



Chapter 14

*Pricing and
Estimating*



Pricing and Estimating

Information available to one bidder is generally available to others.

- ❖ **This is an essential part of the planning process.**
- ❖ **Forms the basis for establishing standards for budgets, man-hours, material costs, contingencies, etc.**
- ❖ **Specific pricing strategies must be developed for each situation.**

Two Types Of Acquisition Policies

Type I acquisition:

One-of-a-kind contract with little or no follow-on potential

Objective:

- Win the contract
- Execute it profitably

Type II Acquisition:

- ❖ ***One of many contracts***
- ❖ ***An entry point to larger follow-up project contracts***

Objective:

- Win the contract
- Perform with excellence

Type I Acquisition:
One-of-a-Kind Program with Little or No
Follow-On Business

1. Develop cost model and estimating guidelines; design proposed project/program baseline for minimum cost, to minimum customer requirements.
2. Estimate cost realistically for minimum requirements.
3. Scrub the baseline. Squeeze out unnecessary costs.
4. Determine realistic minimum cost. Obtain commitment from performing organizations.
5. Adjust cost estimate for risks.
6. Add desired margins. Determine the price.
7. Compare price to customer budget and competitive cost information.
8. Bid only if price is within competitive range.

Type II Acquisition:
New Program with Potential for Large
Follow-On Business or Representing a
Desired Penetration into New Markets

1. Design proposed project/program baseline compliant with customer requirements, with innovative features but minimum risks.
2. Estimate cost realistically.
3. Scrub baseline. Squeeze out unnecessary costs.
4. Determine realistic minimum cost. Obtain commitment from performing organizations.
5. Determine "should-cost" including risk adjustments.
6. Compare your final cost estimate to customer budget and the "most likely" winning price.
7. Determine the gross profit margin necessary for your winning proposal. This margin could be negative!
8. Decide whether the gross margin is acceptable according to the must-win desire.
9. Depending on the strength of your desire to win, bid the "most likely" winning price or lower.
10. If the bid price is below cost, it is often necessary to provide a detailed explanation to the customer of where the additional funding is coming from. The source could be company profits or sharing of related activities. In any case, a clear resource picture should be given to the customer to ensure cost credibility.



Pricing and Estimation

- ❖ ***Good estimating requires that information be collected prior to the initiation of the estimating process. Typical information includes:***
 - Recent experience in similar work
 - Professional and reference material
 - Market and industry surveys
 - Knowledge of the operations and processes
 - Estimating software and databases if available
 - Interviews with subject matter experts

TYPES OF ESTIMATES

❖ ***Order of magnitude estimates***

- Made without any detailed engineering data
- May use past experience
- Accuracy +- 35% within the scope of the project

❖ ***Approximate (rule of thumb) estimates***

- Made without any detailed engineering data
- May use previous similar projects --
- Accuracy +- 15%

❖ ***Definitive (or detailed) estimates***

- Prepared from well-defined engineering data, vendor quotes, unit prices, etc. Accuracy +- 5%

❖ ***Estimating manual***

- Developed over time
- Use to price out “effort”. Accuracy +-10%

Additional Estimating Methods

❖ *Direct Estimate*

- Estimate/experienced person
- Requires judgement

❖ *Estimate by analogy*

- Compare with similar activities
- Requires judgement

❖ *Factored method*

- Based on historical data
- Requires equipment lists, sizes
- Starts with equipment quotes

❖ *Gross proration method*

- Based on historical data
- Near duplicate information



Additional Estimating Methods

- ❖ ***Detailed estimate***

- ***Uses the WBS***
 - ***Takes the WBS down several levels***

- ❖ ***Quotation method***

- Compare three quotations
 - Select the best quotation

- ❖ ***Handbook manuals***

- ❖ ***Learning curves***



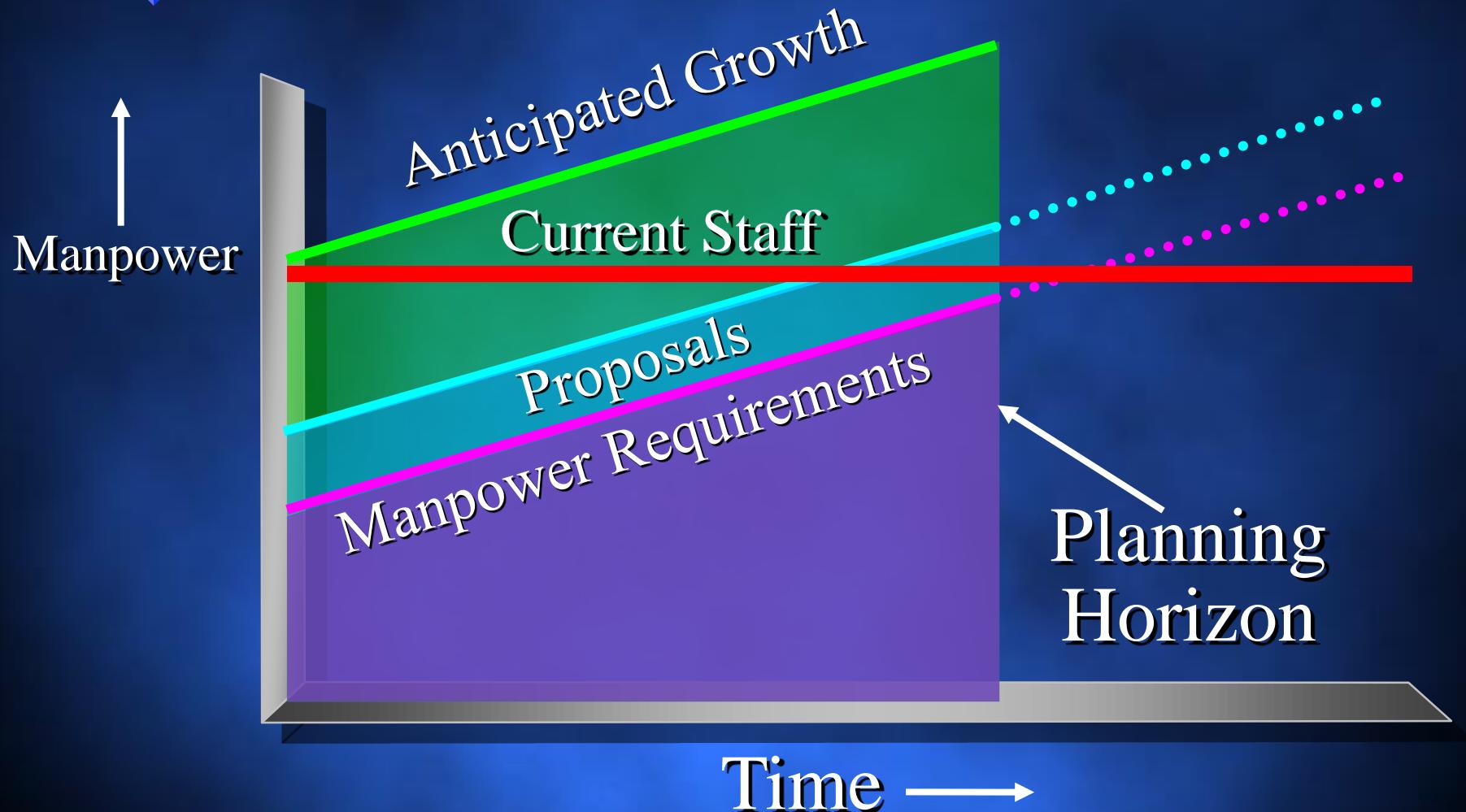
Construction Cost Estimates



Cost Foundations

- ❖ Actual costs to date and estimates to completion
- ❖ Proposal data
- ❖ Marketing intelligence
- ❖ Management goals
- ❖ Past performance and trends

Capacity Planning





Establishing The Project Budget

PRICING OUT A PROJECT

- ❖ Provide a complete definition of the work to be done.
- ❖ Develop/construct a Logic Network Diagram.
- ❖ Construct the WBS and estimate the activities (time/cost).
- ❖ Review these (time/cost) with the respective functional managers.
- ❖ Decide on a course of action.
- ❖ Establish acceptable costs for each WBS-activity.
- ❖ Review the base costs with your sponsor.
- ❖ Develop the pricing cost report.
- ❖ Document this in the project file.



Pricing Method

- ❖ **Work is priced out at the department average, and all work performed is charged to the project at the department average salary, regardless of who accomplished the work.**



Pricing Method (Continued)

- ❖ Work is priced out at the department average, but all work performed is billed back to the project at the actual salary of those employees who perform the work.



Pricing Method Continued)

- ❖ The work is priced out at the salary of those employees who will perform the work, and the cost is billed back the same way.



Capital Budgeting

- ❖ Payback Period
- ❖ Discounted Cash Flow (DCF)
- ❖ Net Present Value (NPV)
- ❖ Internal Rate of Return (IRR)



Payback Period

- ❖ The payback period is the exact length of time needed for a firm to recover its initial investment as calculated from cash inflows. Payback period is the *least* precise of all capital budgeting methods because the calculations are in dollars and not adjusted for the time value of money

Example

TABLE 14–15. CAPITAL EXPENDITURE DATA FOR PROJECT A

Initial Investment	Expected Cash Inflows				
	<i>Year 1</i>	<i>Year 2</i>	<i>Year 3</i>	<i>Year 4</i>	<i>Year 5</i>
\$10,000	\$1,000	\$2,000	\$2,000	\$5,000	\$2,000

Time value of Money

- ❖ Everyone knows that a dollar today is worth more than a dollar a year from now. The reason for this is because of the time value of money. To illustrate the time value of money, let us look at the following equation:

$$FV = PV(1 + k)^n$$

where FV = Future value of an investment

PV = Present value

k = Investment interest rate (or cost of capital)

n = Number of years



Discounted Cash Flow Analysis

- ❖ These methods utilize the time value of money to find the equivalances of the cash flows for a specific time period.
 - Present Worth
 - Annual Worth
 - Benefit/ Cost Ratio
 - Internatl Rate of Return



*Capital Budgeting
Must Consider Taxes
And Depreciation*



Chapter 15

Cost Control



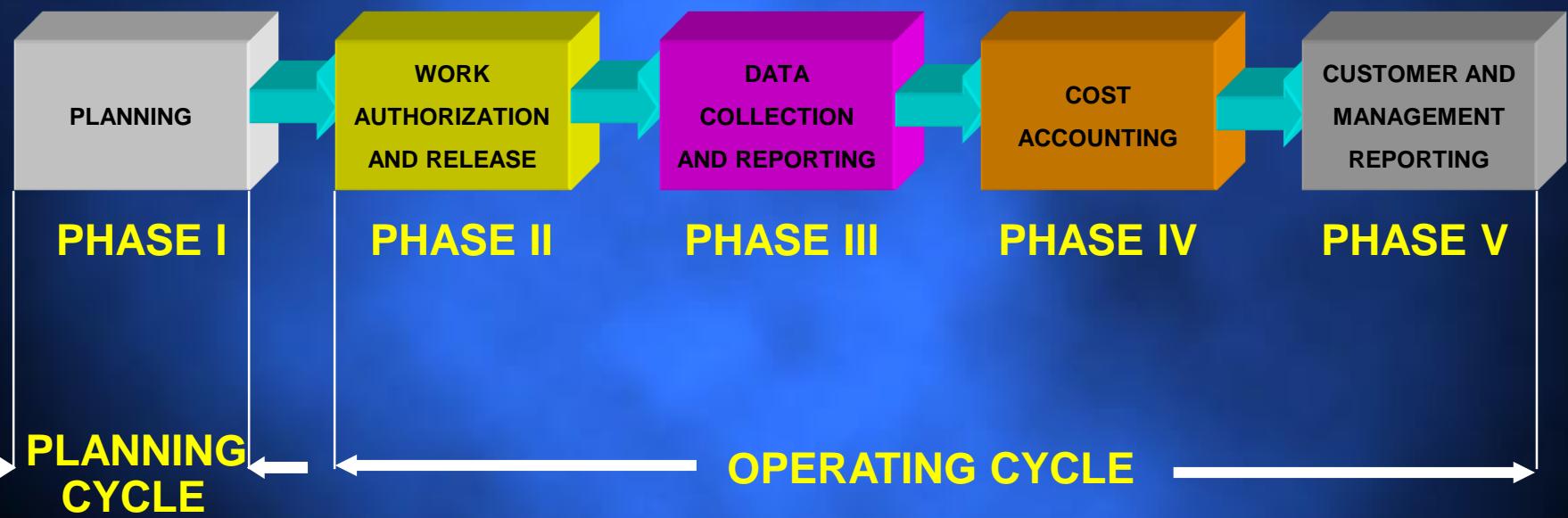
*Do Project
Managers Control
Costs, Monitor Costs
Or Both?*



Cost Management

- ❖ Cost estimating
- ❖ Cost accounting
- ❖ Project cash flow
- ❖ Company cash flow
- ❖ Direct labor costing
- ❖ Overhead rate costing
- ❖ Others, such as incentives, penalties, and profit-sharing

Cost And Control System





Cost Control Requirements

- ❖ Measure resources consumed
- ❖ Measure status and accomplishments
- ❖ Compare measurements to projections and standards
- ❖ Provide the basis for diagnosis and re-planning



Cost Control Requirements

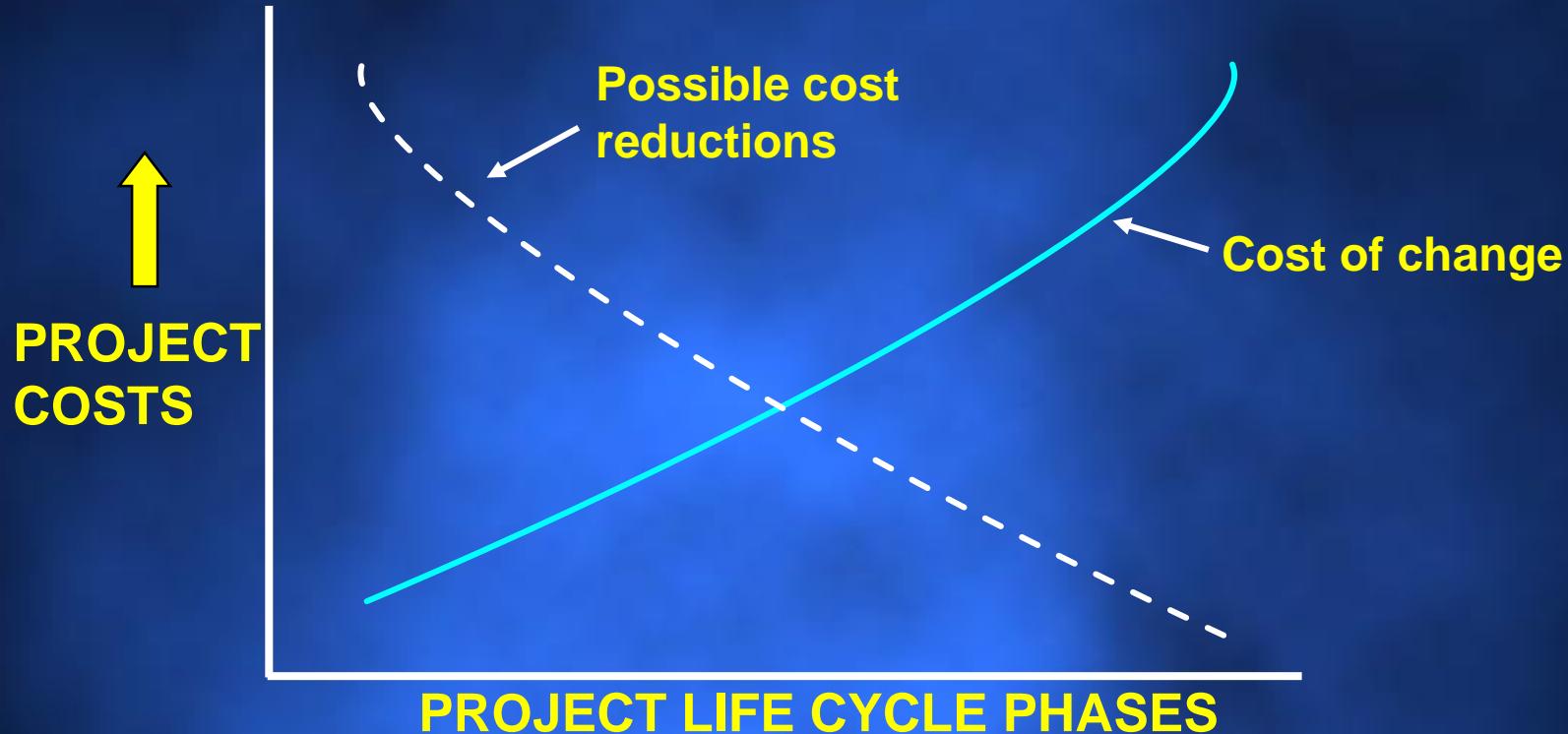
- ❖ Thorough planning of the work to be performed to complete the project
- ❖ Good estimating of time, labor, and costs
- ❖ Clear communication of the scope of required tasks
- ❖ A disciplined budget and authorizations of expenditures
- ❖ Timely accounting of physical progress and cost expenditures
- ❖ Periodic re-estimation of time and cost to complete remaining work

Cost Control Requirements

(Continued)

- ❖ Frequent, periodic comparison of actual progress and expenditures to schedules and budgets, both at the time of comparison and at project completion

WHEN TO IMPLEMENT A COST MANAGEMENT SYSTEM



CONCLUSION

A cost management system should be implemented right at the beginning of the life cycle of the project.



Cost Data

- ❖ **Labor**
- ❖ **Material**
- ❖ **Other direct charges**
- ❖ **Overhead**

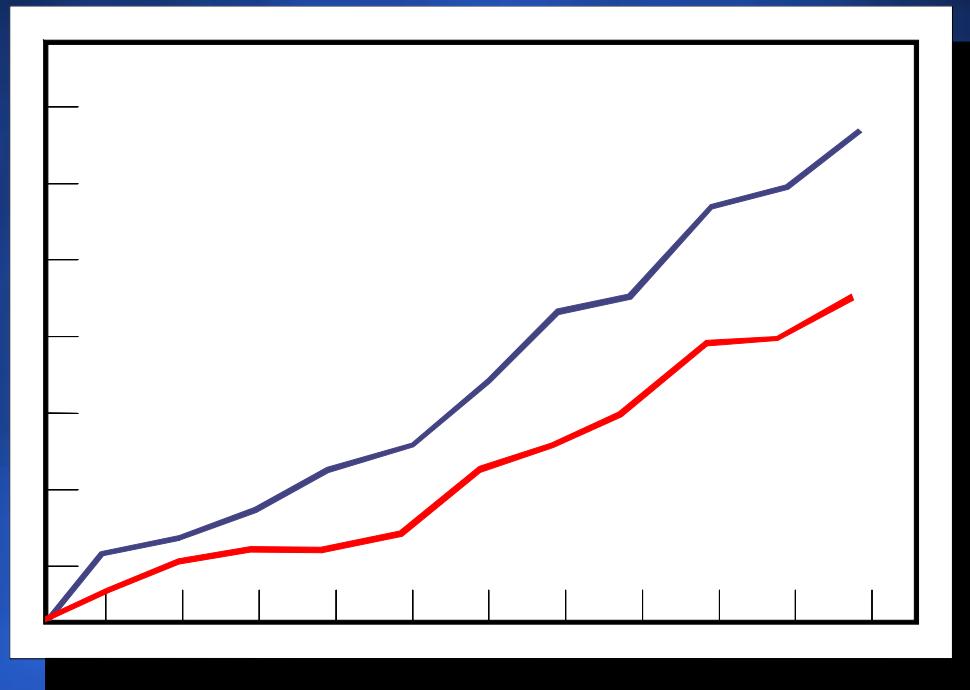


Types of Budgets

- ❖ **Distributed budget**
- ❖ **Management budget**
- ❖ **Undistributed budget**
- ❖ **Contract changes**



Variance Analyses



VARIABLES FOR VARIANCE ANALYSIS

- ❖ **BUDGETED COST FOR WORKED SCHEDULED (BCWS)** IS THE BUDGETED AMOUNT OF COST FOR WORD SCHEDULED TO BE ACCOMPLISHED PLUS THE AMOUNT OF LEVEL OF EFFORT OR APPORTIONED EFFORT SCHEDULED TO BE ACCOMPLISHED IN A GIVEN TIME PERIOD.
- ❖ **BUDGETED COST FOR WORK PERFORMED (BCWP)** IS THE BUDGETED AMOUNT OF COST FOR COMPLETED WORD, PLUS BUDGETED FOR LEVEL OF EFFORT OR APPORTIONED EFFORT ACTIVITY COMPLETED WITHIN A GIVEN TIME PERIOD. THIS IS SOMETIMES REFERRED TO AS AN “EARNED VALUE.”
- ❖ **ACTUAL COST FOR WORK PERFORMED (ACWP)** IS THE AMOUNT REPORTED AS ACTUALLY EXPENDED IN COMPLETING THE WORK ACCOMPLISHED WITHIN A GIVEN TIME PERIOD.



Variances

- ❖ The **cost variance** compares deviations only from the budget and does not provide a measure of comparison between work scheduled and work accomplished.
- ❖ The **scheduling variance** provides a comparison between planned and actual performance but does not include costs.



Measurements

- ❖ **Measurable efforts:** discrete increments of work with a definable schedule for accomplishment, whose completion produces tangible results.
- ❖ **Level of effort:** work that does not lend itself to subdivision into discrete scheduled increments of work, such as project support and project control.



COST VARIANCE CALCULATION

$$CV = BCWP - ACWP$$

A **NEGATIVE** VARIANCE
INDICATES A COST OVERRUN



SCHEDULE VARIANCE CALCULATION

$$SV = BCWP - BCWS$$

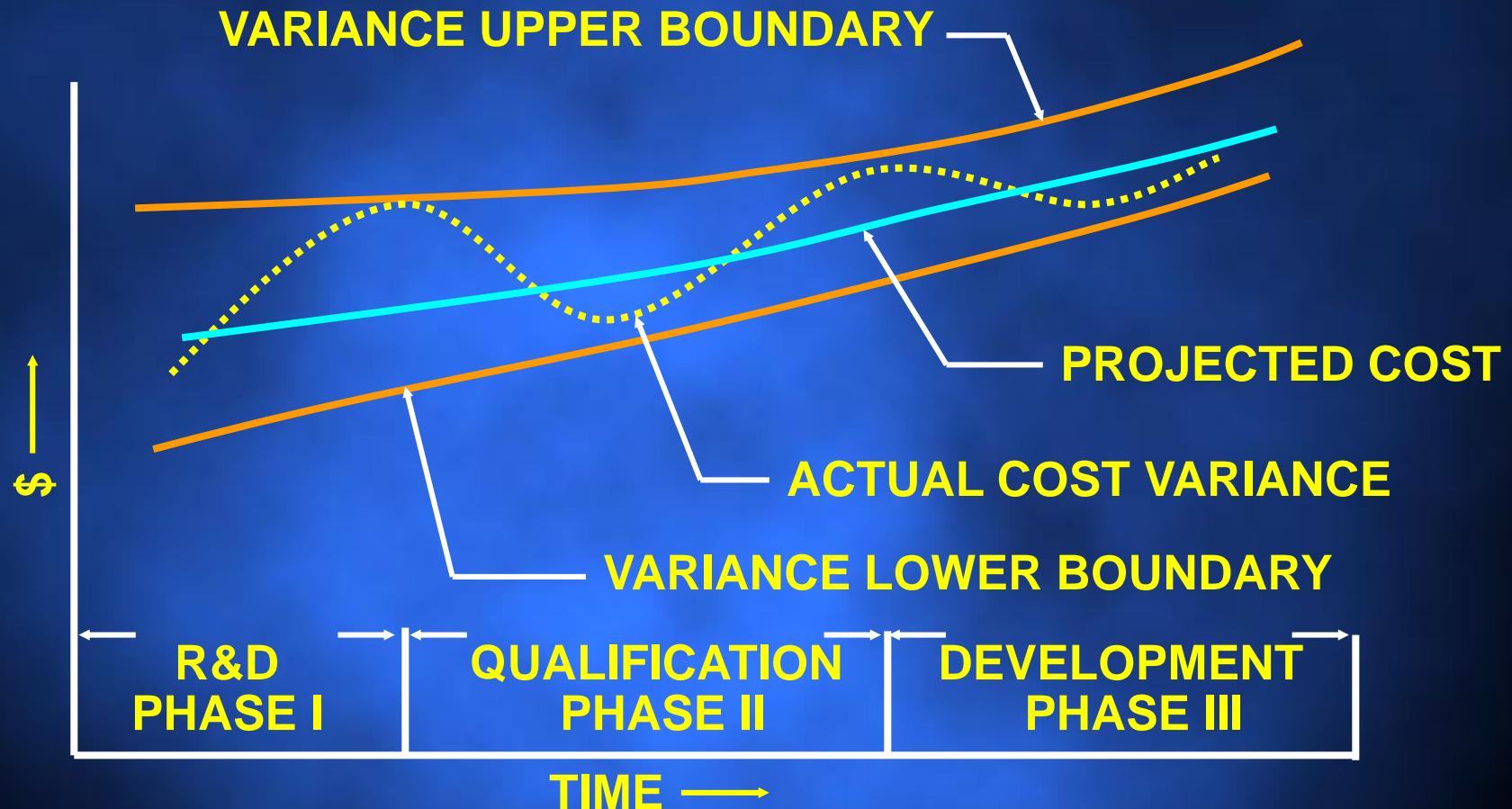
A NEGATIVE VARIANCE INDICATES
A BEHIND SCHEDULE CONDITION

VARIANCE PERCENTS

$$\text{SCHEDULE VARIANCE \% (SVP)} = \frac{\text{SV}}{\text{BCWS}} \times 100$$

$$\text{COST VARIANCE \% (CVP)} = \frac{\text{CV}}{\text{BCWP}} \times 100$$

Project Variance Analysis





Information Requirements

- ❖ Budgeted cost for work scheduled (BCWS)
- ❖ Budgeted cost for work performed (BCWP)
- ❖ Actual cost for work performed (ACWP)
- ❖ Estimated cost at completion
- ❖ Budgeted cost at completion
- ❖ Cost and schedule variances/explanations
- ❖ Traceability

Variance Analysis

Questions

- ❖ **What is the problem causing the variance?**
- ❖ **What is the impact on time, cost, and performance?**
- ❖ **What is the impact on other efforts, if any?**
- ❖ **What corrective action is planned or under way?**
- ❖ **What are the expected results of the corrective action?**



VARIANCE REPORTING

Variance reporting is accomplished at each reporting interval. However, the variance threshold reports are exception reports and occur only when the variances exceed the upper and lower boundaries of the project variances envelope.



REPORTING INTERVALS

- ❖ Depends on the type of organization and characteristics of the projects.
- ❖ Project-driven organization - weekly.
- ❖ Non-project-driven organization - monthly



The 50/50 rule

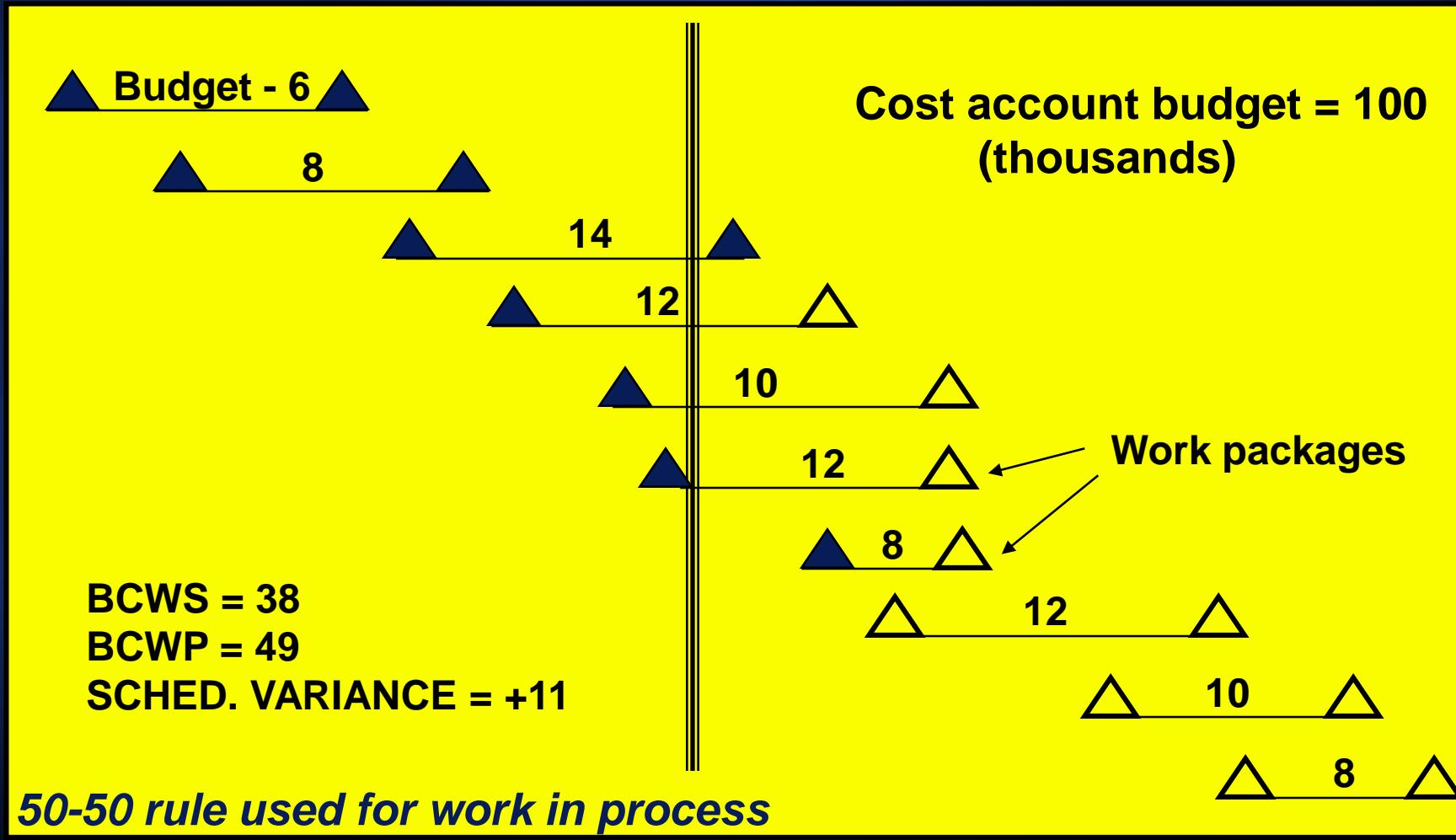
HALF OF THE BUDGET FOR EACH ELEMENT IS RECORDED AT THE TIME THAT THE WORK IS SCHEDULED TO BEGIN AND THE OTHER HALF AT THE TIME THE WORK IS SCHEDULED TO BE COMPLETED.

FOR A PROJECT WITH A LARGE NUMBER OF ELEMENTS THE AMOUNT OF DISTORTION FROM SUCH A PROCEDURE IS MINIMAL.

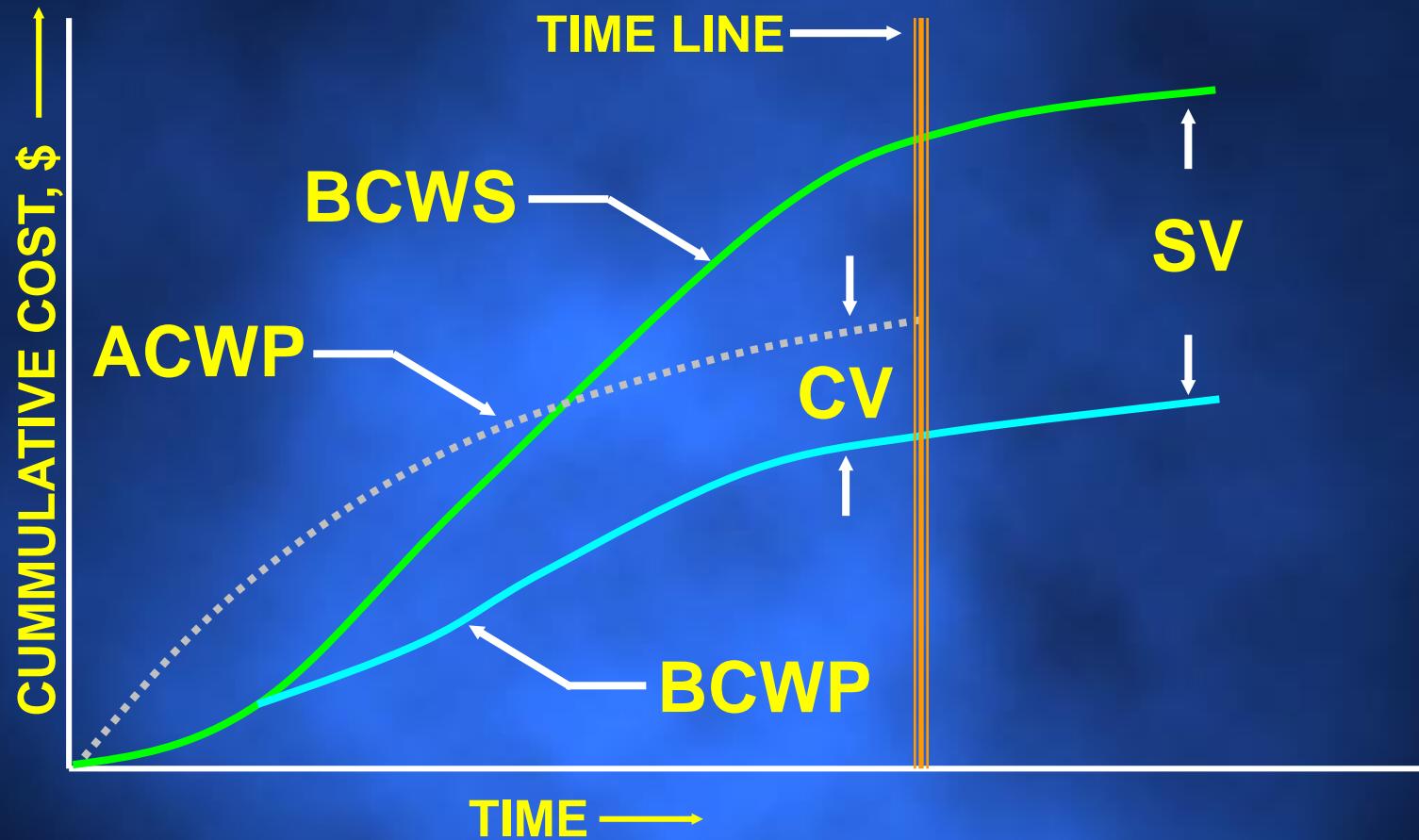
ANALYSIS

Budgeted cost for work

Scheduled (BCWS)
Performed (BCWP)



Earned Value Status Reporting





*Estimated Cost At
Completion*

ESTIMATE AT COMPLETION (EAC)

$$EAC = \frac{ACWP}{BCWP} \times \text{Budget at completion (BAC)}$$

The estimate at completion is the best estimate of the total cost at the completion of the project.

The EAC is a periodic evaluation of the status of the project - usually on a monthly basis or until a significant change has been identified.



PROGRESS REPORTING

Progress reporting needs to answer four fundamental questions:

1. Where are we today (time and cost)?
2. Where will we end up (time and cost)?
3. What are the present and future risks?
4. Are there any special problems that need to be addressed and what can management do to help?

Monthly Project Report

1. VARIANCE ANALYSIS (Cost in Thousands)

1 June 1997

Subtask	Milestone Status	Budgeted Cost Work Scheduled	Budgeted Cost Work Performed	Actual Cost	Variance, %	
		Schedule	Cost			
1	Completed	100	100	100	0	0
2	Completed	50	50	55	0	-10
3	Completed	50	50	40	0	20
4	Not Started	70	0	0	-100	--
5	Completed	90	90	140	0	-55.5
6	Not started	40	0	0	-100	--
7	Started	50	50	25	0	50
8	Not started	0	0	0	--	--
Total		450	340	360	-24.4	-5.9



2. ESTIMATE AT COMPLETION (EAC)

EAC = $(360/340) \times 579,000 = \$613,059$

Overrun = $613,059 - 579,000 = \$34,059$

3. COST SUMMARY

Costs are running approximately 5.9% over budget due to higher salaried labor.

4. SCHEDULE SUMMARY

The 24.4% behind schedule condition is due to subtasks 4 and 6 which have not yet begun due to lack of raw materials and the 50/50 method for booking costs. Overtime will get us back on schedule but at an additional cost of 2.5% of direct labor costs.



5. MILESTONE REPORT

Milestone/ Subtask	Scheduled Completion	Projected Completion	Actual Completion
1	4/1/97		4/1/97
2	5/1/97		5/1/97
3	5/1/97		4/23/97
4	7/1/97	7/1/97	
5	6/1/97		6/1/97
6	8/1/97	8/1/97	
7	9/1/97	9/1/97	
8	10/1/97	10/1/97	



6. ACTIVITY REPORT

<u>Current Problem</u>	<u>Potential Impact</u>	<u>Corrective Action</u>
(a) Lack of raw materials.	Cost overruns and behind schedule condition.	Overtime is scheduled. We will try to use lower salaried staff. Raw materials are expected to be on dock next week.
(b) Customer unhappy with test results.	May need additional planning.	Customer will provide us with revised statement of work on 6/15/97.



*Status Reporting Is
More Than Just A
Computer Printout.*



Cost Problems

- ❖ Poor estimating techniques and/or standards, resulting in unrealistic budgets
- ❖ Out-of-sequence starting and completion of activities and events
- ❖ Inadequate work breakdown structure
- ❖ No management policy on reporting and control practices
- ❖ Poor work definition at the lower levels of the organization



Cost Problems (Continued)

- ❖ Management reducing budgets or bids to be competitive or to eliminate “fat”
- ❖ Inadequate formal planning that results in unnoticed, or often uncontrolled, increases in scope of effort
- ❖ Poor comparison of actual and planned costs
- ❖ Comparison of actual and planned costs at the wrong level of management
- ❖ Unforeseen technical problems



Cost Problems *(Continued)*

- ❖ Schedule delays that require overtime or idle time costing
- ❖ Material escalation factors that are unrealistic

Problem Areas in Cost Control

❖ ***Organization:***

- Inadequate Work Breakdown Structure
- Poor work definition at working levels
- Lack of formal system procedures

❖ ***Planning and budgeting:***

- Inadequate forward planning
- Over-allocation of budget
- Poor integration of budget, schedule, work authorization

❖ ***Accounting:***

- Inability to account for cost of material on applied basis

❖ ***Analysis:***

- Determination of status not based on work package completion
- Comparison of actual vs. planned costs at improper level

❖ ***Revisions:***

- Failure to maintain valid measurement baseline



Cost Problems Per Phase

❖ **Proposal Phase**

- Failure to understand customer requirements
- Unrealistic appraisal of in-house capabilities
- Underestimating time requirements



Cost Problems Per Phase

- ❖ **Planning phase**

- Omissions
- Inaccuracy of the work breakdown structure
- Misinterpretation of information
- Use of wrong estimating techniques
- Failure to identify and concentrate on major cost elements
- Failure to assess and provide for risks



Cost Problems Per Phase

- ❖ **Negotiation phase**
 - Forcing a speedy compromise
 - Procurement ceiling costs
 - Negotiation team that must “win this one”



Cost Problems Per Phase

- ❖ **Contractual phase**
 - Contractual discrepancies
 - SOW different from RFP requirements
 - Proposal team different from project team



Cost Problems Per Phase

- ❖ **Design phase**
 - Accepting customer requests without management approval
 - Problems in customer communications channels and data items
 - Problems in design review meetings



Cost Problems Per Phase

❖ Production phase

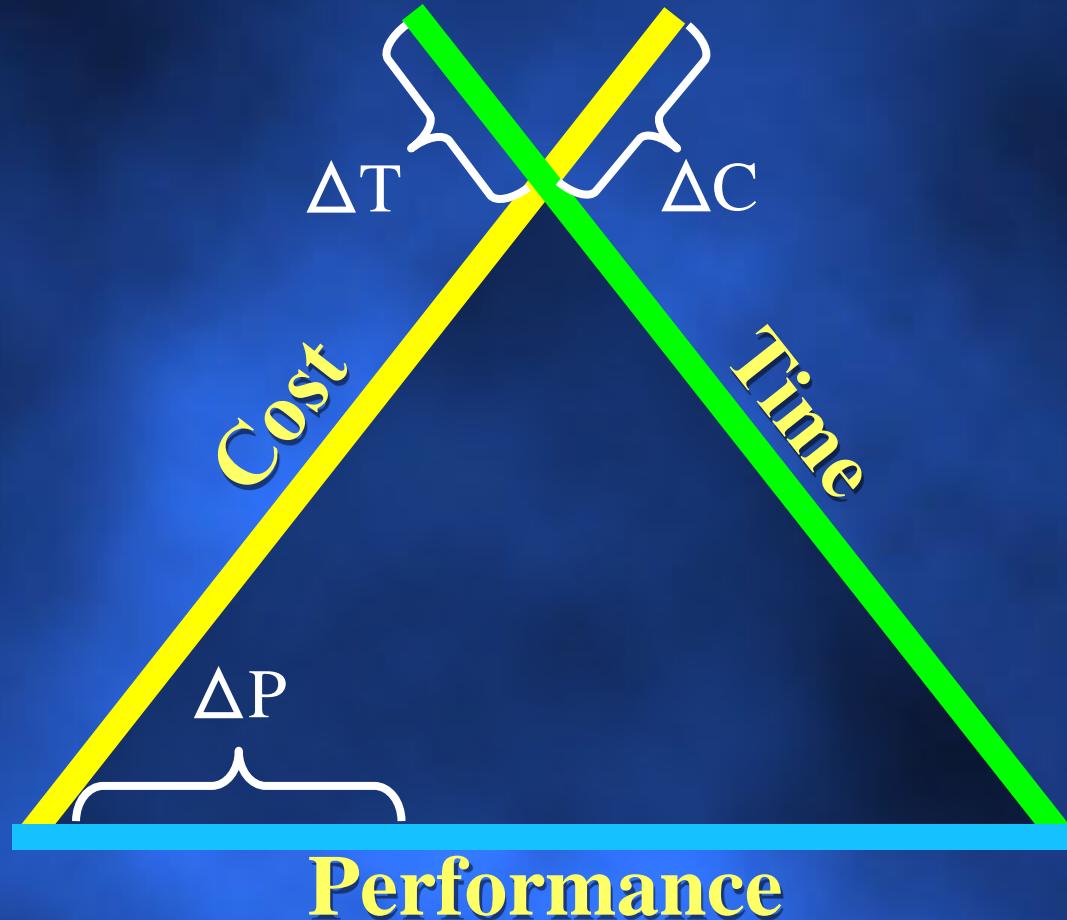
- Excessive material costs
- Specifications that are not acceptable
- Manufacturing and engineering disagreement



Chapter 16

*Trade-off Analysis In
A Project
Environment*

Tradeoffs



Note: Δ = Deviations from original plan



Tradeoff Questions

- ❖ Is the information pertinent?
- ❖ Is the information current?
- ❖ Are the data complete?
- ❖ Who has determined that this situation exists?
- ❖ How does he know this information is correct?
- ❖ If this information is true, what are the implications for the project?



Unexpected Problems

- ❖ **Human errors/failures**
 - Impossible schedule commitments
 - Poor control of design changes
 - Poor project cost accounting
 - Machine failures
 - Failure to receive a critical input
 - Failure to receive anticipated approvals



Unexpected Problems

- ❖ **Uncertain Problems**
 - Too many concurrent projects
 - Labor contract expiration
 - Change in project leadership
 - Possibility of project cancellation



Unexpected Problems

- ❖ **Unexpected Problems**
 - Over-committed company resources
 - Conflicting project priorities
 - Cash flow problems
 - Labor contract disputes
 - Delay in material shipment
 - “Fast-track” people having been promoted off of the project
 - Temporary employees having to be returned to their home base



Unexpected Problems

(Continued)

- Inaccurate original forecast
- Change in market conditions
- New standards having been developed