



European Aviation Safety Agency

**DRAFT** REGULATORY IMPACT ASSESMENT<sup>1</sup>

FOR EVIDENCE BASED TRAINING

**RMT.0599**<sup>2</sup>

**Evidenceand competency based training**

<sup>1</sup> The cover page might be adjusted following the format of those bodies it is addressed to.

<sup>2</sup> Only if related to certain Rulemaking Task(s).



## EXECUTIVE SUMMARY

The Regulatory Impact Assessment demonstrates that implementation of Evidence-Based training on voluntary basis by the operators is the preferred option in regulating recurrent training and checking of flight crew. It provides an opportunity for the AOC holders to take a decision to implement EBT system for the recurrent training and checking of the flight crew, including licence proficiency checks (LPCs) and operator proficiency checks (OPCs).

Evidence show that the proper implementation of EBT will bring a significant contribution to aviation safety by strengthening the core competences of flight crews and helping them to handle abnormal and unexpected situations safely. It is expected that the safety benefit of EBT would be demonstrated over time by continually improving a system targeted at focused learning. Implementation of the programme should ensure a level of safety equivalent to that provided by compliance with ORO.FC.230 of Appendix 9 to Annex I (Part-FCL) to Regulation (EU) No 1178/2011, by continuing to focus on legacy items of check, albeit within a different structure. Safety benefits should be expected through a more qualitative approach, using core competencies to develop resilience by exposure to challenging situations.

The level of education and training of personnel of AOC holders is expected to be strengthened and improved due to the EBT. The EBT concept is designed to maximise learning and minimise formal checking. Where checking is required, it should evolve towards measuring the process of managing situations rather than only the outcome of this process. This will lead to a substantial change towards providing more learning opportunities, by recognising the expectation that professionals should continuously strive to learn and develop their capabilities, rather than only being focussed on demonstrating performance according to minimum regulatory standards. The pilots will be assessed and their licences will be revalidated on the basis of evidence from EBT evaluation modules, instead of a licence proficiency check. Therefore, the proposal is expected to have positive social impact on the stakeholders. Negative social impact is expected for the examiners whose workload would be reduced due to the revalidation of the licences not based on a single simulator session, but based on the evidence, gained through the EBT system. Reduced workload might affect negatively the current role, position and the number of examiners. Although the amount of training in EBT remains unchanged, the role of the trainer will be now performed under the privileges of TRI licence, instead of TRE licence.

The CBA analysis for a medium/large operator with 1000 pilots concludes that the implementation of EBT in recurrent training and checking of flight crew is a cost-effective solution. It is expected to cost 0.32% of a medium/large operator's turnover which is 0.03% more than the expenditure that same operator makes for running traditional recurrent training and checking for its pilots (very low negative economic impact in terms of costs). In addition, it has the potential to generate significant economic benefits and to introduce an estimated saving of EUR 900 per pilot/year which represent around EUR 900,000 saving per year for the operator which represents 0.02% of operator's turnover. The profitability indicators show that the return of investment is generated a little bit 3 years after EBT implementation, considering that competent authorities grant full economic alleviations to the operator. The cost-benefit analysis for a small operator with 100 pilots supports the overall positive economic results. Similarly to the medium operator, EBT has the potential to generate significant economic benefits and to introduce an estimated saving of EUR 1000 per pilot/year which represent around EUR 100,000 saving per year for the operator. The profitability indicators show that the return of investment is generated 4 years after EBT implementation, considering that competent authorities grant economic alleviations to the operator. The net benefit represents around 0.1% of the annual turnover of a small operator. Despite that, a small operator may encounter difficulties in EBT implementation that are exhaustively analysed in the document.

The requirement for inspectors to be competent in the approval of and oversight over EBT programmes would result in increased competent authority's costs for staff training in the short term which will be offset with normalisation of the workload in the consecutive years in EBT oversight. In addition, the workload and the relative costs for the CA is expected to decrease with the time, as there might be a greater take-up of the EBT programmes by AOC holders. As EBT implementation supports performance- and risk based oversight, the overall impact on the CA is considered very low negatively affected in the first years and neutral in the consecutive years.

Finally, the RIA illustrates that the proposed rules for voluntary implementation of EBT by AOC holders contribute to maintaining a high level of aviation safety while providing a cost-efficient and socially acceptable framework.

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## 1. Regulatory Impact assessment (RIA)

The Regulatory impact assessment is performed for the RMT.0599 Evidence Based Training for recurrent training and checking of pilots, according to the provisions of Subpart FC – Flight Crew of Annex III (Part-ORO) to the Regulation No 956/2012, hereafter referred to Air Operations Regulation.

The current document should be considered as draft and is prepared for the sake of consultation with the relevant stakeholders.

### 1.1. What is the issue

Rapid technological changes and a diverse, dynamic and competitive operating environment create a need for effective and efficient training aligned with the needs of the job. Traditional approaches to training development involve decomposition of jobs into elements or tasks. For each task/element, there is a related objective, an assessment, and associated elements in a training plan. A limitation of this approach is that each task/element must be taught and assessed. In complex systems or when jobs evolve rapidly, it may not be possible to accommodate all these elements. Moreover, learners may demonstrate the ability to perform any number of tasks, without being competent in their job. In that context, pilots need to be exposed to the unexpected in a learning environment, and be more challenged and immersed in dealing with complex situations, rather than repetitively being tested in the execution of specific predefined manoeuvres.

Furthermore, the checking of flight crew does not measure sufficiently the process of managing situations, as it is mainly focused on the outcome of the process by demonstrating performance according to minimum regulatory standards. Hence, it lags behind providing more learning opportunities, recognising the expectation that professionals should continuously strive to learn and to develop their capabilities.

Competency based training (CBT) is an approach in the training and assessment, characterised by a performance orientation, putting emphasis on performance standards and their measurement and developing training with regard to the specified performance standard<sup>3</sup>. CBT has been successfully used across many industries. It is based on a job-related performance that encompasses technical task-related skills, and non-technical performance. The Evidence Based Training (EBT) approach to CBT is to ensure that of flight crew's performance is captured across a range of observable behavioural indicators, thus guaranteeing that what is trained and checked is relevant to the job.

#### 1.1.1. Regulatory background and evolution

The Agency started in September 2015 RMT.0696 'Implementation of Evidence-based Training within the European regulatory framework' and created an EBT Task Force, to develop interim guidance material (GM) in order to promote a standardised and consistent means for the implementation of EBT within the existing rule structure. This first step was completed with the publication of the ED Decision 2015/027/R, containing a GM1 to ORO.FC.230 and GM1 to ORO.FC.A.245, published in December 2015. RMT.0696 followed an accelerated process within the existing regulatory system to bring forward the safety benefits of EBT, by maintaining the existing implementing rules (IRs) and acceptable means of

<sup>3</sup>. ICAO DOC 9995 Definition

compliance (AMC), in order to provide a robust safety net until more experience in the EBT concept is gained.

RMT.0696 was planned as an interim steep preceding RMT.0599 to gain implementation experience in the EBT concept, and to identify some difficulties and inconsistencies that will need to be addressed through RMT.0599 'Evidence-based and competency-based training' (review of ORO.FC).

Presently, EASA MSs (and other NAAs that have elected to adhere to the European aviation IRs) do not have a regulatory framework that lends itself to the full implementation of EBT. In fact, within the current regulatory framework, it is only possible to achieve a mixed implementation of EBT<sup>4</sup>. The published ED Decision 2015/027/R 'Implementation of evidence-based training within the European regulatory framework' allows some operators a mixed implementation of EBT, making the training methodologies more accessible to aircraft operators. Despite that, the current European regulatory system does not allow a full implementation of EBT.

Data analyses<sup>5</sup> reveal the difficulties encountered by pilots when faced with surprising or unexpected situations. The commercial aviation system has a high level of safety reliability, but there remains a resistant rate of serious and fatal accidents. The availability of substantial data allows a systemic improvement, mostly through reactive redesign, improved operations, training and maintenance/airworthiness activities. This means that within a given rate, more serious events will become less predictable over time. Since these events could not provide answers to complex linear models, alternative explanations are needed. They can be seen as due to an unexpected combination or aggregation of conditions or events.

The continuous development of pilot core competencies is seen as an effective means to address what will be unexpected and ultimately unforeseeable, the so-called 'black swan' events. One of the key facets of EBT is learning enabled through exposure to unexpected, dynamic and challenging situations. Exposure during training to variable and dynamic threat conditions should help pilots develop and improve their processes of handling unpredictable events. With variability of exposure, confidence should be developed through the repetitive deployment of core competencies under many different conditions and across the aircraft flight envelope. The EBT project is a global safety initiative whose objective was to determine the relevance of existing pilot training and to identify the most critical areas of pilot training according to aircraft generation. The outcome of this initiative was the publication of ICAO Doc 9868 'Procedures for Air Navigation Services — Training (PANS-TRG)' (Chapters 5 and 6). In May 2013 ICAO published Doc 9995 which contains the details of a new approach to recurrent training and checking of flight crew. As part of RMT.0599, the Agency commits to the development of a dedicated regulation to enable the full deployment of EBT programmes in accordance with the philosophy defined in ICAO Doc 9995.

The implementation of EBT within the European aviation regulatory framework is a paradigm shift, assessing crew performance across a range of core competencies, rather than checking performance in managing prescribed events. Training topics drawn from comparative risk analyses are used as a vehicle for developing and assessing core competencies. Given the paradigm shift proposed by competency-based programmes like EBT, one of the principle challenges for implementation is the adaptation of the current instructor and examiner population to the concept. With this in mind, national aviation

<sup>4</sup> implementation of a mixed EBT programme means that only some portion of the recurrent assessment and training is dedicated to the application of EBT

<sup>5</sup> IATA, Data Report for Evidence-based Training, First Edition, August 2014

authorities (NAAs) and operators implementing EBT should focus on the development of instructor and examiner competencies. Safety risk assessment

An analysis of fatal aircraft accidents worldwide for the period 2001–2011 shows that in more than 50 % of these accidents the action of the flight crew was the primary causal factor (CAA UK, 2013). This analysis shows that flight crew handling skills were a factor in 14 % of the accidents whereas flight crew non-technical skills were a factor in more than twice as many (32 %). It is generally accepted that further improvements in flight safety require a comprehensive review of pilot training (IATA, 2013), and the accident statistics show that the emphasis of this training should be placed on developing the non-technical as well as technical pilot skills.

Traditional recurrent training requirements for pilots operating with airlines are, to a large extent, not relevant to the operation of modern multi-crew transport category aeroplanes (IATA, 2011) and have not kept up with the development of the operating environment. The current requirements are largely based on the evidence of accidents involving early-generation jet aircraft (IATA, 2013) and do not reflect the risks of the today operating environment.

Operators and industry bodies have recognised that the traditional training processes do not guarantee that the trained pilots are competent, or they do not adequately address 'human factors' issues (IATA, 2013). Therefore, the implementation of EBT should be a first step towards the full implementation of a Competency Based Training (CBT) framework in all aspects of flight crew training and licensing.

The following safety recommendations are derived from specific accident/incident contexts. RMT.0599 will ensure that they are taken into account in the scope of the recurrent EBT and checking, either as regards training events during the recurrent training, i.e. 'equivalence of malfunctions', or enhancing training for a specific core competency:

- FRAN-2013-017: The French Accident Investigation Board recommends that EASA, in coordination with manufacturers, operators and major non-European aviation authorities ensure that go-around training integrates instruction explaining the methodology for monitoring primary flight parameters, in particular pitch, thrust then speed.
- FRAN-2013-018: The French Accident Investigation Board recommends that EASA, in cooperation with the national civil aviation authorities and major non-European aviation authorities, ensure that during recurrent periodic training, training organizations and operators give greater importance to the assessment and maintenance of the monitoring capabilities of public transport pilots.
- FRAN-2013-022: The French Accident Investigation Board recommends that EASA review regulatory requirements for initial and periodic training in order to ensure that go-arounds with all engines operating are performed sufficiently frequently during training.
- FRAN-2013-033: The French Accident Investigation Board recommends that EASA, in cooperation with the national civil aviation authorities and major non-European aviation authorities, ensure that the risks associated with dispersion and/or channelized attention during the go-around, to the detriment of the primary flight parameters, be taught to crews.
- FRAN-2013-035: The French Accident Investigation Board recommends that EASA, in coordination with manufacturers, operators and major non-European aviation authorities, study

whether to extend these measures to other procedures requiring high workload in a short time frame.

- FRAN-2014-005: The French Accident Investigation Board recommends that EASA, in coordination with national authorities, make changes to the training requirements for pilots so as to include periodic reminders on the effects of contaminants such as ice on stall and loss of control on take-off.
- FRAN-2015-062: [unofficial translation]: EASA should define the terms on how an operator can set up a risk based training as described in ICAO Doc 9995. [French] [original text] - L'AESA définit les modalités permettant à un exploitant de mettre en oeuvre la formation basée sur les risques telle que précisée dans le doc OACI 9995 de l'OACI. [Recommandation 2015-062]
- NETH-2014-005 : To the regulators involved in with the manufacturing of transport category aircraft, European Aviation Safety Agency (Europe), Federal Aviation Administration (FAA), Agencia Nacional de Aviacao (Brasil), Civil Aviation Administration of China, Federal Air Transport Agency (Russian Federation), Japan Civil Aviation Bureau, and Transport Canada. Review the applicable regulations on initial and recurrent flight training to assess whether they adequately address the potential degradation of situational awareness (basic pilot skills) and flight path management due to increased reliance on aircraft automation by flight crews.
- SWED-2012-006: EASA is recommended to ensure that initial and recurrent pilot training includes mandatory rejected take-off exercises that cover events of a sudden loss of engine thrust below VMCG. (RL 2012:21 R6)
- UNKG-2007-062: It is recommended that the European Aviation Safety Agency should, in consultation with other National Airworthiness Authorities outside Europe, consider requiring training for flight by sole reference to standby instruments to pilots during initial and recurrent training courses.

#### 1.1.2. Who is affected

The following stakeholders are affected by the proposed changes of the RMT.0599 EBT in recurrent training and checking of pilots:

- CAT Operators – Full deployment of EBT by the AOC holders will require some changes regarding the recurrent flight crew training and checking (operator proficiency check (OPC) and licence proficiency check (LPC)) in order to accommodate the training under the new philosophy. The impacts will differ for operators who are currently providing legacy (traditional) recurrent training (under the existing 'prescriptive' requirements) and for those who implemented Alternative training and qualification programme (ATQP). The latter ones are considered much more advanced and close to the implementation of EBT.
- Competent authorities – Within the new regulatory proposals and EBT framework, competent authorities are responsible for approval of EBT recurrent pilot training and regulatory oversight, following the Doc 9995 ICAO Manual of Evidence- based training.
- Pilots – They would be the ultimate "user" of the new provisions. However, their role is analysed from the perspective of the impacts for the AOC holders who would undertake necessary

changes to swift the recurrent training and checking to EBT model. Therefore, they are not analysed individually.

- Instructors and examiners, according to subpart J and K, Part FCL of Regulation No 1178/2011 and most notably Type Rating Instructors (TRI) and Type Rating Examiners (TRE). Although the RMT.0599 is not directly addressed to instructors and examiner (there is another RMT.0596 — Review provisions for examiners and instructors of Subpart J & K in Part-FCL which is supposed to integrate the provisions of the EBT for instructors and examiners), it affects directly the roles and positions of instructors and examiners and therefore the impact on them is analysed in the current document.

### 1.1.3. How could the issue/problem evolve

As a matter of example, in the last decade, Safety Investigation Authorities (SIA) have issued 99 Safety Recommendations (SR) related to the training of the flight crew (see Annex 1). These SR were issued as result of the investigation of 55 occurrences (accident, in most of the cases) involving a CAT aeroplane operation with MTOW above 5.700 kg, where the SIA judged the training provided to the flight crew was inadequate, inefficient or insufficient for the flight crews to recognise flight deviations and to handle them safely. In almost all cases, the crew received the training prescribed by prescribed requirements at the time of the occurrence.

It is acknowledged that EBT will provide a more flexible and efficient framework for the operators to define the flight crew training better addressing the core competencies and to tailor additional training needs based on specific risks faced by each operator. In 3 SR, the implementation of EBT is explicitly addressed.

If no action is planned and/or carried out, these safety issues may remain at stake.

Traditional approaches to training could not solve the outlined issues. As mentioned, traditional or legacy training involve the decomposition of jobs into elements or tasks which must be taught and assessed. This approach has some limitation, because in complex systems or when jobs evolve rapidly, it may not be possible to accommodate all these elements. Moreover, learners may demonstrate the ability to perform any number of tasks, without being competent in their job.

The adaptability and flexibility of human work, however, is also the reason for the failures that occur, although it is rarely the actual cause behind those failures. Actions and responses are almost always based on a limited rather than complete analysis of the current conditions, i.e. a trade-off between thoroughness and efficiency. Still, since this is the normal mode of acting, normal actions can, by definition, not be wrong. Failures occur when this adjustment goes awry, but both the actions and the principles of adjustment are technically correct.

In order to respond to these challenges, continuous development of pilot core competencies is seen as an effective means to address them. EBT enables exposure to unexpected, dynamic and challenging situations to variable and dynamic threat conditions which should help pilots develop and improve their processes of handling unpredictable events. With variability of exposure, confidence should be developed through the repetitive deployment of core competencies under many different conditions and across the aircraft flight envelope.



## 1.2. What we want to achieve — objectives

The objectives of the European Union (EU) in the field of civil aviation are defined in Article 2 of Regulation (EC) No 216/2008<sup>6</sup> (hereafter referred as the Basic Regulation). This RMT will contribute to the achievement of these objectives by addressing the issues outlined above.

The specific objectives of this proposal are to:

1. ensure that recurrent pilot training and checking is adequate to provide a pilot with the necessary knowledge, skills and attitude to react quickly and in an effective way to unexpected and challenging events, considering the high level of technology and automation in the aircrafts ;
2. addressing safety recommendations and risks, identified above;
3. decide on the best efficient way to comply with ICAO requirements, especially with regard to the evidence-based training taking into account the aforementioned ICAO amendments;

## 1.3. How it could be achieved — options

The definition of the policy options followed an analysis of the most controversial issues, regarding the implementation of EBT for the recurrent training and checking. The following options have been identified to solve the issues, explained above.

**Table 1: Initial list of policy options**

<b>Option</b>	<b>Short title</b>	<b>Description</b>
0	No policy change	Continuation of traditional legacy training or Alternative training and qualification programme (ATQP) in delivering recurrent training and checking to flight crew. In addition, ED Decision 2015/027/R <sup>7</sup> developed interim guidance material (GM) in order to promote a standardised and consistent means for the implementation of EBT within the existing rule structure. It allows therefore, mixed implementation of EBT where only some portion of the recurrent assessment and training is dedicated to the application of EBT.  The risks and the problems stay unresolved, as mentioned in the issue analysis.
1	Voluntary EBT training	It provides an opportunity for the AOC holders to take a decision to implement EBT system for the recurrent training and checking of the flight crew, including licence proficiency checks (LPCs) and operator proficiency checks (OPCs). It means that the operator shift from following the existing “prescriptive” (traditional/legacy) training or Alternative training and qualification programme (ATQP) to EBT recurrent training and checking.  This option has three sub-options:
1.1	<i>Implement EBT within the current</i>	<i>It envisages a traditional Line Professions check (LPC) and renewal/revalidation of the licence according to the current system (1 module LPC and 3 other modules of</i>

<sup>6</sup> Regulation (EC) No 216/2008 of 20/02/2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/E

<sup>7</sup> <https://www.easa.europa.eu/system/files/dfu/ED%20Decision%202015-027-R%20-%20Explanatory%20Note%20.pdf>

Option	Short title	Description
	licence revalidation process	EBT). During the LPC simulator check the pilots follow check of prescriptive manoeuvres, according to the Appendix 9 of Regulation 1178/2011.  This option maintains the current examination system, performed by the Type Rating Examiners (TRE) based on the simulator results.
1.2	Implement EBT with revalidation of licence restricted to the AOC holder	It envisages that the licence will not be revalidated, but it will have a restricted validation within the AOC holder. It will not be signed by an examiner, but by an AOC holder. This sub-option will allow the AOC holder to be in control of the EBT who carries the responsibilities of effective implementation of EBT.
1.3	Implement EBT with separation of the administrative action of revalidation of licence and technical assessment/check of the pilots	This option envisages a separate processes for the administrative work for revalidation of the pilot licence and a technical work for assessment of the pilot.  The administrative work will be maintained and performed by the TRE, as the current system suggests. TRE will continue to revalidate the licence, however not based on the simulator results, but based on evidence, provided by EBT. This option guarantees that the pilots will be assessed and their licences will be revalidated on the basis of additional evidence from EBT evaluation modules. The assessment will be disconnected from the revalidation of the licence and this would ensure more objective process of the revalidation.  The revalidation of the licence will be signed by the TRE and the validity of the licence will be maintained for 1 year (as currently).  The technical part will be performed by the AOC, Type rating instructors (TRI) based on the concept of the continuous monitoring of the pilots performance.
2	Mandating EBT recurrent training and checking	This option envisages mandating EBT for all operators and discontinuation of the legacy training. Implementation of mandatory use of Competency Based Training (CBT) in all flight crew training performed by an AOC holder. Furthermore, for those type of aircraft subject to EBT (see Appendix 2 of ICAO Doc 9995), its implementation would be mandatory, by removing the current prescriptive rules, thus making EBT the only alternative to ATQP. In terms of the content, this policy option has the same features and description as policy option 1. However, it is defined as a separate alternative, because it refers to mandating EBT.

Based on an initial analysis of the options, the following sub-options have been discarded due to the reasons mentioned below:

**Table 2 - List of discarded policy options**

Sub-Option	Title	Rational for being discarded
1.1	Implement EBT within the current licence revalidation process	This option has been discarded due to the following reasons: <ul style="list-style-type: none"> <li>Retaining LPC in its current form does not support the EBT competency based training (PANS training) according to ICAO doc 9995.</li> </ul>

1.2	Implement EBT with revalidation of licence restricted to the AOC holder	<p>Assessing the performance of the pilots based on the simulator results in the LPC does not consider the whole EBT concept.</p> <p>This option has been discarded due to the following reasons:</p> <ul style="list-style-type: none"> <li>• It implies restricted validation of the licence to the particular AOC holder (similar to MPL type rating).</li> <li>• It may lead to potential problems with third country authorities (in the SAFA inspections), because there might be a risk of grounding the aircraft, as there licence will not have validation period.</li> <li>• The pilots will not be able to work for another AOC holder, because the revalidation will be only for the AOC holder for whom they are working. This may have potential negative social and economic costs and might lead to administrative burden.</li> <li>• It would deteriorate the level playing field between the AOC holders.</li> <li>• The role of the examiners would disappear and thus leading to serious negative social and economic impact.</li> <li>• There is legal uncertainty in the MS national legal system, because the revalidation of the licence is a public service with a public document, issued by the competent authorities.</li> </ul>
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The final list of retained policy options is enclosed in the table below.

**Table 3 Final list of policy options**

Option	Short title	Description
0	No policy change	Continuation of traditional legacy training in delivering recurrent training to pilots. The risks and the problems stay unresolved, as mentioned in the issue analysis.
1	Voluntary EBT training	<p>It provides an opportunity for the AOC holders to take a decision to implement EBT system for the recurrent training and checking of their pilots and to swift from following the existing “prescriptive” (traditional/legacy) training or Alternative training and qualification programme (ATQP) to EBT.</p> <p>It envisages a separate processes for the administrative work for revalidation of the pilot licence and a technical work for assessment of the pilot.</p> <p>The administrative work will be maintained and performed by the TRE, as the current system suggests. TRE will continue to revalidate the licence, however not based on the simulator results, but based on evidence, provided by EBT. This option guarantees that the pilots will be assessed and their licences will be revalidated on the basis of additional evidence from EBT evaluation modules. The assessment will be disconnected from the revalidation of the licence and this would ensure more objective process of the revalidation.</p>

Option	Short title	Description
		<p>The revalidation of the licence will be signed by the TRE and the validity of the licence will be maintained for 1 year (as currently).</p> <p>The technical part will be performed by the AOC, Type rating instructors (TRI) based on the concept of the continuous monitoring of the pilots performance.</p>
2	Mandating EBT recurrent training and checking	<p>This option envisages mandating EBT for all operators and discontinuation of the legacy training. Implementation of mandatory use of Competency Based Training (CBT) in all flight crew training performed by an AOC holder. Furthermore, for those type of aircraft subject to EBT (see Appendix 2 of ICAO Doc 9995), its implementation would be mandatory, by removing the current prescriptive rules, thus making EBT the only alternative to ATQP.</p>

## 1.4. Methodology and data

### 1.4.1. Data collection

This RIA is performed based on several sources:

- Questionnaires to the operators, participating in the Rulemaking group for the task RMT.0599: There were 6 AOC holders who provided data on their experience to commence and/or run EBT recurrent training and checking, starting from different basis. As mentioned in the issue analysis, within the current regulatory framework, it is only possible to achieve a mixed implementation of EBT<sup>8</sup>. Due to the novelty of the EBT approach in the EU context, there is not extensive expertise in the EASA MS operators/ATOs for its implementation. The information was, therefore, sought also outside EU. In addition, important distinction was made with regard to the “background” type of recurrent training and checking of the operator. Some operators run traditional/legacy training, others provide alternative training and qualification programme (ATQP) to their pilots. In addition, the size of the operator has also been considered in estimating the impacts. The analysis, therefore, recognises different impacts for small/medium operators in starting and running EBT.
- Questionnaire to other operators who undertake EBT for recurrent training and checking: apart from data from the Rulemaking group, complementary sources (e.g. data from other operators) were sought to ensure representativeness of the different business models and operators who are initiating a swift towards EBT. Hence, the analysis of the expected costs and benefits are based on real cases.
- Questionnaire to the competent authorities: Data, regarding the impact of the EBT on workload, fees, charges and internal work was analysed for EU and non- EU competent authorities. They were contacted as part of or through the Rulemaking group members, some of whom were representatives of the competent authorities.

<sup>8</sup> implementation of a mixed EBT programme means that only some portion of the recurrent assessment and training is dedicated to the application of EBT

### 1.4.2. Methodology applied

RIA is developed by combining different Impact Assessment tools:

1. **Cost Benefit Analysis (CBA):** it is applied for the economic impacts, because the data on benefits and costs were sufficiently quantified and monetarised. The method entails identifying and evaluating expected economic benefits and compliant costs for the industry to implement EBT. The outcome is expressed in terms of net present value (NPV), cost-benefit ratio and year of return of investments in EBT. Apart from its advantage to measure and quantify the net benefits, the CBA method is chosen due to its quality to quantify the costs and benefits over time. This is considered highly relevant, because the benefits of the EBT are unevenly distributed in the years of EBT implementation and the model captures that feature. However, the CBA is performed mainly for the economic impacts. There is no quantification of the safety impacts, because of the limitations in the EASA safety analysis. It is concluded that safety impacts will be qualitatively assessed. The reference period in the CBA is 10 years (2017-2027) and the analysis is made following the European Commission guidelines for CBA<sup>9</sup>. The CBA is performed in several steps:

**STEP 1** – Estimation of the costs in implementing recurrent traditional/prescriptive training and checking (baseline scenario)

**STEP 2** - Estimation of the costs (one-off and recurrent) for preparation and implementation of EBT

**STEP 3** - Calculation of the difference between costs for EBT recurrent training and checking and traditional recurrent training and checking (delta of EBT costs)

**STEP 4** - Distribution of the one-off and recurrent costs for EBT, as well as recurrent costs for legacy training in 10 years' time

**STEP 5** - Quantification and monetarisation of the economic benefits in EBT, e.g. alleviations, envisaged in the regulatory proposal for operators who might be granted with these privileges upon the discretion of the competent authority's decision. Distribution of the economic benefits in 10 years' time

**STEP 6** – Comparison of the economic benefits and costs for EBT. Calculation of cost-benefit ratio and year of return of investments in EBT.

2. **Multi-criteria analysis:** For the safety, social impact where no full monetisation is possible, Multi-criteria analysis is used. It allows comparing all options by scoring them against a set of criteria. Each criterion needs to receive a certain weight. MCA covers a wide range of techniques that aim at combining a range of positive and negative impacts into a single framework to allow easier comparison of scenarios. The scoring of the impacts uses a scale of – 5 to + 5 to indicate the negative and positive impacts of each option (i.e. from 'very low' to 'very high' negative/positive impacts). Intermediate levels of benefits are termed 'low', 'medium' and 'high' to provide for a total of five levels in each one of the positive and negative directions, with also a 'no impact' score possible.

**Table 4 — Scale with scoring of the impacts**

<b>Positive impact</b>	<b>Score</b>	<b>Negative impact</b>	<b>Score</b>
+ 5	Very high positive impact	– 5	Very high negative impact
+ 4	High positive impact	– 4	High negative impact

<sup>9</sup> [http://ec.europa.eu/smart-regulation/better\\_regulation/documents/com\\_2015\\_215\\_en.pdf](http://ec.europa.eu/smart-regulation/better_regulation/documents/com_2015_215_en.pdf)

+ 3	Medium positive impact	– 3	Medium negative impact
+ 2	Low positive impact	– 2	Low negative impact
+ 1	Very low positive impact	– 1	Very low negative impact
0	Neutral	—	—

For the economic impacts, the scale above is detailed use the following definition for the economic scale:

**Table 5 Definition of economic scale**

		NAAS	AIRLINES
	Turnover (M€) 1 000	150 000	
QUALITATIVE DESCRIPTION	Score Turnover impact		
VERY HIGH IMPACT	+/- 5 > +1.5%		
	]1 to 1.5 %[	15.0	2 500
HIGH IMPACT	+/- 4 ]0.8 to 1 %[	10.0	1 500
	]0.6 to 0.8 %[	8.0	1 200
MEDIUM IMPACT	+/- 3 ]0.4 to 0.6 %[	6.0	900
	]0.2 to 0.4 %[	4.0	600
LOW IMPACT	+/- 2 ]0.1 to 0.2 %[	2.0	300
	]0.05 to 0.1 %[	1.0	150
VERY LOW IMPACT	+/- 1 ]0.02 to 0.05 %[	0.5	75
	]0 to 0.02 %[	0.2	30
NO IMPACT	0	0.0	0

- Case studies:** Due to the complexity of the issue and different business models that are existing for operators<sup>10</sup>, it is difficult to represent all different models and analyse the impact for them. Therefore, it is suggested to illustrate the impact through examples of the impacts for the options. Hence, there are two examples of operators who undertake EBT. One is a small size operator (with a small fleet and 100 pilots) and a medium/large operator (with 1000 pilots). All assumptions, regarding the type of the operators are presented in Annexes 2 and 3.
- Impacts analysed:** The present RIA analysed the impacts, regarding several criteria: safety, social, economic. These criteria follows the main objectives of the Basic Regulation. Contrary to EASA internal practice to analyse “General aviation and proportionality issues” as a separate criterion, it is not kept as such in the current task. Reasons are that General Aviation is not in the scope of this proposal<sup>11</sup> and proportionality issues are analysed in the economic impacts. The proposed approach ensures that the impact are assessed only once, avoiding any risks of double counting.

In addition, the methodology recognizes some other important remarks:

<sup>10</sup> Point to point operator (P2P), Hub and Spoke operator (H&S), Operators running mainly long-haul and/or short-haul flights or combination of them, etc.

<sup>11</sup> The RMT.0599 may study the extension of EBT to General Aviation in 2019.

- Each option is analysed separately, considering the baseline. The assessment of the impacts is made, considering potential costs and benefits having in mind the baseline scenario. However, as policy option 1 and 2 are very similar in terms of the content (both bear same elements and regulatory proposals), the differentiation between them is made mainly with regard to way EBT will be implemented by the stakeholders: in the first case on voluntary basis, in the second case as a compulsory requirement.
- The same principle, mentioned above applies also to the economic impacts. The baseline, e.g. costs for recurrent training and checking for legacy training are quantified and monetarised. The costs/benefits of EBT implementation are also monetarised and then the overall impact of EBT is presented in terms of the delta of EBT, e.g. the difference between the costs for EBT training and checking and costs for legacy training and checking. The current approach allows visualisation of the real impact of the additional costs for EBT implementation.
- RIA is performed using a compensatory method<sup>12</sup> in assessing the impacts. This method allows trade-off between different impact assessment criteria, e.g. low scores on one criterion may be compensated by high scores on another. Furthermore, the same principle is applied in the assessment of impacts for different stakeholders within one criterion (e.g. safety, social, economic). The use of compensatory method is in line with EASA internal procedures and good practice.

## 1.5. What are the impacts

### 1.5.1. Safety impact

#### Option 0 – No policy changes

Safety risks continue, as mentioned in the issue analysis. The exposure to the safety risks will remain and the safety level will be maintained. Therefore, the safety level score is assessed as neutral (score 0).

#### Option 1 - Voluntary EBT training

Due to the nature of EBT, it is difficult to assess its safety impact. However, there are evidence showing that the proper implementation of EBT will bring a significant contribution to aviation safety by strengthening the core competences of flight crews and helping them to handle abnormal and unexpected situations safely.

Several research studies have been carried out in the development of the EBT concept and its later assessment. In the context of this RIA, it is worth mentioning the Man4Gen<sup>13</sup> Study, which among other tasks, showed the transferability of the core competences between scenarios. This conclusion would reinforce the idea that training the flight crews in core competences, rather than in executing of specific manoeuvres, enables them to handle a wider range of scenarios with higher levels of resilience.

In addition, the experience of operators that have implemented EBT or training methodologies with similar goals (i.e. Advanced Qualification Program – AQP) shows that flight crews are better prepared to take over highly automated operations and to apply a more consistent and quick decision making in those moments with high workload. These operators have also noticed the positive feedback from the flight crews being trained with those training methodologies, as they feel better prepared, especially

<sup>12</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/7612/1132618.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7612/1132618.pdf)

<sup>13</sup> [www.man4gen.eu](http://www.man4gen.eu)

with regards to the performance of the Line Oriented Evaluation (LOE). The data<sup>14</sup> shows that the remedial training for flight crew who fail in the licence proficiency checks (LPCs) and operator proficiency checks (OPCs) is reduced by half (50%) after the implementation of EBT. This is a significant benefit not only from safety perspective, but also has a positive economic implication.

It is expected that the safety benefit of EBT would be demonstrated over time by continually improving a system targeted at focused learning<sup>15</sup>. Implementation of the programme should ensure a level of safety equivalent to that provided by compliance with ORO.FC.230 of Appendix 9 to Annex I (Part-FCL) to Regulation (EU) No 1178/2011, by continuing to focus on legacy items of check, albeit within a different structure. Safety benefits should be expected through a more qualitative approach, using core competencies to develop resilience by exposure to challenging situations.

This option would have the potential to deliver a significant improvement in safety. An EBT training programme is intended to identify operational risks by using multiple sources of operational data to determine the prioritisation of training topics linked to a competency-based training framework. As examples<sup>16</sup>, the analysis of worldwide data revealed consistent and significant risks in the following areas:

- Flight path — Manual aircraft control: Manual aircraft control skills of pilots can be expected to deteriorate over time as aircraft design improves and the use of automation increases, unless supported by training to maintain and further develop these skills.
- The unstable approach paradox: Despite the reduction in unstable approaches, the go-around remains a high-risk flight phase, and increased training focus on go-arounds mitigates this risk.
- Cockpit resource management: According to the Data Report for EBT, flights where outstanding communication and leadership have been observed involve significantly less errors and undesired aircraft states than flights where poor leadership and communication have been observed. This reinforces the need for a continued focus on these skills.
- Surprise: The effect of the current high levels of operational safety is that the effects of surprise may compound any event. Training to react and recover from surprise events forms a key part of the EBT programme.
- Prioritisation of training topics: The prioritisation of training topics is the most important result from the data analysis of the EBT report. This process involved the assessment of inputs from multiple data sources and ranking of threats, errors and competencies, as well as causal factors from incidents and accidents. The process is a key part in translating data into useful training events and scenarios that can be used to assess and develop pilot performance in recurrent training programmes. The process used for the Data Report for EBT is transparent and repeatable and results in a list of prioritised training topics. Three levels of priority (A, B and C, with A having the highest priority) are used to determine the frequency of pilot exposure to the training topics within a 3-year rolling recurrent training programme.

As EBT training paradigm has embedded there safety risks, it demonstrates safety benefits of a risk-based approach to recurrent training and checking of flight crew. In addition to the improvement from

<sup>14</sup> Based on the feedback by operators who implemented full EBT worldwide, 2008-2015, EASA questionnaire 2016

<sup>15</sup> IATA, Data Report for Evidence-based Training, 2013.

<sup>16</sup> IATA, Data Report for Evidence-based Training, 2013



an increased take-up of EBT, aircraft operators would be able to develop less complex training programmes, tailored to the identified risks, and to implement the principles of CBT in all training programmes. The overall result would be better training for the pilots involved and a lower flight-crew-related accident rate in the future. Although, the implementation of EBT within this option is voluntary, it is expected to be approached by significant number of operators due to the benefits it renders. Hence, the safety impact of Option 1 is scored as +1 (low positive impact).

#### Option 2 - Mandating EBT recurrent training and checking

This option would provide higher level of safety as it would ensure that all flight crew training for AOC holders is conducted in a competency-based framework tailored to the risks identified in operations. It is therefore, scored with +2 (low positive safety impact).

Based on the analysis above, the safety impact assessment is visualised as follows:

**Table 6 – Safety impacts per option**

<i>Criteria</i>	<i>Option 0 No policy change</i>	<i>Option 1 Voluntary EBT training</i>	<i>Option 2 Mandating EBT recurrent training and checking</i>
Safety impact	Neutral. Safety level is maintained.	Very low positive impact, because it would be applied on voluntary basis. The flight crews would be better prepared to take over highly automated operations and to apply a more consistent and quick decision making in those moments with high workload, leading to expected decrease in the lower flight-crew-related accident rate in the future	Low positive safety impact, because it would apply to the whole population of flight crew and AOC holders in EASA Member States and would render more safety benefits.
	0	+1	+2

### 1.5.2. Social impact

#### Option 0 – No policy changes

No social impact is anticipated from option 0. The social impact score is 0 (no impact/neutral).

#### Option 1 - Voluntary EBT training

This option has the following social impacts:

- Positive impact on consultancies and companies with EBT expertise: It is expected that the number of consultancies and companies with EBT expertise would increase as they would expand their business and might increase the number of employees. Positive effects would be generated for the training developers and trainings providers, because many aircraft operators would need to develop/improve expertise and strengthen knowledge in the field.
- Positive impact on AOC holders and flight crew: The level of education and training of personnel of AOC holders is expected to be strengthened and improved due to the EBT. The EBT concept is designed to maximise learning and minimise formal checking. Where checking is required, it should evolve towards measuring the process of managing situations rather than only the outcome of this process. This will lead to a substantial change towards providing more learning

opportunities, by recognising the expectation that professionals should continuously strive to learn and develop their capabilities, rather than only being focussed on demonstrating performance according to minimum regulatory standards. The pilots will be assessed and their licences will be revalidated on the basis of additional evidence from EBT evaluation modules. In addition, EBT is focused on the deployment of core competencies, and on the process of using them to mitigate challenging situations, rather than on the measurement of simple outcomes in the performance of standard manoeuvres. Therefore, 'competency-based training is the approach used to deliver the content of EBT programmes' (ICAO Doc 9995, Chapter 7). Based on the improved skills and competencies, EBT might also have also a potential positive effect on the flight crew career development. Another positive impact lies within the proposed changes for revalidation of the flight crew licences. It is suggested that there would be separate processes for the administrative work for revalidation of the pilot licence and a technical work for assessment of the pilot. The administrative work will be maintained and performed by the TRE, as the current system suggests. TRE will continue to revalidate the licence, however not based on the simulator results, but based on evidence, provided by EBT. This option guarantees that the pilots will be assessed and their licences will be revalidated on the basis of additional evidence from EBT evaluation modules. Therefore, the revalidation process would be more objective and that might gain additional positive social benefit for the flight crew.

- Positive impact on Type rating instructors (TRI)/Type rating examiners (TRE): They would be positively affected by the option, because they will receive competency based training that would improve their knowledge and skills. The line check of the flight crew (line evaluation in EBT terminology) will require an EBT instructor, while so far it is performed by a nominated person. That change would result in strengthening the role of the TRI as he/she needs to perform the line check/line evaluation in EBT.
- Negative impact on TRE: the workload and the volume and scope of the work, performed by the TRE would be reduced due to the revalidation of the licences not based on a single simulator session, but based on the evidence, gained through the EBT system. Reduced workload might affect negatively the current role, position and the number of examiners. Although the amount of training in EBT remains unchanged, the role of the trainer will be now performed under the privileges of TRI licence, instead of TRE licence. .
- Positive impacts on competent authorities (CA): the inspectors at the CA will be positively affected, because they would improve their knowledge following EBT training and/or participation in all phases of the implementation of EBT by the operator and overseeing the training of TRI/TRE.

Based on the analysis above, the overall social impact of policy option 1 is scored as +2 (low positive).

### **Option 2 - Mandating EBT recurrent training and checking**

The above mentioned impacts are valid for Option 2 as well and even this option is expected to trigger much higher positive social impact (medium positive impact +3), because the positive impacts explained above will be applied to all operators (higher population), flight crew, etc. In addition, it would cater more opportunities for development of the EBT training developers and providers and thus positively affect the employment.

**Table 7 – Social impacts per option**



Criteria	Option 0 No policy change	Option 1 Voluntary EBT training	Option 2 Mandating EBT recurrent training and checking
Social impact	No social impacts.	Low positive: Improvement in the skills, knowledge of all stakeholders; more objective revalidation licence process, based on evidence, provided by EBT. Some negative impacts for TRE who will decrease their volume of work for licence revalidation.	Medium positive: Same impacts for all stakeholder as in Option 1, but applied to all AOC holders, flight crew, EBT training developers/providers, etc. Some negative impacts for TRE who will decrease their volume of work for licence revalidation.
	0	+2	+3

### 1.5.3. Economic impact

#### Option 0 – No policy changes

No impact.

#### Option 1 - Voluntary EBT training

The economic impacts are analysed for operators and for EASA MS competent authorities. As mentioned in the methodological note, a cost-benefit analysis (CBA) is performed to assess the costs and benefits in implementing EBT.

#### 1.5.3.1 Economic impact for the operators

The current section contains major elements from the CBA from the 2 case studies: Case study 1: Economic impacts for a medium/large operator and Case study 2: Economic impacts for a small operator. Full models with the main assumptions and calculations for the 2 cases are enclosed in Annex 2 (for medium/large operator) and Annex 3 (for small operator). For the sake of efficiency and simplicity, the current section explains in details case study 1, while all assumptions and calculations for case study 2 are included in Annex.

Both case studies are prepared for operators that run traditional/ prescriptive recurrent training and checking and need to go through the whole preparation process for EBT implementation. The cases do not analyse the transition costs for an operator who is currently running ATQP recurrent training to shift to EBT training, because ATQP operators are much more advanced in the implementation of competency-based training and the efforts for them to deploy EBT would be much less in comparison to the legacy training operator. Therefore the case studies exemplify situation which is much more common and would entail all type of costs (that could be quantified). It is assumed that the ATQP operator would get benefit of full CBA which illustrates the type of compliance costs and expected economic benefits.

#### Case study 1: Economic impacts for a medium/large operator

That case study is prepared for an operator with the following assumptions:

General assumptions:

- The airline is not a flight time limited airline (e.g. the pilots do not reach the maximum yearly flight time hours e.g. 1000 in 12 months, according to ORO.FTL.210).

- The airline is a day duty limited airline (e.g. the limitation of the pilots is by number of duty days available).
- The airline is running both long-haul and short-haul flights. For simplicity reasons, the flight crew is assumed to carry out short-haul flights.
- Number of pilots (captains and first officer): 1000.
- Number of instructors/examiners: 100, indicatively 10% of pilot population
- Number of line checks per year 600 line checks all 1000 pilots which are performed in 600 line checker working days
- Number of FSTD (hereafter referred as simulator sessions): 2800 sim session OPC/LPC per year for all pilots at the company (500 crews 4 session per crew which are in total 2000 sessions per crew; a coefficient of 1.4 is applied to calculate the realistic number of simulator session due to the inefficiency in terms of number of pilots undertaking simulators, e.g. not always the captain and the first officers are coupled in the simulator session);
- 1 FTE = 180 working days
- The crew need to travel to the main basis, which is in EUK, where the training is carried out.
- Development and update of the training programme under the legacy training is 80 working days.
- Fees and charges for approval of the recurrent training programme are 8400 EUR (source UK fee rate)
- There is annual refresher training for the TRI/TRE is 1 working day.
- Annual remuneration of a training manager is 200,000 EUR per year EUR (full cost for the operator, including gross salary plus the social securities for the operator).
- Annual remuneration of an instructor/examiner is estimated at 200,000 EUR (full cost for the operator, including gross salary plus the social securities for the operator).
- Annual remuneration of a pilot is estimated at 200,000 EUR (full cost for the operator, including gross salary plus the social securities for the operator). It is calculated on the basis of the average remuneration of captain and first officer per year.
- Annual remuneration of a captain, performing the line check is estimated at 200,000 EUR (full cost for the operator, including gross salary plus the social securities for the operator).
- Annual remuneration of a trainer performing the ground training is estimated at 100,000 EUR.

Assumptions, regarding the operator proficiency check (OPC) and the licence proficiency check (LPC)

- There are 1 LPC and 2 OPC per year per crew and 1 training session per year per crew. In total, there are 4 sessions per year equivalent to 4 working days. For 3 years, it is considered that the baseline operator is doing 48 hours simulator per crew.
- At the operator's main basis/HQ premises are the simulators. There are costs for travelling of the pilots to the main crew base/HQ. 50% of pilots are travelling to the main basis/HQ for simulator exercise. A coefficient of 0.5 is considered to capture this assumption. For the sake of

the exercise, it is assumed that the HQ is in UK. The per diem rate is taken for UK which is currently 280 EUR per day<sup>17</sup>.

- TRI/TRE does OPC/LPC every 6 months 2.1 days. In total, they are engaged for 4.2 days per year per pilot, because the TRE needs to do right (either) hand seat qualification or other type of courses.
- Ideally when OPC and LPC are rostered, 1 TRI/TRE does OPC and LPC in 2.1 days every 6 months 4 days in total per pilot. In reality the flight crew are coupled for the OPC and LPC. If the people are coupled within the same day 2 pilots do the OPC and LPC. Therefore a coefficient of 0.6 is considered.
- The cost for simulator per session is 1200 EUR per crew.

Assumptions, regarding the ground training:

- Ground training is 1 day per year per pilot.
- A trainer, conducting ground training is involved 1 day for 4 Pilots. For 1000 pilots trainers are engaged 250 working days.
- The per diems for travel to the main base for the ground training is 3 days per pilot per year (incl/ 2 days for travelling per year per pilot/FO and 1 day for training). 50% of all pilots are travelling to the main base. Coefficient of 0.5 is used to capture that assumption.

Assumption, regarding remedial training:

- Remedial training for OPC/LPC is provided to 2.6% of the pilots/FO who failed in OPC and LPC checks, e.g. 26 pilots.
- Remedial training for line check is provided to 0.25% of the pilots/FO who failed in line checks, e.g. 2.5 pilots of all 1000 pilots. Since it is negligible, it is not considered in the analysis.
- After the remedial training, the pilots pass OPC, LPC.
- It is assumed that the pilots in remedial training need to fly to the main basis to do the OPC/LPC.

All assumptions, regarding case study 1 are presented in Annex 2.

### **STEP 1 – Estimation of the costs in implementing recurrent traditional/prescriptive training and checking (baseline scenario)**

The starting point in analysing the impacts of EBT implementation is defining the current costs in implementing recurrent traditional/prescriptive training and checking. The table below illustrates the costs for an operator to run prescriptive/legacy/ traditional recurrent training and checking for flight crew.

<sup>17</sup> <https://ec.europa.eu/europeaid/sites/devco/files/perdiem-rate-20150318.pdf>

**Table 8 - Baseline scenario: costs for an operator to run prescriptive/legacy/ traditional recurrent training and checking for flight crew**

type of costs	type of costs	coeffi cient rate	Baseline: Legacy training (calculated for a medium/large operator/year)				total cost for the operator (per year) in EUR
			working days per year	Full time equivalent (FTE) per year	unit cost EUR per year	total unit cost (per pilot/instructor year) in EUR (FTE* unit cost)	
<b>1. Update of the recurrent training programme</b>	Recurrent		80	0.44	200,000.00	88,888.89	88,888.89
<b>1a.Approval of recurrent training programme (fees and charges)</b>	Fixed, recurrent					8,400.00	8,400.00
<b>2. Costs for instructors/examiners for refresher training (1 day per instructor/examiner)</b>	recurrent		1	0.01	200,000.00	1111.11	111,111.11
<b>3. OPC and LPC</b>							
<i>3.1 Cost for OPC &amp; LPC recurrent training (4 sessions per year in 4 days per pilot/ year)</i>	Recurrent		4	0.02	200,000.00	4,444.44	4,444,444.44
<i>3.2 Per diems for travelling and doing OPC and LPC ( 4 days per pilot/year)</i>	Recurrent	0.5	8		280.00	2,240.00	112,000.00
<i>3.3 Costs for TRI/TRE per year to provide OPC and LPC (1 instructor/examiner 2 days every 6 months, in total 4 days per year per pilot)</i>	Recurrent	0.6	4	0.02	200,000.00	4,444.44	2,666,666.67
<i>3.4 Cost for the simulators (1200 EUR per session/crew) 2800 sessions for 1000 crew per year</i>	Recurrent		2800		1,200.00		3,360,000.00
<b>4. Line check/Line evaluation of competency</b>							
<i>4.1 Cost for line check (1 day line check per pilot; 600 line checks for all 1000 pilots)</i>	recurrent		600	3.33	200,000.00		666,666.67
<b>5. Ground training</b>							
<i>5.1 Cost for a trainer for 1 day ground training</i>	Recurrent		250	1.39	100,000.00	138,888.89	138,888.89

type of costs	type of costs	coeffi- cient rate	Baseline: Legacy training (calculated for a medium/large operator/year)				
			working days per year	Full time equivale nt (FTE) per year	unit cost EUR per year	total unit cost (per pilot/instruc tor year) in EUR (FTE* unit cost)	total cost for the operator (per year) in EUR
(250 days for all 1000 pilots)							
5.2 Cost for ground training per pilot (alternative occupancy for 1 day training)	Recurrent		1	0.01	200,000.00	1,111.11	1,111,111.11
5.3 Allowance/per diem for travel of crew to the main crew base/ HQ for ground training (the trip is 2 days per year per pilot/FO + 1 day for the training).	Recurrent	0.50	3		280.00	840.00	420,000.00
6. Remedial training							
6.1 Cost per crew to do OPC & LPC recurrent training (4 sessions per year plus days for travelling to the simulator - 4 days in addition (one day before the simulator, 1 day after it is finished); in total 8 days	Recurrent						115,555.56
6.2 Per diem for the pilot to do OPC & LPC recurrent training (allowances for 8 days per pilot for travelling, stay, perform checks, back)	Recurrent						2,912.00
6.3 Costs for TRI/TRE per year to do OPC and LPC (in total 5 days per year per pilot)	Recurrent						69,333.33
6.4 Cost for simulators (1200 EUR per session/pilot; 4 sessions per pilot/year)	Recurrent						87,360.00
Total costs							13,403,338.67
Turnover of the operator with 1000 pilots							4,567,000,000
% of costs for recurrent training as regards the operator's turnover							0.29%

**STEP 2- Estimation of the costs (one-off and recurrent) for preparation and implementation of EBT**

As a second step are calculated the costs for implementation of EBT. These costs are made, considering the following assumptions:

- All general assumptions, regarding the operator, explained in Step 1 are valid in EBT.
- The implementation of EBT requires in most of the cases the same type of recurrent costs as for the traditional/legacy/prescriptive training. Therefore, the recurrent costs from the traditional model (e.g. for OPC, LPC) are kept with the same amounts and same origin in the EBT model.
- In addition, there are supplementary costs for the preparation, adoption and implementation of EBT. These costs are analysed as one-off and additional recurrent costs due to the deployment of EBT as follows:
  - Operator is using an external consultant for 20 days to help develop the EBT competency framework and EBT training programme and to train EBT manager.
  - The consultant train instructors to deliver EBT training: each instructor is trained for 3 working days. 1 day training for the consultant costs 1300 EUR. All 100 instructors are trained for 30 days.
  - The instructors/examiners are engaged for 4 days for EBT training (3 days training and 1 working day competency assessment (one-off costs). These days are calculated as part of the EBT costs, because they refer to the alternative occupancy of the TRI/TREs (instead of providing instructions/examining, they are engaged in training).
  - Operator's training manager is conducting EBT training for 20 days (one-off cost).
  - Operator's training manager is developing an EBT training programme for the all flight crew for 100 days (one-off cost).
  - Operator is purchasing an IT assessment tool to support the implementation of EBT. The tools will be used for electronic reporting/statistical analysis for EBT training, for safety reporting programmes, monitoring of pilot performance. It costs EUR 100 000 (one-off cost).
  - Costs for maintaining licences for IT tool are EUR 10 000 per year.
- All other recurrent costs and assumptions, identified for the legacy training are valid for EBT (costs for OPC, LPC, line check, ground training, and remedial training).

The table below illustrates the costs for preparing and implementing EBT (one-off costs and recurrent costs).



Table 9 –Costs for an operator to run EBT recurrent training and checking for flight crew

type of costs	EBT costs (calculated for a medium/large operator/year)					
	type of costs	working days per year	Full time equivalent (FTE) per year	unit cost EUR per year	total unit cost (per pilot/instructor/examiner/year) in EUR (FTE* unit cost)	total cost for the operator (per year) in EUR
<b>1. Preparatory costs</b>						
1a.External assistance in setting up the EBT framework to develop the competency framework and develop training programme	One-off					100,000.00
1b.Training of EBT project team (manager)	One-off	20	0.11	200,000.00		22,222.22
1c.Development of EBT training programme by training manager	One-off	100	0.56	200,000.00		111,111.11
1d.Update of the recurrent training programme	Recurrent Same as for legacy training	80	0.44	200,000.00		88,888.89
1e.Approval of recurrent training programme (fees and charges)	Recurrent Same as for legacy training					8,400.00
1f.Costs for consultants to train instructors to deliver EBT training and assessment (10 classes for 10 instructors 3 days each instructor)	One-off	3		1,300.00	3,900.00	390,000.00
1g.Training of instructors for EBT (3 days per instructor) alternative occupancy and 1 day competency assessment per TRI/TRE	one-off	4	0.02	200,000.00	4,444.44	444,444.44
1j.Costs for instructors/examiners for refresher training for EBT (1 day per instructor/examiner)	Recurrent Same as for legacy training	1	0.01	200,000.00	1,111.11	111,111.11
2. Purchase of equipment (IT tool: Electronic reporting/Statistical analysis) for EBT training (for safety reporting programmes, monitoring of pilot performance)	One-off					100,000.00
2a. Costs for maintaining licences for IT tool	Recurrent New for EBT					10,000.00
<b>3. OPC and LPC / EBT modules</b>						

type of costs	EBT costs (calculated for a medium/large operator/year)					
	type of costs	working days per year	Full time equivalent (FTE) per year	unit cost EUR per year	total unit cost (per pilot/instructor/examiner/year) in EUR (FTE* unit cost)	total cost for the operator (per year) in EUR
<b>3.1 Cost for OPC &amp; LPC recurrent training (4 sessions per year in 4 days per pilot/year)</b>	Recurrent Same as for legacy training					4,444,444.44
<b>3.2 Per diems for travelling and doing OPC and LPC ( 4 days per pilot/year)</b>	Recurrent Same as for legacy training					112,000.00
<b>3.3 Costs for TRI/TRE per year to provide OPC and LPC (1 instructor/examiner 2 days every 6 months, in total 4 days per year per pilot)</b>	Recurrent Same as for legacy training					2,666,666.67
<b>3.4 Cost for the simulators (1200 EUR per session/crew) 2800 sessions for 1000 crew per year</b>	Recurrent Same as for legacy training					3,360,000.00
<b>4. Line check/Line evaluation of competency</b>						
<b>4.1 Cost for line check (1 day line check per pilot; 600 line checks for all 1000 pilots)</b>	Recurrent Same as for legacy training					666,666.67
<b>5. Ground training</b>						
<b>5.1 Cost for a trainer for 1 day ground training (250 days for all 1000 pilots)</b>	Recurrent Same as for legacy training					138,888.89
<b>5.2 Cost for ground training per pilot (alternative occupancy for 1 day training)</b>	Recurrent Same as for legacy training					1,111,111.11
<b>5.3 Allowance/per diem for travel of crew to the main crew base/ HQ for ground training (the trip is 2 days per year per pilot/FO + 1 day for the training).</b>	Recurrent Same as for legacy training					420,000.00
<b>6. Remedial training</b>						
<b>6.1 Cost per crew to do OPC &amp; LPC recurrent training (4 sessions per year plus days for travelling to the simulator - 4 days in addition (one day before the simulator, 1 day after it is finished); in total 8 days</b>	Recurrent Same as for legacy training					115,555.56

type of costs	EBT costs (calculated for a medium/large operator/year)					
	type of costs	working days per year	Full time equivalent (FTE) per year	unit cost EUR per year	total unit cost (per pilot/instructor/examiner/year) in EUR (FTE* unit cost)	total cost for the operator (per year) in EUR
<b>6.2 Per diem for the pilot to do OPC &amp; LPC recurrent training (allowances for 8 days per pilot for travelling, stay, perform checks, back)</b>	Recurrent Same as for legacy training					2,912.00
<b>6.3 Costs for TRI/TRE per year to do OPC and LPC (in total 5 days per year per pilot)</b>	Recurrent Same as for legacy training					69,333.33
<b>6.4 Cost for simulators (1200 EUR per session/pilot; 4 sessions per pilot/year ;)</b>	Recurrent Same as for legacy training					87,360.00
<b>Total</b>						<b>14,581,116.44</b>
<b>Turnover of the operator with 1000 pilots</b>						
<b>% of costs for recurrent training as regards the operator's turnover</b>						<b>0.32%</b>

### STEP 3 - Calculation of the difference between costs for EBT recurrent training and checking and traditional recurrent training and checking (delta of EBT costs)

As already illustrated in Step 1 and Step 2, there are many type of EBT recurrent cost that would be the same as a in the legacy training. Therefore, a delta (difference) between the EBT one-off and recurrent costs and legacy training recurrent costs is made to exemplify the real impact in terms of additional costs for EBT implementation. The table below shows the difference (the delta).

**Table 10 –Difference between costs for an operator to run EBT and cost for running legacy recurrent training and checking**

type of costs	EBT costs (EUR/year)	Legacy training costs (EUR/year)	Difference
<b>1. Preparatory costs</b>			
<b>1a.External assistance in setting up the EBT framework to develop the competency framework and develop training programme</b>	100,000.00	0	100,000.00
<b>1b.Training of EBT project team (manager)</b>	22,222.22	0	22,222.22
<b>1c.Development of EBT training programme by training manager</b>	111,111.11	0	111,111.11

type of costs	EBT costs (EUR/year)	Legacy training costs (EUR/year)	Difference
<b>1d.Update of the recurrent training programme</b>	88,888.89	88,888.89	0.00
<b>1e.Approval of recurrent training programme (fees and charges)</b>	8,400.00	8,400.00	0.00
<b>1f.Costs for consultants to train instructors to deliver EBT training and assessment (10 classes for 10 instructors 3 days each instructor)</b>	390,000.00	0	390,000.00
<b>1g.Training of instructors for EBT (3 days per instructor) alternative occupancy and 1 day competency assessment per TRI/TRE</b>	444,444.44	0	444,444.44
<b>1j.Costs for instructors/examiners for refresher training for EBT (1 day per instructor/examiner)</b>	111,111.11	111,111.11	0.00
<b>2. Purchase of equipment (IT tool: Electronic reporting/Statistical analysis) for EBT training (for safety reporting programmes, monitoring of pilot performance)</b>	100,000.00	0	100,000.00
<b>2a. Costs for maintaining licences for IT tool</b>	10,000.00	0	10,000.00
<b>3. OPC and LPC / EBT modules</b>			0.00
<b>3.1 Cost for OPC &amp; LPC recurrent training (4 sessions per year in 4 days per pilot/year)</b>	4,444,444.44	4,444,444.44	0.00
<b>3.2 Per diems for travelling and doing OPC and LPC ( 4 days per pilot/year)</b>	112,000.00	112,000.00	0.00
<b>3.3 Costs for TRI/TRE per year to provide OPC and LPC (1 instructor/examiner 2 days every 6 months, in total 4 days per year per pilot)</b>	2,666,666.67	2,666,666.67	0.00
<b>3.4 Cost for the simulators (1200 EUR per session/crew) 2800 sessions for 1000 crew per year</b>	3,360,000.00	3,360,000.00	0.00
<b>4. Line check/Line evaluation of competency</b>			0.00
<b>4.1 Cost for line check (1 day line check per pilot; 600 line checks for all 1000 pilots)</b>	666,666.67	666,666.67	0.00
<b>5. Ground training</b>			0.00
<b>5.1 Cost for a trainer for 1 day ground training (250 days for all 1000 pilots)</b>	138,888.89	138,888.89	0.00
<b>5.2 Cost for ground training per pilot (alternative occupancy for 1 day training)</b>	1,111,111.11	1,111,111.11	0.00

type of costs	EBT costs (EUR/year)	Legacy training costs (EUR/year)	Difference
<i>5.3 Allowance/per diem for travel of crew to the main crew base/ HQ for ground training (the trip is 2 days per year per pilot/FO + 1 day for the training).</i>	420,000.00	420,000.00	0.00
<b>6. Remedial training</b>			0.00
<i>6.1 Cost per crew to do OPC &amp; LPC recurrent training (4 sessions per year plus days for travelling to the simulator - 4 days in addition (one day before the simulator, 1 day after it is finished); in total 8 days</i>	115,555.56	115,555.56	0.00
<i>6.2 Per diem for the pilot to do OPC &amp; LPC recurrent training (allowances for 8 days per pilot for travelling, stay, perform checks, back)</i>	2,912.00	2,912.00	0.00
<i>6.3 Costs for TRI/TRE per year to do OPC and LPC (in total 5 days per year per pilot)</i>	69,333.33	69,333.33	0.00
<i>6.4 Cost for simulators (1200 EUR per session/pilot; 4 sessions per pilot/year ;)</i>	87,360.00	87,360.00	0.00
<b>Total</b>	<b>14,581,116.44</b>	<b>13,403,338.67</b>	<b>1,177,777.78</b>
	<b>Incl. total one-off costs only for EBT</b>		<b>1,167,778</b>
	<b>Incl. total recurrent costs only for EBT</b>		<b>10,000</b>
<b>Turnover of the operator with 1000 pilots</b>		<b>4,567,000,000</b>	
<b>% of costs from the operator's turnover</b>	<b>0.32%</b>	<b>0.29%</b>	<b>0.03%</b>

Based on the data above, the one-off (initial investment costs) will be around MEUR 1,167 and the recurrent costs will be around EUR 10,000. In total the costs the additional costs for an operator to prepare and implement EBT are estimated as MEUR 1.177 which represents 0.03% increase in comparison to the operator's annual turnover. That increase has a **very low negative impact**, according to the scale with definition of the economic impact (see table 4).

#### **STEP 4- Distribution of the one-off and recurrent costs for EBT, as well as recurrent costs for legacy training**

The above mentioned costs are distributed unevenly within 1-2 years' time depending on the business model of the operator. For the sake of the case study, it is assumed that:

- There are 2 years for EBT preparation. The first preparatory year, the operator runs traditional training and starts EBT one-off costs (training of a manager to be EBT manager and consultancy to develop EBT framework and training programme). The second preparatory year, traditional

training is still running, while the rest of the EBT one-off costs are executed (development of EBT training programme, purchase of assessment IT tool, and training of instructors for initial course of EBT).

- The year when the EBT training starts is year 3, after all one-off costs for EBT are made. Every consecutive year (from year 4+), EBT is running as envisaged with the recurrent costs, explained above.
- The model is prepared for 10 year's period.

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Table 11 Costs for implementation of EBT in 10 years' period

years		1	2	3	4	5	6	7	8	9	10
short description	Baseline: Legacy training	Preparatory year: running traditional training +EBT investment one-off costs (training of a manager to be EBT manager and consultancy to develop EBT framework and training programme)	Preparatory year: running traditional training + EBT investment one-off costs (development of EBT training programme, purchase of assessment IT tool, training of instructors for initial course of EBT)	First year of EBT implementatio n discontinue legacy training,	Second year of EBT implementat ion, discontinue legacy training	All EBT costs	All EBT costs	All EBT costs	All EBT costs	All EBT costs	All EBT costs
1	<b>Total costs</b>	<b>13,403,338.67</b>	<b>13,525,560.89</b>	<b>14,448,894.22</b>	<b>13,413,338.67</b>	<b>13,413,338.67</b>	<b>13,413,338.67</b>	<b>13,413,338.67</b>	<b>13,413,338.67</b>	<b>13,413,338.67</b>	<b>13,413,338.67</b>
<b>One-off investment costs for EBT</b>											
2	Training of a EBT training manager (20 days to develop competency framework) (one-off)	22,222.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Consultancy to train EBT manager and develop EBT framework and training programme (one-off)	100,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Training of instructors to deliver EBT training (costs for consultants and daily wages of the instructors) (one-off)		834,444.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Purchase of IT tool (one-off)		100,000.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
6	Develop EBT recurrent training programme by the training manager (one-off)		111,111.11								

years	1	2	3	4	5	6	7	8	9	10
<b>Recurrent costs for legacy/EBT training</b>										
7 Legacy training (recurrent costs)	13,403,338.67	13,403,338.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8 Update of EBT recurrent training programme by the training manager (recurrent, same cost as for the legacy training)	0.00	0.00	88,888.89	88,888.89	88,888.89	88,888.89	88,888.89	88,888.89	88,888.89	88,888.89
9 Costs for instructors/examiners for refresher training for EBT (1 day per instructor/examiner) (recurrent, same cost as for the legacy training)			111,111.11	111,111.11	111,111.11	111,111.11	111,111.11	111,111.11	111,111.11	111,111.11
10 Approval of the changes in the recurrent training programme by the CA (recurrent, same cost as for the legacy training)			8,400.00	8,400.00	8,400.00	8,400.00	8,400.00	8,400.00	8,400.00	8,400.00
11 EBT modules (former OPC and LPC) (recurrent, same cost as for the legacy training)	0.00	0.00	10,583,111.11	10,583,111.11	10,583,111.11	10,583,111.11	10,583,111.11	10,583,111.11	10,583,111.11	10,583,111.11
12 EBT Line check (recurrent, same cost as for the legacy training)	0.00	0.00	666,666.67	666,666.67	666,666.67	666,666.67	666,666.67	666,666.67	666,666.67	666,666.67
13 EBT Ground training (recurrent, same cost as for the legacy training)	0.00	0.00	1,670,000.00	1,670,000.00	1,670,000.00	1,670,000.00	1,670,000.00	1,670,000.00	1,670,000.00	1,670,000.00
14 EBT Remedial training (recurrent, same cost as for the legacy training)	0.00	0.00	275,160.89	275,160.89	275,160.89	275,160.89	275,160.89	275,160.89	275,160.89	275,160.89





	years	1	2	3	4	5	6	7	8	9	10
	as for the legacy training)										
15	Costs for maintaining licences for IT tool (recurrent, new cost for EBT)	0.00	0.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
16	<b>delta EBT costs in comparison to legacy training costs</b> <i>For years 2017 and 2018 (line 1 - line 5) and for all other years (line 15)</i>	<b>122,222.22</b>	<b>1,045,555.56</b>	<b>10,000.00</b>	<b>10,000.00</b>	<b>10,000.00</b>	<b>10,000.00</b>	<b>10,000.00</b>	<b>10,000.00</b>	<b>10,000.00</b>	<b>10,000.00</b>



**STEP 5 - Quantification and monetarisation of the economic benefits in EBT, e.g. alleviations, envisaged in the regulatory proposal for operators who might be granted with these privileges upon the discretion of the competent authority's decision. Distribution of the economic benefits**

The implementation of EBT is expected to bring economic benefits as follows:

- Line check: Two years after EBT implementation an operator may be allowed to extend the line check, e.g. a pilot's line check requirement is reduced from 1 per year to 1 every two years. The benefit is the saving from the costs that the operator pays annually for the line check of all flight crew.
- Ground training: A pilot's Safety equipment procedure (SEP) training requirement is reduced from 1 per year to 1 every two years. The benefit is saving a daily wage of the flight crew. In addition, less CRM training is expected due to the integration of non-technical competencies in the EBT programme.
- Saving due to decrease in % of pilots who fail in OPC/LPC: Saving in daily wage of flight crew for the time that he/she does not fly.
- Indirect saving (flexibility): A reduction in pilot workload is expected due to flexibility to run simulator session away from the peak flying months. The benefit is estimated as 1% of the annual wage of a pilot saved, multiply by the number of the pilots who would be available to fly instead of going to simulator. More details, regarding the calculation of 1% efficiency are provided in Annex 2.

Some of these economic benefits are already known and granted to the operators that run ATQP. Currently, the ATQP programme and its alleviations bring a return on investment in a period of about seven years<sup>18</sup>.

These benefits may be granted to the operators after at least 2 years of EBT implementation upon the decision of the competent authority. The latter needs to approve type and the timing of the alleviations.

In the case study, it is assumed that:

- The economic benefits (as mentioned above) will be granted fully after 2 years after EBT implementation by the competent authority to the operator. This expectation is based on the historical data on granting alleviations to operators running ATQP training.
- Two years after EBT implementation, the operators' flight crew attain less failures in OPC/LPC (20% decrease in remedial training, e.g. 2.08% of pilots fail in comparison to the level before EBT implementation of 2.6% failure rate in passing OPC/LPC).
- Three years after EBT implementation, the operators' flight crew attain 40% less failures in OPC/LPC (e.g. 1.56% of pilots fail in comparison to the level before EBT implementation of 2.6% failure rate in passing OPC/LPC)
- Four years after EBT implementation, the operators' flight crew attain 50% less failures in OPC/LPC (e.g. 1.3% of pilots fail in comparison to the level before EBT implementation of 2.6% failure rate in passing OPC/LPC). That level is kept until the end of the analysed 10 years' period.

<sup>18</sup> The return of investment depends on complexity of operations, type of aircraft, approval process, etc.

- All general assumptions, regarding the operator are kept in the model.

Regarding the case study, the economic benefits are quantified as follows:

- Saving due to decrease in % of pilots failed in OPC/LPC: The benefit is calculated based on the difference between the costs, spent by the operator on the remedial training (EUR 275,160.89) minus the costs that the operator are actually paying for the decreased % of the pilots who fail in OPC/LPC (the operator pays remedial training only for 2.08% of pilots, e.g. (EUR 220,128.71). The difference of the two amounts is generated as saving for the operator.
- Line check: the costs for the line check are divided by two ( $\text{EUR } 666,666.67 / 2 = 333,333.33$ )
- Ground training: the costs for the ground training for all pilots (alternative occupancy for 1 day training per pilot) are reduced by half ( $\text{EUR } 1,111,111.11 / 2 = 555,555.56$ )
- Indirect saving (flexibility): the efficiency of 1% of the annual wage of a pilot saved, multiply by the number of the pilots who would be available to fly instead of going to simulator, e.g. ( $\text{EUR } 200,000 * 1\% * 100 = \text{EUR } 200,000$ )

Based on these assumptions and explanations, the economic benefits are monetarised in the table below.

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Table 12 Economic benefits in implementation of EBT in 10 years' period

years		1	2	3	4	5	6	7	8	9	10
short description	Base line: Legacy training	Preparatory year: running traditional training +EBT investment one-off costs	Preparatory year: running traditional training + EBT investment one-off costs	First year of EBT implementation discontinues legacy training. No economic benefits. Still high failure rate of pilots (2.6% as in legacy training)	Second year of EBT implementation, discontinues legacy training. No economic benefits. Still high failure rate of pilots (2.6% as in legacy training)	All EBT costs. Start of all benefits with less failures in OPC/LPC (2.08% of pilots fail)	All EBT costs. Continued benefits with less failures in OPC/LPC (1.56% of pilots fail)	All EBT costs. Continued benefits with less failures in OPC/LPC (1.3% of pilots fail)	All EBT costs and all benefits as in the previous year	All EBT costs and all benefits as in the previous year	All EBT costs and all benefits as in the previous year
<b>17</b>	<b>TOTAL benefits</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>1,143,921.07</b>	<b>1,198,953.24</b>	<b>1,226,469.33</b>	<b>1,226,469.33</b>	<b>1,226,469.33</b>	<b>1,226,469.33</b>
18	Saving due to decrease in % of pilots failed in OPC/LPC: Saving in daily wage of flight crew for the time that he/she does not fly.	0.00	0.00	0.00	0.00	55,032.18	110,064.36	137,580.44	137,580.44	137,580.44	137,580.44
19	Line check: pilot's line check requirement is reduced from 1 per year to 1 every two years	0.00	0.00	0.00	0.00	333,333.33	333,333.33	333,333.33	333,333.33	333,333.33	333,333.33
20	Ground training: Safety equipment procedure (SEP) training: A pilot's SEP training requirement is reduced from 1 per year to 1 every two years.	0.00	0.00	0.00	0.00	555,555.56	555,555.56	555,555.56	555,555.56	555,555.56	555,555.56
21	Indirect saving (flexibility): A reduction in pilot workload due to flexibility to run SIM away from the peak flying months.	0.00	0.00	0.00	0.00	200,000.00	200,000.00	200,000.00	200,000.00	200,000.00	200,000.00

**STEP 6 – Comparison of the economic benefits and costs for EBT. Calculation of cost-benefit ratio and year of return of investments in EBT.****Table 13 Cost- benefit analysis in implementation of EBT in 10 years' period <sup>19</sup>**

years		1	2	3	4	5	6	7	8	9	10
<b>No</b>	<b>short description</b>	Preparatory year: running traditional training +EBT investment one-off costs	Preparatory year: running traditional training + EBT investment one-off costs	First year of EBT implementation discontinue legacy training. No economic benefits. Still high failure rate of pilots (2.6% as in legacy training)	Second year of EBT implementation, discontinue legacy training. No economic benefits. Still high failure rate of pilots (2.6% as in legacy training)	All EBT costs. Start of all benefits with less failures in OPC/LPC (2.08% of pilots fail)	All EBT costs. Continued benefits with less failures in OPC/LPC (1.56% of pilots fail)	All EBT costs. Continued benefits with less failures in OPC/LPC (1.3% of pilots fail)	All EBT costs and all benefits as in the previous year	All EBT costs and all benefits as in the previous year	All EBT costs and all benefits as in the previous year
16	<b>EBT costs</b>	122,222.22	1,045,555.56	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
17	<b>EBT benefits</b>	0.00	0.00	0.00	0.00	1,143,921.07	1,198,953.24	1,226,469.33	1,226,469.33	1,226,469.33	1,226,469.33
	<b>NPV delta EBT costs</b>	122,222.22	966,674.88	8,889.96	8,548.04	8,219.27	7,903.15	7,599.18	7,306.90	7,025.87	6,755.64
	<b>NPV EBT benefits</b>	0.00	0.00	0.00	0.00	940,219.73	947,550.16	932,015.89	896,169.13	861,701.09	828,558.74
	<b>Cumulative NPV EBT costs</b>	122,222.22	1,088,897.11	1,097,787.07	1,106,335.11	1,114,554.38	1,122,457.53	1,130,056.71	1,137,363.61	1,144,389.48	1,151,145.12
	<b>Cumulative NPV EBT benefits</b>	0.00	0.00	0.00	0.00	940,219.73	1,887,769.90	2,819,785.79	3,715,954.92	4,577,656.00	5,406,214.74
<b>Profitability indicators</b>											
	NPV EBT benefits - NPV EBT costs	-122,222.22	-966,674.88	-8,889.96	-8,548.04	932,000.46	939,647.02	924,416.72	888,862.23	854,675.22	821,803.09
	Saving per pilot per year	0.00	0.00	0.00	0.00	932.00	939.65	924.42	888.86	854.68	821.80
	Portion of the net benefits as % of the annual turnover					0.02%	0.02%	0.02%	0.02%	0.02%	0.02%
	Benefit/Cost ratio (cumulative NPV EBT benefits/cumulative NPV EBT costs)	0.00	0.00	0.00	0.00	0.84	1.68	2.50	3.27	4.00	4.70

<sup>19</sup> The costs and benefits are discounted with 4% discount rate ([http://ec.europa.eu/regional\\_policy/sources/docgener/studies/pdf/cba\\_guide.pdf](http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf))

years	1	2	3	4	5	6	7	8	9	10
Years for return of investment (break-even point, year when cumulative costs = cumulative benefits)				Between 3-4 years return of investment after the implementation of EBT						

The CBA analysis for a medium/large operator concludes that the implementation of EBT in recurrent training and checking of flight crew is a cost-effective solution. It is expected to cost 0.32% of a medium/large operator's turnover which is 0.03% more than the expenditure that same operator makes for running traditional recurrent training and checking for its pilots. In addition, it has the potential to generate significant economic benefits and to introduce an estimated saving of EUR 900 per pilot which represent around EUR 900,000 saving per year for the operator. The profitability indicators show that the return of investment is generated 3 years after EBT implementation, considering that competent authorities grant full economic alleviations to the operator. The net benefit represents around 0.02% of the annual turnover of a medium/large operator.

### Case study 2: Economic impacts for a small operator

That case study is prepared for an operator with the following assumptions:

General assumptions, regarding the baseline scenario (legacy training operator):

- Volume of fleet 10 aircrafts
- Number of pilots (captains and FO): 100
- Number of instructor/examiners: 10; indicatively 10% of pilot population.
- Number of line checks per year for all pilot: 60 which are performed in 60 working days
- Number of simulator sessions: 280 session OPC/LPC per year for all pilots (50 crews 4 session per crew in total 200 sessions per crew with a coefficient of 1.4 due to the inefficiency.
- Development and update of the training programme under the legacy training is 10 working days.
- For 3 years, it is considered that the baseline operator is doing 48 hours simulator per crew.
- All other assumptions, made under the case study 1 are valid and applied in that case.

Assumptions, regarding EBT implementation:

- Operator is using an external consultant to develop the EBT competency framework, training programme and to train EBT manager and instructors for EBT
- Training manager pass EBT training of 5 days (one-off cost)
- The development of an EBT training programme by the training manager is 10 days (one-off cost).
- Operator is using an external consultant to train instructors/examiners to deliver EBT training: each trainee/instructor is trained for 3 working days. 1 day training is 500 EUR instructor/day (one-off cost).
- The operator engages the Instructor/examiners for 4 days in EBT training: 3 working days for training and 1 working day for competency assessment (one-off cost).
- Recurrent costs are the same as in the legacy training.
- Operator needs 1 year time to prepare for EBT implementation.

- EBT benefits are granted 2 years after the EBT implementation, but progressively: 30% the third year, 60% the fourth year, 100% fifth year and every consecutive all benefits are granted within 10 years' period of analysis.
- Failure rate in OPC/LPC is decreased progressively, but the first 2 years in the EBT implementation they remain the same as in the legacy training (2.6%). In the following years, year 3 after EBT implementation, the failure rate is reduced to 2.08%; year 4 after EBT implementation, the failure rate is 1.56% of the pilot population year 5 and after it reaches its maximum decrease of 1.3% of pilots.

All assumptions, regarding case study 2 are presented in Annex 3.

The CBA for the small operator is performed, following the same methodology as in case study 1. All calculations are presented in Annex 3. For the sake of efficiency and better presentation of the results, the current section contains only the conclusions from the analysis. Full details are given in Annex 3.

The CBA analysis for a small operator concludes that there are benefits for the small operators in implementing EBT in recurrent training and checking of flight crew. Despite that, a small operator may encounter difficulties to implement EBT as follows:

- EBT requires collecting and analysing the operator's own and/or the general fleet data, as well as operations-specific data. The existence of high quality robust operational data is a powerful tool with which to adjust priorities in training, in particular to provide justification for reductions in frequency of certain topics, in order to provide capacity in the training program to address operator identified issues and risks. The purpose of data collection and analysis is to provide the source from which adjustments to the training program can be made with confidence that the result is indeed an improvement. Data collection should provide for a detailed analysis of existing threats and identify potential weaknesses in the level of the operator's operational safety. This may also be indicated by flight crew performance. The costs for such data collection and assessment might be an impediment for a small operator to implement EBT. Although, these costs are not quantified in the CBA model (due to lack of reliable data), their impact is analysed in the chapter "Sensitivity analysis".
- A small operator needs to make initial costs (one-off) to deploy EBT (indicative amount EUR 80 000) which represent 0.11% more than the expenditure that same operator makes for running traditional recurrent training and checking for its pilots. These costs mainly refer to the necessary external expertise to train the operator's staff in EBT, to train instructors, to deploy an IT tool that will support EBT, etc.

Nevertheless, Option 1 would not have a negative impact, because this option will be implemented on voluntary basis. Furthermore, similarly to a medium operator, EBT has the potential to generate significant economic benefits and to introduce an estimated saving of EUR 1000 per pilot which represent around EUR 100,000 saving per year for the operator. The profitability indicators show that the return of investment is generated 4 years after EBT implementation, considering that competent authorities grant economic alleviations to the operator. The net benefit represents around 0.1% of the annual turnover of a small operator.



### 1.5.3.2 Economic impact for the competent authorities

The requirement for inspectors to be competent in the approval of and oversight over EBT programmes would result in increased competent authorities (CA) costs for staff training in the short term. According to the estimations of the competent authorities, the impact of EBT deployment in an operator would cost them:

- The first 2 years after the EBT implementation, there would be certain workload for the CA: additional 150-160 hours for initial training of the flight inspectors on EBT; approval on the development of the competency framework and approval of the training programme, evaluate safety cases; additional 40 hours for oversight of the training of the TRI/TRE when an operator trains them.
- Afterwards, the workload is expected to decrease to a level of 50-70 hours per operator for approval of the training programmes and regular oversight, because the scope of the work would reduce to regular approval of the training programmes and regular oversight. In addition, the workload and the relative costs for the CA is expected to decrease with the time, as there might be a greater take-up of the EBT programmes by AOC holders.

As regards the oversight, the workload of the CA is not expected to increase, because EBT implementation supports performance- and risk based oversight. Therefore, the overall impact on the CA is considered very low negatively affected in the first years and neutral in the consecutive years.

Overall, the economic impact for Option 1 is assessed with low positive impact and is scored with +2.

#### Option 2 - Mandating EBT recurrent training and checking

The assessment of the economic impacts for the stakeholders for this option is based on the analysis, performed in Option 1. In fact, all costs and benefits are relevant for medium/large operators and competent authorities. Option 2, however, has some drawbacks in terms of proportionality issues and most predominantly on small operators.

In this option all airlines would need to invest in the development of EBT programmes. Despite the potential benefits identified in terms of safety and economy, there would be a negative impact on airlines that did not have the resources (in short-term plan) or expertise to develop EBT after the adoption of the rules. This impact would be most significant on smaller operators. It is expected that this Option could undermine the commercial viability of many small airlines and air taxi operators. Overall, this option may potentially limit the accessibility to the market to some AOCs and as a result, it is considered that it may generate a low negative impact.

Therefore, Option 2 is considered to have a low negative economic impact (score -2).

For Option 1 and 2: Impacts that are not quantified:

The implementation of EBT requires that the operator has a robust system for collection and analysis of operator's own data, as well operations- specific data. This should comprise flight data, training data, operator's safety reports, fleet data, etc. The existence of high quality robust operational data is a powerful tool with which to adjust priorities in training, in particular to provide justification for reductions in frequency of certain topics, in order to provide capacity in the training program to address operator identified issues and risks<sup>20</sup>. The costs, related to this process and not quantified in the analysis.

<sup>20</sup> IATA, Data Report for Evidence-based Training, 2013

However, they need to be considered as integral part of the EBT compliance costs. Their impact is analysed in the chapter “Sensitivity analysis”.

**Table 14 – Economic impacts per option**

<i>Criteria</i>	<i>Option 0 No policy change</i>	<i>Option 1 Voluntary EBT training</i>	<i>Option 2 Mandating EBT recurrent training and checking</i>
Economic impacts	No impact	Low positive impact: total net benefit in the range of 0.02-0.1% of an operator’s turnover, depending on the type of the operator. Very low negative impact on CA on the first years of EBT implementation and neutral in the consecutive years. Positive impact for small operators who may decide to implement or not EBT.	Low negative impact on airlines that did not have the resources or expertise to develop EBT after the adoption of the rules, especially on small operators. Although the CBA shows that the EBT is beneficial for small operators, it is expected that they may not be ready to implement immediately after rules are adopted. In short term the proposal may affect negatively their business and to undermine their commercial viability. This is considered crucial for their existence and may limit their accessibility to the market.
	0	+2	-2

## 1.6. Conclusion

### 1.6.1. Comparison of options

The table below summarises the impacts of all options.

**Table 15 –Assessment of all options**

<i>Criteria</i>	<i>Option 0 No policy change</i>	<i>Option 1 Voluntary EBT training</i>	<i>Option 2 Mandating EBT recurrent training and checking</i>
Safety	0	+1	+2
Social	0	+2	+3
Economic	0	+2	-2
<b>TOTAL</b>	<b>0</b>	<b>+5</b>	<b>+3</b>

The final results of RIA demonstrates that Option 1 Voluntary EBT training is the preferred option for regulating EBT in recurrent training and checking of flight crew. It contributes to maintaining a high level of aviation safety while providing a cost-efficient and socially acceptable framework.

#### *Question to stakeholders*

*Stakeholders are also invited to comment on the RIA and to provide any other quantitative information they may find necessary to bring to the attention of EASA. As a result, the relevant parts of the RIA might be adjusted on a case-by-case basis.*

### 1.6.2. Sensitivity analysis

The current chapter analyse the effect of the non-quantifiable costs (presented in the economic impacts) on the results from the Cost-benefit analysis. Different simulations are performed to integrate possible costs for data analysis of operator's own data and operations-specific data (costs that were not quantified in the Cost-benefit analysis). These costs resulted in increasing the total costs that the small operators which affects the period for return of investment. Instead of achieving a return of investment 4 years after EBT is implement, the return is prolonged in the following years. The higher these costs would be, the longer would be the period for return of investment. Thought that the final outcome of the CBA, e.g. EBT implementation for a small operator is beneficial, is still valid and is not negatively impacted by the non-quantifiable costs.

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## 1.7. Annexes

Annex 1 List of safety recommendations, linked to RMT.0599



Anex 1 Safety  
recommendations.xl

Annex 2 Cost-benefit analysis for medium/large operator, including assumptions

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	2017	2018	2019	2020	2021
short description	Baseline: Legacy training	Preparatory year: running traditional training +EBT investment one-off costs (training of a manager to be EBT manager and consultancy to develop EBT framework and training programme)	Preparatory year: running traditional training + EBT investment one-off costs (development of EBT training programme, purchase of assessment IT tool, training of instructors for initial course of EBT)	First year of EBT implementation, discontinue legacy training, no EBT benefits, still high failure rate of pilots (2.6% as in legacy training)	Second year of EBT implementation, discontinue legacy training, no EBT benefits, still high failure rate of pilots (2.6% as in the legacy training)
years		1	2	3	4
<b>1 Total costs</b>	<b>13,403,338.67</b>	<b>13,525,560.89</b>	<b>14,448,894.22</b>	<b>13,413,338.67</b>	<b>13,413,338.67</b>
<b>One-off investment costs for EBT</b>					
<b>2</b> Training of a EBT training manager (20 days to develop competency framework) (one-off)		22,222.22	0.00	0.00	0.00
<b>3</b> Consultancy to train EBT manager and develop EBT framework and training programme (one-off)		100,000.00	0.00	0.00	0.00
<b>4</b> Training of instructors to deliver EBT training (costs for consultants and daily wages of the instructors) (one-off)			834,444.44	0.00	0.00
<b>5</b> Purchase of IT tool (one-off)			100,000.00	0.00	0.00
<b>6</b> Develop EBT recurrent training programme by the training manager (one-off)			111,111.11		
<b>Recurrent costs for legacy/EBT training</b>					
<b>7</b> Legacy training (recurrent costs)		13,403,338.67	13,403,338.67	0.00	0.00
<b>8</b> Update of EBT recurrent training programme by the training manager (recurrent, same cost as for the legacy training)		0.00	0.00	88,888.89	88,888.89
<b>9</b> Costs for instructors/examiners for refresher training for EBT (1 day per instructor/examiner) (recurrent, same cost as for the legacy training)				111,111.11	111,111.11
<b>10</b> Approval of the changes in the recurrent training programme by the CA (recurrent, same cost as for the legacy training)				8,400.00	8,400.00
<b>11</b> EBT modules (former OPC and LPC) (recurrent, same cost as for the legacy training)		0.00	0.00	10,583,111.11	10,583,111.11
<b>12</b> EBT Line check (recurrent, same cost as for the legacy training)		0.00	0.00	666,666.67	666,666.67
<b>13</b> EBT Ground training (recurrent, same cost as for the legacy training)		0.00	0.00	1,670,000.00	1,670,000.00
<b>14</b> EBT Remedial training (recurrent, same cost as for the legacy training)		0.00	0.00	275,160.89	275,160.89
<b>15</b> Costs for maintaining licences for IT tool (recurrent, new cost for EBT)		0.00	0.00	10,000.00	10,000.00
<b>16 delta EBT costs in comparison to legacy training costs: For years 2017 and 2018 (line 1 - line 5) and for all other years (line 15)</b>		<b>122,222.22</b>	<b>1,045,555.56</b>	<b>10,000.00</b>	<b>10,000.00</b>
<b>17 TOTAL benefits</b>		<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>18</b> Saving due to decrease in % of pilots failed in OPC/LPC: Saving in daily wage of flight crew for the time that he/she does not fly.		0.00	0.00	0.00	0.00
<b>19</b> Line check (after 2 years of EBT implementation an operator should be allowed to extend the line check): a pilot's line check requirement is reduced from 1 per year to 1 every two years		0.00	0.00	0.00	0.00
<b>20</b> Ground training: Safety equipment procedure (SEP) training: A pilot's SEP training requirement is reduced from 1 per year to 1 every two years. The benefit is saving a daily wage of the flight crew. Less CRM training is expected due to the integration of non-technical competencies in the EBT programme (1 day per pilot/year to 1 day pilot/3 years).		0.00	0.00	0.00	0.00
<b>21</b> Indirect saving (flexibility): A reduction in pilot workload due to flexibility to run SIM away from the peak flying months. The benefit is the 1% of the annual wage of a pilot saved, multiply by the number of the pilots who would be available to fly instead of going to simulator.		0.00	0.00	0.00	0.00

Annex 3 Cost-benefit analysis for small operator, including assumptions

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<b>Main assumptions in developing the baseline recurrent training</b>		
The baseline is developed for a small operator, according to the assumption below.		
fleet 10 aircrafts		
pilots (captains and FO): 100		
instructors: 10		
60 line checks per year for all 100 pilots which are performed in 60 working days		
400 sim session OPC/LPC per year for all pilots (50 crews 4 session per crew); 200 sessions per crew; coefficient of 1.4 due to the inefficiency; 280 sim session OPC/LPC per year for the company		
1 FTE = 180 working days (flying, training)		
The crew need to travel to the main basis, where the training is carried out. It is assumed that the main basis is in UK.		
Development and update of the training programme is 10 working days.		
Fees and charges for approval of the recurrent training programme (included in the development of training programme) 8400 EUR		
Costs for 1 FTE training manager 200,000 EUR per year		
There are 1 LPC and 2 OPC per year per crew and 1 training session per year per crew. Every 6 months 2 days training and checking: 1 session (1 day) LPC and OPC combined and 1 session of training (1 day); Once per year: 2 session (2 days): 1 session in OPC and 1 session of training. <b>In total, there are 4 sessions per year and each session is 3-4 hours in 2 consecutive days which is equivalent to 8 working days.</b> For 3 years, it is considered that the baseline operator is doing 48 hours simulator per crew.		
Annual remuneration per pilot is estimated at around 200,000 EUR (full cost for the operator, including gross salary plus the social securities for the operator). It is calculated on the basis of the average remuneration of captain and first officer per year.		
The baseline operator is considered that has not a main basis/HQ in the place, where the simulators are. Therefore, he needs to pay the travel of the pilots to the main crew base/HQ. 80% of pilots are travelling to the main basis/HQ for simulator exercise. 20% are not travelling. A coefficient of 0.8 is considered to capture this assumption. For the sake of the exercise, it is assumed that the HQ is in UK. The per diem rate is taken for UK which is currently 280 EUR per day.		
The trip for OPC and LPC is for 2 days every 6 months which equals to 4 days per year per pilot/FO.		
In legacy training: TRI/TRE do OPC/LPC every 6 months 2.5 days. In total, they are engaged for 5 days per year per pilot.		
Ideally when OPC and LPC are rostered, 1 TRI/TRE does OPC and LPC in 2 .5 days every 6 months 5 days in total per pilot. In reality the FC are coupled for the OPC and LPC. If the people are coupled within the same day 2 pilots do the OPC and LPC. Therefore a coefficient of 0.6 is considered.		
Annual remuneration of instructor/examiner is estimated at 200,000 EUR.		
The cost for simulator per session is 1200 EUR per crew.		
Annual remuneration of captain, performing the line check is estimated at 200,000 EUR.		
Ground training is 1 day per year per pilot.		
A trainer, conducting ground training is involved 1 day for 4 Pilots. For 100 pilots a trainer is engaged for 25 working days.		
Annual remuneration of a trainer performing the ground training is estimated at 100,000 EUR.		
The trip for ground training is for 2 days per year per pilot/FO. 80% of all 100 pilots are travelling to the main basis.		
Remedial training for OPC/LPC is provided to 2.6% of the pilots/FO who failed in OPC and LPC checks, e.g. 2.6 pilots.		
Remedial training for line check is provided to 0.25% of the pilots/FO who failed in line checks, e.g. 0.25 pilots of all 100 pilots. Since it is negligible, it is not considered in the analysis.		
After the remedial training, pilots pass OPC, LPC.		
It is assumed that the pilots in remedial training need to fly to the main basis to do the OPC/LPC.		
<b>Main assumptions in EBT</b>		
<b>Preparatory costs</b>		
Operator is using an external consultant to help develop the EBT competency framework, to develop the training programme and to train EBT manager and instructors for EBT		
EBT training of a training manager is 5 days (one-off).		
Development of the training programme by the manager is 10 days (one-off).		
Update of EBT training programme per year 10 days and is done by the EBT training manager (recurrent)		
CA fees for approval of EBT programme is the same as in the legacy training (no change). TE.RPRO.00034-006 © European Aviation Safety Agency. All rights reserved. ISO 9001 certified.		
Costs for 1 FTE EBT training manager 200,000 EUR per year		
Training of instructors to deliver EBT training: each trainee/instructor is trained for 3 working days. 1 day training is 500 EUR instructor/day.		
Instructor wage is 200 000 EUR (including gross salary and social securities)		
Instructor/TRE competency assessment is 1 working day. (one-off)		