# 2023 Research Infrastructure WORKSHOP

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## Performance Measurement & Management (Part 1): Creating the Project Baseline

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# Overview of Presentation

**Takeaway: Every Project Needs a Complete, Accurate, and Pre-Determined Definition of Success—i.e., "The Baseline"**

- **What is a Project Baseline?**
  - Definitions
  - The Baseline Development Process
- **Scope:**
  - The WBS Development Process
  - Tools & Examples
- **Integrated Master Schedule**
  - The IMS Development Process
  - Tools & Examples
- **Budget**
  - The Budget Development Process
  - Tools & Examples
- **Contingencies**
  - The Contingency Development Process
  - Tools & Examples
- **Wrap-Up/Summary & Questions**


**I: PEPs, Project Objectives, Requirements, & Impacts**

https://researchinfrastructureoutreach.com/knowledge-gateway/part-i-mid-scale-project-planning-management/


**II: Baselines, Risk, & Contingency**

https://researchinfrastructureoutreach.com/knowledge-gateway/part-ii-mid-scale-project-development-definition-and-risk/

https://researchinfrastructureoutreach.com/knowledge-gateway/


**III: Performance Measurement, Change Control, & Reporting**

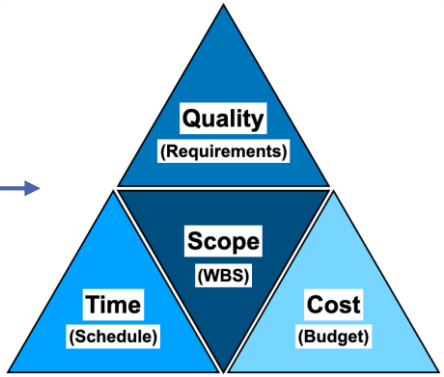
https://researchinfrastructureoutreach.com/knowledge-gateway/part-iii-mid-scale-project-performance-management/

# What is a Project Baseline?

**Takeaway: The Project Baseline Should Be Scaled & Tailored to the Project's Size, Complexity, & Stage of Development**

**Baseline = Performance Measurement Baseline = Project Definition**
(a/k/a "Iron Triangle" = "Golden Triangle" = "Scope + Triple Constraints"…)
**= Work Breakdown Structure + Quality Requirements + Schedule + Budget**

**Budget Contingency** + **Schedule Contingency** + **Scope/Quality Contingency**




Preliminary Proposal → Full Proposal → Award → Post-Award

Less Detail — **The Project Baseline Details Develop & Evolve With Stage of Project (Progressive Elaboration!)** — More Detail

Small, Simple Project → Large, Complex Project

Less Complexity
Simpler Tools

**Level of Complexity of Baseline Elements and Sophistication of Management Tools Depend on Size, Complexity of Project; a/k/a the "Goldilocks" Zone**

More Complexity
More Sophisticated Tools

# The Process


**I: PEPs, Project Objectives, Requirements, & Impacts**

https://researchinfrastructureoutreach.com/knowledge-gateway/part-i-mid-scale-project-planning-management/

**Takeaway: High-Level Objectives → Specific Deliverables → Everything Else…**

Start

**1. Define Project Objectives:**
ID Key Project Stakeholders
Project Mission Statement

**2. Define Project Deliverables:**
Scope
Key Performance Parameters, Reqs

**3. Determine Acquisition Approach:**
Procurement Plans
QA/QC Verification/Validation Plans

**4. Determine Resource Reqs:**
Project Labor
Non-Labor Resources

**5. Define Time Reqs./Constraints:**
Key External Milestones
Activities w/ Logic & Durations

**6. Define Cost Estms./Constraints:**
Top-Down Cost Constraints
Bottom-Up Estimates

**7. Identify & Assess Key Project Risks:**
Technical, Acquisition,
Programmatic, External, Comms, etc…

Project Baseline

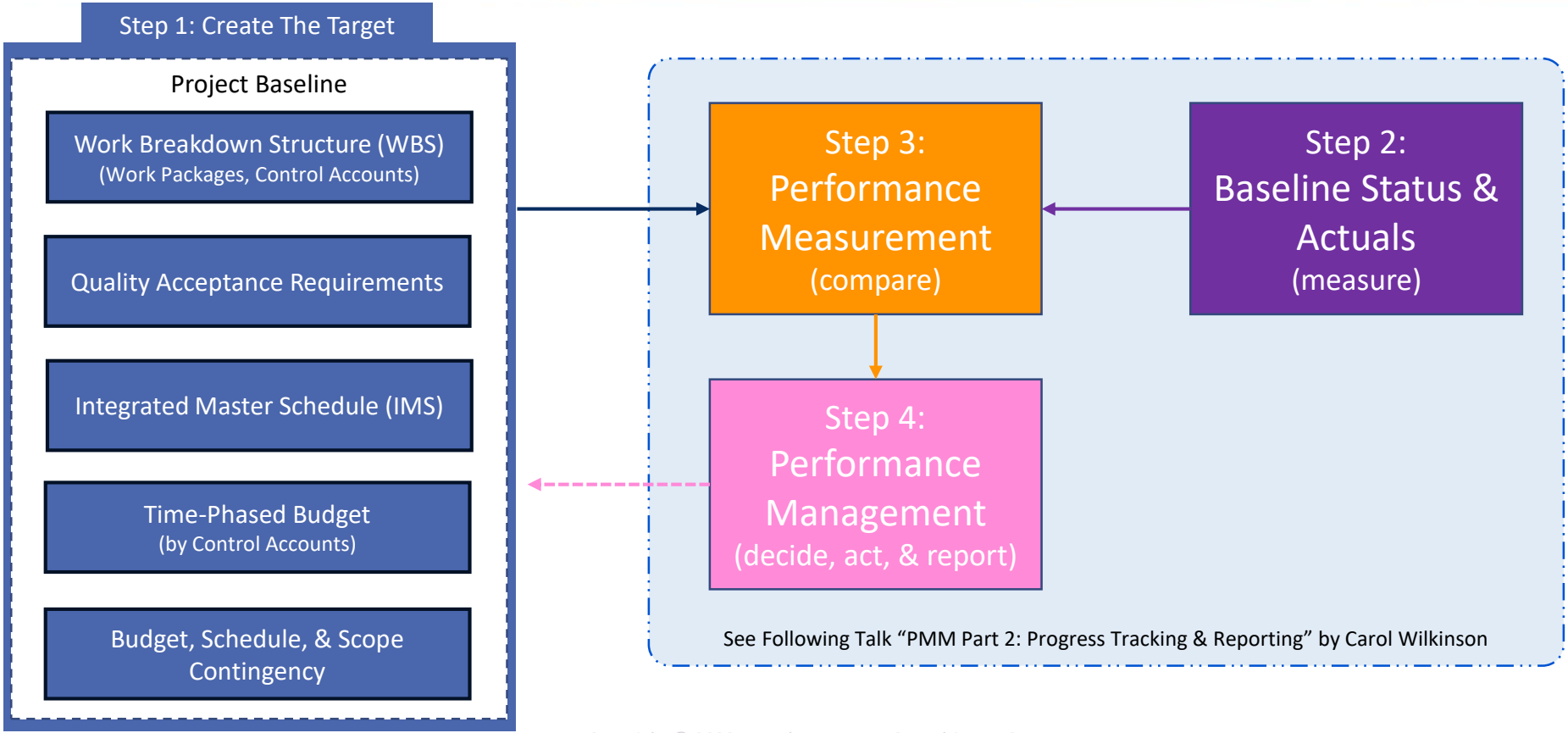
- Work Breakdown Structure (WBS)
  (Work Packages, Control Accounts)
- Quality Acceptance Requirements
- Integrated Master Schedule (IMS)
- Time-Phased Budget
  (by Control Accounts)
- Budget, Schedule, & Scope Contingency

***"Always begin with the end in mind."***

**Stephen Covey**
*The Seven Habits of Highly Successful People*

# Why is a Baseline So Important?

**Takeaway: Project Baseline = "Target" Against Which Progress & Performance Are Measured, Adjusted**



# Scope Development


**Baselines, Risk, & Contingency**

https://researchinfrastructureoutreach.com/knowledge-gateway/part-ii-mid-scale-project-development-definition-and-risk/

**Takeaway: First Identify Scope, Then Organize It Based On Your Specific Project Needs…**

**Work Breakdown Structure (WBS): hierarchical listing of total project scope; i.e., "deliverables" (products, results, services)**

Project Objectives → **Work Breakdown Structure (WBS)** → Quality Acceptance Requirements → Acquisitions Approaches → Resource Requirements → Integrated Master Schedule → Time-Phased Project Budget → Risk Identification & Assessment → Contingency Requirements

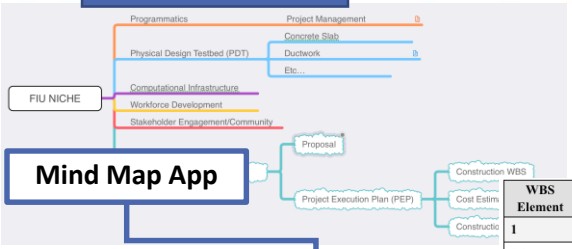
| Development Process: | How-To: | Typical Tools & Apps: |
|---|---|---|
| 1. Identify Scope | • Start with Mission Statement, high-level objectives<br>• Brainstorm with Team, Stakeholders; "R&D" similar projects<br>• Progressive elaboration; start high-level and then add detail<br>• Remember: Scope = Nouns (Schedule Activities = Verbs)<br>• Gather Acceptance Requirements, other notable info in parallel<br>• Be wary of Scope Creep! | • Whiteboards, Text Lists, "Yellow Stickies"…<br>• Mind Maps, Charting Programs (Miro, Visio, OmniGraffle)<br>• Spreadsheets (Excel, Google Sheets) |
| 2. Organize & Document Scope | • Document in Hierarchical Work Breakdown Structure (WBS)<br>• Align/Organize WBS via Acquisitions Approach ("deliveries")<br>• Establish Control Accounts ("ownership & tracking")<br>• Lowest Level = Work Packages (scheduled with activities, costed)<br>• Keep WBS Simple (but not too simple!) | • Mind Mapping software (MindNode, MindMeister…)<br>• Outlining applications (Word, OmniOutliner)<br>• Spreadsheets (Excel, Google Sheets…)<br>• Commercial PM Software (Smartsheets, Dash360…) |
| 3. Review, Modify, Formalize WBS | • Verify all scope accounted for—and don't double-count<br>• Review and verify WBS with Stakeholders<br>• Modify, iterate, and elaborate as required<br>• Add WBS tier numbering as late as reasonable to do so<br>• Approve & Configuration-control the WBS<br>• "Publish" the WBS | • Versioning-control software (PDM Works, Docushare, Sharepoint, MS Teams, et al)<br>• Project Website |

# NICHE WBS Development

**Takeaway: Use The Tools That Make Sense To You…**

**National Full-Scale Testing Infrastructure for Community Hardening in Extreme Wind, Surge, and Wave Events**
**Florida International University**
**Awarded Mid-scale RI-1 Design Project ($12.84M)**
**Project Objective: Produce Designs & Plans for Full Construction Project**

## 1. Identify Scope

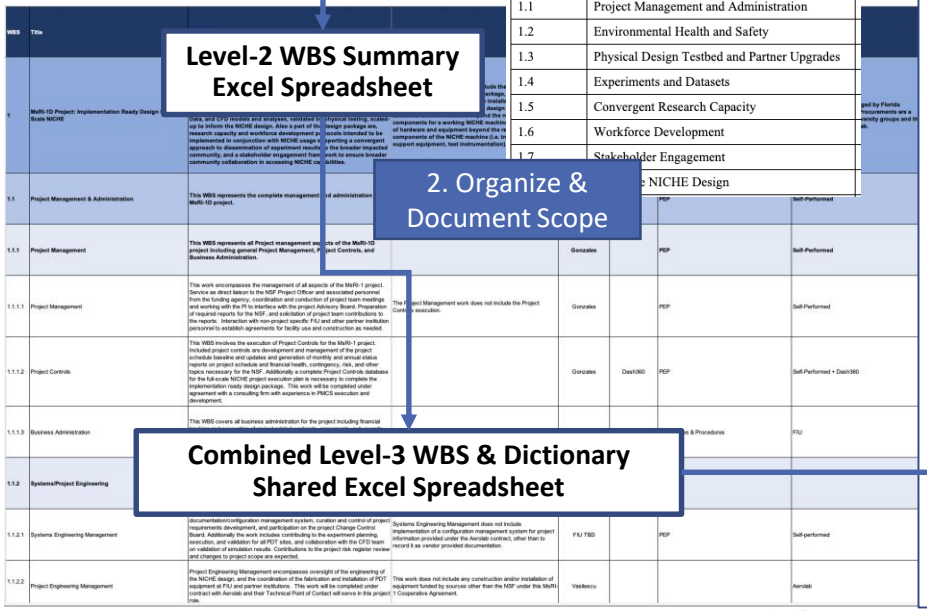



**Mind Map App**

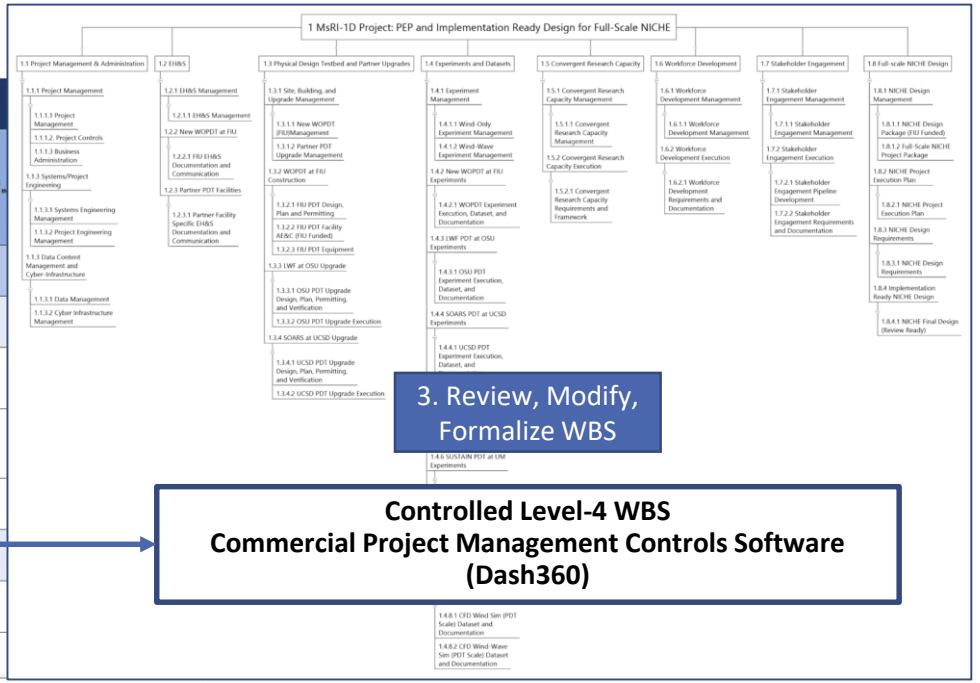
## 2. Organize & Document Scope

**Level-2 WBS Summary Excel Spreadsheet**

| WBS Element | WBS Description |
|---|---|
| 1 | Project |
| 1.1 | Project Management and Administration |
| 1.2 | Environmental Health and Safety |
| 1.3 | Physical Design Testbed and Partner Upgrades |
| 1.4 | Experiments and Datasets |
| 1.5 | Convergent Research Capacity |
| 1.6 | Workforce Development |
| 1.7 | Stakeholder Engagement |
| | NICHE Design |



**Combined Level-3 WBS & Dictionary Shared Excel Spreadsheet**




## 3. Review, Modify, Formalize WBS

**Controlled Level-4 WBS**
**Commercial Project Management Controls Software (Dash360)**

# Schedule Development


**Baselines, Risk, & Contingency**

https://researchinfrastructureoutreach.com/knowledge-gateway/part-ii-mid-scale-project-development-definition-and-risk/

**Takeaway: Establish & Link Schedule Activities to Support Acquisition Approach & Creation of Deliverables**

## Integrated Master Schedule (IMS): Work Package (WP) aligned, logically-linked series of activities required to create scope

Project Objectives → Work Breakdown Structure (WBS) → Quality Acceptance Requirements → Acquisitions Approaches → Resource Requirements → **Integrated Master Schedule** → Time-Phased Project Budget → Risk Identification & Assessment → Contingency Requirements

| Development Process: | How-To: | Typical Tools & Apps: |
|---|---|---|
| 1. Gather Schedule Constraints, Factors | • Determine high-level time constraints, need-by milestones…<br>• Establish acquisitions approaches, resource requirements… | • Whiteboards, ”Sticky” Notes, Text Documents, Spreadsheets… |
| 2. Create Master Timeline | • Assign Subject Matter Experts (SMEs) to WP-based schedule tracks; provide guidance & templates… but rely on their expertise<br>• Create WP-based logical flow of activities based on acquisition approach(s)<br>• Think: input/output dependencies.<br>• Combine individual WP logic into master logical flow of work; include inter-WP logic<br>• Layer on ”Project Scope” (e.g., Project Management activities)<br>• Add durations, milestones, resource loading…. | • Diagramming software (Lucid Chart, Miro, OmniGraffle, Visio, PowerPoint, Keynote, et al…)<br>• Spreadsheets (Excel, Google Sheets…)<br>• Scheduling Apps (MSProject, OmniPlan, Smart Sheets…)<br>• Enterprise-class Scheduling Software (Primavera (P6))<br>• PMCS Consultants |
| 3. Review, Optimize & Formalize | • GAO : Comprehensive, well-Constructed, Controlled, Credible?<br>• Focus on Critical Path and Near-Critical Paths<br>• Ensure no surprises with Key Stakeholders; Communicate!<br>• Approve & Configuration-control the Schedule<br>• “Publish” the Schedule | • Versioning-control software (PDM Works, Docushare, Sharepoint et al…)<br>• Project Website |

# NICHE Schedule Development

**Takeaway: Different Tools Required For Different Stages of Project Development**

1. Gather Schedule Constraints, Factors

**Milestone Chart**

**Simplified Excel-Based Planning Bar Chart Timeline**

**Complete Gantt Chart In Primavera Scheduling Application**

WBS 1.3 Wind-Only PDT and Partner Upgrades

WBS 1.4 Experiments and Datase

2. Create Master Timeline

**Individual Work Package Logical Flowcharts Created in Miro Charting Application**

3. Review, Optimize & Formalize

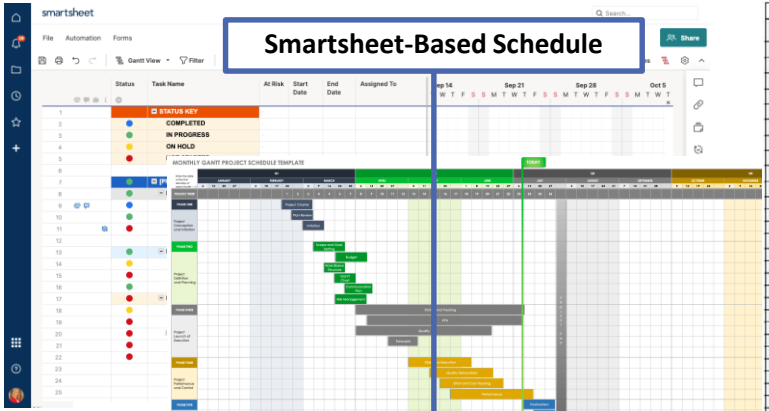
# IceCube Schedule Dev.

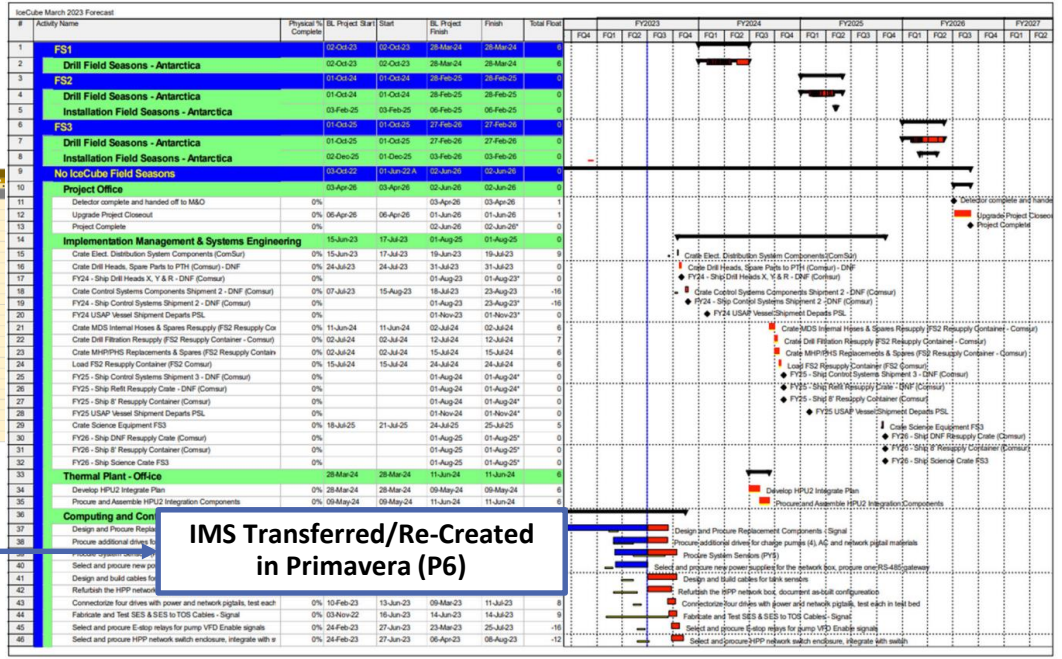
**Takeaway: Tailoring & Scaling "Up" Sometimes Required to Support Project Needs…**

**IceCube Upgrade Project**
**University of Wisconsin - Madison**
**Funded Mid-scale RI-2 Project (Re-Baselined: ~$40M)**
**Goal: Drill, Install, & Commission 8 New Advanced**
**Neutrino Detector "Strings" to Existing IceCube Facility at the South Pole, Antarctica**

3. Review, Optimize & Formalize

**Smartsheet-Based Schedule**




**IMS Transferred/Re-Created in Primavera (P6)**

# Budget Development


**Baselines, Risk, & Contingency**

https://researchinfrastructureoutreach.com/knowledge-gateway/part-ii-mid-scale-project-development-definition-and-risk/

**Takeaway: Schedule Activities → Cost Estimates → Time-Phased Budget**

## Time-Phased Budget: Work package-aligned, bottom-up-estimated spending plan

Project Objectives → Work Breakdown Structure (WBS) → Quality Acceptance Requirements → Acquisitions Approaches → Resource Requirements → Integrated Master Schedule → **Time-Phased Project Budget** → Risk Identification & Assessment → Contingency Requirements

| Development Process: | How-To: | Typical Tools & Apps: |
|---|---|---|
| 1. Gather Cost Data, Inputs | • Schedule Activity Durations, Acquisition Approaches<br>• Approved Labor Rates<br>• Vendor Quotes & Historical Costs<br>• Indirect Costs (IDC)/Facility & Admin Costs (F&A)/Overhead Rates | • Spreadsheets (e.g., Excel, Google Sheets…) |
| 2. Estimate Work Package Costs & Create Time-Phased Budget | • Create Individual Work Package Basis of Estimates (BOEs)<br>• Methods: historical, analogous, parametric, bottom-up time & materials, vendor quotes, etc…<br>• Document assumptions & methods<br>• ∑ Work Package estimates equal rolled-up project cost estimate<br>• Establish control accounts & ownership (CAMs)<br>• Time-phase the costs to create a required project budget (BAC)<br>• (Note: Total Project Cost = BAC + Contingency) | • Spreadsheets (Excel, Google Sheets…)<br>• Construction est. software (e.g., RSMeans, Buildxact…)<br>• Commercial Project Management Software (e.g., Deltek Cobra, InEight Estimate, Smartsheets, Dash360…) |
| 3. Review, Optimize & Formalize | • Scrub costs; ensure nothing missing, no double bookings<br>• Uniform Guidance: “Reasonable, Allocable, & Allowable”<br>• GAO : Comprehensive, Well-Documented, Accurate, & Credible<br>• No surprises with Key Stakeholders; communicate!<br>• Review & configuration-control the budget<br>• “Publish” the Budget | Versioning-control software (PDM Works, Docushare, Sharepoint et al)<br>Project Website |


# Contingency Development


**Baselines, Risk, & Contingency**

https://researchinfrastructureoutreach.com/knowledge-gateway/part-ii-mid-scale-project-development-definition-and-risk/

**Takeaway: Risk Assessment → Contingency Needs**

**Contingency: Un-allocated money, time, and scope/quality to cover costs of issues if they arise on project**

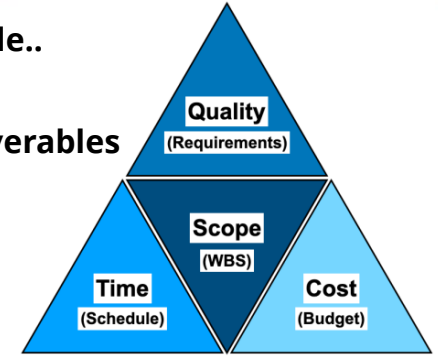
Project Objectives → Work Breakdown Structure (WBS) → Quality Acceptance Requirements → Acquisitions Approaches → Resource Requirements → Integrated Master Schedule → Time-Phased Project Budget → Risk Identification & Assessment → **Contingency Requirements**

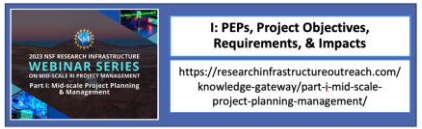
| Development Process: | How-To: | Typical Tools & Apps: |
|---|---|---|
| 1. Identify & Document Risks | • Use "Left Brain": Systematic Identification<br>• Use "Right Brain": Brainstorming, Brain-Writing…<br>• Use "Someone Else's Brain": Other projects' experiences, external consultants<br>• Create & populate Project Risk Register | • Spreadsheets (e.g., Excel, Google Sheets…)<br>• Mind Maps (Mindnode, Mindmeister…)<br>• Issue Tracking Software (Jira…)<br>• Commercial PM Software (@Risk, Dash360, etc…) |
| 2. Analyze & Respond to Risks | • Qualitative Assessment (Pre-Sort): Likelihood, Importance<br>• Quantitative Assessment: Probability x Impact = Exposure<br>• Reduce Risks to Acceptable Level: Avoid, Transfer, Mitigate | • Spreadsheets (e.g., Excel, Google Sheets…)<br>• Commercial PM/Risk Software (@Risk, Riskonnect, Safran, Dash360…) |
| 3. Determine Reqd. Contingency | • Simple: %-based, Comparison to other projects, ∑ Risk Exposure<br>• Moderate: Risk-Factored Analysis<br>• Advanced: Monte Carlo Analyses (Risk Register, Schedule, Budget, Combined Schedule + Budget…) | • "DIY" Spreadsheets<br>• Commercial Monte Carlo Applications |

# Summary of Presentation

**Takeaway: The Baseline Development Process Is the Same… but Unique Projects Require Unique Tools & Sophistication.**

- **Baseline = Performance Measurement Baseline = Project Definition = Iron Triangle..**
  - Baseline = **Scope** + Quality + Schedule + Budget (& Contingency)
- **Baseline development starts with turning high-level objectives into specific deliverables**
  - Include a WBS Dictionary & Quality Acceptance Requirements (i.e., how to measure & verify)
- **Build the Schedule around creating/verifying/delivering the Scope**
  - Start with the Acquisition plans for all Scope elements in WBS
- **A Budget is created from cost estimates to perform Schedule activities**
- **Contingency should be sufficient to cover Risk Exposure**
- **Progressive Elaboration (& Teamwork)**
- **The 3 Most Important Rules of Baseline Development:**
  - 1) Communicate; 2) Communicate; 3) Communicate!
- **Choose "Goldilocks" tools that are compatible with your project**
  - Consider: size, complexity, needs, organizational culture, long-term impacts, ease of use…
- **Watch the 3 Webinars!**






# Questions?