Title	***Accelerator Controls Infrastructure Upgrades***			
Project Requestor	Ned Arnold			
Date	8/25/08			
Group Leader(s)	Ned Arnold			
Machine or Sector Manager	All			
Category	Obsolescence, Spares, and Upgrades			
Content ID*	APS_1255512	Rev.	2	08/28/2008 9:18 AM

*This row is filled in automatically on check in to ICMS. See Note [1]

Description:

Start Year (FY)	**FY09**	**Duration (Yr)**	**5 years**

Objectives:

Provide urgent upgrades and necessary maintenance to the accelerator control system infrastructure. This includes obsolescence remediation, infrastructure upgrades to keep pace with increasing demands of the technical systems, and evolution of technology to maintain the high availability of the APS Control System. It also involves updating, replacing, or adding several software applications to modernize the software infrastructure. This will eliminate the inefficiencies of maintaining software built on 20-year old technology. Necessary upgrades are distributed over a five-year period to minimize impact to Operations.

Benefit:

Maintain the current operation of the control system, modernize numerous systems for more efficient maintainability, meet the increasing demands of the technical systems, and continue to meet the availability goals of the APS project.

Risks of Project: See Note [2]

This proposal includes upgrades to existing systems, so the requirements of the systems are well known and present minimal risk to the project.

Consequences of Not Doing Project: See Note [3]

If the control system is not adequately maintained, degradation in performance, functionality, and availability can be expected.

Cost/Benefit Analysis: See Note [4]

Description:

The following controls hardware infrastructure items have been identified as needing substantial renovations within the next five years.

Item	FY09	FY10	FY11	FY12
Controlled Access System	60			
Liquid Nitrogen Delivery System Controls	15			
Eliminate Bitbus in SR		120		
Eliminate Bitbus in Injector			30	
Eliminate 680x0 CPU boards			200	200
Additional switches for subnet partitioning		80	10	
LINAC Timing System	30			
Timing Systems				100
Event system				100
Next generation hardware platform R&D	25	25	25	
Embedded controls; tools & R&D	25	25	25	
Oscilloscopes for Ops support	50	50		
Application servers (ctlappsxxx, ctlrdpxxx, gateways, etc)			40	
Lab/Office Equipment	90	50	100	
M&S to support software infrastructure upgrade	100	100	25	25
Sub-total (untaxed)	395	450	505	425
Total (estimated w tax of 13%)	**446**	**509**	**571**	**480**

Software becomes obsolete just like hardware. A substantial investment is needed to update our controls software Infrastructure and tools to bring them in line with other modern facilities and to ensure cost-effective maintainability and ease of extensibility for the future. In addition to rewriting some critical tools, new applications are envisioned that will greatly enhance the operational support of the accelerator. Listed below are some of the major initiatives required to properly support accelerator operations for the next 10-15 years:

• Motif-based GUI applications: Motif is the graphics library used for our major graphical tools (medm, alh, StripTool, etc) and these are becoming increasingly difficult to maintain due to our continued use of this outdated technology. About 14 control-room applications will need to be retired, replaced or rewritten using modern standards and technology.

• MATLAB Integration: MATLAB, a numerical computing environment and programming language, has become a universally recognized tool for scientists and engineers. MATLAB's rich toolset and computational capabilities satisfy many routine control requirements that previously would have required the development of custom applications. Integrating MATLAB (or equivalent) into the APS Controls Framework will make this capability conveniently available for general use.

• Process Variable Naming Convention: Over the years, the naming of our process variables has degraded to an almost un-maintainable level. Conventions, tools, and procedures must be developed to bring some consistency to this critical issue. This must be done in a way that will not interfere with operations yet will yield the desired outcome.

• Accelerator-Wide Knowledge Base: To continue to meet our very stringent downtime budgets with aging accelerator components, a knowledge base that encompasses all of the technical systems of the accelerator will be a valuable tool. Such a knowledge base will capture "routine" expertise from subject matter experts and make it conveniently available for expedient fault recovery and optimization of machine performance.

• RTOS roadmap: Since the APS chose VxWorks as our primary real-time operating system (1990), several other options have become available that could reduce the annual maintenance costs yet provide equivalent performance and features. An effort to evaluate the feasibility of switching to another RTOS should be undertaken.

• EPICS Base: There is a substantial list of needed enhancements to EPICS base that have lacked the necessary resources to get them completed. Some of these will be needed to implement other items on this list. These enhancements will improve the capability, efficiency and maintainability of the hundreds of EPICS-based applications that must be supported for the life of the APS.

• IRMIS: Our Integrated Relational Model of Installed Systems continues to provide easy access to the vast amount of information about the hardware and software deployed at APS. Since this tool came along after the initial construction of APS, there are numerous enhancements necessary for it to become a truly exhaustive description of the entire control system. Two major enhancements are the inclusion of cables and the description of each connector on each component. Such capabilities will assist in minimizing the mean-time-to-repair when critical systems fail, an occurrence that must be planned for due to the aging accelerator facility.

Funding Details

Cost: ($K)
Use FY08 dollars.

Strategic Project Proposal
Funding Details
FY 08 $

Cost ($k)

Year	AIP	Contingency
1	446	15%
2	509	15%
3	571	15%
4	480	15%
5		

Contingency may be in dollars or percent. Enter figure for total project contingency.

Effort: (FTE)
The effort portion need not be filled out in detail by March 28

Year	Mechanical Engineer	Electrical Engineer	Physicist	Software Engineer	Tech	Designer	Post Doc	Total
1		1		4	0.5			5.5
2		1		4	0.5			5.5
3		1		4	0.5			5.5
4		1		4	0.5			5.5
5		1		4	0.5			5.5
6								0
7								0
8								0
9								0

Notes:

[1] **ICMS**. Check in first revision to ICMS as a *New Check In*. Subsequent revisions should be checked in as revisions to that document i.e. C*heck Out* the previous version and C*heck In* the new version. Be sure to complete the *Document Date* field on the check in screen.

[2] **Risk Assessment.** Advise of the potential impact to the facility or operations that may result as a consequence of performing the proposed activity. Example: If the proposed project is undertaken then other systems impacted by the work
include ... (If no assessment is appropriate then enter NA.)

[3] **Consequence Assessment.** Advise of the potential consequences to the facility or to operations if the proposal is not executed. Example: If the proposed project is not undertaken then ____ may happen to the facility. (If no assessment is appropriate then enter NA.)

[4] **Cost Benefit Analysis.** Describe cost efficiencies or value of the risk mitigated by the expenditure.

Example: Failure to complete this maintenance project will result in increased total costs to the APS for emergency repairs and this investment of ___ will also result in improved reliability of ____. (If no assessment is appropriate then enter NA.)