

<b>SUBJECT:</b>	<b>FERMILAB RESEARCH ALLIANCE PROJECT MANAGEMENT</b>	<b>NUMBER:</b>	12.PM-001
<b>RESPONSIBILITY:</b>	<b>Office of Project Support Services</b>	<b>REVISION:</b>	4.1
<b>APPROVED BY:</b>	<b>Head, Office of Project Support Services</b>	<b>EFFECTIVE:</b>	<b>7/6/2016</b>
<b>TITLE</b>	<b>Project WBS, OBS, RAM</b>		

## 1.0 PURPOSE

This procedure provides guidelines and formats for the development of the project Work Breakdown Structure (WBS), WBS Dictionary, Organizational Breakdown Structure (OBS), and Responsibility Assignment Matrix (RAM). The WBS subdivides and logically organizes the entire project scope into its component elements to establish a framework for effective management control of the project's scope, schedule, and budget. The WBS Dictionary is a set of specific definitions that describe the scope of each work element identified in the WBS. The OBS is a project organization framework for identification of accountability, responsibility, management, and approvals of all authorized scope. The RAM integrates the organizational structure depicted in the OBS with the work structure depicted in the WBS, establishing ownership of the work.

## 2.0 SCOPE

The scope of this procedure is to describe these project tools and provide guidelines for their development. All projects using the Fermi Research Alliance, LLC (FRA) Earned Value Management System (EVMS) must have a WBS, WBS Dictionary, OBS, and RAM.

## 3.0 RESPONSIBILITIES

### 3.1 Project Manager (PM) is responsible for

- establishing project requirements and criteria
- developing the project work scope by using appropriate design and engineering resources to create a technical description
- working with the Control Account Managers (CAMs) and functional line management to identify the resources for the project
- defining the WBS, WBS Dictionary, OBS, and RAM for the project for internal control and for external reporting
- maintaining the WBS, WBS Dictionary, OBS, and RAM as controlled documents
- ensuring the preparation of drawings, specifications, procurement documents, installation and test instructions, and other documents to establish and record the project configuration, including as-built documentation
- storage and management of documents listed above
- providing project office staff for executing project controls systems referenced in this procedure

### 3.2 Project Controls Specialist (PCS) is responsible for

- advising CAMs and PM of FRA EVMS requirements to ensure the project is compliant

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## 4.0 PROCEDURE

### 4.1 Work Breakdown Structure (WBS)

The project WBS is a product-oriented grouping of work elements that organizes and defines the total scope of the project. The WBS is a multi-level framework that organizes and graphically displays elements representing the work to be accomplished in logical relationships. Each descending level represents an increasingly detailed definition/division of a project component. The WBS is the structure that integrates and relates all project work (technical, schedule, and budget) and is used throughout the lifecycle of a project to identify, assign, and track specific work scopes. The WBS is created to the level required by the PM to plan and manage the project. In the Project Execution Plan, the agreed level of detail for scoping and reporting with the customer is defined. Each project will have a WBS unique to that project. A sample Work Breakdown Structure can be found in Appendix C.

#### 4.1.1 WBS Development Process

WBS development at Fermilab will take into account the following:

- The WBS provides the framework for the scope, schedules, and budgets. It includes the entire scope of the project. The WBS does not include scope outside the baseline.
- The WBS contains product-oriented or services-oriented elements, which are successively subdivided into increasingly detailed and manageable work products or elements.
- Each WBS element represents an aggregation of all its subordinate elements. Valid WBS elements have a specific output (i.e., product or service), discernible beginning and ending dates, and assigned resources.
- The WBS has elements that can be assigned to individual managers who will be responsible for the planning and control of the scope represented by each of these elements.
- The WBS is coded so that cost, schedule summarization, and roll-ups are possible from the work package level to the Control Account (CA) level, and to each higher-level WBS element such that the sum of all elements equals the total project.
- The WBS consists of a number of levels and extends to at least the CA level. During initial development, CAs may not yet be defined. This guidance is meant to apply to the completed WBS at the end of the planning process.
- The total project will be referred to as level 1 in the WBS.
- At its upper levels, the WBS can have lifecycle-phase elements (i.e., initiation, definition, execution, and transition/closeout) to allow for the close-out of completed work at a high level in the WBS. In the DOE system, these lifecycle phase elements can align with specific Critical Decisions (CD).
- At its upper levels, the WBS has elements designated for reporting performance data to the funding agencies.
- All of the items appearing on the WBS are traceable to items on the project schedule.
- The WBS includes elements at the control account (CA) level for major subcontracted efforts.
- The WBS does not include contingency since this does not represent project work.

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**4.2 WBS Dictionary:** The WBS Dictionary is a set of specific definitions that describe the scope of each work element identified in the WBS. It defines each element in terms of the content of the work to be performed. The WBS Dictionary also documents or references the relevant requirements that pertain to this element. The WBS Dictionary demonstrates that the scope of work for the project and the WBS are fully reconciled. Each project will have a WBS Dictionary unique to that project. A sample WBS Dictionary can be found in Appendix C. This format is not required, but the information contained must be included in any format used.

**4.3 Organizational Breakdown Structure (OBS):** The project OBS is a functionally oriented division of the individuals and organizations responsible for performing the work on a specific project. The OBS is an organizational framework used for identifying accountability, responsibility, management and approvals of all authorized work scope. The OBS helps management focus on establishing the most efficient organization to perform project work scope by taking into consideration availability and capability of management and technical staff, including subcontractors, to achieve the project objectives.

The OBS identifies the organization responsible for completing each major segment of work. The assignment of lower-level segments to responsible managers provides a key control point for management purposes.

Major subcontractors are to be included in the OBS in addition to internal project organizations. A major subcontractor is defined as a subcontractor with contractual EVMS flow-down requirements, i.e. responsible for more than \$20M, and not a firm-fixed-price subcontract.

Each project will have an OBS unique to that project. A sample OBS can be found in Appendix D.

**4.4 Responsibility Assignment Matrix (RAM):** The RAM is an essential element of the project plan that integrates the organizational structure defined in the OBS with the scope of work outlined in the WBS. The RAM establishes ownership of the work depicted in the WBS by linking the WBS and the OBS. The intersection of the WBS and OBS, as shown on the RAM, is the CA. EVMS RAMs will identify the CAMs for these intersection points by name, but the CAMs organizational affiliation is not required on the RAM. The intersection point will also include the Budgeted Cost of Work Scheduled (BCWS), resulting in a “dollarized RAM.” The sum of the CAs will total the total project BCWS. Each project will have a RAM unique to that project. Sample RAMs can be found in Appendix E.

**4.5 Development Process:** The PM will identify the staff resources and the organizations necessary to participate in the planning and execution of the project. The PM will seek agreement with the line management of these organizations as to their role and extent of involvement, based on initial project requirements. The PM will then assemble the project team and develop the project’s OBS and RAM. The assignment of CAMs, as required to complete the RAM, will be with the concurrence of line management. For purposes of the project organization, all CAMs report to the PM.

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**5.0 REFERENCES**

DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*  
*FRA Earned Value Management System Description*  
 EVMS Procedure 12.PM-002, *Control Accounts, Work Packages, Planning Packages*

**6.0 APPENDICES**

- 12.PM-001A:** Appendix A: Signature Page and Revision History
- 12.PM-001B:** Appendix B: Acronyms and Glossary
- 12.PM-001C:** Appendix C: Work Breakdown Structure (WBS) and Dictionary– Sample
- 12.PM-001E:** Appendix D: Organizational Breakdown Structure (OBS) – Sample
- 12.PM-001F:** Appendix E: Responsibility Assignment Matrix (RAM) – Sample

**Appendix A**  
**SIGNATURE PAGE AND REVISION HISTORY**

This procedure approved by:



7/5/16

**Marc Kaducak**  
**Acting Head, Office of Project Support Services**  
**Fermi National Accelerator Laboratory**

**DATE**

**TABLE OF REVISIONS**

Author(s)	Description	Revision	Date
	Initial Version	0	10/17/08
E. McCluskey	In Appendix B changed the definition of Control Account and added a definition for Control Account Manager.	1	12/02/08
E. McCluskey	Revised OBS definition	2	03/27/09
M. Kaducak	Updated DOE O 413.3A to DOE O 413.3B Added section on major subcontractors to Section 4.3 Changed title blocks from OPMO to OPSS, Used more recent examples in Appendices C-E	3	08/18/13
R. Marcum	Added PCS responsibility and clarification on what is a major contractor. Updated RAM and OBS examples appendix.	4	12/18/15
R. Marcum	Clarified what a major contractor is per consensus of HEP laboratory workshop, added another example of RAM, and other minor updates.	4.1	7/6/16

## Appendix B ACRONYMS AND GLOSSARY

**BCWS** — Budgeted Cost of Work Scheduled

**CA** — Control Account

**CAM** — Control Account Manager

**CD** — Critical Decision

**DOE** — U.S. Department of Energy

**EVMS** — Earned Value Management System

**FRA** — Fermi Research Alliance, LLC

**OBS** — Organizational Breakdown Structure

**PCS** — Project Controls Specialist

**PM** — Project Manager

**RAM** — Responsibility Assignment Matrix

**WBS** — Work Breakdown Structure

**Contract** - A contract is a mutually binding agreement that obligates the seller to provide the specified product and obligates the buyer to pay for it.

**Contractor** - An individual, partnership, company, corporation, or association having a contract with a contracting agency for the design, development, maintenance, modification, or supply of deliverable items and/or services under the terms of a contract.

**Control Account (CA)** - A key management control point located at the natural intersection point of the WBS and the OBS, where functional responsibility for work is assigned. It represents the point at which budgets (resource plans) and actual costs are accumulated and compared to earned value for management control purposes.

**Control Account Manager (CAM)** – The member of the project team responsible for the performance defined in a Control Account and for managing the resources authorized to accomplish the tasks.

**Critical Decision (CD)** - On DOE projects, a formal determination made by the Acquisition Executive and/or designated official at a specific point in a project life cycle that allows the project to proceed. Critical Decisions occur in the course of a project: at the determination of Mission Need (CD-0), at the completion of conceptual design (CD-1), at project baselining (CD-2), at the commencement of execution (CD-3), and at turnover (CD-4).

**Project** - In general, a unique effort that supports a program mission; has defined start and end points; is undertaken to create a product, facility, or system; and contains interdependent activities planned to meet a common objective or mission. A project is not constrained to any specific element of the budget structure (e.g., operating expense or plant and capital equipment). Construction, if required, is part of the total project. Projects include planning and execution of construction, renovation, modification, environmental restoration, decontamination and decommissioning efforts, and large capital equipment or technology development activities. Tasks that do not include the above elements, such as basic research, grants, ordinary repairs, maintenance of facilities, and operations, are not considered projects.

**Project Execution Plan (PEP)** - The plan for the execution of the project, which establishes roles and responsibilities and defines how the project will be executed. Every project implementing Earned Value management will have a unique project execution plan.

**Schedule** - A plan that defines when specified work is to be done to accomplish program objectives on time.

**System** - A collection of interdependent equipment and procedures assembled and integrated to perform a well-defined purpose. It is an assembly of procedures, processes, methods, routines, or techniques united by some form of regulated interaction to form an organized whole.

**Work Breakdown Structure (WBS)** - A product-oriented grouping of project elements that organizes and defines the total scope of the project. The WBS is a multilevel framework that organizes and graphically displays elements representing work to be accomplished in logical relationships. Each descending level represents an increasingly detailed definition of a project component. Project components may be products or services. It is the structure and code that integrates and relates all project work (technical, schedule, and cost) and is used throughout the life cycle of a project to identify and track specific work scopes.

**Work Breakdown Structure Dictionary** - A listing of work breakdown structure elements with a short description of the work-scope content in each element.

**Work Package** - A task or set of tasks performed within a control account.

## Appendix C

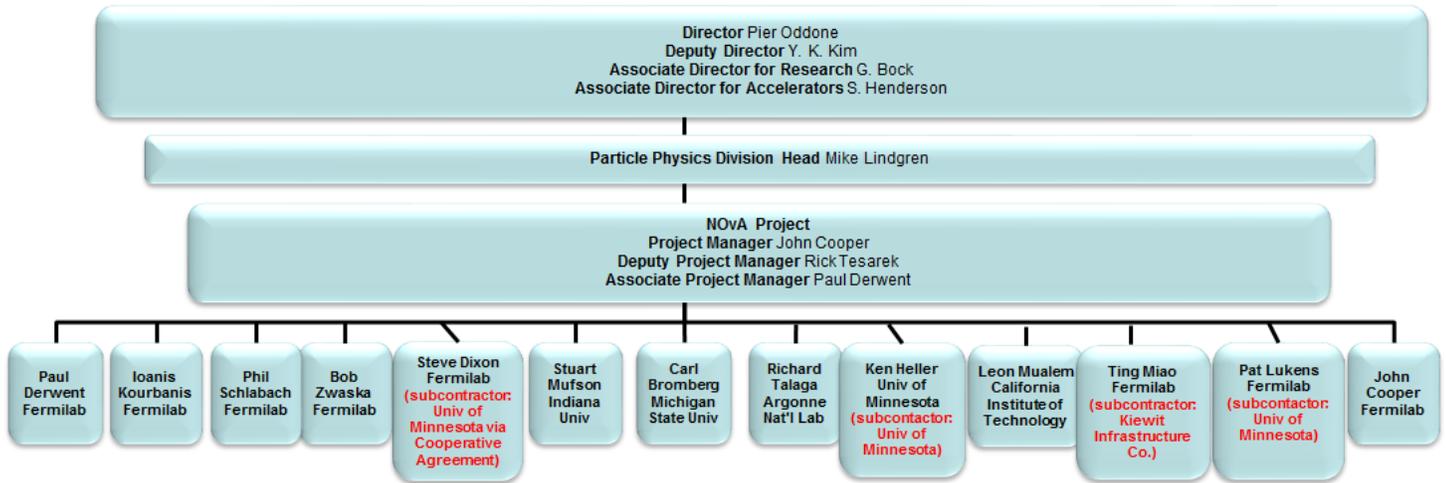
### EXAMPLE OF WBS AND DICTIONARY (OUTLINE FORMAT)

This example is a representation of part of the LBNE WBS. WBS elements 130.01 through 130.05 are only shown to WBS level 2. WBS element 130.06 has been expanded to WBS level 5 to show additional detail in this area.

WBS Element #	WBS Element Name	WBS Description
130	LBNE	LBNE project will construct a 700-kW beamline and Muon detector on the FNAL site and build a large surface liquid argon detector with associated cryogenics system as a far detector at Sanford Underground Research Facility in South Dakota, all with required conventional facilities.
130.01	Project Office	Staff labor assembled in the Project Office, who administer and manage activities that encompass the entire project, such as liaison with DOE and Laboratory management, project management, reporting, regulatory compliance, quality assurance, risk, budget, document management, safety, project controls, etc. Also included is M&S and travel to support the staff and the office functions, as well as M&S for project-wide activities such as contracting for the NEPA process
130.02	Beamline	Includes all phases of design, procurement, construction, installation, commissioning, and testing of the LBNE Beamline at Fermilab. The conventional, horn-focused neutrino beam shall be of sufficient intensity and appropriate energy to meet the goals of the LBNE project with respect to Long-Baseline neutrino-oscillation physics
130.03	Near Detector Systems	Includes management, systems engineering and integration support, design, procurement, installation and testing, and commissioning of the Near Detector Complex.
130.04	Water Cherenkov Detector - Conceptual Design	Conceptual design of a Water Cherenkov Detector (WCD) in an underground cavern at a site ~1300 km from Fermilab
130.06	Conventional Facilities	Includes all phases of design, procurement, installation and construction of facility improvements necessary to support the projects technical components including the Beamline and Far Detector. This includes all site improvements, tunnels, halls, service buildings and caverns at Fermilab and the Far Site
130.06.01	CF Project Management	Management oversight for all conventional facilities for LBNE including L2 manager's burdened cost, Deputy L2 manager's burdened cost & all travel associated with conventional facilities.
130.06.02	CF - Near Site	All conventional facilities necessary to support the Near Site.
130.06.02.01	CF NS - Project Management	Near site L3 project management team to manage the design, engineering, procurement, construction, inspection, commissioning, and startup of the conventional facilities. Interface with other system managers to coordinate system requirements, safety, environmental, and financial issues including Earned Value Management System (EVMS).
130.06.02.02	Conceptual Design	All conceptual design and engineering for the near site conventional facilities including: all project infrastructure; site infrastructure and service buildings for LBNE 5, Target Complex (LBNE 20), and LBNE 30; and tunnels & halls for the Extraction Enclosure, Primary Beamline Enclosure, the Decay Tunnel, and the Absorber Hall.
130.06.02.03	Preliminary Design	All preliminary design and engineering for the near site conventional facilities including: all project infrastructure; site infrastructure and service buildings for LBNE 5, Target Complex (LBNE 20), and LBNE 30; and tunnels & halls for the Extraction Enclosure, Primary Beamline Enclosure, the Decay Tunnel, and the Absorber Hall.
130.06.02.04	Final Design	All final design and engineering for the near site conventional facilities including: all project infrastructure; site infrastructure and service buildings for LBNE 5, Target Complex (LBNE 20), and LBNE 30; and tunnels & halls for the Extraction Enclosure, Primary Beamline Enclosure, the Decay Tunnel, and the Absorber Hall.
130.06.02.05	Construction	All construction, construction management, construction observation, and commissioning for the near site conventional facilities.
130.06.02.05.01	CF NS Construction Management	Construction Management and additional FESS support for the oversight of construction, construction observation, and commissioning for all near site conventional facilities for LBNE during the construction phase. This also includes Disputes Review Board, owner provided QC services, A/E services during construction and FESS staff augmentation.
130.06.02.05.02	Project Infrastructure	Construction and commissioning for project infrastructure and site work not specific to the Primary Beamline Enclosure/Extraction Enclosure, LBNE 5 site, Target Complex (LBNE 20) site, and LBNE 30 Absorber site.
130.06.02.05.03	Site Infrastructure & Service Buildings	Construction, outfitting, and site work of the Service Buildings at the Near Site.
130.06.02.05.03.01	LBNE 5	Site work, site access road, service / support buildings, and infrastructure directly associated with, and in close proximity to, the LBNE 5 site. This includes all surface and near surface structures, utilities, and site work.
130.06.02.05.03.02	Target Complex (LBNE 20)	Site work, site access roads, service / support buildings, and infrastructure directly associated with, and in close proximity to, the Target Complex (LBNE 20) site. This includes all surface and near surface structures, utilities, and site work.
130.06.02.05.03.03	LBNE 30	Site work, site access roads, service / support buildings, and infrastructure directly associated with, and in close proximity to, the LBNE 30 site. This includes all surface and near surface structures, utilities, and site work.
130.06.02.05.04	Tunnels & Halls	Construction and Outfitting of the underground beamline facilities at the Near Site.
130.06.02.05.04.01	Extraction Enclosure	Construction and Commissioning of the Extraction Enclosure from the MI-10 extraction point of the Main Injector to beyond the Main Injector Shielding zone (Station 4+00).
130.06.02.05.04.02	Primary Beamline Enclosure	Construction and Commissioning of the Primary Beamline Enclosure from the edge of the Main Injector Shielding zone (Station 4+00) to the Target Complex (Station 10+43).
130.06.02.05.04.03	Decay Pipe	Construction and commissioning of the Decay Pipe from the Target Complex to the Absorber Hall.
130.06.02.05.04.04	Absorber Hall	Construction and commissioning of the Absorber Hall. This includes construction of underground enclosures and conventional facility outfitting of these facilities.
130.06.03	Conventional Facilities Far Site	All conventional facilities necessary to support the far site Liquid Argon Detector (LAR) at the Surface.
130.06.03.01	CF FS Project Management	Far site L3 project management team to manage the design, engineering, procurement, construction, inspection, commissioning, and startup of the Liquid Argon Detector (LAR) conventional facilities at the Surface. Interface with other system managers to coordinate system requirements, safety, environmental, and financial issues including Earned Value Management System (EVMS).
130.06.03.02	Conceptual Design	All conceptual design and engineering for the far site Liquid Argon Detector (LAR) conventional facilities at the Surface.
130.06.03.03	Preliminary Design	All preliminary design and engineering for the far site Liquid Argon Detector (LAR) conventional facilities at the Surface.
130.06.03.04	Final Design	All final design and engineering for the far site Liquid Argon Detector (LAR) conventional facilities at the Surface.
130.06.03.05	Construction	All construction, construction management, construction observation, and commissioning for the far site Liquid Argon Detector (LAR) conventional facilities at the Surface.
130.06.03.05.01	CF FS Construction Management	Construction Management and additional construction support for the oversight of construction, construction observation, and commissioning for all Liquid Argon Detector (LAR) conventional facilities at the Surface during the construction phase. This also includes Disputes Review Board, owner provided QC services, and A/E services during construction.
130.06.03.05.02	Site Infrastructure & Service Buildings	Construction of the surface facilities, site work, and infrastructure related to LAR conventional facilities at the Surface.
130.06.03.05.03	Pit Excavation and Construction	Construction of the detector pit and detector hall related to LAR conventional facilities at the Surface.

## Appendix D EXAMPLE OF OBS

This example OBS shows an organizational structure from the Fermilab Directorate to the project's control account managers and supervisory staff.



## Appendix E EXAMPLES OF RAM

These examples of simple RAMs show how the control accounts are intersections of the Project WBS and OBS. The budgets for each CA are shown, making these “dollarized” RAMs.

### USCMS Upgrade Project Responsibility Assignment Matrix (RAM)

December 2015			Control Account Managers										Total BAC	Total Remaining BCWS	
Note: Shown in Dollars			16263N Nahn, Steve	06318V Heintz, Ulrich	15111N Hirschauer, James F	09291V Kubota, Yuichi	04888V Johns, Will	10711N Cheung, Harry	14304N Verzocchi, Marco	12345V Ecklund, Karl	00515V Smith, Wesley H.	07889 Rumerio, Paolo			
Control Account	% Complete	%LOE	BAC												
401.01 Project Management															
In-progress	51%	100%	6,140,944											6,140,944	3,003,262
401.02.02 HCAL Management															
In-progress	50%	100%										338,924		338,924	169,823
401.02.03 HF Front-End															
In-progress	93%	0%		1,980,261										1,980,261	141,461
401.02.04 HB/HE Front-End															
In-progress	34%	3%			9,377,908									9,377,908	6,221,948
401.02.05 HCAL Back End															
In-progress	83%	3%				1,556,463								1,556,463	269,229
401.03.02 FPIX Management															
In-progress	71%	71%					433,760							433,760	125,275
401.03.03.01 Components - Module															
In-progress	56%	0%						2,770,365						2,770,365	1,225,469
401.03.03.02 Components - Electronics															
In-progress	75%	10%						3,305,633						3,305,633	839,255
401.03.03.03 Components - Mechanical Structures & Cooling															
In-progress	87%	0%						2,955,516						2,955,516	383,951
401.03.04 Assembly & Testing															
In-progress	38%	23%							1,282,189					1,282,189	792,163
401.03.05 Pilot System															
In-progress	100%	35%								100,232				100,232	
401.04.02 Trigger Management															
In-progress	65%	100%									182,463			182,463	63,351
401.04.03 MUON Trigger															
In-progress	64%	20%									2,311,674			2,311,674	831,850
401.04.04 Calorimeter Trigger															
In-progress	77%	23%									2,990,282			2,990,282	685,013
<b>Grand Total</b>	<b>59%</b>	<b>25%</b>	<b>6,140,944</b>	<b>1,980,261</b>	<b>9,377,908</b>	<b>1,556,463</b>	<b>433,760</b>	<b>9,031,513</b>	<b>1,282,189</b>	<b>100,232</b>	<b>5,484,418</b>	<b>338,924</b>	<b>35,726,610</b>	<b>14,752,050</b>	

### Utility Upgrade Project Responsibility Assignment Matrix (RAM)

April, 2015 Current Data	Control Account Manager			
	Alber, Russell J	Wielgos, Randal J	Federowicz, Charles A	Grand Total
<b>600.01 Project Management</b>				
BAC	2,737,948	-	-	<b>2,737,948</b>
% Complete	26%	-	-	<b>26%</b>
%LOE	100%	-	-	<b>100%</b>
<b>600.02 High-Voltage Electrical Upgrade</b>				
BAC	-	13,518,896	-	<b>13,518,896</b>
% Complete	-	10%	-	<b>10%</b>
%LOE	-	19%	-	<b>19%</b>
<b>600.03 Industrial Cooling Water Upgrade</b>				
BAC	-	-	14,015,128	<b>14,015,128</b>
% Complete	-	-	12%	<b>12%</b>
%LOE	-	-	16%	<b>16%</b>
<b>600.04 Other Project Costs (OPC)</b>				
BAC	-	-	1,100,000	<b>1,100,000</b>
% Complete	-	-	68%	<b>68%</b>
%LOE	-	-	68%	<b>68%</b>
<b>Total BAC</b>	<b>2,737,948</b>	<b>13,518,896</b>	<b>15,115,128</b>	<b>31,371,972</b>
Total % Complete	26%	10%	16%	<b>14%</b>
Total %LOE	100%	19%	20%	<b>26%</b>