

Learning Technologies Project FY10 Performance Report
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PROJECT DESCRIPTION

NASA's Learning Technologies Project (LT) is a NASA-wide education technology development initiative. LT supports the development of projects that deliver NASA content through revolutionary technologies to enhance education in the areas of science, technology, engineering and mathematics (STEM). Research and development are at the core of the LTP mission. The Learning Technologies Project is part of NASA's e-Education Project and is NASA's educational technology incubator. LTP seeks to enhance formal and informal education in STEM fields with the goal of increasing the number of students in those fields of study. The Learning Technologies Project combines the talents of educators, industry, academia, non-profit organizations and NASA's Mission Directorates to develop educational technologies that enable, empower, and educate learners of diverse backgrounds, characteristics, and abilities. The Learning Technologies project office is located at Goddard Space Flight Center in Greenbelt, Maryland. LT is a NASA-wide initiative with representatives and projects at several NASA Centers and an administrative structure incorporating each of the ten Centers in the decision making process. There are full-time project personnel at GSFC and JSC.

PROJECT GOALS

The LT project goal is to place primary focus on advance use of technologies to help address the Agency goal to increase the completion of STEM degrees and "Strengthen NASA and the Nation's future workforce." The LTPO has established a research and development direction for joint public/private industry-education ventures that target research in games and virtual worlds for learning and training, and supports the overall eEducation Roadmap and existing investment in the area of games and learning. LT's research falls into the three broad categories of games, virtual worlds and cyberlearning (with considerable necessary overlap).

LT has established NASA eEducation Island in the virtual world Second Life. This virtual worlds presence allow LT to support NASA Education projects in using immersive synthetic environments. LT is currently working with representatives from across NASA and other government agencies on research and projects in Second Life. LT will expand those collaborations to take advantage of the opening of Second Life to teens in January 2011. Research continues to explore other virtual world options including OpenSim, ActiveWorlds and Blue Mars.

The Moonbase Alpha game was launched in 2010 as a precursor to the NASA-themed massively multiplayer online STEM learning game (MMO). The MMO will be developed with Astronaut: Moon, Mars and Beyond, LLC with the goal of creating a persistent virtual world game environment that fosters increased STEM learning and career interest. LT will provide access to NASA subject matter experts, fund educational and evaluation teams and facilitate communication and collaboration. While the MMO is in development, LT will leverage the success of Moonbase Alpha with the release of curricular support materials and enhanced access to the game for classroom use.

LT will undertake research in cyberlearning for the purpose of developing a roadmap focused on identifiable trends in education innovation. This research will tap the expertise of digital learning experts at GSFC as well as reports from national educational research organizations.

PROJECTS

NASA-based Massively Multitplayer Online STEM Learning Game Project is an effort to tap the power of virtual world games for the benefit of STEM learning and career exploration. This innovative project is being developed partnership with the IPP Office using a multi-agreement, coordinated approach:

- **Developer Space Act:** In FY10 a non-reimbursable space act agreement was signed with Astronaut: Moon, Mars and Beyond, LLC (Project Whitecard, Wisdom Tools and ARA/Virtual Heroes).
- **Education Cooperative Agreement:** A team lead by Challenger Learning Centers was selected to bring instructional design and educational expertise to the MMO project.
- **Subject Matter Experts:** Subject Matter Experts (SME) will be recruited from across the agency to work with the development and education teams on MMO content.
- **Evaluation Cooperative Agreement:** SRI was selected to perform independent evaluation of the effectiveness of the MMO. SRI will study the effectiveness of Moonbase Alpha to develop instrument to apply to the MMO.

MoonBase Alpha was developed as a proof of concept demonstration game to show that NASA content (Lunar Architecture) could be combined with a state-of-the-art game engine (Unreal Engine 3) to create and engaging game that is commercial quality, inspirational and fun. The game has been downloaded more than 220,000 times since its release in July 2010.

- **Maintain Community:** An active Moonbase Alpha community is supported through discussion boards at Steam and a Facebook page. Community members including teachers and students are engaged and supported through those sites.
- **Expand Accessibility:** In FY11, LT plans to develop a non-Steam based version of Moonbase Alpha to make access easier for users in environments with download restrictions. The possibility of creating additional scenarios for the game will be explored.
- **Curricular Materials:** Support materials for using Moonbase Alpha with students in class will be developed in FY11. A team of FIRST engineers and scientists is working with teachers at LARC on the project.

eEducation Roadmap: Support the continued dissemination and use of the eEducation strategic research roadmap identify key eEducation research questions and technical requirements. Continue to build networks and partnerships across NASA, with other Federal agencies and commercial and academic organizations in the area of virtual worlds. In FY11, a new roadmap will be developed and expanded to include cyberlearning, mobile computing devices to existing focus areas.

Virtual Worlds: LT maintains NASA eEducation Island as an outpost in the virtual world Second Life. The island facilitates LT virtual worlds research and acts as launching point for supporting other NASA education efforts seeking to engage the VW community. In FY10, LT supported the LRO/LCROSS missions, Classroom of the Future, INSPRIRE and Informal Education's Miami Science Center Teen Expo in Second Life.

Cyberlearning/Distance Learning Events: Leverage the capabilities of internet based cyberlearning technology and resources from the NASA-DLN to produce single-event STEM focused immersive interactions with schools and universities that support EPO goals and outcomes of NASA missions agency-wide.

PROJECT BENEFIT TO OUTCOME

The NASA-based massively multiplayer online STEM learning game project will eventually contribute to Outcome 2 in the area of providing NASA resources for students. The project currently benefits Outcome 2 in the following areas:

2.3.3 Number of approved materials that are electronically accessible

2.3.4 Customer satisfaction data regarding relevance of NASA educational resources.

2.3.5 Customer satisfaction data regarding effectiveness of NASA educational resources.

2.3.6 Use of technology to improve data collection, reporting strategies & dissemination

In addition, projects address objectives 1.1, 1.3 and 3.1 and PART measures regarding the number of individuals reached through eEducation media.

PROJECT ACCOMPLISHMENTS

Learning Technologies worked closely with the Innovative Partnerships Program Office to craft an original strategy for finding a partner to develop a NASA-based massively multiplayer online STEM learning game. A non-reimbursable space act agreement was signed with Astronaut: Moon, Mars and Beyond, LLC in FY10. The MMO project continues to draw press attention in both print and web media. To date, more than 100 articles have appeared about the project in education, science and game magazines and blogs.

LTP funded .1 FTE at each NASA Center.

The MMO Education CAN awards were made in FY10 to a team lead by the Challenger Learning Centers and SRI.

The Moonbase Alpha release was a critical success in terms of numbers of downloads and reviewer and player responses. With 220,000 downloads in the first three months from release, it ranks in the top 10% of games (90% of released games never reach more than 50,000 players). Moonbase Alpha has generated more than 100 articles in print, web, radio and video media.

Emphasizing LT's infrastructural role, the LT virtual worlds team at JSC was able to support several other Education and Mission Directorate projects come online in Second life in FY10. LRO/LCROSS, COTF and NASA Glenn, INSPIRE and Informal Education's Miami Science Center Youth Expo each developed a presence in Second Life with support from LT.

LT work in virtual worlds was recognized in the publication of the chapter, *Making the case for MUVES in education* in a volume on multi-user virtual environments in school from IGI publishing in October 2010. The LT virtual world research lead has been invited to give the keynote address at the 2011 Immersive Media Summit in Boston.

With an investment in Elluminate eLearning and collaboration technology, along with leveraging the NASA DLN infrastructure, the LT single event cyberlearning efforts experienced an increase in demand by NASA's missions and directorates. In FY10, the LT DL team produced 25 events that connected

missions and NASA Subject Matter Experts (SMEs) to 477 students, 99 K-12 teachers and 12 university faculty nationwide. The events supported the increase of STEM engagement and motivation goals of SMD, ESMD and Engineering Directorates. Event partners included LCROSS, Earth Science Week, and the Solar Dynamics Observatory Pre-Launch.

PROJECT CONTRIBUTIONS TO PART MEASURES

Individuals reached through NASA eEducation Resources:

The Learning Technologies website:

- 845,171 Web Hits
- 1000% increase over FY09

NASA eEducation Island in Second Life

- 12788 Second Life visitors
- 12% decrease from FY09
- 15.27 minutes average visit

Moonbase Alpha

- 220,000 downloads
- 36 minutes average engagement time

Efficiency

- \$0.66 per interaction*
- 95% reduction from FY09

**Interaction cost is calculated using the NETS method of dividing the total number of interactions by the full project budget.*

IMPROVEMENTS MADE IN THE PAST YEAR

Learning Technologies continued to work very closely with the Innovative Partnerships Program Office and the Legal Patent Office and General Counsel's Office at GSFC to develop a non-reimbursable space act agreement to develop a NASA-based massively multiplayer online STEM learning game. The concept and approach are both innovative and the process has required an extensive amount of interaction between the offices involved in this pioneering effort. LT worked closely with the Summer of Innovation team to develop and award an SOI non-reimbursable space agreement solicitation in FY10. The successful release of Moonbase Alpha led to a tenfold increase in the number of page views at <http://www.nasa.gov/education/LT>. That traffic resulted in LT being the top ranked NASA Education page in the last quarter of FY10. With the signing of the MMO SAA, the awarding of the MMO research CAN's and the development and release of MBA, LT made significant strides in FY10 towards obtaining publishable outcomes for the eEducation research roadmap which is consistent with a national effort to invest in digital play to advance STEM motivation, engagement and degree completion. The research focus areas and priorities that have begun include:

- 1) Instructional Design – understanding effective motivation, engagement and learning strategies for game play;
- 2) Stimulating Questions and Answering Questions – how to take advantage of the benefits offered by emerging technologies to facilitate inquiry and get questions answered.
- 3) Feedback and Assessment – the learning environment that identifies errors, corrects them and allow the learner to proceed to mastery.

- 4) Building Simulations and Synthetic Environments - how to build complex virtual environments that reflect current understanding of physics, chemistry, biology, mathematics, and other disciplines that permit exploration based pedagogy.

The investment in Elluminate eLearning technology made NASA content more accessible to more classrooms than ever before. Its easy to install and use properties has facilitated a considerable increase in access to students, teachers and faculty seeking NASA resources to support their STEM education goals.

PROJECT PARTNERS

- Virtual Heroes/ARA, Project Whitecard and Wisdom Tools have signed a non-reimbursable space act agreement with LT and IPP to develop the NASA-based massively multiplayer online STEM learning game *Astronaut: Moon, Mars and Beyond*. In FY10 the team shared contacts, information and exhibit space and materials.
- Valve, the owner of the Steam game distribution and support network. LT has an agreement with Valve to distribute Moonbase Alpha.
- The JSC Learning Technologies team on all elements of Second Life work and research and virtual worlds' accessibility research.
- The GSFC Innovative Partnership Program Office and GSFC Patent Law Office and General Counsel's Office were invaluable partners in the developing and executing the concept of a targeted, non-reimbursable space act agreement for a solicitation tool for an innovative education project.
- During FY10, the LT project office shared information and insights in the areas of game and virtual world technology with or on behalf of Informal, Formal and Higher Education, the Exploration Systems and Space Operations Mission Directorates, the Digital Learning Network, Classroom of the Future, INSPIRE, Goddard, Langley, Marshall and Ames.
- LT has been working closely with NOAA on virtual worlds research and application in FY10 and co-presented on virtual worlds at the NASA IT Summit in August.
- The Army Game Studio collaborated on the development and public relations surrounding Moonbase Alpha.
- The National Science Teachers Association has begun collaboration with LT this year with an effort to leverage NASA eEducation resources with their professional development activities.
- The Challenger Center for Space Science Education has joined the LT team with a Cooperative Agreement to engage teachers and students throughout their network with our MMO STEM education research.
- SRI, a world renown institution for evaluation has joined the LT team with a Cooperative Agreement to evaluate our STEM engagement and motivation goals for the MMO along with assessing the learning impacts of the MMO.
- The Air Force Research Lab has pledged collaboration with LT for researching engagement and motivation of STEM for increasing degree completion using virtual worlds and games.