



# *Chapter 17*

# *Risk Management*



# *Basic Concept*

- ❖ **Risk management focuses on:**
  - Known unknowns
  - Proactive management



**The alternative to proactive management is reactive management, also called crisis management. This requires significantly more resources and takes longer for problems to surface.**



# ***RISK MANAGEMENT***

- ❖ RISK MANAGEMENT FOCUSES ON THE FUTURE
- ❖ RISK AND INFORMATION ARE INVERSELY RELATED



# **RISK MANAGEMENT (CONT.)**

- ❖ **HISTORICALLY, WE FOCUSED OUR ATTENTIONS ON SCHEDULE AND COST RISK MANAGEMENT.**
  
- ❖ **TODAY, OUR PRIMARY EMPHASIS IS ON TECHNOLOGICAL RISK MANAGEMENT:**
  - **CAN WE DESIGN IT AND BUILD IT?**
  - **WHAT IS THE RISK OF OBSOLESCENCE?**



# *Definition Of Risk*

**Risk<sub>event</sub>** = f(Likelihood, Impact)

- Likelihood is the probability of occurrence
- Impact is the amount at stake



# *Tolerance For Risk*

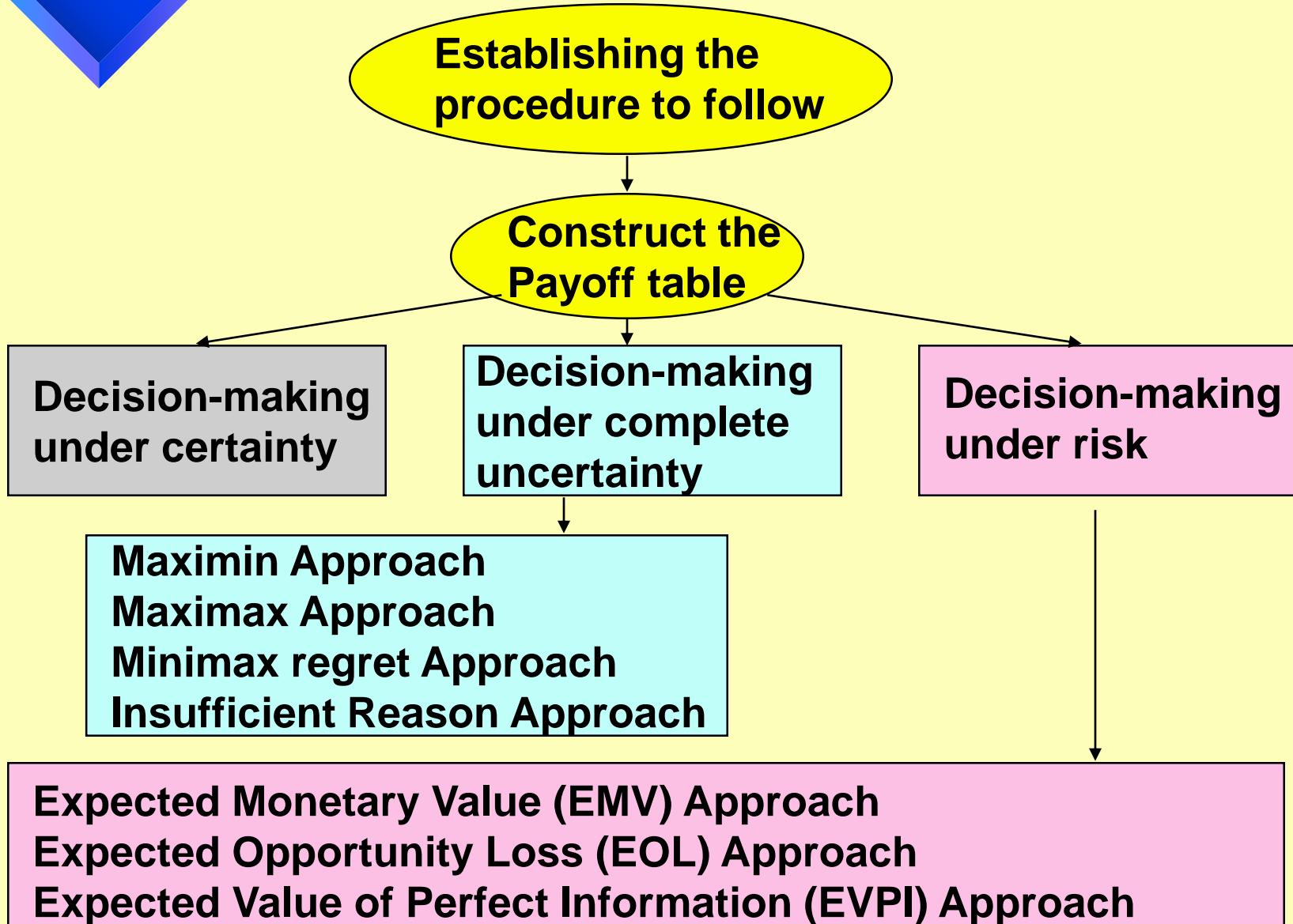
- ❖ Risk avoider
- ❖ Risk neutral
- ❖ Risk lover



# *Decision-Making Categories*

- ❖ Complete uncertainty
- ❖ Relative uncertainty (partial information)
- ❖ Complete certainty

# *Developing and Using Payoff Tables*





## **FIVE STEPS TO DEVELOP PAYOFF TABLE**

- ❖ **List all the alternatives.**
- ❖ **List the future consequences of each alternative.**
- ❖ **Identify the payoffs associated with each combination.**
- ❖ **Assess the degree of certainty that these combinations will materialize**
- ❖ **Decide on a decision criterion.**

# *Risk Management Processes*

- ❖ **Risk planning**
- ❖ **Risk assessment**
  - Risk identification
  - Risk analysis/quantification
- ❖ **Risk handling**
- ❖ **Risk monitoring**



# *Developing Contingency Plans*



# *Types Of Risks (General)*

- ❖ **Business risks**
- ❖ **Insurable (pure) risk**
  - Direct property damage
  - Indirect consequential loss
  - Legal liability
  - Personnel



# *Types Of Risk (PMI Method)*

- ❖ External – unpredictable
- ❖ External – predictable
- ❖ Internal – non-technical
- ❖ Internal – technical
- ❖ Legal

# *Risk Handling*

**Four response options for risks  
are:**

- ❖ **Assumption (retention)**
- ❖ **Avoidance**
- ❖ **Control (mitigation)**
- ❖ **Transfer**



# ***RISK MANAGEMENT PROCESS***

- ❖ PLAN RISK MANAGEMENT
- ❖ RISK IDENTIFICATION
- ❖ RISK ANALYSIS
- ❖ QUALITATIVE RISK ANALYSIS
- ❖ QUANTITATIVE RISK ANALYSIS
- ❖ PLAN RISK RESPONSE
- ❖ MONITOR AND CONTROL RISKS



# **PLAN RISK MANAGEMENT**

- ❖ Plan for risk management (risk planning) is the detailed formulation of a program of action for the management of risk.
- ❖ It is the process to:
- ❖ Develop and document an organized, comprehensive, and interactive risk management strategy.
  - ❖ ● Determine the methods to be used to execute a program's risk management strategy.
  - ❖ ● Plan for adequate resources.



# **RISK IDENTIFICATION**

- ❖ The methods for identifying risks are numerous. Common practice is to classify project risk according to its source.
- ❖ Objective sources: recorded experience from past projects and the current project as it proceeds
  - Lessons learned files
  - Program documentation evaluations
  - Current performance data
- ❖ Subjective sources: experiences based upon knowledgeable experts
  - Interviews and other data from subject matter experts



# RISK ANALYSIS

- ❖ Risk analyses are often based on detailed information that may come from a variety of techniques, including but not limited to:
  - Analysis of plans and related documents
  - Comparisons with similar systems
  - Data from engineering or other models
  - Experience and interviewing
  - Modeling and simulation
  - Relevant lessons-learned studies
  - Results from tests and prototype development
  - Sensitivity analysis of alternatives and inputs
  - Specialist and expert judgments



# QUALITATIVE RISK ANALYSIS

- ❖ A commonly used qualitative risk analysis methodology involves risk scales for estimating probability of occurrence and consequence of occurrence, coupled with a risk mapping matrix.
- ❖ The risk is evaluated using expert opinion against all relevant probability of occurrence scales as well as the three consequences of occurrence scales, and the results are then transferred onto a risk mapping matrix to convert these values to a corresponding risk level.
- ❖ The risk is included in a prioritized list based upon the risk level as well as other considerations



# **QUANTITATIVE RISK ANALYSIS**

- ❖ Several methodologies are commonly used in quantitative risk analyses.
- ❖ These include, but are not limited to,
  - payoff matrices,
  - decision analysis (typically decision trees),
  - expected value,
  - Monte Carlo process



# **PLAN RISK RESPONSE**

- ❖ Planning risk responses (risk handling) includes specific methods and techniques to deal with known risks and opportunities, identifies who is responsible for the risk or opportunity, and provides an estimate of the resources associated with handling the risk or opportunity, if any. I



# ***PLAN RISK RESPONSE (cont.)***

- ❖ There are several factors that can influence our response to a risk or opportunity:
  - Amount and quality of information on the actual hazards that caused the risk (descriptive uncertainty)
  - Amount and quality of information on the magnitude of the damage (measurement uncertainty)
  - Personal benefit to project manager for accepting the risk or opportunity (voluntary risk or opportunity)
  - Risk or opportunity forced upon the project manager (involuntary risk or opportunity)



# ***PLAN RISK RESPONSE (cont.)***

- The existence of cost-effective alternatives (equitable risks or opportunities)
- The existence of high-cost alternatives or possibly lack of options (inequitable risks or opportunities)
- Length of exposure to the risk or time available for the opportunity



# **MONITOR AND CONTROL RISKS**

- ❖ The monitoring and control process systematically tracks and evaluates the effectiveness of risk response actions against established metrics.
- ❖ Monitoring results may also provide a basis for developing additional risk response strategies, or updating existing risk response strategies, and reanalyzing known risks.



# **MONITOR AND CONTROL RISKS (Cont.)**

Some techniques suitable for risk monitoring and control that can be used in a program-wide indicator system include:

- ❖ ● **Earned Value (EV):** This uses standard cost/schedule data to evaluate a program's cost performance (and provide an indicator of schedule performance) in an integrated fashion.
- ❖ ● **Program Metrics:** These are formal, periodic performance assessments of the selected development processes, evaluating how well the development process is achieving its objective.

# **MONITOR AND CONTROL RISKS (Cont.)**

- ❖ **Schedule Performance Monitoring:** This is the use of program schedule data to evaluate how well the program is progressing to completion.
- ❖ **Technical Performance Measurement:** This is a product design assessment that estimates, through engineering analysis and tests, the values of essential technical performance parameters of the current design as effected by risk response actions.



# *Chapter 18*

# Learning Curves

# *Learning Curve Theory*

- ❖ The time required to perform a task decreases as the task is repeated.
- ❖ The amount of improvement decreases as more units are produced.
- ❖ The rate of improvement has sufficient consistency to allow its use as a prediction tool.



# *Learning Curve Phrases*

- ❖ **Slope of the curve.** A percentage figure that represents the steepness (constant rate of improvement) of the curve.
- ❖ **Unit one.** The first unit of product actually completed during a production run.



# *Learning Curve Phrases*

- ❖ **Cumulative average hours.** The average hours expended per unit for all units produced through any given unit.
- ❖ **Unit hours.** The total direct labor hours expended to complete any specific unit.
- ❖ **Cumulative total hours.** The total hours expended for all units produced through any given unit.



# *Sources of Experience*

- ❖ **Labor efficiency.**
- ❖ **Work specialization and methods improvements.**
- ❖ **New production processes.**
- ❖ **Getting better performance from production equipment.**
- ❖ **Changes in the resource mix.**



# *Sources of Experience* (Continued)

- ❖ Product Standardization.
- ❖ Product redesign.
- ❖ Incentives and disincentives.



# *Learning Curve Selection*

- ❖ **Similarity between the new item and an item or items previously produced.**
- ❖ **Physical comparisons**
  - **Addition or deletion of processes and components**
  - **Differences in material, if any**
  - **Effect of engineering changes in items previously produced**



# *Learning Curve Selection*

*(Continued)*

- ❖ Duration of time since a similar item was produced
  - Condition of tooling and equipment
  - Personnel turnover
  - Changes in working conditions or morale
- ❖ Other comparable factors between similar items
  - Delivery schedules
  - Availability of material and components
  - Personnel turnover during production cycle of item previously produced



# *Learning Curve Selection*

*(Continued)*

- Comparison of actual production data with previously extrapolated or theoretical curves to identify deviations.



# *Learning Curve Development*

- ❖ A statistically derived relationship between the pre-production unit hours and first unit hours can be applied to the actual hours from the pre-production phase.
- ❖ A cost estimating relationship (CER) for first-unit cost based on physical or performance parameters can be used to develop a first-unit cost estimate.

# *Learning Curve Development*

*(Continued)*

- ❖ The slope and the point at which the curve and the labor standard value converge are known. In this case, a unit-one value can be determined. This is accomplished by dividing the labor standard by the appropriate unit value.



# ***Loss of Learning***

- ❖ Manufacturing personnel learning.
- ❖ Supervisory learning.
- ❖ Continuity of productivity.
- ❖ Methods.
- ❖ Special tooling.



# *Learning Curve Limitations*

- ❖ The learning curve does not continue forever. The percentage decline in hours/dollars diminishes over time.
- ❖ The learning curve knowledge gained on one product may not be extendable to other products unless there exist shared experiences.
- ❖ Cost data may not be readily available in order to construct a meaningful learning curve.

# *Learning Curve Limitations*

*(Continued)*

- ❖ Cost data may not be readily available in order to construct a meaningful learning curve. Other problems can occur if overhead costs are included with the direct labor cost, or if the accounting codes cannot separate work packages sufficiently in order to identify those elements that truly demonstrate experience effects.
- ❖ Quantity discounts can distort the costs and the perceived benefits of learning curves.



# *Learning Curve Limitations*

*(Continued)*

- ❖ Inflation must be expressed in constant dollars. Otherwise, the gains realized from experience may be neutralized.
- ❖ Learning curves are most useful on long-term horizons (i.e., years). On short-term horizons, benefits perceived may not be the result of learning curves.



# *Learning Curve Limitations*

*(Continued)*

- ❖ External influences, such as limitations on materials, patents, or even government regulations, can restrict the benefits of learning curves.
- ❖ Constant annual production (i.e., no growth) may have a limiting experience effect after a few years.



# *Chapter 19*

# *Contract Management*



# *Procurement Strategies*

- ❖ **Corporate procurement strategy:** the relationship of specific procurement actions to the corporate strategy
- ❖ **Project procurement strategy:** the relationship of specific procurement actions to the operating environment of the project



# *Procurement Objectives*

- ❖ **Procure all goods/services from a single source.**
- ❖ **Procure all goods/services from multiple sources.**
- ❖ **Procure only a small portion of the goods/services.**
- ❖ **Procure none of the goods/services.**

# *Procurement Management*

- ❖ **Requirement cycle:** definition of the boundaries of the project
- ❖ **Requisition cycle:** analysis of sources
- ❖ **Solicitation cycle:** the bidding process
- ❖ **Award cycle:** contractor selection and contract award
- ❖ **Contract administration cycle:** managing the subcontractor until completion of the contract

# *Procurement Planning*

- ❖ Defining the need for the project
- ❖ Development of the statement of work, specifications, and work breakdown structure
- ❖ Performing a make or buy analysis
- ❖ Laying out the major milestones and the timing/schedule
- ❖ Cost estimating, including life-cycle costing
- ❖ Obtaining authorization and approval to proceed



# *Specifications*

- ❖ **Specifications are written, pictorial, or graphic information that describe, define, or specify the services or items to be procured. There are three types of specifications:**



# *Types of Specifications*

- ❖ **Design specifications:** These detail what is to be done in terms of physical characteristics. The risk of performance is on the buyer.
- ❖ **Performance specifications:** These specify measurable capabilities the end product must achieve in terms of operational characteristics. The risk of performance is on the contractor.



# *Types of Specifications* *(Continued)*

- ❖ **Functional specifications:** This is when the seller describes the end use of the item to stimulate competition among commercial items, at a lower overall cost. This is a subset of the performance specification, and the risk of performance is on the contractor.



# *The Make Decision*

- ❖ Less costly (but not always!!)
- ❖ Easy integration of operations
- ❖ Utilize existing capacity that is idle
- ❖ Maintain direct control
- ❖ Maintain design/production secrecy
- ❖ Avoid unreliable supplier base
- ❖ Stabilize existing workforce



# *The Buy Decision*

- ❖ Less costly (but not always!!)
- ❖ Utilize skills of suppliers
- ❖ Small volume requirement (not cost effective to produce)
- ❖ Having limited capacity or capability
- ❖ Augment existing labor force
- ❖ Maintain multiple sources (qualified vendor list)
- ❖ Indirect control



# *Conducting the Procurements*

- ❖ Evaluating/confirming specifications (are they current?)
- ❖ Confirming sources
- ❖ Reviewing past performance of sources
- ❖ Producing solicitation package



# *Solicitation Package*

- ❖ Bid documents (usually standardized)
- ❖ Listing of qualified vendors (expected to bid)
- ❖ Proposal evaluation criteria
- ❖ Bidder conferences
- ❖ How change requests will be managed
- ❖ Supplier payment plan



# *Solicitation Cycle*

- ❖ Advertising
- ❖ Negotiation
- ❖ Small purchases (i.e., office supplies)



# *Negotiation Processes*

- ❖ Request for information (RFI)
- ❖ Request for quotation (RFQ)
- ❖ Request for proposal (RFP)



# *Negotiation Factors*

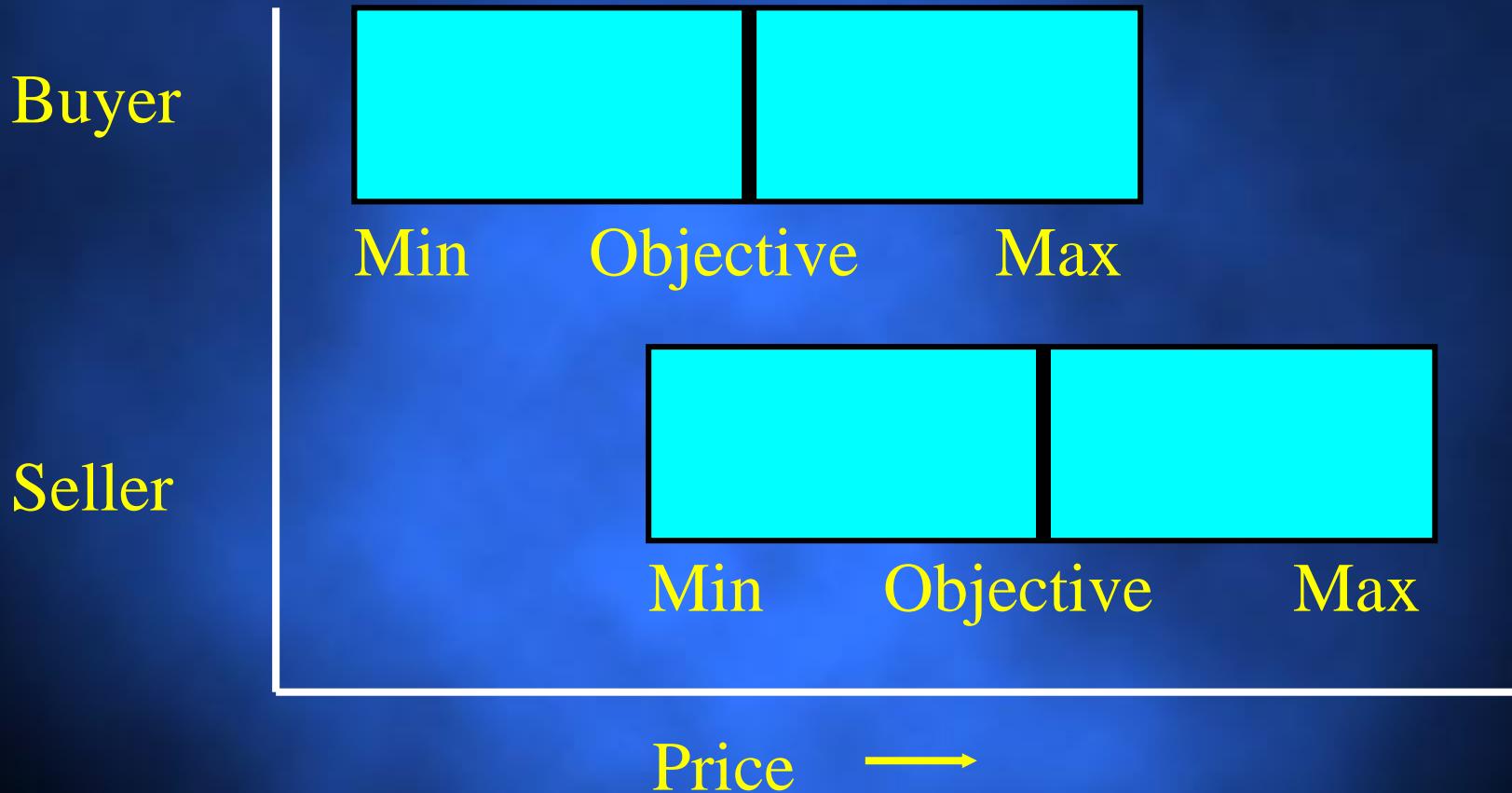
- ❖ Compromise ability
- ❖ Adaptability
- ❖ Good faith



# *Negotiation Planning*

- ❖ Develop objectives (i.e., min-max positions)
- ❖ Evaluate your opponent
- ❖ Define your strategy and tactics
- ❖ Gather the facts
- ❖ Perform a complete price/cost analysis
- ❖ Arrange “hygiene” factors

# *Negotiation Objective-Setting*





*Contract Negotiations  
Requires Knowing When  
To Speak And When To  
Be Quiet.*



*Research Your  
Customer Before  
Entering Into Contract  
Negotiations*



# *Award Cycle*

- ❖ **Conclusion:** The objective of the award cycle is to negotiate a contract type and price that will result in reasonable contractor risk and provide the contractor with the greatest incentive for efficient and economic performance.



# *Contracting Elements*

- ❖ **Mutual agreement:** There must be an offer and acceptance.
- ❖ **Consideration:** There must be a down payment.
- ❖ **Contract capability:** The contract is binding only if the contractor has the capability to perform the work.
- ❖ **Legal purpose:** The contract must be for a legal purpose
- ❖ **Form provided by law:** The contract must reflect the contractor's legal obligation, or lack of obligation, to deliver end products.



# *Contract Forms*

- ❖ **Completion contract:** The contractor is required to deliver a definitive end product.
- ❖ **Term contract:** The contract is required to deliver a specific “level of effort,” not an end product.



# *Contract Selection Criteria*

- ❖ Overall degree of cost and schedule risk
- ❖ Type and complexity of requirement (technical risk)
- ❖ Extent of price competition
- ❖ Cost/price analysis
- ❖ Urgency of the requirements
- ❖ Performance period
- ❖ Contractor's responsibility (and risk)



# *Contract Selection Criteria*

*(Continued)*

- ❖ Contractor's accounting system (is it capable of earned value reporting?)
- ❖ Concurrent contracts (will my contract take a back seat to existing work?)
- ❖ Extent of subcontracting (how much work will the contractor outsource?)

# *Contract Administration Cycle*

- ❖ Change management
- ❖ Specification interpretation
- ❖ Adherence to quality
- ❖ Warranties
- ❖ Subcontractor management
- ❖ Production surveillance
- ❖ Waivers
- ❖ Contract breach

# *Contract Administration Cycle* *(Continued)*

- ❖ Resolution of disputes
- ❖ Project termination
- ❖ Payment schedules
- ❖ Project closeout



# *Order of Precedence*

- A. **Specifications (first priority)**
- B. **Other instructions (second priority)**
- C. **Other documents, such as exhibits, attachments, appendices, SOW, contract date requirements list [CDRL], etc. (third priority)**
- D. **Contract clauses (fourth priority)**
- E. **The schedule (fifth priority)**



# *Type of Changes*

- ❖ **Administrative change**
- ❖ **Change order**
- ❖ **Contract modification**
- ❖ **Undefinitized contractual action**
- ❖ **Supplemental agreement**
- ❖ **Constructive change**

# *Causes of Constructive Changes*

- ❖ Defective specification with impossibility of performance
- ❖ Erroneous interpretation of contract
- ❖ Over-inspection of work
- ❖ Failure to disclose superior knowledge
- ❖ Acceleration of performance
- ❖ Late or unsuitable owner or customer furnished property



# *Causes of Constructive Changes (Cont)*

- ❖ Failure to cooperate
- ❖ Improperly exercised options
- ❖ Misusing proprietary data

# *Reasons for Termination for Convenience of the Customer*

- ❖ Elimination of the requirement
- ❖ Technological advances in the state-of-the-art
- ❖ Budgetary changes
- ❖ Related requirements and/or procurements
- ❖ Anticipating profits not allowed



# *Reasons for Termination for Default Due to Contractor's Actions*

- ❖ **Contractor fails to make delivery on scheduled date.**
- ❖ **Contractor fails to make progress so as to endanger performance of the contract and its terms.**
- ❖ **Contractor fails to perform any other provisions of the contract.**

# *Contract Administration*

## *Rights*

- ❖ **Reject the entire shipment**
- ❖ **Accept the entire shipment (barring latent defects)**
- ❖ **Accept part of the shipment**