NexSummit LLC
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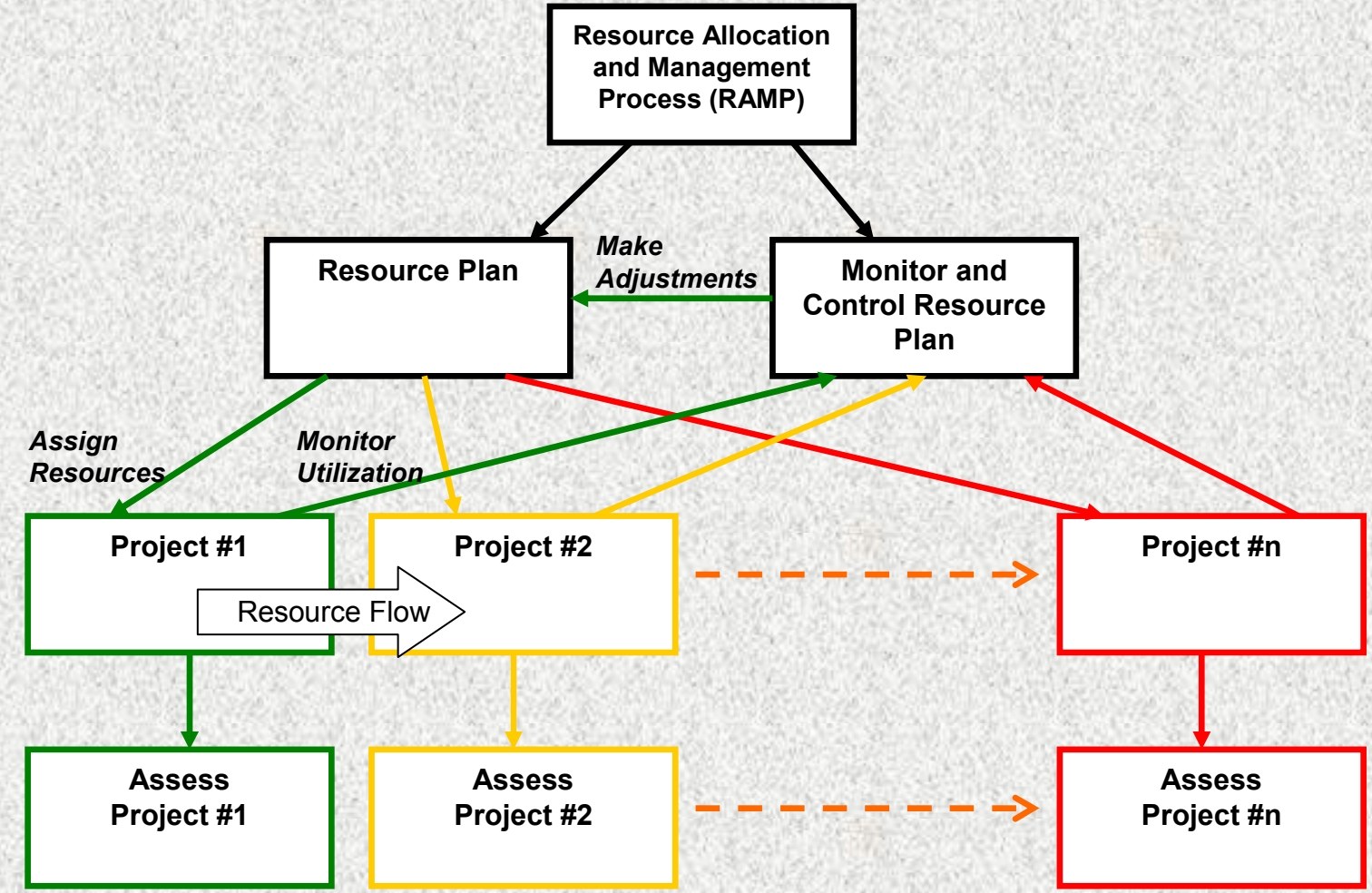
Institutionalizing Resource Planning and Management Part II

10-15-05

Agenda

- Background and Problem Statement
- Part I: Define a Resource Management Process
- **Part II: Managing the Second Project**
  - **Impact of the First Project on the Second**
  - **Process Improvements**
  - **Dealing with Interruptions**



Resource Mgmt - Root Cause
- More Training Required
- Unclear Responsibilities
- Gap in Skill Sets
- Overcommitted

Resource Mgmt – Symptoms
- Lack of Resources
- Resources were late
- Resources were frequently pulled back
- Resources were constantly interrupted

Root Cause
- Poor Project Execution
- Poor Process Execution

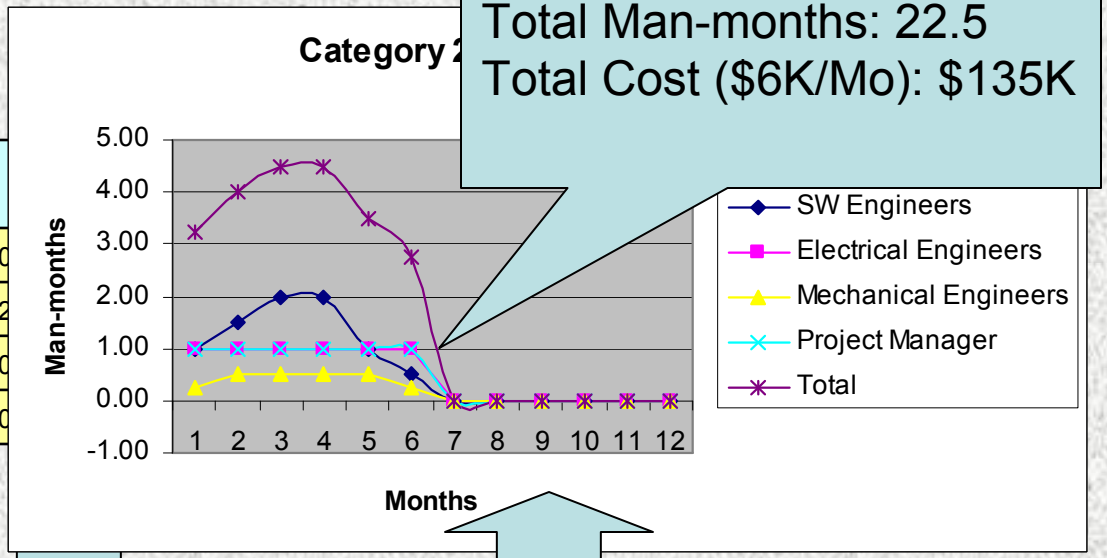
Getting Buy-in for Change

- Process Improvement is not always Supported
  - Sometimes considered a deterrent to meeting deadlines
  - Two groups need to buy-in
    - Management
    - Engineers
  - Use Models to show the COST OF DELAYS

Planning Project #1

Engineering Models

Category 2 Model	Phase
Electrical Engineering	1.0
Mechanical Engineering	0.2
Software Engineering	1.0
Project Manager	1.0

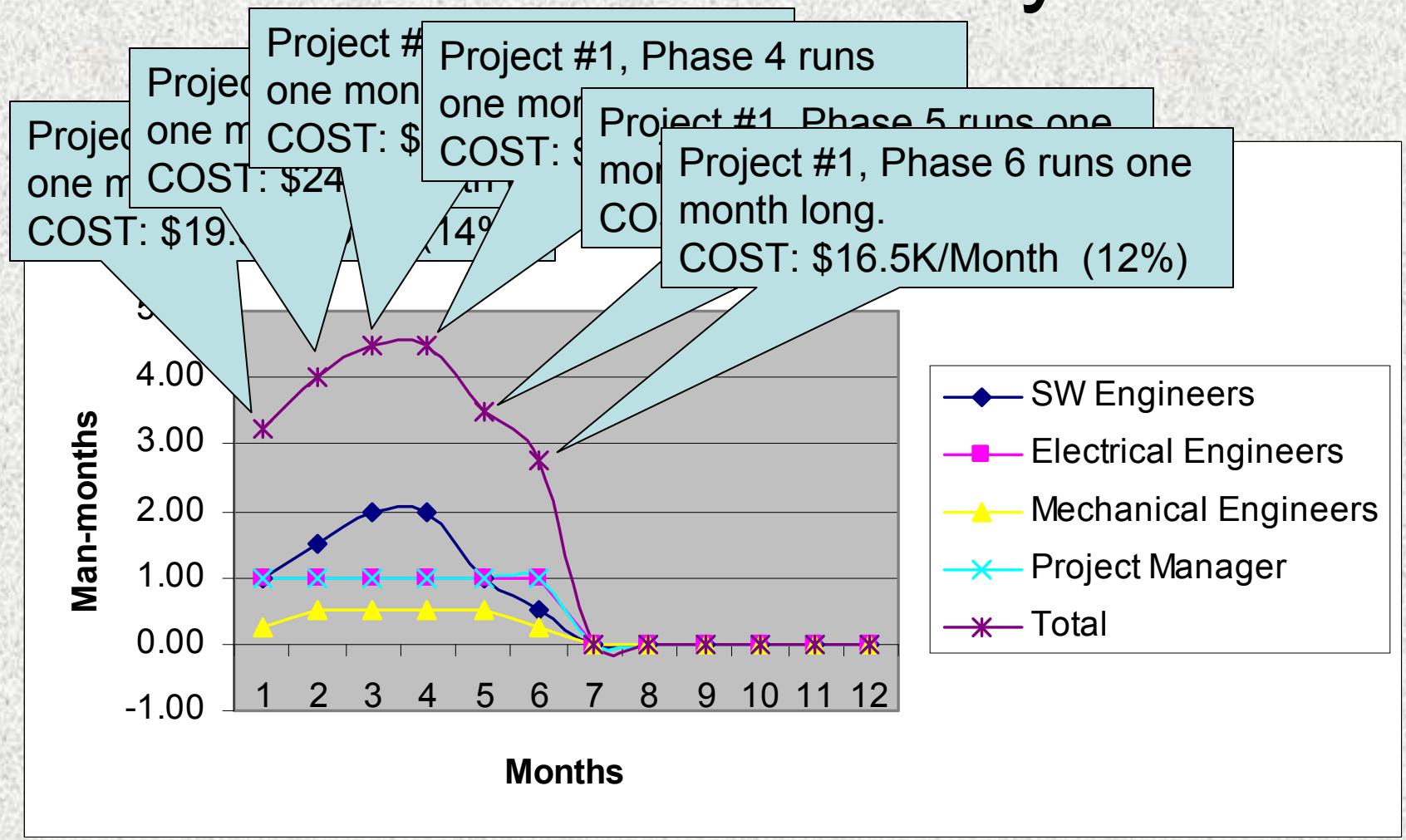


Total Man-months: 22.5
Total Cost ($6K/Mo): $135K

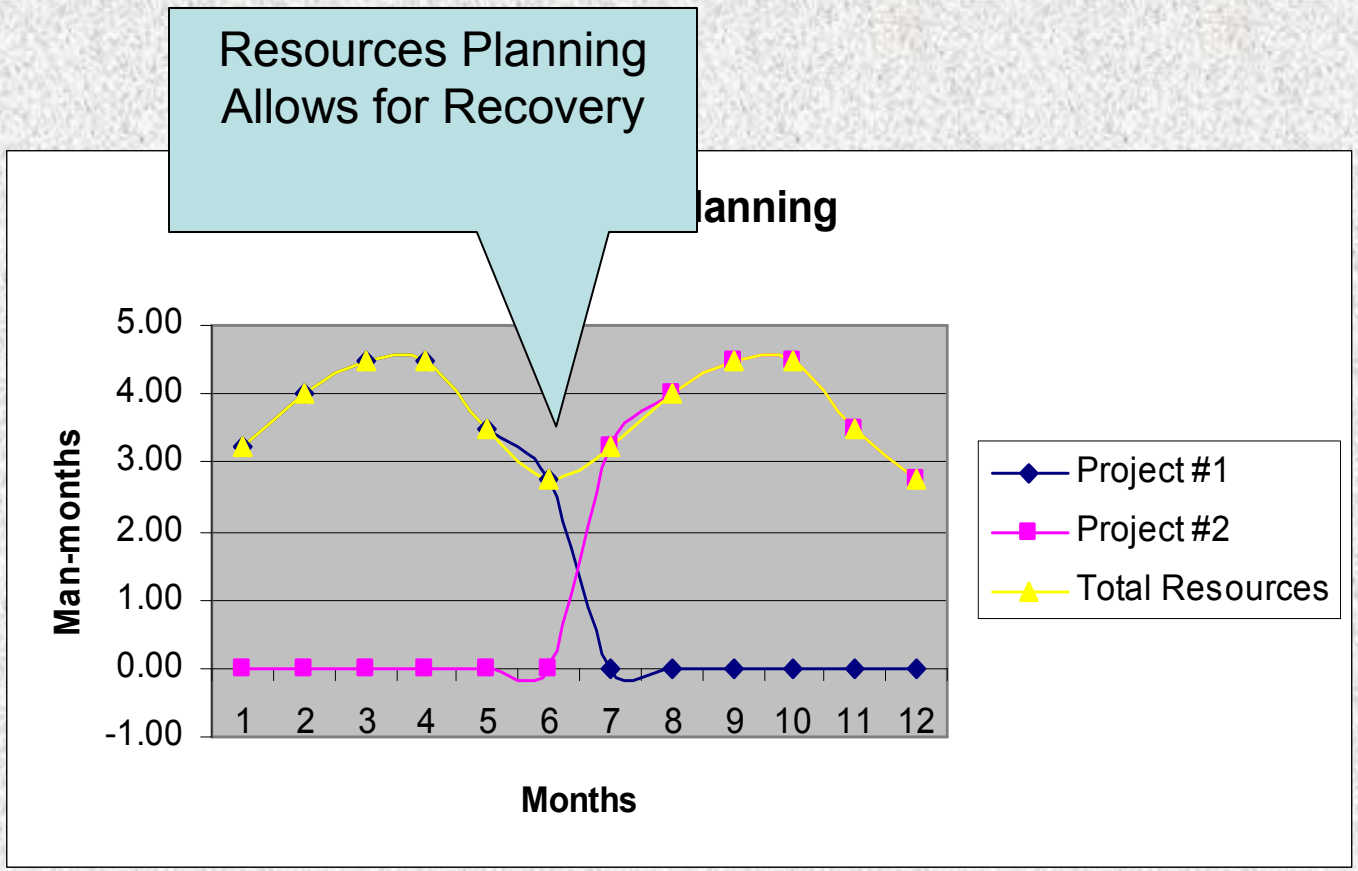
Small Embedded System

Category 2 Project Model	Ph 1	Ph 2	Ph 3	Ph 4	Ph 5	Ph 6							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
SW Engineers	1.00	1.50	2.00	2.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	8.00
Electrical Engineers	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00
Mechanical Engineers	0.25	0.50	0.50	0.50	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	2.50
Project Manager	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00
Total	3.25	4.00	4.50	4.50	3.50	2.75	0.00	0.00	0.00	0.00	0.00	0.00	22.50

The Cost of Delays



Planning Project #2



Project Scenarios

- Three Scenarios
  - Project #1, Phase 1-4 are late
  - Project #1, Phase 5 and 6 are late
  - Project #1 requires redesign

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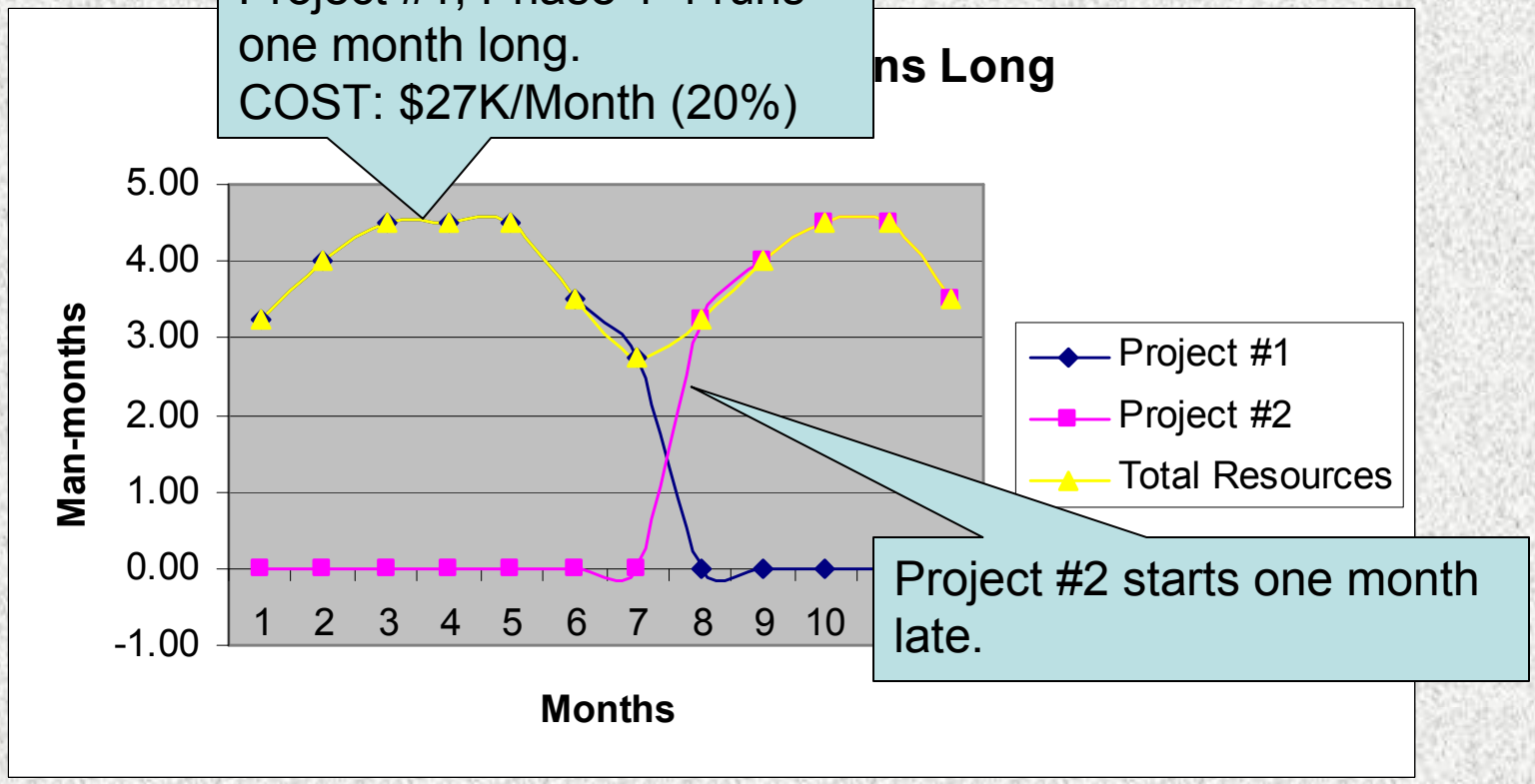
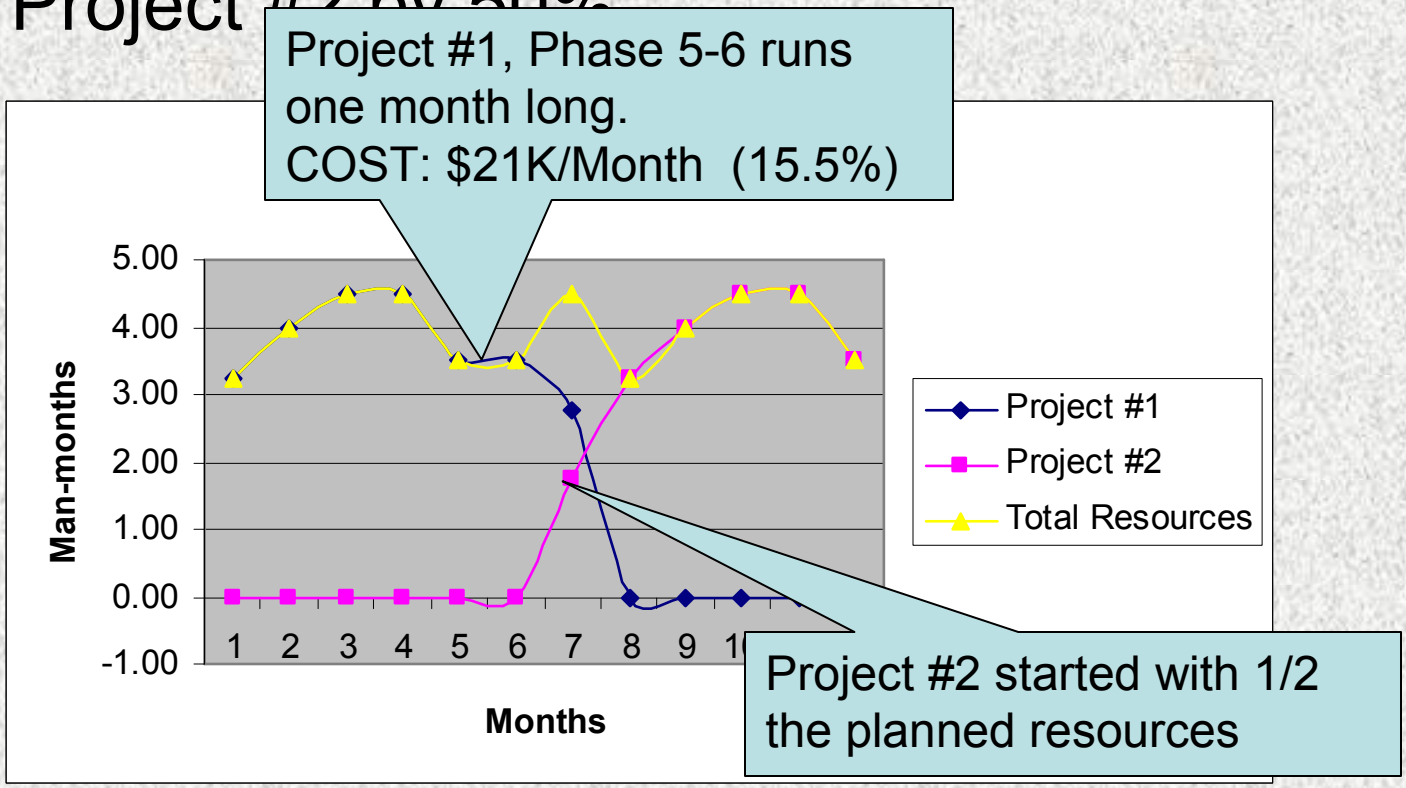
Effects of Project #1: Scenario 1

- A one month delay in Project #1, Phases 1 through 4 will delay Project #2 the same amount



Effects of Project #1: Scenario 2

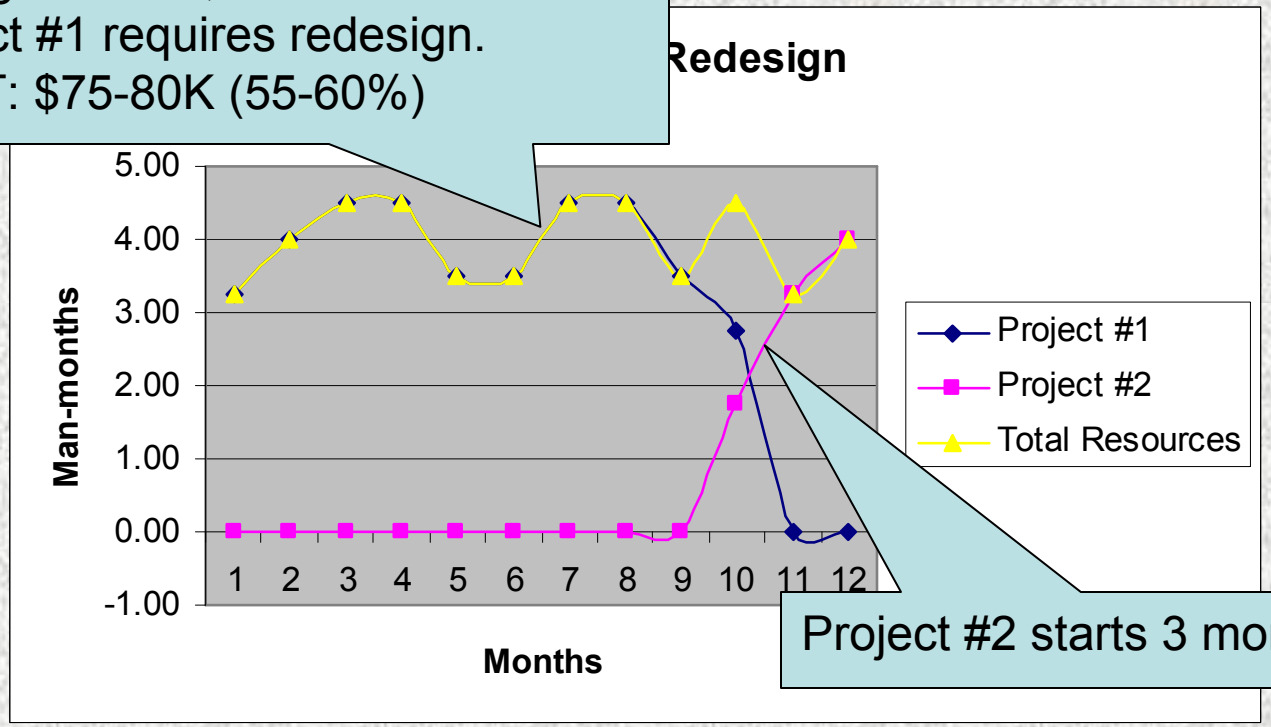
- A one month delay will in Project #1, Phase 5 and 6 will reduce the number of resources to start Project #2 by 50%



Effects of Project #1: Scenario 3

- Project #1 requires Redesign, Project #2 delayed 3 Months.

During Phase 5, It's determined Project #1 requires redesign.
COST: $75-80K (55-60%)



Project #2 starts 3 months late

Why Phase 1, 2 and 3 Push Out?

- Decomposition of Requirements
  - Added Requirements
  - Missing Requirements
- Underestimating
  - Estimates did not account for decomposition
  - Estimates did not use proper skill levels
- Proof of Concept (POC) Problems
  - Poor POC Results delay final requirements
  - When finalized, some redesign required

Why Phase 4 Pushes Out?

- Implementation Problems
  - Unable to work Independently (weak design)
  - Large number of coordination meetings
  - Poor execution (gaps in skill/training)
  - Inadequate tools and equipment
- Poor Vendor Selection
- Underestimated
  - More work than estimated (lines of code)
  - Estimated for wrong skill level
- Late Parts Procurement

Why Phase 5 and 6 Push Out?

- System/Product starts to come together
  - Uncover new requirements
  - Uncover missing requirements
  - Identify changes to original requirements
  - Vendor deliveries are late and don't integrate well

Why Product needs Redesign?

- Doesn't Meet Expectations
  - Invention
  - Errors in original requirements
  - Implementation drifts from original requirements
  - Vendor can not deliver

Where do you feel the impact?

The 7 Common Reasons impact the project late in the development.

Cause/Reason for Project #1 Delays	Phases 1-4			Redesign
Invention	Yes			Yes
Resources	**Yes**	Mayb	Maybe	No
Missing Requirements	Yes	**Yes**	Yes	Maybe
Added Requirements	Yes	**Yes**	Yes	Maybe
Requirements Not Traced	Yes	Yes	**Yes**	Yes
Development Process	**Yes**	Yes	Yes	Maybe
Underestimating	**Yes**	Yes	Yes	No
Parts Procurement	No	**Yes**	Yes	No
Vendor Selection	Yes	**Yes**	Yes	Maybe
Interruptions	**Yes**	Yes	Yes	No

Effects of Project #1

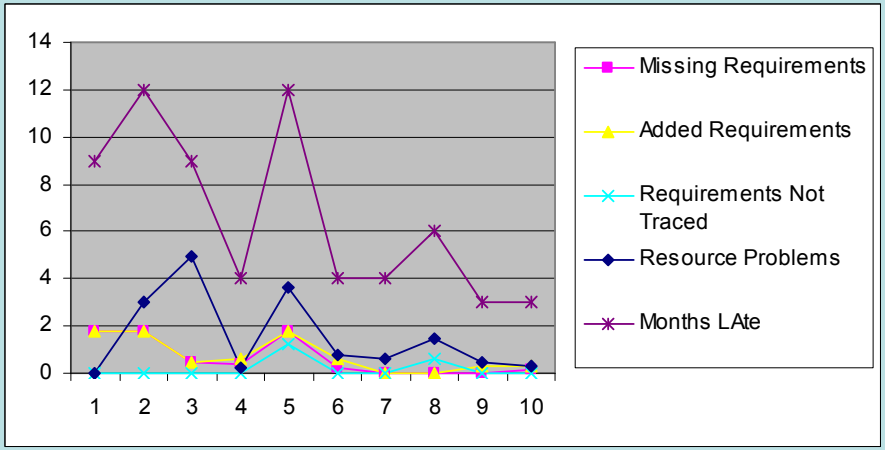
- Find the balance for Phase 1 through 4
  - Too many short cuts will lead to redesign and add significant cost to Project #1 and significantly impact the start of Project #2
  - Too much upfront work will delay and add cost to Project #1 and delay the start of Project #2

Case Study: 10 Projects

	SW Project #1	Ne	Ne	Ne	Im	Ne	SW	Ne	Ne	Ne	Average Percentage
Resource Problems	0										20
Vendor Selection	10										16
											15
											10.5
Added Requirements											10.5
Missing Requirements	20										7.5
Interruptions	20										5.5
Underestimating	0										7
Process	20	10	10	5	0	15	0	0	0	0	6
Requirements not Traced	0	0	0	0	**10**	0	0	10	0	0	2
Result	S	S	S	S	**R**	S	S	R	S	S	
Months Late	9	12	9	4	12	4	4	6	3	3	

Though a low occurrence, wher
were not traced, the result w

Resource and Requirement Problems correlated to late projects



Adding Requirements

- Problem
  - Phase 1-4: Requirements typically added by the development team as the product gets further broken down and analyzed.
  - Phase 5 and 6: New requirements get added…
    - By the team when the product starts to come together.
    - By Sales, Marketing and Customer as they start the demo/use the new product.
    - Adds significant delay.
  - Redesign: Maybe. If added requirement is a big change.

Missing Requirements

- Problem
  - Phase 1-4: Missed requirements typically found by the development team as the product gets further broken down and analyzed.
  - Phase 5 and 6: Missed requirements are found…
    - When the product starts to take shape and stakeholders see the product.
    - Adds significant delay
  - Redesign: Maybe. If missing requirement is a big oversight.

Requirements not Traced

- Problem
  - Phase 1-4: Derived requirements and subsequent designs may drift or alter Product Requirements.
  - Phase 5 and 6: If not traced, drifting requirements are found …
    - When the product verification and validation is performed.
    - Adds significant delay
  - Redesign: Yes. If requirements have departed significantly from the original requirements.

Dealing with Requirements

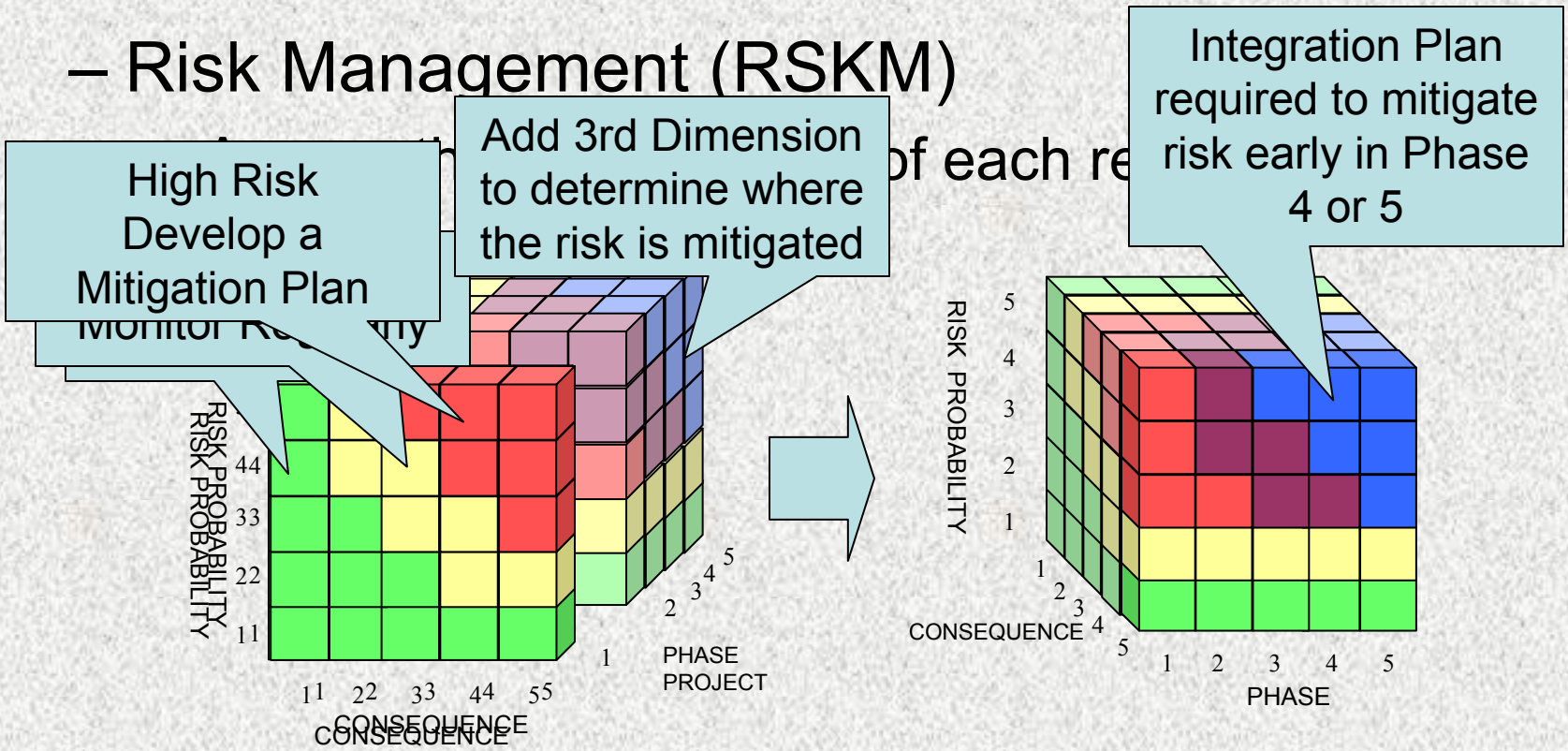
- Solution
  - Develop and document as complete a set of requirements upfront as you can
  - Requirements Development (RD)
    - SG1 - Develop Customer Requirement
    - SG2 - Develop Product Components
    - SG3 - Analyze and Validate Requirements
  - Find the balance
    - You may need to move forward without all the requirements

Dealing with Requirements

- Solution
  - Requirements Management (REQM)
    - Obtain Understanding of Requirements
    - Obtain Commitment to Requirements
    - Manage Requirement Changes
    - Maintain bi-directional Traceability
  - Use the Trace Matrix as the basis for all design reviews

Dealing with Requirements

- Solution
  - Risk Management (RSKM)



Dealing with Requirements

- Solution
  - Product Integration (PI)
  - Define Incremental Configurations
    - Define 2 to or more Configurations for Incremental Deliveries
    - Integrate high risk requirements in first configurations
      - Proof of Concept or Repeat POC results
      - System or Software Architectures
      - New protocols, outsourced technology
      - New user Interface or features
      - Installation Requirements
    - Integrate lower risk requirements second

Case Study: 10 Projects

	SW Project #1	New Tool #1	New Feature #1	New Feature #2	Improvement #1	New Feature #3	SW Project #2	New Tool #2	New Feature #4	New Tool #3	Average Percentage
Resource Problems	0	25	55	5	30	20	15	25	15	10	20
Vendor Selection						15	35	25	30	25	16
Invention						10	25	20	20	10	15
Parts Procurement						15	15	20	20	25	10.5
Added Requirements			5	15	15	15	0	0	10	10	10.5
Missing Requirements		15	5	10	15	5	0	0	0	5	7.5
Interruptions	20	0	10	5	0	5	5	0	0	10	5.5
Underestimating	0	20	10	10	15	0	5	0	5	5	7
Process	20	10	10	5	0	15	0	0	0	0	6
Requirements not Traced	0	0	0	0	10	0	0	10	0	0	2
Result	S	S	S	S	R	S	S	R	S	S	
Months Late	9	12	9	4	12	4	4	6	3	3	

Underestimating went down as the Process Improved

Underestimating

- Problem
  - Phase 1-4: Underestimating is due to…
    - Missing key process steps
    - Aggressive or optimistic estimates
    - Tip of the ice berg. Decomposition reveals more work.
  - Phase 5 and 6: Underestimating is due to…
    - Poor Integration Planning.
    - Does not take into account requirement changes.
  - Redesign: Underestimating normally doesn't cause redesign.

Underestimating

- Solution
  - Project Planning (PP)
    - Establish the Scope of the Project (i.e., WBS)
    - Establish Estimates for Work Products (i.e., Lines of Code, Number of Requirements, PCB Complexity
    - Determine Estimates of Effort and Cost
    - Develop Models based on Past Estimates

Underestimating

- Solution
  - Implement Process Templates for Estimating
  - Tie Estimates to the Process

Formatt developing Cha

Defines Responsib

Provi G

De

Makes sure nothing gets missed when estimating

Defines Links for Gantt Chart

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Task	*Task Name/ Paragraph*	*Task Responsibility*	*Tailor*	*Inputs*	*Task Description*	*Outputs*	*Est.*
3	Develop Product Requirements	Technical Leader	2, 3, 4	Customer Requirements	- Review Customer Requirements - Develop Functional Specification - Develop Performance Specs - Develop Operational Scenarios - Verify Industry Standards, Certification and Compliance Requirements - Develop Product Requirements - Analyze and Validate Requirements	Product Requirements	160 hrs

Case Study: 10 Projects

	SW Project #1	New Tool #1	New Feature #1	New Feature #2	Improvement #1	New Feature #3	SW Project #2	New Tool #2	New Feature #4	New Tool #3	Average Percentage
Resource Problems	0	25	55	5	30	20	15	25	15	10	20
Vendor Selection	10	0	0	20	0	15	35	25	30	25	16
Invention	10	15	5	30	5	10	25	20	20	10	15
Parts Procurement	0	0	0	0	10	15	15	20	20	25	**10.5**
Added Requirements	20	15	5	15	15	15	0	0	10	10	10.5
Missing Requirements	20	15	5	10	15	5	0	0	0		7.5
Interruptions	20	0	10	5	0	5	5	0	0		5.5
Underestimating	0	20	10	10	15	0	5	0			7
Process	20	10	10								
Requirements not Traced	0	0	0								
Result	S	S	S								
Months Late	9	12	9	4	12	4	4	6	3	3	

As Requirements Management improved, Parts became a problem.

Parts Procurement

- Problem
- Late Parts will hold up Product Integration
  - Phase 1-4: Phase 1-4 may be delayed due to…
    - Technology and Vendor selection
    - Poor planning
    - Waiting for the entire design to be complete
  - Phase 5 and 6: Late Parts Procurement is due to…
    - Poor execution of Phase 1-4
    - Requirements change impacts material on order
  - Redesign: Late Parts normally don't cause redesign.

Parts Procurement

- Solution
  - Drive Parts to the Product Integration Plan
  - Use Bill of Material (BOM) as the WBS
    - Revision Levels used to track progress

BOM Level								Description	Part Number	Rev	ECO #	COMMENTS
0	1	2	3	4	5	6	7					
x								System Configuration-003	A32413-003	A	15023	Target 6/17/05
	x							Common Base	A32160-003	A	15024	
		x						COMPUTER, PC RACK	P56480	0		
			x					Kit, Electrical Components	P63419	0		Kit provided by Vendor
				x				PCB – Backplane	P63435	2		
				x				PCB – Processor	P63426	1		

Case Study: 10 Projects

	SW Project #1	New Tool #1	New Feature #1	New Feature #2	Improvement #1	New Feature #3	SW Project #2	New Tool #2	New Feature #4	New Tool #3	Average Percentage
Resource Problems	0	25	55	5	30	20	15	25	15	10	20
Vendor Selection	10	0	0	20	0	15	35	25	30	25	16
Invention	10	15	5	30	5	10	25	20	20	10	15
Parts Procurement	0	0	0	0	10	15	15	20	20		10.5
Added Requirements	20	15	5	15	15	15	0	0	10		10.5
Missing Requirements	20	15	5	10	15	5	0	0			7.5
Interruptions	20	0	10	5	0	5	5	0		0	5.5
Underestimating	0	20	10								
Process	20	10	10								
Requirements not Traced	0	0	0								
Result	S	S	S	S	R	S	S	R	S	S	
Months Late	9	12	9	4	12	4	4	6	3	3	

As Requirements Management improved, Vendor Selection became a problem.

Vendor Selection

- Problem
  - Phase 1-4: Vendor selection delays project due to…
    - Underestimating the evaluation/selection process
    - Underestimating the monitor and control.
    - Poor Vendor Execution
  - Phase 5 and 6: Vendor Deliveries delay the project due to…
    - Poor Integration Planning.
    - Not meeting requirements.
  - Redesign: Too often poor vendor selection requires redesign

Vendor Selection

- Solution
  - Supplier Agreement Management (SAM)
    - Determine Acquisition Type
    - Develop potential Supplier List
    - Evaluate potential Suppliers
    - Select Supplier and Establish Agreement

Vendor Selection

- Solution
  - Request for Proposal (RFP)

Request for Proposal Outline

1	*Introduction*
2	*Proposal Guidelines and Evaluation*
3	*Confidentiality*
4	*RFP Questions and Submittals*
5	*Corporate Profile*
6	*Geographic Location of Sites*
7	*Scope of Work*
8	*Requirements*
9	*Appendix A: Intent to Bid Form*
10	*Appendix B: Non-disclosure Form*
11	*Appendix C: Integration Guidelines*
12	*Appendix D: Coding Guidelines*
13	*Appendix E: Diagnostic Guidelines*
14	*Appendix F: Architecture Framework*
15	*Training Requirements*

Vendor Selection

- Solution
  - Decision Analysis and Resolution (DAR)

Selection Criteria	Alternative 1			Alternative 2			Alternative 3		
	Rating	Weight	Overall	Rating	Weight	Overall	Rating	Weight	Overall
Functionality	7	0.25	1.75	5	0.25	1.25	6	0.25	1.5
Performance	9	0.3	2.7	7	0.3	2.1	7	0.3	2.1
Cost	5	0.2	1.0	9	0.2	1.8	7	0.2	1.4
Schedule/Product Availability	5	0.1	0.5	7	0.1	0.7	5	0.1	0.5
Product Life/Expandability	7	0.05	0.35	7	0.05	0.35	7	0.05	0.35
Manufacturability	8	0.05	0.4	6	0.05	0.3	5	0.05	0.25
Serviceability	8	0.1	0.8	8	0.1	0.8	3	0.1	0.3
Reliability	4	0.05	0.2	5	0.05	0.25	5	0.05	0.25
Total		1.00	7.7		1.00	7.55		1.00	6.65

Getting Buy-in for More Change

- Two groups need to buy-in
  - Management
  - Engineers
- Use History to show the SAVINGS created by changing

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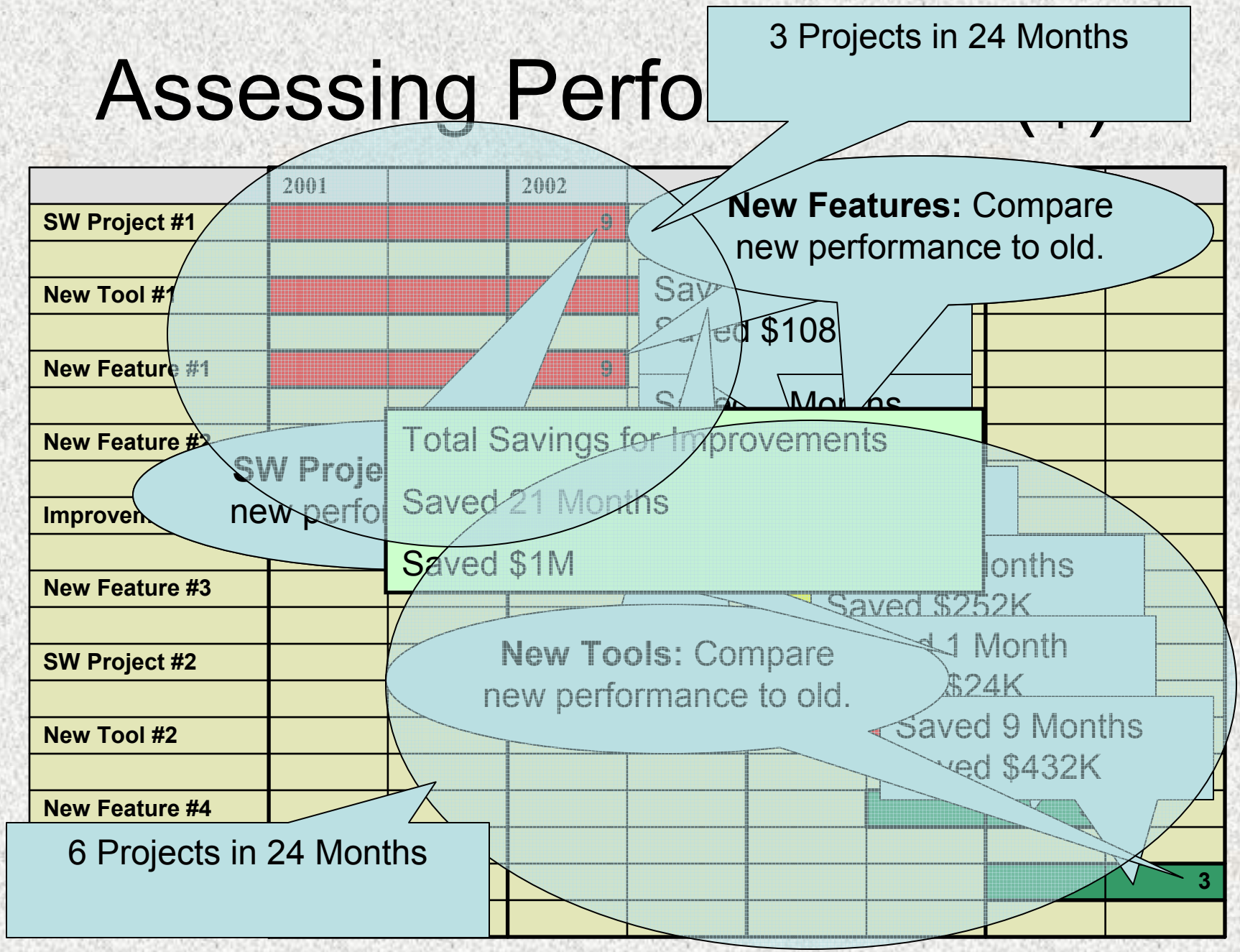
Assessing Perfo



Getting Started

- Don’t wait to start to gather data
- Capture this information at any time
  - Meet with projects groups and have then fill out the survey on the last few projects.
  - Data will be compiled from memory making it less reliable, but will serve as a starting point.
  - Compile metrics and identify an improvement plan.

Improving Process Mid-stream

Improving Process Mid-stream

- If Project was started with ad hoc Practices, Confront the 6 Problem Areas
  - Adding Requirements
  - Missing or Incomplete Requirements
  - Requirements not Traced
  - Project Underestimated
  - Parts Procurement (Integration Plan)
  - Vendor Selection

Improving Process Mid-stream

- Review the methods used to develop Requirements, Estimates, Parts Procurement and Vendor Selection
- Determine Gaps in the Methods
  - Old versus New
- Make Adjustments Appropriately
- Re-negotiate where possible

Project Monitoring and Control

- Begin new Monitor and Control Methods
  - Identify roadblocks that will cause goals to be missed
  - Proactively address roadblocks
  - Try to minimize multitasking, keep sequential
- Start Weekly Reviews and Adjustments
  - Adjust assignments for roadblocks/interruptions
- Anticipate Interruptions from Quarterly Revenue Goals

Dealing with Interruptions

Case Study: 10 Projects

	SW Project #1	New Tool #1	New Feature #1	New Feature #2	Improvement #1	New Feature #3	SW Project #2	New Tool #2	New Feature #4	New Tool #3	Average Percentage
Resource Problems	0	25	55	5	30	20	15	25	15	10	20
Vendor Selection	10	0	0	20	0	15	35	25	30	25	16
Invention											5
Parts Procurement											0.5
Added Requirements											0.5
Missing Requirements	20	15		10	15		0	0		5	7.5
Interruptions	20	0	10	5	0	5	5	0	0	10	**5.5**
Underestimating	0	20	10	10	15	0	5	0	5		7
Process	20	10	10	5	0	15	0	0			6
Requirements not Traced	0	0	0								
Result	S	S	S								
Months Late	9	12	9								

First 3 Projects: Interruptions (8.

Next 3 Projects: Interruptions (3.

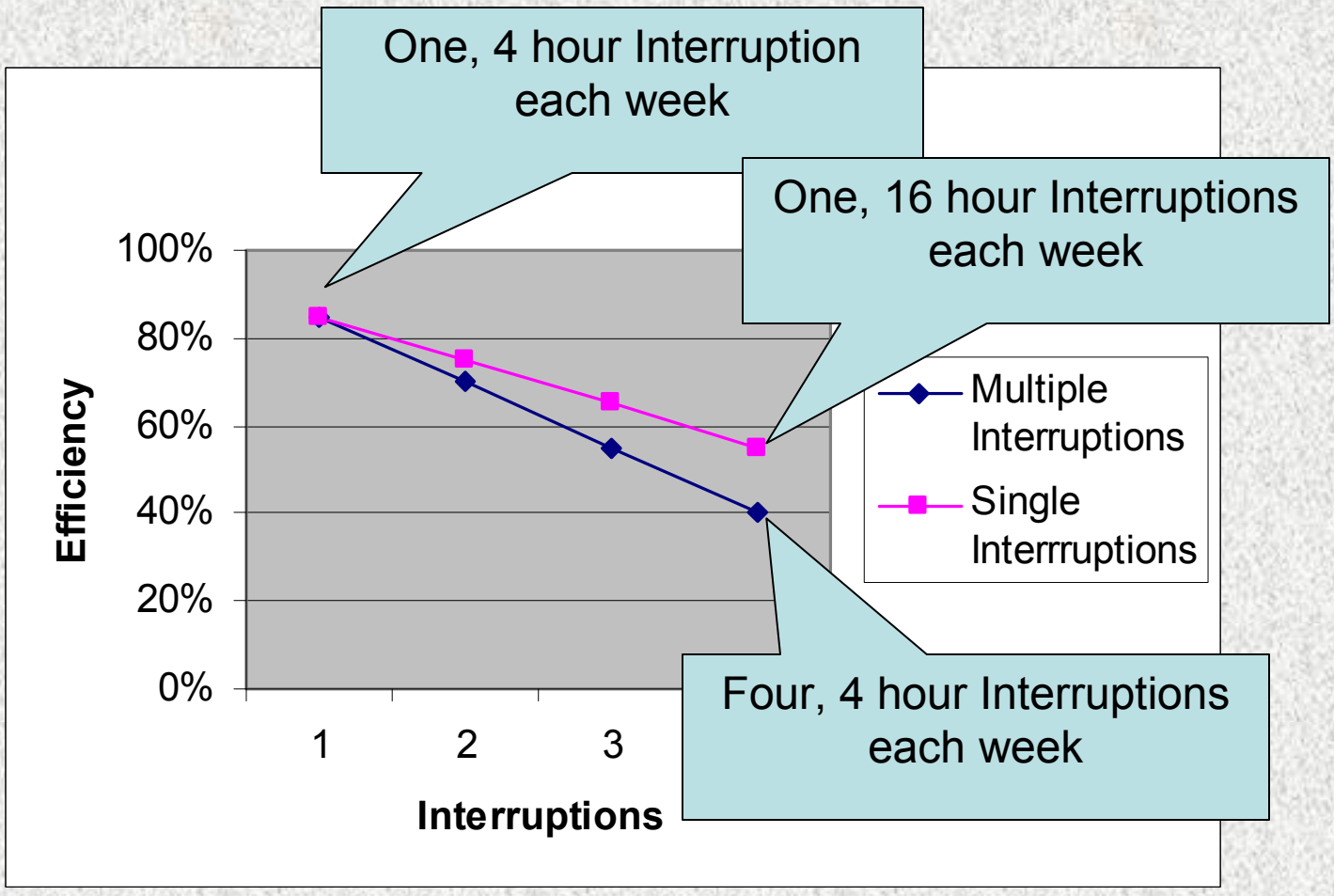
Next 4 Projects: Interruptions (3.75%)

Interruptions are reduced as execution improves.

Interruptions

- Two Way Street
  - Improved Execution Reduces Interruptions
  - Controlling Interruptions, Improves Execution
- Must do both!

Interruptions



Planning for Interruptions

- Evaluate the Performance of Previous Project
  - Do you expect Interruptions?
- If so, Keep Problems from Escalating
  - Develop method to report problems
  - Establish an Escalation procedure
  - Develop a single point contact
  - Plan problems
  - Dealing with Interruptions

Reporting Problems

- Define how to report a problem
- Define the content of the report
  - Description of the problem
  - Steps to reproduce
  - Frequency of occurrence
  - Severity
  - S/N, SW Version , Revision
- Define responsibilities
- Expected results and response

Escalation Procedure

- Clearly defines
  - What an escalation is
  - What an escalation isn't
- Clearly define responsibilities
- Defines how to report the escalation
- Defines the expected results and response time

Single Point Contact

- Communicates the new methods
- Reviews problems and confirms the report
- Contact for escalations
- Negotiates deliverables
- Owner of the plan
- Proactively reports status and delay

Planning for Problems

- Estimating the Scope of Interruptions
  - Uncover Hidden Problems
- Estimating the Effort of Interruptions
  - Use Category Estimates
- Identifying the Risk due to Interruptions
  - Define the Severity of the Problem
  - Define the Probability
  - Set Priority

Planning for Problems

- Plan Resources to Handle Interruptions
  - Carry a constant resource level in Resource Plan, at least.
  - Use Skills Inventory List to select alternates
- Plan for Recovery
  - Treat Interruptions as a Project
  - If they are planned, they are no longer interruptions

Dealing with Interruptions

- Structure Your Project to Deal with Interruptions
  - Establish Core and Floating Resources
  - Look for Commonality
  - Break Project into Smaller Tasks
  - Don’t let Interruptions hold up Material

Interruptions will Occur

Unplanned Projects Roadmap

Unplanned Projects	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Escalation 1	3	0	0	0	0	0	0	0	0	0	0	0
Escalation 2	0	3	4	0	0	0	0	0	0	0	0	0
Escalation 3	0	3	3	0	0	0	0	0	0	0	0	0

Setup	
Start	Phase
1	3
2	3
2	3

Phase Length					
1	2	3	4	5	6
0	0	1	0	0	0
0	0	1	1	0	0
0	2	2	0	0	0

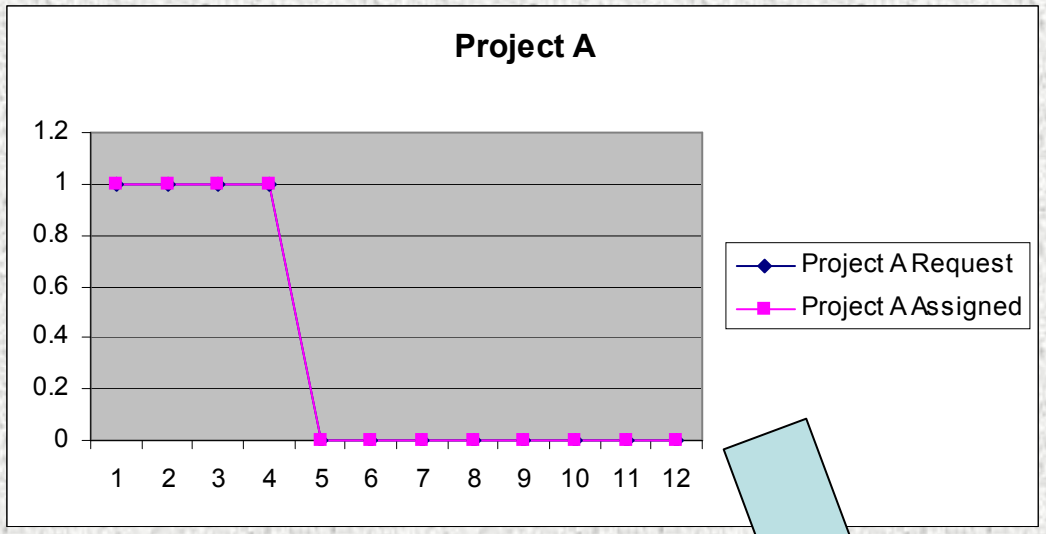
Assign Resource 1

Assign Resource 1 to the Escalations

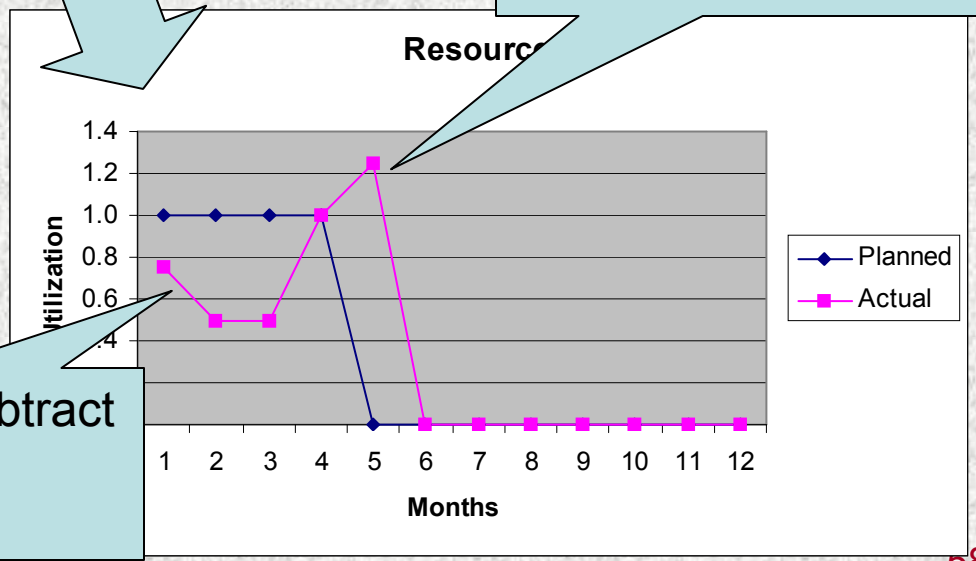
Unplanned Projects	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov		Assigned	Model
Escalation 1	0.25	0	0	0	0	0	0	0	0	0	0	0	1	2
Escalation 2	0	0.25	0.25	0	0	0	0	0	0	0	0	0	1	2
Escalation 3	0	0.25	0.25	0	0	0	0	0	0	0	0	0	1	2

Unplanned Model	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Model 1	0.50	0.50	0.50	0.50	0.50	0.50
Model 2	0.25	0.25	0.25	0.25	0.25	0.25
Model 3	0.10	0.10	0.10	0.10	0.10	0.10
Model 4	0.10	0.10	0.10	0.10	0.10	0.10

Predict the Impact



Plan Predicts the Impact on the Project



Escalations Subtract from Plan

Conclusions

- Focus on process improvements that will reduce surprises late in the project
  - Requirements Development
  - Requirements Management
  - Risk Identification and Mitigation
  - Product Integration
  - Project Planning
    - Better Estimating and Material Management
  - Supplier Management

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Conclusions

- Use models from the Resource Plan to gain support for changes and improvements
  - Cost of Delays
  - Cost of Savings
- Plan Interruptions as a Project.
- Include Interruptions in the Roadmap as a “negative” and predict impact.

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