			x			x	
	ISI Upset recovery		CLB, DES			Recovery: Demonstration, in-seat instruction: The instructor should position the aircraft within but close to the edge of the normal flight envelope before handing control to the trainee to demonstrate the restoration of normal flight. Careful consideration should be given to flying within the normal flight envelope.				x			x	
	Workload, distraction, pressure	B		This is not considered a topic for specific attention on it's own, more as a reminder to programme develpers to ensure that pilots are exposed to immmerisive trainig scenarios which expose them to managable high workload and distractions during the course of the EBT programme, at the defined frequency	Managing available resources efficiently to prioritize and perform tasks in a timely manner under all circumstances	Intentionally blank	Intentionally blank							

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
				Generation 3 Jet - Recurrent Assessment and Training Matrix			Competency map							
Evaluation & Scenario Based Training Phases	Adverse wind	C	TO	Adverse wind/crosswind. This includes tailwind but not ATC miss-reporting of the actual wind	Recognise adverse wind conditions Observe limitations	Take-off with different crosswind/tailwind/gust conditions						x		x
			TO			Take-off with unreported tailwind		x			x			
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswind incl. shifting wind directions				x		x	x	
			APP			Adverse wind scenario resulting in increasing tailwind below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below 15 m (50 ft) (not reported)		x		x		x		
			APP, LDG			Crosswind with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
	Engine failure	C	TO	Any engine failure or malfunction, which causes loss or degradation of thrust that impacts performance. This is distinct from the engine-out manoeuvres described in the manoeuvres training section above, which are intended only for the practice of psychomotor skill and reinforcement of procedures in managing engine failures.	Recognise engine failure Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	Take-off low speed	x		x			x		x
			TO			Take-off high speed below V1	x		x			x		x
			TO			Take-off above V1	x					x	x	x
			TO			Initial climb	x					x	x	
			APP			Engine malfunction	x					x		x
			CRZ			Engine failure in cruise								
			LDG			On landing				x				
	Fire and smoke management	C	GRD	This includes engine, electric, pneumatic, cargo fire, smoke or fumes.	Recognise fire, smoke or fumes Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	Fire in cargo or cabin/cockpit at gate	x	x				x		x
			GRD			Fire during taxi	x	x				x		x
			GRD			Fire with no cockpit indication	x	x				x		x
			TO			Take-off low speed	x		x		x	x		
			TO			Take-off high speed below V1	x		x		x	x		
			TO			Take-off high speed above V1	x				x	x		
			TO			Initial climb	x				x	x		
			CRZ			Cargo fire						x	x	x
			APP			Engine fire in approach (extinguishable)		x				x		
			APP			Engine fire in approach (non-extinguishable)		x			x	x		
			APP			Flight deck or cabin fire		x			x	x		
	Loss of communications	C	GRD	Lost or difficult communications. Either through pilot miss-selection or a failure external to the aircraft. This could be for a few seconds or a total loss.	Recognise loss of communications Take appropriate action Execute appropriate procedure as applicable Use alternative ways of communications Manage consequences	Loss of communications during ground manoeuvring	x	x						
			TO			Loss of communications after take-off	x					x		
			APP			Loss of communications during approach phase, including go-around	x	x				x	x	
	Managing loading, fuel, performance errors	C		A calculation error by one or more pilots, or someone involved with the process, or the process itself, e.g. incorrect information on the load sheet.	Anticipate the potential for errors in load/fuel/performance data Recognise inconsistencies Manage/avoid distractions Make changes to paperwork/aircraft system(s) to eliminate error Identify and manage consequences	This can be a demonstrated error, in that the crew may be asked to deliberately insert incorrect data, for example to take-off from an intersection with full length performance information. The crew will be asked to intervene when acceleration is sensed to be lower than normal, and may be part of the operator procedures, especially when operating mixed fleets with considerable variations in MTOM.	x	x						x

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 3 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Navigation	C	GRD	External NAV failure. Loss of GPS satellite, ANP exceedance of RNP, loss of external NAV source(s),	Recognise a NAV degradation. Take appropriate action Execute appropriate procedure as applicable Use alternative NAV guidance Manage consequences	External failure or a combination of external failures degrading aircraft navigation performance	x		x			x	x	
			TO, CLB, APP, LDG			External failure or a combination of external failures degrading aircraft navigation performance		x			x	x	x	
	Operations or type specific	C		InIntentioanally blank	Intentionally blank	Intentionally blank	Intentionally blank							
	Pilot incapacitation	C	TO	Consequences for the non-incapacitated pilot.	Recognise incapacitation Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences	During take-off	x	x			x	x		
						During approach	x			x				x
	Runway or taxiway condition	C	TO	Contamination or surface quality of the runway, taxiway, or tarmac including foreign objects	Recognise hazardous runway condition Observe limitations Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Planned anticipated hazardous conditions with dispatch information provided to facilitate planning and execution of appropriate procedures						x		
			TO			Unanticipated hazardous conditions, e.g. unexpected heavy rain resulting in flooded runway surface		x			x	x		
			TO			Stop / Go decision in hazardous conditions					x	x		x
	Traffic	C	CLB, CRZ, DES	Traffic conflict. ACAS RA or TA, or visual observation of conflict, which requires evasive manoeuvring	Anticipate potential loss of separation Recognise loss of separation Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	ACAS warning requiring crew intervention		x				x	x	x
	Windshear recovery	B	TO	With or without warnings including predictive. A windshear scenario is ideally combined into an adverse weather scenario containing other elements.	Anticipate potential for windshear Avoid known windshear or prepare for suspected windshear Recognise windshear encounter Take appropriate action Apply appropriate procedure correctly Assure aircraft control Recognise out of windshear condition Maintain or restore a safe flight path Assess consequential issues and manage outcomes	Predictive windshear warning during take-off					x	x		
			TO			Windshear encounter during take-off	x				x	x		
			TO			Windshear encounter after rotation						x		x
			TO			Predictive windshear after rotation					x	x		
			APP			Predictive windshear during approach	x				x	x		
			APP			Windshear encounter during approach	x				x	x		

APPENDIX J

Training Program Development Guidance – Generation 2 (Jet)

1 GENERAL

This Appendix provides the recurrent assessment and training matrix for turbo-jet aeroplanes of the second generation. A list of such aeroplanes is in the Background section sub-paragraph 3. Aircraft Generations

Using the data of the matrix, operators can develop recurrent training programs based on the EBT concept. It is imperative that the guidance in this manual be well understood by developers of an EBT program.

2 ASSESSMENT AND TRAINING MATRIX

The assessment and training matrix for turbo-jet aeroplanes of the second generation is contained in the remaining pages of this Appendix.

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
	Generation 2 Jet - Recurrent Assessment and Training Matrix						Competency map							
Manoeuvres Training Phase	Rejected take-Off	A	TO	Engine failure after the application of take-off thrust and before reaching V1,	Demonstrates manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detects deviations through instrument scanning Maintains spare mental capacity during manual aircraft control Maintains the aircraft within the flight envelope Applies knowledge of the relationship between aircraft attitude, speed and thrust	From initiation of take-off to complete stop (or as applicable to procedure)	x			x				
	Failure of critical engine between V1 & V2	A	TO	Failure of a critical engine from V1 and before reaching V2 in lowest CAT I visibility conditions		The manoeuvre is considered to be complete at a point when aircraft is stabilised at normal engine-out climb speed with the correct pitch and lateral control, in trim condition and, as applicable, autopilot engagement	x			x				
	Failure of critical engine between V1 & V2	B	TO	Failure of a critical engine from V1 and before reaching V2 in lowest CAT I visibility conditions		The manoeuvre is considered to be complete at a point when aircraft is stabilised in a clean configuration with engine-out procedures completed	x			x				
	Emergency descent	C	CRZ	Initiation of emergency descent from normal cruise altitude		The manoeuvre is considered to be completed once the aircraft is stabilised in emergency descent configuration (and profile)	x		x	x				
	Engine-out approach & go-around	A	APP	With a critical engine failed, manually flown normal precision approach to DA, followed by manually flown go-around, the whole manoeuvre to be flown without visual reference		This manoeuvre should be flown from intercept to centreline until acceleration after go-around. The manoeuvre is considered to be complete at a point when aircraft is stabilised at normal engine-out climb speed with the correct pitch and lateral control, in trim condition and, as applicable, autopilot engagement* (describe generally critical part of manoeuvre)	x			x				
	Go-around	A	APP	Go-around, all engines operative		High energy, initiation during the approach at 150 to 300 m (500 to 1000 ft) below the missed approach level off altitude	x		x	x				
	Go-around	A	APP	Go-around, all engines operative followed by visual circuit, manually flown		Initiation of go-around from DA followed by visual circuit and landing	x		x	x				
	Go-around	A	APP	Go-around, all engines operative		During flare/rejected landing	x		x	x				
	Engine-out landing	A	LDG	With a critical engine failed, normal landing		Initiation in a stablilised engine-out configuration from not less than 3 nm final approach, until completion of roll out	x			x				
Evaluation & Scenario Based Training Phases	Adverse Weather	A	GND	Thunderstorm, heavy rain, turbulence, ice build up to include de-icing issues, as well as high temperature conditions. The proper use of use of anti-ice and de-icing systems should be included generally in appropriate scenarios.	Anticipate adverse weather Prepare for suspected adverse weather Recognise adverse weather Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Predictive windshear warning before take-off, as applicable	x	x				x		
			TO			Adverse weather scenario, e.g. thunderstorm activity, precipitation, icing		x			x	x		x
			TO			Windshear encounter during take-off, not predictive	x			x			x	
			TO			Predictive windshear warning during take-off	x	x				x	x	
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			CRZ			Windshear encounter scenario during cruise	x		x			x	x	x
			APP			Reactive windshear warning during approach or go-around	x		x	x			x	
			APP			Predictive windshear warning during approach or go-around	x	x				x	x	
			APP			Thunderstorm encounter during approach or on missed approach	x					x	x	
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP			Non-precision approach in cold temperature conditions, requiring altitude compensation for temperature, as applicable to type	x	x					x	
			APP, LDG			Crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
			APP			Reduced visibility even after acquiring the necessary visual reference during approach, due to rain or fog	x	x				x		
	Approach, visibility close to minimum	A	APP	Any situation where visibility becomes a threat	Recognise actual conditions Observe aircraft and/or procedural limitations Apply appropriate procedure if applicable Maintain directional control and safe flight path	Approach in poor visibility	x		x	x				x
			APP			Approach in poor visibility with deteriorations necessitating a decision to go-around	x		x	x				
			LDG			Landing in poor visibility				x		x	x	

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 2 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Automation management	A	ALL	The purpose of this topic is to encourage and develop effective flight path management through proficient and appropriate use of flight management system(s), guidance and automation including transitions between modes, monitoring, mode awareness and vigilance and flexibility needed to change from one mode to another. Included in this topic is the means of mitigating errors described as: mishandled auto flight systems, inappropriate mode selection, flight management system(s) and autopilot usage.	Knows how and when to use flight management system(s), guidance and automation Demonstrates correct methods for engagement and disengagement of auto flight system(s) Demonstrates appropriate use of flight guidance, auto thrust and other automation systems Maintains mode awareness of auto flight system(s), including engagement and automatic transitions Reverts to different modes when appropriate Detects deviations from the desired aircraft state (flight path, speed, attitude, thrust, etc.) and takes appropriate action. Anticipate mishandled auto flight system Recognise mishandled auto flight system. Take appropriate action if necessary Restore correct auto flight state Identify and manage consequences	ACAS warning, recovery and subsequent engagement of automation	x		x					
			ALL			FMS tactical programming issues, e.g. step climb, runway changes, late clearances, destination re-programming, executing diversion	x		x					
			ALL			Recoveries from TAWS, management of energy state to restore automated flight	x		x	x				
			ALL			Amendments to ATC cleared levels during altitude capture modes, to force mode awareness and intervention	x		x				x	
			TO			Late ATC clearance to an altitude below acceleration altitude	x		x				x	
			TO, APP			Engine-out special terrain procedures	x		x				x	
			CRZ			Forcing AP disconnect followed by re engagement, recovery from low or high speed events in cruise	x		x	x			x	
			CRZ			Engine failure in cruise to onset of descent using automation	x		x					
			CRZ			Emergency descent	x		x					
			DES, APP			Managing high energy descent capturing descent path from above (correlation with unstable app training)	x		x				x	
			APP			No ATC clearance received prior to commencement of approach or final descent	x		x				x	
			APP			Reactive windshear and recovery from the consequent high energy state	x		x				x	
			APP			Non precision or infrequently flown approaches using the maximum available level of automation	x		x					
			APP			Gear malfunction during approach		x				x		x
			APP			ATC clearances to waypoints beyond programmed descent point for a coded final descent point during an approach utilising a final descent that is commanded by the flight management system.	x		x				x	
	Competencies, non-technical (CRM)	A	APP	This encapsulates communication; leadership and teamwork; problem solving and decision making; situation awareness; workload management. Emphasis should be placed on the development of leadership, shown by EBT data sources to be a highly effective competency in mitigating risk and improving safety through pilot performance	Communication: Demonstrates effective use of language, responsiveness to feedback and that plans are stated and ambiguities resolved. Leadership and teamwork: Uses appropriate authority to ensure focus on the task. Supports others in completing tasks. Problem solving & decision making: Detects deviations from the desired state, evaluates problems, identifies risk, considers alternatives and selects the best course of action. Continuously reviews progress and adjust plans. Situation awareness: Has an awareness of the aircraft state in its environment; projects and anticipates changes. Workload management: Prioritises, delegates and receives assistance to maximise focus on the task. Continuously monitors the flight progress.	GPS failure prior to commencement of approach associated with position drift and a terrain alert					x	x	x	
			DESC			Cabin crew report of water noise below the forward galley indicating a possible toilet pipe leak, with consequent avionics failures					x	x	x	
			CRZ			Smoke removal but combined with a diversion until landing completed.		x			x	x	x	x
			CRZ			ACAS warning immediately following a go-around, with a descent manoeuvre required.		x			x	x	x	x
	Go-around management	A	APP	Any threat or error which can result in circumstances which require a decision to go-around, in addition to the execution of the go-around. Go-around scenarios should be fully developed to encourage effective leadership and teamwork, in addition to problem solving and decision making, plus execution using manual aircraft control or flight management system(s) and automation as applicable. Design should include the element of surprise and scenario-based go-arounds should not be predictable and anticipated. This topic is completely distinct from the go-around manoeuvre listed in the manoeuvres training section that is intended only to practice psychomotor skill and a simple application of the procedures.		Adverse weather scenario leading to a reactive windshear warning during approach	x	x					x	x
			APP			Adverse weather scenario leading to a predictive windshear warning during approach or go-around	x	x					x	x
			APP			Adverse weather scenario, e.g. thunderstorm activity, heavy precipitation or icing forcing decision at or close to DA/MDA	x					x	x	x
			APP			DA with visual reference in heavy precipitation with doubt about runway surface braking capability	x					x	x	x
			APP			Adverse wind scenario resulting in increasing tailwind below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below 15 m (50 ft) (not reported)		x		x		x		
			APP			Lost of difficult communications resulting in no approach clearance prior to commencement of approach or final descent	x		x				x	
			APP			Birds, large flocks of birds below DA once visual reference has been established				x		x	x	
			APP			System malfunction, landing gear malfunction during the approach								

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 2 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Manual aircraft control	A	ALL	The competency description is "Maintains control of the aircraft in order to assure the successful outcome of a procedure or manoeuvre."	Desired competency outcome: Demonstrates manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detects deviations through instrument scanning Maintains spare mental capacity during manual aircraft control Maintains the aircraft within the flight envelope Applies knowledge of the relationship between aircraft attitude, speed and thrust	Flight with unreliable airspeed, which may be recoverable or not recoverable	x			x			x	
			ALL			Alternate flight control modes according to malfunction characteristics	x			x				x
			ALL			ACAS RA to descend or ATC immediate descent	x	x		x				
			DES			TAWS warning when deviating from planned descent routing, requiring immediate response	x			x	x			
			TO			Scenario immediately after take-off which requires an immediate and overweight landing			x	x	x	x		
			TO			Adverse wind, crosswinds with or without strong gusts on take-off	x			x				
			TO			Adverse weather, windshear, windshear encounter during take-off, with or without reactive warnings	x			x			x	
			TO			Engine failure during initial climb, typically 30-60 m (100-200 ft)	x	x		x				x
			CRZ			Windshear encounter scenario during cruise, significant and rapid change in windspeed or down/updrafts, without windshear warning	x		x			x	x	x
			APP			Adverse weather, windshear, windshear encounter with or without warning during approach	x		x	x			x	
			APP			Adverse weather, deterioration in visibility or cloud base, or adverse wind, requiring a go-around from visual circling approach, during the visual segment	x	x	x	x		x	x	x
			APP, LDG			Adverse wind, crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
			APP, LDG			Adverse weather, adverse wind, approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP, LDG			Circling approach at night in minimum in-flight visibility to ensure ground reference, minimum environmental lighting and no glide slope guidance lights								
			APP, LDG			Runway incursion during approach, which can be triggered by ATC at various altitudes or by visual contact during the landing phase	x			x			x	
			LDG			Adverse wind, visibility, type specific, special consideration for long bodied aircraft, landing in minimum visibility for visual reference, with crosswind	x	x		x			x	
			LDG			System malfunction, auto flight failure at DA during a low visibility approach requiring a go-around flown manually.	x		x	x			x	
	ISI Monitoring, cross checking, error management, mismanaged aircraft state	A	ALL	Developed scripted role-play scenarios encompassing the need to monitor flight path excursions from the instructor pilot (PF), detect errors and make appropriate interventions, either verbally or by taking control as applicable. The scenarios should be realistic and relevant, and are for the purpose of demonstration and reinforcement of effective flight path monitoring. Demonstrated role-play should contain realistic and not gross errors, leading at times to a mismanaged aircraft state, which can also be combined with upset management training.	Recognise mismanaged aircraft state. Take appropriate action if necessary Restore desired aircraft state Identify and manage consequences	In-seat instruction: Deviations from the flight path, in pitch attitude, speed, altitude, bank angle		x					x	
			ALL			In-seat instruction: Simple automation errors (e.g. incorrect mode selection, attempted engagement without the necessary conditions, entering wrong altitude or speed, failure to execute the desired mode) culminating in a need for direct intervention from the PM, and where necessary taking control.		x					x	
			APP			In-seat instruction: Unstable approach or speed/path/vertical rate not congruent with required state for given flight condition	x	x					x	x
			LDG			In-seat instruction: Demonstration exercise - recovery from bounced landing, adverse wind, strong gusts during landing phase, resulting in a bounce and necessitating recovery action from the PM	x			x			x	

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 2 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Unstable approach	A	DES, APP	Reinforce stabilised approach philosophy and adherence to defined parameters. Encourage go-arounds when crews are outside these parameters. Develop and sustain competencies related to the management of high energy situations		ATC or terrain related environment creating a high energy descent with the need to capture the optimum profile to complete the approach in a stabilised configuration	x		x				x	
			DES, APP			ATC or terrain related environment creating a high energy descent leading to unstable conditions and requiring a go-around	x		x				x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP, LDG			Crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
	Adverse wind	B	TO	Adverse wind/crosswind. This includes tailwind but not ATC miss-reporting of the actual wind	Recognise adverse wind conditions Observe limitations Apply appropriate procedures Maintain directional control and safe flight path	Take-off with different crosswind/tailwind/gust conditions						x		x
			TO			Take-off with unreported tailwind		x			x			
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswind incl. shifting wind directions				x		x	x	
			APP			Adverse wind scenario resulting in increasing tailwind below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below 15 m (50 ft) (not reported)		x		x		x		
			APP, LDG			Crosswind with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 2 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Aircraft system malfunctions, including operations under MEL	B	ALL	Any internal failure(s) apparent or not apparent to the crew Any item cleared by the MEL but having an impact upon flight operations. E.g. thrust reverser locked Malfunctions to be considered should have one or more of the following characteristics: Immediacy Complexity Degradation of aircraft control Loss of primary instrumentation Management of consequences	Recognise system malfunction Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences Applies crew operating procedure where necessary. Responds appropriately to additional system abnormals associated with MEL dispatch Charactertistics of malfunctions to be considered: Immediacy Complexity Degradation of aircraft control Loss of primary instrumentation Management of consequences	For full details see the Malfunction Clustering methodology and results. At least one malfunction with each characteristic should be included every year. Combining characteristics should not reduce the number of malfunctions below 4 for each crewmember every year according to the EBT module cycle. See Part I 3.8.3 System malfunctions requiring immediate and urgent crew intervention or decision, e.g. fire, smoke, loss of pressurisation at high altitude, failures during take-off, brake failure during landing Example: Fire System malfunctions requiring complex procedures, e.g. multiple hydraulic system failures, smoke and fumes procedures Example: Major dual system electrical or hydraulic failure System malfunctions resulting in significant degradation of flight controls in combination with abnormal handling characteristics, e.g. jammed flight controls, certain degradation of FBW control Examples: Jammed horizontal stabiliser Flaps and/or slats locked Malfunctions resulting in degraded flight controls System failures that require monitoring and management of the flight path using degraded or alternative displays Unreliable primary flight path information, unreliable airspeed Example: Flight with unreliable airspeed Example: Fuel leak	Intentionally blank							
			ALL											
			ALL											
			ALL											
			ALL											
			ALL											
			TO			MEL items with crew operating procedures applicable during take-off						x		
			TO			Response to an additional factor that is affected by MEL item (e.g. system failure, runway state)		x		x		x		
			GRD			Malfunction during pre-flight preparation and prior to departure	x					x	x	
			GRD			Malfunction after departure	x					x	x	
			GRD			Malfunctions requiring immediate attention (e.g. bleed fault during engine start, hydraulic failure during taxi)								
			TO			Take-off high speed below V1	x				x	x		
			TO			Take-off high speed above V1	x					x		
			TO			Initial climb	x					x		
			APP			On approach	x					x		x
			APP			Go-around	x					x		x
			LDG			During landing	x	x		x		x	x	

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 2 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Compliance	B	ALL	Compliance failure. Consequences of not complying with operating instructions (e.g. SOP). This is not intended to list scenarios, but instructors should ensure that observed non-compliances are taken as learning opportunities throughout the programme. In all modules of the programme, the FSTD should as far as possible be treated like an aircraft, and non-compliances should not be accepted simply for expediency.	Recognise that a compliance failure has occurred Make a verbal announcement Take appropriate action if necessary Restore safe flightpath if necessary Manage consequences	The following are examples of potential compliance failures, and not intended to be developed as scenarios as part of an EBT Module: 1. Requesting flap beyond limit speed 2. Flaps or slats in the wrong position for phase of flight or approach 3. Omitting an action as part of a procedure 4. Failing to initiate or complete a checklist 5. Using the wrong checklist for the situation	Intentionally blank							
	Engine failure	B	TO	Any engine failure or malfunction, which causes loss or degradation of thrust that impacts performance. This is distinct from the engine-out manoeuvres described in the manoeuvres training section above, which are intended only for the practice of psychomotor skill and reinforcement of procedures in managing engine failures.	Recognise engine failure Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	Take-off low speed	x		x			x		x
			TO			Take-off high speed below V1	x		x			x		x
			TO			Take-off above V1	x					x	x	x
			TO			Initial climb	x					x	x	
			APP			Engine malfunction	x					x		x
			CRZ			Engine failure in cruise								
			LDG			On landing				x				
	Fire and smoke management	B	GRD	This includes engine, electric, pneumatic, cargo fire, smoke or fumes.	Recognise fire, smoke or fumes Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	Fire in cargo or cabin/cockpit at gate	x	x				x		x
			GRD			Fire during taxi	x	x				x		x
			GRD			Fire with no cockpit indication	x	x				x		x
			TO			Take-off low speed	x		x		x	x		
			TO			Take-off high speed below V1	x		x		x	x		
			TO			Take-off high speed above V1	x				x	x		
			TO			Initial climb	x				x	x		
			CRZ			Cargo fire						x	x	x
			APP			Engine fire in approach (extinguishable)		x				x		
			APP			Engine fire in approach (non-extinguishable)		x			x	x		
			APP			Flight deck or cabin fire		x			x	x		
	Landing	B	LDG	Pilots should have opportunities to practice landings in demanding situations at the defined frequency. Data indicates that landing problems have their roots in a variety of factors, including appropriate decision manking, in addition to manual aircraft control skills if difficult environmental conditions. The purpose of this item is to ensure pilots are exposed to this during the programme	Landing in demanding envornmental conditions, with malfunctions as appropriate	This topc should be combined with Adverse Weather, Aircraft System Malfunctions or any topic that can provide exposure to a landing in demanding conditions	Intentionally blank							
	Surprise	B		The data analysed during the development of this manual and of the EBT concept indicated substantial difficulties encountered by crews when faced with a threat or error, which was a surprise, or an unexpected event. The element of surprise should be distinguished from what is sometimes referred to as the "startle factor", the latter being a physiological reaction. Wherever possible, consideration should be given towards variations in the types of scenario, times of occurrences and types of occurrence, so that pilots do not become overly familiar with repetitions of the same scenarios. Variations should be the focus of EBT programme design, and not left to the discretion of individual instructors, in order to preserve programme integrity and fairness	Exposure to an unexpected event or sequence of events at the defined frequency	Intentionally blank	Intentionally blank							

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
	Generation 2 Jet - Recurrent Assessment and Training Matrix						Competency map							
Evaluation & Scenario Based Training Phases	Windshear recovery	B	TO	With or without warnings including predictive. A windshear scenario is ideally combined into an adverse weather scenario containing other elements.	Anticipate potential for windshear Avoid known windshear or prepare for suspected windshear Recognise windshear encounter Take appropriate action Apply appropriate procedure correctly Assure aircraft control Recognise out of windshear condition Maintain or restore a safe flight path Assess consequential issues and manage outcomes	Predictive windshear warning during take-off					x	x		
			TO			Windshear encounter during take-off	x				x	x		
			TO			Windshear encounter after rotation						x		x
			TO			Predictive windshear after rotation					x	x		
			APP			Predictive windshear during approach	x				x	x		
			APP			Windshear encounter during approach	x				x	x		
	Loss of communications	C	GRD	Lost or difficult communications. Either through pilot miss-selection or a failure external to the aircraft. This could be for a few seconds or a total loss.	Recognise loss of communications Take appropriate action Execute appropriate procedure as applicable Use alternative ways of communications Manage consequences	Loss of communications during ground manoeuvring	x	x						
			TO			Loss of communications after take-off	x					x		
			APP			Loss of communications during approach phase, including go-around	x	x				x	x	
	Managing loading, fuel, performance error	C		A calculation error by one or more pilots, or someone involved with the process, or the process itself, e.g. incorrect information on the load sheet.	Anticipate the potential for errors in load/fuel/performance data Recognise inconsistencies Manage/avoid distractions Make changes to paperwork/aircraft system(s) to eliminate error Identify and manage consequences	This can be a demonstrated error, in that the crew may be asked to deliberately insert incorrect data, for example to take-off from an intersection with full length performance information. The crew will be asked to intervene when acceleration is sensed to be lower than normal, and may be part of the operator procedures, especially when operating mixed fleets with considerable variations in MTOM.	x	x						x
	Navigation	C	GRD	External NAV failure. Loss of GPS satellite, ANP exceedance of RNP, loss of external NAV source(s),	Recognise a NAV degradation. Take appropriate action Execute appropriate procedure as applicable Use alternative NAV guidance Manage consequences	External failure or a combination of external failures degrading aircraft navigation performance	x		x			x	x	
			TO, CLB, APP, LDG			External failure or a combination of external failures degrading aircraft navigation performance		x			x	x	x	
	Operations or type specific	C		Intentionally blank	Intentionally blank	Intentionally blank	Intentionally blank							
	Pilot incapacitation	C	TO	Consequences for the non-incapacitated pilot.	Recognise incapacitation Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences	During take-off	x	x			x	x		
						During approach	x			x				x
	Runway or taxiway condition	C	TO	Contamination or surface quality of the runway, taxiway, or tarmac including foreign objects	Recognise hazardous runway condition Observe limitations Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Planned anticipated hazardous conditions with dispatch information provided to facilitate planning and execution of appropriate procedures						x		
			TO			Unanticipated hazardous conditions, e.g. unexpected heavy rain resulting in flooded runway surface		x			x	x		
			TO			Stop / Go decision in hazardous conditions					x	x		x
	Terrain	C	ALL	Alert, warning, or conflict	Anticipate terrain threats Prepare for terrain threats Recognise unsafe terrain clearance Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Restore safe flight path Manage consequences	ATC clearance giving insufficient terrain clearance	x	x			x			
			ALL			Demonstration of terrain avoidance warning systems						x	x	x
			TO, CLB			Engine failure where performance is marginal leading to TAWS warning		x		x				x
			DES			"Virtual mountain" meaning the surprise element of an unexpected warning. Care should be exercised in creating a level of realism, so this can best be achieved by an unusual and unexpected change of route during the descent						x	x	x

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 2 Jet - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Traffic	C	CLB, CRZ, DES	Traffic conflict. ACAS RA or TA, or visual observation of conflict, which requires evasive manoeuvring	Anticipate potential loss of separation Recognise loss of separation Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	ACAS warning requiring crew intervention		x				x	x	x
	Upset recovery	C	ALL	An airplane upset is defined as an airplane in flight unintentionally exceeding the parameters normally experienced in line operations or training. 1. Pitch attitude greater than 25° nose up. 2. Pitch attitude greater than 10° nose down. 3. Bank angle greater than 45°. 4. Within pitch and bank angle normal parameters, but flying at airspeeds inappropriate for the conditions.	Recognise upset condition Take appropriate action Assure aircraft control Maintain or restore a safe flight path Assess consequential issues Manage outcomes	Upset recognition: Demonstration of the defined normal flight envelope and any associated changes in flight instruments, flight director systems, and protection systems. This should take the form of an instructor led exercise to show the crew the points beyond which an upset condition could exist.			x	x			x	x
			TO, APP			Upset recognition and recovery Severe windshear or wake turbulence during take-off or approach			x	x		x	x	
			CLB, DES			Upset recognition and recovery - demonstration at a suitable intermediate level, with turbulenece as appropriate, practice steep turns and note the relationship between bank angle, pitch and stalling speed				x			x	
			CRZ			Upset recognition and recovery at the maximum cruise flight level for current aircraft weight, turbulence to trigger overspeed conditions (If FSTD capability exists, consider use of vertical wind component to add realism)			x	x		x	x	
			CRZ			Upset recognition and recovery at the maximum cruise flight level for current aircraft weight, turbulence and significant temperature rise to trigger low speed conditions (If FSTD capability exists, consider use of vertical wind component to add realism)	x			x			x	
			CRZ			Upset recognition and recovery - demonstration at a normal cruising altitude, set conditions and disable aircraft systems as necessary to enable trainee to complete stall recovery according to OEM instructions	x			x			x	
			APP			Upset recognition and recovery - demonstration at an intermediate altitude during early stages of the approach, set conditions and disable aircraft systems as necessary to enable trainee to complete stall recovery according to OEM instructions	x			x			x	
	ISI Upset recovery		CLB, DES			Recovery: Demonstration, in-seat instruction: The instructor should position the aircraft within but close to the edge of the normal flight envelope before handing control to the trainee to demonstrate the restoration of normal flight. Careful consideration should be given to flying within the normal flight envelope.				x			x	

APPENDIX K

Training Program Development Guidance – Generation 2 (Turboprop)

1 GENERAL

This Appendix provides the recurrent assessment and training matrix for turbo-propeller aeroplanes of the second generation. A list of such aeroplanes is in the Background section sub-paragraph 3. Aircraft Generations

Using the data of the matrix, operators can develop recurrent training programs based on the EBT concept. It is imperative that the guidance in this manual be well understood by developers of an EBT program.

2 ASSESSMENT AND TRAINING MATRIX

The assessment and training matrix for turbo-propeller aeroplanes of the second generation is contained in the remaining pages of this Appendix.

Generation 2 Turboprop - Recurrent Assessment and Training Matrix

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
							Competency map							
Manoeuvres Training Phase	Rejected take-Off	A	TO	Engine failure after the application of take-off thrust and before reaching V1,	Demonstrates manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detects deviations through instrument scanning Maintains spare mental capacity during manual aircraft control Maintains the aircraft within the flight envelope Applies knowledge of the relationship between aircraft attitude, speed and thrust	From initiation of take-off to complete stop (or as applicable to procedure)	x			x				
	Failure of critical engine between V1 & V2	A	TO	Failure of a critical engine from V1 and before reaching V2 in lowest CAT I visibility conditions		The manoeuvre is considered to be complete at a point when aircraft is stabilised at normal engine-out climb speed with the correct pitch and lateral control, in trim condition and, as applicable, autopilot engagement	x			x				
	Failure of critical engine between V1 & V2	B	TO	Failure of a critical engine from V1 and before reaching V2 in lowest CAT I visibility conditions		The manoeuvre is considered to be complete at a point when aircraft is stabilised in a clean configuration with engine-out procedures completed	x			x				
	Emergency descent	C	CRZ	Initiation of emergency descent from normal cruise altitude		The manoeuvre is considered to be completed once the aircraft is stabilised in emergency descent configuration (and profile)	x		x	x				
	Engine-out approach & go-around	A	APP	With a critical engine failed, manually flown normal precision approach to DA, followed by manually flown go-around, the whole manoeuvre to be flown without visual reference		This manoeuvre should be flown from intercept to centreline until acceleration after go-around. The manoeuvre is considered to be complete at a point when aircraft is stabilised at normal engine-out climb speed with the correct pitch and lateral control, in trim condition and, as applicable, autopilot engagement* (describe generally critical part of manoeuvre)	x			x				
	Go-around	A	APP	Go-around, all engines operative		High energy, initiation during the approach at 150 to 300 m (500 to 1000 ft) below the missed approach level off	x		x	x				
	Go-around	A	APP	Go-around, all engines operative followed by visual circuit, manually flown		Initiation of go-around from DA followed by visual circuit and landing	x		x	x				
	Go-around	A	APP	Go-around, all engines operative		During flare/rejected landing	x		x	x				
	Engine-out landing	A	LDG	With a critical engine failed, normal landing		Initiation in a stablilised engine-out configuration from not less than 3 nm final approach, until completion of roll out	x			x				
Evaluation & Scenario Based Training Phases	Adverse Weather	A	GND	Thunderstorm, heavy rain, turbulence, ice build up to include de-icing issues, as well as high temperature conditions. The proper use of use of anti-ice and de-icing systems should be included generally in appropriate scenarios.	Anticipate adverse weather Prepare for suspected adverse weather Recognise adverse weather Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Predictive windshear warning before take-off, as applicable	x	x				x		
			TO			Adverse weather scenario, e.g. thunderstorm activity, precipitation, icing		x			x	x		x
			TO			Windshear encounter during take-off, not predictive	x			x			x	
			TO			Predictive windshear warning during take-off	x	x				x	x	
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			CRZ			Windshear encounter scenario during cruise	x		x			x	x	x
			APP			Reactive windshear warning during approach or go-around	x		x	x			x	
			APP			Predictive windshear warning during approach or go-around	x	x				x	x	
			APP			Thunderstorm encounter during approach or on missed approach	x					x	x	
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP			Non-precision approach in cold temperature conditions, requiring altitude compensation for temperature, as applicable to type	x	x					x	
			APP, LDG			Crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
			APP			Reduced visibility even after acquiring the necessary visual reference during approach, due to rain or fog	x	x				x		
	Aircraft system management	A		Normal system operation according to defined instructions.	This is not considered as a stand alone topic. It links with the topic "compliance" Where a system is not managed according to normal or defined procedures, this is determined as a non-compliance	See "compliance" above. There are no defined scenarios, but the instructor should focus on learning opportunities when system management non-compliances manifest themselves during other scenarios.	Intentionally blank							

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 2 Turboprop - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Automation management	A	ALL	The purpose of this topic is to encourage and develop effective flight path management through proficient and appropriate use of flight management system(s), guidance and automation including transitions between modes, monitoring, mode awareness and vigilance and flexibility needed to change from one mode to another. Included in this topic is the means of mitigating errors described as: mishandled auto flight systems, inappropriate mode selection, flight management system(s) and autopilot usage.	Knows how and when to use flight management system(s), guidance and automation Demonstrates correct methods for engagement and disengagement of auto flight system(s) Demonstrates appropriate use of flight guidance, auto thrust and other automation systems Maintains mode awareness of auto flight system(s), including engagement and automatic transitions Reverts to different modes when appropriate Detects deviations from the desired aircraft state (flight path, speed, attitude, thrust, etc.) and takes appropriate action. Anticipate mishandled auto flight system Recognise mishandled auto flight system. Take appropriate action if necessary Restore correct auto flight state Identify and manage consequences	ACAS warning, recovery and subsequent engagement of automation	x		x					
			ALL			FMS tactical programming issues, e.g. step climb, runway changes, late clearances, destination re-programming, executing diversion	x		x					
			ALL			Recoveries from TAWS, management of energy state to restore automated flight	x		x	x				
			ALL			Amendments to ATC cleared levels during altitude capture modes, to force mode awareness and intervention	x		x				x	
			TO			Late ATC clearance to an altitude below acceleration altitude	x		x				x	
			TO, APP			Engine-out special terrain procedures	x		x				x	
			CRZ			Forcing AP disconnect followed by re engagement, recovery from low or high speed events in cruise	x		x	x			x	
			CRZ			Engine failure in cruise to onset of descent using automation	x		x					
			CRZ			Emergency descent	x		x					
			DES, APP			Managing high energy descent capturing descent path from above (correlation with unstable app training)	x		x				x	
			APP			No ATC clearance received prior to commencement of approach or final descent	x		x				x	
			APP			Reactive windshear and recovery from the consequent high energy state	x		x				x	
			APP			Non precision or infrequently flown approaches using the maximum available level of automation	x		x					
			APP			Gear malfunction during approach		x				x		x
			APP			ATC clearances to waypoints beyond programmed descent point for a coded final descent point during an approach utilising a final descent that is commanded by the flight management system.	x		x				x	
	Competencies, non-technical (CRM)	A	APP	This encapsulates communication; leadership and teamwork; problem solving and decision making; situation awareness; workload management. Emphasis should be placed on the development of leadership, shown by EBT data sources to be a highly effective competency in mitigating risk and improving safety through pilot performance	Communication: Demonstrates effective use of language, responsiveness to feedback and that plans are stated and ambiguities resolved. Leadership and teamwork: Uses appropriate authority to ensure focus on the task. Supports others in completing tasks. Problem solving & decision making: Detects deviations from the desired state, evaluates problems, identifies risk, considers alternatives and selects the best course of action. Continuously reviews progress and adjust plans. Situation awareness: Has an awareness of the aircraft state in its environment; projects and anticipates changes. Workload management: Prioritises, delegates and receives assistance to maximise focus on the task. Continuously monitors the flight progress.	GPS failure prior to commencement of approach associated with position drift and a terrain alert					x	x	x	
			DESC			Cabin crew report of water noise below the forward galley indicating a possible toilet pipe leak, with consequent avionics failures					x	x	x	
			CRZ			Smoke removal but combined with a diversion until landing completed.		x			x	x	x	x
			CRZ			ACAS warning immediately following a go-around, with a descent manoeuvre required.		x			x	x	x	x
	Compliance	A	ALL	Compliance failure. Consequences of not complying with operating instructions (e.g. SOP). This is not intended to list scenarios, but instructors should ensure that observed non-compliances are taken as learning opportunities throughout the programme. In all modules of the programme, the FSTD should as far as possible be treated like an aircraft, and non-compliances should not be accepted simply for expediency.	Recognise that a compliance failure has occurred Make a verbal announcement Take appropriate action if necessary Restore safe flightpath if necessary Manage consequences	The following are examples of potential compliance failures, and not intended to be developed as scenarios as part of an EBT Module: 1. Requesting flap beyond limit speed 2. Flaps or slats in the wrong position for phase of flight or approach 3. Omitting an action as part of a procedure 4. Failing to initiate or complete a checklist 5. Using the wrong checklist for the situation	Intentionally blank							

Generation 2 Turboprop - Recurrent Assessment and Training Matrix

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Evaluation & Scenario Based Training Phases	Go-around management	A	APP	Any threat or error which can result in circumstances which require a decision to go-around, in addition to the execution of the go-around. Go-around scenarios should be fully developed to encourage effective leadership and teamwork, in addition to problem solving and decision making, plus execution using manual aircraft control or flight management system(s) and automation as applicable. Design should include the element of surprise and scenario-based go-arounds should not be predictable and anticipated. This topic is completely distinct from the go-around manoeuvre listed in the manoeuvres training section that is intended only to practice psychomotor skill and a simple application of the procedures.		Adverse weather scenario leading to a reactive windshear warning during approach	x	x					x	x
			APP			Adverse weather scenario leading to a predictive windshear warning during approach or go-around	x	x					x	x
			APP			Adverse weather scenario, e.g. thunderstorm activity, heavy precipitation or icing forcing decision at or close to DA/MDA	x					x	x	x
			APP			DA with visual reference in heavy precipitation with doubt about runway surface braking capability	x					x	x	x
			APP			Adverse wind scenario resulting in increasing tailwind below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below 15 m (50 ft) (not reported)		x		x		x		
			APP			Lost of difficult communications resulting in no approach clearance prior to commencement of approach or final descent	x		x				x	
			APP			Birds, large flocks of birds below DA once visual reference has been established				x		x	x	
			APP			System malfunction, landing gear malfunction during the approach								
	Manual aircraft control	A	ALL	The competency description is "Maintains control of the aircraft in order to assure the successful outcome of a procedure or manoeuvre."	Desired competency outcome: Demonstrates manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detects deviations through instrument scanning Maintains spare mental capacity during manual aircraft control Maintains the aircraft within the flight envelope Applies knowledge of the relationship between aircraft attitude, speed and thrust	Flight with unreliable airspeed, which may be recoverable or not recoverable	x			x			x	
			ALL			Alternate flight control modes according to malfunction characteristics	x			x				x
			ALL			ACAS RA to descend or ATC immediate descent	x	x		x				
			DES			TAWS warning when deviating from planned descent routing, requiring immediate response	x			x	x			
			TO			Scenario immediately after take-off which requires an immediate and overweight landing			x	x	x	x		
			TO			Adverse wind, crosswinds with or without strong gusts on take-off	x			x				
			TO			Adverse weather, windshear, windshear encounter during take-off, with or without reactive warnings	x			x			x	
			TO			Engine failure during initial climb, typically 30-60 m (100-200 ft)	x	x		x				x
			CRZ			Windshear encounter scenario during cruise, significant and rapid change in windspeed or down/updrafts, without windshear warning	x		x			x	x	x
			APP			Adverse weather, windshear, windshear encounter with or without warning during approach	x		x	x			x	
			APP			Adverse weather, deterioration in visibility or cloud base, or adverse wind, requiring a go-around from visual circling approach, during the visual segment	x	x	x	x		x	x	x
			APP, LDG			Adverse wind, crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		
			APP, LDG			Adverse weather, adverse wind, approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP, LDG			Circling approach at night in minimum in-flight visibility to ensure ground reference, minimum environmental lighting and no glide slope guidance lights								
			APP, LDG			Runway incursion during approach, which can be triggered by ATC at various altitudes or by visual contact during the landing phase	x			x			x	
			LDG			Adverse wind, visibility, type specific, special consideration for long bodied aircraft, landing in minimum visibility for visual reference, with crosswind	x	x		x			x	
			LDG			System malfunction, auto flight failure at DA during a low visibility approach requiring a go-around flown manually.	x		x	x			x	

Competency map

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 2 Turboprop - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	**ISI** Monitoring, cross checking, error management, mismanaged aircraft state	A	ALL	Developed scripted role-play scenarios encompassing the need to monitor flight path excursions from the instructor pilot (PF), detect errors and make appropriate interventions, either verbally or by taking control as applicable. The scenarios should be realistic and relevant, and are for the purpose of demonstration and reinforcement of effective flight path monitoring. Demonstrated role-play should contain realistic and not gross errors, leading at times to a mismanaged aircraft state, which can also be combined with upset management training.	Recognise mismanaged aircraft state. Take appropriate action if necessary Restore desired aircraft state Identify and manage consequences	In-seat instruction: Deviations from the flight path, in pitch attitude, speed, altitude, bank angle		x					x	
			ALL			In-seat instruction: Simple automation errors (e.g. incorrect mode selection, attempted engagement without the necessary conditions, entering wrong altitude or speed, failure to execute the desired mode) culminating in a need for direct intervention from the PM, and where necessary taking control.		x					x	
			APP			In-seat instruction: Unstable approach or speed/path/vertical rate not congruent with required state for given flight condition	x	x					x	x
			LDG			In-seat instruction: Demonstration exercise - recovery from bounced landing, adverse wind, strong gusts during landing phase, resulting in a bounce and necessitating recovery action from the PM	x			x			x	
	Unstable approach	A	DES, APP	Reinforce stabilised approach philosophy and adherence to defined parameters. Encourage go-arounds when crews are outside these parameters. Develop and sustain competencies related to the management of high energy situations		ATC or terrain related environment creating a high energy descent with the need to capture the optimum profile to complete the approach in a stabilised configuration	x		x				x	
			DES, APP			ATC or terrain related environment creating a high energy descent leading to unstable conditions and requiring a go-around	x		x				x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswinds incl. shifting wind directions				x		x	x	
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP, LDG			Crosswinds with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 2 Turboprop - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Aircraft system malfunctions, including operations under MEL	B	ALL	Any internal failure(s) apparent or not apparent to the crew Any item cleared by the MEL but having an impact upon flight operations. E.g. thrust reverser locked Malfunctions to be considered should have one or more of the following characteristics: Immediacy Complexity Degradation of aircraft control Loss of primary instrumentation Management of consequences	Recognise system malfunction Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences Applies crew operating procedure where necessary. Responds appropriately to additional system abnormals associated with MEL dispatch	For full details see the Malfunction Clustering methodology and results. At least one malfunction with each characteristic should be included every year. Combining characteristics should not reduce the number of malfunctions below 4 for each crewmember every year according to the EBT module cycle. See Part I 3.8.3	Intentionally blank							
			ALL		Immediacy	System malfunctions requiring immediate and urgent crew intervention or decision, e.g. fire, smoke, loss of pressurisation at high altitude, failures during take-off, brake failure during landing Example: Fire								
			ALL		Recognise system malfunction Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences Applies crew operating procedure where necessary. Responds appropriately to additional system abnormals associated with MEL dispatch Immediacy Complexity Degradation of aircraft control Loss of primary instrumentation Loss of primary instrumentation Management of consequences	For full details see the Malfunction Clustering methodology and results. At least one malfunction with each characteristic should be included every year. Combining characteristics should not reduce the number of malfunctions below 4 for each crewmember every year according to the EBT module cycle. See Part I 3.8.3 System malfunctions requiring immediate and urgent crew intervention or decision, e.g. fire, smoke, loss of pressurisation at high altitude, failures during take-off, brake failure during landing Example: Fire System malfunctions requiring complex procedures, e.g. multiple hydraulic system failures, smoke and fumes procedures Example: Major dual system electrical or hydraulic failure System malfunctions resulting in significant degradation of flight controls in combination with abnormal handling characteristics, e.g. jammed flight controls, certain degradation of FBW control Examples: Jammed horizontal stabiliser Flaps and/or slats locked Malfunctions resulting in degraded flight controls System failures that require monitoring and management of the flight path using degraded or alternative displays Unreliable primary flight path information, unreliable airspeed Example: Flight with unreliable airspeed Example: Fuel leak								
			ALL											
			ALL											
			ALL											
			TO			MEL items with crew operating procedures applicable during take-off						x		
			TO			Response to an additional factor that is affected by MEL item (e.g. system failure, runway state)		x		x		x		
			GRD			Malfunction during pre-flight preparation and prior to departure	x					x	x	
			GRD			Malfunction after departure	x					x	x	
			GRD			Malfunctions requiring immediate attention (e.g. bleed fault during engine start, hydraulic failure during taxi)								
			TO			Take-off high speed below V1	x				x	x		
			TO			Take-off high speed above V1	x					x		
			TO			Initial climb	x					x		
			APP			On approach	x					x		x
			APP			Go-around	x					x		x
			LDG			During landing	x	x		x		x	x	
	Engine failure	B	TO	Any engine failure or malfunction, which causes loss or degradation of thrust that impacts performance. This is distinct from the engine-out manoeuvres described in the manoeuvres training section above, which are intended only for the practice of psychomotor skill and reinforcement of procedures in managing engine failures.	Recognise engine failure Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	Take-off low speed	x		x			x		x
			TO			Take-off high speed below V1	x		x			x		x
			TO			Take-off above V1	x					x	x	x
			TO			Initial climb	x					x	x	
			APP			Engine malfunction	x					x		x
			CRZ			Engine failure in cruise								
			LDG			On landing				x				

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
	Generation 2 Turboprop - Recurrent Assessment and Training Matrix						Competency map							
Evaluation & Scenario Based Training Phases	Landing	B	LDG	Pilots should have opportunities to practice landings in demanding situations at the defined frequency. Data indicates that landing problems have their roots in a variety of factors, including appropriate decision manking, in addition to manual aircraft control skills if difficult environmental conditions. The purpose of this item is to ensure pilots are exposed to this during the programme	Landing in demanding envornmental conditions, with malfunctions as appropriate	This topc should be combined with Adverse Weather, Aircraft System Malfunctions or any topic that can provide exposure to a landing in demanding conditions	Intentionally blank							
	Surprise	B		The data analysed during the development of this manual and of the EBT concept indicated substantial difficulties encountered by crews when faced with a threat or error, which was a surprise, or an unexpected event. The element of surprise should be distinguished from what is sometimes referred to as the "startle factor", the latter being a physiological reaction. Wherever possible, consideration should be given towards variations in the types of scenario, times of occurrences and types of occurrence, so that pilots do not become overly familiar with repetitions of the same scenarios. Variations should be the focus of EBT programme design, and not left to the discretion of individual instructors, in order to preserve programme integrity and fairness	Exposure to an unexpected event or sequence of events at the defined frequency	Intentionally blank	Intentionally blank							
	Terrain	B	ALL	Alert, warning, or conflict	Anticipate terrain threats Prepare for terrain threats Recognise unsafe terrain clearance Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Restore safe flight path Manage consequences	ATC clearance giving insufficient terrain clearance	x	x			x			
			ALL			Demonstration of terrain avoidance warning systems						x	x	x
			TO, CLB			Engine failure where performance is marginal leading to TAWS warning		x		x				x
			DES			"Virtual mountain" meaning the surprise element of an unexpected warning. Care should be exercised in creating a level of realism, so this can best be achieved by an unusual and unexpected change of route during the descent						x	x	x
	Workload, distraction, pressure	B		This is not considered a topic for specific attention on it's own, more as a reminder to programme develpers to ensure that pilots are exposed to immmerisive trainig scenarios which expose them to managable high workload and distractions during the course of the EBT programme, at the defined frequency	Managing available resources efficiently to prioritize and perform tasks in a timely manner under all circumstances	Intentionally blank	Intentionally blank							
	Adverse wind	C	TO	Adverse wind/crosswind. This includes tailwind but not ATC miss-reporting of the actual wind	Recognise adverse wind conditions Observe limitations Apply appropriate procedures Maintain directional control and safe flight path	Take-off with different crosswind/tailwind/gust conditions						x		x
			TO			Take-off with unreported tailwind		x			x			
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			APP			Increasing tailwind on final (not reported)	x	x				x	x	
			APP			Approach and landing in demanding weather conditions, e.g. turbulence, up and downdrafts, gusts and crosswind incl. shifting wind directions				x		x	x	
			APP			Adverse wind scenario resulting in increasing tailwind below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below DA (not reported)		x		x		x		
			APP			Adverse wind scenario including strong gusts and/or crosswind out of limits below 15 m (50 ft) (not reported)		x		x		x		
			APP, LDG			Crosswind with or without strong gusts on approach, final and landing (within and beyond limits)	x			x		x		

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 2 Turboprop - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Approach, visibility close to minimum	C	APP	Any situation where visibility becomes a threat	Recognise actual conditions Observe aircraft and/or procedural limitations Apply appropriate procedure if applicable Maintain directional control and safe flight path	Approach in poor visibility	x		x	x				x
			APP			Approach in poor visibility with deteriorations necessitating a decision to go-around	x		x	x				
			LDG			Landing in poor visibility				x		x	x	
	Fire and smoke management	C	GRD	This includes engine, electric, pneumatic, cargo fire, smoke or fumes.	Recognise fire, smoke or fumes Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	Fire in cargo or cabin/cockpit at gate	x	x				x		x
			GRD			Fire during taxi	x	x				x		x
			GRD			Fire with no cockpit indication	x	x				x		x
			TO			Take-off low speed	x		x		x	x		
			TO			Take-off high speed below V1	x		x		x	x		
			TO			Take-off high speed above V1	x				x	x		
			TO			Initial climb	x				x	x		
			CRZ			Cargo fire						x	x	x
			APP			Engine fire in approach (extinguishable)		x				x		
			APP			Engine fire in approach (non-extinguishable)		x			x	x		
			APP			Flight deck or cabin fire		x			x	x		
	Loss of communications	C	GRD	Lost or difficult communications. Either through pilot miss-selection or a failure external to the aircraft. This could be for a few seconds or a total loss.	Recognise loss of communications Take appropriate action Execute appropriate procedure as applicable Use alternative ways of communications Manage consequences	Loss of communications during ground manoeuvring	x	x						
			TO			Loss of communications after take-off	x					x		
			APP			Loss of communications during approach phase, including go-around	x	x				x	x	
	Managing loading, fuel, performance errors	C		A calculation error by one or more pilots, or someone involved with the process, or the process itself, e.g. incorrect information on the load sheet.	Anticipate the potential for errors in load/fuel/performance data Recognise inconsistencies Manage/avoid distractions Make changes to paperwork/aircraft system(s) to eliminate error Identify and manage consequences	This can be a demonstrated error, in that the crew may be asked to deliberately insert incorrect data, for example to take-off from an intersection with full length performance information. The crew will be asked to intervene when acceleration is sensed to be lower than normal, and may be part of the operator procedures, especially when operating mixed fleets with considerable variations in MTOM.	x	x						x
	Navigation	C	GRD	External NAV failure. Loss of GPS satellite, ANP exceedance of RNP, loss of external NAV source(s),	Recognise a NAV degradation. Take appropriate action Execute appropriate procedure as applicable Use alternative NAV guidance Manage consequences	External failure or a combination of external failures degrading aircraft navigation performance	x		x			x	x	
			TO, CLB, APP, LDG			External failure or a combination of external failures degrading aircraft navigation performance		x			x	x	x	
	Operations or type specific	C		InIntentioanally blank	Intentionally blank	Intentionally blank	Intentionally blank							
	Pilot incapacitation	C	TO	Consequences for the non-incapacitated pilot.	Recognise incapacitation Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences	During take-off	x	x			x	x		
						During approach	x			x				x
	Runway or taxiway condition	C	TO	Contamination or surface quality of the runway, taxiway, or tarmac including foreign objects	Recognise hazardous runway condition Observe limitations Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Planned anticipated hazardous conditions with dispatch information provided to facilitate planning and execution of appropriate procedures						x		
			TO			Unanticipated hazardous conditions, e.g. unexpected heavy rain resulting in flooded runway surface		x			x	x		
			TO			Stop / Go decision in hazardous conditions					x	x		x
	Traffic	C	CLB, CRZ, DES	Traffic conflict. ACAS RA or TA, or visual observation of conflict, which requires evasive manoeuvring	Anticipate potential loss of separation Recognise loss of separation Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	ACAS warning requiring crew intervention		x				x	x	x

	Assessment and training topic	Frequency	Flight phase for activation	Description (include type of topic, being threat, error or focus)	Desired outcome (includes performance criteria OR training outcome)	Example scenario elements	Application of procedures	Communication	Flight path management, automation	Flight path management, manual control	Leadership and teamwork	Problem solving and decision making	Situation awareness	Workload management
Generation 2 Turboprop - Recurrent Assessment and Training Matrix							Competency map							
Evaluation & Scenario Based Training Phases	Upset recovery	C	ALL	An airplane upset is defined as an airplane in flight unintentionally exceeding the parameters normally experienced in line operations or training. 1. Pitch attitude greater than 25° nose up. 2. Pitch attitude greater than 10° nose down. 3. Bank angle greater than 45°. 4. Within pitch and bank angle normal parameters, but flying at airspeeds inappropriate for the conditions.	Recognise upset condition Take appropriate action Assure aircraft control Maintain or restore a safe flight path Assess consequential issues Manage outcomes	Upset recognition: Demonstration of the defined normal flight envelope and any associated changes in flight instruments, flight director systems, and protection systems. This should take the form of an instructor led exercise to show the crew the points beyond which an upset condition could exist.			x	x			x	x
			TO, APP			Upset recognition and recovery Severe windshear or wake turbulence during take-off or approach			x	x		x	x	
			CLB, DES			Upset recognition and recovery - as applicable and relevant to aircraft type, demonstration at a suitable intermediate level, with turbulenece as appropriate, practice steep turns and note the relationship between bank angle, pitch and stalling speed				x			x	
			CRZ			Upset recognition and recovery at the maximum cruise flight level for current aircraft weight, turbulence to trigger overspeed conditions (If FSTD capability exists, consider use of vertical wind component to add realism)			x	x		x	x	
			CRZ			Upset recognition and recovery at the maximum cruise flight level for current aircraft weight, turbulence and significant temperature rise to trigger low speed conditions (If FSTD capability exists, consider use of vertical wind component to add realism)	x			x			x	
			CRZ			Upset recognition and recovery - demonstration at a normal cruising altitude, set conditions and disable aircraft systems as necessary to enable trainee to complete stall recovery according to OEM instructions	x			x			x	
			APP			Upset recognition and recovery - demonstration at an intermediate altitude during early stages of the approach, set conditions and disable aircraft systems as necessary to enable trainee to complete stall recovery according to OEM instructions	x			x			x	
	ISI Upset recovery		CLB, DES			Recovery: Demonstration, in-seat instruction: The instructor should position the aircraft within but close to the edge of the normal flight envelope before handing control to the trainee to demonstrate the restoration of normal flight. Careful consideration should be given to flying within the normal flight envelope.				x			x	
	Windshear recovery	C	TO	With or without warnings including predictive. A windshear scenario is ideally combined into an adverse weather scenario containing other elements.	Anticipate potential for windshear Avoid known windshear or prepare for suspected windshear Recognise windshear encounter Take appropriate action Apply appropriate procedure correctly Assure aircraft control Recognise out of windshear condition Maintain or restore a safe flight path Assess consequential issues and manage outcomes	Predictive windshear warning during take-off					x	x		
			TO			Windshear encounter during take-off	x				x	x		
			TO			Windshear encounter after rotation						x		x
			TO			Predictive windshear after rotation					x	x		
			APP			Predictive windshear during approach	x				x	x		
			APP			Windshear encounter during approach	x				x	x		

APPENDIX L

Training Program Development Guidance – Generation 1 (Jet)

1 GENERAL

This Appendix addresses the case of turbo-jet aeroplanes of the first generation. A list of such aeroplanes is in the Background section sub-paragraph 3. Aircraft Generations.

Given the very small number of turbo-jet aeroplanes of the first generation in current use in commercial air transport operations and the lack of appropriate FSTD for recurrent training, it has not been deemed possible to provide an assessment and training matrix for those aeroplanes.

APPENDIX M

Example Grading Scales

Based upon the methodologies and criteria described in Chapter 6, the following grading option was selected (i.e., the option that best met the criteria) and was used as basis for the further development:

A COMPETENT/NOT YET COMPETENT statement for the session

Grading the competency for each session (one grade per competency)

Textual comment highlighting exemplary and below-norm performance

It is assumed that for satisfactory performance to be achieved in an EBT program, procedures, and maneuvers designed in the program will have been executed. Where this is not the case, any additional training may require demonstration of the execution of any applicable procedure or maneuver.

Development of the Grading Scales

The next step is the development of the grading scales. Thirteen options were assessed against each criterion. The assessments were then multiplied with their weighting of the criteria obtained.

A 5-point numerical grading scale was selected.

Development of The Word Pictures

Word pictures describe the various steps of the five level grading scale developed. They are a direct function of the underlying behavioral indicator and were created using standardized elements, allowing clearer comparability, easier instructor standardization and thus better inter-rater-reliability.

Each word picture is thus constructed, according to the VENN methodology of grading, combining the four elements (A, B, C, D):

A = WHAT LEVEL (e.g. The pilot did not communicate effectively…)

B = HOW OFTEN (e.g. …by rarely demonstrating…)

C = HOW MANY (e.g. … any of the behavioral indicators when required…)

D = OUTCOME (e.g. … which resulted in an unsafe situation.)

Competency Grades

The following wording is used in the example 5-point system to describe performance according to behavioral indicators, and in this example it is important to note that the minimum acceptable performance level is 2.

Application of Procedures

1. The pilot did not apply procedures correctly, by rarely demonstrating any of the behavioral indicators when required, which resulted in an unsafe situation.
2. The pilot applied procedures at the minimum acceptable level, by only occasionally demonstrating some of the behavioral indicators when required, but which overall did not result in an unsafe situation.
3. The pilot applied procedures adequately, by regularly demonstrating most of the behavioral indicators when required, which resulted in a safe operation.
4. The pilot applied procedures effectively, by regularly demonstrating all of the behavioral indicators when required, which enhanced safety.
5. The pilot applied procedures in an exemplary manner, by always demonstrating all of the behavioral indicators when required, which significantly enhanced safety, effectiveness and efficiency.

Communication

1. The pilot did not communicate effectively, by rarely demonstrating any of the behavioral indicators when required, which resulted in an unsafe situation.
2. The pilot communicated at the minimum acceptable level, by only occasionally demonstrating some of the behavioral indicators when required, but which overall did not result in an unsafe situation.
3. The pilot communicated adequately, by regularly demonstrating most of the behavioral indicators when required, which resulted in a safe operation.
4. The pilot communicated effectively, by regularly demonstrating all of the behavioral indicators when required, which enhanced safety.
5. The pilot communicated in an exemplary manner, by always demonstrating all of the behavioral indicators when required, which significantly enhanced safety, effectiveness and efficiency.

Aircraft Flight Path Management, Automation

1. The pilot did not manage the automation effectively, by rarely demonstrating any of the behavioral indicators when required, which resulted in an unsafe situation.

2. The pilot managed the automation at the minimum acceptable level, by only occasionally demonstrating some of the behavioral indicators when required, but which overall did not result in an unsafe situation.

3. The pilot managed the automation adequately, by regularly demonstrating most of the behavioral indicators when required, which resulted in a safe operation.

4. The pilot managed the automation effectively, by regularly demonstrating all of the behavioral indicators when required, which enhanced safety.

5. The pilot managed the automation in an exemplary manner, by always demonstrating all of the behavioral indicators when required, which significantly enhanced safety, effectiveness and efficiency.

Aircraft Flight Path Management, Manual Control

1. The pilot did not control the aircraft effectively, by rarely demonstrating any of the behavioral indicators when required, which resulted in an unsafe situation.

2. The pilot controlled the aircraft at the minimum acceptable level, by only occasionally demonstrating some of the behavioral indicators when required, but which overall did not result in an unsafe situation.

3. The pilot controlled the aircraft adequately, by regularly demonstrating most of the behavioral indicators when required, which resulted in a safe operation.

4. The pilot controlled the aircraft effectively, by regularly demonstrating all of the behavioral indicators when required, which enhanced safety.

5. The pilot controlled the aircraft in an exemplary manner, by always demonstrating all of the behavioral indicators when required, which significantly enhanced safety, effectiveness and efficiency.

Leadership & Teamwork

1. The pilot did not lead or work as a team member effectively, by rarely demonstrating any of the behavioral indicators when required, which resulted in an unsafe situation.

2. The pilot led and worked as a team member at the minimum acceptable level, by only occasionally demonstrating some of the behavioral indicators when required, but which overall did not result in an unsafe situation.

3. The pilot led and worked as a team member adequately, by regularly demonstrating most of the behavioral indicators when required, which resulted in a safe operation.

4. The pilot led and worked as a team member effectively, by regularly demonstrating all of the behavioral indicators when required, which enhanced safety.

5. The pilot led and worked as a team member in an exemplary manner, by always demonstrating all of the behavioral indicators when required, which significantly enhanced safety, effectiveness and efficiency.

Problem Solving & Decision Making

1. The pilot did not solve problems or make decisions effectively, by rarely demonstrating any of the behavioral indicators when required, which resulted in an unsafe situation.

2. The pilot solved problems and made decisions at the minimum acceptable level, by only occasionally demonstrating some of the behavioral indicators when required, but which overall did not result in an unsafe situation.

3. The pilot solved problems and made decisions adequately, by regularly demonstrating most of the behavioral indicators when required, which resulted in a safe operation.

4. The pilot solved problems and made decisions effectively, by regularly demonstrating all of the behavioral indicators when required, which enhanced safety.

5. The pilot solved problems and made decisions in an exemplary manner, by always demonstrating all of the behavioral indicators when required, which significantly enhanced safety, effectiveness and efficiency.

Situation Awareness

1. The pilot's situation awareness was not adequate, by rarely demonstrating any of the behavioral indicators when required, which resulted in an unsafe situation.

2. The pilot's situation awareness was at the minimum acceptable level, by only occasionally demonstrating some of the behavioral indicators when required, but which overall did not result in an unsafe situation.

3. The pilot's situation awareness was adequate, by regularly demonstrating most of the behavioral indicators when required, which resulted in a safe operation.

4. The pilot's situation awareness was good, by regularly demonstrating all of the behavioral indicators when required, which enhanced safety.

5. The pilot's situation awareness was exemplary; all behavioral indicators were always demonstrated when required, which significantly enhanced safety, effectiveness and efficiency.

Workload Management

1. The pilot did not manage the workload effectively, by rarely demonstrating any of the behavioral indicators when required, which resulted in an unsafe situation.

2. The pilot managed the workload at the minimum acceptable level, by only occasionally demonstrating some of the behavioral indicators when required, but which overall did not result in an unsafe situation.

3. The pilot managed the workload adequately, by regularly demonstrating most of the behavioral indicators when required, which resulted in a safe operation.

4. The pilot managed the workload effectively, by regularly demonstrating all of the behavioral indicators when required, which enhanced safety.

5. The pilot managed the workload in an exemplary manner, by always demonstrating all of the behavioral indicators when required, which significantly enhanced safety, effectiveness and efficiency.

APPENDIX N

Frequently Asked Questions

Basic Questions

What is Evidence Based Training (EBT)?

EBT relates to a new assessment and training concept designed to develop competency to manage risks in operations

What problems does EBT address?

The industry has never conducted a strategic review of airline pilot training. The design and reliability of modern aircraft, a rapidly changing operational environment and the realization that not enough has been done to address human factors issues, have prompted this review.

Will EBT be mandatory?

No, EBT is a voluntary program to be implemented by states, operators and ATO’s

What are the benefits of EBT?

Maximizing the benefit from sophisticated training tools, in other words the FSTD qualified according to ICAO Doc 9625, level VII. Making the best use of time available to develop resilience to potential risks, by exposing pilots to these risks in a LEARNING environment.

What is the meaning of “competent”?

EBT uses the ICAO definition of competency, which is amplified into an example scheme including 8 separate areas. These should be the driver for all assessment and training activities, and the key countermeasure in the TEM model.

What training does EBT apply to?

Recurrent licensing and operator assessment and training.

Questions about the regulatory environment

Where does EBT fit into regulations?

Once the applicability date comes into effect, EBT recurrent training will be enshrined into ICAO procedures and guidance material as an accepted methodology to satisfy recurrent training requirements for crews operating transport category aeroplanes. Each local CAA will then have to decide whether and how to implement EBT.

What is the difference between EBT and AQP?

There are many synergies between EBT and AQP, and it is likely that AQP will fit within the structure and recommendations for EBT. The difference is that EBT is not intended to be an alternative, and that it will be utilized as widely as possible, benefitting from the use of global fleet and operational data to validate and adapt training programs to fit different generations of aircraft.

Where does EBT fit into pilot licensing? Where does EBT fit with pilots type ratings?

Eventually EBT is intended to form the basis for type rating and license assessment and training.

How does MPL fit into EBT?

MPL is a defined competency-based approach to ab-initio pilot training. Although addressed separately in ICAO documentation, the risk analysis, validated by real evidence gleaned by the EBT project team and documented in the Data Report for Evidence-based Training, can be used to adapt MPL programs to more accurately represent challenges in the operating environment.

What is the relationship between SMS and Evidence-based Training?

The reactive data assimilation part of SMS may reveal adverse safety trends, which have the potential for mitigation in training. EBT programs can be easily adapted to reflect specific needs

Are the standards going to become regulatory?

There will be no standards at the level of ICAO, but there will be procedures established within ICAO Doc 9868 PANS-TRG

I am not EASA regulated. What will EBT mean for me?

Guidance material is being created at ICAO level, and a great deal of effort is also being made in collaboration with many CAA’s to facilitate adoption of the principles

How will the CAA oversee an evidence-based training program?

Substantial changes in regulatory oversight are not needed. The most effective means would be to look at programs in a qualitative way sampling activity where possible.

Questions on concept and design of EBT

How are aircraft generations broken out?

According to data provided from hull loss insurers, which is the background to the hull loss comparison, with some minor adaptations for coherence in levels of automation and FMS.

Where did the data evidence for EBT come from? What data are required to develop and change an evidence-based training program?

A combination of LOSA, reviews of aircraft accidents and serious incidents, results and from AQP and ATQP programs, FDA and air safety report data.

How is the data updated to keep EBT relevant/current?

A standing committee will be proposed at the conclusion of the initiative, to review trends and suggest changes to the program framework.

Are there standards for how the data are analyzed and used?

There are processes relating to each type of available data, in terms of de-identification and usage. Each data set requires a particular approach.

Is there a requirement for sharing the data with the regulator?

The results of the world fleet analysis will be made available to all interested parties in a de-identified form. Where airlines choose to adapt programs to meet specific challenges indicated by their data, this will be a matter between the airline and CAA.

Questions on implementation

Will EBT require additional instructor training?

Yes, additional training will be required as the conduct of the session and the evaluation technique will differ from hitherto requirements.

Who will train the instructors?

Trainers knowledgeable of EBT and competency-based training will conduct instructor training. No changes to existing CAA instructor approval processes is necessary.

Is competency-based training a prerequisite for EBT?

EBT is competency-based training and requires detailed and careful planning, instructor training, and continual analysis of results in order to be successful

Where do I find information to develop and implement EBT?

In the EBT-related chapters of ICAO Doc 9868 PANS-TRG, ICAO Doc 9995 Manual on Evidence-based Training and in the regulations of those CAA's which choose to adopt EBT.

Will EBT drive specific training device requirements?

EBT will focus the training content on a risk assessment. These will most probably expand the required simulation scenarios and/or capabilities. Eventually EBT will in consequence also require a development of the training devices.

What is the EBT airline adaptation process like?

This will depend on the regulatory framework, which governs the conduct of each specific airline

How much customization for the operator is possible/necessary?

Following the method of the EBT design in ICAO Doc 9868 PANS-TRG should have a maximum of freedom to design their training and checking programs to their individual requirements i.e., risks of operation.

How much time will it take to implement EBT?

There should be no additional time compared to traditional training programs except the data collection within the airline to determine their specific risk matrix.

Does an airline have to follow the evidence-based training template precisely?

No, but it should follow the principles and philosophy of EBT according to the ICAO Manual, and the local CAA rules.

Is there a template that can be followed to meet the minimum requirements for an evidence-based training program?

The EBT Baseline Program was constructed based on 48 hrs time in an FSTD qualified for the purpose of recurrent assessment (checking) and training, over a 3-year period. The Enhanced EBT Program is designed to be specific to operator, and therefore there is no standard program.

Economic questions

Will EBT result in reduction of base training requirements?

No.

How much will it cost?

The central question posed at the commencement of work on EBT was whether more could be achieved within the existing cost structure. EBT is not intended to add cost, though clearly there will be some cost in program development and transitional arrangements.

How will the length of an evidence-based training program compare to current programs?

The length of the programs will generally be similar.

General questions

Who participated in ITQI to create EBT?

The industry, a combination of international organizations, aircraft OEM's, pilot representative bodies, operators, training organizations and academic institutions.

How do FAA and EASA differ related to evidence-based training?

Both have been supportive, there are some synergies with ATQP in Europe and AQP in the US. The FAA indicates that EBT will be used as a basis for improving existing AQP programs. EASA plan rulemaking activity on EBT in 2014.

What is the role of aircraft manufacturers related to evidence-based training?

Aircraft OEM's provided considerable manpower support and data input during the development process of EBT.

Who is sponsoring EBT?

The industry, a combination of international organizations, aircraft OEM's, pilot representative bodies, operators, training organizations and academic institutions.

Which carriers will benefit from EBT?

All operators applying EBT assessment and training will benefit.

to order:

www.iata.org/publishing

iatalearning@iata.org

+1 (514) 390 6777

+1 (514) 874 9043

Follow us on Twitter: www.twitter.com/iata

Join us on Linkedin: www.iata.org/linkedin

Follow us on Youtube: www.youtube.com/iatatv

Printed in Canada

ISBN 978-92-9252-191-2