

NASA Learning Technologies



LTP Phase 2 Requirements Specification

Last updated: 20 September, 2004
Revision: 07
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Reviewers¹

Name	Function or Office	Comments ("?" = addressed in)
Dr. Shelley Canright	NASA Education Enterprise Program Executive for Technology & Products	Rev 02 comments ? Rev 03 Rev 03 comments ? Rev 04 Rev 06 comments ? Rev 07
John Entwistle	LT Project Review Committee	Concurs with Rev 01
Ron Fortunato	LT Project Review Committee	Rev 01 comments ? Rev 02
Dr. Ed Landesman	LT Project Review Committee	Rev 01 comments ? Rev 02
Dr. Daniel Laughlin	LT Project Review Committee	Rev 01 comments ? Rev 02
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Introduction

This document presents the universal requirements of the four Learning Technologies projects progressing to Phase 2. All four projects are offered Phase 2 funding subject to, among other factors, their acceptance and continued adherence to these requirements. The requirements have been developed by the LT Project Review Committee and the LT Project Office, and have undergone review by the Review Committee and the NASA Education Enterprise Program Executive for Technology and Products.

This document has been revised (in revision 06) to reflect modified and new requirements for FY 2005, the third and final year of LT Project funding.

Comments or questions on these requirements should be addressed to Patrick Hogan, Learning Technologies Project Director, at Patrick.Hogan@nasa.gov.

Overview

The Learning Technologies Projects develop and refine leading-edge or cutting-edge technologies that are in use within NASA missions and/or projects to enhance the teaching and learning of scientific concepts.

¹ Past reviewers no longer active on the review team are identified by a gray background.

During FY05, LTP will continue its research and incubation of four selected (Phase 2) immersive technologies to include development of a sample investigation using the technologies for appropriate infusion into NASA STEM educational experiences. The intended outcome is to develop a body of technology tools, mostly software, that enable educators and curriculum developers to use these tools to support and build products to teach science and mathematics concepts and topics. *FY05 will mark the final year of funding for these Phase 2 Projects through the Technology & Products Office.*

LTP is intended to directly respond to **Outcome 6.4.1 Education Technology Research & Development** — *Identify and implement four new advanced technology applications that will positively impact learning* — and provide evidence supporting the intent of this outcome. The LT Project Office, and all projects funded under LT, are expected to know and follow the Nods as related to information technology (IT). It is NASA policy to ensure that IT and information resources are acquired and managed in a manner that implements the policies, procedures and priorities of the Agency and the federal government. NPD references under e-Education activities include:

- NPD 1382.17 – NASA Privacy Policy
- NPD 2200.1 – Management of NASA Science & Technology Information (STI)
- NPD 2800.1A – Managing IT
- NPD 2810.1A – NASA Information Security Policy
- NPD 7120.5 – Program/Project Management
- NASA Enterprise Architecture
- NASA Public Web Sites Implementation Plan

In August 2004, the LTP was one of 12 major education programs reviewed by an external panel. Major strengths and weaknesses across the evaluation criteria (See Section 1.5 and listed education program operating principles) were identified and communicated to the LT Project Office. It is a requirement of both the LTPO and the LT projects to carefully reflect upon the recommendations made by this panel and to appropriately address them in shaping FY05 annual plans.

1 General Requirements

All Phase 2 LT projects are subject to the following requirements.

1.1 Focus on Core Technology and Componentry

In order to ensure the widest utility of the project's technology, the projects shall focus their phase 2 efforts on developing componentry for use in educational applications or curriculum. To ensure this, and to emphasize the technology's development as componentry, the project's core technology and software deliverables shall be integrated with at least two independently developed educational applications or curriculum. One of these shall be selected by the LT Project Office; the other shall be recruited by the

project's Project Manager. Arrangement for performance of the integration effort is the responsibility of the project team.

1.2 Collaboration with Educational Associates

In order to ensure educational value, educational appropriateness, and alignment with national standards of the project deliverables, the project shall recruit and work closely with one or more experienced educational technology experts familiar with the research and state of the art in the project's educational technology domain. These experts shall guide and assist the project team in its choices of educational material, delivery metaphors and user interface, and with technology evaluation of the project deliverables and the technology those deliverables incorporate. The LT Project Office can assist in recruitment of these experts. (See section 1.3 below.)

1.3 Collaboration with LT Project office

The LT Project Office will make available a technical and planning consultant (currently Tom Gaskins) to assist the project teams with software technology, project planning, and coordination with the Project Office. The office will also assist in locating and recruiting instructional technology consultants to help the project team discover and interpret education technology research that would guide them in their design and deliverable decisions (as described in section 1.2 above). The project manager shall keep these consultants continually apprised of significant decisions, of project status, and of any likelihood of deviations from the project's plans, deliverables or schedule.

1.4 Planning

The project shall collaborate with the LT Office to compose an annual performance plan. This plan shall include a statement of goals and objectives, a comprehensive description of deliverables for the planning year, a schedule, and an evaluation plan to document outcomes and demonstrate progress toward achieving objectives. In addition, both recommendations as presented to the LTPO in the August 2004 program review and the September 2004 LT Project Annual Review are to be addressed in the plan. Specific recommendations as mapped to three of the six education operating principles are:

Customer Focus : There is not enough focus on defining the requirements for application of the technologies. Defining the needs of customers and defining requirements for application of these NASA resources is a major requirement for success of the Learning Technologies program.

Partnerships : LT projects need to leverage partnerships with commercial enterprises and other non-government organizations (NGOs), and network with other NASA programs and projects as supporting resources. The broader leverage that can be obtained through corporate and NGO partnerships will contribute to the sustainability of the projects, add intellectual resources, more fully establish and leverage project(s) value and promote broader distribution and application among other benefits. There is a great need to make a sustained effort to market to relevant target groups.

Evaluation: There is a critical need to put in place mechanisms to capture user feedback and convert this feedback to improve LT systems. Clever technology should not be developed for its own sake. The ultimate issue to address is “do these technologies actually make a difference?” (6.4.1 -- *implement four new advanced technology applications that will positively impact learning*)

The schedule shall include technology and deliverable milestones, as well as the recruitment, incorporation, and review of the educational technology experts. Upon mutual agreement between the project manager and the LT Project Office, this plan and schedule shall become a metric by which the project’s performance is evaluated.

In addition, the project team shall clearly articulate how the plan contributes to the Education Enterprise annual performance goals that support NASA e-Education Objective (6.4) and Outcome 6.4.1 and Agency’s strategic objectives and strategic outcomes for education.

Prior to final LT Project Office approval of annual project plans, those plans shall be completed and approved (email confirmation) by the respective **Center Education Director**, and forwarded to the LTPO no later than November 19. They will be posted November 22 at the NASA Learning Technologies website.

1.5 Portfolio Management

Under the auspices of the Education Enterprise’s Technology & Products Office, the LT Project Office follows a portfolio management approach. This approach includes a rigorous evaluation of Phase 2 projects; periodic progress reports on performance metrics; annual performance evaluations using common criteria; and access to performance information for the entire portfolio. The portfolio management approach will provide information necessary for reallocation of resources; sunsets to projects, if necessary; and ensure a coordinated, non-duplicative set of Phase 2 projects that work together to achieve NASA’s education goals.

The Education Enterprise has established operating principles. Every NASA-sponsored education program or activity is to be developed, implemented and evaluated according to these principles. LT Phase 2 projects shall build their technology tools in keeping with these *Education Program Operating Principles*:

Customer focus	Designed to respond to a need identified by the education community, a customer, or a customer group.
Content	Makes direct use of NASA content, people, or facilities to involve educators, students and/or the public in NASA science, technology, engineering, and mathematics.
Pipeline	Makes a demonstrable contribution to attracting diverse populations to careers in science, technology, engineering, and mathematics.
Diversity	Reaches identified targeted groups.

Evaluation	Implements an evaluation plan to document outcomes and demonstrate progress toward achieving objectives.
Partnership & Sustainability	Achieves high leverage and/or sustainability through intrinsic design or the involvement of appropriate local, regional, or national partners in their design, development, and dissemination.

1.5.1 Monthly Status

By the final Wednesday of each month, each project shall submit to the LTPO a status brief. The brief shall provide explanation within the following four areas and using the following color key and indicators, provide status. In addition, accomplishments for the time period should be listed.

	Green	Yellow	Red
COST- Evaluate how the Project budget is performing (EAC-Estimate At Complete) against the approved Program/Project Plan* budget (BAC-Budget At Complete), and FY Actual versus Planned performance.	Progress according to plan • Meeting management plans or commitments	Area of Concern. • Problem can be resolved within reporting organization.	Significant Problem • Help required beyond the reporting organization to address the problem.
SCHEDULE- Evaluate how the Project schedule is performing to ensure major milestones and the Program/Project delivery date(s) approved in the Program/Project Plan are met.	Progress according to plan • Meeting management plans or commitments	Area of Concern. • Problem can be resolved within reporting organization.	Significant Problem • Help required beyond the reporting organization to address the problem.
Technical Performance- Evaluate how the Project is meeting the requirements that are documented in the approved Program/Project Plan.	Progress according to plan • Meeting management plans or commitments	Area of Concern. • Problem can be resolved within reporting organization.	Significant Problem • Help required beyond the reporting organization to address the problem.
Management Issues- Evaluate management products/processes and other management responsibilities to ensure ability of the Program/Project to meet commitments.	Progress according to plan • Meeting management plans or commitments	Area of Concern. • Problem can be resolved within reporting organization.	Significant Problem • Help required beyond the reporting organization to address the problem.

Monthly status reports are due to the LTPO by the Monday preceding the final Wednesday of each month so this information can be compiled and submitted to the NASA Education Technology and Products Program Office Program Executive (Monday October 25, November 22, December 27, etc)

1.5.2 Quarterly Review

The project shall undergo review each quarter of the project's duration. This review shall be conducted with LT Office staff. The reviews shall consist of a demonstration of the state of the project's technology and deliverables, an assessment of the project's status relative to its schedule, and an evaluation and possible adjustment of the project's direction and deliverables.

A quarterly report shall subsequently be submitted and made available from the LT Project Office internal web site for access by HQ Program Executive for Technology & Products Program Office and others, as identified. These reports are one business week following the end of each quarter (January 7, March 18*, July 7, and October 7). Due to

the semi-annual review of funding, the second quarter report needs to be submitted by March 18.

1.5.3 Semi-annual Review of Funding

Project funding shall be evaluated mid-year (prior to start of third quarter of the fiscal year) relative to the demonstrated performance of the project team and to the educational value of the project's technology. Projects not meeting their deliverables, schedule or other commitments, or whose technology has or is clearly becoming obsolete, or has insufficient alignment with NASA education goals and objectives may have their LT funding reduced or eliminated. (Such a proposed action will be forwarded by the LT Project Office to HQ and acted upon only upon concurrence and/or further direction by the NASA Education Enterprise Program Executive for Technology and Products.)

1.6 Domain-Expert Validation

By March 1, 2005, the project's technology and proposed deliverables shall be formally presented and demonstrated to one or more scientific or technological forums appropriate to the project's topic material. The feedback from these presentations shall be compiled and delivered to the LT Project Office.

1.7 Mission Directorate CIO and Education Officer Review

Project teams shall present their projects annually to the appropriate NASA Mission Directorate Chief Information Officers and Education Officers.

As described in section 1.4 above, annual project plans shall be approved by the Center Education Director of the project team's primary NASA center.

1.8 Lack of Encumbrance on Dissemination

The project deliverables shall not be encumbered by licensing restrictions unacceptable to the LT Project Office. They shall allow public dissemination of object code, data, imagery and electronic models without payment of royalties, other fees, or "share-back" requirements, including those imposed by use of independently developed free or purchased software, hardware, or data.

All source forms of code, data, electronic imagery and models created or caused to be created (i.e., "contracted" or "out-sourced") by the project should be unencumbered for public dissemination. It is recognized that this may not be feasible in all cases, but it should be given high priority in all outsourcing decisions.

1.9 Hardware and Software Target

The project's deliverables shall operate with end-user interactive performance acceptable to the LT Office on personal computers running Windows XP Home and on those computers running Mac OS-X, at the then-current service release of these operating systems. Minimal hardware of these computers is a single 1.5 GHz CPU, 512 MB of RAM, one 40 GB disk, one DVD ROM, 1024 by 768 graphics resolution, and additional graphics or audio hardware each costing no more than \$400 at the time of project

commencement. These requirements are meant to ensure that the project's deliverables will operate acceptably on computer hardware and software purchased today and typically used by students and educators. Operation on Linux is not a requirement.

Run-time requirements shall include only commonly required software, such as an operating system, expected to be present on the user's computer. Accessibility software (e.g., JAWS) may also be required by the project software if the accessibility software is expected to be a normal part of the user's computer environment. Also permissible as run-time requirements are freely available and commonly used software such as a Java virtual machine, .Net run-time, Acrobat Reader, and major-brand media players. Exceptions to this may be made for minimal-cost software, but only with the approval of the LT Office.

The existence at run-time of a high-speed connection to the internet or a local network cannot be assumed, but the project deliverables may provide significantly more functionality in the presence of such connections. If a connection does not exist, the user must be able to utilize a significant subset of the functionality and content.

Deliverables targeted to PDAs shall assume a Pocket PC 2003 or Palm operating system and a device costing less than \$500 in late 2003.

1.10 Integration Feasibility

The developed software technology shall be easy to integrate into independently developed applications by independent software developers. Integration ability shall be programming-language independent, and support at a minimum project-technology clients using that client's choice of either Java, C# or C++ at the then-current versions and development platforms of those languages on Windows XP and Mac OS-X operating systems. XML shall be used to convey data, execution instructions and configuration information whenever appropriate. Existing appropriate and adequate standards shall be used when available.

1.11 Reliability

The project's software deliverables shall be thoroughly tested by the project team or its designee to ensure correct and trouble-free operation and behavior when interoperating with an application and an end-user.

1.12 Documentation

In support of item 1.10 above, the project shall provide professional quality documentation describing to software developers how to use the technology, and fully declaring and explaining the software or hardware interfaces. The documentation shall be accompanied by examples and, as appropriate to each project, a list of available data sources or other content repositories that the technology can operate with.

To the extent a deliverable provides direct, interactive access by a user, professional quality documentation and integrated electronic "Help" shall be provided with the deliverable.

1.13 Registration of Sharable Components and Content

To encourage re-use and discovery of the developed materials, the project shall register its software components, data and educational materials in appropriate public registries and databases. Suitable metadata describing the software shall accompany the registration. XML schemas defined by the project shall be registered with the NASA portal schema registry at xml.nasa.gov, and with other schema registries as appropriate.

1.14 Development Procedures and Mechanisms

The LT Office will establish procedures that projects shall use to protect, share and disseminate their deliverables. The Phase 2 projects shall actively participate in this infrastructure.

1.15 Best Practices for Software Development

The project deliverables shall be continually functional and available for operation on Windows XP PCs and Mac OS-X PCs. The LT Project Office is to possess operational, up-to-date source code, build and install instructions and installation software for all software deliverables. It is the responsibility of the project team to make reasonable efforts to ensure the LT Project Office is kept up-to-date.

1.16 Delivery

The LT Project Office is responsible for arranging intermediate and final dissemination of the project deliverables during the LT funding period. The LT Project Office will establish guidelines and mechanisms that the project shall use to deliver materials to the LT Project Office.

1.17 Deployment Plan and Requirements

During the final LT funding year, the project should demonstrate its usefulness and ability to serve its educational promise. By November 1, 2004 the project team shall form and submit to the LT Office a plan for deployment of its technology and deliverables during FY 2005. The plan shall identify specific educational curriculum or materials that will utilize the project technology during this final funding year.

1.18 Continuation Plan

In order to assess the likelihood that the project's technology and deliverables will be available, supported and usable beyond the LT funding commitment, the project shall form and submit by 1 December, 2004 a plan for ongoing development and deployment of the project technology and deliverables beyond the end of FY 2005. The plan shall identify how the project's technology will be maintained, deployed and supported in deployment, who will perform that work, and the entities that have been enlisted to deploy the technologies in curriculum or educational materials. The LT Office will evaluate the plan to determine whether a full third year of funding is justified relative to the expected long-term support and utilization of the technology.