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Manual of Evidence-based Training

Approved by the Secretary General and published under his authority

First Edition — 2013

International Civil Aviation Organization

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AMENDMENTS

Amendments are announced in the supplements to the *Catalogue of ICAO Publications;* the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

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FOREWORD

This manual is intended to provide guidance to Civil Aviation Authorities, operators and approved training organizations in the 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 programmes*, and 9.4.4, *Pilot proficiency checks.* Implementation guidance is contained in the *Evidence-based Training Implementation Guide* (2012, a joint publication by ICAO, the International Air Transport Association (IATA) and the International Federation of Airline Pilots Associations), available from the IATA website at www.iata.org.

First Edition
At the inaugural meeting to develop constituent elements of the International Air Transport Association (IATA) Training and Qualification Initiative (ITQI) in 2007, representations were made by stakeholders to include a strategic review of airline pilot training as part of the sponsored activity.

The background to these representations is as follows: 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 required a strategic review of airline pilot training. In addition to the wealth of accident and incident reports, the provision of flight data analysis offers the possibility to identify risks encountered in actual operations and to tailor training programmes to mitigate those risks that flight crew members face in operations.

In response, IATA facilitated the creation of an international working group to conduct the strategic review of airline pilot training, commencing with the recurrent training element. The international working group comprised Civil Aviation Authorities, academic institutions, aircraft original equipment manufacturers, airlines, international organizations, pilot representative bodies and training organizations.

The international working group established a new methodology for the development and conduct of a recurrent training and assessment programme, titled Evidence-based Training (EBT), which is fully described in this manual.

The aim of this programme is to identify, develop and evaluate the competencies required to operate safely, effectively and efficiently in a commercial air transport environment whilst addressing the most relevant threats according to evidence collected in accidents, incidents, flight operations and training. This document is intended to enable the implementation of more effective training to improve operational safety. Additionally, and recognizing the criticality of competent instructors in any training programme, the manual provides specific additional guidance on the required qualifications of instructors delivering EBT.

Since the underpinning data analysis is what guides the content of Evidence-based Training programmes, the associated data and related documents will be subject to a systematic review and update process to ensure their continued accuracy and the relevance of guidance material.

Comments on this manual, particularly with respect to its application, usefulness and scope of coverage, would be appreciated. These will be taken into consideration in the preparation of subsequent editions. Comments concerning the manual should be addressed to:

The Secretary General
International Civil Aviation Organization
999 University Street,
Montréal, Quebec H3C 5H7
Canada

The following list contains the member organizations of the international working group, and other organizations that contributed towards the development of EBT:

Air Arabia

Air France

Air Berlin

Airbus S.A.S.

ATR

The Boeing Company

Bombardier Inc.

British Airways Plc

CAE Inc.

Cathay Pacific Airways Ltd.

Civil Aviation Authority – United Kingdom

Civil Aviation Department – Hong Kong, China

Civil Aviation Safety Authority – Australia

Delta Airlines Inc.

Deutsche Lufthansa AG

Dragonair

Direction générale de l'aviation civile – France

EasyJet

Embraer S.A.

Emirates Airline

ETOPS S.A.S.

Etihad Airways

European Aviation Safety Agency (EASA)

European Cockpit Association (ECA)

Federal Aviation Administration – United States of America

Flight Safety International

General Civil Aviation Authority – United Arab Emirates

Griffith University

Gulf Air

Gulf Aviation Academy

International Air Transport Association

International Civil Aviation Organization

International Federation of Airline Pilots Associations (IFALPA)

LOSA Collaborative

LMQ Ltd

Mechtronix Systems Inc.

National Aerospace Laboratory (NLR) - Netherlands

Oxford Aviation Academy

Qantas Airways Ltd

Qatar Airways

Research Integrations Inc.

Royal Aeronautical Society (RAeS)

Royal Holloway, University of London

Saudi Arabian Airlines

Thomsonfly Ltd

Transport Canada

Virgin Australia

Wizz Air

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GLOSSARY

Note.— Much of the information in this section comes from Annex 1 — Personnel Licensing, *Annex 6* — Operation of Aircraft, *Part I* — International Commercial Air Transport — Aeroplanes *and the* Procedures for Air Navigation Services — Training *(Doc 9868).*

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

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

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

Competency. A combination of knowledge, skills 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.

Competency element. An action that constitutes a task that has a triggering event and a terminating event that clearly defines its limits, and an observable outcome.

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

Critical flight manoeuvres. Manoeuvres 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.

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.

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

EBT instructor. A person who has undergone a screening and selection process, successfully completed an approved course in delivering competency-based training, and is subsequently authorized to conduct recurrent assessment and training within an approved EBT programme.

EBT module. A session or combination of sessions in a qualified FSTD, as part of the three-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.

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

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.

Instructor. A person authorised to provide practical training to a trainee or student for an aviation licence, rating or endorsement.

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

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

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

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

Performance criteria. Simple, evaluative statements on the required outcome of the competency element and a description of the criteria used to measure whether the required level of performance has been achieved.

Phase of flight. A defined period within a flight.

Scenario. Part of a training module plan that consists of predetermined manoeuvres and training events.

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.

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ABBREVIATIONS AND ACRONYMS

(Used in this manual)

A/C	Aircraft
AAL	Above aerodrome level
ACAS	Airborne collision avoidance system
ANP	Actual navigation performance
APP	Approach
AQP	Advanced qualification programme
ATC	Air traffic control
ATO	Approved training organization
ATQP	Alternative training and qualification programme
CAA	Civil aviation authority
CAST	Commercial air safety team
CLB	Climb
CRM	Crew resource management
CRZ	Cruise
DA	Decision altitude
DES	Descent
EBT	Evidence-based training
FAA	Federal Aviation Administration (of the United States of America)
FBW	Fly by wire
FDA	Flight data analysis
FMS	Flight management system
FSTD	Flight simulation training device
GND	Ground
GPS	Global positioning system
IATA	International Air Transport Association
IFALPA	International Federation of Airline Pilots Associations
ISI	In-seat instruction
KSA	Knowledge, skills and attitudes
LDG	Landing
LOSA	Line operations safety audit
MDA	Minimum descent altitude
MTOM	Maximum take-off mass
NAV	Navigation
Neo	New engine option
OEM	Original equipment manufacturer(s)
ops	operations
PF	Pilot flying
PM	Pilot monitoring
PRM	Precision runway monitor
RA	Risk assessment or ACAS resolution advisory *(context dependent)*
RNP	Required navigation performance
RNP-AR	Required navigation performance — Approval required
SARPs	Standards and Recommended Practices
SMS	Safety management system
SOP	Standard operating procedure

TA	Traffic advisory
TAWS	Terrain awareness and warning system
TO	Take-off
V1	Take-off decision speed
V2	Take-off safety speed

PUBLICATIONS

(Referred to in this manual)

Convention on International Civil Aviation (Doc 7300)

Annex 1 — *Personnel Licensing*

Annex 6 — *Operation of Aircraft,*

Part I — *International Commercial Air Transport — Aeroplanes,* and

Part II — *International General Aviation — Aeroplanes*

Procedures for Air Navigation Services — Training (Doc 9868)

Manual of Criteria for the Qualification of Flight Simulation Training Devices (Doc 9625), Volume I — *Aeroplanes*

Manual on the Approval of Training Organizations (Doc 9841)

Joint ICAO, IATA and IFALPA publication: *Evidence-based Training Implementation Guide*

IATA publication: *Data Report for Evidence-based Training*

Part I

EVIDENCE-BASED TRAINING DEVELOPMENT

AND

PROGRAMME OUTLINE

Chapter 1

BACKGROUND

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

1.2 At the same time, aircraft design and reliability improved substantially, leading to a situation where many accidents occurred in aircraft that were operating without malfunction. Controlled flight into terrain is a good example of this principle, resulting in a hull loss where inadequate situation awareness is almost always a contributing factor.

1.3 It is impossible to foresee all plausible accident scenarios, especially in today's aviation system where its complexity and high reliability mean that the next accident may be something completely unexpected. EBT addresses this by moving from pure scenario-based training, to prioritizing the development and assessment of key competencies, leading to a better training outcome. The scenarios recommended in EBT are simply a vehicle and a means to assess and develop competence. Mastering a finite number of competencies should allow a pilot to manage situations in flight that are unforeseen by the aviation industry and for which the pilot has not been specifically trained.

1.4 The core competencies identified in EBT encompass what was previously known as both technical and non-technical knowledge, skills and attitudes, aligning the training content with the actual competencies necessary in the context of contemporary aviation.

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

Note 1.— The compendium of the data referred to in paragraph 1.5 is documented in the Data Report for Evidence-based Training, *which can be obtained free-of-charge from the International Air Transport Association (IATA) web-site.*

Note 2.— Paragraph 3.1.2 provides a list of aeroplane types grouped in six generations.

1.6 The aim of this programme is to develop and evaluate the identified competencies required to operate safely, effectively and efficiently in a commercial air transport environment whilst addressing the most relevant threats

according to evidence collected in accidents, incidents, flight operations and training. This manual is intended to enable the implementation of more effective training to improve operational safety, focusing on the recurrent training of airline pilots. Additionally and recognizing the criticality of competent instructors in any training programme, the manual provides specific additional guidance on the required qualifications of instructors delivering EBT.

Chapter 2

APPLICABILITY AND AIMS

2.1 APPLICABILITY

2.1.1 This manual is intended to provide guidance to civil aviation authorities, operators and approved training organizations in the recurrent assessment and training of pilots conducted in flight simulation training devices (FSTDs), referred to in Annex 6 to the Convention on International Civil Aviation, *Operation of Aircraft*, Part I, *International commercial Air Transport — Aeroplanes,* 9.3, Flight crew member training programmes*,* and 9.4.4, *Pilot proficiency checks* in addition to Annex 1 to the Convention on International Civil Aviation, *Personnel Licensing*, 1.2.5, Validity of licenses. It may also provide guidance for approved 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).

2.1.2 This manual includes guidance for the development of training programmes and the assessment of flight crew performance, in addition to information for instructors conducting the training. The purpose of training and assessment within this programme is to establish competency and provide for continuous and measurable improvement in flight crew performance during line operations.

2.1.3 Aeroplanes considered for application of the guidance in 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 of 30 or more passengers for turbo-propeller aeroplanes referred to in this manual as turboprops.

2.1.4 This manual does not formally consider training media, but will assume that the assessment and training described will be conducted in an FSTD qualified to an appropriate level in accordance with CAA rules (Doc 9625 — *Manual of Criteria for the Qualification of Flight Simulation Training Devices* refers). It is recognized that there will be aspects of any recurrent training programme which are conducted outside the environment of a qualified FSTD, but the EBT programme described in this manual is intended to relate only to FSTD assessment and training.

2.2 AIMS

2.2.1 Chapter 5, *Evidence-based Training*, of the *Procedures for Air Navigation Services — Training* (Doc 9868) contains high-level provisions for the implementation of EBT[1]. This manual expands on those provisions and provides to civil aviation authorities the detailed guidance necessary for the effective oversight of the development and implementation of an EBT recurrent assessment and training programme for pilots in FSTDs.

Note.— Guidance for the implementation of an EBT training programme by an organization is contained in the Evidence-based Training Implementation Guide*, a joint ICAO, IATA and IFALPA publication.*

2.2.2 EBT recognizes the need to develop and evaluate crew performance according to a set of competencies without necessarily distinguishing between the “non-technical” (e.g. CRM) and the “technical” competencies needed in

1 Introduced in Amendment 2 to Doc 9868.

order to operate safely. Any area of competence assessed not to meet the required level of performance shall also be associated with an observable behaviour that could lead to an unacceptable reduction in safety margin.

2.3 BENEFITS

2.3.1 The paradigm shift proposed under the EBT programme is not simply to replace a sometimes outdated set of critical events with a new set, but to use the events as a vehicle for developing and assessing crew performance across a range of necessary competencies. In addition, EBT refocuses the instructor population onto analysis of the root causes to correct inappropriate actions, rather than simply asking a flight crew member to repeat a manoeuvre with no real understanding as to why it was not successfully flown in the first instance.

2.3.2 Finally, it is recognized that in today's high-fidelity simulator environment, very sophisticated training tools exist that are often not used effectively, as regulation is biased much more towards checking. EBT seeks to redress the imbalance between training and checking. It recognizes that an assessment of competence is necessary, but once completed, pilots learn more effectively when being trained by competent instructors to perform tasks and manage events measured according to a given set of behavioural indicators, while not under pure test conditions.

Chapter 3

PRINCIPLES AND PROGRAMME PHILOSOPHY

3.1 BACKGROUND

3.1.1 *General.* This chapter is intended to describe the development and construction of the baseline EBT programme, and the work that was undertaken to develop the specific guidance material in Appendices 2 to 7 to Part II, containing the generation-specific training matrix and model programmes.

3.1.2 *Applicability.* The EBT programme and philosophy is intended to be applied as the means of assessing and training key areas of flight crew performance in a recurrent training system, according to Annex 6, Part I, 9.3, Flight crew member training programmes, and 9.4.4, Pilot proficiency checks. The EBT programme takes into account the differences between aeroplane generations by tailoring the recurrent training programme to the particular aeroplane generation. The following is considered to be representative of the generations of aeroplanes considered 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

3.1.3 *Methodology of EBT design.* EBT is a programme designed to develop and evaluate all areas of flight crew competency relevant to recurrent training. In order to do this a comprehensive list of threats and errors was created. This list is categorized by criticality with respect to aircraft generations and phases of flight.

3.2 COMPETENCIES

The first component in the development of the EBT concept is a set of competencies contained in Appendix 1 to Part II. This is a complete framework of competencies, competency descriptions and related behavioural indicators, encompassing the technical and non-technical knowledge, skills and attitudes to operate safely, effectively and efficiently in a commercial air transport environment. The competencies contained in Appendix 1 to Part II were used to develop the Baseline EBT programme. However, operators are encouraged to develop their own competency system, which should list observable behavioural indicators, meeting their specific needs and including a comprehensive set of technical and non-technical knowledge, skills and attitudes.

3.3 TRAINING CRITICALITY SURVEY

3.3.1 The second component of the EBT methodology is based on a training criticality survey identifying threats and errors in each phase of flight.

3.3.2 Pilots experienced in operations and training completed individual fleet and operation specific risk analyses. These analyses were combined and collated according to aircraft generation, as listed in 3.1.2.

3.3.3 Threats and errors were listed by flight phase for eight phases of flight. In addition, potential threats and errors occurring in most if not all flight phases are listed separately in a distinct “phase”. The eight phases considered are described below.

Threats/Errors	*All flight phases*	*Potential threats/errors in any or all phases of flight*
Pre-flight and 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 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 and post-flight	Phase 8	From reaching taxi speed until engine shutdown

3.3.4 Potential threats and errors were characterized in three dimensions: likelihood, severity and training benefit, as follows:

a) *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;

Note.— Example of a wind shear on take-off: likelihood level is evaluated depending on the frequency of wind shear events during which a pilot has to intervene to ensure a safe outcome, not just the frequency of the occurrence itself (which will possibly be more frequent).

b) *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; and

Note.— The most likely outcome, not the worst possible outcome, should be considered.

c) *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.

3.4 DATA COLLECTION

3.4.1 The purpose of the data collection is to provide a reference programme of events based upon aircraft generations, to be utilized for the development of competencies in the baseline EBT programme (see Chapter 4 of this Part). It is necessary to collect real world data from accidents, incidents, flight operations and training to feed and validate course development. Data collection as described in this manual has been used to construct the baseline EBT programme, and will be reviewed and updated on a continual basis. The enhanced EBT programme described in Chapter 5 of this Part is intended to create an improvement to the baseline programme, utilising operator-specific data.

3.4.2 In order to develop the EBT concept, data was collected from the following entities:

a) operators;

b) manufacturers;

c) accident investigation authorities;

d) international aviation organizations; and

e) Civil Aviation Authorities.

3.4.3 The following data sources were used in the data collection and are described in the *Data Report for Evidence-based Training*:

a) Line Operations Safety Audit (LOSA) EBT reports;

b) EBT study of accidents and incidents;

c) flight data analysis studies;

d) training data studies;

e) airline pilot survey on training effectiveness;

f) scientific reports; and

g) training criticality survey.

3.5 DATA ANALYSIS

3.5.1 *Data derivation and analysis processes.* A preliminary data analysis was completed at the level of each individual data source, followed by a global corroborative analysis combining all sources. The following paragraphs describe key sources and their individual processes.

a) *Accident and incident analysis process.* The first action consisted in a global analysis of all factors. When required, more detailed studies were performed. The following steps were adhered to unless otherwise indicated, or when data was statistically not relevant:

1) a global analysis of all aircraft generations — both combining and comparing different generations;

2) specific analysis of each aircraft generation;

3) relevance of competencies;

4) study of trend over time;

5) analysis by flight phase;

6) evaluation of “trainability”; and

7) determination of priority of factors based on rates, risk and trainability.

Note 1.— The accident and incident data considered in the analyses was normalized according to:

a) all accidents and incidents;

b) aircraft generation and severity (fatal or non-fatal, accident or incident); and

c) the total number of departures.

Note 2.— Results are expressed as rates and sometimes as risk (meaning likelihood times severity levels).

b) *Training criticality survey process.* The training criticality survey produced a number of matrices with threats and errors by phase of flight (see 3.3.3), which were assigned 3 levels according to 3.3.4 for aircraft types listed in 3.1.2. Analysis of the training criticality survey was completed according to the following process:

1) For a given generation the median of the distribution of the calculated results from the risk matrix (the product of likelihood, severity and training benefit levels) was identified across all phases. Everything above the median was retained provided the training benefit level was indicated at 3 (moderate) or above;

2) The median of the distribution of the risk (the product of likelihood and severity levels) was identified across all flight phases. Everything not considered in 1) and above this median was retained;

3) All items not retained in 1) and 2) with a training benefit 4 (significant) or above were identified. Every item complying with this criterion was retained; and

Note.— Any item evaluated to be relevant in only one flight phase was considered in that specific phase. Any item evaluated to be relevant in multiple phases can be trained in any of these phases.

4) A conclusion with relative weighting was determined.

c) *Evidence Table process.* The Evidence Table includes findings from the various sources. The following process was adhered to:

1) findings were identified with several keywords; and

2) the findings determined a set of conclusions by which training priority was determined.

Note 1.— Where applicable, findings were identified to reinforce the accident/incident factor analysis.

Note 2.— The Evidence Table *is contained in the* Data Report for Evidence-based Training*.*

3.5.2 *Data Report for Evidence-based Training.* This is a broadly based study using multiple industry sources and different types of analytical techniques. The conclusions yielded by the study are sourced from a large number of mutually reinforcing findings from various independent analyses, including those below.

a) Line operations safety audit (LOSA) and supporting data.

1) The key study defining the focus of the effort is a LOSA report, produced by *The LOSA Collaborative*, containing the analysis of approximately 10 000 flights within the LOSA archival database. The observed operational flight deck situations were examined from the perspective of how they relate directly or indirectly to training needs.

2) Several other studies augment and support the LOSA report, addressing automation, psychomotor skill decay and detailed results from operators using the Advanced Qualification Programme (AQP) or the Alternative Training and Qualification Programme (ATQP). Operators using these advanced training programmes provided extensive information over a three-year period, including detailed metrics of training and operational data.

3) In addition, various operators provided flight recorder data, for the purpose of flight data analysis with a standardized set of events and technical parameters. Over 3 million flights were analysed from various regions of the world. This flight data study confirms and provides deeper insight into, as well as quantitative measures for, some of the important issues raised by the LOSA report.

b) Analysis of hull loss and fatal accidents.

1) A second component of the report is an accident and incident analysis of all data within the United States of America's National Transport Safety Board (NTSB) accident and incident database from 1962 to 2010. Over 3 000 accidents and incidents were analysed with respect to the threats and errors contained in the training criticality survey (see paragraph 3.3) of over 20 types and 6 generations of aircraft. The results of this study are used to test the degree of consistency with the methodology for EBT development.

2) This same accident and incident analysis also looks at the EBT competencies (contained in Appendix 1 to Part II) from the standpoint of how they distribute themselves over the history of accidents and over the generations of aircraft as a way of demonstrating training needs. The study also surveys the opinions of the pilot analysts regarding whether improved training could have mitigated to some degree the outcome of the accidents and incidents analysed.

c) Other sources.

Finally, various other methods are used to determine the results and conclusions of the report. These included a survey of pilots, who were asked to make comments on the suitability of existing recurrent training programmes. In addition, several industry and aviation safety studies were used to test consistency with the analyses performed as part of the EBT development. Certain other studies were used for contextual or background methodology information. These included the Commercial Air Safety Team (CAST) accident analysis data tables and results from other FAA studies showing technical training and operational characteristics across aircraft types and aircraft generational differences.

3.5.3 *Review process.* It is intended that this work will continue to be reviewed periodically using any trends highlighted during continuing analysis of line operations, training systems and fatal accident and hull losses. The guidance contained within this manual will be amended accordingly.

3.6 RECURRENT ASSESSMENT AND TRAINING — PROGRAMME OUTLINE

3.6.1 The EBT recurrent assessment and training of the competencies (contained in Appendix 1 to Part II) are considered over a three-year recurrent assessment and training cycle. For the purposes of the construction of model training programmes as listed in Appendices 2 to 7 to Part II, the programme has been developed to include a notional exemplar 48 hours for each crew member over a three-year period in a suitably qualified flight simulation training device (FSTD). The training programme is divided into modules. The three phases of a module (evaluation, manoeuvres training and scenario-based training) are described in Chapter 7 of Part I.

3.6.2 The evaluation phase of each module will periodically be the focus of licence renewal or revalidation, and may ultimately be the means by which Licensing Authorities continue to ensure that competence is maintained to hold a professional licence and type rating as applicable.

3.6.3 *Assessment and grading system*. A full description of the competencies is provided in Appendix 1 to Part II. It is essential to note that an operator intending to use this framework should in addition develop a clear assessment and grading system for expected crew performance. Competencies are a fundamental component of the grading system. It is not the intention of this document to fully describe a grading system, but a grading system should be used for crew assessment, in addition to providing quantifiable data for the measurement of the training system performance. It can range from a simple “acceptable/unacceptable” grading performance system to a graduated relative measurement system.

3.6.4 *Assessment and training guidance*. The assessment and training guidance matrix is an extraction of all threats and errors from the relevant training critically survey data correlated to specific training scenarios amplified by behavioural indicators and competencies considered critical to the management of a specified threat or error. For details, see Appendices 2 to 7 to Part II.

3.6.5 *Training to competency*. The core principle of EBT is training to competency. It is based on a systematic approach through which assessment and training are based on the measurement of how well a trainee demonstrates a set of competencies.

3.6.6 *Quality management*. The training system performance should be measured and evaluated in respect of the organizational objectives. Monitoring should include a feedback system to identify trends and ensure corrective action where necessary. The quality system of the operator or training organization, as defined in Doc 9841, the *Manual on the Approval of Training Organizations,* should monitor alignment with the EBT assessment and training guidelines recommended in this manual.

3.6.7 *Feedback system*. For the purpose of collecting data from an EBT programme, and making adjustments and continuous improvement to the training system, an operator should implement a performance feedback system utilising defined metrics (see paragraph 5.3).

3.6.8 *Future development*. The programme should be reviewed periodically and consider:

a) potential new threats and errors;

b) potential changes in priority based upon data; and

c) feedback from existing EBT programmes.

3.6.9 *Continuing data analysis*. Whilst the EBT data analysis is substantial and supportive of the programmes 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 analysed 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. This manual will be updated as a result of the continuing data analysis.

3.7 GUIDANCE FOR REGULATORY OVERSIGHT

Early engagement and partnership with the national CAA is crucial to the success of EBT implementation. Suggested processes for regulatory approval are provided in Chapter 2 of Part II. Where pilot representative bodies exist, it is also recommended that they are engaged from the outset.

3.8 EBT RECURRENT ASSESSMENT AND TRAINING PROGRAMME PHASES

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

a) *Evaluation phase.* This phase consists of scenarios developed in accordance with the methodology described in Chapter 7 of this Part. The assessment should be realistic and the scenario should be representative of the operator's environment.

b) *Manoeuvres training phase.* This phase consists of manoeuvres that place significant demand on a proficient crew. Manoeuvres 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 manoeuvres are provided in Appendices 2 to 7 to Part II, according to aircraft generation with indications of the recommended frequency of the manoeuvre in an EBT programme; and

c) *Scenario-based training phase.* This phase forms the largest phase in the EBT programme, and is designed to focus on the development of competencies, 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 external 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 system malfunctions. For this programme to be fully effective, it is important to recognise that these predetermined scenarios are simply a means to develop competency, and not an end or "tick box" exercise in themselves.

3.8.2 *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 that 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 than considered in the recurrent EBT training conducted in an FSTD.

3.8.3 *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. Malfunction characteristics should be considered in isolation from any environmental or operational context, as set out in Table I-3-1 below.

Table I-3-1. Malfunction characteristics and crew performance

Characteristic	*Description of required crew performance*	*Examples*
Immediacy	System malfunctions requiring immediate and urgent crew intervention or decision	Fire, smoke, loss of pressurisation 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

Note.— This refers to the case of recurrent training and assessment conducted in an FSTD qualified by the CAA at the appropriate level for recurrent training and assessment. Other malfunctions not covered by the characteristics detailed in 3.8.2 and 3.8.3 continue to require review and appropriate procedural knowledge training conducted in a less qualified but suitable environment (classroom, flight procedures training device, etc.), as an additional component of EBT. This is intended simply as a means of offloading the need to perform such training in a highly qualified FSTD, which has much greater potential benefit in other areas.

3.8.4 *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;

d) internal/external guidance;

e) visual segment;

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

g) non-standard glide path; and

h) low visibility operations.

3.8.5 *Considerations for the frequency of approach training*. Go-around training from various stages of the approach should form an integral and frequent element of approach training. Frequency of training may be reduced for types of approaches that are conducted regularly in line operation.

Chapter 4

IMPLEMENTATION OF THE BASELINE EBT PROGRAMME

4.1 GENERAL PRINCIPLES

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

a) development of a set of competencies (see Appendix 1), and of an assessment and grading system;

b) training of instructors, including standardization and inter-rater reliability assurance; instructor training programmes should ensure the instructor's capability to conduct the training and assessment of the competencies;

c) availability of information to pilots regarding EBT principles, methodology and the set of competencies to demonstrate, including performance criteria; and

d) availability of a measurement of training system performance.

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

a) the definition of an implementation and operations plan;

b) the adaptation of the programmes defined in Appendices 2 to 7 to Part II according to the generation of aircraft (fleet) and type of operation for the operator;

c) the EBT programme implementation (an initial limited trial phase should be considered by the CAA);

d) the review of training effectiveness upon receipt of sufficient training system data; and

e) the adjustment and continuous improvement of the training programme according to the training system feedback.

Note.— Appendices F and G to the Manual on the Approval of Training Organizations *(Doc 9841) also provide guidance to approved training organizations and CAAs on managing risk while planning for and implementing a proof-of-concept trial.*

4.2 STAGED IMPLEMENTATION

4.2.1 An operator or ATO may consider the need for a staged implementation of an EBT programme in defined steps towards the goal of full implementation of EBT. In all circumstances the minimum requirements specified in paragraph 4.1 should be completed. 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 programme syllabus elements. Pilots should be trained in accordance with Chapter 6 of this Part, paragraph 6.1 . Instructors should be selected, trained and assessed in accordance with Chapter 6 of this Part, paragraphs 6.2 and 6.3. The development and application of defined performance criteria for the behavioural indicators to training events and scenarios will enable a more effective outcome using existing programme syllabus elements.

b) *Mixed implementation*. Implementation of a mixed EBT programme 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 regulations or rules permit such a programme as part of the operator's specific training and assessment, but preclude such a programme for the revalidation or renewal of pilot licences. This phased implementation recognizes the potential for such an EBT programme to be developed and implemented in advance of any future enabling regulatory changes, which may then permit total implementation.

4.3 BASELINE EBT PROGRAMME

4.3.1 In contrast to an enhanced EBT programme (described in Chapter 5 of this Part), which provides benefits in operation-specific training, the baseline EBT programme is a generation-specific, ready-made programme. It does not require detailed analysis or programme design by the operator or the ATO. It only needs the necessary adaptation to aircraft type and operation, and the development of an assessment and grading system.

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

4.3.3 *Documentation and records*. Wherever possible, existing record keeping processes should be utilized and enhanced to provide for effective monitoring of programme effectiveness.

4.3.4 *Guidance for regulatory oversight*. Guidance for the CAA oversight is contained in Chapter 2 of Part II.

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Chapter 5

IMPLEMENTATION OF THE ENHANCED EBT PROGRAMME

5.1 ENHANCED EBT PROGRAMME

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

5.2 COLLECTION AND ANALYSIS OF OPERATIONS DATA

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

5.2.2 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;

d) *operator's specific operational challenges* that relate to route network, aerodromes used, weather, etc.; and

e) *world fleet data* with an analysis of available safety data from operations with similar aircraft types and similar operations; this should include OEM data.

5.2.3 *Operational characteristics of the operator*. When enhancing a baseline EBT training programme, it is important to first analyse 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.

5.2.4 *Competency framework*. An identical competency framework is applied to both baseline and enhanced EBT programmes. It is advantageous to develop, train and assess competencies utilising 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 programme. By continuing to focus on the complete set of identified competencies, the operator's EBT programme will continue to prepare flight crews for both known and unforeseen threats and errors.

5.2.5 *Data, methods and tools*. The data collection and analysis generally need to cover various types of data, both from within the training activity (inner loop) and from the flight operations and safety management system (outer loop). Data analysis can be as simple as analysing the operator's mission and making sure that operator-specific threats are accounted for in the training programme. Alternatively, the analysis may be carried out using sophisticated flight data analysis software. Paragraphs 5.2.6 to 5.2.9 below discuss various data sources in detail.

5.2.6 *Reporting systems*. Safety reporting programmes form the most classic source of safety information. Examples include air safety reports, mandatory occurrence reports and voluntary confidential safety reports. These programmes can be mandatory, voluntary, confidential and, in some cases, anonymous. Successful reporting programmes 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.

5.2.7 Flight data analysis (FDA)

5.2.7.1 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. 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.

5.2.7.2 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 programme. From the trends, adjustments can be made in the training programme 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.

5.2.7.3 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.

5.2.8 Flight deck observation

5.2.8.1 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.

5.2.8.2 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, etc.) are captured, and the "whys and hows" missed by FDA are also observed. The principal disadvantage is a relatively high human resource requirement.

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

5.2.9 Participation in data sharing groups

5.2.9.1 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 programmes and other factors. While some of such data may be valuable, care must be taken not to drive the training programme too extensively on the basis of such external data.

5.2.9.2 Participation in data sharing groups may yield significant benefits to an operator's training programme when planning the launch of new operations such as additional routes, aircraft types, destinations, in terms of training needs, hazard identification and threat and error management.

5.2.9.3 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 represent an important opportunity to access such data.

5.3 COLLECTION AND ANALYSIS OF TRAINING DATA

5.3.1 *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 metrics 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) the 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.

5.3.2 Training metrics are an invaluable component in supporting an EBT training programme 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.

5.4 INTEGRATION OF ANALYSIS

5.4.1 Any data system used has its own strengths, weaknesses and bias. In order to overcome shortcomings of individual data analysis, whether it is training data related to 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.

5.4.2 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 analysing it in combination with training data requires a close liaison between the safety and the training departments.

5.5 PROGRAMME DEVELOPMENT

5.5.1 Enhanced EBT programme development 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.

5.5.2 In addition to the baseline EBT programme (see Appendices 2 to 7 to Part II), the information and data used to create the training scenarios should be derived according to the principles laid out in 5.2, 5.3 and 5.4.

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

a) completion of the steps required in paragraph 4.1;

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

c) execution of a risk and training analysis, as described in the *Data Report for Evidence-based Training*;

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

e) definition of the enhanced EBT programme: this includes the outline guidance for the training programmes 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 the *Manual of Criteria for the Qualification of Flight Simulation Training Devices* (Doc 9625), Volume I — *Aeroplanes*.

5.5.4 Each periodic EBT module should consist of a session or sessions in a suitably qualified FSTD. Each module should normally contain the three phases described in Chapter 3 of this Part, paragraph 3.8.1.

5.5.5 On completion of programme 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 programme development and customization.

5.5.6 *Documentation and records*. Wherever possible, existing record-keeping processes should be utilized and enhanced to provide for effective monitoring of programme effectiveness.

5.5.7 *Guidance for regulatory oversight.* Guidance for the CAA oversight is contained in Chapter 2 of Part II.

Chapter 6

PILOTS AND INSTRUCTORS

6.1 PILOTS

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

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

a) competencies and related behaviour indicators;

b) purpose of each phase of EBT (see Chapter 3 of this Part, 3.8.1);

c) assessment methods and performance criteria; and

d) operator or ATO grading system.

6.2 INSTRUCTORS — GENERAL

Competency-based training programmes, such as EBT and ab-initio MPL courses, are highly dependent upon the analytical and assessment skills of the instructor cadre. Furthermore, it is important that only those individuals who possess a good understanding of the learning process and how to positively influence human behaviour are considered for instructor positions. Prospective instructors should be selected, trained and qualified in accordance with the provisions in Chapter 6, paragraph 6.1.2 of the *Procedures for Air Navigation Services – Training* (Doc 9868)[1].

6.3 INSTRUCTORS — EBT

6.3.1 Instructors conducting EBT should be knowledgeable about the competencies contained in Appendix 1 to Part II, in order to enable them to make effective assessments, provide guidance to flight crew members to improve performance and make recommendations for additional training where necessary.

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

1 As outlined in Amendment 2 to PANS-TRG.

6.3.3 The training programmes for the instructor role should focus on development of competence in the following specific areas:

a) the competencies contained in Appendix 1 to Part II, in particular the measuring of behaviours observed according to the defined grading system used by the operator or ATO;

b) in accordance with the assessment and grading system of the operator or training organization, making assessments by observing behaviours; gathering objective evidence regarding the behavioural indicators in Appendix 1 to Part II;

c) correlating between observed behaviour and potential outcome in training situations;

d) recognizing and highlighting good performance;

e) determining root causes for deviations below the standards of performance; and

f) identifying situations that could result in unacceptable reductions in safety margins.

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

6.3.5 All instructors should receive annual refresher training, and be re-assessed in the competencies specified in 6.3.3 every three years.

Chapter 7

CONDUCT OF EBT

7.1 GENERAL

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

7.2 PREPARATION

7.2.1 *Creation of lesson plans*. Lesson plans should be created in accordance with the respective appendix (see Appendices 2 to 7 to Part II).

7.2.2 *Standardization of instructors*. Before delivering instruction or conducting assessment within the EBT programme all instructors should be trained and standardized in accordance with the guidance contained in Chapter 6 of this Part.

7.2.3 *Information to pilots*. Prior to the implementation of an EBT programme all pilots should be made familiar with the EBT principles, philosophy, phases of the training programme and the means by which they will be assessed and trained (see Chapter 6, paragraph 6.1).

7.3 BRIEFING

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

7.3.1.1 Objectives:

a) demonstrate at least the minimum required standard in all the competencies;

b) enhance handling skills; and

c) enhance the trainee's ability to prevent, mitigate and manage most relevant threats and errors.

7.3.1.2 Structure of the session:

a) evaluation phase;

b) manoeuvres training phase; and

c) scenario-based training phase.

Note.— In certain circumstances the CAA may consider that the evaluation phase is conducted in a different sequence to the one advocated in this manual. This is intended to enable coherence with certain existing AQP programmes.

7.4 EVALUATION PHASE

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

7.4.2 The purpose of the evaluation phase is to:

a) observe and assess flight crew competency;

b) collect data to further develop and validate the effectiveness of the training system; and

c) identify individual training needs.

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

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

7.4.5 *Content*. The evaluation phase should consist of a line-oriented flight scenario during which there are one or more occurrences for the purpose of evaluating one or more key elements of the required competencies. The root cause rather then the symptoms in any deficiency should be identified. Details are specified in Appendices 2 to 7 to Part II.

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

7.5 MANOEUVRES TRAINING PHASE

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

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

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

7.5.4 Specific details of the manoeuvres and frequency of training are detailed in Appendices 2 to 7 to Part II.

7.6 SCENARIO-BASED TRAINING PHASE

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

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

7.6.3 *Content*. This training should consist of line-oriented flight scenarios during which one or more threats may be introduced. Details are specified in Appendices 2 to 7 to Part II. The contents of this training should be adapted to develop the weaker competencies identified during the evaluation phase.

7.7 ASSESSMENT

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

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

7.7.3 Assessment should be accomplished by relating the observed crew behaviour to the competencies outlined in Appendix 1 to Part II or to an equivalent system. The competencies should not be used as a checklist. The determination of crew competence should be made solely with reference to defined standards established by the operator or training organization.

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

7.8 DEBRIEFING

7.8.1 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.

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

7.8.3 Where appropriate and once the outcome has been announced the debriefing should be a facilitated discussion where flight crew members should be encouraged to critique themselves. The Instructor should provide feedback to the crew to encourage the changes needed and also to provide specific recommendations to improve individual flight crew member's performance.

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

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

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

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

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

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

7.8.6 The differences between instruction and facilitation techniques are highlighted in Table I-7-1.

Table I-7-1. Instruction and facilitation techniques

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

	Instruction technique	*Facilitation technique*
Who talks the most?	Instructor	Trainee
What is the timescale?	Finite	Infinite
Where is the focus?	Instructor – task	Trainee — performance and behaviour
What is the workload?	Moderate	High
What are instructors' thoughts?	Judgemental	Non-judgemental
How is progress evaluated?	Observation	Guided self-assessment

Part II

EVIDENCE-BASED TRAINING PROGRAMME

Chapter 1

DESCRIPTION OF THE PROCESS FOR DEVELOPING AN EBT RECURRENT TRAINING PROGRAMME

1.1 GENERAL

1.1.1 Appendices 2 to 7 form the basis for the construction of EBT recurrent assessment and training programmes. In order to address all assessment and training topics at the defined frequency, a training programme of 48 FSTD hours over a three-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.

1.1.2 Each Appendix 2 to 7 comprises information from which a recurrent assessment and training programme should be developed for a specific generation of aeroplanes. For each Appendix, this information data is extracted from a comprehensive assessment and training matrix described in paragraph 2 and contained in the respective Appendix.

1.1.3 This manual is not intended to cover areas of recurrent flight crew training outside the normal scope of that 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 programme, but these should be the focus of additional areas of recurrent training not covered in this manual in order to adequately address them, using an appropriate training method.

1.1.4 The *competency map* columns in the assessment and training matrix of Appendices 2 to 7 reflect the training principle behind EBT and are linked to the competencies described in Appendix 1; the defined scenarios serve as tools to assess and develop those competencies.

1.1.5 Data referred to in this manual has been analysed 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. Prioritization of training topics per generation uses both of these tools. Depending on the case, the assessment and training topics are drawn from:

a) both sources;

b) the Evidence Table alone; or

c) 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*.*

1.1.6 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 programme 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.

1.1.7 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 manoeuvres. Modern generation aircraft are also more complex, and pilots have more to learn in 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.

1.2 GUIDANCE FOR USING THE EBT RECURRENT ASSESSMENT AND TRAINING MATRIX

1.2.1 Appendices 2 to 7 to Part II contain generation-specific assessment and training matrices. This section describes the component elements in the column headings of the matrix as follows.

1.2.2 *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 or demonstration exercise.

1.2.3 *Frequency.* The priority of the topic to be considered in an EBT programme, according to evidence is linked to a recommended frequency. 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 three-year cycle of the EBT programme.

1.2.4 *Flight phase for activation.* The flight phase for the realization of the critical threat or error in the assessment and training scenario as set out in Table II-1-1.

1.2.5 *Description (includes type of topic, being threat, error or focus).* A description of the training topic.

1.2.6 *Desired outcome (includes performance criteria or training outcome).* Simple evaluative statements on the desired outcome.

Table II-1-1. Flight phase for activation

Abbreviation	*Flight Phase*	*Part I, 3.3.3 Phase #*	*Description*
ALL	All	All flight phases	Any or all phases of flight
GND	Flight planning, pre-flight, engine start and taxi-out Taxi-in, engine shut-down, post-flight and flight closing	Phase 1 and Phase 8	Ground phases up to when the crew increases thrust for the purpose of taking-off. From the speed that permits the aircraft to be manoeuvred by means of taxiing for the purpose of arriving at a parking area until the crew completes post-flight and flight closing duties.
TO	Take-off	Phase 2	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 manoeuvring altitude or to continue the climb for the purpose of cruise.
CLB	Climb	Phase 3	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	Cruise	Phase 4	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	Descent	Phase 5	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	Approach	Phase 6	This phase begins when the crew initiates changes in aircraft configuration and/or speeds enabling the aircraft to manoeuvre 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 manoeuvring altitude or to continue the climb for the purpose of cruise.
LDG	Landing	Phase 7	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 manoeuvred by means of taxiing for the purpose of arriving at a parking area.

1.2.7 *Example scenario elements.* A list of example scenarios addressing the training topic. This list contains only key elements of sample scenarios; operators are encouraged to develop alternative scenarios.

1.2.8 *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.

1.3 IMPLEMENTATION OF A BASELINE EBT PROGRAMME

A summary process for end users wishing to implement the baseline EBT programme is contained in the Attachment to this Appendix.

1.4 EBT MODULES

1.4.1 *General.* The purpose of the EBT programme 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 the appendices 2 to 7 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 minimise competence decay over time.

1.4.2 *Cyclical frequency of assessment of training topics.* The Baseline EBT programme should be constructed to contain all topics for the aircraft generation listed, with those listed under "A" to be included at every EBT module, those listed "B" at half the frequency of "A" and those listed "C" at least once during the three-year cycle. In a bi-annual programme the "A" items will be included once every six months, "B" once every year, and "C" once every three years.

1.5 EVALUATION PHASE

1.5.1 *Evaluation phase, selection of assessment topics and scenarios.* The ideal balance in a three-year EBT programme 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 endeavour to balance the focus of evaluations (typically six over a three-year period) to each competency. The development of real-time realistic scenarios, which enable the crew to utilize all resources at their disposal, is a key element to the evaluation. Topics should be used from the "A" list for the aircraft generation, and combined effectively without undue focus on multiple and unrealistic malfunctions, or undue repetition of standard manoeuvres detailed in the manoeuvres training phase.

1.5.2 The first scenario in the evaluation phase should 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 flight crew time to assimilate their environment. 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.

1.6 MANOEUVRES TRAINING PHASE

The critical elements of each manoeuvre are described in the matrix of Appendices 2 to 7. This is not real-time training, but allows crews the time to practise and improve performance in largely psychomotor skill-based exercises. It is important to maintain the focus on skill, and not to turn this into a LOFT-style training. Once the pilot has completed the critical part of the manoeuvre successfully, the aim has been achieved. Repositioning of the flight simulation, to focus training on the intended manoeuvres 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”.

1.7 SCENARIO-BASED TRAINING PHASE

1.7.1 *Surprise.* 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 that 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, but not left to the discretion of individual instructors in order to preserve programme integrity and fairness.

1.7.2 *Compliance.* The data analysed 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 programme. This means that 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 unless clearly necessary in the particular circumstances to maintain or achieve a higher level of safety.

1.7.3 Development and assessment of the pilot-monitoring (PM) role

1.7.3.1 *Background.* The pilot monitoring (PM) plays a vital role in operational safety. One of the objectives of the EBT programme 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.

1.7.3.2 Assessment and training. 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.

1.7.4 In-seat instruction

1.7.4.1 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, for example to simulate 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.

1.7.4.2 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 by in-seat instruction, there should be no negative consequences to any assessment of performance for the duration of the in-seat instruction. Once in-seat instruction has ceased and/or control is transferred, subsequent performance may be assessed in the normal way.

1.7.4.3 Examples are given in the assessment and training matrix in the Appendices 2 to 7 and should be confined to simple acts or omissions for the purpose of eliciting active and effective monitoring and, where necessary, intervention by the pilot monitoring. Topics marked “ISI” are intended to be the focus of instructor in-seat instruction. In these cases topics should be combined together to create an in-seat instruction scenario to be used at the determined frequency. The following training topics are considered for instructor in-seat instruction:

1) monitoring, cross-checking, error detection, mismanaged aircraft state; and

2) upset management.

Attachment to Chapter 1

Summary process for end-users wishing to implement the baseline EBT programme

Table II-1-Att-1 below is intended as a simplified guide, summarizing key steps to be followed during the implementation of a recurrent assessment and training programme 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 this Manual.

*Note 1.— 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.*

Note 2.— Guidance for the implementation of EBT training programmes is contained in the Evidence-based Training Implementation Guide*(an ICAO/IATA/IFALPA joint publication).*

Table II-1-Att-1. Key steps in implementation

Step		*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 Chapter 2 of Part II. 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 programme 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 Chapter 2 of Part II. Agreement in principle should be reached before detailed programme 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

Step		*Reference*	*Description*	*Parties involved*
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 programme syllabus elements. Instructors and pilots should be trained in the methodologies according to Chapter 6 of Part I. 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 programme syllabus elements.	CAA, operator/ATO
1B		4.2 of Part I	Mixed implementation. Implementation of a mixed EBT programme 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 programme as part of the operator's specific training and assessment, but preclude such a programme for the revalidation or renewal of pilot licences. This phased implementation recognises the potential for such an EBT programme 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 standardisation.	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 programme. 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
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

Step		*Reference*	*Description*	*Parties involved*
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.	3.8.3 of Part I	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.	3.8.4 of Part I	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 2 to 7 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 assessment 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	Programme design.		EBT programme design. The programme 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.	Programme design team

Step		*Reference*	*Description*	*Parties involved*
8	Adaptation of training programme 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 programme for use. Care should be exercised if deviations from the recommended priorities or frequency are made. Data analysed 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
9**	Instructor training and standardization.	4.1.1 and 6.3 of Part I	Instructor EBT programme standardisation, which should be a formalized approach to ensure a consistent and standardized approach to the EBT programme prior to implementation, including practical training reinforcing application of the assessment and grading system and maximising inter-rater reliability.	CAA, operator/ATO
10	Instructor competency assessment.	6.3 of Part I	Prior to conducting instruction and assessment within an EBT programme, all 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 6.1.1 of Part I	Pilots should be briefed about the principles and methodology of EBT, competencies and performance criteria, 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 programme.	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 analysed at a predetermined frequency, to establish system effectiveness and where necessary, make corrections to the programme. 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	Operator/ATO

Step		*Reference*	*Description*	*Parties involved*
			essential for safety improvement and the partnership between all parties.	
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 utilised 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 programme.	Operator/ATO, pilot representation

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Chapter 2

REGULATORY APPROVAL

2.1 NATIONAL CIVIL AVIATION AUTHORITIES

2.1.1 Civil Aviation Authorities (CAA) differ significantly in size and scope depending on the specific mandate provided by their State. As per the *Convention on International Civil Aviation*, all Contracting States do have a common underpinning objective and responsibility when it comes to civil aviation: 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.

2.1.2 Article 12 of the Convention states that “Each contracting State undertakes to adopt measures to insure that every aircraft flying over or manoeuvring within its territory and that every aircraft carrying its nationality mark, wherever such aircraft may be, shall comply with the rules and regulations relating to the flight and manoeuvre of aircraft there in force. Each contracting State undertakes to keep its own regulations in these respects uniform, to the greatest possible extent, with those established from time to time under this Convention... Each contracting State undertakes to insure the prosecution of all persons violating the regulations applicable.”

2.1.3 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. Article 38 of the Convention recognizes the sovereignty of the State and makes provisions for the filing of differences when circumstances so warrant.

2.1.4 Annex 19 to the Convention — *Safety Management*, applicable in November 2013, institutes the responsibility of Contracting States 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 the 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.

2.1.5 Besides employing best practices in risk management, CAA’s need to be assured that changes to the regulatory status quo are supported by evidence, which provides irrefutable proof that any proposed 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.

2.2 REGULATORY CONSIDERATIONS

2.2.1 States have differing organizational constructs in the design of their civil aviation authorities, which will greatly influence the approach necessary for gaining approval of an EBT programme. It is likely that a proposal to adopt evidence-based training philosophies into existing airline training programmes will require a carefully managed process designed to meet both licensing and operational suitability requirements. Often the CAA, due to its distinct specialization requirements, manages licensing and operations independently. Both the applicant and the CAA therefore need to be respectful of these considerations in charting out a plan to adequately assess the impact of the proposal on both domains.

2.2.2 Any change to training that is designed to satisfy the initial qualification or maintenance requirements of a civil aviation licence, rating, or privilege is likely to be subjected to rigorous consideration by the CAA. Requirements of CAAs vary for such consideration. Some CAAs, for example, may require the operator to produce a comprehensive safety case for the proposed change. Others will not opt for 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; and

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

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

Note.— Although indiscriminate use is discouraged, Article 38 to the Convention does permit the filing of differences for those States that find it impracticable to adhere in all respects to ICAO Standards. However, the filing of a difference regarding licensing Standards may jeopardize the recognition as valid of the affected licences by other Contracting States.

2.2.4 Whilst operational efficiency is not of direct relevance to the safety oversight role of the CAA, the maintenance of, or improvements in, operational efficiency will be an important consideration for the management of the operator.

2.3 OBTAINING REGULATORY APPROVAL

2.3.1 Stakeholders usually approach their CAA in order to request relief or exemptions from specific regulatory provisions. It becomes incumbent upon the applicant for EBT programme approval, if the EBT programme does not fully comply with national regulations, to facilitate the approval process by way of a robust and well argued proposal.

2.3.2 To that end, if the stakeholder is of the firm belief that the proposal will meet the objectives outlined in paragraphs 7.2.2 and 7.2.3 of Part I, 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 being sought in level of safety, efficiencies or outcomes;

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 proof-of-concept trial.

2.3.3 With all these factors addressed the applicant needs to devise, for consideration by the CAA, a detailed draft proof-of-concept plan that has been subjected to a rigorous risk management process.

2.3.4 The overall objective is to be able to create and operate within a controlled and realistic environment that permits the proof-of-concept trial to proceed under safe conditions. Examples of considerations that would form part of a risk profiling exercise are:

a) selection and training of staff;

b) training programme development, validation, and review;

c) development and maintenance of training courseware;

d) administrative staff duties in support of the training programme, the instructors and students;

e) delivery of training;

f) record-keeping;

g) assessment and examination processes; and

h) client and Licensing Authority feedback.

2.3.5 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 programmes. 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 endeavour.

2.3.6 In order to promote an efficient and effective national transportation system, the CAA is 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 with the CAA of the importance to proceed.

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

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APPENDIX 1

CORE COMPETENCIES AND BEHAVIOURAL INDICATORS

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

Competency	*Competency description*	*Behavioural 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 SOPs 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

Competency	*Competency description*	*Behavioural indicator*
		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*	*Behavioural 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[1] 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.

1 This behavioural indicator should only be used in the context of debriefing after an EBT session and not be recorded.

Competency	*Competency description*	*Behavioural indicator*
		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

APPENDIX 2

TRAINING PROGRAMME DEVELOPMENT GUIDANCE — GENERATION 4 (JET)

1. GENERAL

1.1 This Appendix provides the recurrent assessment and training matrix for turbo-jet aeroplanes of the fourth generation. A list of such aeroplanes is in Part I, 3.1.2.

1.2 Using the data in the matrix, operators can develop recurrent training programmes based on the EBT concept. It is imperative that the guidance in Part I of the manual be well understood by developers of an EBT programme.

1.3 Chapter 1 of Part II contains the description of the assessment and training matrix and how to use it, while the Attachment to Chapter 1 contains a summary process for end users wishing to implement the baseline EBT programme.

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	Demonstrate manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detect deviations through instrument scanning Maintain spare mental capacity during manual aircraft control Maintain the aircraft within the flight envelope Apply 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 stabilized engine-out configuration from not less than 3 NM final approach, until completion of roll-out	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 and 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 Recognize adverse weather Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Predictive wind shear warning before take-off, as applicable	x	x				x		
			TO			Adverse weather scenario, e.g. thunderstorm activity, precipitation, icing		x			x	x		x
			TO			Wind shear encounter during take-off, not predictive	x			x			x	
			TO			Predictive wind shear warning during take-off	x	x				x	x	
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			CRZ			Wind shear encounter scenario during cruise	x		x			x	x	x
			APP			Reactive wind shear warning during approach or go-around	x		x	x			x	
			APP			Predictive wind shear 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 including 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		

Generation 4 Jet — 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							
Evaluation and 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, 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.	Know how and when to use flight management system(s), guidance and automation Demonstrate correct methods for engagement and disengagement of auto flight system(s) Demonstrate appropriate use of flight guidance, auto thrust and other automation systems Maintain mode awareness of auto flight system(s), including engagement and automatic transitions Revert to different modes when appropriate Detect deviations from the desired aircraft state (flight path, speed, attitude, thrust, etc.) and take appropriate action. Anticipate mishandled auto flight system Recognize 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 approach training)	x		x				x	
			APP			No ATC clearance received prior to commencement of approach or final descent	x		x				x	
			APP			Reactive wind shear 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	

	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 and scenario-based training phases	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	<u>Communication:</u> Demonstrate effective use of language, responsiveness to feedback and that plans are stated and ambiguities resolved. <u>Leadership and teamwork:</u> Use appropriate authority to ensure focus on the task. Support others in completing tasks. <u>Problem solving and decision making:</u> Detect deviations from the desired state, evaluate problems, identify risk, consider alternatives and select the best course of action. Continuously review progress and adjust plans. <u>Situation awareness:</u> Have an awareness of the aircraft state in its environment; project and anticipate changes. <u>Workload management:</u> Prioritize, delegate and receive assistance to maximize focus on the task. Continuously monitor the flight progress	GPS failure prior to commencement of approach associated with position drift and a terrain alert					x	x	x	
			DES			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.	Recognize that a compliance failure has occurred Make a verbal announcement Take appropriate action if necessary Restore safe flight path 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 and 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 wind shear warning during approach	x	x					x	x
			APP			Adverse weather scenario leading to a predictive wind shear 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 or 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 4 Jet — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and 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 normal 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, wind shear, wind shear 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			Wind shear encounter scenario during cruise, significant and rapid change in windspeed or down/updrafts, without wind shear warning	x		x			x	x	x
			APP			Adverse weather, wind shear, wind shear 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 including 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	

	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							
			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	
Evaluation and 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	Recognize 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 including 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 4 Jet — Recurrent Assessment and Training Matrix							Competency map							
Evaluation and scenario-based training phases	Adverse wind	B	TO	Adverse wind/crosswind. This includes tailwind but not ATC mis-reporting of the actual wind	Recognize 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 including 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 and 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	Recognize system malfunction Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences Apply crew operating procedure where necessary. Respond appropriately to additional system abnormals associated with MEL dispatch 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 System failures that require extensive management of their consequences (independent of operation or environment) Example: Fuel leak	Intentionally blank							
			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		
			GND			Malfunction during pre-flight preparation and prior to departure	x					x	x	
			GND			Malfunction after departure	x					x	x	
			GND			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		

	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							
			APP			On approach	x					x		x
			APP			Go-around	x					x		x
			LDG			During landing	x	x		x		x	x	
Evaluation and 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" topic 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 knowledge of systems and their interactions should be developed 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	Recognize 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 making, in addition to manual aircraft control skills if difficult environmental conditions exist. The purpose of this item is to ensure that pilots are exposed to this during the programme	Landing in demanding environmental conditions, with malfunctions as appropriate	This topic should be combined with the adverse weather topic, aircraft system malfunctions topic or any topic that can provide exposure to a landing in demanding conditions	Intentionally blank							
	Runway or taxiway condition	B	TO	Contamination or surface quality of the runway, taxiway, or tarmac including foreign objects	Recognize 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

	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 and scenario-based training phases	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 Recognize 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 4 Jet — Recurrent Assessment and Training Matrix							Competency map							
Evaluation and scenario-based training phases	Workload, distraction, pressure	B	ALL	This is not considered a topic for specific attention on its own, but more as a reminder to programme developers to ensure that pilots are exposed to immersive training scenarios which expose them to manageable high workload and distractions during the course of the EBT programme, at the defined frequency	Manage 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, miscommunication, 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 Recognize, 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	Recognize 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 4 Jet — Recurrent Assessment and Training Matrix							Competency map							
Evaluation and scenario-based training phases	Fire and smoke management	C	GND	This includes engine, electric, pneumatic, cargo fire, smoke or fumes	Recognize 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
			GND			Fire during taxi	x	x				x		x
			GND			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	GND	Lost or difficult communications. Either through pilot mis-selection or a failure external to the aircraft. This could be for a few seconds or a total loss	Recognize 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	ALL	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 Recognize 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 instructed 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 this 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 4 Jet — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and scenario-based training phases	Navigation	C	GND	External NAV failure. Loss of GPS satellite, ANP exceeding RNP, loss of external NAV source(s)	Recognize 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	Recognize 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		
			APP			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 Recognize 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 and 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.	Recognize 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 wind shear 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 turbulence 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	

	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 and scenario-based training phases	ISI Upset recovery	C	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	
	Wind shear recovery	C	TO	With or without warnings including predictive. A wind shear scenario is ideally combined into an adverse weather scenario containing other elements.	Anticipate potential for wind shear Avoid known wind shear or prepare for suspected wind shear Recognize wind shear encounter Take appropriate action Apply appropriate procedure correctly Assure aircraft control Recognize out of wind shear condition Maintain or restore a safe flight path Assess consequential issues and manage outcomes	Predictive wind shear warning during take-off					x	x		
			TO			Wind shear encounter during take-off	x				x	x		
			TO			Wind shear encounter after rotation						x		x
			TO			Predictive wind shear after rotation					x	x		
			APP			Predictive wind shear during approach	x				x	x		
			APP			Wind shear encounter during approach	x				x	x		

APPENDIX 3

TRAINING PROGRAMME DEVELOPMENT GUIDANCE — GENERATION 3 (JET)

1. GENERAL

1.1 This Appendix provides the recurrent assessment and training matrix for turbo-jet aeroplanes of the third generation. A list of such aeroplanes is in Part I, 3.1.2.

1.2 Using the data in the matrix, operators can develop recurrent training programmes based on the EBT concept. It is imperative that the guidance in Part I of the manual be well understood by developers of an EBT programme.

1.3 Chapter 1 of Part II contains the description of the assessment and training matrix and how to use it, while the Attachment to Chapter 1 contains a summary process for end users wishing to implement the baseline EBT programme.

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	Demonstrate manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detect deviations through instrument scanning Maintain spare mental capacity during manual aircraft control Maintain the aircraft within the flight envelope Apply 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 stabilized 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 stabilized engine-out configuration from not less than 3 NM final approach, until completion of roll-out	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 and 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 Recognize adverse weather Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Predictive wind shear warning before take-off, as applicable	x	x				x		
			TO			Adverse weather scenario, e.g. thunderstorm activity, precipitation, icing		x			x	x		x
			TO			Wind shear encounter during take-off, not predictive	x			x			x	
			TO			Predictive wind shear warning during take-off	x	x				x	x	
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			CRZ			Wind shear encounter scenario during cruise	x		x			x	x	x
			APP			Reactive wind shear warning during approach or go-around	x		x	x			x	
			APP			Predictive wind shear 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 including 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 and 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, 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.	Know how and when to use flight management system(s), guidance and automation Demonstrate correct methods for engagement and disengagement of auto flight system(s) Demonstrate appropriate use of flight guidance, auto thrust and other automation systems Maintain mode awareness of auto flight system(s), including engagement and automatic transitions Revert to different modes when appropriate Detect deviations from the desired aircraft state (flight path, speed, attitude, thrust, etc.) and take appropriate action. Anticipate mishandled auto flight system Recognize 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 approach training)	x		x				x	
			APP			No ATC clearance received prior to commencement of approach or final descent	x		x				x	
			APP			Reactive wind shear 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	

	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 and scenario-based training phases	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	<u>Communication:</u> Demonstrate effective use of language, responsiveness to feedback and that plans are stated and ambiguities resolved. <u>Leadership and teamwork:</u> Use appropriate authority to ensure focus on the task. Support others in completing tasks. <u>Problem solving and decision making:</u> Detect deviations from the desired state, evaluate problems, identify risk, consider alternatives and select the best course of action. Continuously review progress and adjust plans. <u>Situation awareness:</u> Have an awareness of the aircraft state in its environment; project and anticipate changes. <u>Workload management:</u> Prioritize, delegate and receive assistance to maximize focus on the task. Continuously monitor the flight progress	GPS failure prior to commencement of approach associated with position drift and a terrain alert					x	x	x	
			DES			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.	Recognize that a compliance failure has occurred Make a verbal announcement Take appropriate action if necessary Restore safe flight path 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 3 Jet — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and 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 wind shear warning during approach	x	x					x	x
			APP			Adverse weather scenario leading to a predictive wind shear 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 or 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 and 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 normal 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, wind shear, wind shear 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			Wind shear encounter scenario during cruise, significant and rapid change in windspeed or down/updrafts, without wind shear warning	x		x			x	x	x
			APP			Adverse weather, wind shear, wind shear 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 including 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	

	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							
			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	
Evaluation and 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	Recognize 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 including 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 and scenario-based training phases	Adverse wind	B	TO	Adverse wind/crosswind. This includes tailwind but not ATC mis-reporting of the actual wind	Recognize 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 including 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 and 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	Recognize system malfunction Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences Apply crew operating procedure where necessary. Respond appropriately to additional system abnormals associated with MEL dispatch 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 System failures that require extensive management of their consequences (independent of operation or environment) Example: Fuel leak	Intentionally blank							
			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		
			GND			Malfunction during pre-flight preparation and prior to departure	x					x	x	
			GND			Malfunction after departure	x					x	x	
			GND			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		

	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 and scenario-based training phases			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” topic 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	Recognize 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 making, in addition to manual aircraft control skills if difficult environmental conditions exist. The purpose of this item is to ensure that pilots are exposed to this during the programme	Landing in demanding environmental conditions, with malfunctions as appropriate	This topic should be combined with the adverse weather topic, aircraft system malfunctions topic 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 3 Jet — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and scenario-based training phases	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							
	Wind shear recovery	B	TO	With or without warnings including predictive. A wind shear scenario is ideally combined into an adverse weather scenario containing other elements	Anticipate potential for wind shear Avoid known wind shear or prepare for suspected wind shear Recognize wind shear encounter Take appropriate action Apply appropriate procedure correctly Assure aircraft control recognize out of wind shear condition Maintain or restore a safe flight path Assess consequential issues and manage outcomes	Predictive wind shear warning during take-off					x	x		
			TO			Wind shear encounter during take-off	x				x	x		
			TO			Wind shear encounter after rotation						x		x
			TO			Predictive wind shear after rotation					x	x		
			APP			Predictive wind shear during approach	x				x	x		
			APP			Wind shear encounter during approach	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 and scenario-based training phases	Workload, distraction, pressure	B	ALL	This is not considered a topic for specific attention on its own, but more as a reminder to programme developers to ensure that pilots are exposed to immersive training scenarios which expose them to manageable high workload and distractions during the course of the EBT programme, at the defined frequency	Manage 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, miscommunication, 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 Recognize, 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	Recognize 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 and scenario-based training phases	Fire and smoke management	C	GND	This includes engine, electric, pneumatic, cargo fire, smoke or fumes	Recognize 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
			GND			Fire during taxi	x	x				x		x
			GND			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	GND	Lost or difficult communications. Either through pilot mis-selection or a failure external to the aircraft. This could be for a few seconds or a total loss	Recognize 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	ALL	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 Recognize 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 instructed 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 this 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 and scenario-based training phases	Navigation	C	GND	External NAV failure. Loss of GPS satellite, ANP exceeding RNP, loss of external NAV source(s)	Recognize 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	Recognize 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		
			APP			During approach	x			x				x
	Runway or taxiway condition	C	TO	Contamination or surface quality of the runway, taxiway, or tarmac including foreign objects	Recognize 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 Recognize 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 Recognize 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 and 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.	Recognize 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 wind shear 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 turbulence 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 4

TRAINING PROGRAMME DEVELOPMENT GUIDANCE — GENERATION 3 (TURBOPROP)

1. GENERAL

1.1 This Appendix provides the recurrent assessment and training matrix for turbo-propeller aeroplanes of the third generation. A list of such aeroplanes is in Part I, paragraph 3.1.2.

1.2 Using the data in the matrix, operators can develop recurrent training programmes based on the EBT concept. It is imperative that the guidance in Part I of the manual be well understood by developers of an EBT programme.

1.3 Chapter 1 of Part II contains the description of the assessment and training matrix and how to use it, while the Attachment to Chapter 1 contains a summary process for end users wishing to implement the baseline EBT programme.

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 Turboprop — 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	Demonstrate manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detect deviations through instrument scanning Maintain spare mental capacity during manual aircraft control Maintain the aircraft within the flight envelope Apply 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 stabilized 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 stabilized engine-out configuration from not less than 3 NM final approach, until completion of roll-out	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 Turboprop — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and scenario-based training phases	Adverse Weather	A	GND	Thunderstorm, heavy rain, turbulence, ice buildup 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 Recognize adverse weather Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Predictive wind shear warning before take-off, as applicable	x	x				x		
			TO			Adverse weather scenario, e.g. thunderstorm activity, precipitation, icing		x			x	x		x
			TO			Wind shear encounter during take-off, not predictive	x			x			x	
			TO			Predictive wind shear warning during take-off	x	x				x	x	
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			CRZ			Wind shear encounter scenario during cruise	x		x			x	x	x
			APP			Reactive wind shear warning during approach or go-around	x		x	x			x	
			APP			Predictive wind shear 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 including 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 Turboprop — Recurrent Assessment and Training Matrix							Competency map							
Evaluation and 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, 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.	Know how and when to use flight management system(s), guidance and automation Demonstrate correct methods for engagement and disengagement of auto flight system(s) Demonstrate appropriate use of flight guidance, auto thrust and other automation systems Maintain mode awareness of auto flight system(s), including engagement and automatic transitions Revert to different modes when appropriate Detect deviations from the desired aircraft state (flight path, speed, attitude, thrust, etc.) and take appropriate action. Anticipate mishandled auto flight system Recognize 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 approach training)	x		x				x	
			APP			No ATC clearance received prior to commencement of approach or final descent	x		x				x	
			APP			Reactive wind shear 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	

	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 Turboprop — Recurrent Assessment and Training Matrix							Competency map							
Evaluation and scenario-based training phases	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	<u>Communication:</u> Demonstrate effective use of language, responsiveness to feedback and that plans are stated and ambiguities resolved. <u>Leadership and teamwork:</u> Use appropriate authority to ensure focus on the task. Support others in completing tasks. <u>Problem solving and decision making:</u> Detect deviations from the desired state, evaluate problems, identify risk, consider alternatives and select the best course of action. Continuously review progress and adjust plans. <u>Situation awareness:</u> Have an awareness of the aircraft state in its environment; project and anticipate changes. <u>Workload management:</u> Prioritize, delegate and receive assistance to maximize focus on the task. Continuously monitor the flight progress	GPS failure prior to commencement of approach associated with position drift and a terrain alert					x	x	x	
			DES			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.	Recognize that a compliance failure has occurred Make a verbal announcement Take appropriate action if necessary Restore safe flight path 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 3 Turboprop — Recurrent Assessment and Training Matrix							Competency map							
Evaluation and 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 wind shear warning during approach	x	x					x	x
			APP			Adverse weather scenario leading to a predictive wind shear 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 or 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 Turboprop — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and 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 normal 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, wind shear, wind shear 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			Wind shear encounter scenario during cruise, significant and rapid change in windspeed or down/updrafts, without wind shear warning	x		x			x	x	x
			APP			Adverse weather, wind shear, wind shear 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 including 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	

Generation 3 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							
			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	
Evaluation and 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	Recognize 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 including 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 Turboprop — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and 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	Recognize system malfunction Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences Apply crew operating procedure where necessary. Respond appropriately to additional system abnormals associated with MEL dispatch 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 System failures that require extensive management of their consequences (independent of operation or environment) Example: Fuel leak	Intentionally blank							
			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		
			GND			Malfunction during pre-flight preparation and prior to departure	x					x	x	
			GND			Malfunction after departure	x					x	x	
			GND			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		

Generation 3 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							
			APP			On approach	x					x		x
			APP			Go-around	x					x		x
			LDG			During landing	x	x		x		x	x	
Evaluation and 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" topic 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	Recognize 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 practise landings in demanding situations at the defined frequency. Data indicates that landing problems have their roots in a variety of factors, including appropriate decision making, in addition to manual aircraft control skills if difficult environmental conditions exist. The purpose of this item is to ensure that pilots are exposed to this during the programme	Landing in demanding environmental conditions, with malfunctions as appropriate	This topic should be combined with the adverse weather topic, aircraft system malfunctions topic 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 3 Turboprop — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and scenario-based training phases	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	C	ALL	Alert, warning, or conflict	Anticipate terrain threats Prepare for terrain threats Recognize 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 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							
Evaluation and 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.	Recognize 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 wind shear 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 turbulence 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	

	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 Turboprop — Recurrent Assessment and Training Matrix							Competency map							
Evaluation and scenario-based training phases	Workload, distraction, pressure	B		This is not considered a topic for specific attention on its own, but more as a reminder to programme developers to ensure that pilots are exposed to immersive training scenarios which expose them to manageable high workload and distractions during the course of the EBT programme, at the defined frequency	Manage 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 mis-reporting of the actual wind	Recognize 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 including 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 Turboprop — Recurrent Assessment and Training Matrix							Competency map							
Evaluation and scenario-based training phases	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	Recognize 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	GND	This includes engine, electric, pneumatic, cargo fire, smoke or fumes	Recognize 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
			GND			Fire during taxi	x	x				x		x
			GND			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	GND	Lost or difficult communications. Either through pilot mis-selection or a failure external to the aircraft. This could be for a few seconds or a total loss	Recognize 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	

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Generation 3 Turboprop — Recurrent Assessment and Training Matrix							Competency map							
Evaluation and scenario-based training phases	Managing loading, fuel, performance errors	C	ALL	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 Recognize 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 instructed 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 this may be part of the operator procedures, especially when operating mixed fleets with considerable variations in MTOM	x	x						x
	Navigation	C	GND	External NAV failure. Loss of GPS satellite, ANP exceeding RNP, loss of external NAV source(s)	Recognize 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	Recognize 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		
			APP			During approach	x			x				x
	Runway or taxiway condition	C	TO	Contamination or surface quality of the runway, taxiway, or tarmac including foreign objects	Recognize 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

	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 Turboprop — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and 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 Recognize loss of separation Take appropriate action Apply appropriate procedure correctly Maintain aircraft control Manage consequences	ACAS warning requiring crew intervention		x				x	x	x
	Wind shear recovery	B	TO	With or without warnings including predictive. A wind shear scenario is ideally combined into an adverse weather scenario containing other elements.	Anticipate potential for wind shear Avoid known wind shear or prepare for suspected wind shear Recognize wind shear encounter Take appropriate action Apply appropriate procedure correctly Assure aircraft control Recognize out of wind shear condition Maintain or restore a safe flight path Assess consequential issues and manage outcomes	Predictive wind shear warning during take-off					x	x		
			TO			Wind shear encounter during take-off	x				x	x		
			TO			Wind shear encounter after rotation						x		x
			TO			Predictive wind shear after rotation					x	x		
			APP			Predictive wind shear during approach	x				x	x		
			APP			Wind shear encounter during approach	x				x	x		

APPENDIX 5

TRAINING PROGRAMME DEVELOPMENT GUIDANCE — GENERATION 2 (JET)

1. GENERAL

1.1 This Appendix provides the recurrent assessment and training matrix for turbo-jet aeroplanes of the second generation. A list of such aeroplanes is in Part I, 3.1.2.

1.2 Using the data in the matrix, operators can develop recurrent training programmes based on the EBT concept. It is imperative that the guidance in Part I of the manual be well understood by developers of an EBT programme.

1.3 Chapter 1 of Part II contains the description of the assessment and training matrix and how to use it, while the Attachment to Chapter 1 contains a summary process for end users wishing to implement the baseline EBT programme.

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.

Generation 2 Jet — 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	Demonstrate manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detect deviations through instrument scanning Maintain spare mental capacity during manual aircraft control Maintain the aircraft within the flight envelope Apply 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				
Manoeuvres training phase	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				
Manoeuvres training phase	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				
Manoeuvres training phase	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				
Manoeuvres training phase	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				
Manoeuvres training phase	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				
Manoeuvres training phase	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				
Manoeuvres training phase	Go-around	A	APP	Go-around, all engines operative		During flare/rejected landing	x		x	x				
Manoeuvres training phase	Engine-out landing	A	LDG	With a critical engine failed, normal landing		Initiation in a stabilized engine-out configuration from not less than 3 NM final approach, until completion of roll-out	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 and 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 Recognize adverse weather Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Predictive wind shear warning before take-off, as applicable	x	x				x		
			TO			Adverse weather scenario, e.g. thunderstorm activity, precipitation, icing		x			x	x		x
			TO			Wind shear encounter during take-off, not predictive	x			x			x	
			TO			Predictive wind shear warning during take-off	x	x				x	x	
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			CRZ			Wind shear encounter scenario during cruise	x		x			x	x	x
			APP			Reactive wind shear warning during approach or go-around	x		x	x			x	
			APP			Predictive wind shear 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 including 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	Recognize 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	

Generation 2 Jet — 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							
Evaluation and 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, 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.	Know how and when to use flight management system(s), guidance and automation Demonstrate correct methods for engagement and disengagement of auto flight system(s) Demonstrate appropriate use of flight guidance, auto thrust and other automation systems Maintain mode awareness of auto flight system(s), including engagement and automatic transitions Revert to different modes when appropriate Detect deviations from the desired aircraft state (flight path, speed, attitude, thrust, etc.) and take appropriate action. Anticipate mishandled auto flight system Recognize 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 approach training)	x		x				x	
			APP			No ATC clearance received prior to commencement of approach or final descent	x		x				x	
			APP			Reactive wind shear 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	

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 and scenario-based training phases	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	<u>Communication:</u> Demonstrate effective use of language, responsiveness to feedback and that plans are stated and ambiguities resolved. <u>Leadership and teamwork:</u> Use appropriate authority to ensure focus on the task. Support others in completing tasks. <u>Problem solving and decision making:</u> Detect deviations from the desired state, evaluate problems, identify risk, consider alternatives and select the best course of action. Continuously review progress and adjust plans. <u>Situation awareness:</u> Have an awareness of the aircraft state in its environment; project and anticipate changes. <u>Workload management:</u> Prioritize, delegate and receive assistance to maximize focus on the task. Continuously monitor the flight progress	GPS failure prior to commencement of approach associated with position drift and a terrain alert					x	x	x	
			DES			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 2 Jet — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and 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 wind shear warning during approach	x	x					x	x
			APP			Adverse weather scenario leading to a predictive wind shear 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 or 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 and 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 normal 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, wind shear, wind shear 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			Wind shear encounter scenario during cruise, significant and rapid change in windspeed or down/updrafts, without wind shear warning	x		x			x	x	x
			APP			Adverse weather, wind shear, wind shear 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 including 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	

	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*							
			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	
Evaluation and 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	Recognize 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 including 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 Jet — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and scenario-based training phases	Adverse wind	B	TO	Adverse wind/crosswind. This includes tailwind but not ATC mis-reporting of the actual wind	Recognize 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 including 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		

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	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 and 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	Recognize system malfunction Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences Apply crew operating procedure where necessary. Respond appropriately to additional system abnormals associated with MEL dispatch 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 System failures that require extensive management of their consequences (independent of operation or environment) Example: Fuel leak	Intentionally blank							
			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		
			GND			Malfunction during pre-flight preparation and prior to departure	x					x	x	
			GND			Malfunction after departure	x					x	x	
			GND			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		

	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*							
			APP			On approach	x					x		x
			APP			Go-around	x					x		x
			LDG			During landing	x	x		x		x	x	
Evaluation and 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.	Recognize that a compliance failure has occurred Make a verbal announcement Take appropriate action if necessary Restore safe flight path 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	Recognize 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 Jet — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and scenario-based training phases	Fire and smoke management	B	GND	This includes engine, electric, pneumatic, cargo fire, smoke or fumes	Recognize 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
			GND			Fire during taxi	x	x				x		x
			GND			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 making, in addition to manual aircraft control skills if difficult environmental conditions exist. The purpose of this item is to ensure that pilots are exposed to this during the programme	Landing in demanding environmental conditions, with malfunctions as appropriate	This topic should be combined with the adverse weather topic, aircraft system malfunctions topic or any topic that can provide exposure to a landing in demanding conditions	Intentionally blank							

Generation 2 Jet — 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							
Evaluation and scenario-based training phases	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							
	Wind shear recovery	B	TO	With or without warnings including predictive. A wind shear scenario is ideally combined into an adverse weather scenario containing other elements.	Anticipate potential for wind shear Avoid known wind shear or prepare for suspected wind shear Recognize wind shear encounter Take appropriate action Apply appropriate procedure correctly Assure aircraft control Recognize out of wind shear condition Maintain or restore a safe flight path Assess consequential issues and manage outcomes	Predictive wind shear warning during take-off					x	x		
			TO			Wind shear encounter during take-off	x				x	x		
			TO			Wind shear encounter after rotation						x		x
			TO			Predictive wind shear after rotation					x	x		
			APP			Predictive wind shear during approach	x				x	x		
			APP			Wind shear encounter during approach	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 and scenario-based training phases	Loss of communications	C	GND	Lost or difficult communications. Either through pilot mis-selection or a failure external to the aircraft. This could be for a few seconds or a total loss	Recognize 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	ALL	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 Recognize 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 instructed 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 this may be part of the operator procedures, especially when operating mixed fleets with considerable variations in MTOM	x	x						x
	Navigation	C	GND	External NAV failure. Loss of GPS satellite, ANP exceeding RNP, loss of external NAV source(s)	Recognize 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	Recognize 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		
			APP			During approach	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 and scenario-based training phases	Runway or taxiway condition	C	TO	Contamination or surface quality of the runway, taxiway, or tarmac including foreign objects	Recognize 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 Recognize 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 Recognize 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 Jet — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and 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.	Recognize 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 wind shear 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 turbulence 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 6

TRAINING PROGRAMME DEVELOPMENT GUIDANCE — GENERATION 2 (TURBOPROP)

1. GENERAL

1.1 This Appendix provides the recurrent assessment and training matrix for turbo-propeller aeroplanes of the second generation. A list of such aeroplanes is in Part I, 3.1.2.

1.2 Using the data in the matrix, operators can develop recurrent training programmes based on the EBT concept. It is imperative that the guidance in Part I of the manual be well understood by developers of an EBT programme.

1.3 Chapter 1 of Part II contains the description of the assessment and training matrix and how to use it, while the Attachment to Chapter 1 contains a summary process for end users wishing to implement the baseline EBT programme.

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.

	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*							
Manoeuvres training phase	Rejected take-off	A	TO	Engine failure after the application of take-off thrust and before reaching V1	Demonstrate manual aircraft control skills with smoothness and accuracy as appropriate to the situation Detect deviations through instrument scanning Maintain spare mental capacity during manual aircraft control Maintain the aircraft within the flight envelope Apply 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 stabilized engine-out configuration from not less than 3 NM final approach, until completion of roll-out	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 and 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 Recognize adverse weather Take appropriate action Apply appropriate procedure correctly Assure aircraft control	Predictive wind shear warning before take-off, as applicable	x	x				x		
			TO			Adverse weather scenario, e.g. thunderstorm activity, precipitation, icing		x			x	x		x
			TO			Wind shear encounter during take-off, not predictive	x			x			x	
			TO			Predictive wind shear warning during take-off	x	x				x	x	
			TO			Crosswinds with or without strong gusts on take-off	x			x				
			CRZ			Wind shear encounter scenario during cruise	x		x			x	x	x
			APP			Reactive wind shear warning during approach or go-around	x		x	x			x	
			APP			Predictive wind shear 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 including 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" topic below. 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 and 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, 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.	Know how and when to use flight management system(s), guidance and automation Demonstrate correct methods for engagement and disengagement of auto flight system(s) Demonstrate appropriate use of flight guidance, auto thrust and other automation systems Maintain mode awareness of auto flight system(s), including engagement and automatic transitions Revert to different modes when appropriate Detect deviations from the desired aircraft state (flight path, speed, attitude, thrust, etc.) and take appropriate action. Anticipate mishandled auto flight system Recognize 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 approach training)	x		x				x	
			APP			No ATC clearance received prior to commencement of approach or final descent	x		x				x	
			APP			Reactive wind shear 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	

	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 and scenario-based training phases	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	<u>Communication:</u> Demonstrate effective use of language, responsiveness to feedback and that plans are stated and ambiguities resolved. <u>Leadership and teamwork:</u> Use appropriate authority to ensure focus on the task. Support others in completing tasks. <u>Problem solving and decision making:</u> Detect deviations from the desired state, evaluate problems, identify risk, consider alternatives and select the best course of action. Continuously review progress and adjust plans. <u>Situation awareness:</u> Have an awareness of the aircraft state in its environment; project and anticipate changes. <u>Workload management:</u> Prioritize, delegate and receive assistance to maximize focus on the task. Continuously monitor the flight progress	GPS failure prior to commencement of approach associated with position drift and a terrain alert					x	x	x	
			DES			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.	Recognize that a compliance failure has occurred Make a verbal announcement Take appropriate action if necessary Restore safe flight path 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 2 Turboprop — Recurrent Assessment and Training Matrix							Competency map							
Evaluation and 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 wind shear warning during approach	x	x					x	x
			APP			Adverse weather scenario leading to a predictive wind shear 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 or 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 Turboprop — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and 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 normal 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, wind shear, wind shear 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			Wind shear encounter scenario during cruise, significant and rapid change in windspeed or down/updrafts, without wind shear warning	x		x			x	x	x
			APP			Adverse weather, wind shear, wind shear 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 including 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	

	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							
			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	
Evaluation and 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	Recognize 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 including 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 and 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	Recognize system malfunction Take appropriate action including correct stop/go decision Apply appropriate procedure correctly Maintain aircraft control Manage consequences Apply crew operating procedure where necessary. Respond appropriately to additional system abnormals associated with MEL dispatch Immediacy Complexity Degradation of aircraft control 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 System failures that require extensive management of their consequences (independent of operation or environment) Example: Fuel leak	Intentionally blank							
			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		
			GND			Malfunction during pre-flight preparation and prior to departure	x					x	x	
			GND			Malfunction after departure	x					x	x	
			GND			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		

	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							
			APP			On approach	x					x		x
			APP			Go-around	x					x		x
			LDG			During landing	x	x		x		x	x	
Evaluation and scenario-based training phases	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	Recognize 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				
	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 making, in addition to manual aircraft control skills if difficult environmental conditions exist. The purpose of this item is to ensure that pilots are exposed to this during the programme	Landing in demanding environmental conditions, with malfunctions as appropriate	This topic should be combined with the adverse weather topic, aircraft system malfunctions topic 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 2 Turboprop — Recurrent Assessment and Training Matrix							*Competency map*							
Evaluation and scenario-based training phases	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 Recognize 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 Turboprop — Recurrent Assessment and Training Matrix							Competency map							
Evaluation and scenario-based training phases	Workload, distraction, pressure	B		This is not considered a topic for specific attention on its own, but more as a reminder to programme developers to ensure that pilots are exposed to immersive training scenarios which expose them to manageable high workload and distractions during the course of the EBT programme, at the defined frequency	Manage 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 mis-reporting of the actual wind	Recognize 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 including 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 and scenario-based training phases	Approach, visibility close to minimum	C	APP	Any situation where visibility becomes a threat	Recognize 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	GND	This includes engine, electric, pneumatic, cargo fire, smoke or fumes	Recognize 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
			GND			Fire during taxi	x	x				x		x
			GND			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	GND	Lost or difficult communications. Either through pilot mis-selection or a failure external to the aircraft. This could be for a few seconds or a total loss	Recognize 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	

	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 and scenario-based training phases	Managing loading, fuel, performance errors	C	ALL	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 Recognize 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 instructed 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 this may be part of the operator procedures, especially when operating mixed fleets with considerable variations in MTOM	x	x						x
	Navigation	C	GND	External NAV failure. Loss of GPS satellite, ANP exceeding RNP, loss of external NAV source(s)	Recognize 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	Recognize 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		
			APP			During approach	x			x				x
	Runway or taxiway condition	C	TO	Contamination or surface quality of the runway, taxiway, or tarmac including foreign objects	Recognize 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 Recognize 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 and 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.	Recognize 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 wind shear 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 turbulence 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	

	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 and scenario-based training phases	Wind shear recovery	C	TO	With or without warnings including predictive. A wind shear scenario is ideally combined into an adverse weather scenario containing other elements.	Anticipate potential for wind shear Avoid known wind shear or prepare for suspected wind shear Recognize wind shear encounter Take appropriate action Apply appropriate procedure correctly Assure aircraft control Recognize out of wind shear condition Maintain or restore a safe flight path Assess consequential issues and manage outcomes	Predictive wind shear warning during take-off					x	x		
			TO			Wind shear encounter during take-off	x				x	x		
			TO			Wind shear encounter after rotation						x		x
			TO			Predictive wind shear after rotation					x	x		
			APP			Predictive wind shear during approach	x				x	x		
			APP			Wind shear encounter during approach	x				x	x		

APPENDIX 7

TRAINING PROGRAMME DEVELOPMENT GUIDANCE — GENERATION 1 (JET)

1. GENERAL

1.1 This Appendix addresses the case of turbo-jet aeroplanes of the first generation. A list of such aeroplanes is in Part I, 3.1.2.

1.2 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.

— END —