



## Course Outline

### 9. Requirements Management (cont...)

- integration with test or verification traceability – VCRI/ VCRM/RTEM etc.
- software tools supporting requirements management
- pitfalls and pointers in requirements management

### 10. Design Management

- selecting design processes
- managing for innovation
- managing design complexity
- avoiding under-engineering
- avoiding over-engineering
- design traceability
- pitfalls and pointers in design management

### 11. Configuration Management

- what is configuration?
- the concept and types of baseline
- CM standards - EIA, ISO, etc
- the four fundamental CM activities
- examples of CM implementation
- pitfalls and pointers in configuration management

### 12. Interface Management

- objectives of interface management
- interface requirements
- interface design
- ensuring interface consistency
- managing evolution of interfaces in complex systems
- organizational aspects of interface management
- pitfalls and pointers in interface management

### 13. Management of Engineering Data

- objectives of data management
- data modeling
- tool data exchange
- data management vs configuration management
- pitfalls and pointers in data management

### 14. Knowledge Management

- objectives of knowledge management
- protection of new knowledge
- lessons learned
- communication of new knowledge
- use of external knowledge – intellectual property
- pitfalls and pointers in knowledge management

### 15. Engineering Specialty Integration (ESI)

- what makes an engineering specialty special?
- common engineering specialties
- a general approach to ESI
- organizational issues of ESI
- pitfalls & pointers in engineering specialty integration

### 16. Managing System Integration

- drivers to trouble-free system integration
- system integration planning

- role of integration testing
- responsibility of designers
- diagnosing the causes of problems
- incremental system integration
- integration test beds
- metrics for the balance of work in a system integration phase
- pitfalls & pointers in managing system integration

### 17. Managing Verification & Validation

- project-wide V&V
- requirements verification methods
- design verification methods
- system/subsystem verification requirements
- system/subsystem verification methods
- system/subsystem verification design
- system/subsystem verification traceability
- pitfalls and pointers in managing V&V

### 18. Managing the Development of Software-Intensive Systems

- special issues for software-intensive systems
- performance of alternative software development methodologies

### 19. Engineering Cost Management

- tracking systems engineering costs
- controlling systems engineering costs
- pitfalls and pointers in engineering cost management

### 20. Time Management

- tracking time performance
- controlling systems engineering schedule
- pitfalls and pointers in time management

### 21. Systems Engineering Performance Management

- technical performance measurement
- technical progress meetings
- earned value management
- integrated performance measurement
- six-sigma revisited
- pitfalls and pointers in performance measurement

### 22. Risk and Opportunity Management

- the nature of risk
- components of risk
- the nature of opportunity
- the five key activities of risk management
- risk due to technology
- integrating consideration of risk and opportunity into every aspect of the systems engineering
- pitfalls and pointers in risk and opportunity management

### 23. Leading and Managing the Engineering

### Team

- **Video: The Meerkat Way**
- roles of leadership in complex projects
- difference between management and leadership
- power and the influencing of behavior
- situational aspects of leadership styles and follower readiness
- IPT accountabilities
- influences on IPT Performance
- key success factors of IPTs
- team-building and conflict resolution techniques
- successful motivation practices
- effective leader communications

### 24. Stakeholder Management

- determining stakeholder interests
- dealing with conflicting interests
- ensuring stakeholders have influence
- keeping stakeholders informed
- reporting to higher level management

### 25. Other Techniques for Controlling Outcomes

- qualification
- integrated software support to systems engineering and management

### 26. Release and Deployment Management

- release management
- deployment management
- post-implementation reviews

### 27. Project Closure

- archiving of engineering data
- maintenance of engineering data

### 28. Continuous Performance Improvement

- lessons learned
- ISO9000 Quality Management System
- Six Sigma Driving Improvement
- CMMI
- Pitfalls and Pointers in performance improvement

### 29. Professional Societies and Systems Engineering Education

- International Council on Systems Engineering (INCOSE)
- International Institute of Business Analysis (IIBA)
- national systems engineering societies
- other societies with formal systems engineering interest areas
- systems engineering in undergraduate education
- systems engineering in postgraduate education
- systems engineering certifications
- internal systems engineering education programs

### 30. In Closing



For further enquiries please contact:

Project Performance International

[www.ppi-int.com](http://www.ppi-int.com)  
[contact@ppi-int.com](mailto:contact@ppi-int.com)  
+61 3 9876 7345

 **Head Office, Australia**  
PO Box 2385,  
Ringwood North  
VIC 3134, Australia  
Tel: +61 3 9876 7345  
Fax: +61 3 9876 2664

 **United States of America**  
Tel: +1 888 772 5174  
Fax: +1 888 772 5191

 **Brazil**  
Tel: +55 11 3958 8064  
Fax: +55 12 3212 5582

 **United Kingdom**  
Tel: +44 20 3608 6754

# Systems Engineering Management

## 5-Day Course and Workshop



Over many years, experience has shown that projects have difficulty in delivering solutions to stakeholders on time, on budget and satisfying needs. The greater the problem complexity, solution complexity, problem novelty, solution novelty and diversity of stakeholders, the greater the challenge has proven to be.

This 5-day course provides in-depth coverage of how to manage engineering projects to maximise project success, within the project's given constraints. The course establishes principles and provides methods for successfully managing projects, and getting the best out of people, individually and in teams.

[www.ppi-int.com](http://www.ppi-int.com)  
[contact@ppi-int.com](mailto:contact@ppi-int.com)  
P1135-004995-7

  
PROJECT PERFORMANCE  
INTERNATIONAL

## Systems Engineering Management

### Course Objectives

At the conclusion of this course, delegates are expected to have a sound working knowledge of how to go about successfully managing engineering projects, and, after contemplation and consolidation, be ready to take on a systems engineering management role. Delegates will also be better equipped to work in any capacity within projects.

Higher levels of skill and performance in a systems engineering management role will be attained subsequently through practical experience.

### Who Should Attend this Course?

This Systems Engineering Management course is designed for personnel of all types who plan, manage, control, specify or support the development or acquisition of products, including software products, or systems.

### Course Method and Materials:

The course is delivered using a balanced combination of video, presentations, workshops and discussion sessions. The workshops and discussions are focused on putting into practice the techniques covered in the presentations and the lessons to be learned from the videos.

The workshops are used extensively to reinforce learning and to contribute to the development of understanding.

Delegates are provided with a set of comprehensive course notes covering the presentation material and workshop exercises, a Workshop Workbook, a two-CD CDROM of relevant resources, and other materials and checklists for future reference and use.

### Course Availability:

This course is available worldwide for public and on-site delivery (i.e. at client-provided facilities).



## Course Outline

Introductory video (before-after course hours)

### 1. The Value Proposition for World Class Systems Engineering and Management

#### 2. Introduction to Systems Engineering

- the concept of system
- systems thinking
- system life cycle processes
- system life cycle models
- systems-of-systems engineering
- key features of excellence in management
- systems engineering principles and concepts
- overall systems engineering process models
- concurrent/simultaneous engineering
- V model, Wedge model, Double-V model, Multiple V model
- understanding the inputs and the outputs
- defining the problem — requirements analysis
- designing the physical solution
- describing the logical solution — functional and state-based design
- effectiveness evaluation and decision making
- requirements specification writing
- system integration
- verification
- validation
- specialty engineering
- the role of cognitive systems engineering
- **Workshop 1: Systems engineering principles**
- EIA/IS-632, EIA 632, IEEE 1220, ISO/IEC 15288, CMMI systems engineering standards
- key engineering artifacts and their roles
  - systems engineering plans
  - operational concept descriptions
  - interface requirements specifications
  - system requirements specifications
  - software requirements specifications
  - verification requirements specifications
  - architectural design descriptions
  - detailed design descriptions
  - test/verification procedures
  - records of test/verification results
  - validation plans / procedures
  - records of validation results
- other potential artifacts
  - integrated logistics support plan
  - feasibility study reports
  - trade-off study reports
  - simulation reports
  - specification tree
- Model-Based Systems Engineering (MBSE) – languages & methods
- systems engineering in a research environment
- software support to systems engineering
- hardware support to systems engineering

### 3. Introduction to Management

- the role of management
- basic concepts of management in general
- “The Fifth Discipline” - systems thinking
- value stream mapping

### 4. Introduction to Project Management

- relationship to management in general
- the role of project management
- basic concepts of project management
- the PMBOK
- concepts of lean
- concepts of agile
- project management certifications

### 5. Introduction to Engineering Management

- relationship to project management
- the role of engineering management
- engineering the engineering system

### 6. Introduction to Systems Engineering Management

- relationship to engineering management
- the role of systems engineering management
- systems engineering within three different business models
  - internal project
  - development under contract
  - product development in anticipation of sales
- tenets of systems engineering management
- systems engineering management and PRINCE2®
- systems engineering management and logistics support analysis (LSA)
- systems engineering management and contract management
- managing complexity
- managing the development of safety-critical systems

### 7. Planning the Engineering Effort

- styles of development and relationship to planning
- waterfall, incremental, evolutionary, agile, lean, spiral
- concurrent/simultaneous engineering/IPPD
- engineering for modifications
- incorporation of risk and opportunity into planning
- major planning artifacts
  - project (work) breakdown structure (PBS/WBS)
    - types of PBS
    - why the PBS is a foundation of effective engineering management
    - rules in preparing a PBS
    - relationship of the PBS to cost accounts
    - relationship of the PBS to work packages
    - PBS (WBS) development pitfalls and pointers
- **Workshop 2: Developing a PBS/WBS**
  - systems engineering plans
    - scoping SE - the SEP (SEMP)
    - why prepare a SEP?
    - how a SEP may relate to other plans
    - content of the SEP
    - how the SEP relates to ISO 9001
    - pitfalls in preparing a SEP
- stage plans
- product development plans
- specialty engineering plans, e.g. safety, reliability, producibility
- functional plans, e.g. test plans, system integration plans
- costing the engineering effort
  - cost metrics
    - cost models, e.g. COSYSMO, PRICE, SEER
- scheduling the engineering effort

- event-based planning
- sequencing activities
- concepts of critical path, and critical path index
- decision analysis and value/cost engineering
- **Workshop 3: Decision Making in Engineering Planning**
- **Workshop 4: Constructing an EMV Decision Tree**
- using verification and validation
  - verification and validation terms defined
  - verification requirements
  - methods of verification
  - verification design
  - methods of validation
- technical reviews for verification, validation, assessment and control
  - requirements reviews
  - principles of design review
  - architectural design review (ADR)
  - detail design review (DDR)
  - functional reviews
  - system-wide design reviews
  - test readiness review (TRR)
  - requirements satisfaction audits (FCAs)
  - design description (BS-BS) audits (PCAs)
  - technical reviews and incremental builds
  - administration of technical reviews
  - customer involvement in technical reviews
  - pitfalls in conducting technical reviews
- planning pitfalls and pointers

### 8. Organizing and Conducting the Engineering Effort

- knowledge, skills and attitudes conducive to high performance in the nine systems engineering process areas
- alternative organizational strategies – functional, matrix, project
- types of organizational units: teams in general, IPTs, Skunk Works™, process cells
- inside integrated product teams (IPT), and relationship to CE/IPPD
  - when to use IPTs
  - IPT Membership
  - **Workshop 5: IPT Membership**
  - team processes
    - innovation
    - problem solving
    - decision making
    - implementation
    - communication
  - types of IPT
    - team size
    - achieving customer focus
    - challenges to IPT effectiveness
- using product cells
- using functional cells
- keys to success
- staffing the engineering organization
- relationships to customer and supplier organizations
- organizational pitfalls and pointers

### 9. Requirements Management

- selecting requirements analysis processes
- requirements traceability in requirements analysis
- requirements traceability in design
- traceability from goals