

# Next-Generation Spaceflight Training for Mission Operations

*Valerie Gordon, Johnson Space Center*

*Leslie Court, Johnson Space Center*

The Distance Learning team within the Mission Operations Directorate (MOD) Spaceflight Training Management Office is prototyping a next-generation online learning experience for a student population that includes astronauts, flight controllers, instructors, and other MOD personnel. Spaceflight training is a complex, heavily integrated activity, requiring efficiency in both planning and execution to meet flight dates and timely certification requirements for crew and MOD personnel. The goal of this project is to make a case for providing on-demand training that will meet these needs effectively and efficiently. Traditional classroom content is converted to a fully web-based environment, creating interactive, media-rich lectures and multimedia presentations available from any location with access to NASA's intranet. Students can easily access training content at any time to assist in gaining and maintaining proficiency of both technical and soft skills required for spacecraft mission operations.

Historically, MOD has used online training for additional review of content that had already been presented via more traditional methods (i.e., classrooms, mock-up trainers, etc.); however, this same online content has been used as a primary means of training for organizations external to MOD and other NASA centers that are unable to get this training in-house. The team is building on the successes and lessons learned from this previous implementation to develop a proof of concept for the next generation of online training to be implemented in a blended-learning approach, in conjunction with traditional spaceflight training media. Simultaneously, the team is addressing technological upgrades in these online prototypes due to the rapid growth of multiple browser and platform technologies and ensuring that MOD remains in sync with the latest developments in training technology.

The approach for developing and producing this next generation of online training includes identifying and selecting appropriate development and production software; choosing the appropriate training content; producing the online lesson prototypes; and, finally, implementing these lessons for proof of concept. The effectiveness of this technology for future implementation

into formal MOD student training flows will be determined using both a qualitative and quantitative approach.

NASA initially investigated over 50 technological solutions, including both software and hardware, for this project. Selection criteria included the following:

- Low-cost solution for rapid development
- Design flexibility
- Ability to be customized and formatted to support the required training environment
- Compatibility with emerging mobile technology
- Capability for student interaction
- Support of animations in multiple formats
- Synchronization of audio, video, graphics, html, .pdf files, and PowerPoint files in a single template
- Compatibility with existing NASA web servers
- Sharable Content Object Reference Model specification compliance for testing, evaluation, and tracking, as well as for compatibility with other learning management systems, as needed
- Ease of updating final product

Ultimate selection was based on the ability to produce multiple types of lessons with increased student interaction, minimal resource utilization, and accessibility across platforms and browsers. NASA selected four key software technologies from this field—Accordent PresenterPlus, Articulate Studio Pro, TechSmith Camtasia, and Adobe E-Learning Suite. In combination, the various features provide the team with the means to create state-of-the-art e-learning technology.

Training content for the online lesson prototypes was selected based on the existing needs of the student community, the desire to showcase multiple types of online training, and the potential for highlighting increased student interactivity in an online format. Certain content lends itself to online training, such as high-

level overviews of technical information, information that is global to multiple or extensive student populations, introductory hardware or “show and tell” lessons, and simple training scenario lessons that can be filmed on location (i.e., in mock-ups or simulators) with relative ease. Content that is more specialized, skill-based, or that requires hands-on interaction will not lend itself as easily to online training technology. Since MOD training flows incorporate a mixture of content, the proof of concept relies on the integration of these online lesson prototypes with traditional training to result in a successful blended-learning approach.

The chosen content for the online training prototypes will be developed in two training flows. The first flow consists of a series of introductory emergency strategy and hardware lectures and emergency procedural scenarios, intended to be used for International Space Station international partners and flight controllers, with the

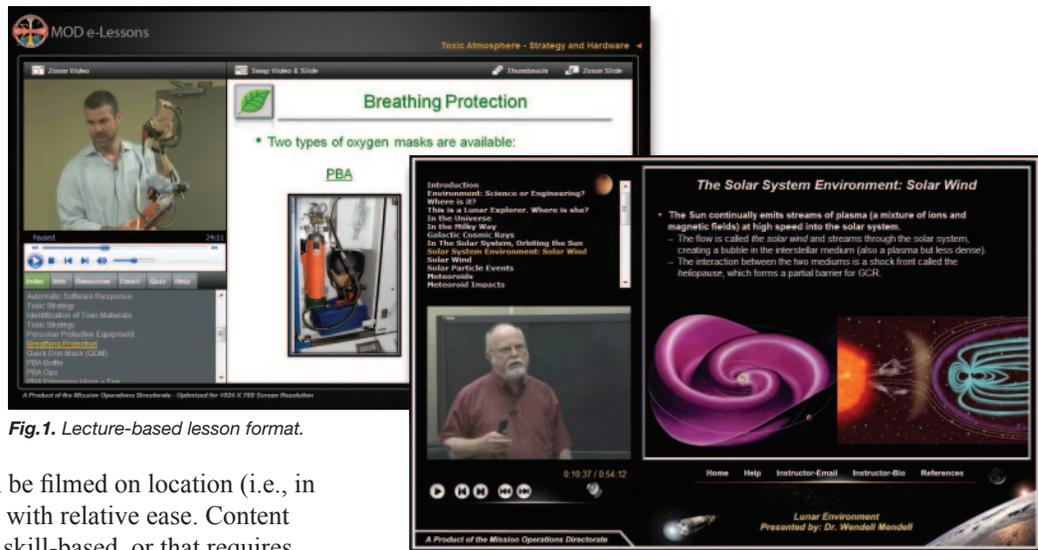


Fig. 1. Lecture-based lesson format.

potential for expansion to additional student populations. The second flow is a combination of introductory information regarding proper evaluation and feedback techniques, as well as self-guided content for introducing flight controller and instructor evaluation forms and terminology to certifying peer evaluators.

The training content is produced in two distinct types of online lesson prototypes: lecture-based and modular-based. The lecture-based lessons provide an online experience that allows the student to view the instructor and presentation material as if they were in the classroom. The online incorporation of the familiar instructional environment allows the student to feel at ease and offers vital visual cues from the instructor, as well as system hardware “show-and-tell” activities (figure 1). The modular-based lessons provide an opportunity for students

to learn the content at their own pace, without requiring an instructor as a guide. These lessons emphasize student interaction and are also useful for presenting scenario-based content that may incorporate multiple elements (figure 2).

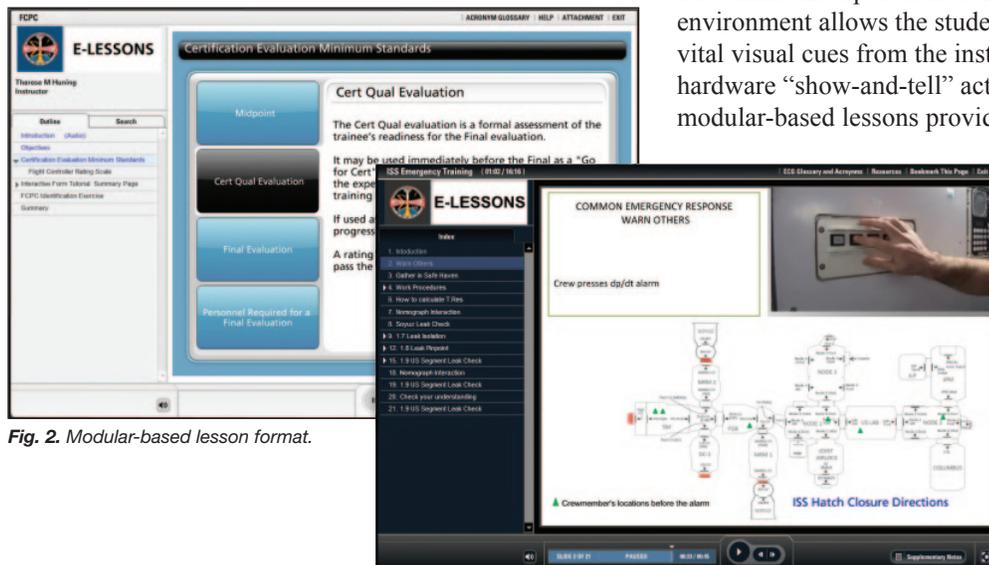


Fig. 2. Modular-based lesson format.

## Next-Generation Spaceflight Training for Mission Operations

continued

**FCPC Identification Exercise**

CIO identifies and confirms the source of a warning. She tells Flight there is no action for the crew and gives him a brief explanation of what has happened. She tells Flight it will take her 10 minutes to assess the impacts and have a recovery plan. In 10 minutes, she gives Flight all the information he needs relative to the vehicle/system and mission objective impacts. CIO also presents the plan she wants to execute. Flight gives her a 'Go' to initiate her plan.

- Problem Recognition and Resolution
- Console Management
- Attitude, Effort and Integrity
- Systems Knowledge

**Exercise Feedback**

Good Answer: There are elements of Systems Knowledge evident. CIO applies systems knowledge to maintain and operate the vehicle when she identifies and confirms the source of a warning, gives Flight an explanation of what happened, identifies the impacts and develops a recovery plan. CIO also demonstrates awareness of systems expertise; however there is not enough information in the scenario description to determine if it is hardware, software or both. *There is a better answer.*

Try Again

**Fig. 3.** Exercise from prototype flight controller performance criteria (FCPC) modular lesson.

Both types of lessons include interactive exercises and quizzes for increased student comprehension and retention, which is key to implementing this technology in MOD training flows, where crew and vehicle safety is paramount (figure 3). The lesson prototypes also feature the following: the capability to e-mail questions to the instructor or subject matter expert; an interactive table of contents to navigate to different sections of the lesson for review; reference material libraries; notes pages that can also serve as closed-captioning; and an interactive glossary of terms and acronyms. Efforts to produce bilingual online lessons have also been successful, and, although there are no bilingual lesson prototypes for this current proof of concept, the team expects to continue to carry this capability into the next generation of online training for the benefit of international partner training content.

Production of these lesson prototypes is currently ongoing. The team is taking a phased approach in implementing the online lessons. The first phase of implementation, in April 2011, included an initial set of lecture- and modular-based lessons from the evaluation training flow, which were provided to a relatively small audience for a preliminary review of the prototype formats in addition to new content. The majority of the emergency training flow is slated to be delivered in summer 2011, and will incorporate the lessons learned from the first implementation phase. This second phase will also include a sufficient mix of both lecture- and modular-based lessons delivered to a wider audience. The final phase will include remaining evaluator and emergency content. In this last phase of implementation, MOD flight controller and instructor students will have an opportunity to experience the fully developed, blended-learning training concept for the evaluator flow—a key step in the proof of concept. All phases of implementation incorporate student surveys to rate the effectiveness, ease of use, and the overall “likeability factor” of this prototype technology, and to request suggestions for improvement.

The success of this concept of training will be measured qualitatively via the student survey feedback and quantitatively by accounting for prototype production time and resource savings estimated from tracked lesson usage. Student comprehension, as measured informally by captured lesson quiz performance data, will also be factored. Based on the initial achievements in the first phase of implementation and the continued, measured advancement in the development of this next generation of training technology, the Distance Learning team is anticipating the launch of a new era of heightened convenience, efficiency, and efficacy in MOD spaceflight training.