e-Learning Concept

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EXECUTIVE SUMMARY

In recognition of current and emerging trends in academia and industry, the Military Committee and Strategic Commanders have identified the need to regularly assess and refine NATO's education and training framework. The composite force mix in current NATO operations requires education and training that enhance greater interoperability and understanding among its participants.

Electronic learning, or e-Learning as it is typically called, represents an innovative and powerful means of delivering this requirement. It offers increased access to education and training opportunities through on-demand availability, cost savings, self-paced courses, consistent and accurate delivery, condensed instruction and opportunities for collaboration. Using e-Learning ensures NATO and partner staff have access to high-quality education and training that can be tailored to individual needs, enabling personnel to effectively contribute to the NATO mission.

e-Learning technologies encompass Advanced Distributed Learning (ADL), Computer-Based Training (CBT), immersive training, mobile learning (m-Learning) and transmedia learning.

e-Learning can be applied in a variety of ways and will be integrated into the mainstream of education and training programmes. NATO currently offers over 400 hours of quality, relevant education and training in a wide variety of subjects and has trained over 65,000 students. Our primary e-Learning support is to NATO operations, exercises and academic programmes.

NATO e-Learning capability recognises teaching strategies and learning theories appropriate to adult learners and places importance on student-centric instruction. All courses follow a curriculum development process known as the Systems Approach to Training (SAT) and a regimented quality assurance plan, both based on industry standards and internationally recognised procedures and guidelines for course development and delivery. These criteria guide the approval, periodic review and monitoring of the courses to ensure quality online educational programmes and successful learning outcomes.

ACT is actively involved in enhancing and promoting the implementation of e-Learning technologies through partnerships and collaboration. Currently, we are working with the NATO Standardisation Agency, partnering with ADL Co-Lab, conducting Cooperative Development Team training to support other education and training institutions in developing an ADL capability and conducting an annual e-Learning Forum that brings together e-Learning developers and customers to share best practices and to showcase the e-Learning capability.

ACT has been designated the permanent organisation to administer and lead the e-Learning capability with the support of NATO and national bodies. In addition, Joint Force Trainer (JFT) assumes responsibility of providing e-Learning support to education and training institutions. e-Learning is continuously evolving and will benefit from new technologies and software tools. By implementing education and training with rich media support, scenarios, simulation and blended learning techniques, e-Learning courses will provide an effective and efficient learning environment. JFT will continue working to implement and reshape the education and training landscape using e-Learning technologies where appropriate.

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1. PURPOSE

The current operating environment of NATO's forces requires an agile and responsive training system. The rapid tempo of change in the operational environment and the speed of introducing new capabilities developed by industry and academia magnify our responsibility to arm the war fighter with the necessary skills in a reduced timeframe and more holistic manner. Similarly, the complexity of sharing the area of operations with a number of governmental, non-governmental and international organisations with differing priorities and in front of a global audience requires the development of tailored training programmes. These new requirements to create a global platform to support all NATO nations, partners and future partners, as well as accommodating the new generation of students' expectations, demand a re-evaluation of our methods and procedures to ensure we meet the expectations.

Keeping a training system up to date periodically requires a paradigm change. It is evident that we need to think, organise, plan, train and execute in ways that allow us to encompass new technologies, collaborate over distance, react faster, train to purpose, spend smarter, open to opportunities, and simplify. We must forge ahead, not become mired down in old ways of operating and training. This is especially true as NATO moves towards a Connected Forces Initiative (CFI) and streamlines the education and training process from the national E&T to NATO individual E&T, exercises and preparation for deployment.

In addition to keeping NATO's educational framework current with academic and industry trends and standards, we must address the contemporaryreduction in military budgets and the responsibility of the nations to provide trained forces, coupled with the requirements to avoid duplication of efforts, pool resources, and engage nations and partners. The composite force mix in current NATO operations requires education and training that enhance greater interoperability and understanding among its participants.

The Alliance places operations and the continuing development of capabilities at the forefront of its strategic priorities (Ref A). The HQ Supreme Allied Command Transformation (SACT) Strategic Plan flows from this guidance and articulates HQ SACT's current missions. One of those missions, specifically, is to "...*train and educate individuals to NATO common standards to provide to the Alliance* leaders, specialists and HQ staffs capable of operating effectively in a combined/joint environment..." (Ref B). This mission provides unambiguous direction concerning the importance attached to the education and training of Alliance personnel consistent with SACT TOR (Ref C).

In response to this, the Military Committee tasked SACT with the mandate to lead the development of an electronic learning (e-Learning) capability for NATO. e-Learning represents an innovative, powerful and cost-efficient means of delivering this requirement.

2. AIM

The aim of this paper is to:

- Describe the current e-Learning framework for education and training to include technologies, methods, standards and guidelines
- Identify current e-Learning solutions and how they are integrated into course offerings
- Identify potential future e-Learning solutions to support NATO education and training, particularly in view of the emphasis on the Connect Forces Initiative's "better use of technology" and "increased education and training".

3. SCOPE

This paper covers the implementation of e-Learning in NATO, including requirements, methods, current and future capabilities, organisational roles and responsibilities, and coordination with NATO partners. Building upon NATO/international educational standards, it offers a strategy for delivering e-Learning to NATO and its partners. It also brings a comprehensive approach to education and training technologies in order to enable efficient and effective high-quality learning.

4. E-LEARNING TECHNOLOGIES

e-Learning is education and training that is delivered to its "users" through a computer or other electronic devices. In comparison to traditional types of instruction, e-Learning can provide students with greater access to learning opportunities, enabling them to learn conveniently at their own pace, independent of location, whenever and wherever they choose. By allowing downloadable or media-based materials or by live connection to a NATO network, including the Internet, e-Learning provides tools that enable synchronous or asynchronous distance learning. It can be utilised to provide a complete standalone course or be used as part of a blended learning programme that supports existing training courses as pre-learning teaching material or as post-course reference.

e-Learning is an important tool to provide education, training and performance support to personnel from NATO and partner nations in a cost-efficient way. Its capabilities can provide an unlimited number of learners with effective, relevant high-quality education and training to increase mission readiness.

4.1. Key Principles of NATO's e-Learning Initiative

Key principles of NATO's e-Learning initiative include:

- **Effectiveness, efficiency and affordability**. Concise instruction based on NATO current and strategic priorities is delivered globally through multiple methods and requires little investment to use.
- **Improved nation and partner engagement**. Courseware is readily available on networks, enabling personnel just-in-time acquisition of knowledge and skills to effectively contribute to the NATO mission.
- **Incorporated guidance**. Standards and guidelines for developing an e-Learning capability are available to education and training institutions.

4.2. Benefits and Challenges of e-Learning

e-Learning provides a variety of benefits to learners and institutions alike and supports national efforts in the areas of education and training.

- **Cost Savings.** Reduced overall cost is possibly the single most influential factor for using e-Learning. Although initially more expensive to produce than classroom-based training, it yields a quick cost savings because it can support an unlimited number of students. The elimination of student travel and lodging is directly quantifiable, and the reduction of time that personnel spend away from the job may be the most positive benefit.

- **Increased Access**. e-Learning can better meet the needs of a geographically dispersed audience. Due to its lack of location constraints, it can provide greater access to instruction and training than more traditional education models. Students only need access to a computer with a CD-ROM or other storage devices or a network connection. Alternatively, students can download lessons and then use them when travelling or time is available.

- **On-Demand Availability.** e-Learning provides flexibility to students due to its 24/7 accessibility. It offers on-demand availability of courses, enabling students to complete training conveniently. Students may enrol at any time and can set their own schedules for completing course requirements and revisit courses if needed.

- **Self-Pacing.** e-Learning is self-paced, allowing students to focus on areas or topics that are most difficult, to pause if necessary and replay those segments as often as needed.

- **Consistent and Accurate Delivery.** Naturally, the best expert in the field may not be present in all classrooms, as instructors vary in experience, style and delivery. However, e-Learning provides a consistent delivery and the opportunity to learn from the best expert in the field.

- **Condensed Instruction.** Through sound instructional design e-Learning delivers condensed "need to know" information and provides the key materials with hyperlinks or attached reference documents for further learning, if required. For example, a weeklong residential course with 25-30 hours of instruction can be repackaged into a concise 8-10 hour course containing the same materials and producing the same learning outcome. This efficient instructional format, coupled with learning comprehension checks or exams, ensures students understand the objectives and provides feedback to the developers or instructors.

- **Collaboration.** e-Learning offers the opportunity to implement online collaborative learning tools through threaded discussion forums, or for learners to talk to classmates and instructors remotely in chat rooms without the limitations of time and location.

There are several challenges experienced by students of e-Learning and they should be managed proactively throughout course design and implementation. Table 1 identifies some of the common challenges and recommended strategies to help ensure student success.

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Challenge	Strategy
Computer Equipment, Software, and Skills: Students must have the availability of a computer with software applications such as word processing, Internet browsers, and the required software drivers and know how to use them.	• Give students easy, clear information or tutorials on how to register, access and operate the tools and technologies. • Provide a list of software needed. Embed a browser check tool in the LMS that can be used to verify the student's computer can run the e-Learning application and help obtain any software programs needed.
Social Interaction: e-Learning can create the drawback of reduced social and cultural interaction such as that regularly occurring in a traditional classroom setting. Some students have difficulty learning in physical isolation from their instructor and classmates.	• This challenge is lessening with advances in communication technologies and the use of collaborative learning tools, such as live chats and blogs, which can provide the social interaction needed by many students.
Discipline and Motivation: Students must have discipline to work independently and they must be motivated to complete course work on their own without the instructor's assistance. Undisciplined or unmotivated students or those with poor study habits may fall behind.	• Provide online learning orientation so students can understand the expectations and demands of e-Learning, such as time management. • Provide embedded prompts and study tips with guidance for completing activities. • Ensure interface is easy to use. • Use a table of contents to break the course into manageable units of study and help focus activities.
Student Support: Mechanisms must be in place to support students in their learning.	• Ensure students know where to get the help they need. Examples: availability of an instructor to answer questions about the course and a help desk to assist with technical difficulties.

Table 1. Challenges Associated with the Use of e-Learning and Strategies for Success

4.3. Applicability

e-Learning can be applied in a variety of ways and will be integrated into the mainstream of education and training programmes. It should be considered under these circumstances:
• As the sole method of instruction when it can appropriately satisfy education and training requirements
• When there is a large number of students distributed over geographic locations
• To augment classroom instruction with an e-Learning component when a blended learning approach is called for
• To provide refresher training that will help to maintain student skills

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4.4. Types of e-Learning Technologies

e-Learning technologies encompass Advanced Distributed Learning (ADL), Computer-Based Training (CBT), immersive learning, mobile learning (m-Learning) and transmedia collaborative learning, as seen in Figure 1.
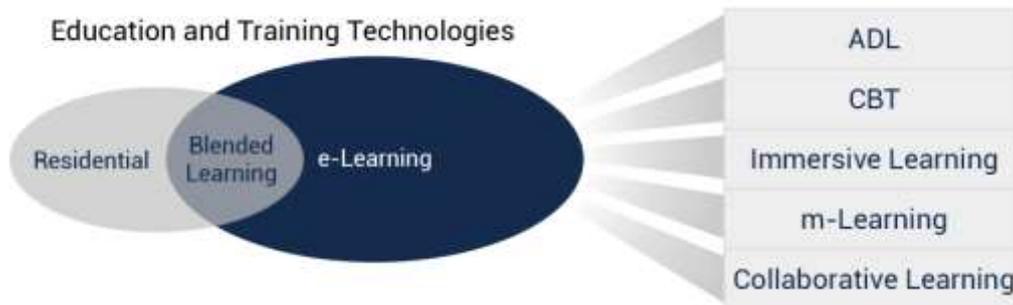

Figure 1. Education and Training Technologies

4.4.1. Advanced Distributed Learning

The most common form of e-Learning presently used in NATO is Advanced Distributed Learning (ADL), which features educational or training courses delivered over a network using a standard web browser. The term *ADL* is used synonymously with the term *Web-Based Training (WBT)*.

NATO offers ADL courses on its two major networks, one with access to the Internet. ADL follows a collection of standards and specifications for e-Learning known as the Sharable Content Object Reference Model (SCORM). SACT ADL courses are located at https://jadl.act.nato.int.

4.4.2. Computer-Based Training

Computer-Based Training (CBT) features educational or training courses delivered directly on a student's computer through CD-ROM or other storage device. It differs from ADL in that it is not delivered over the web or through a Learning Management System and does not require SCORM conformance. There is no requirement for a student to log in to the CBT, and there may be only local tracking of student progress or course completion. The use of CBT is discouraged, as this medium is harder to deliver and is out of date as soon as published.

4.4.3. Immersive Training

Immersive training uses a computer-based simulated environment to replicate a real-life or hypo-thetical situation in a graphically rich and dynamic setting. Students are immersed and involved in the training and learning process through interactive simulations and game-based applications. Immersive training supports one student or multiple small teams working together to solve a problem, rehearse techniques or enhance their skills. Through the use of enabling objectives and scripting, student actions and responses can be monitored and tested to ensure the objectives have been met. It can be web-based utilising distributed training or downloaded to standalone computers or mobile devices.

Serious games and virtual worlds, both examples of immersive training, are designed to engage students in a wide range of educational activities. Serious games use elements of game-play to train and educate. They allow mission planning and rehearsal exercises that can be replicated on demand.

Virtual worlds use online communities through which users can interact with others in the form of avatars, which are graphical representations of people, and 3D images. Students can "roam" and investigate areas and buildings or follow designated paths of exploration. New developments in immersive training allow students to start a course in traditional ADL and then at certain points "jump into" an immersive element and then "jump out" again, with their assessment scores and objectives met duly recorded and following them back to the original lesson.

4.4.4. Mobile Learning

Mobile learning (m-Learning) is the use of portable computing devices, such as iPads and other tablets, laptops, personal digital assistants (PDAs) and smart phones connected to wireless networks. It enables teaching and learning to extend to spaces beyond the traditional classroom. It allows instructors and learners increased flexibility and new opportunities for interaction that is convenient and accessible from virtually anywhere.

The ease of the m-Learning environment, with the typical student accessing data on demand, on a chosen device opens new possibilities as well as new challenges to the training environment. Students have the convenience and flexibility of using a mobile device to assist in the learning process. For example, m-Learning can provide visual guides and quick reference materials to students such as technicians working on equipment. With the GPS capabilities of phones and other mobile devices, courses can be dynamic in nature and guide students during familiarisation training or provide immediate access to support on demand, whether in the workplace or in the field. Though challenges remain, conventional e-Learning courses can be scaled to smaller screen sizes and specifically designed to accommodate mobile devices.

4.4.5. Transmedia (Collaborative) Learning

Transmedia learning is a new terminology being accepted internationally which covers learning from all the available social and multimedia platforms. This includes the old term *collaborative learning*, which supports instruction through interactive methods or online communication using social media tools such as chat rooms and discussion forums, and video tools such as webinars and webcasts as well as normal day-to-day social activities.

Transmedia identifies the creation of a new kind of learning which, although in use every day, has not been recognised until now as a learning or training method. Its tools can be implemented in online and classroom learning environments to propel the traditional educational model into the 21st century, recognising our new generations of learners' preferred methods of learning. Transmedia will support creating, enhancing and spreading content in a rich and fruitful way, allowing opportunities for exploration, interpretation and expansion. It will enable a number of students to work together with an instructor or facilitator and also permit student-to-student exchanges. For example, a student can share

with others his/her insight about how to solve a complex problem. This active exchange of discussion and ideas promotes critical thinking and problem solving.

Transmedia learning activities for educational purposes can be applied in a variety of ways, within a framework of distinct goals and procedures. In contrast to typical social learning tools where students simply log in to a site to chat informally, a transmedia learning activity directly supports learning goals through storytelling, experiences and interaction. It is the deliberate use of these tools to augment or extend learning.

To reap maximum benefits from the use of transmedia learning, both instructors and students must understand their roles in implementing and using the tools, balancing the required objectives and enabling the content to become the story and the focus. There must be a dedicated instructor or subject matter expert for facilitating the collaboration or for monitoring the on-going review and maintenance of a site. Students must comprehend the purpose and intent of each tool used and how it supports their learning goals, plus they must understand how they are expected to contribute to their learning activities. Before beginning an activity, instructors should provide students with an outline of the activity and the intended learning goals.

The use of transmedia learning tools typically requires some additional personnel besides the instructor and students—an administrator to set up the site and manage the technical details required for running it and a dedicated online help desk for support to students.

Transmedia collaborative learning tools include:

Chat Room. A synchronous tool in which a virtual meeting space is used to facilitate instant communication among instructors and students. Users must be present, can type their messages simultaneously, and those messages appear immediately onscreen in the chat room.

Discussion Forum. An asynchronous tool in which students can post and reply to comments published by an instructor or other classmates. Students reply on their own schedule and do not need to be present while posts are being submitted. It permits interaction and collaboration through threaded discussion postings.

Wiki. A web page on a particular subject to which students can collectively contribute. They can prepare, write and post content directly to the page and it can be revised with updated information that appears instantly, unlike traditional printed material that may take a considerable amount of time to write, edit and publish. Students can subscribe to the wiki to receive periodic updates on a subject.

Webinar/Webcast. A tool that delivers an educational session online using streaming video to distribute content to learners. A webinar is synchronous, a live educational session that permits interaction. Students are directed to a specific website to view the video. A webcast is asynchronous, a recorded educational session that can be selected and replayed by students. It can be accessed through a website or embedded in an e-Learning course.

Combining the use of other collaborative tools for follow-on activities to webinars and webcasts is ideal. For example, through use of a webinar or webcast, a problem is presented to students for analysis. An instructor then leads a follow-up discussion through a chat room or a discussion forum through collaborative group work for idea generation and problem solving. Using a chat room, students can communicate with each other in real-time, discussing the problem and brainstorming solutions. If using a discussion forum, students can post information, comment or provide solutions to the problem.

4.4.6. Blended Learning

Blended learning integrates computer-mediated instruction with traditional classroom instruction in a planned, instructionally sound manner. It combines the best features of e-Learning (24/7 accessibility) with the best features of classroom instruction (live, face-to-face interaction). A typical blended learning programme in NATO will have a portion of a resident course replaced by an e-Learning course, which then becomes a prerequisite to the resident course.

Blended learning benefits students, instructors and the institution:

- **Student Preparation**. Students spend time up front to learn basics through the e-Learning component and arrive better prepared for the classroom instruction. The instructor can be confident that students possess a certain level of knowledge and can proceed from that point, devoting more time to lectures, syndicates and other activities.

- **Flexibility.** Because the e-Learning material can be used 24/7, anywhere the student has access to the network, there are no time or location constraints. Since the e-Learning portion is self-paced, students can focus on areas or topics that are most challenging and replay those segments as often as needed or it can be used as reference during the follow-on classroom work.

- **Customised to Match Specific Needs.** A course of study that features blended learning can be tailored to the institution's needs and goals of a specific educational programme by focusing on specific competencies.

- **Constructive Learning Experience:** The e-Learning and resident components are carefully aligned to promote the best possible instruction and provide a good mix of technologies and interactions, resulting in a constructive learning experience.

For clarity, in a blended learning programme both the e-Learning and residential learning components must incorporate instructionally sound methods. As formal educational elements, both must be driven by enabling objectives to fulfil specific learning outcomes. The blended learning model is not simply classroom instruction plus a blend of "anything technology". For example, the online portion does not consist of instructors placing assignments or read-ahead materials online, students researching a topic on the Internet, using e-mail for discussion about the course or the use of electronic bulletin boards. While these activities may be critically important to an overall training programme, they are considered support materials, but not part of the blended learning model.

5. ELEMENTS OF E-LEARNING

Education and training comprise the instructional activities that provide knowledge and skills to NATO personnel for the performance of their assigned duties. The Joint Education, Training and Exercise division at Supreme Allied Command Transformation is responsible for the development, procurement, implementation and evaluation of e-Learning technologies in NATO.

Using e-Learning ensures that NATO and partner staff have access to high-quality education and training that can be tailored to individual needs and delivered cost-efficiently, enabling personnel to effectively contribute to the NATO mission. It can also provide just-in-time training for exercises and operations where staff are given short notice and require operational information in real-time.

5.1. Student-Centric Learning

When designing e-Learning courses, we must strive to fulfil our stated purpose for NATO and its partners: to provide the Alliance with leaders, specialists and HQ staffs capable of operating effectively in a combined/joint environment. While technology is critical to e-Learning, it is just a delivery method and must not overshadow the learning process.

Student-centric learning is an instructional approach in which students influence the content, activities, materials, and pace of learning. This makes learning more a process of discovery and knowledge construction than merely a transfer of knowledge from instructor (or electronic medium) to student. We must keep our focus on the students, their required knowledge, skills, and competencies. NATO's elite group of leaders and problem-solvers are self-directed and capable of making decisions for themselves so they respond well to programmes of instruction that allow them to control the pace of the training and review course segments as they wish. NATO's e-Learning concept, therefore, recognises teaching strategies and learning theories appropriate to adult learners and places importance on student-centric learning (Figure 2).
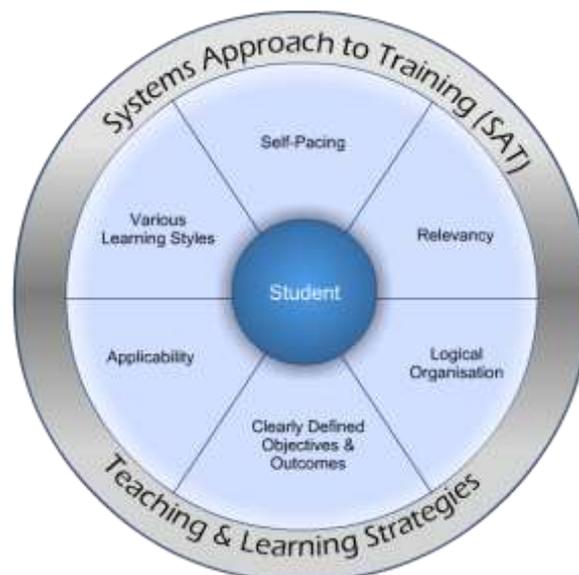

Figure 2. Student-Centric Learning Model

NATO personnel have accumulated a foundation of life experiences and knowledge, including military service within their own countries and with NATO, and will be eager to relate the courseware's theories and concepts to their own situations. Because they are goal-oriented and seek

relevancy, they must be furnished with courses that are logically organised, with clearly defined learning objectives and outcomes, and that are immediately applicable to their NATO responsibilities. Following principles of effective instructional design will focus the instruction on students' needs, as defined through a Training Needs Analysis (TNA). The TNA process identifies the education and training needs of personnel who are to perform a specific job, task or role in NATO, ensuring that any training developed is aligned to specific jobs. Then, through careful use of the Systems Approach to Training (SAT) model, appropriate objectives can be identified and educational solutions presented under the best conditions for learning.

Student-centric learning also recognises that students have different learning styles and preferences. For example, some students learn best through visual stimulation, such as images and written information, and others by audio methods, such as listening to lectures. NATO e-Learning courses are designed to accommodate the most common types of learners: audio, visual and kinaesthetic learners, to create a rich learning experience for all students.

Bearing in mind that learning occurs only when knowledge and/or skills transfer from the instructor, whether human or technological medium, to the student, all NATO e-Learning should be designed to enable students to perform their jobs satisfactorily.

5.2. Learning Management System

SCORM conformant courses run on a Learning Management System (LMS), which is a software application consisting of a suite of tools for management and administration of learning activities. LMSs range from systems for managing education and training records to software for distributing courses over the Internet with features for online collaboration. SACT currently uses an open-source software LMS, which provides these capabilities:

- Management of student enrolments, progress and completions
- Hosting of courses
- Report generation
- Student messaging and notifications
- Assessment and testing
- Recording of grades
- Course completion transcripts

5.3. Levels of Interactivity

e-Learning is presented through interactivity and ranges from linear presentation (page turner) to simulation presentation. The appropriate level of interactivity is matched to support the enabling objectives. Table 2 provides a description of the four levels of interactivity.

Level	Description
1 – Passive	The student acts solely as a receiver of information.
2 - Limited participation	The student makes simple responses to instructional cues.
3 - Complex participation	The student makes a variety of responses using varied techniques in response to instructional cues.
4 - Real-time participation	The student is directly involved in a lifelike set of complex cues and responses.

Table 2. Levels of Interactivity

5.4. Development Hours

The approximate time required to design, develop, test, package, and implement e-Learning courses is based on the interactivity level of the course. Table 3 provides an estimate of development time to produce one hour of e-Learning student instruction.

Interactivity Level	Approximate Hours of Development Time
1 – Passive	150 – 250
2 - Limited participation	250 – 350
3 - Complex participation	350 – 450
4 - Real-time participation	450 – 550

Table 3. e-Learning Development Hours

Development timelines vary by institution and are impacted by several factors, such as the existence of documentation on the subject matter that can be adapted to e-learning or whether the content will need to be written or created; the availability of design templates, which provide efficiencies in development; the types, quality, quantity and availability of media to be used; availability of subject-matter expertise; complexity of the material; experience level of the designers; the presence of clearly defined performance objectives; and a documented agreement of the scope of the instruction.

5.5. Depth of Knowledge

e-Learning supports the Depth of Knowledge (DOK) levels as shown in Table 4.

DoK Level	Description	Key Word
	This DoK requires a level of understanding that will enable a learner to	
Level 100 General	Recall elements and details of structure or process and to recognise or identify specific information.	REMEMBER
Level 200 Foundation skills and concept	Use foundational, conceptual, and procedural knowledge in a controlled working environment with ease and with minimum supervision.	UNDERSTAND
Level 300 Advanced skills and concept	Reason and then develop a plan and sequenced steps. From that, a learner will be able to make some decisions and justification using abstract and complex thinking skills that can be applied in most environments and offer more than one possible answer or approach to solve the problem.	APPLY
Level 400 Expert skills and concept	Investigate and apply solutions to complex problems. Involves the ability to research and process multiple conditions of the problem or task using non-routine manipulations, across disciplines and content utilising multiple resources. The ability to apply this knowledge is based on in-depth complex reasoning, planning, and development skills that have been acquired over an extended period of time.	EXCEL
Level 500 Mastery strategic skills and concept	Have the full extent of understanding that will enable a level of forward leadership reasoning and strategic thinking skills to see outward and immediately plan for today in order to achieve strategic goals of the future.	LEADERSHIP & COMMAND

Table 4. Depth of Knowledge

5.6. Resources: Funding, Staff and Equipment

Resources such as funding, skilled staff, and adequate equipment must be in place to support an e-Learning capability.

Funding. Initial start-up costs may be high, but they are significantly reduced over time after more courses are offered. The quicker development time provides another cost offset. In addition, e-Learning products can be used for extended periods of time and delivered to large and widely dispersed populations, resulting in a significant return on investment.

Staff. e-Learning development is typically carried out by teams with specialised skill sets. Table 5 provides a description of the main roles and responsibilities that e-Learning specialists usually undertake; however, roles vary widely between institutions.

Role	Responsibility
Manager	Prepares, directs and manages project development and delivery, by ensuring all actors are involved and aware of their respondsibilites.
Instructional Designer	Ensures instructional soundness to aid knowledge transfer in the online environment. Selects, writes and edits content; determines instructional strategies, activities and multimedia components; writes test and assessment items.
Multimedia Designer	Prepares the visual layouts of the course. Selects or creates multimedia components to include graphics, images, animations, illustrations, audio, video and other media to effectively communicate the content created by the instructional designer.
Programmer	Responsible for coding, packaging, testing and integration of the course with the LMS.
Subject Matter Expert (SME)	A vital, though temporary, member of the e-Learning team, usually the e-Learning customer, providing knowledge and expertise of the subject matter. Works with the instructional designer to develop the content, ensuring accuracy and relevance of the course components.

Table 5. Development Team Roles and Responsibilities

Equipment. An e-Learning capability requires a wide variety of technical equipment for the development, delivery and management of courses. There must be a check of the institution's information technology infrastructure to guarantee connectivity, including web access and bandwidth availability. Regular maintenance and upgrades are required to keep pace with new technologies.

Software applications are needed for developing the course and also a basic level of software and hardware in order for course materials to be accessed properly by the student. The minimal hardware and software needed by students to take courses are shown in Table 6.

Hardware	Software
• Internet connectivity adapter • Processor • Memory • Hard drive space • CD-ROM drive • Sound card and speakers	• Operating system • Web browser • Software plug-ins (to add specific abilities to a larger software application)

Table 6. Hardware and Software Requirements for e-Learning

6.   DEVELOPMENT STANDARDS AND QUALITY ASSURANCE PLAN

NATO is committed to the development of an environment which recognises the importance of quality in its work. As NATO educational capabilities advance, we aspire to enrich the education offered and to provide continuous learning opportunities for personnel at all levels. This is why we follow a curriculum development process known as the Systems Approach to Training (SAT) and a regimented quality assurance (QA) plan, both based on industry standards and internationally recognised procedures and guidelines for course development and delivery, such as the Sharable Content Object Reference Model (SCORM). These criteria are used for the approval, periodic review and monitoring of the courses to ensure quality online educational programmes and successful learning outcomes.

NATO's goal is to make these standards and quality assurance measures available on a global basis to facilitate collaboration in e-Learning in order to promote the increased availability of effective, interoperable courses. Detailed procedures of these standards and quality assurance measures are documented and available to institutions wishing to implement e-Learning into their course curricula or to assist institutions in improving their e-Learning courses readiness. Procured e-Learning courses and institutions seeking NATO accreditation of a course must also meet these standards and quality assurance measures.

6.1. Systems Approach to Training (SAT)

All NATO education and training programmes, whether instructor-led or e-Learning courses, are defined, designed, developed, delivered, evaluated, validated and managed in accordance with the SAT model. SAT is a holistic and comprehensive education and training process that focuses on operational requirements and the needs of the organisation.

SAT integrates instructional strategies and learning theories to help ensure quality instruction and aids in the transfer of learning—the transfer of knowledge, skills and attitudes from the learning environment to the real world. It provides educators with a standardised, repeatable process to develop a course of instruction. The SAT model includes Analysis, Design, Development, Implementation and Evaluation phases, and is also known as the ADDIE model. Figure 3 illustrates the SAT/ADDIE model and portrays its cyclical nature, which allows for continual evaluation and feedback to ensure a quality programme of instruction. e-Learning's suitability is assessed in the analysis phase and determined in the design phase.
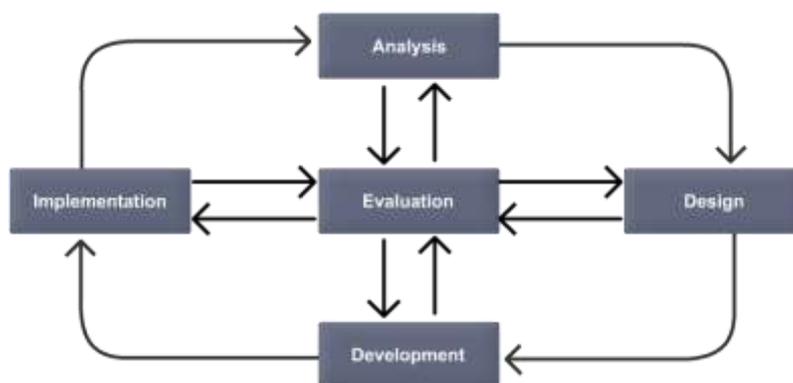

Figure 3. SAT/ADDIE Model

The SAT model ensures that NATO education and training adhere to certain fundamental principles:

- **Performance Orientation.** Education and training are preparation for performance on the job. All instruction focuses on essential skills, knowledge and attitudes required to meet operational requirements and NATO-specific needs.
- **Systems Approach.** Courses and programmes are managed through the SAT model, ensuring that they are defined, produced and maintained through an iterative and interactive series of steps leading from requirement definition to confirmation that the requirement has been satisfied.
- **Optimum Efficiency.** Education and training are developed and conducted in a manner that prevents or eliminates unnecessary effort and ensures continuing cost-effectiveness.
- **Tailored to Audience.** Programmes are tailored to the needs and the learning characteristics of the target population.

6.2. SCORM

Courses developed using e-Learning technologies conform to Sharable Content Object Reference Model (SCORM) specifications. This enables the course and its components to be uploaded with minimum adaptation to any other SCORM-conformant Learning Management System (LMS) using the same version of SCORM. It also allows for the interchange of lessons among courses. For example, one lesson, or Sharable Content Object (SCO), on first aid or the NATO command structure can be used in a multitude of other courses that are unrelated to the original subject.

New courses can be developed using new material as well as SCOs developed by other institutions and can be combined to form a new course entirely restructured and packaged to appear as a single course. The ability of disparate knowledge objects to work together in unanticipated ways creates opportunities to design unique courseware that can be customised to specific learning needs. SCORM supports various levels of complexity from simple text-based pages to rich interactive media content.

In line with the global use and acceptance of SCORM, ACT sponsored the use of SCORM to become a NATO Standard (STANAG). Approved on the 8th May 2013, NATO STANAG 2591 is now under NATO Training Group governance with the United States as the lead nation.

e-Learning using SCORM is characterised by the following properties:

- Accessibility (from any location, remote or local)
- Interoperability (between different e-Learning instructional platforms, media and tools)
- Durability (to withstand base technology changes without significant recoding or redesign)
- Reusability (between different applications, platforms and tools)
- Cost-effectiveness
- Ease of maintainability

6.3. Quality Assurance

NATO e-Learning quality assurance measures are based on a set of criteria, to include:

- Courses defined, produced and maintained in accordance with the SAT model
- Content is accurate, relevant, and fulfils intended learning outcomes
- Students' needs, abilities and interests are at the core of the learning system, with e-Learning as a facilitator or enabler to the learning process
- Use of appropriate presentation strategies, to include interface and screen design that facilitate intuitive navigation

- Use of interactive and stimulating multimedia components (audio, video, illustrations, graphics and animations) that effectively engage the student
- Participation of students in quality assurance activities
- Conformance to the SCORM standard

7. IMPLEMENTATION STRATEGIES

ACT is actively involved in enhancing and promoting the implementation of e-Learning technologies through partnerships and collaboration.

Partnering with ADL Co-Lab. SACT joined the ADL multinational partnership in November, 2010. This collaborative effort between NATO and the ADL Co-Lab enables military, government, industry and academic professionals who share a common interest in ADL and are committed to working with emerging technologies to develop, support and deliver learning. Members can share their experiences in implementing innovative e-Learning solutions and take advantage of unique opportunities to learn about the latest research and events shaping e-Learning.

Cooperative Development Team (CDT) Training. A CDT may consist of e-Learning managers, instructional designers and multimedia designers from education and training institutions and national partnerships that develop e-Learning capabilities. The teams work independently, collaborating with other teams periodically to discuss best practices and new developments in the e-Learning field and to partner on joint projects. Currently there are over 20 active CDTs from NATO and partner nations.

CDT training is an event that provides formal e-Learning training to prepare new CDTs for developing an e-Learning capability or to update established CDTs on new developments and techniques. Through practical exercise, the training takes students (normally a three- or four-person team) through the complete lifecycle of online course development, from initial request to final online product and follow-on evaluation cycle. The training is provided annually or semi-annually. Any institution or nation wishing to be trained and join the CDT community may attend this event.

Starting in 2014, the NATO School will offer a 10-day formal e-Learning course which will enable potential e-Learning developers to receive a comprehensive education on the complete process of development, design and delivery. This course will be open to all NATO and nations including partners. Further details are available on the NSO web site at https://www.natoschool.nato.int/.

NATO e-Learning Forum. The NATO e-Learning Forum, formerly called the ADL Forum, is an annual event which focuses on bringing together e-Learning developers and current and potential e-Learning customers. By allowing this mix of people to discuss best practices, requirements, possibilities and limitations, it enhances the comprehension of all parties and leads to better development plans and acceptance in the field. The NATO e-Learning Forum also brings in academic, industry and military operational speakers to discuss present and future ideas and situations to challenge the group. By bringing many education and training institutions and nations together, the forum enhances our understanding of each other and leads to collaborative work, as well as the chance to showcase the e-Learning capability. As part of the new ACT directive on the management of subject areas and responsibility, in 2014 the e-Learning Forum will also become the e-Learning Discipline conference.

8. FUTURE e-LEARNING CAPABILITY AND THE WAY FORWARD

NATO will continue to reshape the learning experience by offering an ever-expanding range of education and training using emerging technologies. Since the Military Committee tasking was received, technology has moved forward at a staggering pace and SACT continues to monitor and assess new capabilities and equipment. Utilising the skills of NATO and national academics through NATO working groups and panels, as well as attending major events in the education, training and simulation world, SACT will ensure it keeps abreast and makes good use of this fast-moving field.

The organisation continues to examine various technologies that will enhance our ways of delivering education and training to our personnel. As NATO reshapes and expands its education and training framework, learning activities will continue to move far beyond the classroom or lecture hall. Courses will include a robust set of learning opportunities through a variety of delivery mechanisms and new technology components such as virtual classrooms, webcasting and other interactive initiatives.

Since its inception as a part NATO's education and training offerings, e-Learning has grown at a considerable pace and is now considered a substantial asset to the NATO programme.

While the acceptance and use of e-Learning has grown, NATO's capability and capacity has not. Our NATO Education and Training Facilities (NETF) do not have dedicated e-Learning staff and currently use staff members for part-time development work. At ACT, there is a small contractor team but their capacity is already full supporting tasking from Joint Force Trainer. This situation is not ideal, and in 2013 an independent study was commissioned to review the current NATO e-Learning capability as well as use of technology. The study was conducted across all NETFs and other centres using e-Learning. The results and recommendations have been published, and ACT Joint Force Trainer is now finalising the recommendations with the NETFs to go into the NATO e-Learning 2016+ white paper and vision.

The white paper will set the path for increased capacity across NATO and to ensure policies, formats and guidelines are used. It will also look into how technology can assist our current efforts, both classroom-based and online. The paper is due to be published in March 2014, with a view to be implemented for 2016 and beyond.

9. ORGANISATION

ACT, on behalf of both Strategic Commands, has been designated the permanent organisation to administer and lead the e-Learning capability with the support of NATO and national bodies. In addition SACT assumes responsibility of providing e-Learning support, through education and training institutions, for education and training for operations and exercises. Education and training institutions have a unique requirement for e-Learning support, and it is necessary to create a distributed e-Learning core capability at each of these institutions. Harmonising the administration and management is of vital importance to increasing the readiness of personnel for a wide range of missions. To facilitate this harmonisation, SACT will aim to establish and coordinate standards and specifications that provide interoperability, reuse, durability and adaptability. SACT will also have the necessary e-Learning capability to manage the Learning Management System servers and support certain strategic e-Learning requirements when requested.

The coordination of e-Learning, including strategic direction, guidance and support to education and training will be provided by SACT, but the detailed management, administration and server support will be decentralised within the Alliance community among the institutions, ensuring continuous access to registration, tracking, testing, record keeping and the provision of expert help desk support to the user community.

Key stakeholders and users of the NATO e-Learning programme are Allied Command Operations (ACO), the NATO Force Structure, national education and training institutions of NATO, PfP, Mediterranean Dialogue (MD), Istanbul Cooperative Initiative (ICI) nations and contact countries.

SACT responsibilities towards these stakeholders include:

- Develop and deliver the NATO e-Learning concept and directive
- Support education and training institutions in the development of online course curriculum within their education and training programmes and oversee that new online courses are developed in accordance with ACT and Bi-SC directives
- Coordinate requests for new online courses development and provide support where necessary
- Work with education and training institutions to ensure that all online courses are maintained and kept up-to-date.
- Direct and coordinate the appropriate education and training institutions to produce, develop and deliver online courses and content repositories to facilitate the distribution of training materials which may form the nucleus of the training material to be reused by other e-Learning institutions
- Continue and expand annual forums, practical exercises, Cooperative Development Team (CDT) training events in order to share e-Learning concepts and practices
- Develop supplementary e-Learning policy guidance on the use of and standards of compliance with all NATO online education
- Develop an e-Learning capability for the NATO Secret and Mission Secret networks

In accordance with the MC directive, SACT provides guidance and coordination to education and training institutions, applies standardisation to the design, development and delivery of e-Learning, acts as technology lead and conducts accreditation of e-Learning courses. Primary NATO institutions include NATO Defence College (NDC), NATO School Oberammergau (NSO), NATO Communications and Information Systems School (NCISS), NATO Maritime Interdiction Operational Training Centre (NMIOTC), Joint Warfare Centre (JWC), Joint Force Training Centre (JFTC), Centres of Excellence (COEs), Partnership Training Education Centres (PTECs) and national institutions who partner with NATO. This framework is depicted in Figure 5.
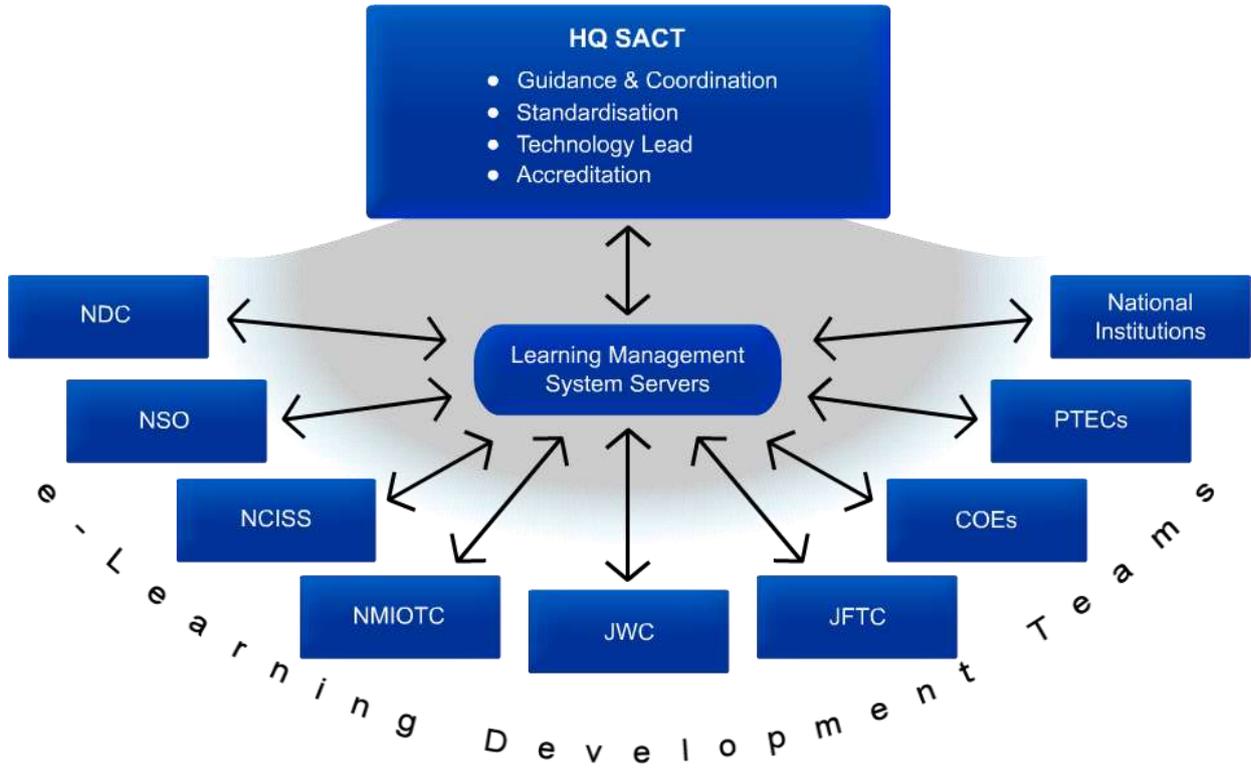

Figure 4. e-Learning Education and Training Community

11. GLOSSARY OF TERMS AND DEFINITIONS

Term	Description
ADL Co-Lab	Comprises military, government, industry and academic professionals who share a common interest in ADL and are committed to working with emerging technologies to develop, support and deliver learning
Advanced Distributed Learning (ADL)	An educational or training course delivered over a computer network using a standard web browser
Blended learning	An integration of computer-mediated instruction with traditional classroom instruction in a planned, instructionally sound manner
Collaborative learning	Supports instruction through interactive methods or online communication using social media tools such as chat rooms and discussion forums, and video tools such as webinars and webcasts
Computer-Based Training (CBT)	An educational or training course delivered directly on a student's computer through CD-ROM or other storage devices
Cooperative Development Team Training	An event that provides formal e-Learning training to prepare new teams for developing an e-Learning capability or to update established teams on new developments and techniques
Cooperative Development Teams	Teams of e-Learning managers, instructional designers and multimedia designers from education and training institutions and national partnerships who develop e-Learning capabilities
Distance learning	Electronically supported instruction that is delivered to students who are geographically separated
Education and training institutions	Institutions that are developers of education and training courses; primary NATO institutions include NATO Defense College (NDC), NATO School Oberammergau (NSO), NATO Communications and Information Systems School (NCISS), NATO Maritime Interdiction Operational Training Centre (NMIOTC), Joint Warfare Centre (JWC), Joint Force Training Centre (JFTC), Centres of Excellence (COEs), Partnership Training Centres (PTCs) and national institutions who partnership with NATO

Term	Description
e-Learning	Education and training that is delivered electronically through a computer or other devices and encompass these technologies: Advanced Distributed Learning (ADL), Computer-Based Training (CBT), Immersive training, mobile learning (m-Learning) and collaborative learning
Immersive training	A computer-based simulated environment that replicates a real-life or hypothetical situation in a graphically rich and dynamic environment
Learning Management System (LMS)	A software application that comprises a suite of tools enabling the management and administration of learning activities
Mobile learning (m-Learning)	The use of portable computing devices, such as iPads and other tablets, laptops, personal digital assistants (PDAs) and smart phones connected to wireless networks
NATO e-Learning Forum	An annual event which focuses on bringing together e-Learning developers and current and potential e-Learning customers
Sharable Content Object Reference Model (SCORM)	A technical specification that enables the interchange and sharing of e-Learning courses across institutions and networks, characterised by accessibility, interoperability, durability, reusability, cost-effectiveness and ease of maintainability
Systems Approach to Training (SAT)	An instructional design model in which courses are defined, designed, developed, delivered, evaluated, validated and managed; provides educators with a standardised, repeatable process to develop a course of instruction; also known as the ADDIE model
Transmedia Learning	An approach to training and education that delivers and reinforces an instructional "message" across multiple media, using diverse entry points into the "narrative" to generate audience involvement with content

12. REFERENCES

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