PROJECT CONTROL
PRINCIPLES
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Optimization of Project Parameters: Performance (P), Schedule (S) and Cost (C)
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
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
Integrated Project Control Process
(Project Feedback Solution)

- **PROJECT BASELINE**
  - At CTR Award

- **PROJECT PLANS**
  - R&D, Organization AIV, Test, Operations

- **PROJECT ATP**
  - Total Project, Dedicated WP’s, Subcos & Supplier
  - ATP = Authority to Proceed

- **PM DECISIONS**
  - • Actions,
  - • Changes,
  - • Redirection

- **ANALYSIS FORECAST**
  - Propose Corrective Actions

- **COMPARE TO PLAN**
  - Deviation Analysis

- **STATUS REVIEW**
  - Status Review

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**Project Control Principles**
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**
Work Breakdown Structure
(sample only)

1st Stage
Contractor "D"
Russia

2nd Stage
Contractor "E"
Ukrain

Fairing
Contractor "I"
Switzerland

Launch Campaign
Contractor "K"
Kazakhstan

1st Stage
Contractor "D"
Russia

Payload
Contractor "H"
USA

Bus
Contractor "G"
France

Propulsion
Contractor "H"
Germany

Interface
Contractor "F"
Japan

Satellite System
Customer
Luxembourg

Supplier of
Launch Vehicle
Contractor "A"
USA

Supplier of
Satellite
Contractor "B"
France

Supplier of
Ground Station
Contractor "C"
UK

Satellite Operations
Contractor "D"
Holland

Tracking
Company "P"
Germany

Monitoring
Company "D"
Holland

Evaluation
Company "Q"
Ireland

Relay
Company "R"
China

TT&C Station
Contractor "L"
Italy

Up-Link
Contractor "M"
Spain

Data Processing
Contractor "N"
Belgium

Telemetry
Contractor "O"
UK
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
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

- Assign Work Package Manager

- Description of WP Tasks to be Performed

- Tasks Explicitly Excluded

- WP Inputs (Documents, Hardware, Software)

- WP Outputs (Products: Hardware, Software, Documents)
Project Control Principles

Project Milestones

• Identify Project Milestones
• Major Milestones
• Payment Milestones
• Other Milestones
• Planned Achievements
• Important Key Events for Control
1. Establish Schedule Baseline

Input *

Objective, requirements, mission plan, etc.

Project task

time

Output **

Deliverables (HW, SW, documentation)
1. Establish Schedule Baseline
   (Sequence of Events)

- Specification
- Design
- Production
- Test

Activity

Dummy Activity
1. Establish Schedule Baseline
   (Sequence of Events and Durations)

   to Specification 4 w
   Design 8 w
   Production 6 w
   Test 2 w
to + 20
## Baseline Milestone Schedule

<table>
<thead>
<tr>
<th>A</th>
<th>INSTALLATION</th>
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<tbody>
<tr>
<td>B</td>
<td>APPROVAL RESPONSIBILITY</td>
</tr>
<tr>
<td>C</td>
<td>ACCOMPLISHMENT RESPONSIBILITY</td>
</tr>
<tr>
<td>H</td>
<td>SCHEDULE TITLE</td>
</tr>
<tr>
<td>J</td>
<td>CONTRACTOR</td>
</tr>
<tr>
<td>K</td>
<td>LEVEL</td>
</tr>
<tr>
<td>D</td>
<td>ORIG. SCHEDULE APPR. (DATE)</td>
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<tr>
<td>E</td>
<td>LAST SCHEDULE CHANGE</td>
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<tr>
<td>F</td>
<td>STATUS AS OF</td>
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### MILESTONES

<table>
<thead>
<tr>
<th>L</th>
<th>KEY MILESTONES</th>
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<tr>
<th>M</th>
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<thead>
<tr>
<th>N</th>
<th>INTERFACES</th>
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<tr>
<th>O</th>
<th>NOTES</th>
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</table>
1. Prepare Schedule Baseline
(sample schedule)

Project Control Principles
1. Establish Schedule Baseline
   (Critical Path Analysis)

Project Control Principles
2. Establish Schedule Targets
(Definition of Milestones)

Activity

Dummy Activity
2. Establish Schedule Targets
   (Definition of Milestones)

   • Identify Project Milestones
   • Major Milestones
   • Payment Milestones
   • Other Milestones
   • Describe Planned Achievements
   • Perform Control
4. Provide Schedule Control
   (Status Monitoring)

- Baseline Planning
- Measurement of Achievements
- Comparison of Planned and Actual
- Deviations to Plan
- Corrective Actions
4. Provide Schedule Control
(Status Monitoring)

<table>
<thead>
<tr>
<th>Aufgaben</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</tbody>
</table>
4. Provide Schedule Control
(Schedule Trend Charts)
5. Identify Schedule Problem Areas

Activities and/or Milestones are not Completed in Time

Progress Information not Available

Work Forecast Shows Delay of Deliverables

Critical Path Analysis not Performed
6. Implement Corrective Actions

- Requesting Additional resources to Complete Activities and/or Milestones on the Critical Path
- Provide Constantly Progress Information
- Introduce Work Around Solutions
- Perform Critical Path Analysis
7. Implement Schedule Reporting

Activities and Milestones Completed

Work Forecast of Activities to be Completed including Time to Completion (TTC)

Schedule Problem Areas and Solutions

Results of Critical Path Analysis
Project Cost Plans

- Cost Account Structure
- Manpower & Cost Plan
- Travel & Subsistence
- Overall Cost Summary
Planning Of Project Resources

- Manpower Requirements
- Material Requirement
- Requirements for Machines
- Facility Requirements
- Travel Requirements
- Others (TBD)
## Manpower and Cost Plan

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<th>RESOURCE</th>
<th>TIME LINE (Month or Quarter)</th>
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<tbody>
<tr>
<td><strong>Manpower (hrs)</strong></td>
<td>100 150 200 250 200 150 100 50</td>
<td>1 200</td>
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<tr>
<td><strong>Costs (T-Euro):</strong></td>
<td></td>
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</tr>
<tr>
<td>o Manpower</td>
<td>10 15 20 25 20 15 10 5</td>
<td>120</td>
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<tr>
<td>o Travel</td>
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</tr>
<tr>
<td>o Material</td>
<td></td>
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<tr>
<td>o Equipment</td>
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<tr>
<td>o Contractors</td>
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<tr>
<td>o Others</td>
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<td></td>
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<tr>
<td><strong>Grand Total</strong></td>
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</table>
## Manpower and Cost Control

<table>
<thead>
<tr>
<th>RESOURCE</th>
<th>MANPOWER &amp; COST STATUS REPORT</th>
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<tbody>
<tr>
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<td>Manpower (Hours)</td>
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<td>Costs (Euro):</td>
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<td>o Suppliers</td>
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<td>o Others</td>
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</tr>
<tr>
<td>Grand Total</td>
<td>195</td>
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</tbody>
</table>
Project Control Principles

Earned Value Methodology

- **ACWP** – Actual Cost Work Performed
- **BCWP** – Budgeted Cost Work Performed
- **BCWS** – Budgeted Cost Work Scheduled

**Cost Plan**

**Actual Costs**

**Time Schedule**

**Cost at Completion (CAC)**

**Cost to Completion (CTC)**

**Accumulated Costs**

**Time Now (TN)**

**Statuskontrolle (01.07.XX)**

- **Plankosten (PK)**
- **Ist-Kosten (IK)**
- **Arbeitswert (AW)**

**Zeitplan**

<table>
<thead>
<tr>
<th>Cost Plan</th>
<th>Actual Costs</th>
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<tr>
<td>Kostenplan</td>
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<td>20 45 45 70 70 75 65 65 65 40 40 40</td>
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<tr>
<td>15 40 40 45 50 60</td>
<td>55 95 140 190 250</td>
</tr>
</tbody>
</table>

**Project Control Principles**
Recommended Project Management Literature

- Madauss, Projektmanagement, 6th Edition, 2000, German
- Verzuh, The Fast Forward MBA in Project Management, 1999
- Terry, Principles of Management, 7th Edition
- ESA, Space Project Management, ECSS-M