Software Project Management

Week 11

1

Today's Lecture

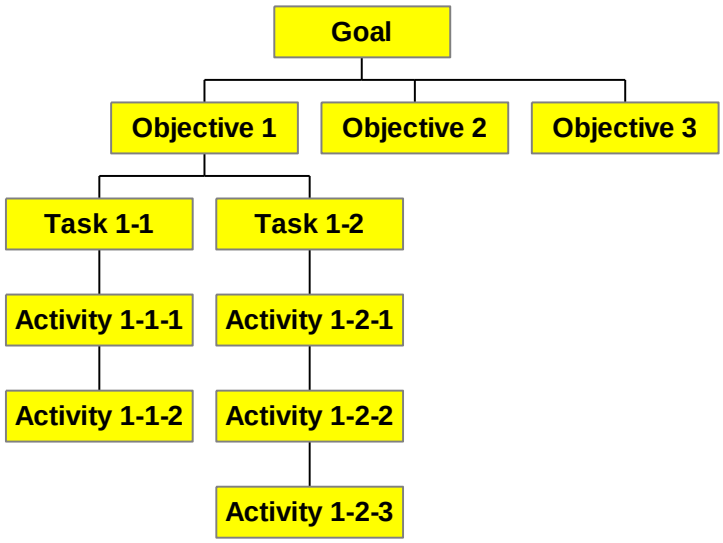
- Budgeting against Schedules

Slides from R S Pressman's book – Software Engineering: A Practitioner's Approach and PMP Prep
And adopted from Booz Allen Hamilton Slides

Project Plan

- Work Breakdown Structure (WBS)
  - Hierarchy of tasks & work packages
  - Estimated task durations
- Responsibility Chart
  - Allocation of tasks to individuals
- Schedule
  - Bar/Gantt chart
  - Network diagram
- Costs & Budgets **Work Breakdown Structure (WBS)**

WBS Example from previous lectures



Building Renovation (Example)

- Design
- Pre-Renovation
- Renovation
- Furnish
- Post-Renovation

Example of a WBS with Details

Activity or Task	Responsible / Resources	Input	Output	Duration	Predecessor
1.0 Design	Mary				
1.1 Determine best 5 potential architects		Listings	Short list	1 wk	
1.2 Interview architects	Mary / Richard			1.25 days	
1.2.1 Architect 1	Mary / Richard			2 hrs	1.1
1.2.2 Architect 2	Mary / Richard			2 hrs	1.2.1
1.2.3 Architect 3	Mary / Richard			2 hrs	1.2.2
1.2.4 Architect 4	Mary / Richard			2 hrs	1.2.3
1.2.5 Architect 5	Mary / Richard			2 hrs	1.2.4
1.3 Select architect	Mary		Architect	1 day	1.2.5
1.4 Prepare 1st draft plan	Architect			3 wks	1.3
1.5 Review draft	Richard [12%]			1 wk	1.4
1.6 Revise draft	Architect			2 wks	1.5
1.7 Receive final plan	Architect, Richard			0 days	1.6

Sample Responsibility Matrix

WBS	Activity/Task Listing	Responsibility for Task		
		Project Manager	Owner	Architect
1	Design	5	5	1
2	Pre-Renovation	2	1	0
3	Renovation	2	3	4
4	Furnishing	2	3	4
5	Post-Renovation	2	5	0

Key to responsibilities

0 None
1 Accomplish
2 Supervise
3 Must be notified
4 Final approval
5 Consult for advice

Project Schedule

- Bar or Gantt Chart
- Network Diagram
  - Critical Path Method (CPM)
  - Program Evaluation & Review Technique (PERT)

Example of a Gantt Chart

Activity or Task	Responsible / Resources	Input	Output	Duration	Predecessor
1.0 Design	Mary				
1.1 Determine best 5 potential architects		Listings	Short list	1 wk	
1.2 Interview architects	Mary / Richard			1.25 days	
1.2.1 Architect 1	Mary / Richard			2 hrs	1.1
1.2.2 Architect 2	Mary / Richard			2 hrs	1.2.1
1.2.3 Architect 3	Mary / Richard			2 hrs	1.2.2
1.2.4 Architect 4	Mary / Richard			2 hrs	1.2.3
1.2.5 Architect 5	Mary / Richard			2 hrs	1.2.4
1.3 Select architect	Mary		Architect	1 day	1.2.5
1.4 Prepare 1st draft plan	Architect			3 wks	1.3
1.5 Review draft	Richard [12%]			1 wk	1.4
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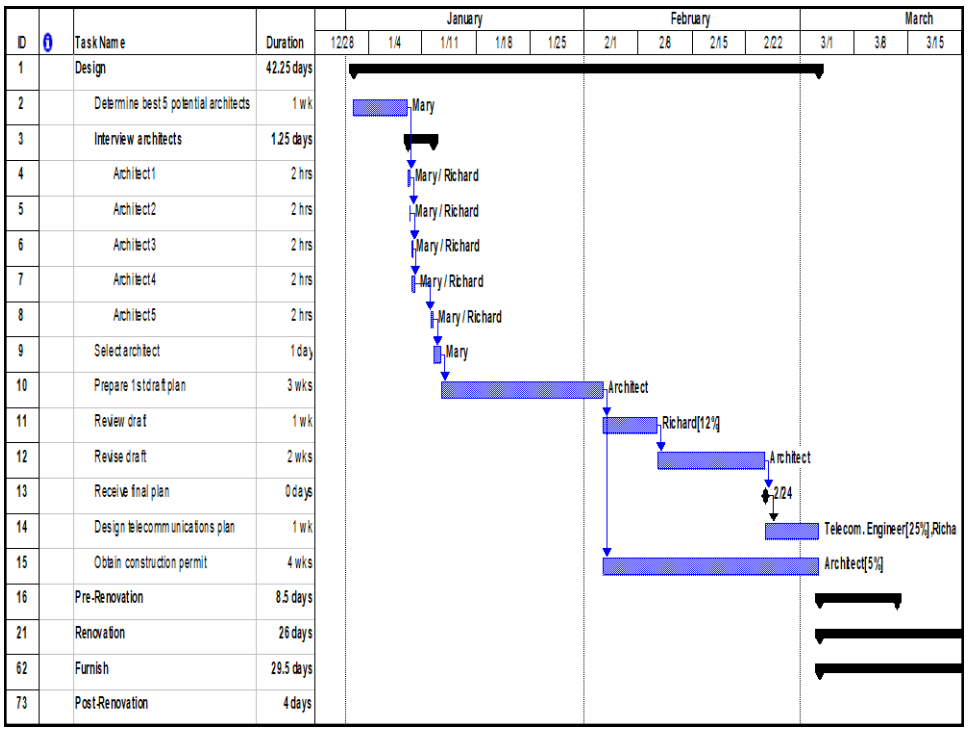
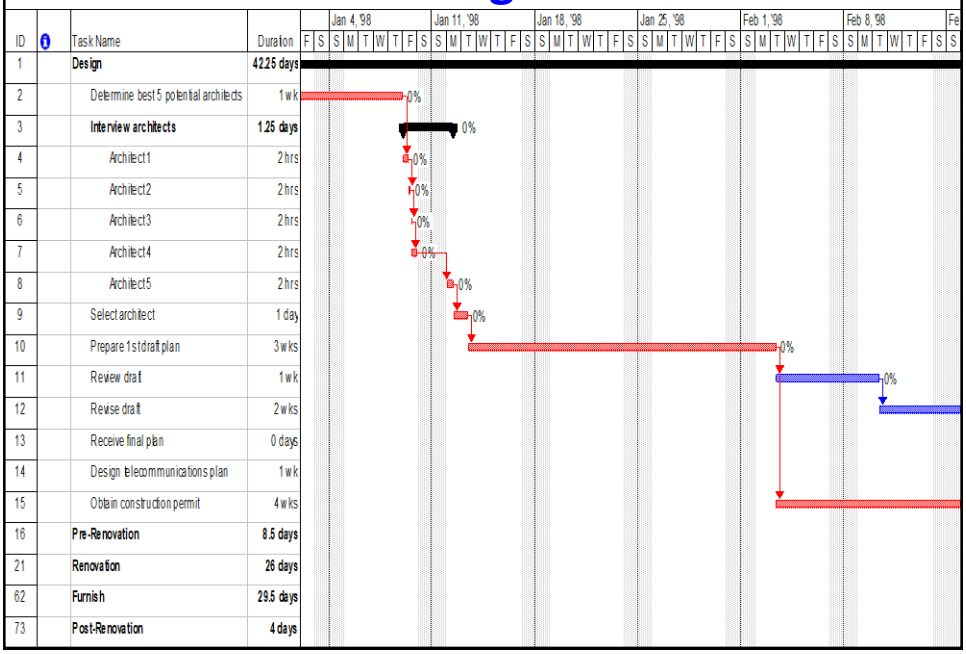


Project Schedule

- Bar or Gantt Chart

- **Network Diagram**
  - Critical Path Method (CPM)
  - Program Evaluation & Review Technique (PERT)

Gantt chart showing critical activities



Basic Project Management Cycle

- Initiation Phase
  - Team formation
  - Goals
  - Objectives
- Planning Phase
  - Scheduling of tasks
  - Budgeting (resource management)
- Control Phase
  - Periodic adjustment of the PLAN
- Closeout Phase

Costs & Budgets

Major concerns of every project is to control

- Time
- Costs

Issues affecting costs

- Amount of time charged by workers
- Duration of time from start to finish
- Time lost due to
  - Factors with control of management
  - Factors beyond control of management
- Resources required to perform project

Cost classification

- Recurring vs. Nonrecurring
- Fixed vs. Variable
- Direct vs. Indirect

Cost Types

- A **fixed cost** is constant, independent of the output or activity level. The annual cost of property taxes for a production facility is a fixed cost, independent of the production level and number of employees.
- A **variable cost** does depend on the output or activity level. The raw material cost for a production facility is a variable cost because it varies directly with the level of production.
- The **total cost** to provide a product or service over some period of time or production volume is total fixed cost plus total variable cost, where:
- total variable cost = (variable cost per unit) (total number of units)

Cost Types

- A **marginal cost** is the variable cost associated with one additional unit of output or activity. A direct labor marginal cost of $2.50 to produce one additional production unit is an example marginal cost.
- **Average cost** is the total cost of an output or activity divided by the total output or activity in units. If the total direct cost of producing 400,000 is $3.2 million, then the average total direct cost per unit is $8.00.
- A r**ecurring cost** is one that occurs at regular intervals and is anticipated. The cost to provide electricity to a production facility is a recurring cost.
- A **non-recurring cost** is one that occurs at irregular intervals and is not generally anticipated. The cost to replace a company vehicle damaged beyond repair in an accident is a non-recurring cost.

Cost Types

- An **incremental cost** represents the difference between some type of cost for two alternatives.
  - Suppose that A and B are mutually exclusive investment alternatives.
  - If A has an initial cost of $10,000 while B has an initial cost of $12,000, the incremental initial cost of (B - A) is $2,000.
  - In engineering economy we focus on the differences among alternatives, thus incremental costs play a significant role in such analyses.
- **Life-cycle costs** refer to costs that occur over the various phases of a product or service life-cycle, from needs assessment through design, production, and operation to decline and retirement.

Direct and Indirect Cost Accounting

- Direct Costs – Costs applicable to, and identified specifically with, the program contract Statement of Work.
- Examples of Direct Costs: Labor, Travel, Material, Subcontractor Charges
- Indirect Costs – Charges that cannot be consistently or economically identified against a specific contract. These are typically calculated by applying rates and factors to the cost base.
- Example of Indirect Costs: Fringe Benefits, Overhead, Material Handling, General & Administrative, Cost of Money.

Sample Indirect Rate Application

Here is an example of indirect rates applied to prime dollars or direct costs. Overhead costs are applied to prime dollars to derive the Total Cost. The application of indirect rates and factors is based on a company's accounting policies and procedures.

Design Engineering Task		
Design Engineer Hours		1,000
Design Engineer Rate/Hour	$	40.00
Prime Dollars	**$**	**40,000.00**
Overhead Rate		100%
Overhead Dollars	$	40,000.00
Total Burdened Dollars	**$**	**80,000.00**
G&A Rate		10%
G&A Dollars	$	8,000.00
Sub-Total	**$**	**88,000.00**
COM Rate		0.05%
COM Dollars	$	44.00
Total Cost	**$**	**88,044.00**
Fee Rate		10%
Fee Dollars	$	8,800.00
Total Price	**$**	**96,844.00**

Direct Costs

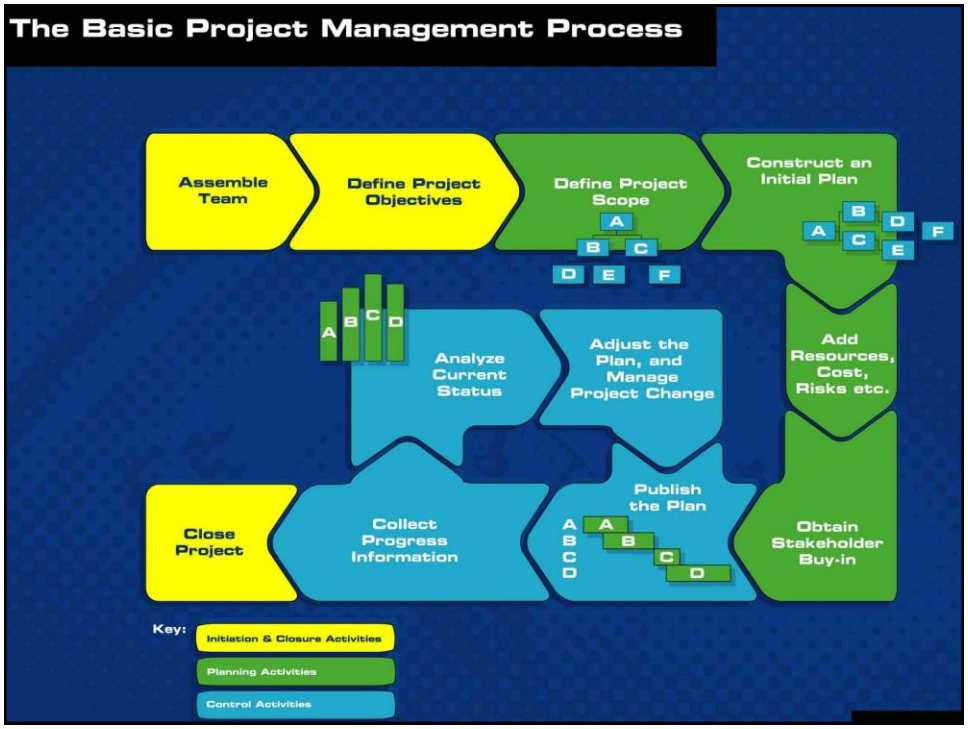
Indirect Cost

Budgets

A budget is a plan that describes authorized expenses for a specified period of time.

Budgets would often include:

- Start-up costs (fixed)
- Resources needed e.g., labor, materials (direct)
- Unit cost for resources (direct)
- Indirect costs
- Total project cost
- Cost sharing



The Budgeting Process

- Define what will be performed (Statement of Work)
- Determine how the work will be structured and tracked (Work Breakdown Structure)
- Assign Responsibility for elements of work (Organizational Breakdown Structure)
- Schedule the authorized work in a manner which describes the sequence of work and identifies significant task interdependencies required to meet the requirements of the program

- Now let's discuss Budgeting.

Two essentials for monitoring

- We need
  - **Schedule**, Which was developed considering:
    - WBS
    - Resources such HR
    - Network showing:
      - what is parallel and what is sequential
      - Critical path
      - Time required for each activity
      - Estimated time to completion
  - **Budget** information
    - Topic in our current discussion

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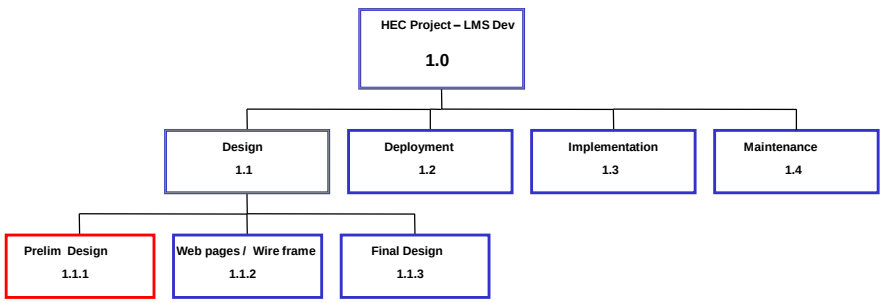
The Budgeting Process

- The budgeting process establishes a means for developing and tracking the cost goals for all contractually authorized work.
- One of the key criteria for establishing an earned value management system is that all major components of a project must be integrated and baselined.
- Major components of the earned value management system include scope, schedule and cost.
- The cost and schedule performance are measured against a baseline to help track the progress of the project.
- But what is a baseline, and how do you establish one?
- Let's review the steps required to establish a cost and schedule baseline on the next page.

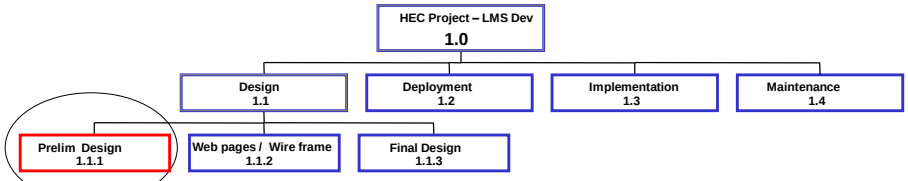
Establish the Schedule Baseline

- Recall the Work Breakdown Structure from Week 3, which defines a project's tasks, processes, responsible parties, etc. Establishing the WBS is the first step in defining the project and in establishing the baseline.

HEC Project Work Breakdown Structure



Establish the Schedule Baseline

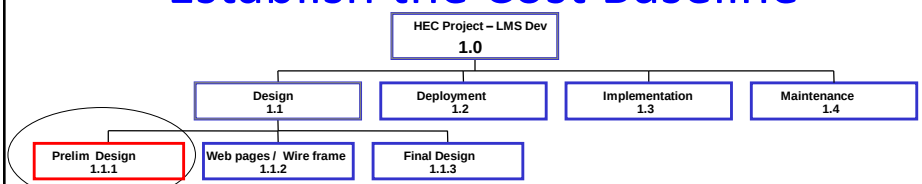


Based on the Project Scope and available resources, the work activities in the WBS are scheduled to establish the Schedule Baseline. This important step was covered in Week 4.

Schedule Baseline

Preliminary Design 1.1.1	Jan	Feb	Mar	Apr	May
1.1.1.1 Define Specifications & Req.					
1.1.1.2 Develop Preliminary Design					
1.1.1.3 Review Preliminary Design					
1.1.1.4 Incorporate Comments					
1.1.1.5 Preliminary Design Complete					

Establish the Cost Baseline

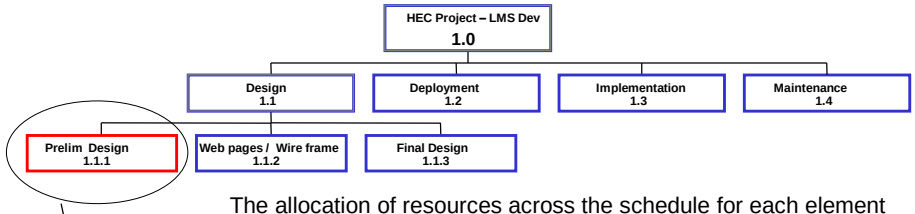


Based on the Project Scope and available resources, the project budget is allocated across the scheduled activities and across time. The time phased allocation of resources, establishes the Cost Baseline. Notice in the chart the time phased hours associated with each task.

Cost Baseline

Preliminary Design 1.1.1 Hours	Jan	Feb	Mar	Apr	May
1.1.1.1 Define Specifications & Req.	1,500	1,000			
1.1.1.2 Develop Preliminary Design		2,000	2,000		
1.1.1.3 Review Preliminary Design			500	500	
1.1.1.4 Incorporate Comments				320	320
1.1.1.5 Preliminary Design Complete					1,000

Integrated Scope, Schedule and Cost



The allocation of resources across the schedule for each element of the project's scope is what creates the project's integrated baseline. The scope, cost, and schedule must be fully integrated to be able to perform EVM. As the chart shows below , each task has an associated schedule and time phased cost.

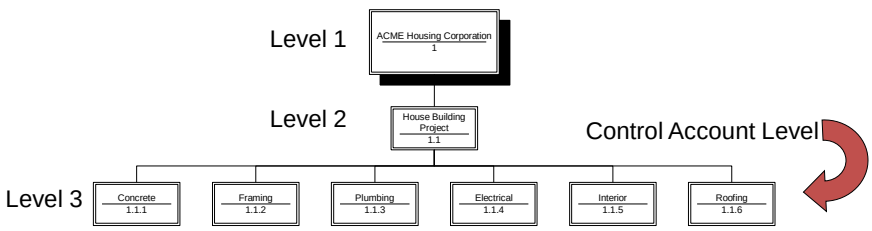
Integrated Cost/Schedule Baseline

Preliminary Design 1.1.1 Hours	Jan	Feb	Mar	Apr	May
1.1.1.1 Define Specifications & Req.	1,500	1,000			
1.1.1.2 Develop Preliminary Design		2,000	2,000		
1.1.1.3 Review Preliminary Design			500	500	
1.1.1.4 Incorporate Comments				320	320
1.1.1.5 Preliminary Design Complete					1,000

A control account is a management control point at which budgets (resource plans) and actual costs are compared to earned value for management control purposes

Control Accounts

- For the House project, it was determined that the performance measurements for the project will be taken at Level 3 (see graphic below). The project manager and the stakeholders must determine the level at which the performance measurement will be required.



Work Packages

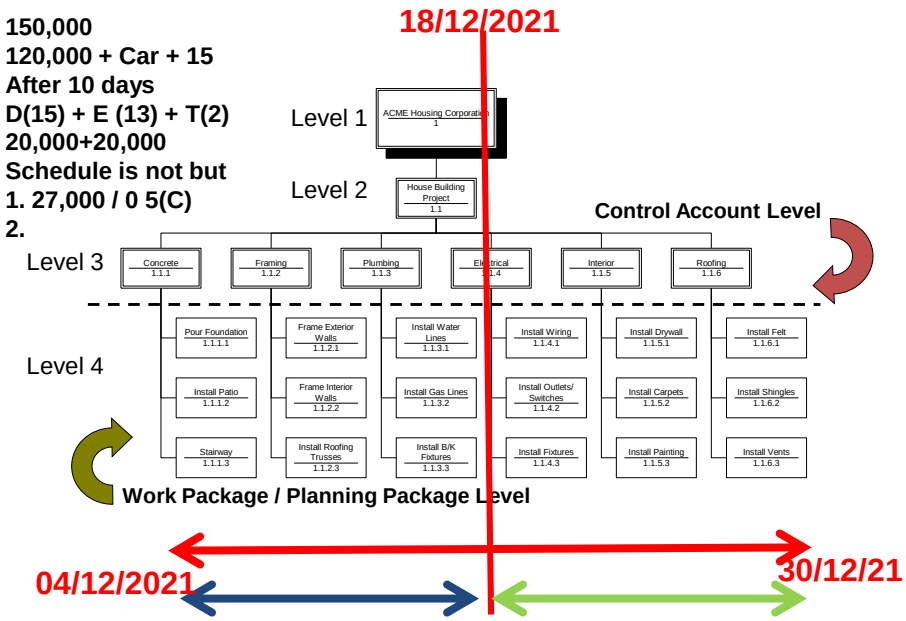
- The detail that builds up to the Control Account Level is contained in Work Packages and Planning Packages. Take a moment now to review Work Packages.
- Work Packages (WP) contain a discrete segment of work below the Control Account level that is defined by
  - a description or brief work statement
  - starting and ending dates
  - completion milestone
  - work-in-process measure
  - time-phased budget expressed in direct labor (hours and/or dollars), material, other direct costs and subcontract dollars
- It is important that the duration of a Work Package be a relatively short span of time (normally, but not limited to, six months or less).
- Now let's take a look at Planning Packages on the next page.

Planning Packages

- Planning Packages reflect a future segment of work within a Control Account that is not yet broken down into detailed work packages. A planning package has a firm budget, estimated start and complete dates, and Statement of Work.
- As work becomes more clearly defined, Planning Packages are converted into Work Packages, with the following constraints. These constraints ensure the initial budget is used appropriately:
  - All planning packages are converted into work packages as requirements are defined, and at a minimum, are scheduled to start at least one month beyond the current reporting period
  - Conversion of planning packages to work packages is reviewed by the Team Leader and documented on a Revision Request (RR)
  - Any conversion involving a change to the schedule or budget of the control account must be accompanied by an RR

Work Packages/Planning Packages

150,000
120,000 + Car + 15
After 10 days
D(15) + E (13) + T(2)
20,000+20,000
Schedule is not but
1. 27,000 / 0 5(C)
2.

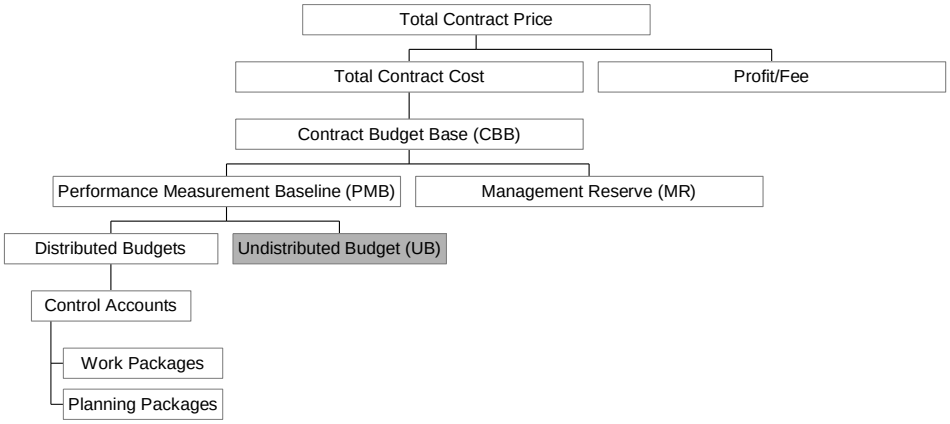


Review

- The budgeting process establishes a means for documenting and tracking the cost goals for all contractually authorized work.
- The baseline is what cost and schedule performance is measured against.
- A Control Account is an assigned WBS Level used to monitor the cost and schedule performance of a significant element of the work.
- Detail below the Control Account Level is contained in Work Packages and Planning Packages.

Undistributed Budget

- Undistributed budget (UB) applies to contractually authorized efforts not yet allocated to WBS elements.
- The UB consists of a budget for authorized changes for which there has not been adequate time to plan the change at the control account level.

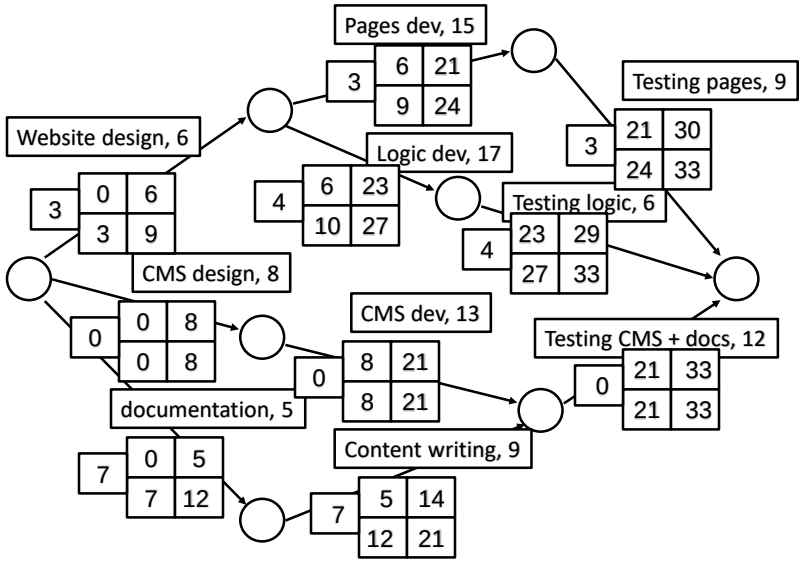


Example 1 : HEC Cost Proposal Development

- So far in the Example HEC LMS development project, we have:
  - Defined what will be performed (Statement of Work)
  - Determined how will it be tracked (Work Breakdown Structure)
- Now we have to:
  - Determine the Proposed Total Cost and Price
  - Assign Developers, Material, ODC, and outsourcing Resources to the Work Elements.
  - Apply Burdens and Fee to derive the Total Cost and Price.

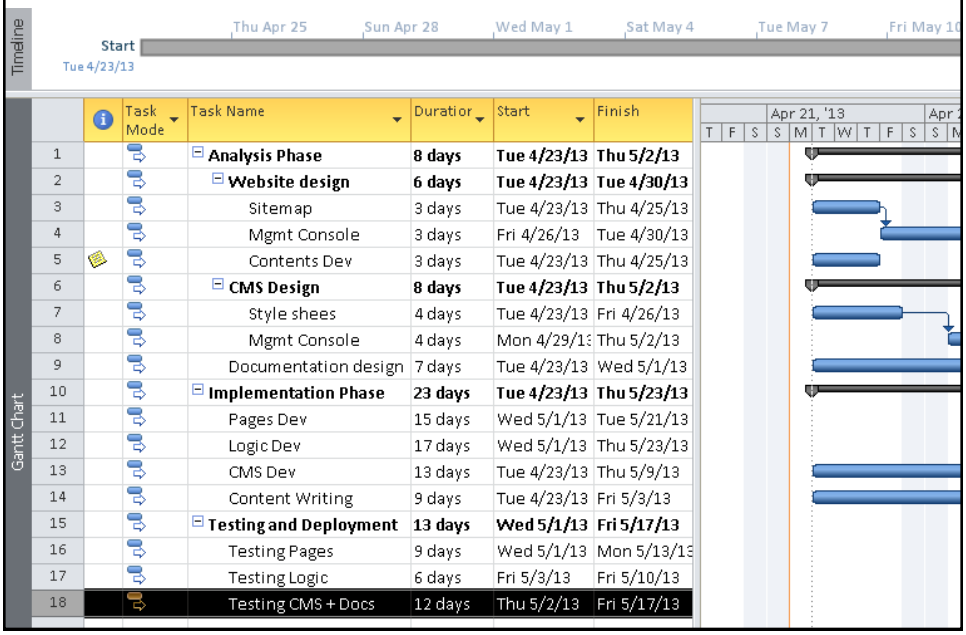
HEC Web system Proposal Development

- To start, we need our Work Breakdown Structure as shown here.



- This insures that we develop cost for only approved project scope.

Project Plan



	Task Mode	Task Name	Duration	Start	Finish
1		**Analysis Phase**	**8 days**	**Tue 4/23/13**	**Thu 5/2/13**
2		**Website design**	**6 days**	**Tue 4/23/13**	**Tue 4/30/13**
3		Sitemap	3 days	Tue 4/23/13	Thu 4/25/13
4		Mgmt Console	3 days	Fri 4/26/13	Tue 4/30/13
5		Contents Dev	3 days	Tue 4/23/13	Thu 4/25/13
6		**CMS Design**	**8 days**	**Tue 4/23/13**	**Thu 5/2/13**
7		Style shees	4 days	Tue 4/23/13	Fri 4/26/13
8		Mgmt Console	4 days	Mon 4/29/13	Thu 5/2/13
9		Documentation design	7 days	Tue 4/23/13	Wed 5/1/13
10		**Implementation Phase**	**23 days**	**Tue 4/23/13**	**Thu 5/23/13**
11		Pages Dev	15 days	Wed 5/1/13	Tue 5/21/13
12		Logic Dev	17 days	Wed 5/1/13	Thu 5/23/13
13		CMS Dev	13 days	Tue 4/23/13	Thu 5/9/13
14		Content Writing	9 days	Tue 4/23/13	Fri 5/3/13
15		**Testing and Deployment**	**13 days**	**Wed 5/1/13**	**Fri 5/17/13**
16		Testing Pages	9 days	Wed 5/1/13	Mon 5/13/13
17		Testing Logic	6 days	Fri 5/3/13	Fri 5/10/13
18		Testing CMS + Docs	12 days	Thu 5/2/13	Fri 5/17/13

Example Estimate

SOFTWARE DEVELOPMENT ESTIMATE TEMPLATE

COMPANY NAME, Project Title, Project Manager

Enter info in white cells, only; shaded cells populate

	ENTER ESTIMATION VARIABLES, BELOW
PROJECT MANAGEMENT EFFORT %	20%
PROJECT MANAGEMENT OFFICE EFFO	20%
PROJECT CONTROL OFFICE EFFORT %	60%
TOTAL SHOULD BE 100% ----------	100%
WORK DAY LENGTH IN HOURS	8
ESTIMATED START DATE	01/01/2021
COMPUTED ESTIMATED END DATE	01/26/2021
ESTIMATED PROJECT DURATION IN W	3.6

PHASE	ESTIMATED HOURS	ACTUAL HOURS
Business Requirements	100	121
Functional Specifications	200	110
Detailed Design	100	80
Code and Unit Test	100	110
System Testing	25	25
User Acceptance Testing	25	25
Project Manager	100	100
Project Control Office	50	50
Project Management Office	50	50

PHASE ACTIVITY	STANDARD WORK EFFORT %	PHASE TEAM SIZE	COMPUTED WORK EFFORT HOURS	COMPUTED TASK DURATION IN WEEKS	COMPUTED AVERAGE RESOURCE HOURLY COST	ESTIMATED COST
Business Requirements	0%	2	121	2	$ -	$ -
Functional Specifications	0%	3	110	1	$ -	$ -

Example Budget

A	B	C	D	E	F	G	H	I	J	K	L
	Year:		0	0	1	1	2	2	3	3	
Ref	Project Expenditures	Rate $ per Unit/Day	Quantity Units/Days	$	Quantity Units/Days	$	Quantity Units/Days	$	Quantity Units/Days	$	Total $
1	**Selection process**										
1.1	Internal resources / staff costs:										
1.1.1	- Information Systems (IS) department	300	10	3000							3000
1.1.2	- user departments	300	20	6000							6000
1.1.3	- procurement department	300	2	600							600
1.2	Travel and expenses	200	12	2400							2400
1.3	Specification / RFP tools and programs	500	2	1000							1000
1.4	Consultancy assistance	0	0	0							0
1.5	Legal assistance	0	0	0							0
	Total selection costs			13000		0		0		0	13000
	Implementation process										
2	**Software costs**										
2.1	Application software user licences	1000	0	0	55	55000	35	35000	0	0	90000
2.2	Software modifications	0	0	0	0	0	0	0	0	0	0
2.3	Additional licences eg Citrix, EDI software	1000	0	0	5	5000	0	0	0	0	5000
2.4	Database user licences	5000	0	0	1	5000	0	0	0	0	5000
2.5	Operating system	0	0	0	0	0	0	0	0	0	0
2.6	Additional security applications	0	0	0	0	0	0	0	0	0	0
	Sub total			0		65000		35000		0	100000

Instructions | Project Budget Template

Conclusion

- At this point we have examined the basics of planning, scheduling, and budgeting to establish the integrated baseline. These items lay the groundwork for maintaining an Earned Value Management System (EVMS). The next module takes us into the details of Earned Value.
- If you have a firm grasp of the concepts covered in these first four modules, feel free to progress to the next module. Otherwise, review the modules to ensure you have a solid understanding of the basics.