



Project Management

IMPRS, Katlenburg-Lindau, 23-25 May 2005

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Project Management

Table of Content

- **Fundamentals of Project Management (PM):** *Life Cycle Considerations, Project Control Methodologies & Tools, Management Information*
- **International Aspects of PM:** *International Co-operations at Government and/or Company Level, Differences: Languages, Currencies, Culture, etc.*
- **Management of High-Tech Complexity:** *Baseline, Specification, Interfaces*
- **Organizational Aspects:** *Structures, Multiple Teams & Disciplines, Different Skills, Responsibilities & Authorities, Location & Staffing*
- **Project Staff:** *Functions, Leadership, Appointment of Project Manager, Motivation*

Project Management

Definition: „Project-Management“

Defined Start and End: *From Goal Setting to Completion and Acceptance by Customer.*

Unique Undertaking: *Design, Development, Prototyping.*

Involves Innovation: *New Technologies.*

High Technical Complexity: *Many Interfaces.*

Involvement of Many People: *Different Skills and Multiple Disciplines.*

High Organizational Complexity: *Multiple Teams, Cooperation's, Joint Ventures.*

Project Management

Definition: „Project-Management“

Planning: *Tasks, Resources, Facilities, Key Personnel, Tools, Financing.*

Organization: *Structure, Interfaces, Responsibilities.*

Team Building: *Selection of Personnel, Identification of Key Personnel.*

Control: *Actual vs. Planning, Feed-Back Solutions, Changes, Analysis.*

Leadership: *Guidance, Decisions, Directions.*

Project Management

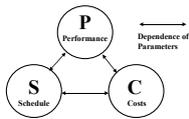
1. Fundamentals of Project Management (PM)

- *Life Cycle Considerations,*
- *Project Control Methodologies & Tools,*
- *Management Information.*

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5

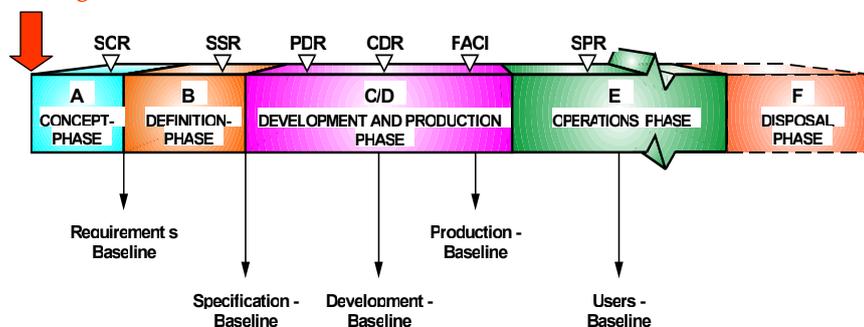
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GOAL

- Performance
- Schedule
- Cost Target

Product Life Cycle (*internationally applied*)



SCR - System-Concept Review

SSR - System-Specification Review

PDR - Preliminary Design Review

CDR - Critical Design Review

FACI - First Article Configuration Inspection

SPR - System Production Review

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Definition: "Product Life Cycle"

Product: Goods or Services to be Developed, Produced, Used and Disposed.

Life Cycle: Process from Cradle to Grave.

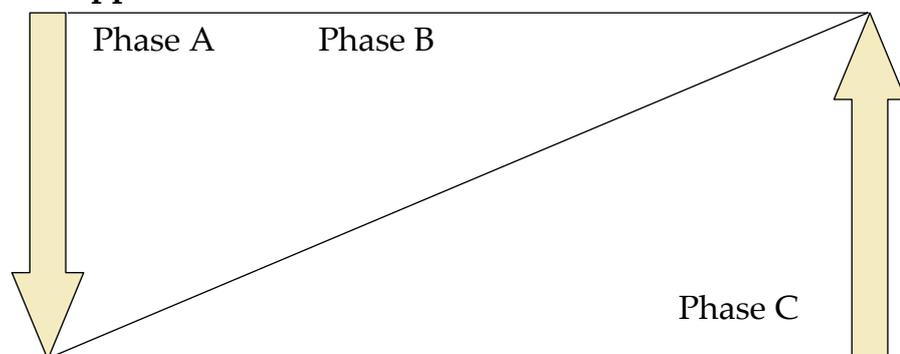
Major Product Phases:

- A. **Concept:** Concept Design, Feasibility Studies and Trade-Offs.
- B. **Definition:** System Specification and Planning.
- C. **Design & Development:** Detailed Design, Prototyping and Development Testing.
- D. **Production:** Manufacturing, Tooling, Testing and Acceptance.
- E. **Operation:** Implementation, Operation & Maintenance.
- F. **Disposal**

Project Management

"Top Down" versus "Bottom Up"

Top Down Approach



Bottom Up Approach

Project Management

Major Review & Decisions Milestones

System Requirements Review (SRR): *business plan confirmed.*

System Concept Review (SCR): *concept freeze.*

System Design Review (SDR): *design freeze.*

- *Preliminary Design Review (PDR)*
- *Critical Design Review (CDR)*

First Article Configuration Inspection (FACI): *product acceptance.*

System Product Review (SPR): *production readiness.*

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Consideration of Life Cycle Costs

1. Definition of Project Phases

- A: Concept Phase
- B: Definition Phase
- C/D: Development and Production
- E: Operations Cost
- F: Disposal

2. Identification of Cost Drivers

3. LCC calculation and Optimization

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Project Funding

Determination of Return of Investment (ROI)

$$\text{ROI} = (\text{R} - \text{O})/\text{I}$$

- Required Investment (I)
- Expected Operating Costs (O)
- Calculated Revenues (R)

All three Factors are of great importance to the Business and must be carefully analysed prior to start of a project.

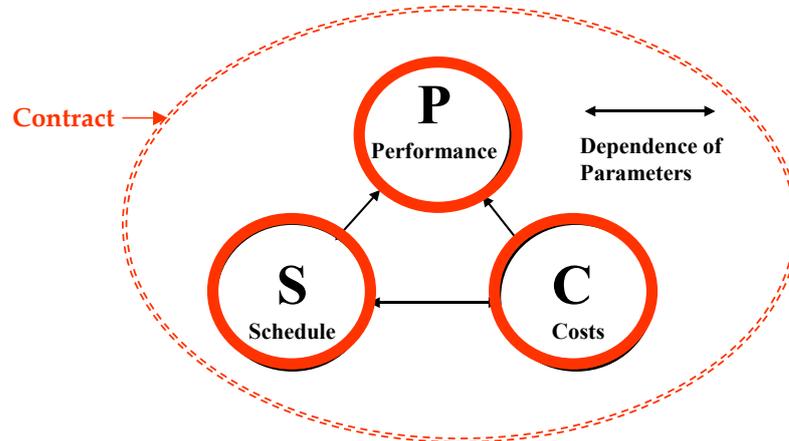
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Consideration of Life Cycle Costs

4. Cost related Design Optimization
5. Development of Cost Targets
6. Identification of Cost Drivers
7. Continues Design To Cost (DTC) Analysis
8. Development of Optimal DTC Solutions

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Optimization of Project Parameters:
Performance (P), Schedule (S) and Cost (C)
„Communicate with each other“

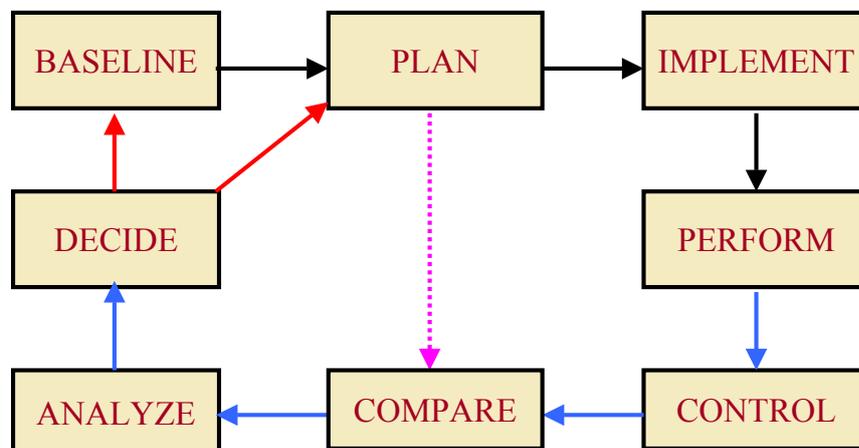


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Management Control Loop (Feedback)



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Project Control Methodologies

- Definition of Project Objectives
- **Work Breakdown Structure (WBS)**
- Identification of Project Milestones
- Preparation of Project Schedules
- Preparation of Cost/Price Plans
- Performance of Status/Cost Control
- **Implementation of Corrective Actions**

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Structuring The Project

- Functional Breakdown
- Product Tree
 - *Hardware*
 - *Software*
 - *Functions*
- Model Matrix
- **Work Breakdown Structure (WBS)**
- **Make or Buy Decision Plan**
- **Work Package Definition(s)**
- Cost Breakdown Structure

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Implement Work Breakdown Structure

Subdivision into Smaller Increments

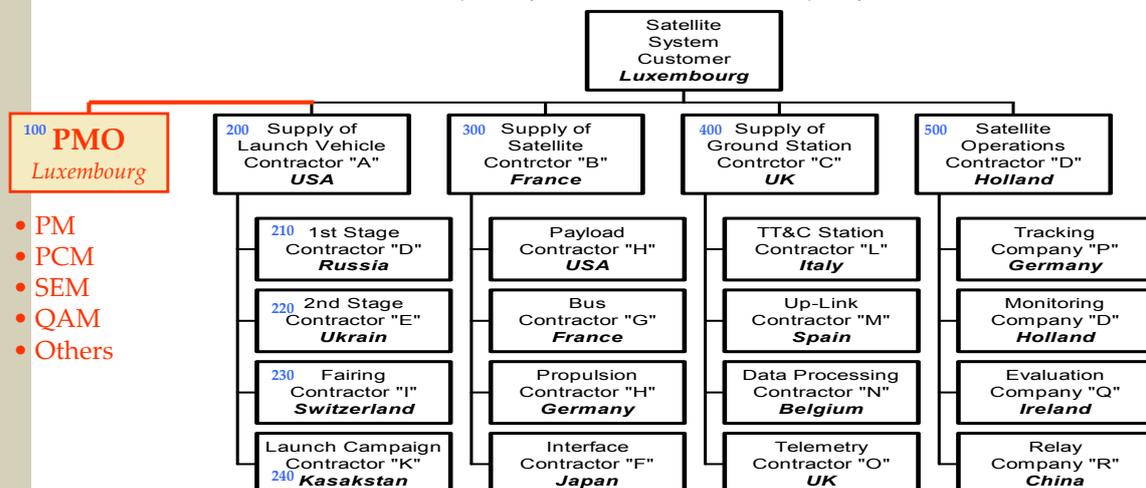
- *Level 1: Total Project*
- *Level 2: Systems of the Project*
- *Level 3: Subsystems of the Project*
- *Level 4: Units/Equipments*
- *Level 5: Work Packages or Components*

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Work Breakdown Structure (sample of an international project)



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Work Breakdown Structure

(WBS as table version)

WBS Item [Nr. & Title]	Responsibility [Coordinates]	Budget [1000 €]	Actual [1000 €]	CTC [1000 €]	CAC [1000 €]	Balance [1000 €]
100 Project Management Office	Name, Tel. Nr. E-Mail, Address, etc.	100	70	40	110	-10
200 Mechanical Subsystem		800	500	275	775	+25
300 Electrical Subsystem		1 200	950	350	1 300	- 100
310 Power Generator		800	600	200	800	0
320 Power Converter		400	350	150	500	- 100
GRAND TOTAL OF THE PROJECT		2 100	1 520	665	2 185	- 85

CTC = Cost to Completion CAC = Cost at Completion

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Work Breakdown Structure (WBS)

A Key to Successful Project Management !!!

The WBS serves several important Purposes, such as:

- *Subdivision of Work*
- *Identification of Project Levels*
- *Work Sharing between Companies*
- *Economic Geographical Distribution of Funds*
- *Implementation of WBS Numbering System (Code) – applicable to the entire Project*
- *Definition of Cost Account Structure*
- *Allocation of Funds*
- *Implementation of Project Control in line with the WBS Code*
- *Assignment of Responsibilities to Companies & Individual Managers*
- *Identification of Interfaces at all Levels*
- *Implementation of Documentation Numbers related to WBS Code*
- *Identification of Work Packages*

Always apply the rule of KISS = Keep It Simple Stupid !!!

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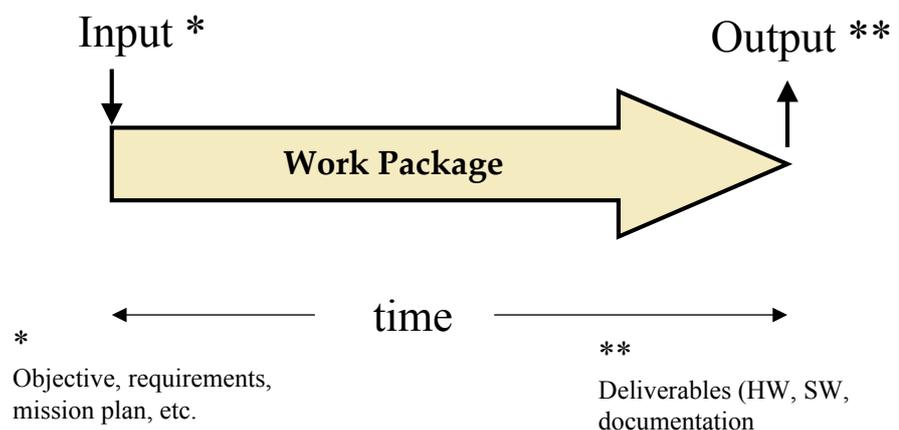
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Content of Work Package Description

- Work Package (WP) Identification
 - *Title*
 - *Identification of the WP in the WBS (WP Number)*
 - *Date of the Start and End of the WP*
 - *Company or Entity in charge of the WP Performance*
- Work Package Manager
- Description of the WP Tasks to be Performed
- Tasks Explicitly Excluded
- • WP Inputs
- Product(s) to be Completed or Delivered →

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Work Package Input/Output



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Sample Project Schedule

(A) INSTALLATION	(H) SCHEDULE TITLE	(K) LEVEL	(D) ORIG. SCHEDULE APPR. (DATE)
(B) APPROVAL RESPONSIBILITY	(J) CONTRACTOR	(G) PROJECT SCHEDULE NO. (LEAVE BLANK)	(E) LAST SCHEDULE CHANGE
(C) ACCOMPLISHMENT RESPONSIBILITY			(F) STATUS AS OF
MILESTONES		TIME SCALE	
(L) KEY MILESTONES			
(M) INTERNAL MILESTONES			
(N) INTERFACES			
(O) NOTES			

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Project Milestones

- Major Project Milestones
- Interface Milestones
- Payment Milestones
- Other Milestones
- Planned Achievements
- Performance Control at Milestones

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Status Monitoring And Control

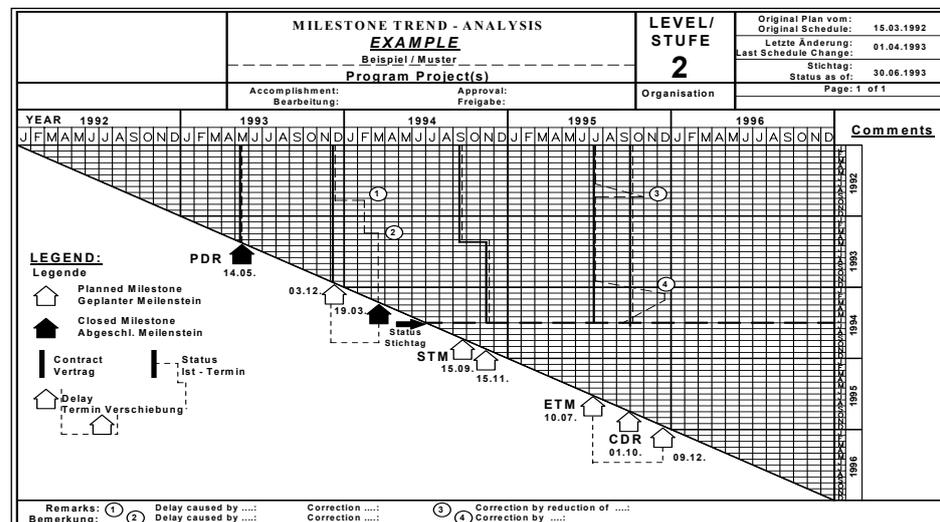
- Baseline Planning
- Measurement of Achievements
- Comparison of Planned and Actual
- Divinations to Plan
- Corrective Actions

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Schedule Trend Chart



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Planning of Project Resources

- Manpower Requirements
- Material Requirement
- Requirements for Machines
- Facility Requirements
- Travel Requirements
- Others (TBD)

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Budgeting and Cost Control

- Establish Resource Budgets
- Agreed on Rates
- Prepare Budget Plan
- Prepare Payment Plan
- Start Cost Control
- Perform Earned Value Analysis

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Sample Resource- and Cost Plan

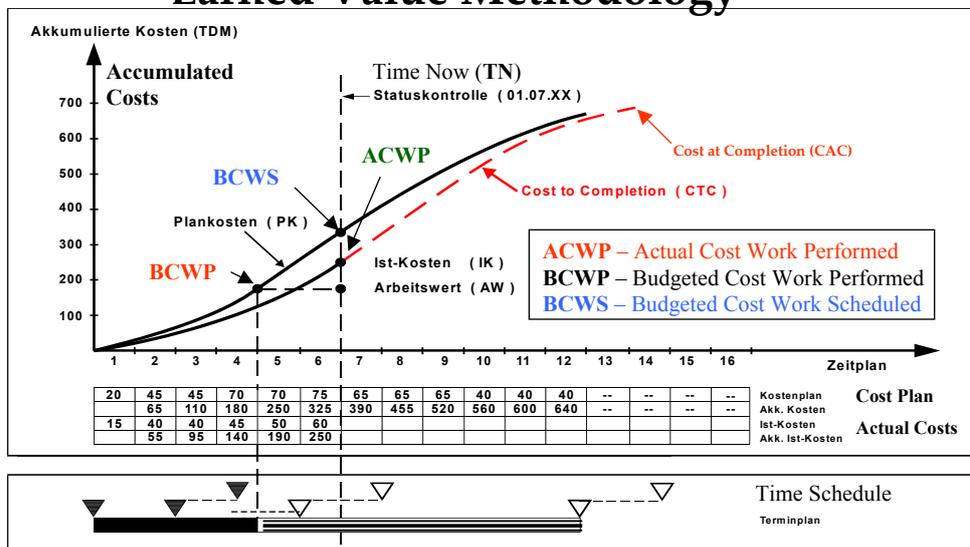
C. Elements	Schedule (Quarter)				Total C.
	300	550	500	400	
Hours	300	550	500	400	1 750
Labour C.	30 000	55 000	50 000	40 000	175 000
Material C.	3 000	8 000	7 000	5 000	23 000
Travel C.	3 000	5 000	4 000	2 000	14 000
Rental C.		10 000	20 000	10 000	40 000
Other C	1 000	3 000	3 000	2 000	9 000
Total Cost	37 000	81 000	84 000	59 000	261 000

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Earned Value Methodology



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Communication Issues

◆ Downwards Communication

- From Management to Staff
- Regular Briefings, Employee Reports
- House Journals, Company Newspapers

◆ Upwards Communication

- From Staff to Management
- Attitude Surveys, Suggestion Schemes

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Communication Issues

◆ Horizontal Communication

- Between Individuals and Teams,
- Between Departments, Workgroups
- Team Work, Product Development
Teams,
- Quality Management Groups
(Operational Excellence)

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Project Information

Verbal Communication

- Discussions
- Meetings
- Conventions

Written Communication

- Memos
- Letters
- Minutes
- Reports
- Documentation
- Publication

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Communication Tools

The Media available to support Communication between Global Partners are basically

- Telephone Conversations
- Telephone Conferencing
- Video Conferencing
- Telefax Information
- Email Information
- Discussion Databases

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Project Management Reports

- Quarterly Progress Report (QPR) to Customer
- Monthly Progress Report (MPR)
- Configuration Status Report (CSR)
- Quarterly Progress Meeting (QPM)
- Project Reviews
- Monthly Subcontractor Status Meetings
- In-House Weekly Status Meetings
- Electronic Connectivity

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Monthly Progress Report (MPR)

- Title Page
- Table of Contents
- Program Structure
- Controlled Milestones (optional)
- Narrative Analysis
- Other Analysis (optional)
- Program Financial Status
- Action Item Status

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The “One Page Status Report”

1. Overall Strategy	2. Major Accomplishments
3. Areas of Concern	4. Next Steps

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2. International Aspects of PM

- *International Co-operation at Government and/or Company Level,*
- *Differences: Languages, Currencies, Culture, etc.*

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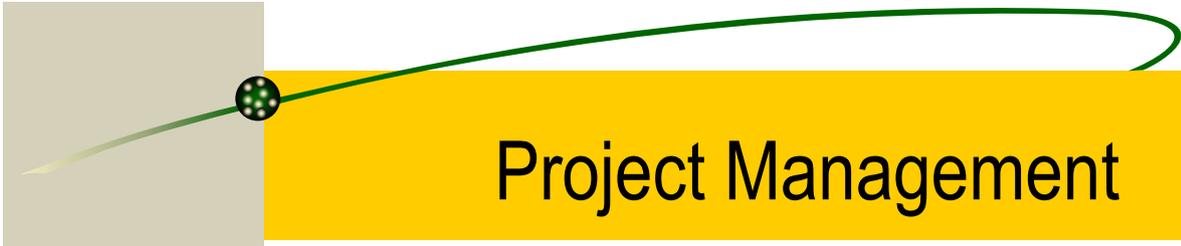
International Project Cooperation

- Definition of International Project Objectives
- Implementation of International Projects Teams
- International Cooperation Agreements
- Legal Implications for International Projects
- Recruitment of International Project Teams
- Collocated Project Office
- Communication Requirements
- Language to be applied

Project Management

Problems of International Projects

- Political Requirements & Restraints
- Geographical Distribution of Work
- Financial Return Concept
- Location of Project Management Office (PMO)
- Staffing Requirements of PMO
- Appointment of Project Manager
- Authority of appointed Project Manager
- Language to be applied
- Law and Rules to be applied



Project Management

Typical Management Issues of International Projects

- Project Language
- Communication Issues
- Cultural Differences
- Project Organisation
- Leadership Style



Project Management

Typical Management Issues of International Projects

- Different Currencies
- Different Exchange Rates
- Different Inflation Rates
- Work Sharing Requirements
- Important Legal Issues

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Language and Communication Issues

Communications between Team Members

- Need to Understand Each Other
- Applied Language(s) (E, F, G, R, S, PL, etc.)
- Openness to Communication

Terms & Definitions Applied

- Professional Language
- Terms, Definitions and Abbreviations
- Desire for understanding

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Language and Communication Issues

Understanding Each Other

- Expressions used
- Hidden Agenda(s)
- Different interpretations
(personnel history)

Team Spirit

- Harmony of the Team
- Need for co-operation

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Agree on Project Language

- **Misunderstandings are often the Reason for Catastrophic Project Failures**
- **Efficient Communication Requires that only ONE single official Language is applied**
- **Important Project Terms and Definitions need to be described**

Project Management

Geographical Distribution

- **Required Work Allocation**
- **Work Allocation Quota (percentage)**
- **Distribution of Noble Work**
- **Contracting to None Member States**
- **Financial Return**
- **Balance of Work Allocation**
- **Other considerations**

Project Management

Work Sharing Concept

- **Distribution of Work (Financial Constraints)**
- **Just Return Concept (Political Requirements)**
- **Noble versus None-Noble Work (Competition)**
- **Avoid Complicated Interfaces (Complexity)**
- **Allow for Competition (Low Cost Solution)**

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Political Requirements and Restraints

- **Military Requirements of Member States**
- **Restricted Transfer of Technology**
- **Political Restrictions of Member States**
- **Regulatory Requirements (international)**
- **Regulatory Requirements (national)**
- **Legal Requirements (international)**
- **Legal Requirements (national)**
- **Others Special Requirements**

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Cultural Differences in International Projects

- **Difficulty to Judge Behaviour of International Partners**
- **Difficulty to Judge Heritage and of International Partners**
- **Trustworthiness of International Partners**
- **Unforeseen Circumstances not known**

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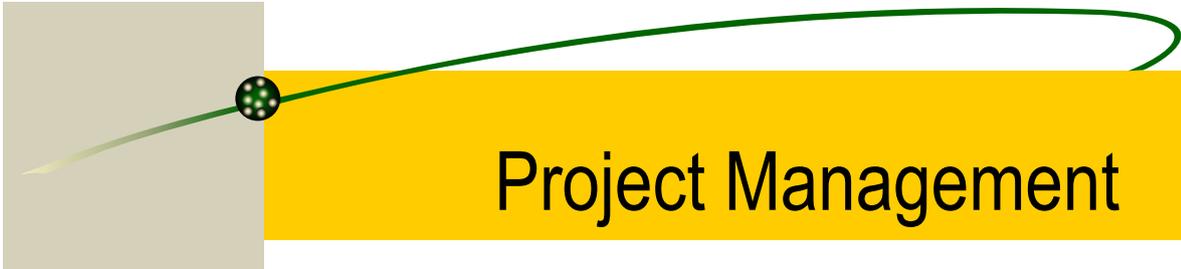
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Cultural Differences in International Projects

- **Lack of Experience with International Partners**
- **Communication (Distance, Language, Culture, etc)**
- **Different Cultural and Educational Background**

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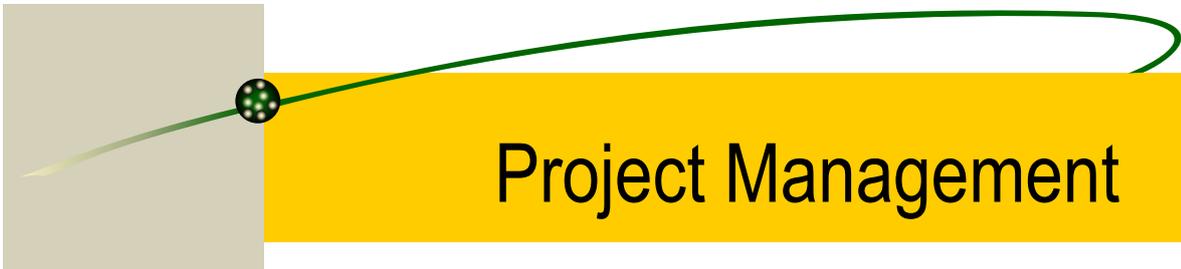
50



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Cultural Differences in International Projects

- International Projects are strongly Impacted by Cultural Differences
- **The Word “YES” may not have the same Meaning at different Cultures**



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Cultural Differences in International Projects

- Social and Educational Differences Exist
- **Solution (Welch, 2002): “Global Training and Learning must become a Top Priority at Globally Operating Companies”**

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3. Management of High-Tech Complexity

- *Baseline Documentation,*
- *Contractual Issues*
- *Specification,*
- *Interfaces,*
- *Work Statement*
- *Project Plans*

Project Management

Baseline Documentation

- **Project Contract** (*legal terms & definitions*)
- **System Specifications** (*technical definition*)
 - System Requirements Specification
 - Subsystem Requirements Specifications
 - Interface Specification
 - Quality Assurance Specification
 - AIT Specification
- **Statement of Work (SOW)**
 - Description of Tasks to be performed
 - Summary of Deliverables
 - Deliverable Items List (DIL) (*hardware & software*)
 - Document Requirements List (DRL)
 - Document Requirements Description

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Important Legal Issues

- **Scope of Work**
- **Deliverables and Key Dates**
- **Price and Payment Conditions**
- **Intellectual Property Rights**
- **Termination for Convenience**

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Baseline Documentation

Sample Table of Content of Project Contracts:

- Scope of Work (Reference to Specifications, SOW and Plans)
- Deliverables and Services and related Prices
- Project Options
- Payment Schedules
- Delivery Dates and Adjustments for late Deliveries
- Progress and Status Reports
- Inspection and Acceptance
- Project Changes and Change Control
- Rights in Data and Proprietary Information
- Intellectual Property Rights
- Subcontractors and Key Personnel
- Communications and Project Language
- Force Majeure
- Arbitration, Applicable Law
- Effective Date of Contract
- End of Contract and Termination

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Baseline Documentation

Sample Table of Content of Space System Specifications:

- Introduction
- Space Segment
 - Spacecraft Design (Satellite or Other Space Object)
 - Spacecraft AIT
 - Associated Ground Support Equipment (MGSE& EGSE)
 - Transportation to Launch Site
- Ground Segment
 - Ground Control Centre (GCC)
 - Tracking System
 - Services
- Software
 - Spacecraft Software
 - GCC Software
 - Software Acceptance (End-to-End-Tests)
 - Software Operating Procedures
- Launch and Launch Support
 - Launch Vehicle Compatibility
 - Launch Site Support
 - Post-Launch Support
- Project Reviews (PDR, CDR, FRR, MRR, FAR)

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57

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Baseline Documentation

Sample Table of Content of a Statement of Work:

- Introduction (Purpose)
- Scope
- General Background
 - Technical Requirements,
 - Constraints
 - Applicable Documents
 - Reference Documents
- Task description
 - Engineering Tasks
 - Design (Hardware and Software)
 - Development
 - Prototyping
 - Tests
 - Prototype Manufacturing
 - Prototype Testing
 - Reporting and Documentation
 - Project Management
- Project Deliverable Items List (DIL)
 - Hardware
 - Software
 - Contract Document Requirements List (CDRL)
 - Data Requirements Description (DRD)

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Baseline Documentation

- **Project Plans**
 - **Work Breakdown Structure (WBS)**
 - **Project Milestone List**
 - **Project Time Schedules**
 - **Project Cost Plans**
 - **Project Control Plan**
 - Schedule Control
 - Cost Control
 - Earned Value Analysis
 - **Documentation Control Plan**
 - **Configuration Control Plan**
 - **Design & Development Plan**
 - **Assembly, Integration & Test (AIT) Plan**
 - **Facility Plan**

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Project Management & Control

- **Status Control**
 - Technical Achievements
 - Critical Areas
 - Documentation
 - Engineering Changes
 - Schedule (Actual vs. Plan, Critical Path)
 - Actions
 - Financial Status
 - Contractual
- **Status vs. Planning**
 - Deviations to Plan
 - Corrective Actions & Resolutions

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Project Management & Control

- **Analysis**
 - Impact to entire Project
 - Consequences to Project Goal
 - Decisions to be taken
- **Management Decisions**
 - **Change of Project Baseline**
 - Technical Requirements
 - Schedule Restraints
 - Financial
 - Contractual
 - **Change of Project Plans**

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4. Organizational Aspects

- *Structures,*
- *Multiple Teams & Disciplines,*
- *Different Skills,*
- *Responsibilities & Authorities,*
- *Location & Staffing*

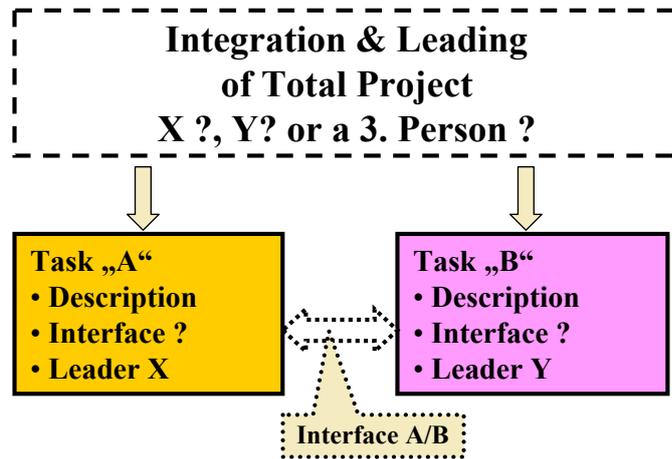
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Organizational Structures

Integration and Leadership of Tasks



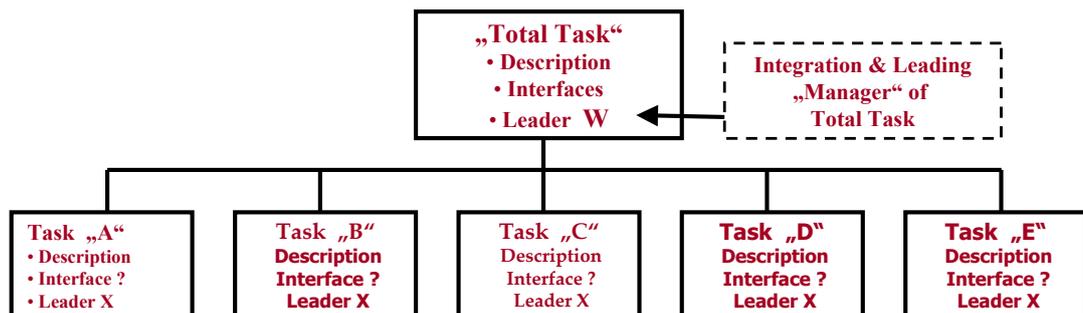
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Implementation of Organizational Structures

Integration and Leading of Organizational Units
at different Levels

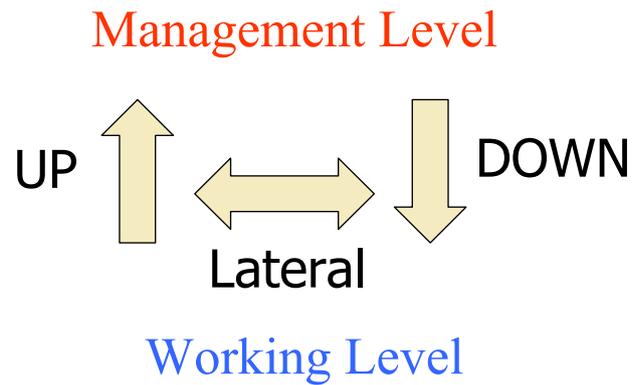


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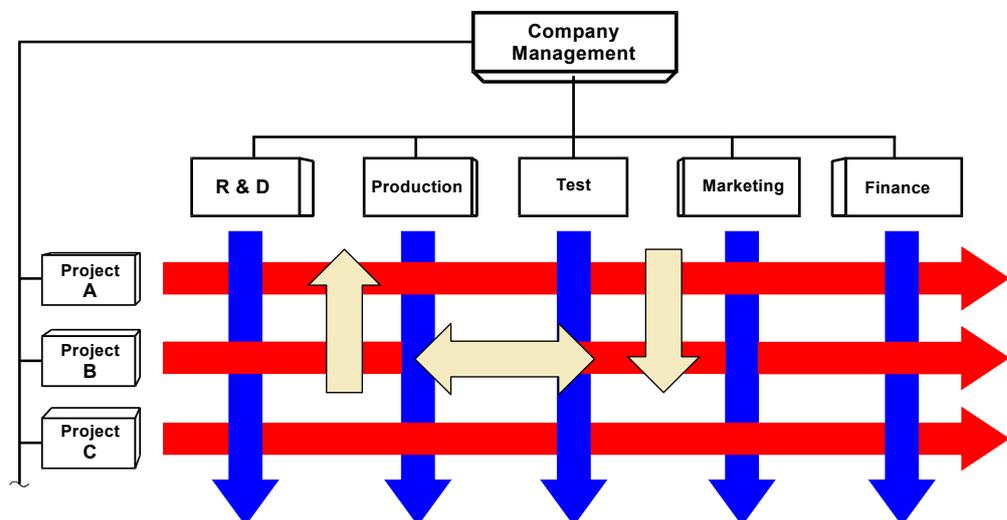
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Two Way Communication between Management and Working Level



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Matrix Organisation



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PM Tasks and Responsibilities

Core Team

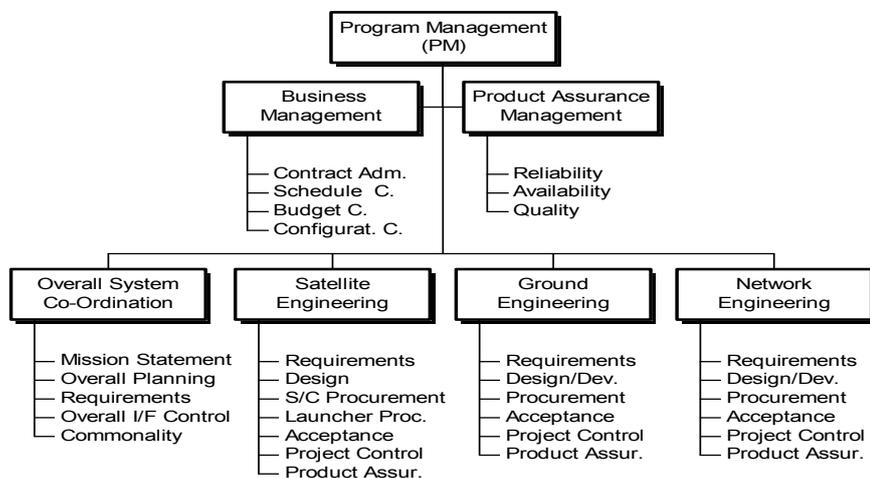
- Systems Engineering Management (SEM)
- Project Control Management (PCM)
- Product Assurance Management (PAM)
- Configuration Control Management (CCM)
- Documentation Control Management (DCM)
- Contracts Officer (CO)
- Others as required

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67

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Sample Program Organisation



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Project Management (PM) Tasks and Responsibilities

The PM has following Responsibilities

- He is the head of the Project Management Office (PMO)
- He is fully authorized to
 - plan,
 - monitor and
 - control the project work
- He is responsible for meeting contractual requirements
- He maintains cognizance of the progress of the project
- The PM will be supported by PMO staff core team

Project Management

Authority of Project Managers

- **Responsibility and Authority must be balanced**
- **Required Authority of Project Managers**
 - *Definition of overall project objectives,*
 - *Appointment and/or acceptance of core team members,*
 - *Definition/Implementation of project plans,*
 - *Definition/Implementation of resources and budgets*
 - *Control of implemented plans, resources and budgets*

Project Management

Organization of International Projects

- A logical Structures with unambiguous Responsibility Assignments is mandatory
- **The Project Manager must be the ONLY Focal Point for all Official Communications**
- The Project Manager must be supported by Key Personnel and Experts

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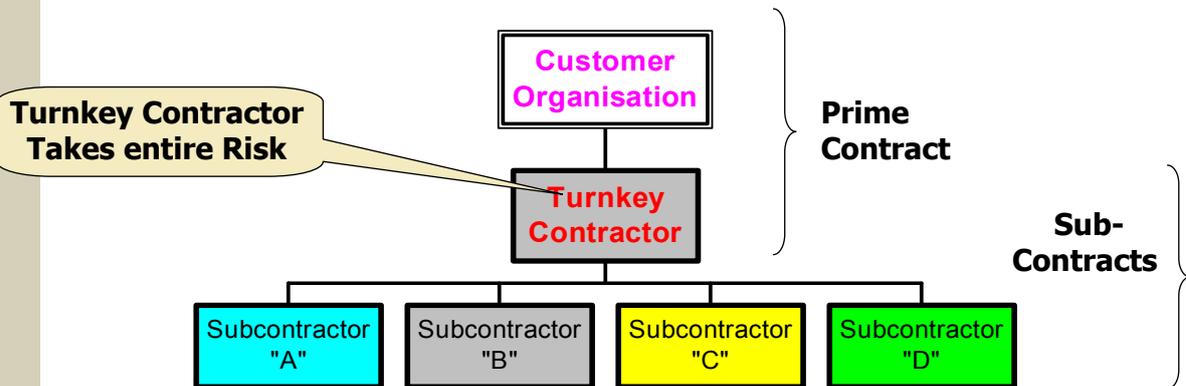
Location and Staffing of the PMO

- **Suggested Location:**
 1. *Vicinity of the Prime Contractor or*
 2. *Geographically central location*
- **Suggested Staffing Requirements:**
 1. *Management Qualification*
 2. *Experience (national projects)*
 3. *Experience (international projects)*
 4. *Availability*
- **Application of Common Language**

Project Team

Classical „Turn-Key Project“ Concept

Problem: Most Primes can not take full Risks!



Conclusion: Find Solution for Risk Sharing!

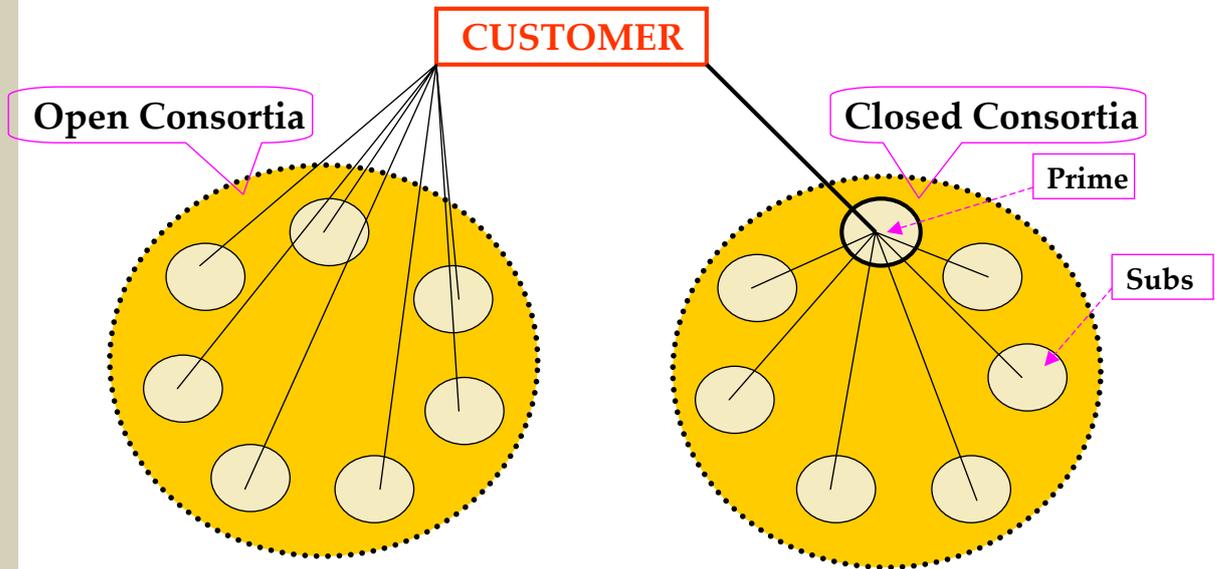
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Start of Consortia

- The Idea has Originated by Banks in the 30th
- Reason: to Cope with High Risks
- Requires: Consortia Contract
 - Rights
 - Obligations
 - Rules & Regulations
- A Consortia may act like a Company
- Two Types of Consortia exist:
 - The ‚Open Consortia‘ – All Partners Communicate External
 - The ‚Closed Consortia‘ – Only The Prime Communicates External

Project Team

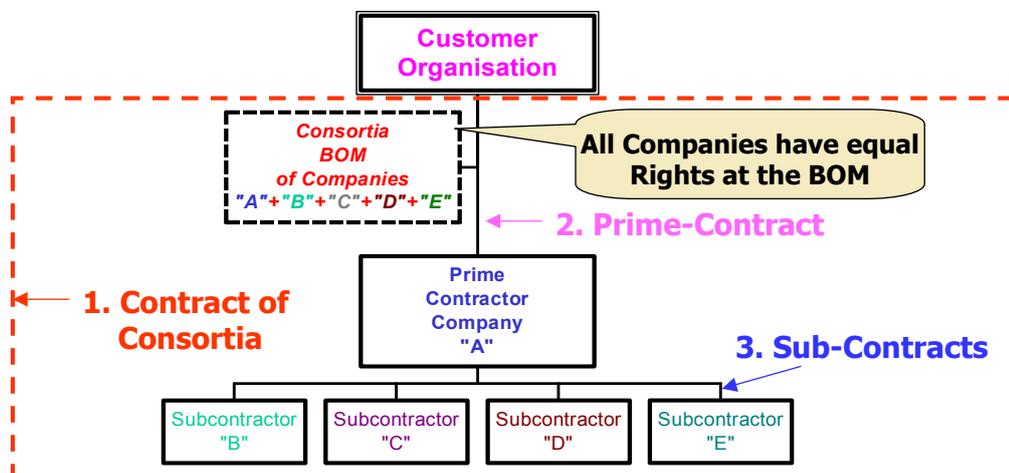
Open and Closed Consortia



Project Team

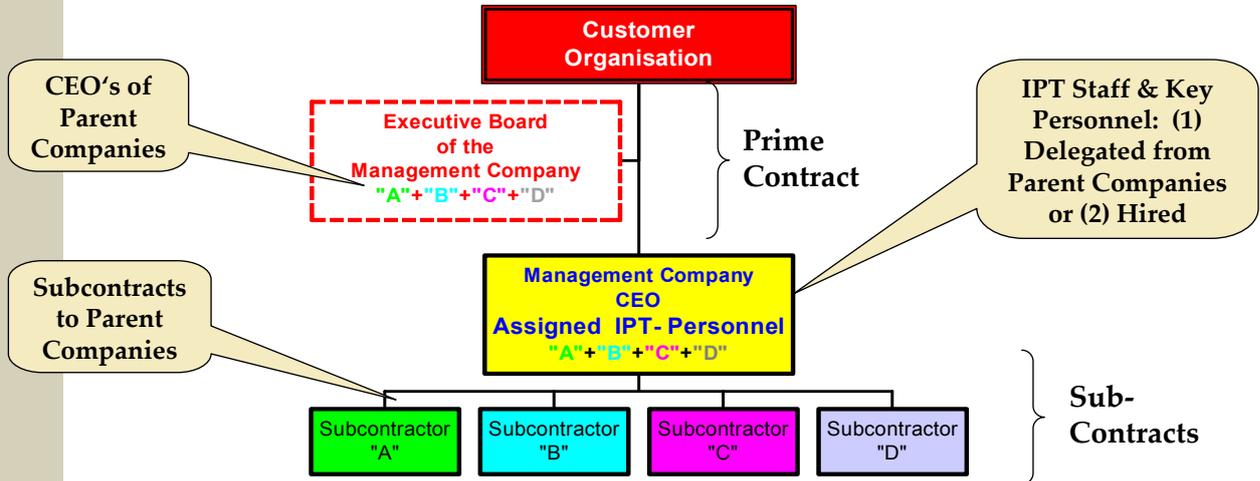
Classical Project Consortia

Risk Sharing through Implementation of Consortia!



Project Team

Management Company with imbedded Integrated Project Team (IPT)

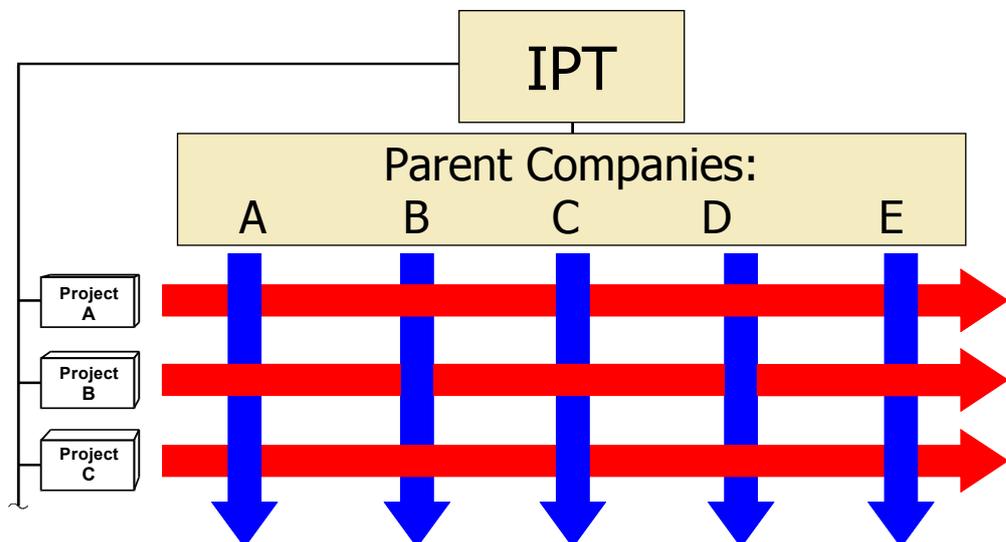


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77

Project Team

Inter-Company Matrix Organization



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78

Project Management

Concept of the 'Integrated Project Team' (IPT)

- Responsibility of IPT
- Hosting Organisation
- Leadership of IPT Project Manager
- Recruiting of IPT Project Manager
- Reporting of IPT Project Manager
- Recruiting of IPT Team Members
- Reporting IPT Team Members
- Overall Control by IPT Project Board

Project Management

Definition of the EEIG

(European Economic Interest Group)

EEIG is an association linking organizations from different countries within the European Community together which have a need for cooperation

EEIG's work within a neutral legal framework that is independent of individual national legal systems

An EEIG is legally separate from the business of its owners, although it exists to carry out tasks for them

An EEIG must be made up of parties from two or more EC member states with their registered office in an EC country

Project Management

5. Project Staff

- *PM-Functions,*
- *Leadership Style,*
- *Appointment of Project Manager,*
- *Motivation Factors*

Project Management

Project Management Functions

- **System Engineering**
- **Subsystem Engineering**
- **Interface Control**
- **Product Assurance**
- **Project Planning & Control**
 - Schedule Control
 - Resource and Cost Control
 - Earned Value Analysis
- **Documentation/Configuration Control**

Project Management

Leadership Style of International Projects

- The Selected Leadership Style may become a Success Factor or the Opposite
- **The chosen Leadership Style must support an Open Dialog**
- Managers and their Staff must frequently Exchange all Important Information

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83

Project Management

Applied Leadership Style

Examples

- **Management by Participation** – *applicable to Soft Projects*
- **Management by Consultation** – *applicable to R&D Projects*
- **Management by Authority** – *applicable to Commercial Projects*
- **Management by Dictation** – *applicable to Project Crisis only*

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84

Project Management

Leadership Style of International Projects

- The assigned Project Manager of a Global Project must be a good Team Player
- **“The best Leaders don’t just Manage but Lead”** (Welch, 2002)

Project Management

Appointment of Project Manager

Recruitment Criteria

- Qualification
- Management Experience
- **International** Project Experience
- Management Skills
- Psychological Skills
- Language Skills
- Political Considerations
- Availability

Project Management

Motivation is an important Responsibility of Project Managers

(Motivation Factors defined by Herzberg)

- **Success**
- **Recognition**
- **Independent Work**
- **Responsibility**
- **Career**
- **Personnel Development**

Project Management

Recommended Follow-On Actions

Implement a ***“Project Management (PM) Entity”*** at your Organization

Prepare and Implement a ***“PM Handbook”*** or Guideline for your Organization

Perform internal ***“PM-Seminars and – Workshops”*** for all Staff concerned

Perform Regular Project Reviews ***“Weekly Progress”, “Monthly Project Status”, “Design Reviews”, “Acceptance Reviews”, etc.***

Implement a ***“Formal Status Reporting and Information System”*** to upper Management



Project Management

Recommended Project Management Literature

Kerzner, Project Management & Study Guide, 8th Edition

Madauss, Projektmanagement, 7th Edition, 2005, German

Verzuh, The Fast Forward MBA in Project Management, 1999

Terry, Principles of Management, 7th Edition

ESA, Space Project Management, ECSS-M Series

PMI, PMBOOK