

# **PIEBASE ROADMAP TO ACHIEVE INDUSTRY VISION FOR INFORMATION EXCHANGE AND SHARING**

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**Prepared by PIEBASE Working Group 5 (Process Industry Executive for achieving Business Advantage using Standards for data Exchange), with contributions from America, Europe and Japan. Version 1.0, Issued 1 October 1997.**

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# PIEBASE ROADMAP TO ACHIEVE INDUSTRY VISION FOR INFORMATION EXCHANGE AND SHARING

## 1.0 Overview

The PIEBASE vision is: "Companies in the process industries shall be able to share and/or exchange electronically the information needed to design, build, operate and maintain process and power plants using internationally accepted standards. By the year 2000, this vision will be achieved for a high impact subset of this information." The process industries include chemicals, petroleum, petrochemicals, pharmaceuticals/fine chemicals, power, and engineering support for these industries.

This document describes the PIEBASE Roadmap for achieving defined milestones of industry data exchange capabilities. Current projects with goals of data exchange and of data sharing are addressed. The Roadmap also describes the paths to success for several projects which have been discussed but not yet started.

The information included in this Roadmap is:

1. This Overview, a general discussion of "the journey."
2. A definition of the objective, or "where we want to go".
3. Project by project diagrams of activities necessary to succeed, or "routes to our destinations."
4. An approximate timeline, though not in enough detail to be a plan, or "when do we arrive?"
5. A listing of some important tasks for PIEBASE.
6. A description and prioritization of needs not covered by current projects.
7. A listing of some obstacles to be overcome, or "detours and bad roads", along with suggested routes around these barriers.

The PIEBASE vision as currently stated, focuses on the time between now and the year 2000. When we successfully achieve this vision, we will have covered less than 40% of the engineering data exchange needs of the industry. To realize the greater vision, beyond 2000, it will be necessary to further define the objectives and expand this Roadmap.

We will need to revise the Roadmap on a regular basis to account for learning, experience and progress. As an evergreen document, the Roadmap should show considerable detail about the following 12 to 24 months. Activities beyond this 24 month "moving horizon" will not be described in detail.

## **1.1 Glossary of Terms**

AP: Application Protocol

AP 221: ISO STEP project for functional data, such as shown on P&I diagrams.

AP 225: ISO STEP project for standard parts data.

AP 227: ISO STEP project for spatial data, as in 3-D process plant design.

AP 228: ISO STEP project for Heating, Ventilation and Air Conditioning data.

AP 230: ISO STEP project for structural steel design data

AP 231: ISO STEP project for process engineering data.

Caesar Offshore: A Norwegian based consortium, working to improve data handing for offshore petroleum installations and for shipbuilding.

ISO: International Organization for Standardization.

ISO TC184/SC4: ISO Technical Committee 84, Subcommittee 4, responsible for industrial data standards which include STEP.

NIST: National Institute of Standards and Technology, an agency of the US government with technical responsibility for STEP development and the Secretariat of ISO SC4.

Japan PlantCALS/STEP: A Japanese consortium to evaluate, promote, and produce standards useful to the Japanese process industry.

PDXI: A consortium of US and European process industry companies, focused on conceptual process engineering data and the sponsoring organization for AP 231.

PISTEP: A consortium of British process industry companies, sponsor of the original version of the Plant Activity Model, and a participant in the development and promotion of AP 221.

PlantSTEP, Inc.: A consortium of process industry companies, primarily in the USA, and the sponsoring organization for AP 227.

POSC: A large consortium of petroleum industry companies with a goal to promote and produce open software and data conventions across their industry.

POSC/Caesar: A joint effort by POSC and Caesar, to produce a set of standards for the exchange and sharing of data, with emphasis on offshore petroleum plants.

SPI-NL: A consortium of Dutch process industry companies, currently managing the AP 221 project.

STEP: STandard for the Exchange of Product Model Data, officially known as ISO10303

## **1.2 Activities and Deliverables in the Near Future**

The following is a list of activities and deliverables for the coming year, now until the end of 2nd Quarter 1998. This list should be updated frequently.

- a) Activity: PIEBASE WG2 to produce a single, comprehensive Process Plant Activity Model.
  - Deliverable: Single Process Plant Activity Model for the industry
- b) Activity: Continue to develop and obtain approval for AP 221 and ATS 321.
  - Deliverable: AP 221 Draft International Standard, Working draft of ATS 321.

- c) Activity: Hold Class Library Workshops
  - Deliverable: Class Library #3
- d) Activity: Develop POSC/Caesar effort toward a new data repository standard.
  - Deliverable: ISO Work Item
- e) Activity: Produce and approve AP 227 International Standard, corresponding ATS.
  - Deliverable: AP 227 International Standard and ATS 327
- f) Activity: Product of AP 231 Draft International Standard.
  - Deliverable: AP 231 Draft International Standard ready for ballot.
- g) Activity: Continue to implement PDXI models as a precursor to AP 231 implementation.
  - Deliverable: Commercial software using the PDXI models.
- h) Activity: Experimentally implement AP 212, 221, 227 and 231 in Japan.
  - Deliverables: Reports on these implementations.
- i) Activity: Experimentally implement non-STEP standards for Procurement and for Remote Maintenance Service in Japan.
  - Deliverables: Reports on these implementations.
- j) Activity: Develop industry understanding of needs and requirements for "APxyz" for areas not addressed by the existing AP projects.
  - Deliverable: Report on this preliminary study.
- k) Activity: Develop common demonstrators for all the projects.
  - Deliverables: Common Demos for at least partial functionality for all projects.
- l) Activity: Complete ETAP Data Repository and develop a demonstration.
  - Deliverables: Demonstration of data sharing using the completed ETAP Data Repository.
- m) Activity: Implement the PIPPIN Data Warehouse and develop related APIs
  - Deliverable: Partially completed PIPPIN Warehouse and APIs

## **2.0 Definition of the "High Impact Subset"**

The high impact subset of information to be exchanged and/or shared by the year 2000 shall include conceptual, schematic/functional, and spatial information about processes, some types of systems, and plants. These information interface specifications must be sufficiently comprehensive to be of high impact in the design, building, operation, and maintenance of process and power plants. Further, these information interface specifications must be applicable for users who need to exchange data among application programs and databases and for users of interfaces to data repositories.

These goals are addressed (though incompletely) by the projects now being sponsored by the various consortia. These include AP 221, AP 227, AP 231, various Japan PlantCALS/STEP initiatives and POSC/Caesar. So, if we can take these projects to successful completion and implementation, plus achieve data compatibility among them, we will have accomplished our 2000 vision. Figure 2.1 shows coverage of each project and Figure 2.2 shows the functional relationships of the projects. Note that Figure 2.2 is adapted from the Plant Activity Model, originally developed by PISTEP.

**Figure 2.1: Coverage Matrix of the Existing Process Plant AP Projects**  
(Adapted from a NIST Presentation Slide)

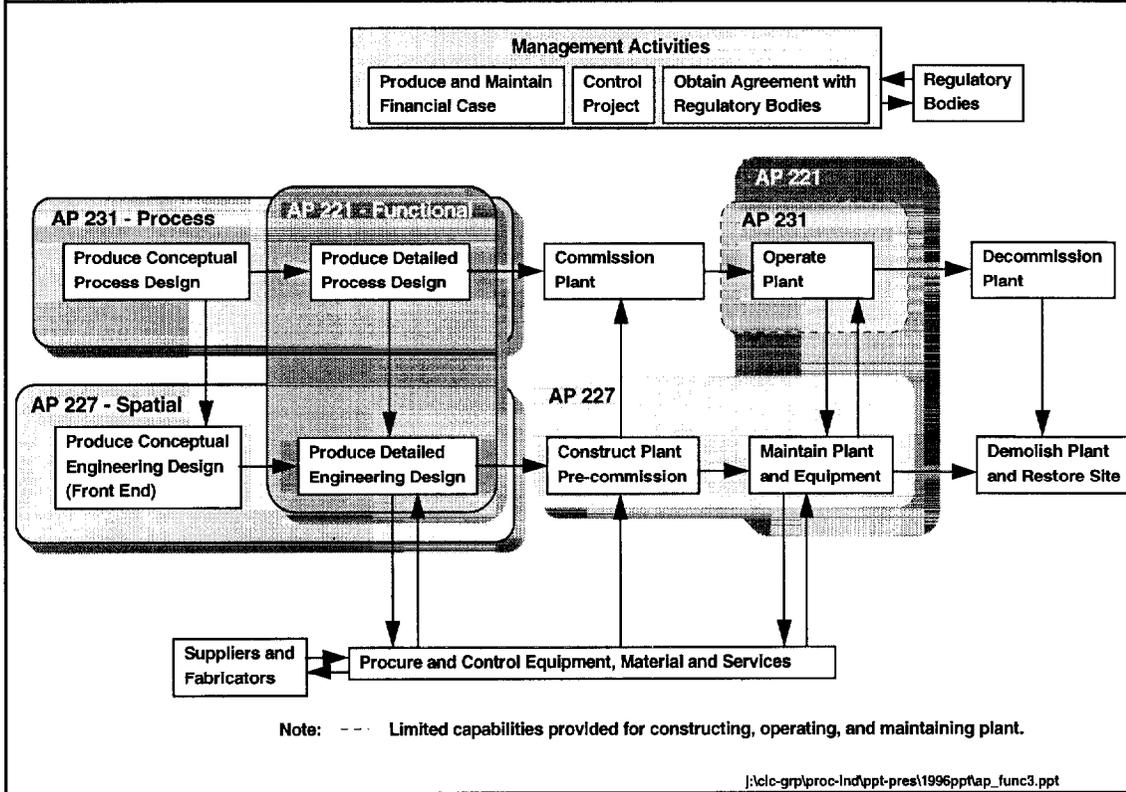
	Conceptual Design		Detailed Design		Fabrication	Construction	Operation	Maintenance
Process	AP 231	AP 231	AP 221					
Process Equipment	AP 231	AP 231	AP 227					
Piping	AP 221	AP 227	AP 221	AP 227	AP 227	AP 227	AP 221	
Instrumentation & Controls	AP 221	AP 212	AP 212					
Electrical	AP 212	AP 212				AP 212		
HVAC	AP 228	AP 228				AP 228		
Structural	AP 230	AP 230	AP 225					
Mechanical Equipment								
Utility								

-  : AP 212 - Electrotechnical Design and Installation CD ballot closed 3/97
-  : AP 221 - Functional Data and Schematic Representation for Process Plant Target CD ballot 7/97
-  : AP 225 - Building Elements Using Explicit Shape Representation Target FDIS 12/97
-  : AP 227 - Plant Spatial Configuration Target DIS ballot 8/97  
Also covers spatial and product ID data for I&C, Elec., HVAC, Struct. and Mech. Eq., and line flow/stream data for
-  : AP 228 - Building Services: Heating, Ventilation & Air Conditioning Future uncertain
-  : AP 230 - Building Structural Frame: Steelwork Target CD ballot ?/98
-  : AP 231 - Process Design and Process Specifications of Major Equipment Target CD ballot 10/97

Much more will be needed beyond 2000, as we will have covered no more than 40% of our data needs with currently planned projects. It should also be noted

that these currently planned projects cover very little data specific to batch processing or to process control.

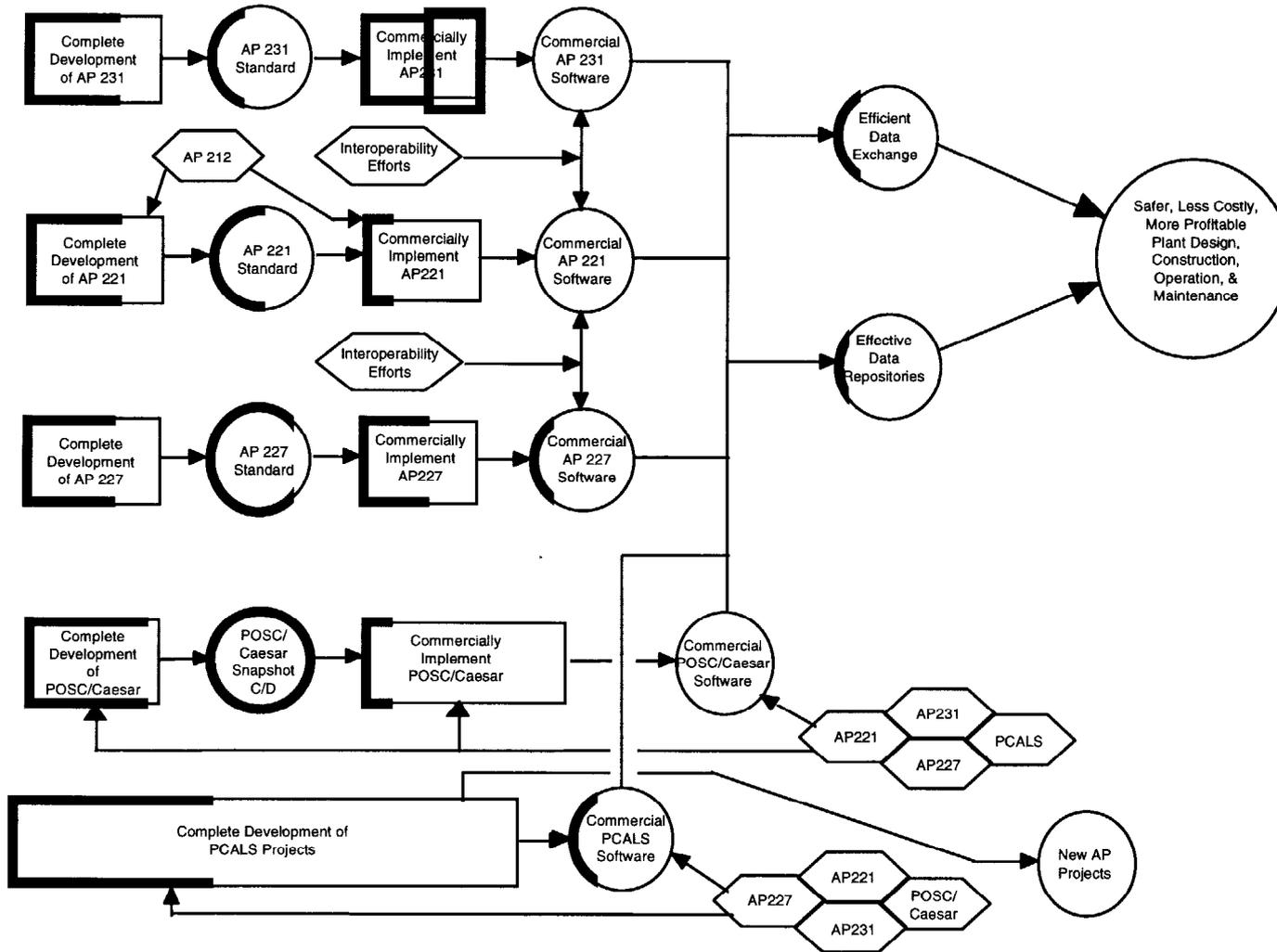
Figure 2.2: **Functional Relationships of Process Industry APs**  
(Adapted from a NIST presentation slide)



### 3.0 Roadmap Diagrams

Figures 3.01 through 3.10, on the following pages, show the activities and deliverables needed to achieve the PIEBASE Vision 2000. The diagrams also attempt to show progress to date on each endeavor, but no attempt is made to show schedules. (These diagrams are adaptations and expansions of a set of similar diagrams supplied by Alan Thomson of BP and Stuart Lord of PISTEP.)

**Figure 3.1: OVERVIEW**

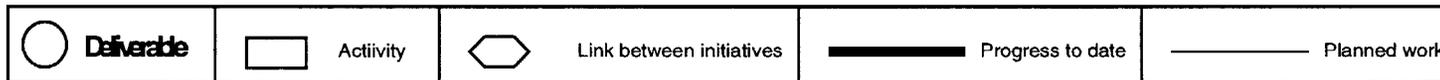
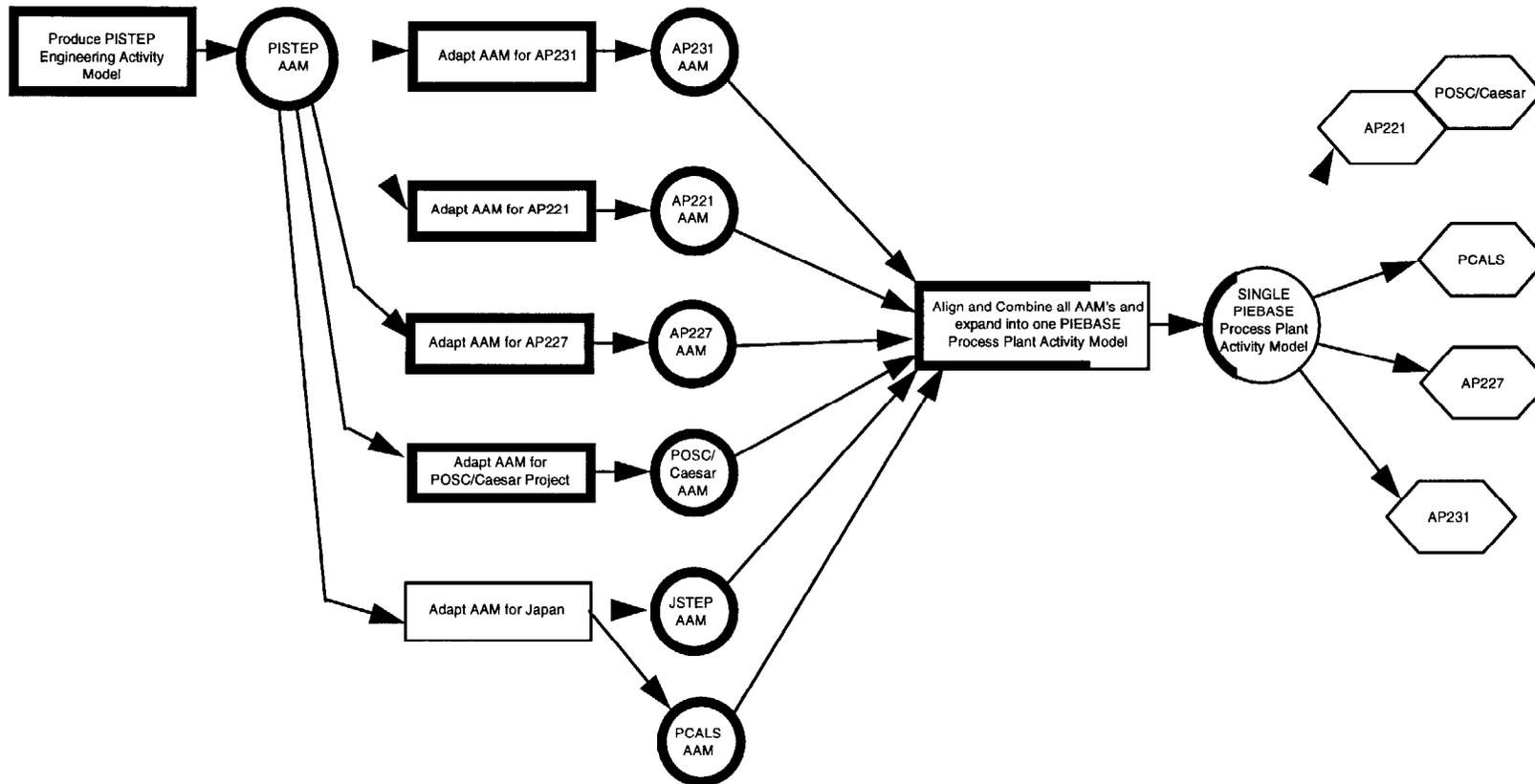


 Deliverable	 Activity	 Link between initiatives	 Progress to date	 Planned work
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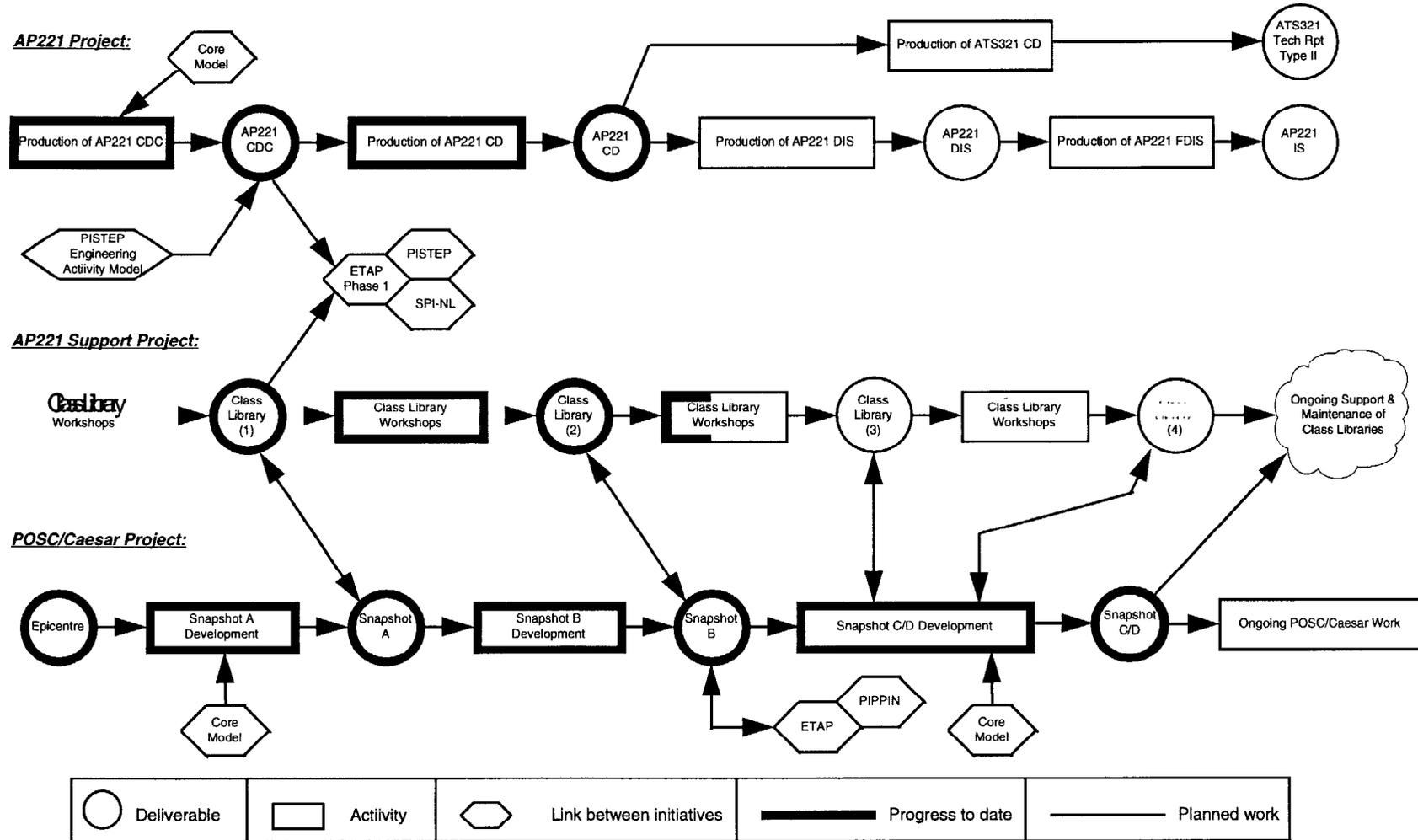
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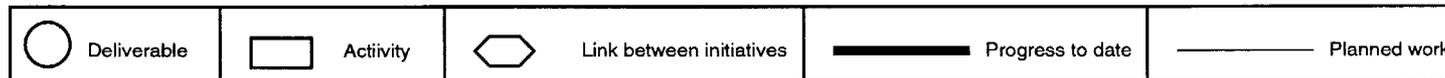
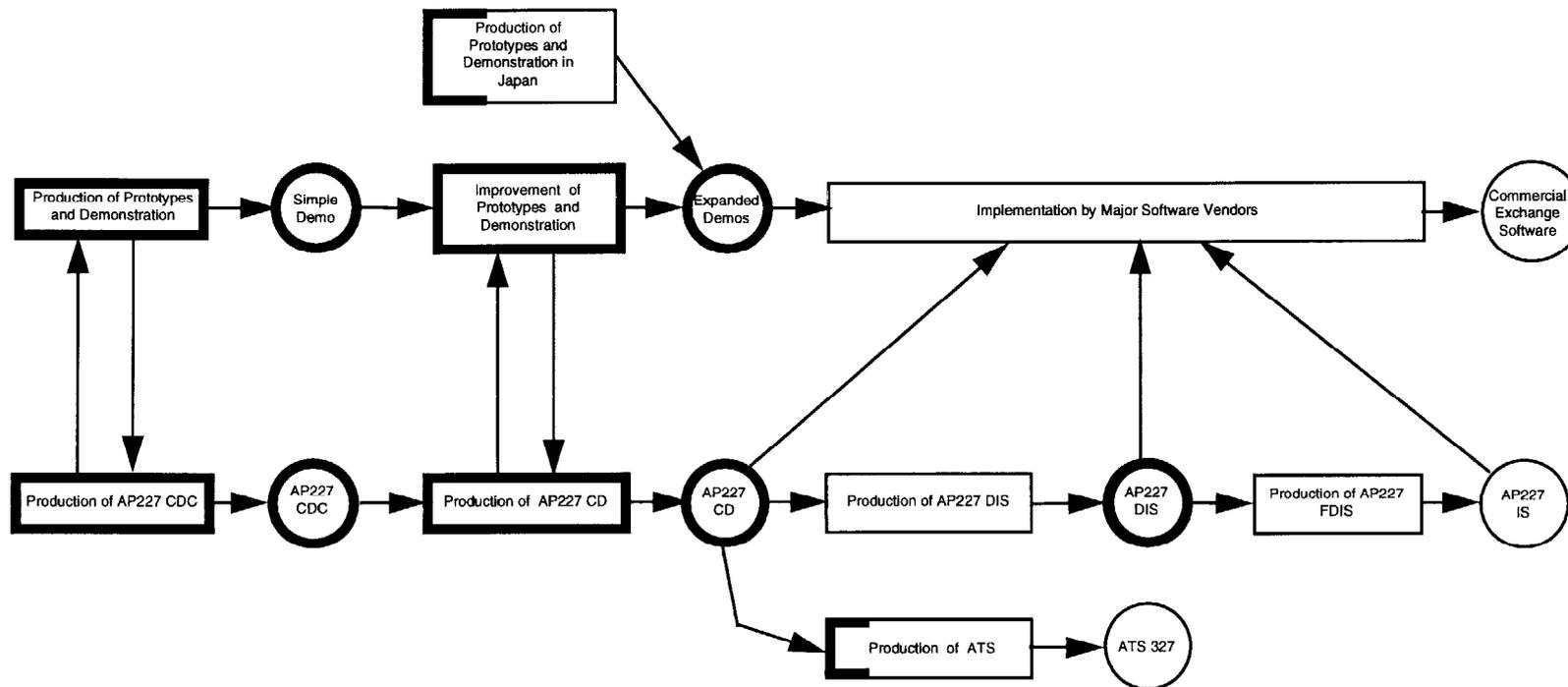
**Figure 3.2: PROCESS PLANT ACTIVITY MODEL PROJECT**  
**(PIEBASE Work Group 2)**



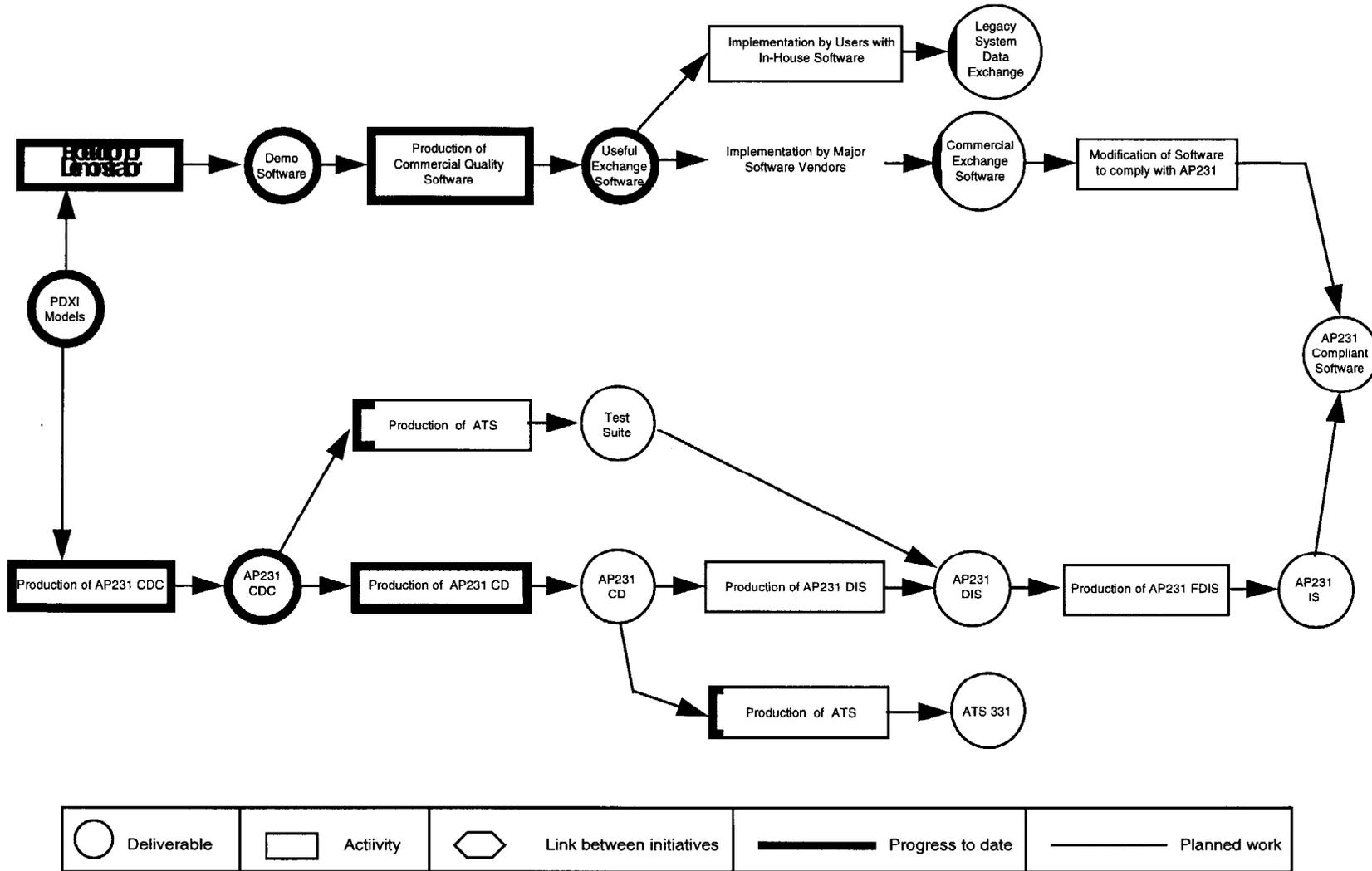
**Figure 3.3: AP 221 and POSC/CAESAR PROJECTS**



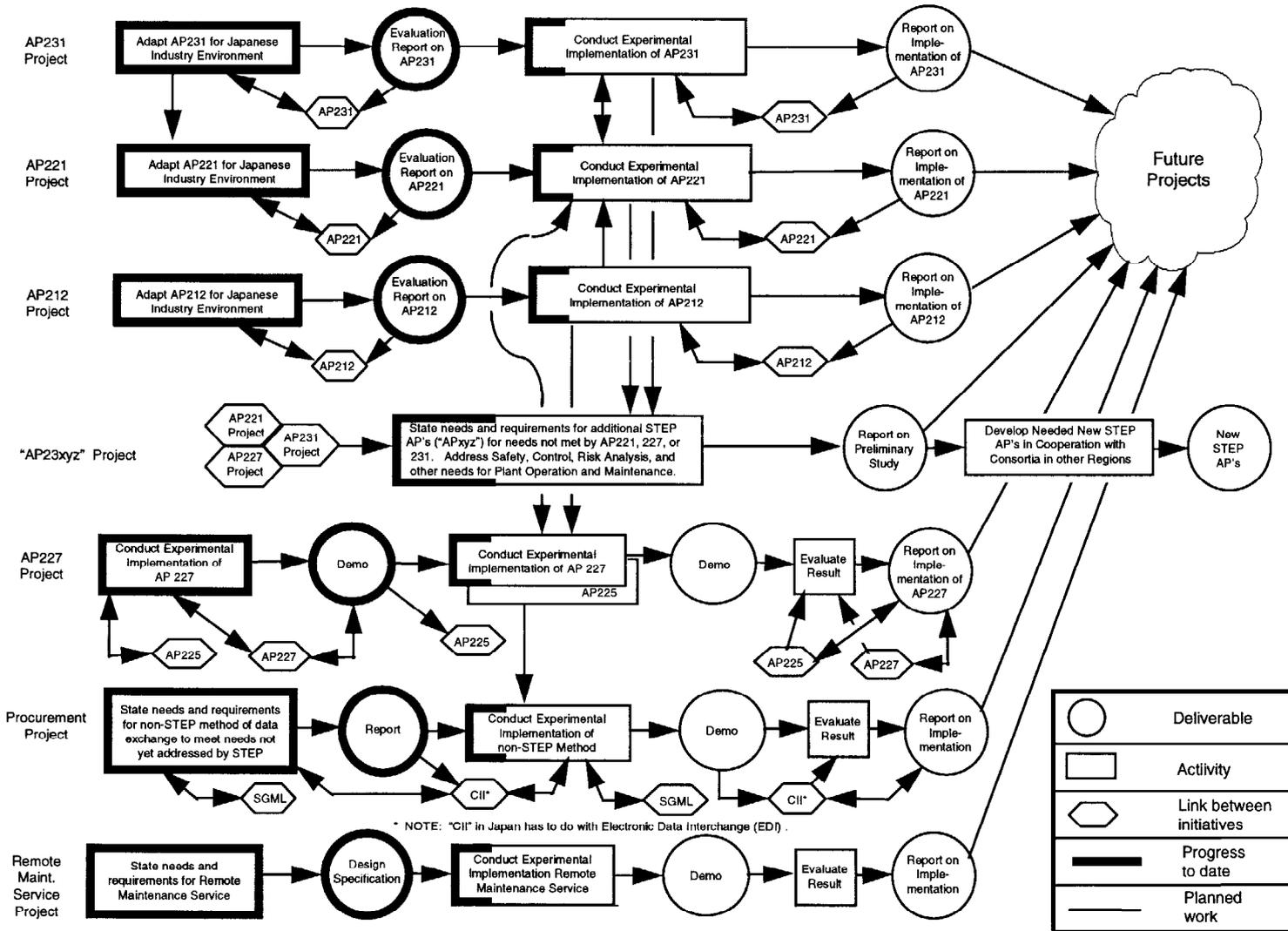
**Figure 3.4: AP 227 SPATIAL CONFIGURATION PROJECT**



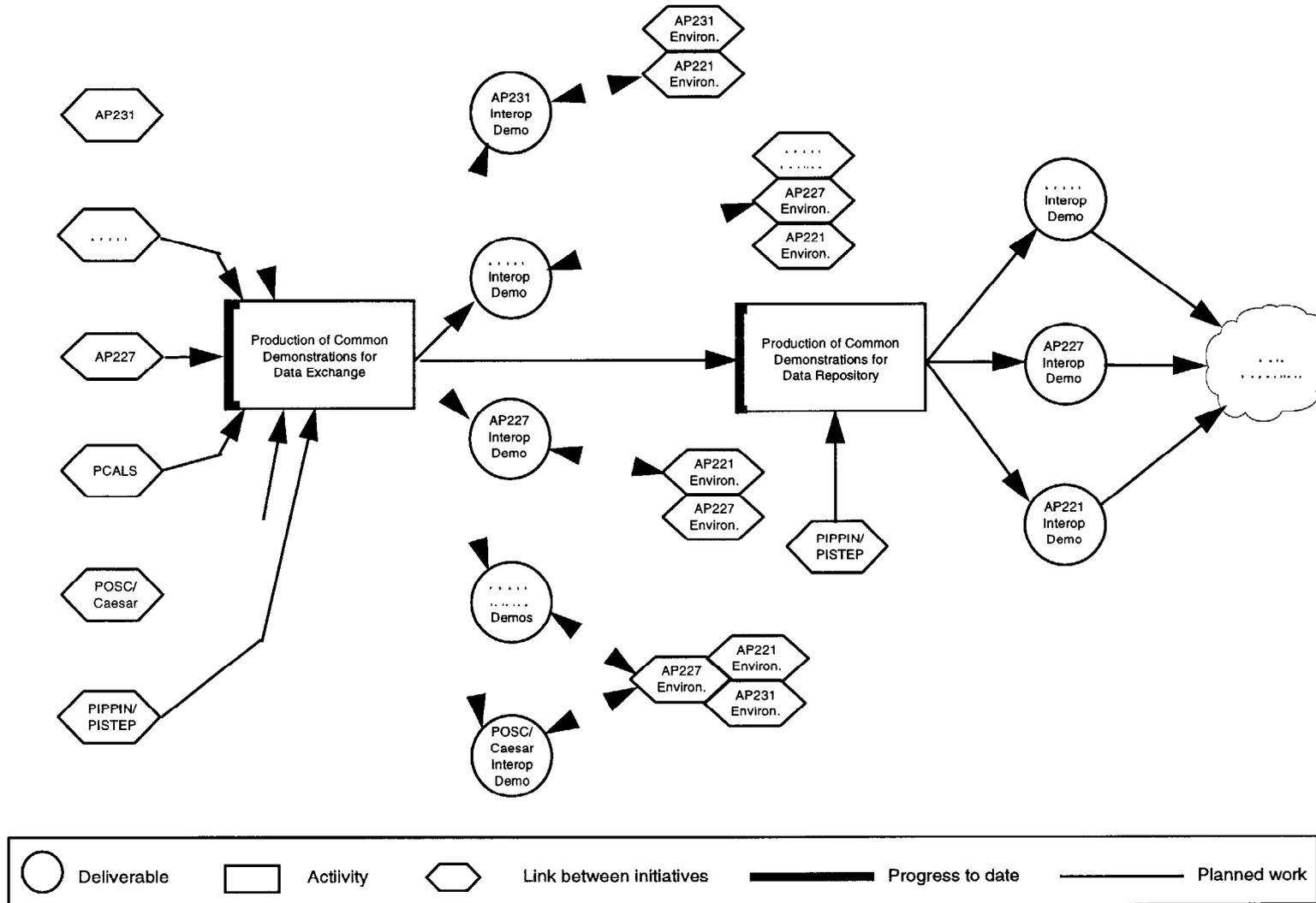
**Figure 3.5: AP 231 PROCESS ENGINEERING PROJECT**



**Figure 3.6: PROJECTS IN JAPAN**



**Figure 3.7: INTEROPERABILITY PROJECT**

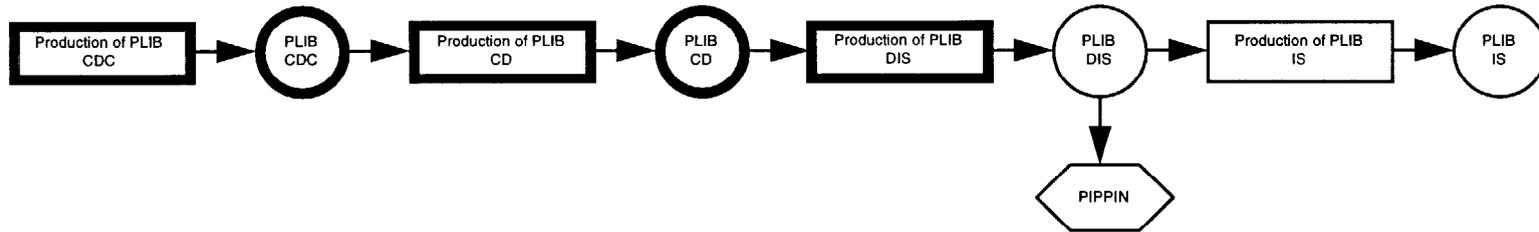




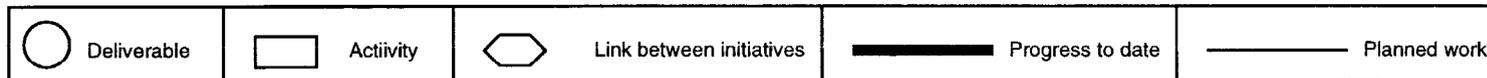
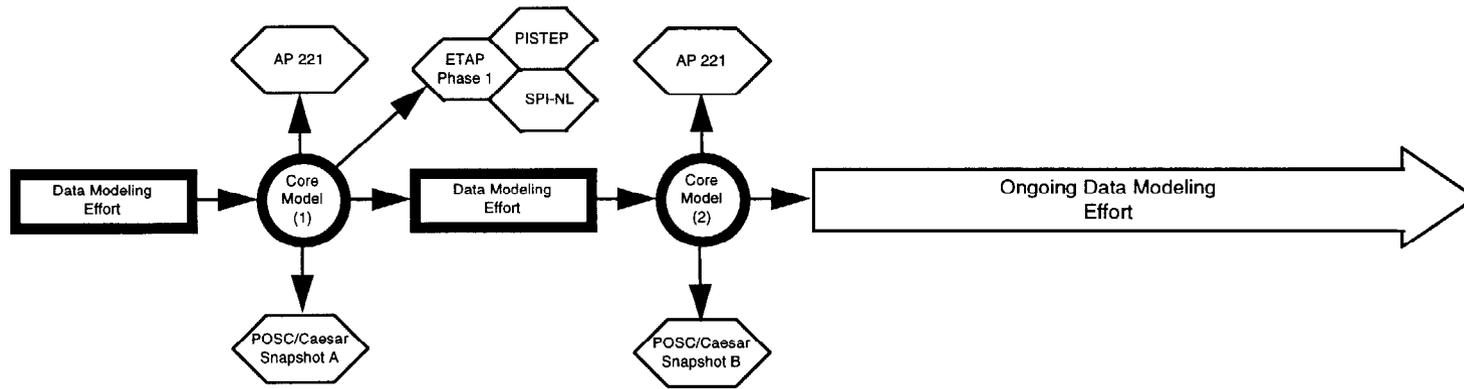


**Figure 3.10: OTHER PROJECTS OF INTEREST**

**PLIB PROJECT:**

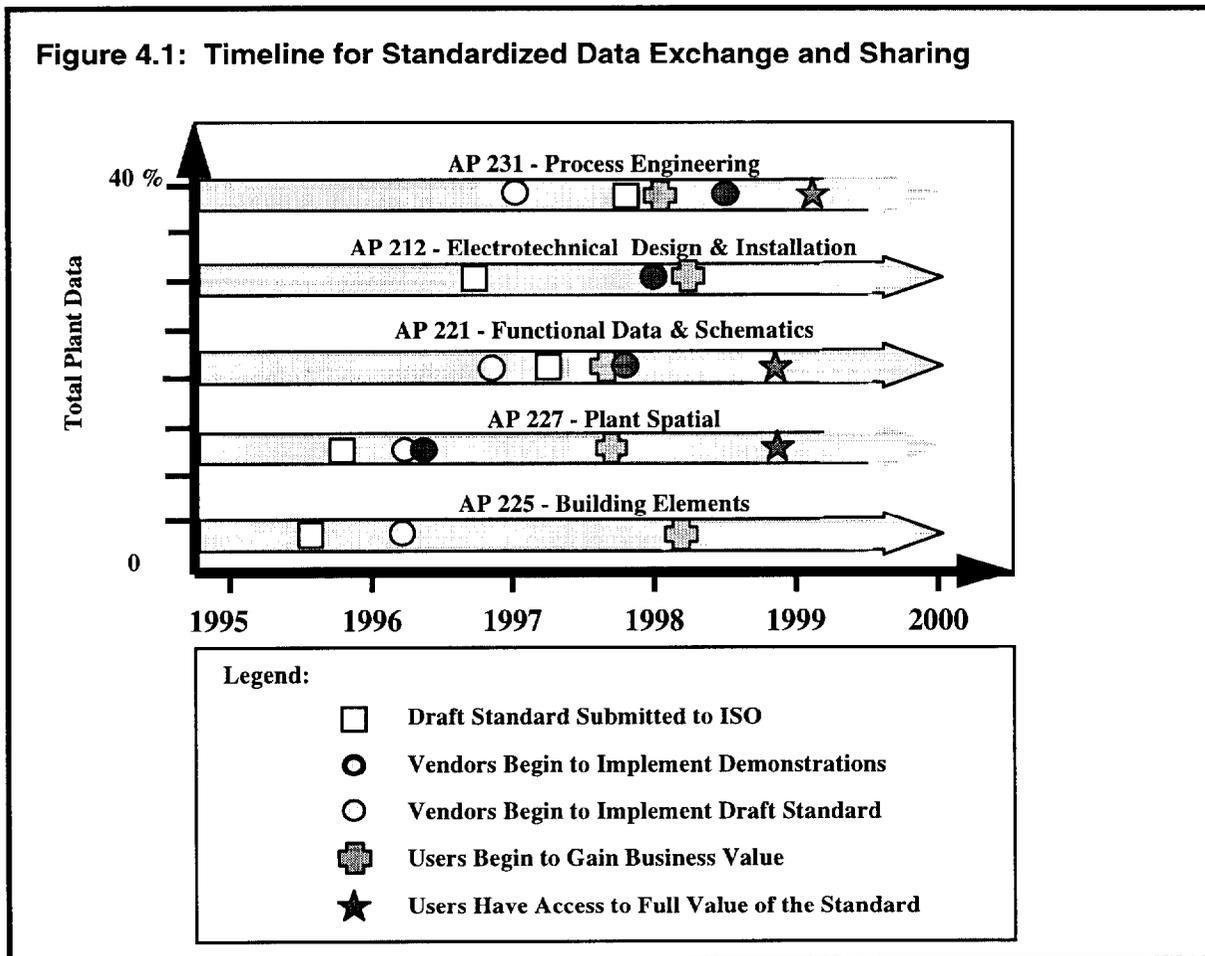


**EPISTLE CORE MODEL PROJECT:**



## 4.0 AP Approval and Implementation Timeline

Figure 4.1 shows the approximate timing to develop, implement, and deliver business value from the ISO APs relevant to the process industries. When these projects are completed, approximately 40% of the industry's data exchange needs will have been met.



Although there are gaps in coverage and some doubt as to universal usefulness of all projects, the successful completion and industrial use of these standards can be expected to deliver substantial business value to industry. This meets the minimum criteria for the initial PIEBASE vision.

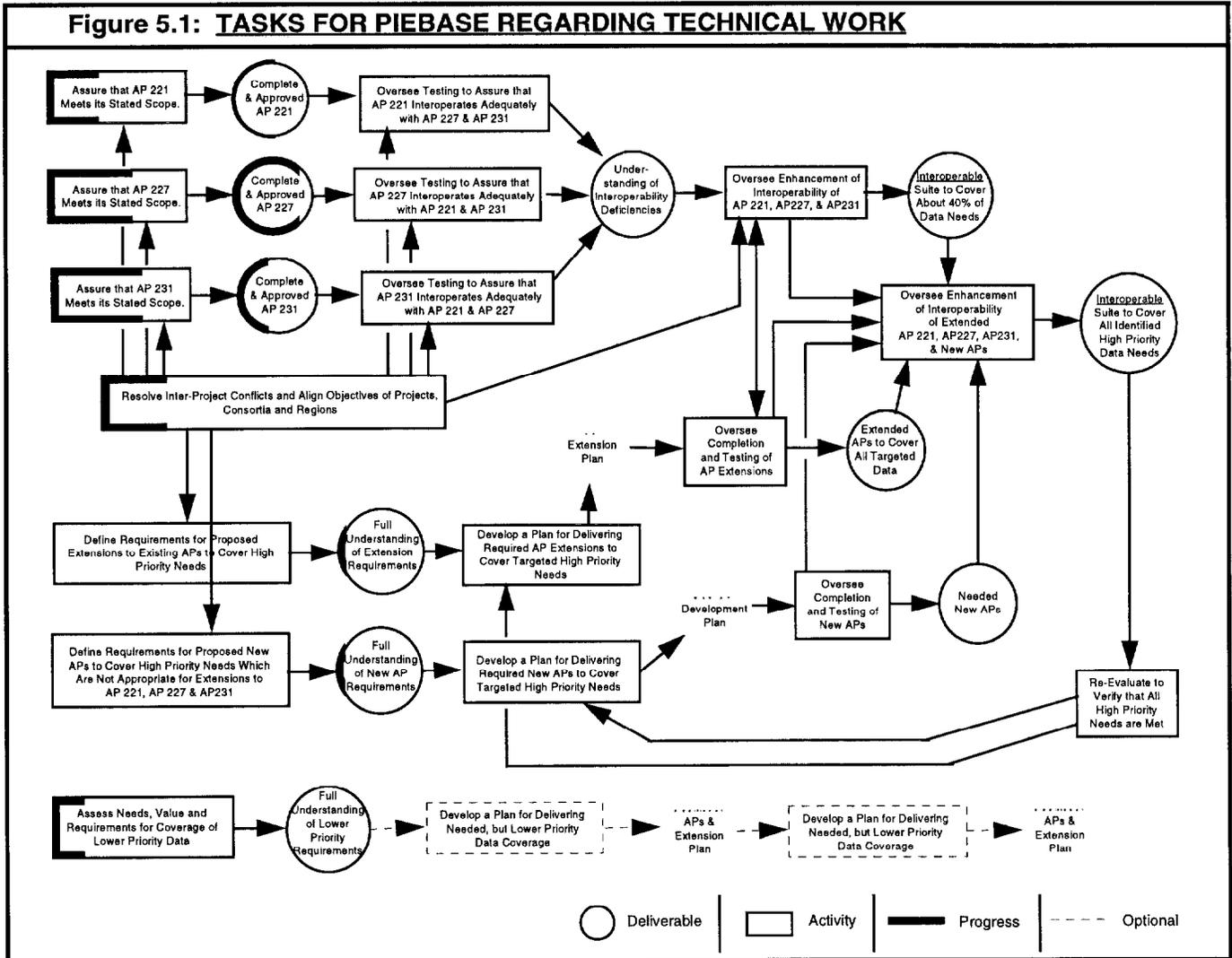
## 5.0 Tasks for PIEBASE

There are a number of important tasks for PIEBASE, which will go beyond completing current projects and reaching of year 2000 goals. These tasks address objectives of value to the entire industry and specific objectives involving more than one project or consortium. Some of these tasks are shown graphically in figures 5.1, 5.2, and 5.3, on the following pages. The tasks will include the following:

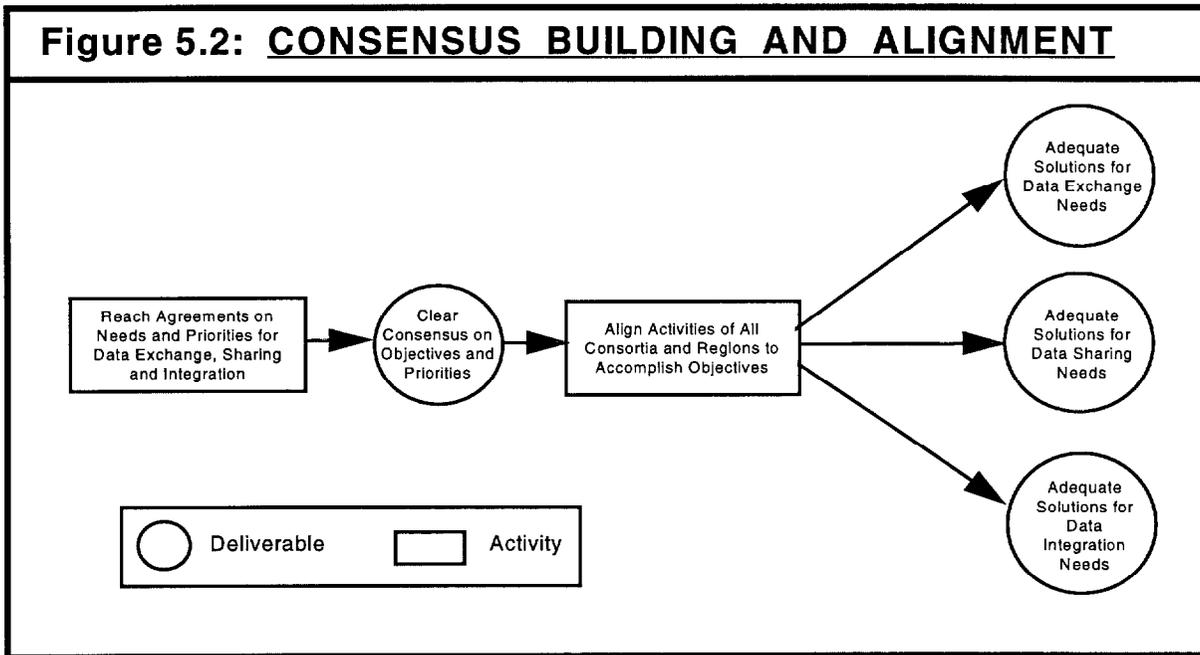
- Clarify industry requirements for data standards and assess viable solutions.
- Engage non-participating industry sectors, e.g., batch, power, food, pulp & paper.

- Assure the utility of each existing AP is tested to meet its stated scope.
- Oversee testing for the required interoperability.
- Define requirements for proposed extensions to existing APs to cover all high priority needs.
- Define AP extensions and boundaries.
- Develop a plan for delivering needed extensions.
- Complete and test extensions.
- Enhance interoperability of the industry APs.
- Resolve inter-project conflicts; align objectives of projects, consortia, and regions.
- Accelerate Implementation to deliver value to industry.

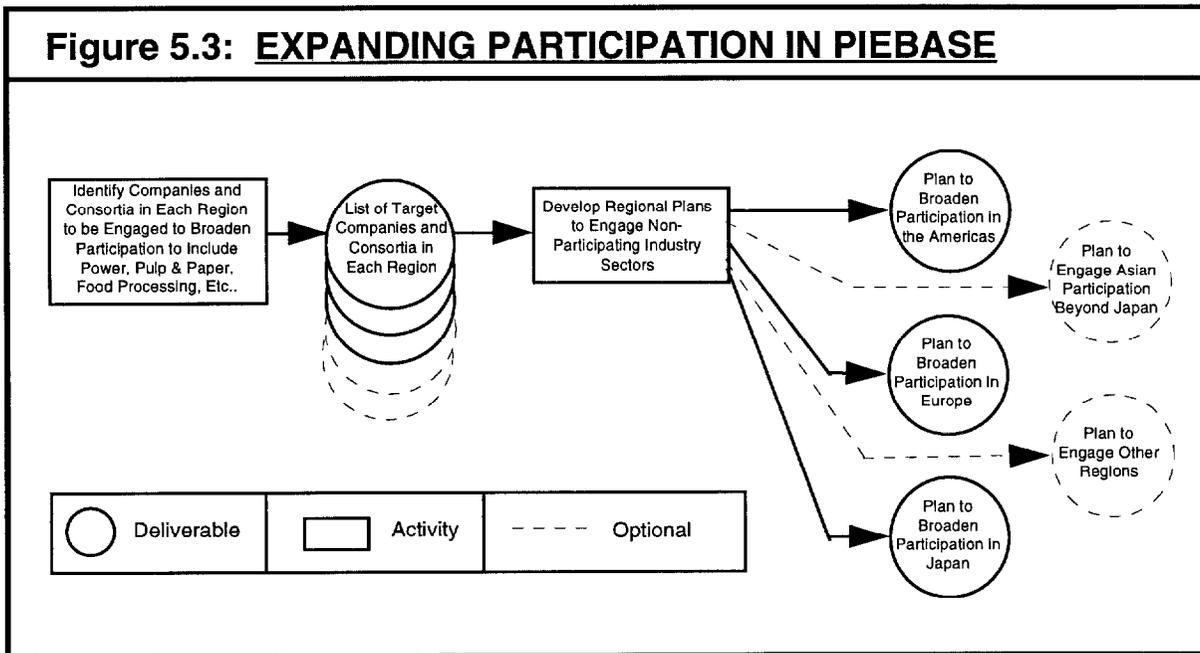
**Figure 5.1: TASKS FOR PIEBASE REGARDING TECHNICAL WORK**



**Figure 5.2: CONSENSUS BUILDING AND ALIGNMENT**



**Figure 5.3: EXPANDING PARTICIPATION IN PIEBASE**



### 5.1 Completing the Job

When the current AP projects are completed, less than half of the engineering information about a plant will be covered. It is very important that certain elements of this data be covered by extensions of the standards work. Standards for other parts of the data may be less important. Information about the design, operation, and maintenance of process, process equipment, piping and control systems will be of highest priority. Standardization of information about Electrical, HVAC, Structural and Mechanical Equipment will have lower priority.

Figure 5.4: Potential Process Plant AP Development, 1998 - 2001

		Conceptual Design	Detailed Design	Fabrication	Construction	Operation	Maintenance
TOP PRIORITY	Process	AP 231	AP 231 & AP 221	Not Applicable	Not Applicable	AP 23X	AP 23X
	Process Equipment	AP 231	AP 231 & AP 227		AP 227	AP 23X	AP 23X
	Piping	AP 221 & AP 227	AP 221 & AP 227	AP 227	AP 227	AP 221	AP 23X
	Instrumentation & Control	AP 221 & AP 212	AP 212 AP 221 AP 231	Not Required	AP 227	AP 221	AP 23X
LOWER PRIORITY	Electrical	AP 212	AP 212	Not Required	AP 212	AP 212 AP 221	AP 23X AP 23X
	HVAC	AP 221 & AP 227	AP 221 & AP 227		AP 227	AP 221	AP 23X AP 23X
	Structural	AP 230	AP 230 & AP 225			Offshore Need	Offshore Need
	Mechanical Equipment					AP 23X	AP 23X
	Utility	AP 221 & AP 227	AP 221 & AP 227	Not Required		AP 23X	AP 23X



In Scope of Current AP Projects

Potential additional Process Plant AP development 1998-2001

AP 221 Extensions - Functional description and schematics of all systems

AP 227 Extensions - Shape and location of all systems and construction information

AP 231 Extensions - Batch processes, additional types of process equipment, and design and change of control systems

AP 23X - Safety and risk analysis for operations and maintenance

(Note: Blocks without labels or colors will require additional study to determine needs, requirements and priorities.)

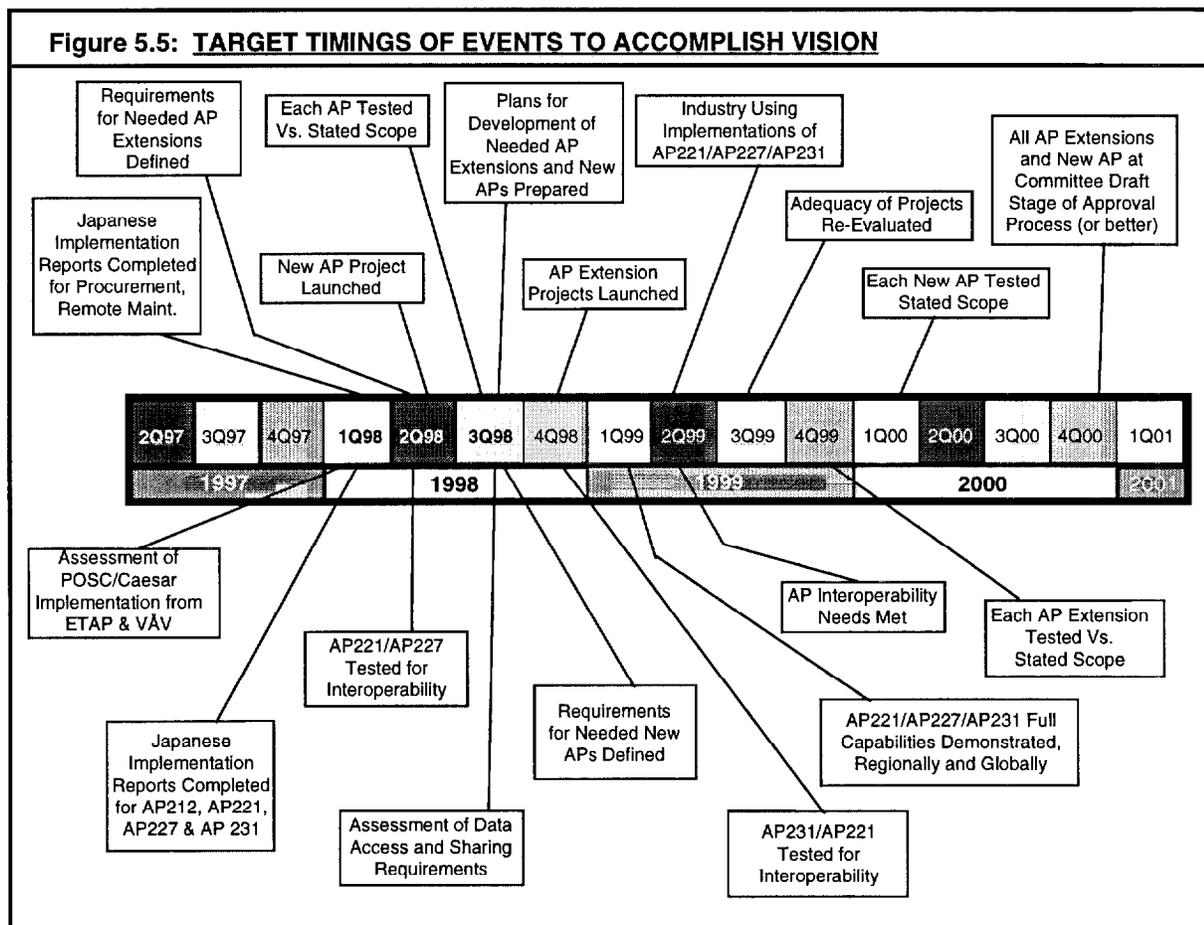
Much of the needed data can be covered by extensions of the three major existing APs: AP 221, AP 227, and AP 231. AP 221 should be extended to include functional description and schematics of all systems. AP 227 should be extended to include the shape and location of all systems, as well as construction information. AP 231 should be extended to include both batch and continuous processes, additional types of process equipment, and the design and change of control systems. One or more additional APs will be needed to cover information about operation, maintenance, procurement, safety of personnel, protecting the environment, etc. Requirements analyses for these additional types of information should be the first step in planning these extensions and new AP projects. Figure 5.4 shows a matrix of the coverage of present AP projects and areas of potentially valuable new work to be done between now and 2001.

Industry sectors have diverse requirements for data exchange, data sharing, and data warehousing. The full spectrum of these requirements and the priorities for

delivering solutions are not yet well understood. To date AP 221, AP 227 and AP 231 have only specified requirements for data exchange formats, although all three projects are investigating the data sharing requirements for their domains of discourse. The POSC/CAESAR Project has initiated a New Work Item to investigate and deliver a conceptual model for data warehouses and the supporting class libraries. PIEBASE is investigating the industry requirements for and the distinctions between:

- Data exchange, e.g., Part 21 files created and read by implementations of APs,
- Data sharing, e.g., interactive access by multiple concurrent users to a set of data in a secure, efficient manner. This could use SDAI (Standard Data Access Interface) implementations of APs, and
- Data integration via a data repository/warehouse based on a common conceptual model, e.g., Oil & Gas New Work Item and the industry priorities for these capabilities will require further analysis by PIEBASE.

Figure 5.5 shows some key target milestone timings needed in order to accomplish the vision. (This diagram needs to be upgraded to add all the key milestones, as well as to improve accuracy of the timeline.)



## 6.0 Obstacles to Success

While the potential benefits of establishing and using standard data exchange methods are very large, the obstacles to success are also formidable. The following is a list of known obstacles and potential problems, which PIEBASE should address:

- a. Industry awareness poor.
- b. Industry participation poor.
- c. Lack of STEP business credibility with industry management.
- d. Inadequate funding of projects.
- e. Technical differences and possible incompatibilities among the AP projects.
- f. Slowness of STEP development and approval processes and procedures.
- g. Poor coordination among STEP and non-STEP initiatives.
- h. Reluctance of software vendors to implement the standards.
- i. Reluctance of owners and EPCs to specify the use of the APs for imminent or near term projects
- j. Lack of global consensus on requirements and priorities for data exchange and sharing

PIEBASE must work to remove or resolve each of these. It may be appropriate to launch additional PIEBASE working groups to address specific obstacles or related groups of obstacles.

Figure 6.1 graphically shows some countermeasures to these obstacles.

