

HUMAN FACTORS



**Guidelines on the use of
e-learning in ATM Part 2**

Pedagogical Aspects

EUROCONTROL

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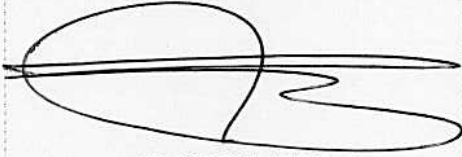
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Abstract			
<p>This is part two of a three-part document on deploying e-learning in an ATM environment. Part 2 considers the pedagogical or training questions which trainers and training developers need to consider when designing and delivering training programmes which include e-learning components.</p> <p>The guidelines focus on integrating e-learning or technology-facilitated learning into ATM-related training programmes by integrating the decision to use e-learning into the overall training analysis, design and development process and by considering a blended approach to training.</p> <p>They provide examples of good practice in the area, suggests a training programme for trainers who want to use technology-facilitated learning and introduces the reader to a number of e-learning ((technology-facilitated learning) tools.</p>			
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1 – INTRODUCTION

E-learning, in broad terms, can be defined as the delivery of training over an electronic network. The meaning behind the word varies in different environments and with different people.

In some environments, for example at a number of universities, e-learning means providing their training material in the form of PowerPoint slides, Word or pdf documents, or through other well-known electronic formats available widely over the Internet or even locally over the network concerned. In other environments, e-learning means using a blend of tools such as wikis, blogs, online chatlines, forums, emails, virtual classrooms, asynchronous computer-based training (CBT) and any other tools which could be used to create a learning experience, electronically and over a network.

In European ATM, the term e-learning is generally used when talking about asynchronous CBT, even though in certain areas other tools are already being used.

This document will cover e-learning using the definition in the first paragraph above.

1.1 *Why is technology in learning so important?*

Before continuing, take a moment to reflect on how many of the things you did in the last 24 hours were facilitated through some sort of connected technology, such as the Internet, mobile phones or a portable mp3/video player?

Connected technology can be said to be an integral part of our daily lives. A lot of things are available by means of technology, ranging from documentation to databases, to news and entertainment. The challenge we face is to learn how to make this technology an integral part of our training delivery. One of the main enablers for using connected technology in ATM training is for instructors to become more comfortable using these technologies.

If we consider that the mission of trainers is to provide effective and efficient training which meets

- training needs,
- the organisation's needs and expectations, and
- our learners' needs and expectations,

one needs to bear in mind that if we are using connected technologies in our daily lives, so are the learners. Up to now, on most occasions where the reasons for using e-learning were explained, the following arguments were given amongst others:

- it is a flexible way of delivering;
- it saves money if delivered to a large number of students at the same time;
- the content source can be better controlled.

However, the time is ripe to also start considering that, since connected technologies are an integral part of our lives, and this is probably truer for the younger generation, a lot of whom have their lives organised around the Internet, mobile phones and all the social and information networking which these bring, technology-facilitated and networked learning is what the learner is starting to expect.

There is a need to better integrate everyday technology into our everyday training.

1.2 What is the aim of these guidelines?

This document aims to provide guidelines and ideas for good practice to those who would like to deploy e-learning in their organisations or to those who are already using e-learning and would simply like to know more.

It is divided into three parts: *the first* relates to organisational issues surrounding e-learning, *the second* to pedagogical aspects, and *the third* to technical aspects.

Specifically Part 2, pedagogical aspects, aims to:

- introduce a number of tools with the aim of showing that e-learning, or technology-facilitated learning, is not solely the subject of a few computer programmers but that it is in the realm of all of those in ATM training. This document demonstrates that whereas there are items for which expert help is necessary, and this is by the way the same for many other things in life, there are many more which could be easily created and managed by trainers as “technology users”, not much differently than in the way one uses word processors or presentation software suites.
- provide a number of tips on good practice when designing and developing training programmes in which e-learning is a component.
- make a case for blended learning where the training design acts on the strengths of each training event to create effective and efficient training.
- make a further step towards integrating e-learning into mainstream ATM training, and not seeing it as a special activity apart from the rest.

This document should not be perceived as training-the-trainer material. In fact, in this document it is suggested that trainers should follow dedicated training course to learn how to use e-learning tools, and on how to integrate them into training delivery. On the other hand, this document does provide guidance material which will lead towards the integration of e-learning into mainstream ATM training.

1.3 Why pedagogical aspects?

Pedagogical aspects can be defined as those actions related to the act, process, or art of imparting knowledge and skill.

In the framework of e-learning in ATM, the aspects which will be explored in this document will relate to how instructors¹ could use e-learning effectively and efficiently to achieve the goal of transferring knowledge and skill to students.

¹ In this document, the terms “instructor” and “trainer” mean the same thing.

The manner in which things are taught is at least as important as the knowledge which the instructors have of the subject-matter which they are teaching.

Quite a number of resources exist in the ATM training environment which guide and teach instructors how to impart knowledge and skills using more classical means of teaching, such as face-to-face classroom teaching or use of ATC simulators. However, in the recent past, a number of other tools (which we could call media) and methods have been added with the advent of accessible technology, both on line (i.e., over the Internet) and off line.

Trainers in ATM need to understand the advantages and possibilities which the use of these new media and methods create. Equally, they need to understand the disadvantages and risks which the inappropriate use of these tools might entail. However, in order to understand how and when to use these methods and tools, trainers need first to learn how to use them themselves and become comfortable with them.

The technological component of certain tools has in some cases slowed down the uptake of the use of these tools by the trainer population. This in turn has created a gap between the learners' expectations of the media and methods used (the younger generation in particular being very comfortable with technology) and their teachers.

This document does not seek to teach trainers all about the effective and efficient use of various e-learning media and methods. It is felt that this should be the scope of a comprehensive training course. However, the document aims to introduce the subject and to help trainers and their managers demystify the use of e-learning in ATM training and encourage them to explore the technology available around them which will in turn help them provide more effective and efficient training.

1.4 Content

The pedagogical aspects part of the document is divided into seven main sections. Each section considers different aspects of how and why to use various e-learning media and methods within ATM training programmes.

The suggestions contained in this document should be seen as guideline material which should be adapted to the local context in which it is to be applied.

1.5 Who is it aimed at?

The pedagogical aspects part of the document is primarily aimed at instructors who have the task of developing and delivering training related to ATM including ATC. Training managers and others who are already or who in future become involved in ATM training will also find useful material in this document.

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2 – BENEFITS FOR THE CLASSROOM TRAINER OF USING E-LEARNING

Technology-facilitated learning, when well integrated into a training course, will be of benefit to the classroom trainer. The trick is to find the right balance, or blend which will enable the strengths of each mode and medium to be used to the full.

As was demonstrated at the EUROCONTROL workshop on using e-learning which focused on pedagogical aspects, classroom trainers can use e-learning and other rich media to complement their classroom training.

The following benefits can be noted:

➔ Use of CBT

- CBT does not automatically mean distance-learning, and a trainer can opt to let the students do computer-based training during classroom sessions.
- If the CBT includes material which allows hands-on interactivity, for example by allowing the students to manipulate certain animations which make a link between cause and effect (examples in ATC are altimetry, theory of flight, meteorology, traffic labels, etc.), the students not only receive the theory but also have a chance to understand how things work through the interactions.
- Also, rich media can be used when showing videos integrated into the CBT.
- Having interactive computer-based training delivered as part of the training course allows the trainer to provide explanations on concepts which are harder for the students to grasp.
- The use of CBT also gives students the chance to manipulate the interactions outside course time.

➔ Use of integrated interactions during presentations

- Trainers can use the same or similar interactions to those delivered by the CBT in their presentations. This has the benefit of providing continuity between the presentations and the CBTs. Also, similarity between the interactions will help retention.

➔ Use of formative questions and computer-based assessments

- Another benefit of integrating e-learning into classroom courses is the possibility of tightly integrating end-of-topic reviews in CBT format into the training plan. These end-of-topic reviews summarise the topics discussed and are available outside course time.
- If these reviews were then complemented by a set of formative questions which help the students to assess the level of understanding, the pack would allow the learning to continue outside course time.

- Examples of good practice showed that students very often found these short after-course sessions beneficial. Very often they would then ask the trainer questions at subsequent sessions on topics which they had not understood well.

➔ Evolution of the trainer's role

- By providing more training resources which are easily accessible by the students, the trainer's role in the training programme evolves from that of a person who needs to know and explain the subject from A to Z to a person who facilitates the learning process, and can concentrate on the areas in which the students are having difficulties.

➔ Meeting students' expectations

- As will be discussed in the next section on “*CONSIDERING THE LEARNER'S EXPECTATIONS*”, the younger generation, who use a lot of technology in everyday life, will find the availability of digital learning resources and computer-based training material motivating because it fits their lifestyle. As a result, they might tend to be more motivated.

Conclusion

Experience at EUROCONTROL's IANS² indicates that a blend of technology-facilitated delivery methods increases the interest and motivation of the students and the quality of training.

² IANS has been delivering ATCO Basic CCC Training on the subject of aircraft using a multimedia package consisting of interactive presentations, CBT, on-line lesson reviews and formative assessments and training notes in digital format. Training results and student and trainer feedback indicate that the quality of training and students' interest in the subject are on the increase.

3 – CONSIDERING THE LEARNER’S EXPECTATIONS

As already mentioned in the introduction, a correct training design and development process also considers the learners’ needs and expectations. It was also argued that technology is part and parcel of everyone’s live, including those of the learners.

In Part 1 of the guidelines on the use of e-learning in ATM, motivation to do the training and to learn was mentioned as being one of the key factors to successful training. Motivation needs to be achieved by combining a number of elements such as:

- the relevance of the training to the learner,
- the pitch at which the training is presented, and
- the experience which surrounds the training programme.

The 3rd bullet point refers to the way in which the learner experiences the training, which influences their motivation and thus the knowledge transfer. The question is how a trainer can influence that experience.

There are many ways in which a good training experience can be created. A process of training analysis, design and development is described in section 4 – on “*PRODUCING EFFECTIVE AND EFFICIENT TRAINING*”. In this process, one needs to consider the methods which fit the learner and the media with which the learner is comfortable.

3.1 *Considering the younger generation*

At the time of writing this document, it could easily be argued that the younger generation are the ones who are the keenest users of networked technology³. This generation, and others who will follow, do not necessarily see networked-technology-facilitated training as a commodity⁴, i.e., something which they expect from training, rather than an add-on to it.

The relevance of this topic in ATM training is confirmed by the fact that the younger generation is one of the main audiences for ATM training. For example, ATCO students are typically recruited at school-leaving age.

This section aims first to provide a brief overview of how the younger generation are using networked technology, and later to explore how the use of this technology could be exploited to create suitable training experience which will implicitly motivate the young learner.

Why is networked technology used?

In this overview of why we, and especially the younger generation, use networked technology, three main areas will be dealt with. These are:

- Accessibility
- Social networking
- Sharing and communicating

³ This term is defined in *Appendix 1 “Definitions”*.

⁴ At the time of writing, a large number of those recruited to become ATCOs were born at approximately the same time as when networked technologies were commercialised.

1. Accessibility

Networked technology is used to access:

- information, for example news, data, documentation, wikis, blogs, etc.;
- entertainment, for example music, films, games, etc.;
- learning, both in an informal way, for example through an internet search, and also in a formal one, for example by accessing a Web-based training package.

2. Social networking

Network technology is used more and more often to enable the individual to feel part of something bigger, for example to keep contact with friends or make new ones.

Examples of tools used for social networking are:

- social platforms such as Facebook and hi;
- instant messaging;
- chatting;
- texting⁵;
- community games, where the objectives of the game cannot be achieved by a single person – e.g., RuneScape;
- virtual reality – e.g., Second Life.

3. Sharing and communicating

Whereas the paradigm regarding knowledge so far has been “knowledge is power”, the younger generation, because they are flooded with information, do not believe that it is worth keeping it to themselves. On the contrary, they believe that they score points if they are the first to “share” the information⁶. Sharing is one of the centre-pieces of the use of networked technology. Sharing and communicating take place through a number of tools such as:

- Blogs, which in many cases, especially with the younger generation, are used as diaries which collect personal experiences but which are shared with everyone on the Web.
- Music and videos, which are shared either through embedded technology such as YouTube, or via peer-to-peer networks where users give each other access to their local hard disks.
- Information and other assets such as images are shared via tools such as emails, instant messaging, etc.

⁵ “Texting” is the term used to cover the actions of sending and receiving short messages by mobile phone.

⁶ Prensky, M. (2006), “Don’t Bother Me Mom – I’m Learning”, p. 43, Paragon House, U.S.A.

How can trainers leverage the use of networked technology for more effective and efficient training in an ATM environment?

All the above could be used during the training design phase (see section “4 –”) to produce blends of training events which respond to the learners’ expectations.

The use of technology in training does not automatically imply distance-learning. As will be seen later in this document, technology has been used to create a good learning experience in a classroom environment. What is important to keep in mind while designing training is to match the training needs with the learners’ characteristics and expectations whilst still meeting the organisational requirements and constraints.

In terms of networked technology in learning, given the use learners are making of this technology, the following guidelines could be applied:

- *Have substantial parts of the training available online and in an interactive way.*

By interactive, we mean that the material should not only be interactive between the computer and the learner but that it should also provide opportunities for interactivity between peer learners, and between learners and trainers. The training programme could be structured in such a way that the need for interacting with peers and trainers is embedded within it.

- *Make available more resources and documentation online, for example training notes or complementary information, either on the Internet or, if sensitive, on a local area network (Intranet).*

Learners are used to searching for anything and everything on the Web at any time. This could be frustrating when this expectation is extrapolated to learning an ATM-related subject and not finding adequate returns. On the other hand, the learning experience could be enhanced if an Internet or Intranet search were to provide satisfactory results. The trainers could take the role of facilitating the information-finding process rather than being the only source of information for the students.

One should also note that this item and the one before it are valid not only for new students but also for all categories of staff who work around the clock in shifts, such as ATCOs or ATSEPs. The idea of having access to knowledge any time anywhere could be very appealing to these categories of staff.

- *Reflect on the way communication between peer learners, and between learners and trainers takes place within training programmes.*

If learners are comfortable sharing information which they have learned, then frameworks which encourage them to share and learn should be established. One idea, for example, could be to build a knowledge base, such as a wiki which needs to be constructed by the learners. In this way, sharing of information and communication is encouraged.

- *Similarly, designing simple but effective community games which oblige the learners to endorse a role and to act the role through a guided situation could be a fun way of raising awareness of subjects such as human factors.*

Likewise in the case of ATC training, extracting certain functions of ATC tasks and presenting them in different contexts in a game environment could enhance the motivation of many to learn by playing with little apparent effort.

The idea is to get closer to the expectations of the learner by presenting them with the items they need to learn, using the methods and media to which they are more likely to be receptive. Since, in general, a large proportion of young learners' leisure time is spent consuming network technologies with no extra effort, the studied introduction of certain of these methods and media into their training would increase training effectiveness and efficiency.

3.2 Conclusion: considering the learner's expectations

One of the three main aspects of good practice in training design is to consider the learner who is to receive the training. If effective and efficient training course are to be designed, the learners' motivation, and therefore the experiences with which they are presented, are important elements to be considered.

Since a large number of people make daily use of networked technology in their lives for various reasons, and since this is especially true of the younger generation, training designers should examine first of all how networked technology is being used, and subsequently how they could use the strong features of this technology to enhance the training experience for the learner, and thus improve the effectiveness and efficiency of training.

4 – PRODUCING EFFECTIVE AND EFFICIENT TRAINING: INTEGRATING E-LEARNING INTO THE TRAINING DESIGN AND DEVELOPMENT PROCESS

It has already been mentioned in this document that the aim of any training programme is for it to be effective and efficient; effective in the sense that it fully achieves its goals and efficient because it needs to deal with time, budgetary and other resourcing constraints.

For a training programme to be both effective and efficient, it needs to be well thought-out, and well designed from the very beginning. Where technological facilitated-learning tools and methods are concerned, it is important for the training designer to consider the elements at the right time and to ask the right questions.

A step-by-step process will avoid taking decisions about the choice of media, too early or too late, for example choosing an asynchronous CBT over another medium before having analysed the nature of the training content.

A step-by-step process will allow effective and efficient training which takes into account:

1. the training requirement,
2. the target audience,
3. and the practical constraints;
4. then making an overall strategy,
5. and deciding on the methods,
6. and only then deciding on the media.

The good-practice process which is suggested in this document is divided into three main parts:

1. Analysis
2. Design and development
3. Implementation, evaluation and improvement

The following subsections will describe the process which should be used in any definition of training. The decision on which methods and media to use, be it e-learning or other (for example classroom face-to-face training) would be taken within this process.

4.1 Analysis

The analysis stage starts with a study of the learning requirement, the target audience and the practical constraints.

The learning requirement is dependent on the nature of the subject-matter and also that of the target audience. It is important to consider these two together because two different target audiences with different levels of initial skill, or knowledge of the subject-matter which needs to be taught, could possibly need a different training approach.

Examples of questions relating to the learning requirements include the following:

- What is the knowledge/skill/behavioural performance which needs to be achieved?
- Is it about knowledge, or skill, or behaviour, or a combination of these?
- What are the performance objectives⁷?
- What is the level of performance which needs to be attained⁸? For example, is it to master or to be able to explain or to use whilst following instructions, or is it to be aware that something new exists?
- What are the training objectives which are needed in order to bring the target audience to the required level of performance? (and here the target audience needs to be considered)

Examples of questions relating to the target audience include the following:

- What are the demographics?
- What is their previous experience with training in general, and with subjects related to the ones which need to be covered in particular in the present training?
- What is their attitude towards training in general?
- What is their present level of knowledge/skill/behaviour in the subject which needs to be covered (i.e., their entry level)?

Similarly, the training designer needs to analyse, at this stage, the constraints which exist in the context.

Questions the designer could ask might be:

- Is there any time pressure on the delivery of the training?
- Is the target audience in one physical place or is it spread over different locations?
- Are there any budgetary constraints?
- Should any activities be selected which include face-to-face meetings with the students, and are there any space constraints?
- Should we opt for any sort of technological tools to facilitate learning, and are there any technology constraints?
- What other systems relate to the training context?

At the end of the analysis stage, the designer should have a better understanding of the context and of all the elements which will enable him/her to first of all draw up a plan to meet the training objectives which will include the choice of training methods to be used.

It is important that the outcome of the training or the constraint is not yet determined at this stage.

⁷ For a definition of performance objectives, please refer to: *EATM 2004*, EATM training progression & concepts; EUROCONTROL.

⁸ See Section 4.3 "Implementation, evaluation and improvement" on taxonomy levels in *EATM 2004*, EATM training progression and concepts; EUROCONTROL.

4.2 Design and development

The input into the design and development phase constitutes the output from the analysis carried out in the previous phase.

This phase starts with the design of a training plan⁹ and the first element of the training plan is to decide which training method or blend of methods will be the most effective in order to achieve the training goal.

A number of methods and media which could be chosen from are listed in the box below:

Note on methods and media		
Although not seemingly obvious at first sight, the method and the media should be separated from one another, as one particular method could be delivered via two or more different media. For example, a method called group instruction could be covered via a medium called face-to-face classroom or via a virtual classroom		
The following is a non-exhaustive list of training methods and media. A number of these are defined in the document <i>EATM 2004: EATM training progression and concepts</i> ; EUROCONTROL.		
Methods		Media* note that many media can include more than one activity
Assignment	On-the-job training	Computer-based-training/Web-based training
Briefing	Part-task practice	Paper assessment
Case study	Reading	Internet
Debriefing	Research	wiki
Exercise	Role play	blog
Facilitated discussion	Simulation	online CBT
Formative assessment	Tutorial	online simulator
Group work	Viewing	virtual classroom
Hands-on	Visit	instant messaging
Helpdesk/support	Workshop	forum
Interactive training	etc.	etc.
Lecture		Computer game
Lesson		Sound
Listening		Book/notes
		Video
		Face-to-face
		Simulator
		Part-task trainer
		Email etc.

* Note that a more detailed description of a number of e-learning media is given later in this document in Chapter 6 – “EXAMPLES OF VARIOUS FORMS OF TECHNOLOGY-

⁹ A number of documents have been written by EUROCONTROL describing how training plans can be constructed. We would refer you to ATCO Basic Training – Training Plans.

FACILITATED-LEARNING TOOLS, AND HOW THEY COULD BE USED

In complex training programmes, applying an approach which takes into consideration a blend of methods is generally a more effective way of achieving the training objectives than using a single method.

When choosing the methods, the training designers should think in terms of the effect they want to create (i.e., the effect of creating effective training). Some of the questions which could be asked, are as follows:

- At what time do the students need to learn theory?
- How should this be done? Individually, or in a group? Should students be asked to do the research, or should the trainer provide the theory?
- What is the effect to be created?
- At what time do the students need to learn skills?
- How should this be done? On the job? Through simulation? Through a role play?
- Should it be done individually or in a group?

The remaining part of this subsection explores a number of points of good practice which should be taken into account during the design and development phase.

Consult guideline documents about training design and development in ATM

Over the past decade, a lot has been written on various aspects of training development and design in the ATM environment. Since the development of e-learning should be seen within the overall training design and development process, the bases for sound design and development are to be found in a number of documents.

These include:

- EATM 1998: Specification of Training Tools and Methods - Aeronautical Information Services
- EATM 2001: Area Control Surveillance Rating with Radar and Terminal Endorsements - Training Plans
- EATM 2001: Specifications on Training Methods and Tools
- EATM 2003: ATCO Basic Training - Training Plans
- EATM 2003: Approach Control Surveillance Rating with Radar and Terminal Endorsements - Training Plans
- EATM 2004: Guidelines for the Preparation and Provision of Written Examinations
- EATM 2004: ATCO Rating Training - Training Plans: Aerodrome Training
- EATM 2004: ATCO Rating Training - Training Plans: Aerodrome Training - Annex B: Detailed Training Plans
- EATM 2004: EATM Training Progression and Concepts
- EATM 2004: Guidelines for a Common Basic Level of Technical Training for Air Traffic Safety Electronics Personnel
- EATM 2005: Guidelines for the Development of Unit Training Plans
- EATM 2007: AIS Training Development Guidelines

These documents are available to download from the EUROCONTROL website:

http://www.eurocontrol.int/humanfactors/public/site_preferences/display_library_list_public.html#13.

It is good practice to consult these documents before starting the design and development exercise.

Considering the assessment during training design

Another item which should be considered during the design phase is how the training will be assessed. The methods of assessment, examples of which are on-the-job check-out, interview, exam or combinations of methods, should be decided during the design phase. As in the case of training provision, the choice of medium for the assessment (e.g., paper or online assessment, face-to-face or telephone interview, etc.) should come later.

Where and how will the training be deployed?

Once the methods are chosen, it is time to decide which parts will be carried out on site and which will be delivered via distance learning. This decision takes into account aspects already considered during the analysis stage.

When choosing the media, the training designer should think of those media the end users have at their disposal and those which they favour. Also, the items identified as constraints during the analysis stage should be taken into account. A medium or set of media should be chosen for each method.

For example, if it is decided that part of the training objectives are to be achieved through role-play, then the medium could be a game designed on a computer or alternatively a role-play exercise in a classroom.

It will be much easier to choose the media in this way, after carrying out the analysis and choosing the methods, rather than to start from the media in the first place. Each method–medium combination becomes a training event¹⁰.

Involving others in the design process and in the planning of resources

It is good practice to involve a number of people other than the training designer(s) at this stage:

- *Subject-matter experts* who will give advice during design and development, and their opinion on the fit of the methods and media to the subject.
- *Representatives of the end-users (students)*, whose advice and involvement should be sought. The involvement of this group will allow the designers to test the assumptions about the choice of methods and media, and the training plan in general. This is also helpful in that end-user involvement often also translates into end-user buy-in to the training programme.
- *Other stakeholders, depending on the context.* For example, the regulator should be at least informed at an early stage.

Towards the end of the design phase, it is important also to plan for the resources which will develop, deliver and review the training. Resource considerations should already have been taken into account during the analysis phase.

Once the design of the training programme is ready (even if it can be reviewed at a later stage), it is time to start with the development.

¹⁰ Reference to the term “training event” will be made again later in the document.

Each training event needs to be developed in such a way as to:

- complete the event;
- respect the sequence of events, i.e.,
 - it is presented in a manner consistent with other events in the programme;
 - it links to items which take place elsewhere in the training programme;
 - it takes into account events which precede it.

Look for similar events already in place

It is good practice to check whether similar events already exist elsewhere in other programmes, or whether there are similar events which would simply need to be modified in order to carry out the training programme in question.

Reusing existing material has the advantage of further improving the value of the training content which the training institution already has. It also saves time, money and resources. Moreover, instead of re-inventing the wheel, effort can then be devoted to improving existing material, rather than merely duplicating it.

4.2.1 Examples of good practice in training design and development specific to e-learning

Whereas the previous set of examples of good practice dealt with general training design and development, the following set relates directly to e-learning.

Not all e-learning development requires technical expertise

Some of the training events need specific technical expertise in order to be developed, whilst others can be technically developed by a training instructor having only basic computer skills.

In the case of e-learning and other computer-based training material, it is a good idea, in case of doubt, to ask the advice of e-learning development experts. There are, however, many things which the average computer user can do without necessarily needing the assistance of programmers and technicians.

Some examples of things which are designed to be developed and delivered by non-technicians are:

- virtual classrooms;
- rapid e-learning modules;
- a number of simple computer games;
- blogs and wikis;
- online forums and chatlines;
- Internet-based research.

A short description of what a number of these are, for what purposes they are best used, and how they could be used is given later in this document.

If you are developing or participating in the development of Web-based training, read the best practice document on this subject.

A team of e-learning developers working in different ATM training organisations have written a set of guidelines on the development of Web-based training material based on their experience and knowledge.

The document is called: “*Good practices for e-learning developers in ATM*” and can be downloaded from the following link:

http://www.eurocontrol.int/humanfactors/gallery/content/public/docs/DELIVERABLES/E-learning Practices V1_Aug07_REP_HUM.pdf.

This document is divided into four main chapters:

1. Instructional design
2. Human factors (i.e., factors relating to behaviour and other human aspects which need to be taken into account by an e-learning developer in order to successfully fulfil his/her role.)
3. Project management
4. Technical aspects

The chapter on instructional design is of particular interest to the training designer as it explores items such as:

- when and when not to use e-learning;
- how best to use e-learning;
- getting to know the learner;
- learning styles;
- considerations on the adult learner;
- considering the task: a focus on ATC;
- the design process;
- subject-matter and interactive matter;
- navigation and “Look and Feel”;
- methods and media to be used in e-learning when teaching: skills, data retention and knowledge.

There are also elements of the human factors and project management chapters which would be of interest to the training designer.

Since the document referred to in this section is freely available to the general public, it is redundant to reproduce parts of it in these guidelines for using e-learning unless the parts concerned are to be used in context different from that presented in the “*Good practices for e-learning developers*” document.

4.2.2 *Example of good practice in training design and development specific to ATM training*

In this subsection, a number of aspects specific to ATM training design and development are considered:

Regulated training

A lot of the training to be delivered in ATM is nowadays regulated. It is good practice during the design and development phases for appropriate documentation and mapping between the training objectives, training plans and training events to be constructed in such a way that they can be easily presented to the authority regulating the training.

Regulation also involves configuration management and version control. In the case of e-learning modules available over a computer network (LAN or the Web), the source could be easily controlled if the development and deployment takes account of this and only publishes one source on a web server. In this way, only those authorised to make modifications to the source would be allowed to manipulate the content.

Similarly, publishing and distributing only one source guarantees, when there are updates, that the learners will always have access to the most recent and most up-to-date version.

The aspect of interaction with the regulator and the advantages of controlling the source through computer-based training should be considered during the design phase.

Blending methods and media makes sense

ATM and especially ATC has been blending training since the very beginning. It has long been recognised that events which are theoretically oriented, need to be complemented by others which are more skill-oriented, and vice versa.

Typical blends in ATC training include:

<i>Method</i>	<i>Medium</i>	
Briefing	Face-to-face meeting	Instructor-led
Debriefing	Face-to-face meeting	Instructor-led
Case study	Training notes	Instructor-led/stand-alone/group work
Part-task practice	Part-task trainer/simulator	Instructor-led/stand-alone/group work
Exercise	Paper	Instructor-led/stand-alone/group work
Reading	Training notes	Stand-alone
Formative assessment	Paper	Stand-alone/instructor-led
Visit	Physical attendance	Instructor-led
Lesson	Class – face to face	Instructor-led
Simulation	Simulator	Instructor-led
On-the-job training	Real environment – face to face	Instructor-led

In the vast majority of events, physical attendance is obligatory (i.e., no distance-training is delivered) because a lot of these events tend to be instructor-led.

With the availability of various new media, the blend can be enriched so that the stronger points of existing method/media combinations are maintained and new method/media combinations are included.

Blending training will be the subject of another section of this document. The good practice to be noted at this stage is that in ATM training the need to blend training has already been recognised. The next improvement should be to integrate new media and methods into the blend in order to further enrich the training experience and to adapt to modern and changing learner expectations.

Use material which is context-relevant to the target audience

Research and experience indicate that a learner tends to be more interested in the training, and better able to retain the knowledge or skill which is to be transferred, if these are embedded in a context with which the learner is familiar, and which they know they will use in the future¹¹.

It is good practice to create examples and stories as well as exercises which are at least inspired by the real world. This is especially true of learners who already have a good degree of proficiency in the subject being taught, but contextually based learning is also relevant for less experienced learners.

Moreover, ATM is a very field-oriented business in which on the one hand practical stories and cases to illustrate learning objectives are readily available, and on the other hand personnel working in the field have a general preference to learn in context and to learn by doing.

This closes the part dedicated to the design and development sub-process.

The next subsection will consider good practices in the implementation of training and its evaluation and improvement.

4.3 *Implementation, evaluation and improvement*

The third and last part of the process described in this section describes the implementation (or delivery) of training, together with the evaluation of the training with the intent of improving it.

A number of examples of good practice as regards organisation of the delivery of training in general and of the e-learning component in particular were explored in the first part of these guidelines concerning organisational matters.

The following are a number of examples of good practice to be borne in mind for this phase of training. Some of them are generic in nature and others are specific to e-learning.

Dry-run the training programme before delivering it

An important step which is often forgotten is to dry-run the training programme before formally delivering it. This includes¹²:

- Testing the assumptions made during design and development that the events to be delivered will have the desired effect.
- Checking that there is a logical flow between successive events.
- Checking the duration of each event and of the training as a whole and ensuring that this corresponds to the time available and to an efficient use of the future students' time.
- Proofreading the documentation.
- In the case of CBT, checking that it is bug-free and that it works as expected is important.

¹¹ Kuhlmann, T. (2007), The rapid eLearning Blog: <http://www.articulate.com/rapid-elearning/>

¹² Those bullets marked with an ϵ are specific to e-learning.

- In case of CBT, testing that the interface used is intuitive for the users is important. It is not good practice to let the developers of the training modules test this as they could be so used to the interface that they might miss obvious problem areas. On the other hand, getting fresh users and asking them to comment on what they are thinking and feeling while doing the CBT is good practice.
- Performing dummy assessments to ensure that the questions asked, are clear, and that answering the questions correctly, in fact demonstrates knowledge transfer.
- Becoming very familiar with the technology to be used. There is nothing worse than demonstrating that you do not know how to use the equipment you have decided to use for teaching purposes.
- Finally, allowing time to act on the observations you make during the dry-runs.

A lot of valuable lessons can be learned during dry-runs. It is good practice to allow time for and to perform a set of such runs prior to the delivery of new training programmes. One should also scale the dry-run activity in proportion to the size of the programme and the level of novelty it includes.

Human contact remains a necessity

If there is only one example of good practice to be remembered for the implementation phase of training, it is that whatever methods and media are chosen, human contact remains a necessity, as described in section 5 of the first part of these guidelines which deal with organisational matters. This means that even in the case of distance asynchronous CBT, a human trainer should be assigned to actively facilitate the training and to follow the students to ensure that they remain motivated, focused and that they do not fall behind.

Evaluation and feedback

It is important to design, develop and deliver effective and efficient training programmes, but it is equally important to create a feedback loop and to improve the training on the basis of the feedback collected.

In face-to-face training, an event or a training programme can be evaluated in different ways.

At the end of an event or at the end of the programme, one can ask the students to comment directly on what they think went well and what they think could be improved. The advantages of this method are that the trainer can clarify any comment made and also that this can generate a positive discussion. The disadvantage is that it is not an anonymous method, and some people may not feel comfortable about speaking out in front of others. Also the discussion could become dominated by a talkative few, and others who might have valid points to add, might simply not speak.

An anonymous questionnaire could be handed out to be filled in at the end of the event. The advantage of this method is that everyone feels comfortable because of the anonymity. There is also a degree of control over the questions asked. The downside is that if the responses are ambiguous, it is impossible to ask for explanations.

Good practice is probably to have a mix of the two methods, and to scale the effort to collect feedback on the event in proportion to its importance to all involved.

In e-learning, whether *synchronous* (i.e., happening in real time, for example a virtual classroom) or *asynchronous* (i.e., where the learner is studying in their own time), collecting feedback is important and possible.

In the case of synchronous training, either or both of the methods described above is/are possible. The only difference would be the medium via which the students and the trainers interact.

In the case of asynchronous training, feedback forms could be attached in electronic format at the end of modules to pop up when a student has finished a module. If this method is used, attention should be given to the duration of the modules. It is not pleasant to submit a feedback form at the end of every module in a course consisting of a large number of modules each averaging 15 minutes in duration. In such cases, other solutions, such as presenting a feedback form at the end of the course (which would cover a larger chunk of training) or randomising the generation of feedback forms, should be envisaged.

One of the advantages of electronic feedback is that at a quantitative level, the analysis of the feedback received, can be automated and accelerated. For the qualitative analysis, however, there are as yet no magical solutions!

Electronic feedback could also be used with face-to-face events. Electronic assessment tools often have functionalities to perform surveys. These functionalities could be used to design feedback forms which could be administered to the students as part of the training blend.

It is important to act on the feedback provided

It almost goes without saying that the feedback received should be acted upon, otherwise the exercise would not be worth the time and effort of all those involved - students and trainers alike.

4.4 Conclusion: Producing effective and efficient training

The main aim of this section was to illustrate how and when e-learning should be integrated within the process of creating a training programme.

A process including three sub-stages (analysis; design, development and implementation; evaluation and improvement) was proposed. Each stage included a description and considerations specific to e-learning and/or to ATM training. A number of good practices were also included.

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5 – TRAINERS IN ATM NEED TO LEARN HOW TO USE TECHNOLOGY-FACILITATED LEARNING TOOLS

Training methods and media are tools which a trainer needs to master as part of their battery of possible combinations in order to create the right experience that which will produce effective and efficient training.

As discussed earlier in this document, the availability of technology provided trainers with additional media for designing, developing and delivering better training. However, the trainer needs to learn how to use these media. The next subsection outlines a number of subjects which need to be covered in a training programme, the aim of which is to provide trainers with ATM knowledge, and give them some opportunity to practise with e-learning-related training methods and media.

5.1 *Possible content of a training course for trainers in technology-facilitated learning*

One of the conclusions of EUROCONTROL's "Workshop on Pedagogic Issues when Using E-learning" organised in 2007, was that trainers in ATM needed a training course which introduces them to, and gets them more comfortable with the various media which fall under the e-learning umbrella.

The following is a list of items which could provide an outline for such a course:

- Media: the attributes of each medium, how it could be used, and hands-on practice:
 - the virtual classroom;
 - chatlines;
 - wikis, blogs, podcasts, webcasts, etc.
- Asynchronous interactive CBT: what can be developed by instructors and when should they seek the help of professional CBT developers:
 - principles of interactivity;
 - principles of instructional design;
 - knowledge, skill acquisition, CBT and ATM;
 - rapid e-learning development:
 - *principles, software, hands-on practice*
- Online assessments
- Games: principles, examples, hands-on practice:
 - games, simulations and e-learning in ATM.

- Collaborative learning methods: principles, examples, hands-on practice:
 - collaborative learning in ATM
- Blended learning: theory, examples, project: producing a blend:
 - Why a blend? - theory'
 - Choice of methods
 - Choice of media.
- Some technical details which an instructor using e-learning should know:
 - What is an LMS?
 - What is an LCMS?
 - SCORM
 - RSS feeds
- Time constraints on an instructor using e-learning: Time needed to:
 - monitor;
 - prepare;
 - update.
- Other developments in the area of networked technology and learning (e.g., mobile learning, etc.)

Ideally such a training programme would be delivered as a distance/online programme and would be composed of a blend of methods and media. The programme would be spread over a blend of group online sessions, individual online sessions, and personal and group work. In this way, the programme itself would be a good illustration of how e-learning could be used in ATM training.

6 – EXAMPLES OF VARIOUS FORMS OF E-LEARNING & TECHNOLOGY FACILITATED-LEARNING TOOLS, AND HOW THEY COULD BE USED

This section introduces various forms of e-learning and e-learning tools which non-specialist users could learn to master. Unlike the training programme which is described in section 0, above, which would aim to go into the subjects proposed in quite some depth, the purpose of the descriptions which is only to provide an overview of the form of e-learning concerned and how it could be used.

6.1 *Forms of e-learning*

This section describes how e-learning training delivery could be organised.

Each is presented here as a pure form. In reality, e-learning delivery does not comprise a single pure form but is made up of a mixture of forms. However, in the principle of blending training, a training designer should choose the forms which will create the right effect given the training need, the target audience and the surrounding context.

6.1.1 Learner-led e-learning

The first form of e-learning described here could be called learner-led e-learning.

This form of e-learning allows the learner to self-pace the training. For example, a lot of asynchronous CBT can be regarded as learner-led. In fact, although guidance can be given to the learner about how to manage the training, it is ultimately left to the individual learner to manage his/her own training.

The advantages of learner-led training are that it makes the learner responsible for his/her learning, and it does so in many dimensions.

For example:

- it allows the learner to pace the study time (go fast or slow);
- it allows the learner to view and review the content as many times as he/she wants;
- it allows the learner to decide at what time he/she wants to learn.

However, learner-led training also entails a number of risks, including the following:

- If the learner is not mature enough, he/she can find it hard to manage the learning from start to finish without any authority supervision.
- If the learner misunderstands, there is very little, to guide them back on track.
- In learner-led training, there is a tendency to take the human trainer out of the loop, and this has its downsides as described elsewhere in this document.

6.1.2 Facilitated e-learning

Facilitated e-learning is a form which combines asynchronous Web-based training with collaborative tools (for example emails or forums) which are also asynchronous.

In facilitated e-learning the trainer is more present, but his/her role is limited to facilitating the learning process. Control of the learning is still in the hands of the learner.

The difference between facilitated and learner-led e-learning is that in this form the learner is not left all alone, and is given guidance on managing the learning because he/she is asked to execute certain tasks within a time schedule (for example, touching base with the trainer at regular intervals by email).

The advantages of this form of e-learning are:

- that it dissipates some of the weaknesses of pure learner-led e-learning;
- that it can build on a level of peer support for the learner through the use of collaborative tools which, for example, will bind learners to work together and learn from one other (for example, binding two learners together, and asking each of them to constructively comment on the other's work before both submit their own work to the trainer).

The disadvantages which could arise from this form of e-learning are that:

- it could seem to be taking away the freedom of independent learners who prefer the pure learner-led form, or
- that there is not enough guidance for the very dependent learners.

There is no magic solution to this problem. The only thing to do is to thoroughly analyse the target audience during the analysis stage as described in section 4 –.

6.1.3 Trainer led e-learning

With this form of training, we move to the other side of the control continuum, with the trainer having control over learning pace and management.

In e-learning, this form manifests itself in the virtual classroom, where the trainer leads the training and the learners have to follow.

The advantages of this form of e-learning are that:

- the learners are guided through the learning path;
- the learners enjoy real-time contact with their trainers and often with their peers;
- the trainers receive instantaneous feedback on whether learners are understanding, and can adapt their approach accordingly.

Some of the disadvantages are that:

- there is one pace and one time for training;
- the learner is reduced to a learning recipient, and a lot of potential initiative for proactive learning investigation and research is lost.

6.1.4 Embedded e-learning

This form of e-learning is so-called because it is embedded into software programmes and is available on a “just in time” basis. Another name for it is *Electronic Performance Support Systems* (EPSS).

This type of e-learning, in its simplest form, is like the help one gets when using a word processor. It could, however, be more complex. For example, if a whole training module on how to use the human-machine interface of a controller working position (CWP) were to be embedded into the simulator on which students learn how to use the CWP. In such a case, the learners would access the training module from the simulator, and this module would ask them to perform actions on the simulator itself, thus learning how to use the real tool through a computer-based training programme embedded within it.

Although this technique has not necessarily been used in ATC, it has been used in a number of systems. For more examples of this form of e-learning, please refer to the white paper: “*Sustainable learning and support in 21C enterprises*” by the Learning Guide, 2004 (www.learningguide.nl).

This form of training could also include helpdesks, hotlines, web pages and wikis which the user/learner of a system might access only if they did not know how to use a specific tool.

The advantage of this form of e-learning is that it constitutes *just-in-time training*. In this case, only the training needed by the learner/user in order to perform is provided.

It maximises training retention because everything learned is carried out within an application context.

The disadvantages are that for integration reasons, it can be very expensive to make embedded e-learning available from inside tools.

Just-in-time learning is a form of informal learning, where, for regulatory or other reasons, it is hard to demonstrate a level of skills or knowledge gain at a specific point in time because the learner has learned only that which they need to use in order to perform.

6.1.5 Conclusion: forms of e-learning

Besides of knowing which form of e-learning to use and how to use it, a trainer also needs to know when the use of a particular form of e-learning will ensure the most effective and efficient training. As mentioned earlier, in practice a blend of forms which adapts to the training need, the context and the target audience is the most beneficial.

This short section on forms of e-learning was intended merely to provide an overview of the various ways in which e-learning can be organised. The next section describes some of the technology-facilitated tools which could be used in e-learning, within the forms outlined above.

6.2 *E-learning tools*

6.2.1 Virtual classrooms

A virtual classroom is a place where students and instructors can meet, via the Internet, to follow a class. The virtual classroom could either be linked to a learning management system (LMS) or function in a stand-alone mode. In the first case, a number of functionalities allow the training designer to blend the events which are to take place via the virtual classroom with other events, such as face-to-face training (for example, in a physical classroom), asynchronous CBT and assessments.

In general, a virtual classroom imitates the possibilities offered to a trainer in a physical classroom, including audio and video to talk to the students, the facility to put a presentation on the student's screen, etc. (more details are given below).

One of the advantages of a virtual classroom is that it allows high-quality communication where students are dispersed and/or where there is some distance between the students and the trainer. Another advantage is that a virtual classroom session can be recorded and then stored for asynchronous viewing as many times as necessary.

One disadvantage is that even in the better and more modern virtual classrooms where thumbnail pictures of the attendants, webcams and other similar features are available, human contact between the students and the trainers is partly missing. This then effects the feedback which the trainer usually uses to pace the training (some students might be feeling lost and the trainer would not even know). Another disadvantage is that a physical classroom is normally a place protected from interruptions, whilst virtual classroom sessions are frequently accessed via the office or home environments where daily interruptions continually occur. These disadvantages should not deter trainers from using this medium. On the other hand, they should be aware of the limitations and apply strategies during the training to overcome them¹³.

In brief, an average virtual classroom offers the following possibilities (the list is not exhaustive):

For both instructors and students:

- voice communication;
- webcam connections;
- chatting via instant messaging;
- transferring files to others in the class;
- having a whiteboard available;
- sharing applications online;
- expressing emotions and typical classroom interactions, e.g. raising a hand.

For the instructor:

- uploading a presentation on screen and presenting it to the class;
- getting the students to view the instructor's computer screen;
- controlling chats, voice interventions and webcams;
- controlling the whiteboard;
- controlling file transfers;

¹³ A course on technology-facilitated learning as introduced in *Section 5* would, for example, discuss such strategies.

- recording a session and making it available to users at a later time;
- asking questions or starting a poll and showing results to the students.

Virtual classrooms are also used occasionally by organisations to broadcast presentations to their remote offices.

Examples of virtual classrooms

The technology behind virtual classrooms is maturing, and the numbers of virtual classroom suites are therefore increasing.

Three examples of virtual classrooms are:

Acrobat Connect Professional from Adobe (www.adobe.com);

SABA Centra from SABA (www.saba.com);

WizIQ from WizIQ (www.wiziq.com).

6.2.2 Assessment tools (e-assessments)

Assessment tools allow trainers and assessors to develop, manage and administer assessments, and to collect assessment results and compile statistics based on a number of parameters.

Assessment tools can be used both, in distance and in face-to-face modes.

The advantages of using an assessment tool over using pen and paper are manifold:

1. An assessment tool enables the user to manage the assessment questions. This means that all the questions pertaining to a particular subject are collected in a question data bank. A number of tags can be added to these questions for example, indicating in which subject they could be used, the level of difficulty, etc.
2. Assessment tools allow users to define questions from an extensive set of question types, such as multiple-choice questions, drag-and-drop questions, etc.
3. These tools allow the definition of assessment parameters, for example, generating different assessments for the same subject but keeping the same level of difficulty; randomising the answers, for example in multiple choice, so that copying answers and cheating become more difficult; generating assessments to be used for training purposes and others to be used for summative exams; defining the duration of assessments (by assessment or by question); etc.
4. Assessment tools usually come with reporting suites which give the assessor the option of advance reporting by individual student performance, group performance, session performance, particular questions which posed a problem, performance of the same assessment over different groups of students, number of times a question from the question bank was used, etc.
5. Assessments tools can also be used to generate surveys and questionnaires and for the collection of their results, such as for example with end-of-training feedback questionnaires.

Assessment tools in general are still limited in the way they handle free-text assessment types. Even though a number of them have features which allow automatic handling of these types of questions using certain keywords and semantics, the performance of such features is generally still not up to the level required by most assessments. They, nevertheless, give the assessor the possibility to score the free-text answer, and then allow the score and comments to be recorded within the tool for reporting and analysis purposes.

Assessment tools can improve the development, delivery and management of assessments. However, certain generic good practices for assessments are valid whether the exam is delivered in pen-and-paper format or via a computer.

Here are a few examples:

Have a good question base for a particular subject. The fewer questions there are, the more repetitive the assessment becomes and the more difficult it is to create “formative” instances – where the students can do practice assessment drills and learn from their mistakes.

Be aware that having the possibility of delivering assessments online does not automatically mean that the assessment is secure. In a face-to-face environment, an invigilator ensures that no cheating takes place during exams. Even though advanced security features allow the more advanced assessment tools to be used to administer exams in distance mode, the cheating factor is still significant. Decide on the importance and criticality of the assessment before deciding on the mode (distance or in class). A class exam can be delivered using a computer, thus providing all the other advantages which an assessment tool can offer.

Assess the validity and reliability of an assessment before delivering it. Validity means the degree to which the assessment actually assesses the student’s knowledge of the subject officially being tested.

Reliability means the degree to which different sessions of the assessment, or the assessment being delivered to different people, will produce similar performances for similar knowledge. This means, for example, that two versions of the same assessment have the same level of difficulty and that the assessment does not discriminate between gender or age or any other skill which has nothing to do with the assessment.

Examples of assessment tools are:

Perception by Question mark (www.questionmark.com)

Question Tools by Question Tools (www.questiontools.com).

Assessment tools will be dealt with in more detail (for example, standards for exporting and importing questions, integration with other systems, etc.) in “*Guidelines on the use of e-learning in ATM, Part 3 – Technological Aspects*”.

6.2.3 Blogs

Blogs are online tools in which one can easily publish items in a logged format (i.e., tagged by date, subject, etc.) on the Web.

Because of their ease of use and success, they are also being used for training purposes.

The principle of a blog is fairly simple:

A blog can be said to be divided into two parts: an administrative part where the author, or set of authors, write, edit, manage and publish their posts, and the reader part which is just like a web page available via an URL.

As mentioned earlier in this document, blogs are being used by many people to write about their daily experiences or to publish their thoughts and opinions. This also has its uses in training, since students could be given an assignment, for example, to capture their learning on a particular subject during a training programme on a blog. This would enable the trainer to monitor and assess the progress the student is making on the particular subject, and also allow the peer students to learn from one another's insights and angles on the subject. An alternative would be for the trainer to publish posts on a training blog in line with the training progress, and ask the students, as an assignment, to react to and work on the items entered.

A tool for creating and managing blogs could be installed to be available on an Intranet or the Internet. It could likewise be integrated into an LMS. This would provide better links between the training programme and the items posted on the blog.

Examples of blogs

Blogs on the Internet can be created free of charge from the following links:

Blogger from Google (www.blogger.com)

Wordpress from Wordpress (www.wordpress.org)

<i>On e-learning</i>	
The e-learning guild research blog:	http://elearningguild.net/research/;
The rapid e-learning blog:	http://www.articulate.com/rapid-elearning/
The ATM e-learning community's blog: The E-Community	http://edtf.blogspot.com
<i>On learning and technology</i>	
Learning blog:	http://www.learning-blog.org/

6.2.4 Wikis

Wikis are online tools which allow documentation to be written, edited and managed online. The principles behind wikis and blogs are relatively similar: they both comprise two parts, an administrative part and a reader part as described in the blog subsection above.

The main things which differentiate wikis from blogs are as follows:

Wikis are more cooperation-oriented whilst blogs (or at least posts within blogs) tend to be individual contributions. In wikis, written and published articles can be edited by others¹⁴.

Wikis tend to be organised in a logical sequence designed by the administrators, with the result that one page links to a number of others, and items on a page link to other pages directly. Blogs tend to be organised chronologically with the latest post appearing on top.

¹⁴ Wikis have edition rights which can be defined by the administrator. These rights can range from one in which everyone can edit the wiki, to one in which only selected users can, to one in which only the administrator can edit content.

Because many users can write and edit the same article, wikis can be used in a collaborative exercise, for example to write a collaborative report online. The alternative for writing similar reports would be to send documents to and fro by email or other document-sharing facility. In this case, if more than two people work on the same document, then the workflow needs to be managed. Even if only two people are working on the same document, the first has to wait until the second has edited it and until the new edited version is received before being able to work on the document. On a wiki, however, everything happens in real time; although while a page in the wiki is being edited, it is locked for other users; as soon as the editing is done, other users can see the results and work on the page accordingly.

Wikis, containing various information on a specific subject, have been used extensively by organisations to share and manage the workforce's knowledge. Similarly in ATM training, notes on a particular subject could be collected in a wiki (which would then be locked to prevent editing).

This would enable students to consult the training documents online (either on an Intranet or on the Internet) without having to open documents and search within them (as wikis offer search facilities which allow keywords to be identified and give results based on relevance).

As in the case of blogs, a tool to create and manage wikis could be installed to be available on an Intranet or on the Internet. It could likewise be integrated with an LMS. This would provide better links between the training programme and the pages found on the wiki.

Examples of wikis

Tools to create wikis on the Internet can be created free of charge from the following links:

Tikiwiki from TikiWiki (www.tikiwiki.org);
 PBWiki from PBwiki (www.pbwiki.com).

The world's most famous wiki – Wikipedia:	http://www.wikipedia.org
On ATM and Aviation Safety: Skybrary:	http://www.skybrary.aero

6.2.5 *Instant messaging*

Instant messaging (IM) tools enable logged users to send and receive instant messages to/from one another.

Initially, IM tools offered the ability to two logged users to send instant text messages (chat) to one another. At the time of writing (IM tools will of course evolve further), IM tools offer many integrated facilities such as voice chatting, webcam connections, file sharing, sending emails and deferred messages, texting, etc.

In training, IM could be used as distance-learning equivalent of face-to-face one-on-one "tutorials" between trainers and students. For example, in ATM these could be used when students are given long asynchronous CBT. The trainer could then schedule regular individual meetings with each student. These meetings would serve multiple purposes, such as to:

- check on student's progress;
- ascertain that the student is understanding and is on the right track;
- test knowledge transfer;
- discuss an assignment;
- check on the student's motivation level;

Trainers wishing to use IM in order to get in contact with their students could choose, either to use the services which are readily available and are used by a large number of users (such as Windows Live Messenger - previously MSN Messenger - or Yahoo Messenger), or install an IM as part of the LMS.

In the latter case, the options of having it available only at Intranet level or only at Internet level are both open, and the choice depends on the effect the organisation wants to create and where the learning is to take place, i.e. at home or at work.

Even though the technical use of IM is fairly simple, trainers planning to use it should learn how to control and structure conversations, as this is not as straightforward as one might think. Features, such as the syntax and the unique lexicon used in IM by regular users, and the fact that it is hard if not impossible for a trainer to verify whether his/her interlocutor has his/her full attention or whether the latter has multiple conversations running in parallel (or even the fact that the trainer might not be connected to the person with whom he/she thinks he/she is conversing!) should be taken into consideration¹⁵.

Examples of IM

As mentioned earlier, two of the mainstream IM services are:

Windows Live Messenger (previously known as MSN Messenger) from Microsoft (get.live.com/messenger/overview/);
 Yahoo! Messenger from Yahoo! (messenger.yahoo.com/);

a third is

Google Talk from Google (www.google.com/talk/).

6.2.6 Forums

Forums are another family of online tools in which a community comes together to share information and to discuss particular subjects.

In a forum, users can either create themes for discussion, post questions on a particular subject, post replies to questions from other users, or simply read items which have already been posted. Forums are good knowledge repositories. A good example of this is how, if one is having difficulty using a particular application software, it is very easy to search for a forum which discusses this software, and if the software is in widespread use and has been around for a while, one often finds that the same question has been asked before and that someone with incredible mastery of the software has answered it.

In forums, the information is organised by theme and in conversation threads (for example, where someone has asked a question, another user has answered it, and yet another user has commented on the answer). Conversation threads are usually organised in chronological order.

¹⁵ These considerations on the use of IM for training purposes would be explored during the trainer's training in technology-facilitated learning.

The access to forums can also be controlled. Read access to many forums is given to the public reader, but contributing to the forum would need a user login. Forums are normally moderated by a person or a group of persons who filter(s) items which, are not in line with the themes which the forum discusses, are offensive in nature, or when a discussion between users heats up to unacceptable levels.

Forums without moderators often die from lack of interest because the information they generate needs to be focussed otherwise the community behind the forum therefore disperses.

Forums have been used in training since the dawn of e-learning, with discussion items being added to asynchronous CBT to enhance the discussion between students and between the instructors and the students. However, lack of visibility on forums (for example, where forum items are visible only if a student logs on to the LMS and goes to the forum page) and of the information they contain, lack of moderation and intervention by the trainers, and lack of student interest in participating, turned the initial experiences into failures or at best into partial successes.

Forums which work need to be:

- well integrated within the training programme (for example, where consulting the forum and posting items are a training requirement);
- well managed and moderated, and for this, trainers need to have considerable time at their disposal;
- visible and user-friendly.

If these conditions are met, then forums can be a good medium to be blended with others, as necessary, in training programmes.

Example of forums

Professional Pilots Rumour Network – PPRuNe (www.pprune.org);
IFATCA forum (www.ifatca.org/phpBB2/index.php).

6.2.7 Podcasts

Podcasts are audio and video files which are available over the Internet to be downloaded and played on portable media players (e.g., mp3¹⁶ players) and computers.

Most radio stations offer their programmes in podcast form which means that once they have been broadcast live, they are subsequently available for downloading to be re-listened to at the listener's own convenience.

Even though most professional podcasts have scripts (allowing for syndication¹⁷) attached to them which enable a user to know when they are available, and to automatically download them to appropriate software called *podcatchers* which will subsequently allow them to easily download the podcasts to mobile devices, or to listen to them directly on their computer, podcasts can simply be recorded (audio and/or video) files which are made available for others to download over the Web.

¹⁶ Mp3 stands for MPEG3, which is the abbreviation for compressed digital audio files.

¹⁷ Syndication is a publishing format which lets people view the headlines of their chosen blogs and/or sites all from the same place.

In training, podcasts could be used to provide variation from text-based information. For example, an interview between the instructor and an expert on the subject-matter could be recorded on an audio recording device, then transformed to mp3 format (by the same device), and subsequently be made available as part of the course resources on an LMS. The process is not that difficult.

The advantage of podcasts is that they can contain easily portable information for students. Also, they often, simply contain audio information. Such audio files can be accessed anywhere, any time, and many find that listening to information instead of reading it, gives them opportunities to study, such as listening to training material while being on a bus or whilst walking (activities which would not necessarily be possible through reading). As with all other tools, podcasting if used in a training blend needs to be used appropriately, at the right time and in the right doses.

Examples of podcasts

As mentioned earlier, all the major radios offer podcast possibilities on their programmes. For an example, see www.bbc.co.uk/radio/podcasts/directory/.

6.2.8 Games

The games referred to in this context are those whose ultimate aim is to teach. The term “game” refers to a very wide range of products, from sophisticated three-dimensional simulations to simple competitions against time. Some games aim to teach knowledge and others are targeted at teaching skills.

The common links between all these variations are amongst other things the element of fun or recreation, the element of competition (either against time or against the computer or against another person), and a contextual element which is appealing to the prospective players.

Games in ATM training could be used more extensively because they are a powerful tool allowing young and old alike to learn in a seemingly effortless manner. Conceptually or graphically sophisticated games can be very expensive to produce (in terms of both time and money) and be beyond the reach of most of our organisations. However, as mentioned earlier, games need not be sophisticated, and to design a game, one does not systematically need the assistance of programmers to produce high-level graphics and outstanding interactivity (although there are instances where the ATM training community should use its e-learning programmers to design and develop more sophisticated games).

Unsophisticated games for training purposes could be simple quizzes or situations in which the student-player is immersed in a situation and asked to take decisions. The decisions taken would then influence the outcomes in the following steps. The students would need to race against time or against other opponents. The one who comes first wins. All those who participate learn.

More sophisticated than the example previously given, a game which has nothing to do with ATC but which teaches bearing and distance appreciation, could be very successful.

For example, a game in which a car has to follow a course and arrive first at its destination but where, instead of using a steering wheel, the player has to type in the headings which the car has to follow, could easily be competitive, whereas giving headings to aircraft in order to maintain separation is too close to reality and would probably not be seen as a competitive endeavour.

Outside ATC and in the broader ATM environment, games could also be used to teach how to deal with new situations. For example, a future supervisor having to deal with his/her staff, the operational environment and the management in a 'Sims'¹⁸ way, or a future safety manager having to provide safety services in an environment other than ATM - perhaps in a formula 1 team, would be effective training experiences. Of course, the latter examples require a substantial budget, effort and qualified staff to produce them, but so do other less interactive, large-scale training programmes.

Trainers in ATM should consider games and computer-based games in their training blends. Games, used in the right doses and with the correct timing, can be very effective methods of training.

Some examples of games templates which could be used by trainers with few technical skills

The following are links to sites where such games can be found¹⁹:

<http://jc-schools.net/trainerials/PPT-games/>

<http://facstaff.uww.edu/jonesd/games/>

<http://www.halfbakedsoftware.com/quandary.php>

<http://www.experiencepoint.com/holiday/2005/>

6.2.9 Rapid e-learning development tools

Rapid e-learning (REL) is a term coined for asynchronous CBT developed by users with no or little programming knowledge. Rapid e-learning CBT is usually lighter and less complex from an interactivity viewpoint than CBT authored using professional courseware-authoring tools.

In simple terms, REL tools provide the trainer with an easy way to author and package content which is then delivered as CBT.

REL tools look very much like common word processors where one of the principles is that the author can add content and place it on a ready-made template using a 'what you see is what you get' (WYSIWYG²⁰) editor. Then through a simple process, the pages can be published to be accessed as CBT. Standard coding, such as SCORM (for example, for the content to be used within an LMS) or some other format, can be wrapped around the content on demand.

A large number of REL tools also offer the possibility of converting PowerPoint™ presentations to CBT and packaging them to work properly in an e-learning environment.

¹⁸ "Sims" is a game which involves simulating and influencing the life of a number of characters who live in the game. The parameters you change on the characters influence their behaviour and their interactions with one another. Visit <http://thesims.ea.com>

¹⁹ Note that the use of some templates might require permission from the intellectual proprietor of the game/quiz.

²⁰ WYSIWYG is a term used to describe an editing tool which allows the user to put items on screen without having to write code, where the items put on screen look the same as when they are published. For example, Microsoft Word is a WYSIWYG editor (what you write and what you print look the same).

REL should not mean shortcuts in the process

There are a number of caveats on the use of REL tools.

For training to be effective and efficient, it still needs to go through the process of analysis – design – development. Rapid development does not mean that aspects such as the right choice of methods and media or instructional design principles do not need to be taken into account.

Transferring presentations to CBT, just because it is technically possible, is not always a good pedagogical approach. Presentations are normally developed with the assumption that a presenter will explain them. CBT will need this explanation to be integrated into the content.

REL tools offer the possibility of integration of rich media²¹ but they do not offer the possibility of developing it. Rich media would still need to be developed outside if the trainer wishes to integrate them into REL-developed CBT. Often the trainer does not have the skills to create rich media and has to ask for professional assistance.

A possible corollary to the above is that REL-developed modules become heavily text-based. People generally find that long text documents are better read offline and many times in printed format. CBT need to have a purpose in order to exist (amongst other things it should remain interactive), and if there is no purpose, then they should not be part of the training programme. The ease of producing CBT should not be used to blindly justify CBT production.

Advantages of REL

Having mentioned the caveats, using REL offers a number of advantages.

It better integrates the participation of the trainer into the development of CBT. Without the use of REL, a large proportion of the development work is done by programmers. This has the effect of reducing the trainers' ownership of the content. With REL, the feeling of ownership of CBT on the part of trainers is strengthened.

Since REL brings e-learning closer to the trainer, the trainer would implicitly consider e-learning media more closely when preparing training blends.

Because the trainer can edit REL-developed content, the maintenance process (e.g., adapting or updating text) is simplified.

REL in ATM training

One example where REL could be specifically used in ATM training is to shorten the lead time for the development of certain content which needs to be quickly deployed and which has a short shelf life.

For example, briefings for new procedures which are requested from the section responsible for training at a late stage (shortly before the procedure is to be deployed) and which, once studied by all those concerned will not be reused, could be good material for REL-developed modules.

Also, where training units (for example, operational units) lack resources to develop heavy CBT, REL offers an extra option to reduce the need to systematically outsource all e-learning development.

²¹ Examples of rich media are videos, flash animations, images, etc.

REL Examples

Captivate and Presenter (www.adobe.com)

Lectora (www.trivantis.com)

6.3 *Conclusion: examples of technology-facilitated learning tools and how these could be used*

The aim of this section was to give an overview of a number of technology-facilitated learning tools which are available to the trainer who does not necessarily have technical skills to develop or deliver training.

The tools described in this section need to be mastered by their users, and thus training needs to be provided. The media to be used to deliver the training needs to be selected within an integrated design and development phase.

As a concluding note to this section, it is interesting to refer to a blog which is published by the Public Library of Charlotte and Mecklenburg County in the U.S., whose authors aim to introduce a number of web tools which could be used for teaching: <http://plcmcl2-things.blogspot.com/>.

7 – BLENDED LEARNING²²

Blended learning has been referred to a considerable number of times throughout this document. The subject is also commonly debated amongst (e-) learning experts. Some on the sceptical side say that it is nothing new and/or that it is just a rebranding exercise by e-learning salespeople in order to sell e-learning to those who prefer classroom face-to-face training. Others, who are more convinced, argue that it represents added value and is an important (or THE) training approach which needs to be applied.

In fact, both sides have their valid points:

- Trainers did not wait for e-learning to arrive before starting to blend their programmes, and if we take the example of ATC training in our industry, we have been blending since the very beginning with mixes of classroom training and simulations accompanied by on-the-job training.
- On the other hand, we would do well to remember that a trainer must be disciplined in the design and development process and in selecting the right methods and media. Remembering the blending principles allows the training designer to consider a number of aspects discussed in *section 4* – on “*PRODUCING EFFECTIVE AND EFFICIENT TRAINING*” with a view to achieving effective and efficient training programmes.

7.1 ***What are the principles of blended learning?***

The first principle is that e-learning (and all technology-facilitated training tools under that umbrella) should not be categorically regarded as substitutes for other media and approaches, but rather as complementing the training media toolkit. Each method and medium should be considered an ingredient in the trainer’s kitchen, readily available to be added to a recipe to create a tasty dish.

The second principle is that blended learning takes account of differences in learning objectives and learner characteristics and in the practicalities of particular situations.

7.2 ***What is blended learning?***

Many wrongly interpret blended learning to mean a grouping of several different method and media combinations which deliver the same objective. Blended learning is not providing the same training in three different ways so that it suits the tastes of everyone.

Blended learning involves adopting an approach in which the effect of each training event is considered and the methods and media are selected accordingly.

The reason for choosing a blended approach is that our current methods and media are rarely sufficient on their own.

²² Based on *Shepherd, C. (2007)*, “Making the case for blended learning”, presentation delivered at EUROCONTROL’s 2007 workshop on using e-learning.

Let us take three examples:

1. *Classrooms* are very beneficial because they create a learning environment free from interruptions, in which the main aim is to learn. Also, in classrooms one can test new approaches without running the risk of failing in the live environment.

However, classrooms are not the real work environment, and therefore what is learned will remain at an artificial level until it is applied on the job.

2. *Computers* are extremely versatile. Their multi-media capabilities are immense. Computers and the Internet are available anywhere at any time. However, computers lack the human touch, especially when it comes to skill acquisition, and a computer cannot yet adapt a training programme to the requirements of an individual and subtly adapt the training approach like an experienced trainer can.

3. *On-the-job training* provides one-on-one training in which a trainee has unique possibilities to learn from experienced professionals in real time and in real job situations.

However, the availability of instructors is limited and very often a trainee only comes into contact with a limited number of experienced professionals. All the potential value of the different viewpoints, tips and tricks of other on-the-job training instructors is not transferred to the trainee.

From these three simple examples, one can see that classroom, computer and on-the-job training all have immense advantages, but they also have their limitations.

The aim of the blended approach is to create an experience in which each method is used for its strengths and is complemented by others in its weaknesses. None of the three methods referred to would be sufficient on its own to train ATM staff, but the three of them together make this possible, often in a very effective and efficient way.

7.3 Conclusion: blended learning

Blended learning involves choosing the right methods and tools for each training event with the aim of creating the best possible training programme, given the objectives, the target audience and the constraints.

What is important to remember is that methods and media, whether e-learning or more traditional, need to be selected in an integrated and informed way.

A good book containing many examples of blended learning recipes is "*The Blended Learning Cookbook*" by Clive Shepherd²³.

²³ Shepherd, C. (2005), "The Blended Learning Cookbook", Saffron Interactive, U.K.

8 – MISCELLANEOUS GOOD PRACTICES IN E-LEARNING

In the following section, a number of other good practices will be presented. Some were collected at EUROCONTROL's 2007 workshop on using e-learning; others are based on knowledge collected by the e-learning team at EUROCONTROL.

8.1 ***Blend, and know the limits of asynchronous e-learning (CBT)***

At the workshop referred to above, one ANSP showed the participants that it was good practice to blend training in the context of training for the implementation of a new system for air traffic controllers.

The blend consisted of:

- training manuals;
- a face-to-face classroom introduction;
- e-learning CBT;
- simulations.

The events were carefully chosen, with each medium being used for its strengths:

- The training manuals provided the detailed information which could be read and consulted as necessary.
- The face-to-face classroom introduction welcomed the controllers to the training programme, explained what was expected of them, what kind of support they might expect, etc., and gave a very high-level overview of the system which was to be introduced.
- The e-learning CBT provided detailed training on the theoretical aspects of the functions of the new system. It also included pseudo-simulations (in the form of animated but isolated situations) which helped the controllers to analyse and train on each function of the system in isolation from the others.
- The simulations provided the controllers with hands-on experience of the new system and a view of how the new functions, introduced and explained in the e-learning modules and training manuals, integrated with each other.

The blend was well balanced and every method/medium combination was well chosen for the right training effect. This good practice shows that it is possible to apply the theory on blended training and on integrating e-learning within the overall training design and development process.

8.2 How to get students to remember more

One of the aims and challenges of learning is to get the students to retain as much as possible. As well as knowing that knowledge retention decreases exponentially over time²⁴, especially where students have to memorise out-of-context or abstract information, techniques for getting learners to remember as much as possible over time can be a great advantage.

Good practices in this regard include the following:

Organise the training content into small digestible bits. The idea behind this is to give the brain time to absorb the information and transfer the relevant parts into the long-term memory.

Design the training event so that it builds on prior knowledge, both in terms of the knowledge the users have outside the training and also on the knowledge they have just acquired from the training. This allows them to associate the information learned with things they already know and which are already in their memory, while at the same time allowing them to revise and reinforce items which they have just learned. Both help retention.

In parallel with the above, relate the training content to the target audience's context. An example of how this can be achieved is by telling stories (factual, or fictitious but closely inspired by the factual) which the target audience know about, or at least can easily identify with, and link the learning to these stories.

Ask questions before providing the answer. Instead of simply giving information in factual form, consider first asking a question and then providing the answer after some kind of interaction. The reason for doing this is that by asking the question, one first triggers an analytical process in the brain. The answer will then satisfy this process. An example of this is that some e-learning modules have topics organised in frequently asked questions (FAQ) format.

These good-practice techniques have been used in e-learning modules developed by EUROCONTROL, and the feedback received from the students has generally been positive.

8.3 Reading is best done offline

This was found to be good practice from the EUROCONTROL e-learning team's experience when developing and using e-learning.

If the training which needs to be developed consists of a lot of text, it is more interesting to find a solution which supports reading rather than producing e-learning modules full of text. The CBT to support the reading could be a short module which summarises the key findings and/or one which includes a summative assessment. The text could be provided as a printable text document which would need to be read.

8.4 Start small but have a plan

As one ANSP which has successfully implemented e-learning within its training programmes showed, a strategy which works could consist of scaling up the activity rather than trying to start off with big projects straight away.

²⁴ *Ebbinghaus, H. (1885)*, as cited on Wikipedia: Forgetting Curve (www.wikipedia.org).

The important thing is to have a plan in which the steps are included (to start small and scale up).

The reason why starting small is being considered an advantage, is that there are many dimensions which need to be considered. A lot of these dimensions were mentioned in part 1 to these guidelines (on organisational issues). From a pedagogical viewpoint "starting small" means:

- analysing which methods and media would be beneficial to the organisation;
- training the staff who will be involved in prospective projects in the media;
- integrating the method/medium into a training programme where it fits;
- adapting the training development and delivery organisation to allow time and resources for the activity (for example, if a trainer will have tutoring/monitoring activities in relation to e-learning, allow time for this within his/her responsibilities).
- developing and delivering the training;
- analysing the strengths and weaknesses and implementing lessons learned;
- analysing whether it is time to scale up.

The ANSP showed us how, from a master plan for the introduction of new technology, it systematically introduced new methods and media within the organisation. In order for the small unit, responsible for this, to remain in control, it did this in a structured and step-by-step manner.

8.5 *Involve staff from the start*

During the 2007 workshop on using e-learning, one ANSP showed the participants how involving its target audience in the design and development of the e-learning component of training, helped in many ways.

The content was more relevant, because it was partly prepared by a pool of controllers who on the one hand knew the target audience's needs, as they were part of this audience, and on the other hand were given time to get to know the subject-matter well.

There was more acceptance by the controllers, because they knew trusted representatives were on the project and were developing material which was straight to the point.

The fact that a pool of controllers learned the subject to be taught in order to develop the e-learning module, provided an extra pool of knowledgeable persons who could then disseminate the knowledge informally in the operations room.

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9 – SUMMARY OF MAIN POINTS

The aim of this document was to highlight the aspects which relate to development and delivery of training (pedagogy) when using e-learning.

The bottom line is that e-learning methods and media need to be integrated within the overall training design and development process and not to be considered as external to it. E-learning, or technology-facilitated learning, can complement a training programme only if it is adequately integrated.

This document has explored different aspects of what the term “adequate” means in this context.

The first section, following the introductory notes, considered the learners and their expectations. It considered training from an angle other than that of an organisation which has a training need and which is governed by a set of constraints. It considered that the learner needs a good training experience for the training to be effective. Part of the training experience can be achieved by using methods and media which best fit the particular learner for the particular training programme in question. This led also to the argument that in general we are all using more and more networked technology in our lives, and that, as a consequence, we implicitly expect the training we carry out as learners to take into account the media which we are most familiar with and which we use most to access information, to network and to share and communicate with others.

The second section showed that the use of e-learning needed to be integrated within the training design and development process. This section ran through this process in some detail and described when, where and how the training methods and media which make up the training events should be selected.

The third section explained that if e-learning is to be properly used in ATM training, the trainers who may come to use e-learning and networked technology in their training needed to receive training on how the tools available could be used. It also proposed a number of aspects which needed to be explored in such training.

The fourth section gave an initial description of a number of tools and when they could be used, including where applicable specificities to the ATM context and examples of where these tools could be found on the Internet and possibly downloaded for trialling.

The fifth section explained in detail what blended learning should be about, and compared training methods and media with ingredients in a kitchen and blended learning with a recipe which will produce a tasty dish.

Finally, the sixth section gave a number of miscellaneous good practices in design and development of delivery of e-learning within broader training programmes. These good practices were mainly based on information gathered at EUROCONTROL’s 2007 workshop on using e-learning and on experience gained by the EUROCONTROL’s e-learning team.

It is hoped that this document has not only allowed the reader to analyse how to use or improve e-learning in their training programmes, but also that it was a good and worthwhile read.

10 – APPENDIX 1: DEFINITIONS

Asynchronous communication: Communication where there is a delay between message and response. Examples of asynchronous communication include the post or, in e-learning terms, CBT, email, discussion forums/bulletin boards and blogs.

Formative assessment: A verbal or written factual assessment given for personal development purposes, which should have an important and lasting influence on individual abilities or attitudes. Should be drawn up for the attention or use of one person in particular. Source: EATM glossary of terms.

Module (e-learning): An individual stand-alone package of limited duration. An e-learning module can be regarded as a building block which, when used as a stand-alone or together with other modules and other features, will make up an e-learning course. Source: IANS e-learning content development process.

Networked technology: A piece of technology, including both hardware and software, which is used in a networked environment to access and share information and data. Examples of networked technology are:

- mobile phones, including phoning and texting;
- networked computers, and the use of the Internet and the World Wide Web to access and share information and to communicate, for example by accessing news on-line, sending and receiving emails, etc.;
- other devices such as portable MP3/video players which can be connected to the network to access information.

Pedagogical aspects can be defined as those actions related to the act, process, or art of imparting knowledge and skill.

Summative assessment: An assessment which represents a summary of the learner's attitudes and abilities over a period of time. This summation should be given in both verbal and written form and must be factual in content. It should not be given by those responsible for coaching a particular learner but should be an independent appraisal by suitably qualified personnel. Source: EATM "Air Traffic Controller training at operational units".

URL – Universal Resource Locator is an addressing scheme used by the World Wide Web browsers for the purpose of locating resources on the Internet. Source: Dictionary of Business Terms. Barron's Educational Series Inc., 2000. Answers.com 30 Jan.2008. <http://www.answers.com/topic/url>

11 – APPENDIX 2: ABBREVIATIONS

ANS:	Air Navigation Services
ANSP:	Air Navigation Service Provider
ATC:	Air Traffic Control
ATCO:	Air Traffic Controller
ATM:	Air Traffic Management
ATSEP:	Air Traffic Safety Electronics Personnel
CBT:	Computer-based Training
EATM:	European Air Traffic Management (the EUROCONTROL Programme Management Directorates)
IANS:	Institute of Air Navigation Services (EUROCONTROL)
IFATCA:	International Federation of Air Traffic Controllers Associations
IM:	Instant Messaging
LAN:	Local Area Network
LCMS:	Learning Content Management System
LMS:	Learning Management System
OJTI:	On-the-job Training Instructor
PDF:	Portable Document Format
REL:	Rapid E-learning
RSS:	Really Simple Syndication
SCORM:	Sharable Content Object Reference Model
URL:	Universal Resource Locator
WBT:	Web-based Training
WYSiWYG:	What you see is what you get

12 – APPENDIX 3: REFERENCES

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13 – APPENDIX 4: HOW WERE THESE GUIDELINES COMPILED?

One of the goals of EUROCONTROL's Sense Programme is to enhance human performance through the sharing of information and knowledge between partners.

The purpose of one of the work packages of this programme is to optimise the integration of e-learning within mainstream training in the European ATM context. Within this work package, it was decided to take the initiative of collecting and sharing knowledge of how e-learning could be used more effectively and more successfully in the ATM training environment. The information the reader will find in this document came mainly from three sources:

- a series of three workshops was organised for the period 2006-2008 around the central theme of using e-learning. In these workshops, the main contributors are the participants themselves who, through facilitated exercises and interaction with one other, build up a body of knowledge on the theme ;
- bilateral interactions between those responsible for e-learning at EUROCONTROL: the Institute of Air Navigation Services (IANS) and partners using e-learning within their curriculum;
- first-hand experience acquired at IANS in delivering e-learning training, and research into the use of e-learning in environments other than ATM.



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