



**RESOURCES**      **SCOPE**      **COST**      **SCHEDULE**

# *Concepts of Project Management*

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## Joseph Knick

- Score mentor for 17 months.
- Instructor for PMI certification program for 7 years.
- Project Manager/Project Controls/Engineer for 49 years
  - Georgia Department of Transportation – Structural Engineer
  - Four commercial nuclear power plants
  - Seven DOE sites and Sellafield nuclear site in UK
- Previous Certifications
  - Registered Professional Engineer (PE) in Virginia
  - Project Management Professional (PMP) with PMI
  - Earned Value Professional (EVP) with AACE-I

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## Course Objective

- Introduce Project Management concepts to general contractors, small building companies, small construction contractors and individual wishing to start similar businesses.
- Provide a basic understanding of project management terms used in contracts for the government project management environment.
- This workshop focuses on six key processes versus the 47 processes, 5 process groups and 10 knowledge areas in the Project Management Institute (PMI) course material. It is not directly targeted for the audience planning to study for the Project Management Professional (PMP) exam.



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## What is a Project?

- A project is temporary in that it has a defined beginning and end in time, and therefore defined scope and resources.(1)
- A project is a series of tasks that need to be completed to reach a specific outcome.(2)

(1) PMI's *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*

(2) *Definitions from Oxford Languages*



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## What is a Project? Examples



### Salt Disposal Unit

Duration: 4 and ½ Year  
Cost: \$150 Million

### Vietnam Veterans War Memorial

Duration: 1 Year 9 Months  
Cost: \$120,000

### Pool Renovation

Duration: 8 Months  
Cost: \$550,000

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## Project Management 101

- Get the Resources
- Scope it.
- Cost it
- Schedule it
- Control it
- Close it
  - Integration of the above and other considerations



*PMBOK defines 47 processes that fit into 5 process groups and 10 knowledge areas. This workshop provides a simplified version of 6 processes*

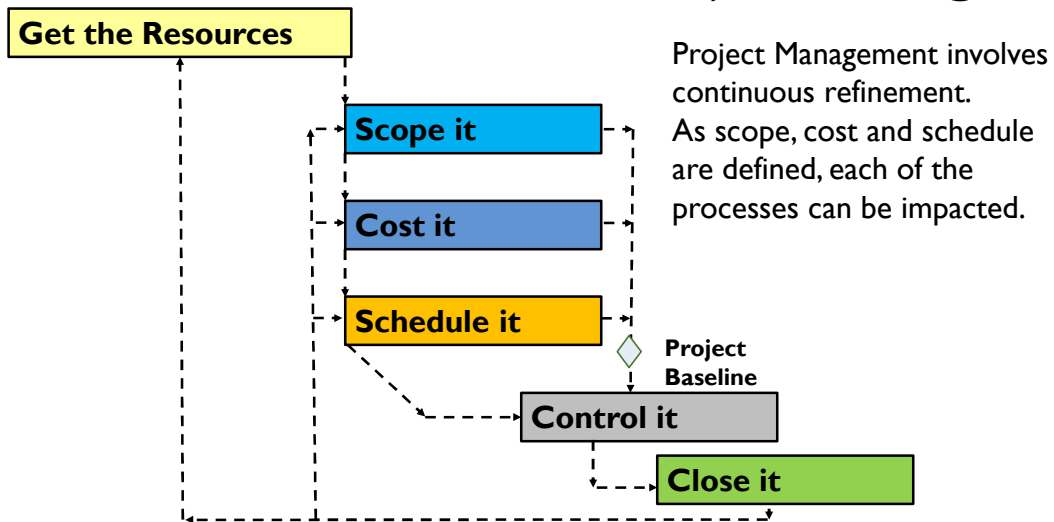
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## Key Processes for Successful Project Management



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## Resources: Assign PM/GC

Project Managers (PM)	Responsible for <b>planning</b> , organizing, and directing the completion of specific projects for an organization while ensuring these projects are within scope, on budget, and on time.
Project Planning	Setting up the project for success. Includes the processes for obtaining the resources, defining the scope, determining the cost, establishing the schedule & baseline, controlling baseline and closing the project

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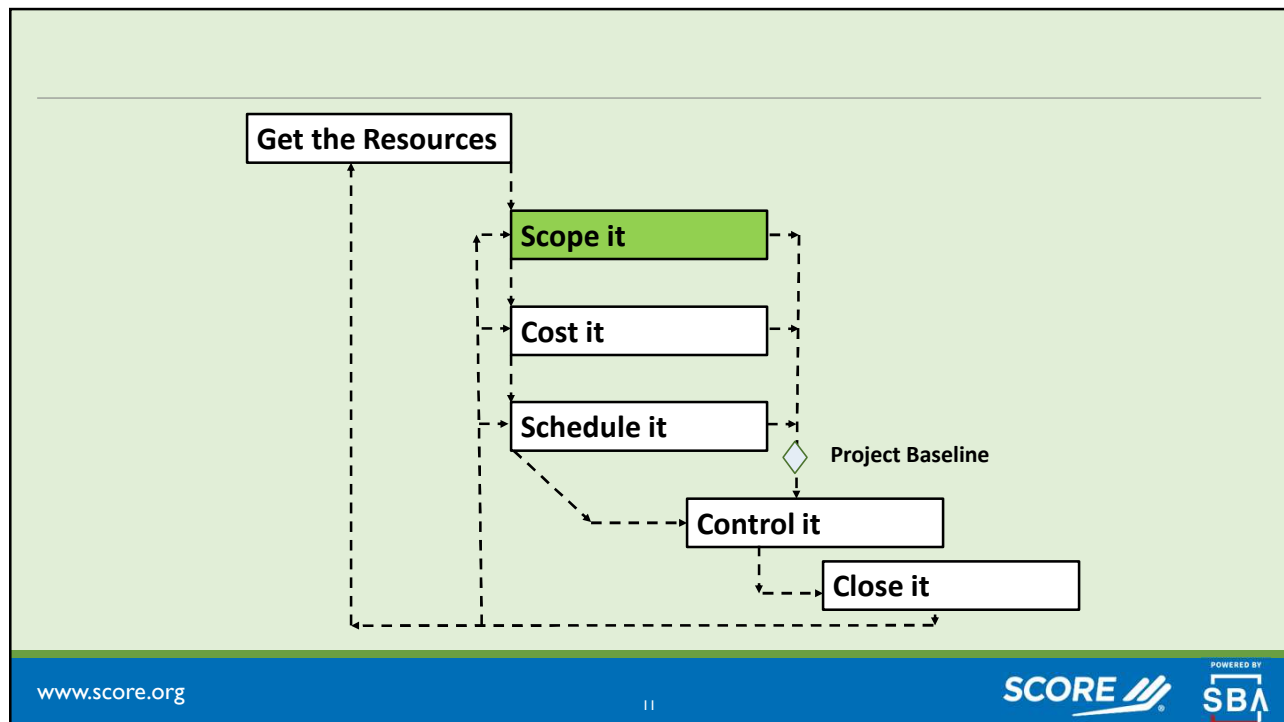
## Resources:

- Subject Matter Experts (SME)
  - “Judgement comes Experience, Experience comes from Bad Judgement”
  - Does the SME know what he or she are doing? Are you buying their expertise or their marketing capabilities?
- Establish stakeholder interface **early** and get buy-in
- Resources Types
 

○ Funding	○ Partners
○ Labor	○ Equipment
○ Sub-Contractors	○ Materials



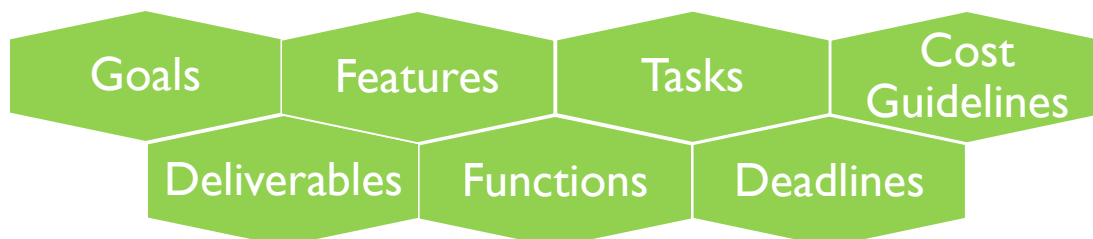
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## Scope:

- What does the customer / stakeholder want?
  - You must have a common understanding among the stakeholders about what goes into project and what factors define its success.
- What needs to be achieved and what work must be done to deliver the project? Defines the following:



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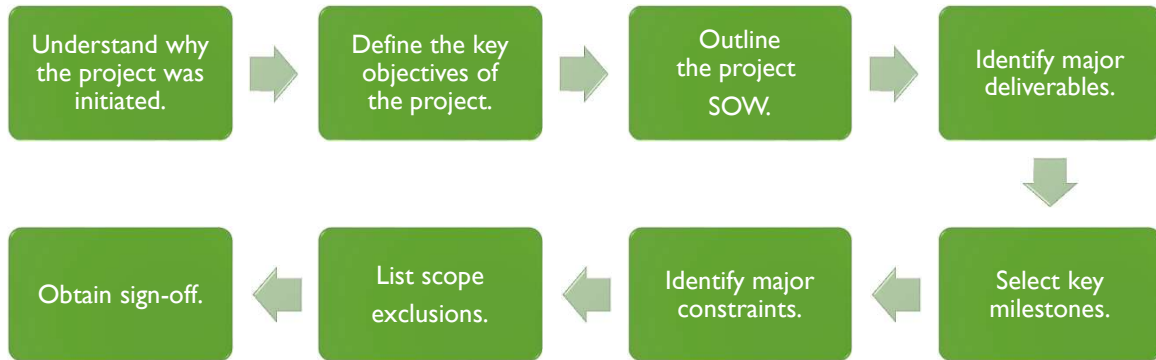
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## Scope it – Statement of Work & Scope

- Develop Statement of Work (SOW)



- Document the scope (SOW, WBS, WBS Dictionary)

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## Scope: Workshop Example

<b>What is purpose of workshop?</b>	Woodworking
<b>Dimensions</b>	30 ft x 20 ft and 8 ft ceiling
<b>Heating and air conditioning (HVAC)</b>	Must be able to filter for saw dust
<b>Electrical</b>	Outlets to support woodworking equipment
<b>Windows</b>	4, insulated
<b>Exterior doors</b>	One large double doors and one single door
<b>Foundation</b>	Slab
<b>Siding</b>	Vinyl
<b>Roof</b>	Shingles must have 30 year life
<b>Walls and ceiling</b>	Must be insulated
<b>Extras</b>	Small bathroom

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## Scope: Workshop Example Cont.

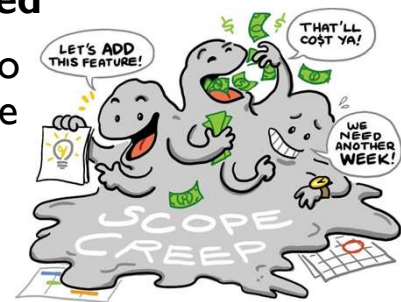
- Exclusions
  - Does not include running power line to workshop
  - Does include water supply line to workshop
  - Does not include running sanitary lines from the workshop
  - Does not include finished floor. Concrete slab will be floor
  - Schedule is based on no more than 5 rain days
- Milestones
  - Exterior must be complete to allow interior work to began 50 workdays after approval of building permit
  - Must be complete 60 workdays after approval of building permit
- Deliverables
  - Approved building permit
  - Approved occupancy permit
- Cost Basis
  - Cost range \$30,000 to \$45,000
  - Costs for major equipment and vehicles are captured in G&A rate



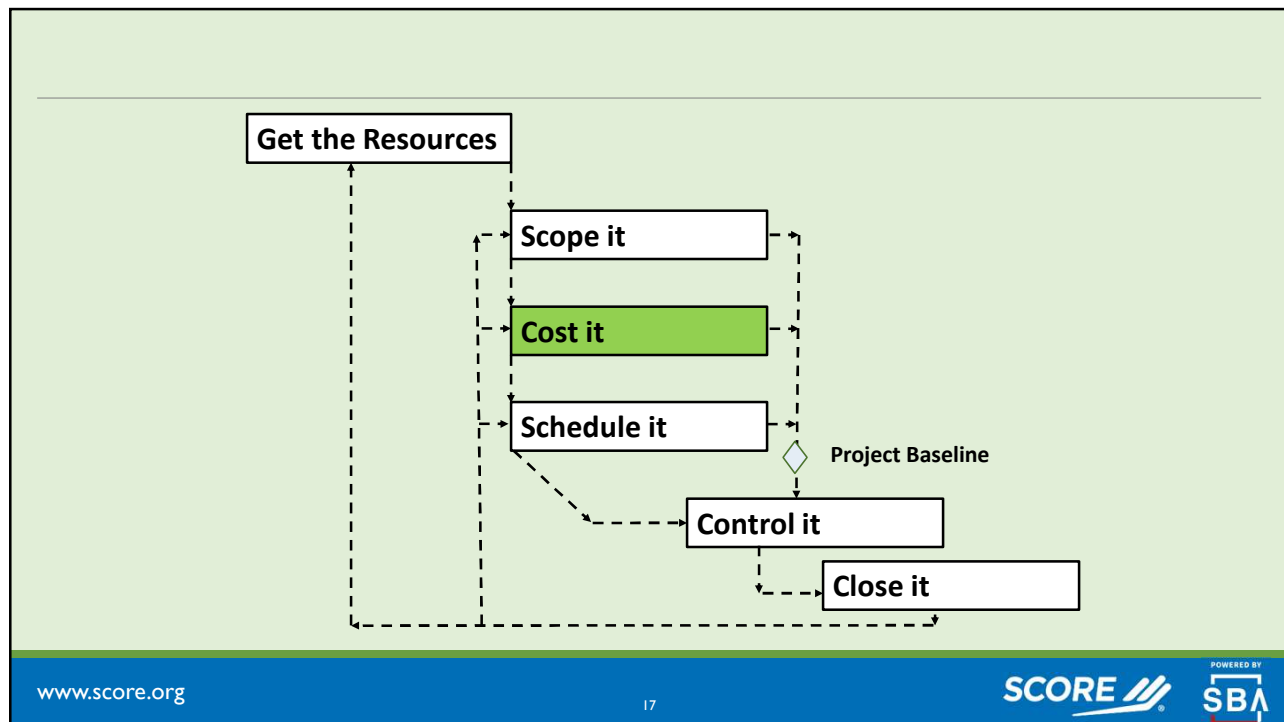
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## Scope: Avoid Scope Creep

- Scope creep in project management refers to changes, continuous or uncontrolled growth in a project's scope, at any point after the project begins. This can occur when the scope of a project is **not properly defined, documented, or controlled**
- Any **scope** not in original scope of work needs to be documented, estimated, reviewed for schedule impact and approved.



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## Cost: Cost Management

- Project Cost Management includes the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget.
- The estimate must forecast the resources and financial investment needed to execute a project successfully. The goal of estimation is to identify all the costs associated with the project and create an accurate budget and timeline.



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## Costs: Budget & Forecast

- The budget is the total estimated costs to complete a project over a defined period.
- The forecast is the actual costs to date and the forecast costs to complete the project
- Project funding often determines the scope of the project and project length. The funding requirements are based on the budget over time.



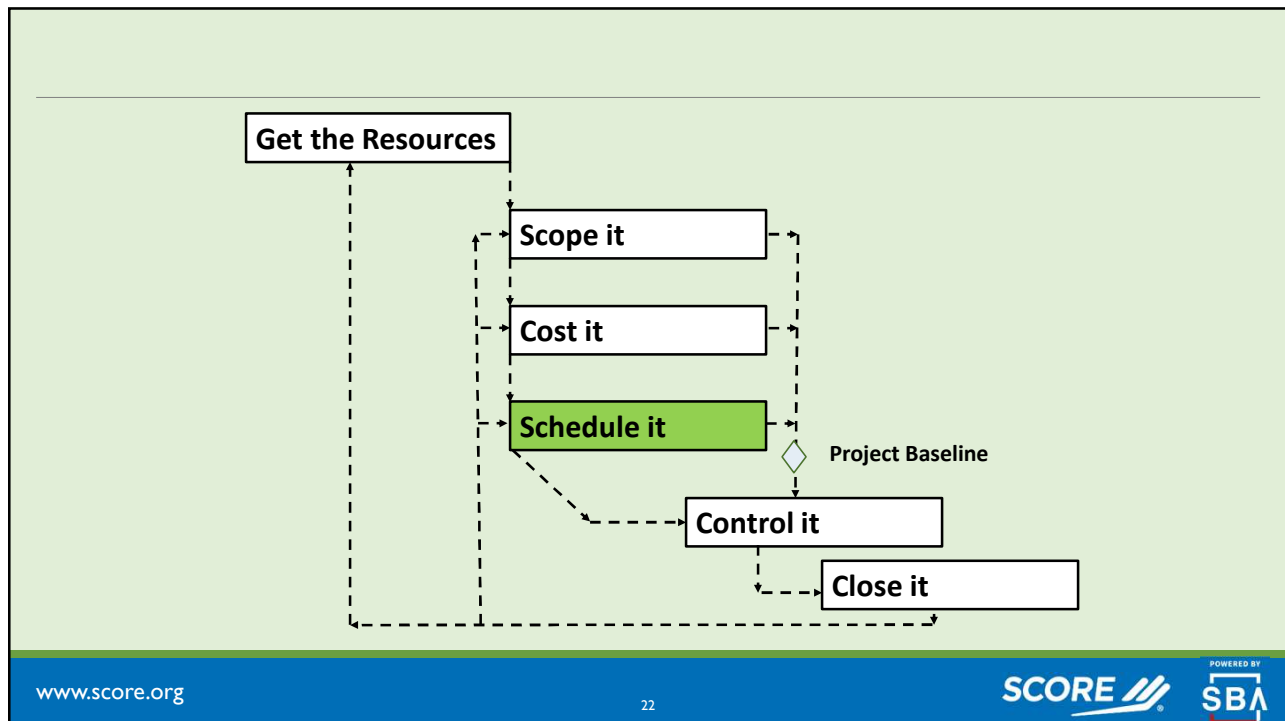
## Costs: Contracts

- Contracts and how they have written often dictate funding requirements and can make or break the project based upon cash flow.
  - Progress payments
  - Material Invoices
- The procurement process requires contractual relationships with outside vendors and suppliers for goods and services needed to successfully complete a project.
  - Net 30 days terms
  - Net 60 days terms

## Costs: Workshop Costs

<b>Direct Costs</b>	<b>Material Costs</b> <small>(includes sales tax)</small>	A bill of materials (BOM) is a comprehensive inventory of the raw materials, assemblies, subassemblies, parts and components, as well as the quantities of each, needed to manufacture a product.	
	<b>Labor Costs</b> <small>(includes SS, FICA &amp; benefits)</small>	Hours worked times the labor rates	
	<b>Current Assets Costs</b>	<ul style="list-style-type: none"> <li>Short Term</li> </ul>	<ul style="list-style-type: none"> <li>Power and Hand Tool Repair and Replacement</li> </ul>
	<b>Subcontract Costs</b>	<ul style="list-style-type: none"> <li>Electrical – Electrical panel installation requires licensed electrician and tie-in to power</li> <li>Plumbing – Licensed plumber for tie-into existing sanitary system</li> </ul>	
<b>Indirect Costs</b>	<b>Fixed Assets Costs</b>	<ul style="list-style-type: none"> <li>Long Term</li> </ul>	<ul style="list-style-type: none"> <li>Vehicles</li> <li>Equipment (compressors, conduit benders, etc.)</li> </ul>
	<b>Administrative Costs</b>	<ul style="list-style-type: none"> <li>Office rental and equipment</li> <li>Bookkeeper / Accountant</li> </ul>	<ul style="list-style-type: none"> <li>Office staff                             <ul style="list-style-type: none"> <li>Material takeoff</li> <li>Procurement</li> </ul> </li> </ul>
	<b>Profit/Fees</b>		

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## Schedule

- Scheduling in project management is the listing of activities, deliverables, and milestones within a project.
- A schedule includes the planned start and finish date, duration, and resources assigned to each activity.
- Effective project scheduling is a critical component of successful time management. Six P's
  - Prior
  - Poor
  - Planning
  - Project
  - Prevents
  - Performance



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## Schedule: Building the Schedule

### Activities

- Develop a list of all activities required to complete a project

### Sequence

- Sequence / establish logic to determine which activities need to be completed first, what activities are dependent of other activities to be completed first

### Resources

- Determine the resources needed to complete each activity.

### Duration

- Determine the duration to complete each activity.

### Resource Limitations

- Resource limitations may drive the durations. The activity being completed may limit the resources, which may be constrained due to physical space.

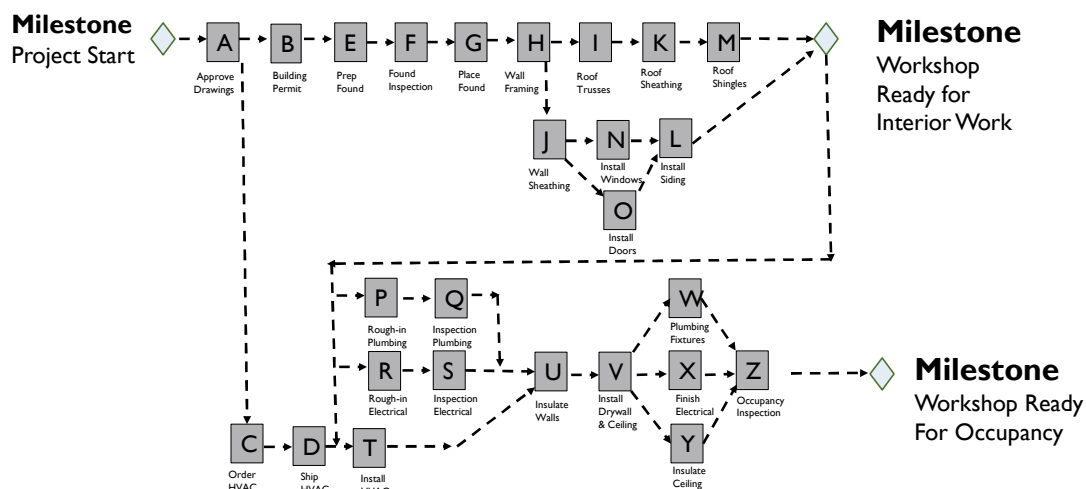
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## Schedule: Workshop Activities

- A. Contractor & customer review and approve drawings
- B. Building permit approved
- C. Order heating and ventilation system (HVAC)
- D. Vendor ship HVAC system
- E. Place plumbing, electrical embeds & anchors
- F. Foundation & embed inspection ←
- G. Place foundation & cure time
- H. Install building framing
- I. Install roof Trusses
- J. Install exterior sheathing
- K. Install roofing sheathing
- L. Install siding
- M. Install roof shingles
- N. Install windows
- O. Install doors
- P. Rough-in plumbing
- Q. Plumbing inspection ←
- R. Rough-in electrical
- S. Electrical inspection ←
- T. Install HVAC system and ductwork
- U. Insulate walls
- V. Install drywall & ceiling
- W. Install plumbing fixtures
- X. Finish electrical
- Y. Insulate ceiling
- Z. Occupancy Inspection & Permit ←

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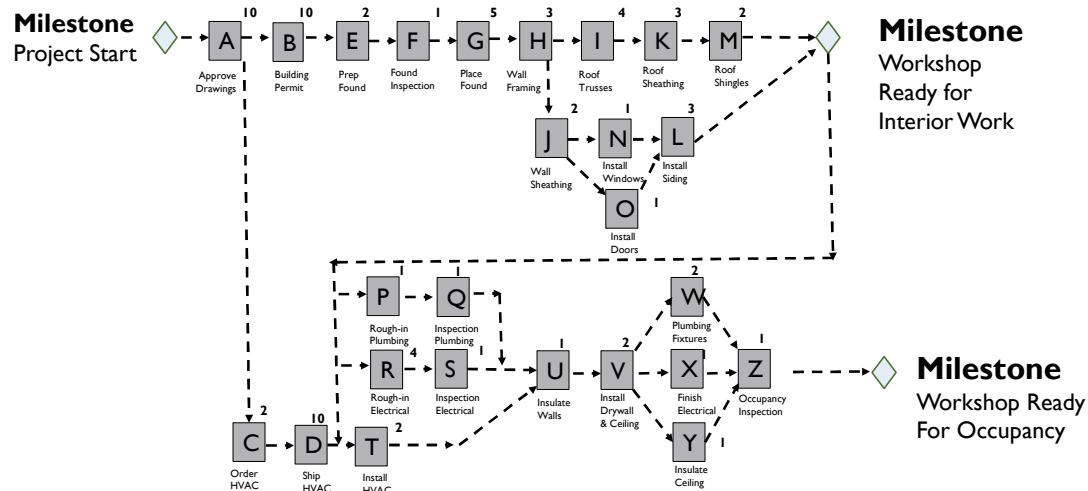
## Schedule: Sequence the Activities



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## Schedule: Determine Durations



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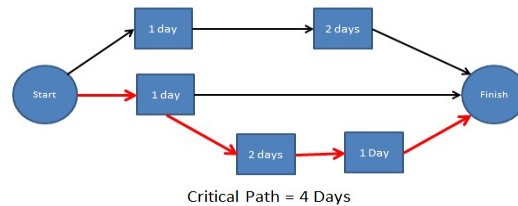
## Schedule: Schedule Network

- A Schedule Network is a graphical representation of a schedule. It helps provide a clear sequence of events for the efficient completion of a project.
- Most scheduling software use Precedence Diagramming Method (PMD). It looks like a chart with a series of blocks and arrows. The blocks represent the activities and the arrows represent the logic or dependences.
- A network will have paths from the start of the project to the completion of the project. These are call network paths.

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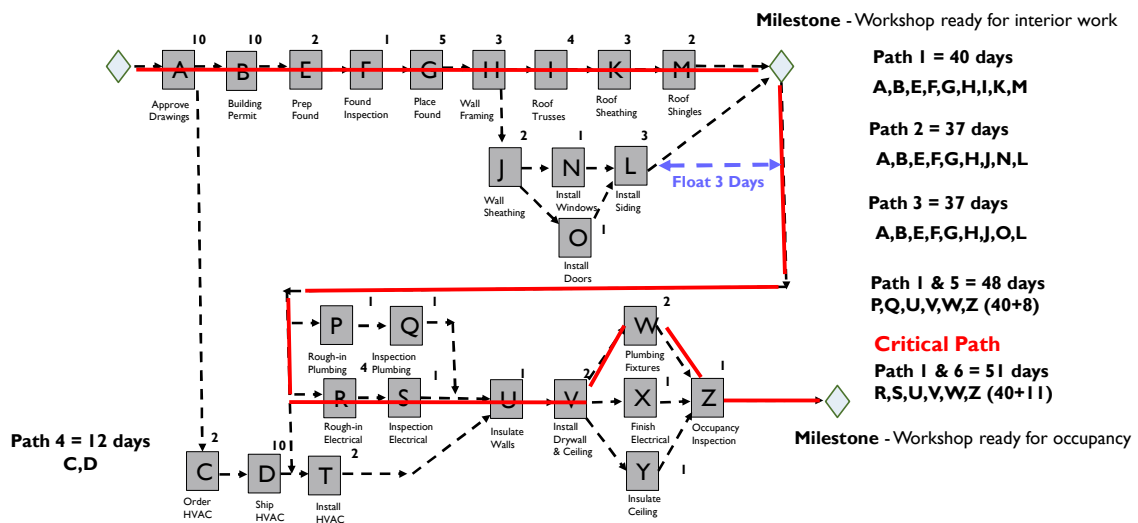
## Schedule: Schedule Network Cont.

- The network path which adds up to the longest overall duration is the project critical path. This determines the shortest time possible to complete the project. A project can have more than one critical path
- If any activity on the critical path slips the project end date will slip.
- Activities not on the critical path have what is called float or slack. The amount of float or slack is the amount of time an activity can slip without delaying the project end date



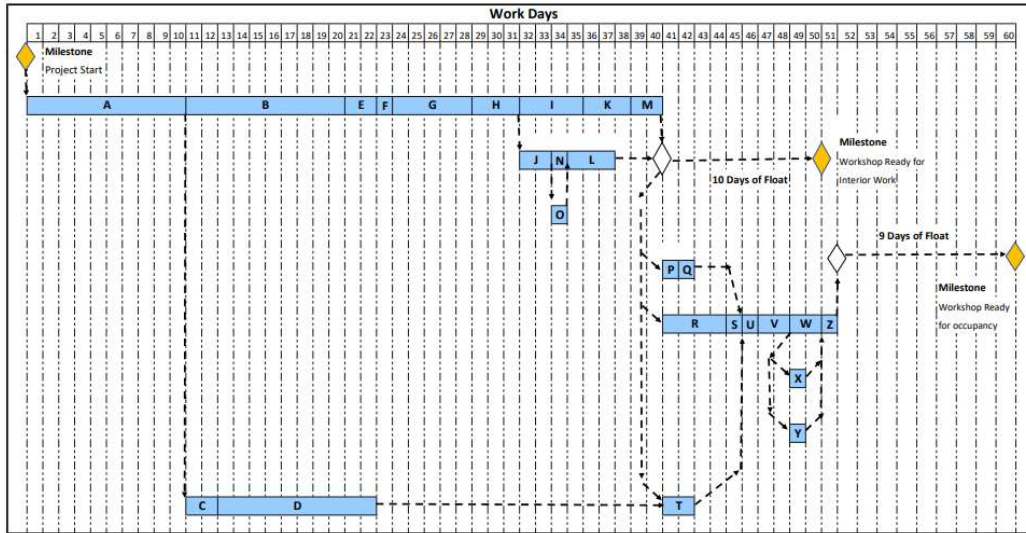
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## Schedule: Critical Path

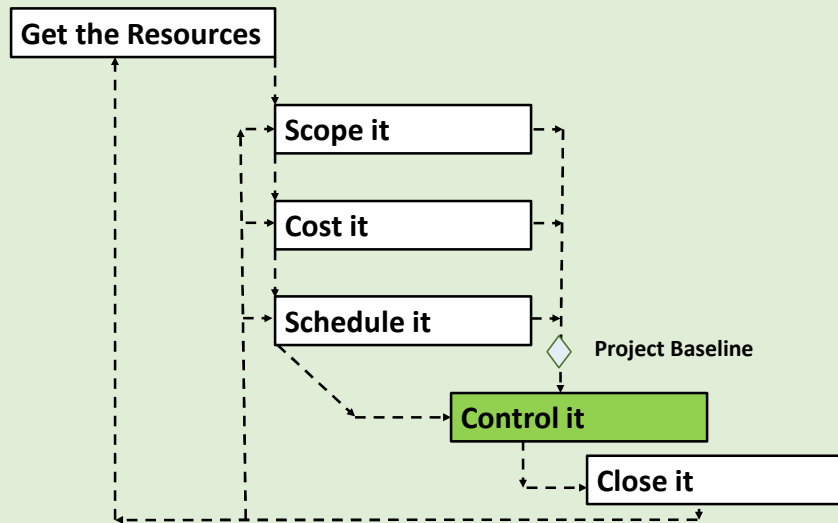


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# Schedule: Time Scale Logic



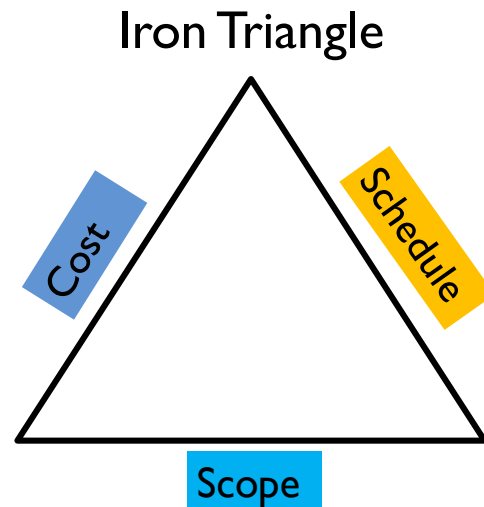
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## Control: Constraints

- The Triple Constraint or Iron Triangle consists scope, cost, and schedule with each being a constraint.
- A change in one constraint will impact at least one other constraint.



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## Control: Constraints

- The Statement of Work (SOW) defines the scope.
- The estimate defines the cost and the cost over time defines the budget.
- The schedule defines the starts and finishes of each activity based upon resources and funding limitations.
- If any of the above items change, the project must have a project change control process.

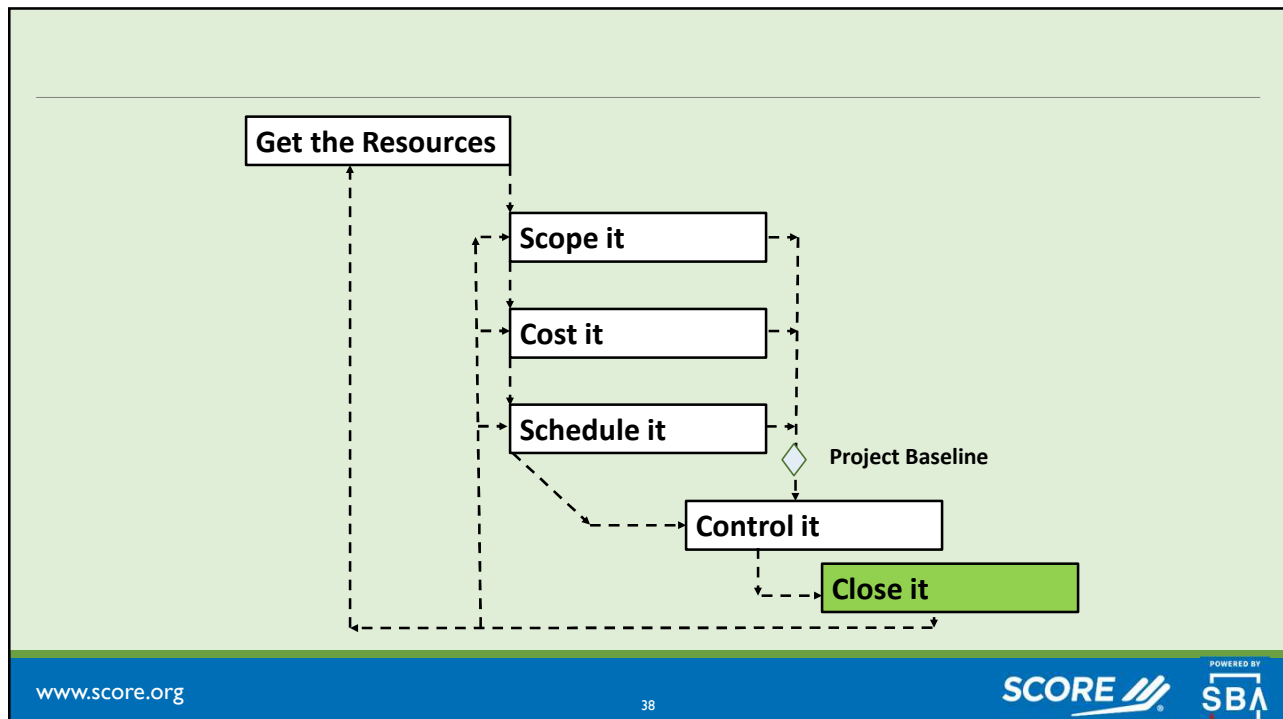
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## Control: Change Control Process

- Identify or propose a change.
- What is impact of the change on scope, cost and/or schedule?
- The proposed change may be accepted or rejected
- If change can not be rejected determine the cause of the change
- Contractor must submit a change order
- Document the change and get stakeholder agreement if required



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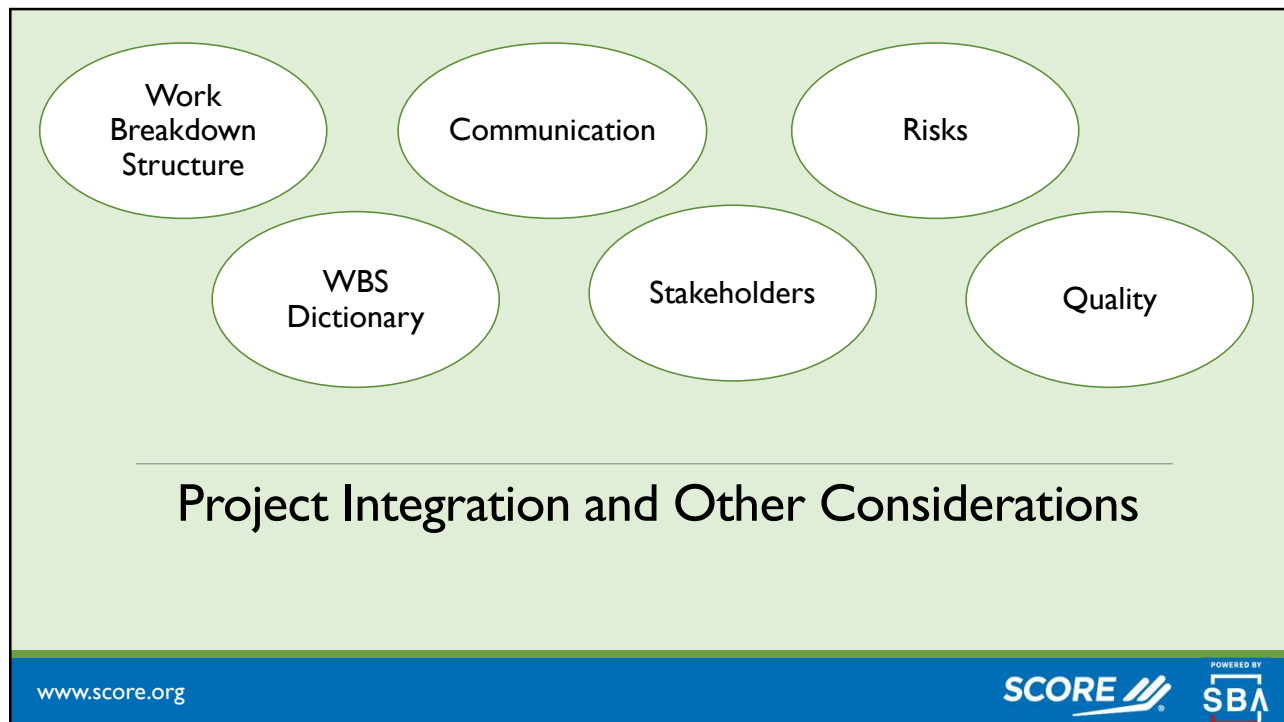
## Close: Finish Project

- The closing process is a process group that refers to those actions that must be done to formally terminate and conclude all tasks, activities, and component parts of a project, or phase of a project.
  - What does completion and/or success mean on a project?
  - The sooner each deliverable is accepted the sooner the project team can concentrate on next deliverable.



## Close: Finish Project Cont.

- What were lessons learned on the project?
  - A good “lessons learned” allows you and your (future) colleagues to learn from the mistakes and successes of the project. A high-quality close-out report will improve future projects.
- When can project team members move on to next project?
- Develop closure punch list
- Close the charge codes.



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## Work Breakdown Structure

- The Work Breakdown Structure provides a common framework for the natural development of the overall planning and control of a contract and is the basis for dividing work into definable increments from which the statement of work can be developed and technical, schedule, cost, and labor hour reporting can be established

WBS

Scope

Cost

Schedule

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## Statement of Work

- Statement of Works are often defined through a WBS dictionary. The WBS Dictionary is one of three components that comprise the scope baseline.
- The Statement of Work (SOW) was previously defined in the scope slide*

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## Work Breakdown Structure

```

graph TD
    WBS01[WBS 01 Workshop] --- WBS0101[WBS 01.01 Civil & Architectural]
    WBS01 --- WBS0102[WBS 01.02 Mechanical]
    WBS01 --- WBS0103[WBS 01.03 Electrical]
    WBS0101 --- T1[01.01.01 Concrete slab]
    WBS0101 --- T2[01.01.02 Framing]
    WBS0101 --- T3[01.01.03 Roof Trusses]
    WBS0101 --- T4[01.01.04 Sheathing]
    WBS0101 --- T5[01.01.05 Siding]
    WBS0101 --- T6[01.01.06 Insulation]
    WBS0101 --- T7[01.01.07 Roof Shingles]
    WBS0101 --- T8[01.01.08 Windows]
    WBS0101 --- T9[01.01.09 Doors]
    WBS0102 --- T10[01.02.01 HVAC unit]
    WBS0102 --- T11[01.02.02 Water supply]
    WBS0102 --- T12[01.02.03 Drain Lines]
    WBS0102 --- T13[01.02.04 Sinks]
    WBS0102 --- T14[01.02.05 Toilet]
    WBS0102 --- T15[01.02.06 Mech embeds]
    WBS0103 --- T16[01.03.01 120 Amp Panel]
    WBS0103 --- T17[01.03.02 Lights]
    WBS0103 --- T18[01.03.03 Equipment]
    WBS0103 --- T19[01.03.04 power supply]
    WBS0103 --- T20[01.03.05 Electrical Embeds]
    
```

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## WBS Dictionary

- WBS Dictionary is an expansion of scope statement by the Work Breakdown Structure
  - Example WBS Dictionary for WBS 01.02.01 – HVAC Unit
    - Purchase and install Bosch Hyper Heat ENERGY STAR 12,000 BTU 1 Ton Ductless Mini Split Air Conditioner and Heat Pump 230-Volt/60 Hz

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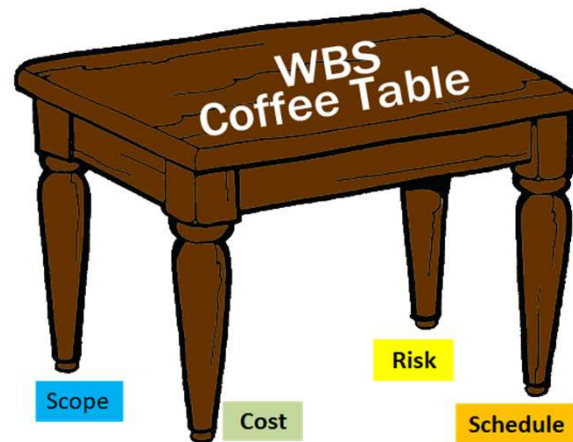
## WBS - Common Frame work

- WBS 01.02.01 - Cost
  - Material
    - HVAC Unit \$1,850
    - Dust collection system \$375
  - Labor
    - Labor Rate \$27.01
    - Labor hours 40
- WBS 01.02.01 - Schedule
  - Activity C – Order HVAC
  - Activity D – Vendor ship HVAC system
  - Activity T - Install HVAC

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## Project Risks

- There are risks associated scope, cost, and schedule



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## Project Risks Cont.

- Technical Risks - Do you have the right scope? Do you have the correct building code? Will project function as designed.
- Estimate Uncertainty – Do have right quantities? Do you have the right material costs? Do you have the right labor costs?
- Schedule Contingency is defined as an amount of time included in the project or program schedule to mitigate (dampen/buffer) the effects of risks or uncertainties identified or associated with specific elements of the project schedule.



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## Quality

- The cost of preventing poor quality is cheaper than cost for rework



## Communications

- Communication, Communication, Communication
- Leadership
  - You have one mouth and two ears, use them in portion
  - Bad news never get better with age
  - People are your best resource, treat them fairly
  - Allow your people to make mistakes if it does not hurt the project or cause a safety issue. They will learn from it.

## Communications

- Stakeholders
  - If Mommy is not happy nobody is happy
  - Keep them informed
  - Bad news never get better with age
  - Document what they mean by success
  - Address all concerns promptly



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## Review of Key Processes

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## Review of Key Processes: Assign Resources

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- Strong Project Manager / General Contractor
  - Leader
  - Experience
  - Communications
- Funding / Capital for Cash Flow
- Office and Project Support
- Equipment, Vehicles and Tools

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## Review of Key Processes: Scope It

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- Statement of Work documented
- Stakeholder / Customer Buy-In
- Define the following:
  - Project Goals
  - Deliverables
  - Tasks
  - Deadlines
  - Cost Guidelines
- What Factors define project success?
- What are risks? (building code change, not all deliverables id)

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## Review of Key Processes: Cost It

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- Estimate the project costs
- Budget is the estimate over time
- Forecast is actual cost for work completed plus estimate for to go work
- Contracts must include method of payment
- Vendor and supplier relationship is essential
- Cash flow is key to survival
- What are cost risks (material & labor costs and quantity needed & hours required to complete the work)

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## Review of Key Processes: Schedule It

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- List of activities
- Sequence required to complete activities
- Determine Resources for each activity
- Determine Durations for each activity
- Determine Critical Path to complete project
- What are risks? (weather, equipment failure, labor shortage)

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## Review of Key Processes: Control It

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- Iron Triangle – A change any constraint, (scope, cost, schedule) will impact at least one other constraint
- Scope Creep must be Controlled
- Any changes must be documented, reviewed for impact and approved

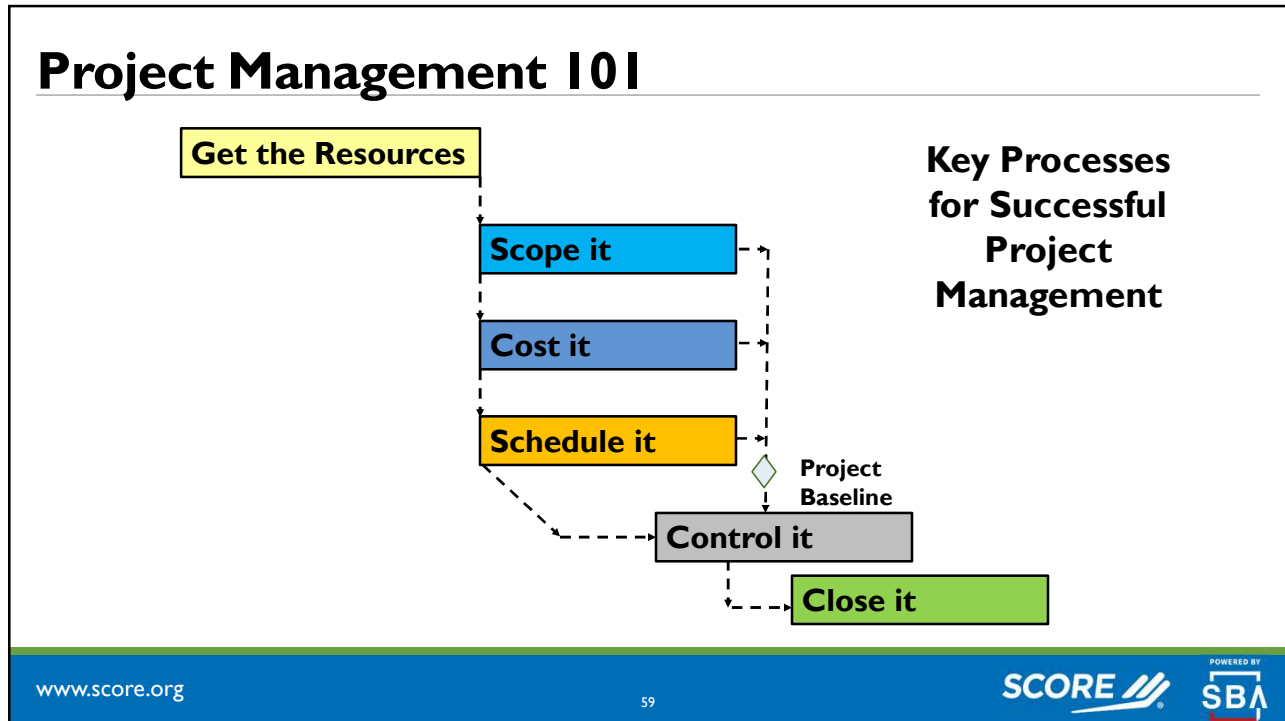
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## Review of Key Processes: Close It

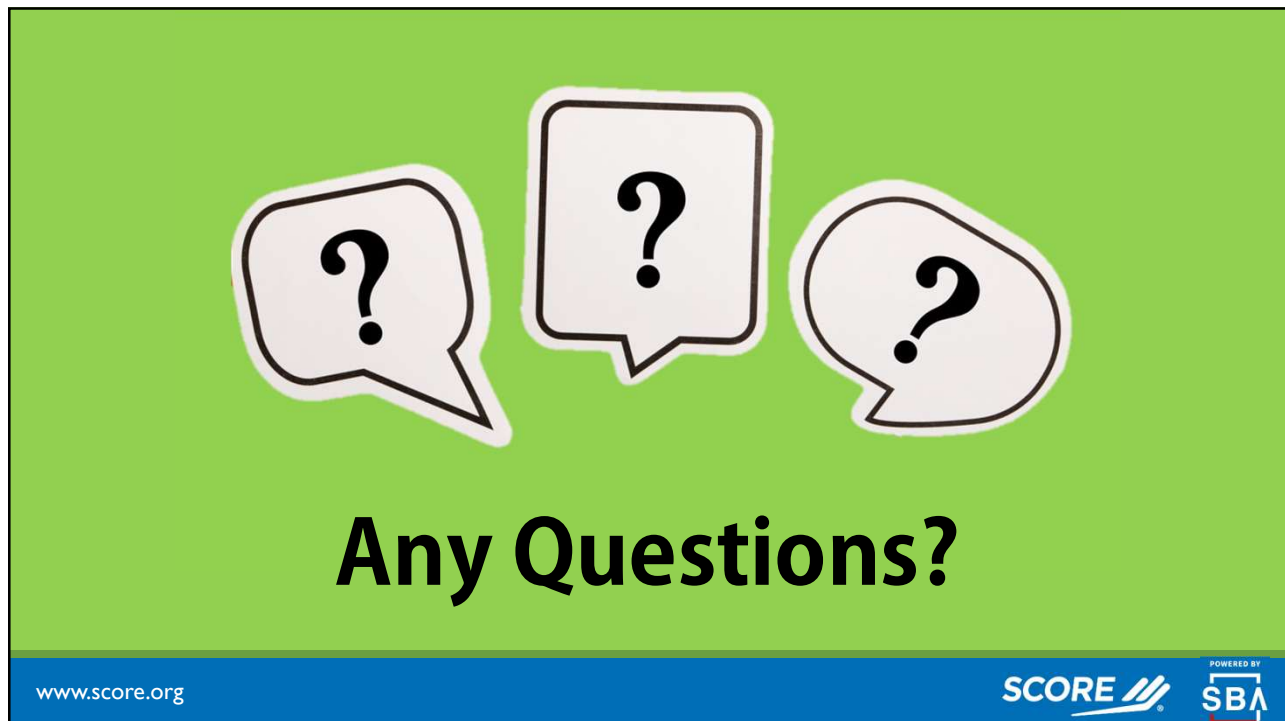
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- Get stakeholder acceptance on each deliverable ASAP
- Allows resources to be freed up for next project
- Document the Lessons Learned (positive & negative)
- Close the Charge Codes

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