NexSummit LLC
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Institutionalizing Resource Planning and Management Part I

10-15-05

Agenda

- **Background and Problem Statement**
- **Part I: Define a Resource Management Process**
  - **Develop a Project Roadmap**
  - **Develop a Resource Plan**
  - **Monitor the Resource Plan**
- Part II: Managing the Second Project

Background

- Organization Overview
  - 40 Engineers:
    - 25 Technologists, EEs, MEs, Designers
    - 15 Software Engineers
  - Overcommitted lead to late deliveries
  - Late deliveries lead to shortcuts
  - Short Cuts lead to poor quality
  - Poor quality lead to escalations and chaos

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Background

- Qualitatively captured the common reasons why projects were 2 or more months late.
  - Captured:
    - Number of Months Late
    - Result: Schedule Delay versus Product Redesign.
  - Captured the reason(s) why the project was late in percent.

New Tool #1

Cause of Problem/Delay	Description	Percentage
Invention	Project problems and delays were due to the normal challenges of invention: “haven’t done this before”.	15%
Resources	Project problems and delays were due to not getting personnel and/or equipment when needed, resources did not have the right skill set or resources did receive necessary training.	25%
Missing Requirements	Project problems and delays were due to poorly defined requirements or requirements were missing.	15%
Added Requirements	As the project progressed, the project was delayed due to adding features to the original requirements.	15%
Requirements Not Traced	Project problems and delays were due to design and implementation tasks that deviated from the requirements during the course of the development.	0%
Development Process	Project problems and delays were due to poor development practices that resulted in unnecessary delays.	10%
Underestimating	The project complexity and/or time estimates were under estimated from the start of the project.	20%
Parts Procurement	Project problems and delays were due to parts were not ordered when they could have due to lack of documentation, BOMs or Purchasing over-sights.	0%
Vendor Selection	Project problems and delays were due to the vendor selected by either contract talks, development methods, technology and/or product delivery	0%
Interruptions	Project problems and delays were due to frequent interruptions from other projects and customer field escalations.	0%

Determine Improvements Areas

Identify 10 comm… reasons why … project is late

When a project is 2 or more … late, record the reason for …

First 3 Projects: … Problems (27%

Next 3 Projects: Resource Problems (18%)

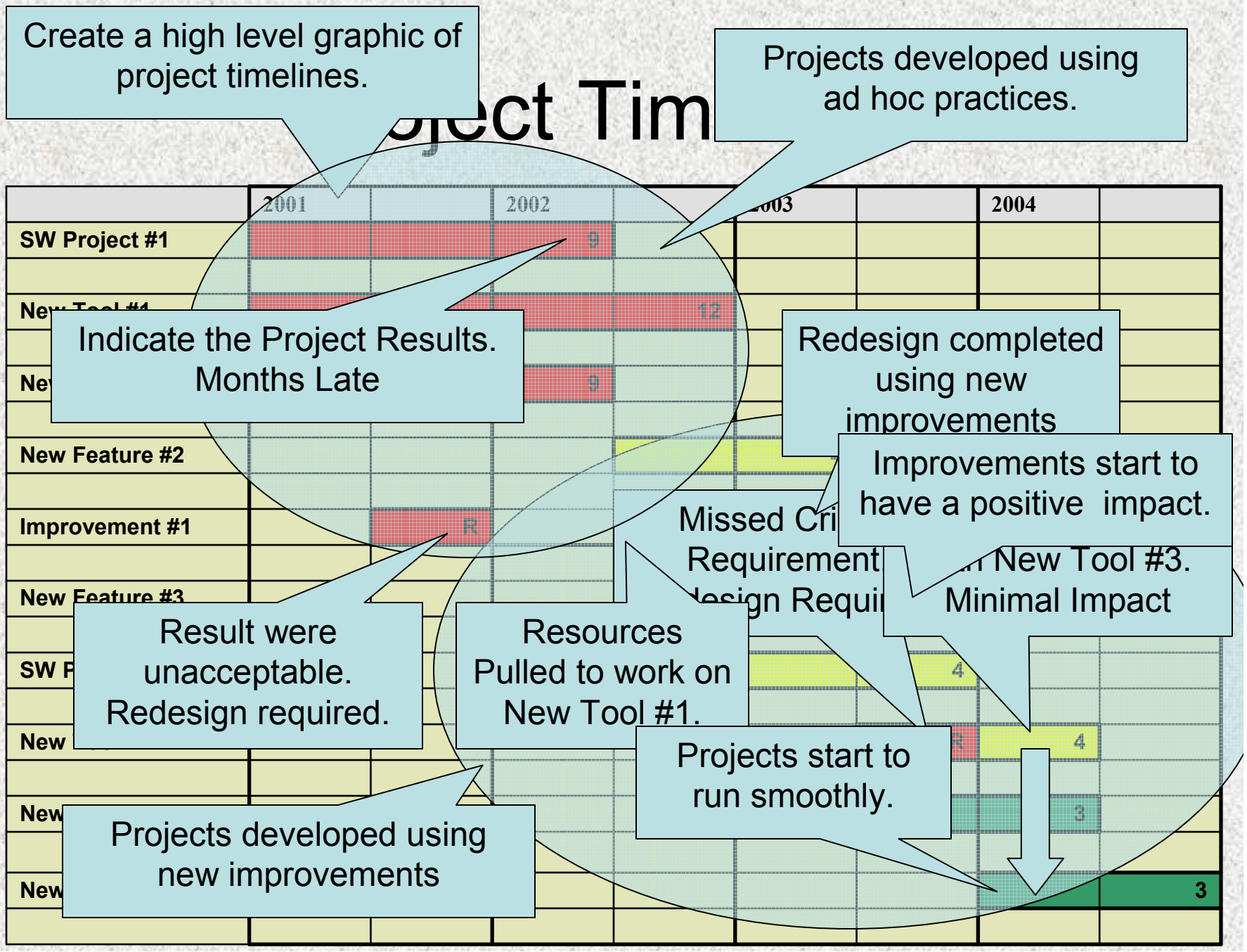
Add improvements that … correct highest percentage. …ects: Resource … 6%)

Invention: (19%)

Record how many

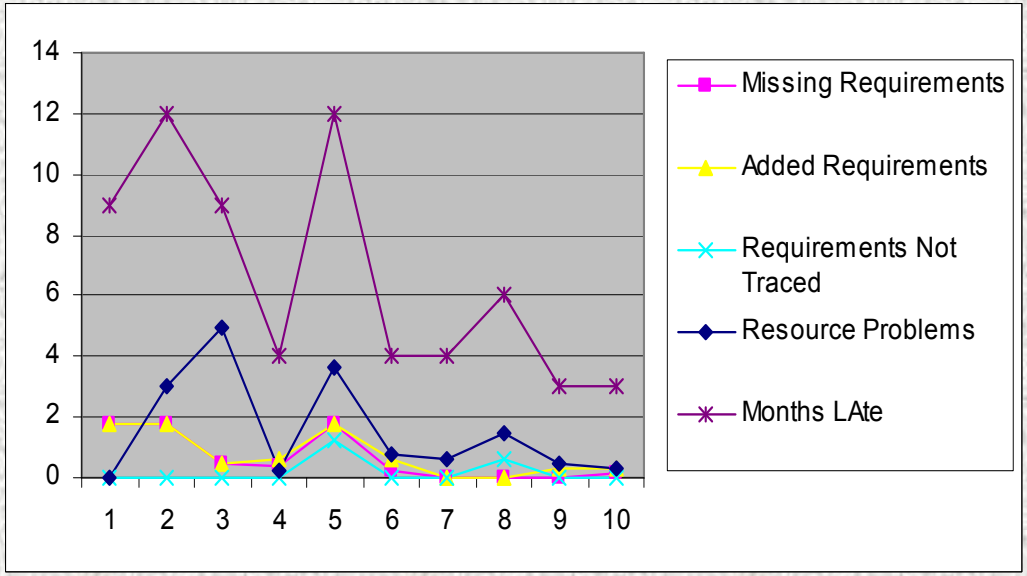
Record the result:
"S" Schedule delay only
"R" Redesign required

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	25	10.5
Added Requirements	20	15	5	15	…	…	…	…	…	10	10.5
Missing Requirements	20	15	5	10	…	…	…	…	…	5	7.5
Inter…	…	0	10	5	0	5	5	0	0	10	5.5
Un…	…	…	10	10	15	0	5	0	5	5	7
Pro…	…	…	10	5	0	15	0	0	0	0	6
Rec…	…	…	0	0	10	0	0	10	0	0	2
Mo…	…	…	9	4	12	4	4	6	3	3	
Result	S	S	S	S	R	S	S	R	S	S	



Resource Problems

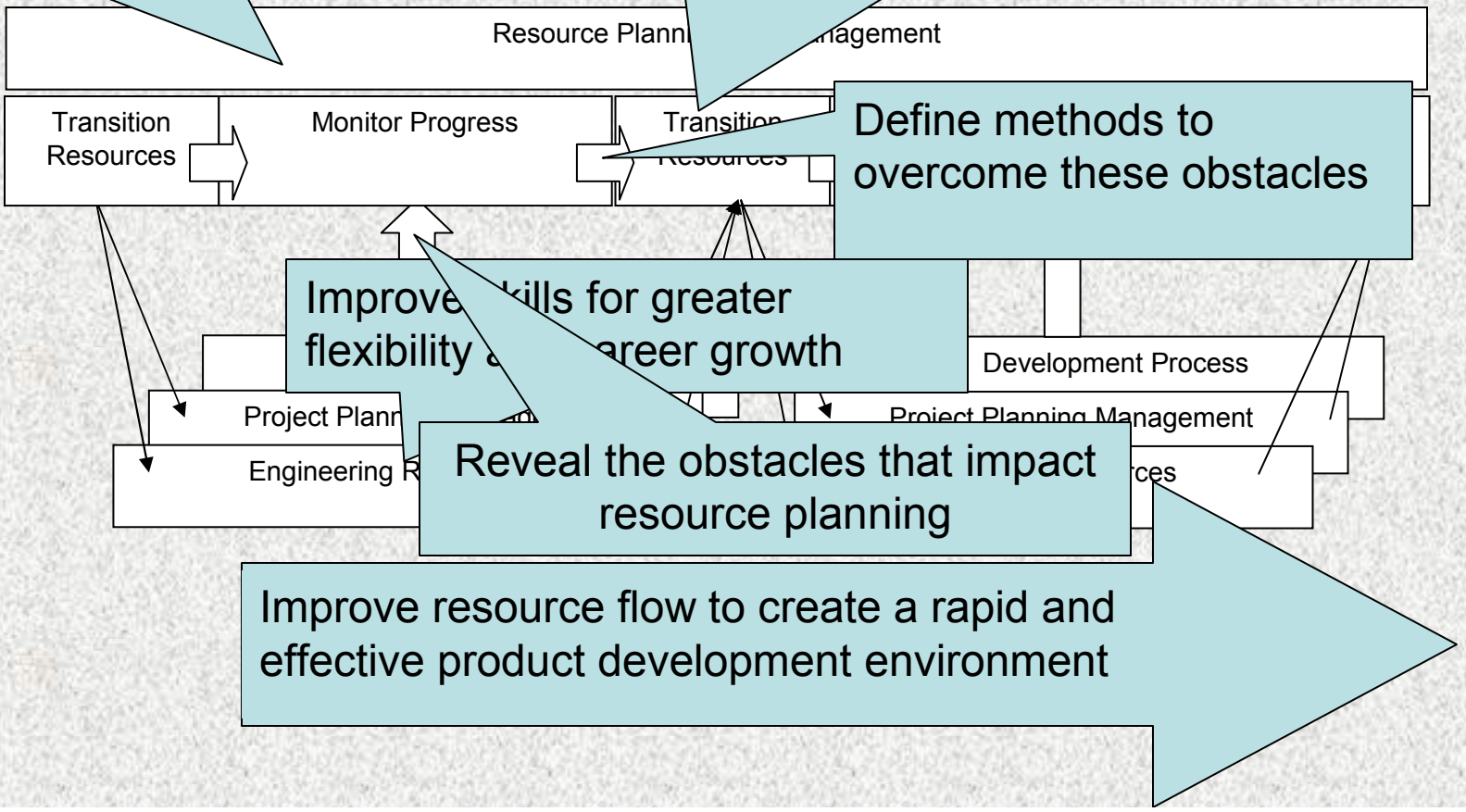
- Too Many Projects/Missing Projects
- Frequently Changing Priorities
- Wrong Skill Set/Lack of Training
- Unclear Responsibilities



A Successful Resource Management Process should…

Provide a view of all projects to and eliminate over commitment

Manage shared resources across multiple projects and product lines



Define methods to overcome these obstacles

Improve skills for greater flexibility and career growth

Reveal the obstacles that impact resource planning

Improve resource flow to create a rapid and effective product development environment

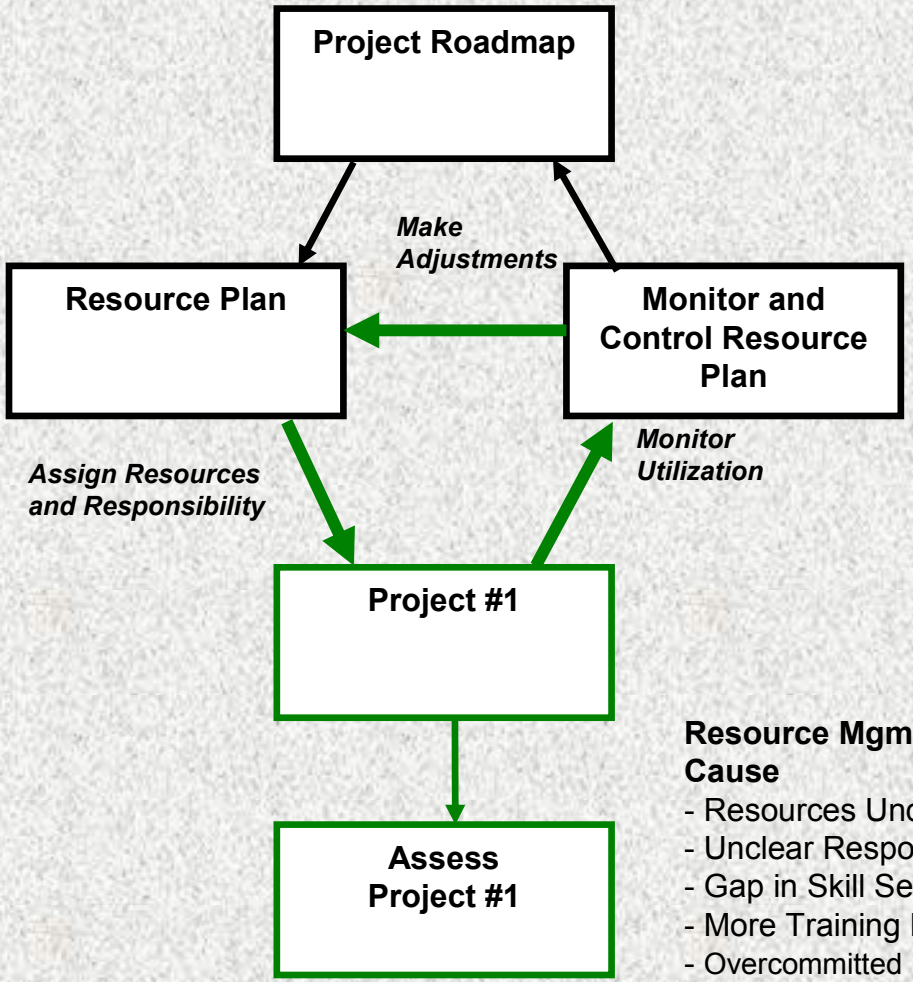
CMMI Generic Practices

- GP2.3 – Provide Resources
  - Provide adequate resources for performing the process, developing work products, and providing the services of the process.
- GP2.4 – Assign Responsibility
  - Assign responsibility and authority for performing the process, developing the work products, and providing the services of the process.
- GP2.5 – Train People
  - Train the people performing or supporting the process as needed

Common Pitfalls

- Plan Resources once a Year for Budgets
- Roll all the Project Gantt Charts up into a Master Plan

Resource Allocation and Management Process (RAMP)



Resource Mgmt - Root Cause

- Resources Underestimated
- Unclear Responsibilities
- Gap in Skill Sets
- More Training Required
- Overcommitted

Fundamentals

- Develop a Project Roadmap
  - Develop a Project List
  - Develop Project Resource Models
    - Project Planning-PA: Estimating Models
  - Develop a Project Priority List
  - Develop a Staffing Plan
  - Analyze and Validate the Roadmap

Fundamentals

- Develop the Resource Plan
  - Develop Job Descriptions
  - Develop a Skills Inventory List
    - Project Planning-PA
  - Develop Performance Models
  - Assign Names to the Roadmap
  - Analyze and Validate the Resource Plan

Develop a Project Roadmap

- Develop a Project List
  - Identify ALL the known projects and commitments and new product ideas.
    - New Product Ideas
    - New Development Projects
    - New Features
    - Sustaining Activities
    - Internal Improvement Projects
  - Identify hard and soft dates for the listed projects.

Develop a Project Roadmap

- Develop Project Resource Models
  - Review projects conducted for the past year to establish models for typical development projects
    - Number of Months in each Development Phase
    - Number of Engineers in each phase
  - Develop Models for each Project Size
    - Category 1 – Small Correction/Improvement
    - Category 2 – New feature requiring one discipline
    - Category 3 – Medium effort with multiple disciplines
    - Category 4 – Large project, all disciplines

Develop a Project Roadmap

- Using Timesheets to Develop Resource Models
  - Time sheets indicate the total man-hours to complete the project
  - Time sheets do not indicate the project length
  - Time sheets are best used to:
    - Improve proposal estimates
    - Determine if project length is too short

Develop a Project Roadmap

- Develop a 2 Dimensional Project Priority List

		Priority = 1	Priority = 2	Priority = 3	Priority = 4	Priority = 5
Priority	**Ranked Examples**	**Product Line A**	**Product Line B**	**Product Line C**	**Product Line D**	**Product Line E**
1 – Critical	Safety Issue Quarterly Shipments					
2 – High	Customer escalation Critical Shipment Product develop – A					
3 - Medium	Non-critical Shipment Critical Obsolete Part Product develop – B					
4 - Low	Product develop – C Non-critical Obsolete Part					

- Priority List will serve as a decision making tool during development

Using EXCEL to develop a Project Roadmap

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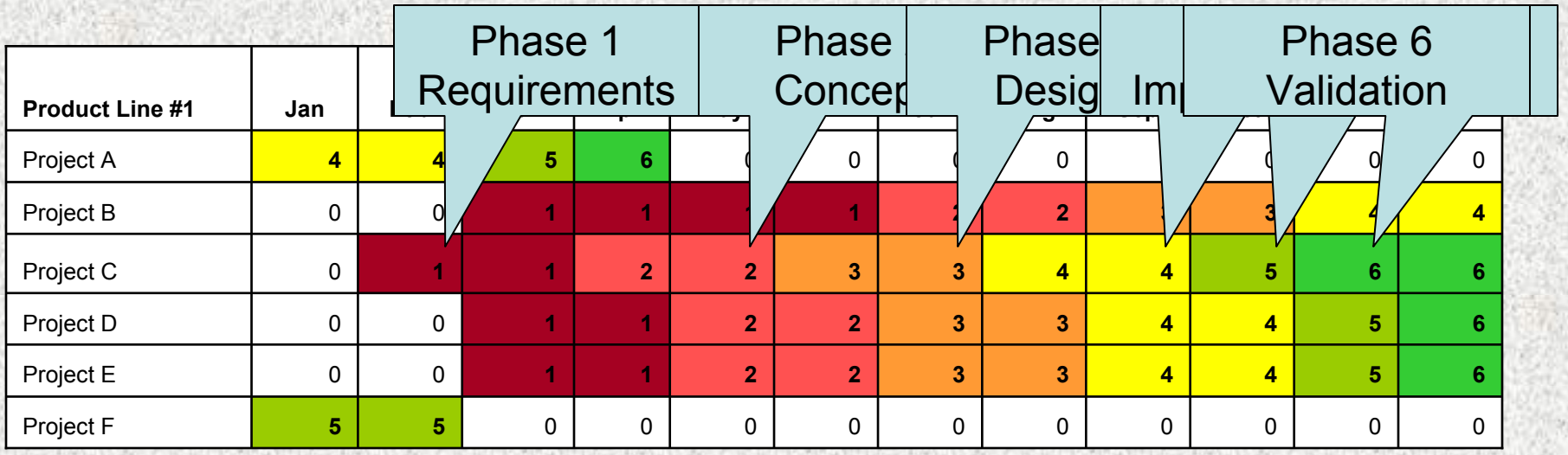
Roadmap Committee

- Background
- 6 Members
- Manual Planning – EXCEL
  - Captured the project length – One cell per month
  - A Phase number was placed in cells (1 through 6)
  - Each Cell with a Phase Number was colored (Red through Green)

Roadmap Committee

Manual Roadmap



Product Line #1	Jan											
Project A	4	4	5	6	0	0	0	0		0	0	0
Project B	0	0	1	1	1	1	2	2	3	3	4	4
Project C	0	1	1	2	2	3	3	4	4	5	6	6
Project D	0	0	1	1	2	2	3	3	4	4	5	6
Project E	0	0	1	1	2	2	3	3	4	4	5	6
Project F	5	5	0	0	0	0	0	0	0	0	0	0

Roadmap Committee

- Problems Encountered
  - Many discussions with actions for next meeting
  - The Roadma[illegible]aintain
  - The Roadmap was difficult to validate
  - The Roadmap was too aggressive and didn't match project estimates

THERE MUST BE A BETTER WAY!

Roadmap Tools

- Develop a viable plan before resources are actually assigned to projects
  - Avoid Over-committing
  - Not Just Graphics but be tied to actual resources
- Easy to Understand
  - Important during kick-off
  - Important for monthly or quarterly reviews
- Easy to Change
  - Ideally: Develop roadmap to drive projects
  - Real life: Every project continues while Roadmap is being developed
  - Goal: Short implementation and approval cycle

EXCEL Roadmap

- Automated EXCEL Spreadsheet
  - Real-time Feedback
  - Real-time Decision Making
  - Very Good Charts and Graphs
- Recommended Tabs
  - Roadmap
  - Resource Targets for each Discipline
    - Systems, SW, EE, ME, etc..
  - Total Staffing
  - Project Summaries

Roadmap Worksheet

- Phase Definition
  - Phase 1: Requirements Phase
  - Phase 2: Concept Phase
  - Phase 3: Design Phase
  - Phase 4: Implementation/Verification
  - Phase 5: Integration/Verification
  - Phase 6: Validation /Product Transfer

Roadmap Worksheet

Project Priorities are used to determine Project Start Dates

Project List and Roadmap

Product Line #1	Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Project A	4	4	5	6	0	0	0	0	0	0	0	0
Project B	0	0	1	1	1	1	2	2	3	3	4	4
Project C	0	1	1	2	2	3	3	4	4	5	6	6
Project D	0	0	1	1	2	2	3	3	4	4	5	6
Project E	0	0	1	1	2	2	3	3	4	4	5	6
Project F	5	5	0	0	0	0	0	0	0	0	0	0

Roadmap Setup

Setup	
Start	Phase
1	0
3	1
2	1
3	1
3	1
1	5

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

Resource Targets Worksheet

Category 3

Category

Category 1

ce Model for Each Discipline

Product Line #1	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Project A	1.00	1.50	2.00	2.00	1.00	1.00
Project B	1.00	1.50	2.00	2.00	1.00	1.00
Project C	1.00	1.00	1.00	1.00	1.00	0.50
Project D	1.00	1.00	1.00	1.00	1.00	0.50
Project E	1.00	1.00	1.00	1.00	1.00	0.50
Project F	0.50	0.50	0.50	0.50	1.00	0.50
Project G	1.00	1.00	1.00	1.00	1.00	0.50

Resource Targets Worksheet

Assign a Model to a Project by entering a "1"

Assigning a Model to a Project

Product Line #1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	D…	EE
Project A	2.00	2.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Electrical Engineering Model (Fixed)

Product Line #1	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Project A	1.00	1.50	2.00	2.00	1.00	1.00

Project Roadmap (Fixed)

Product Line #1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Project A	4	4	5	6	0	0	0	0	0	0	0	0

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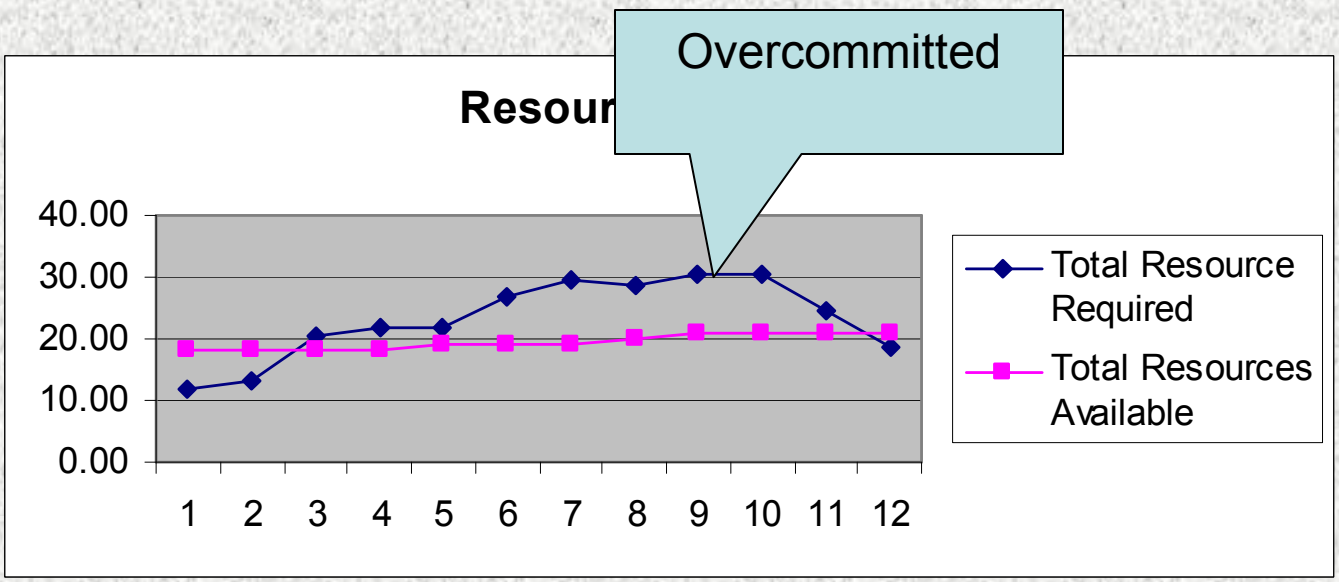
Resource Targets Worksheet

. EE Resource Plan for Product Line #1

Product Line #1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	EE
Project A	2.00	2.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
Project B	0.00	0.00	0.50	0.50	0.50	0.50	1.50	1.50	2.00	2.00	2.00	2.00	1
Project C	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.50	1
Project D	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	1
Project E	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	1
Project F	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
TOTAL	3.0	4.0	4.5	4.5	3.5	3.5	3.5	4.5	5.0	5.0	4.5	3.5	

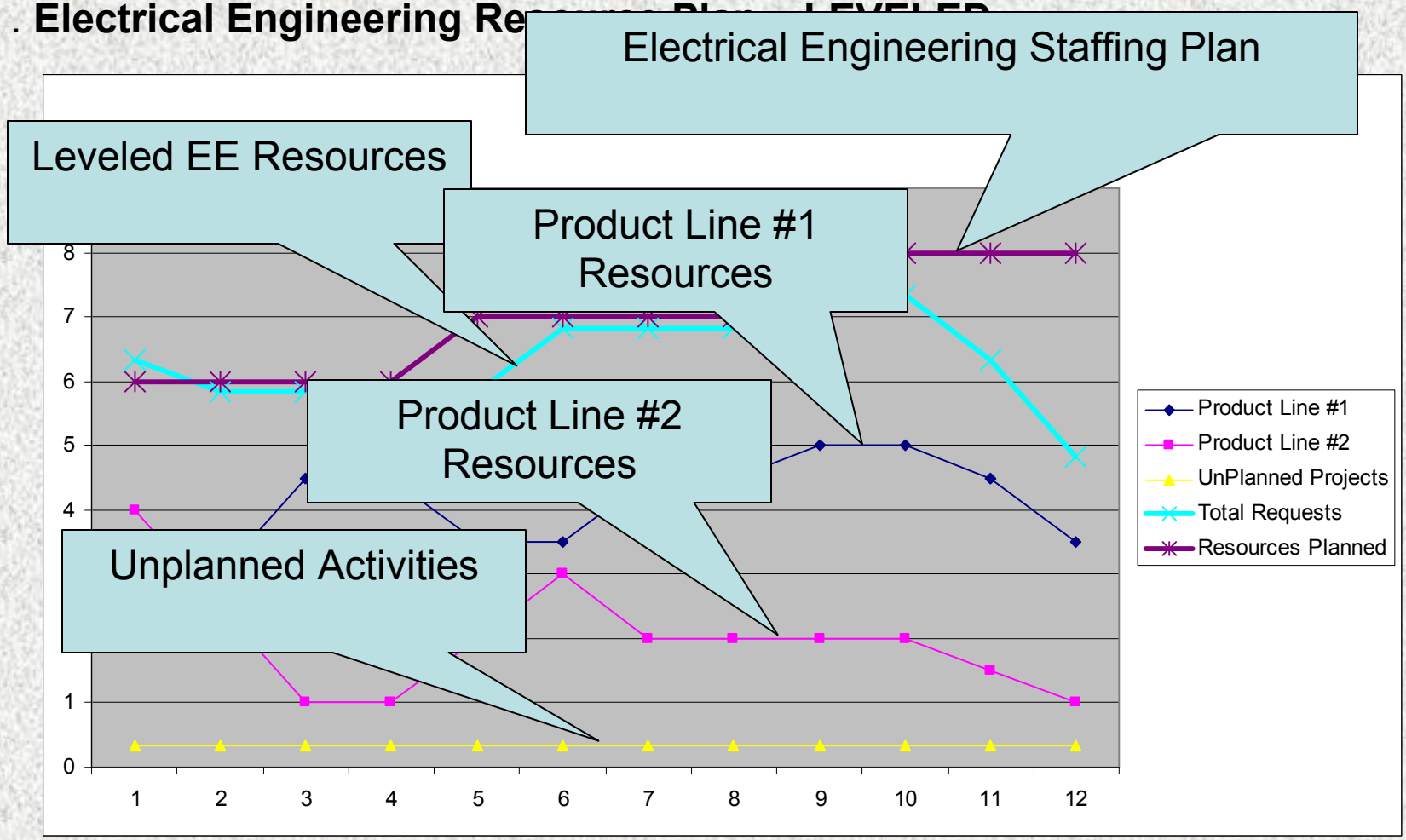
Total Staffing Plan

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Electrical Engineering	6	6	6	6	7	7	7	7	8	8	8	8
Mechanical Engineering	2	2	2	2	2	2	2	2	2	2	2	2
Software Engineering	9	9	9	9	9	9	9	10	10	10	10	10
Project Management	1	1	1	1	1	1	1	1	1	1	1	1
Total Resources Available	**18**	**18**	**18**	**18**	**19**	**19**	**19**	**20**	**21**	**21**	**21**	**21**



Leveling the Roadmap

. **Electrical Engineering Re**



Analyzing the Roadmap

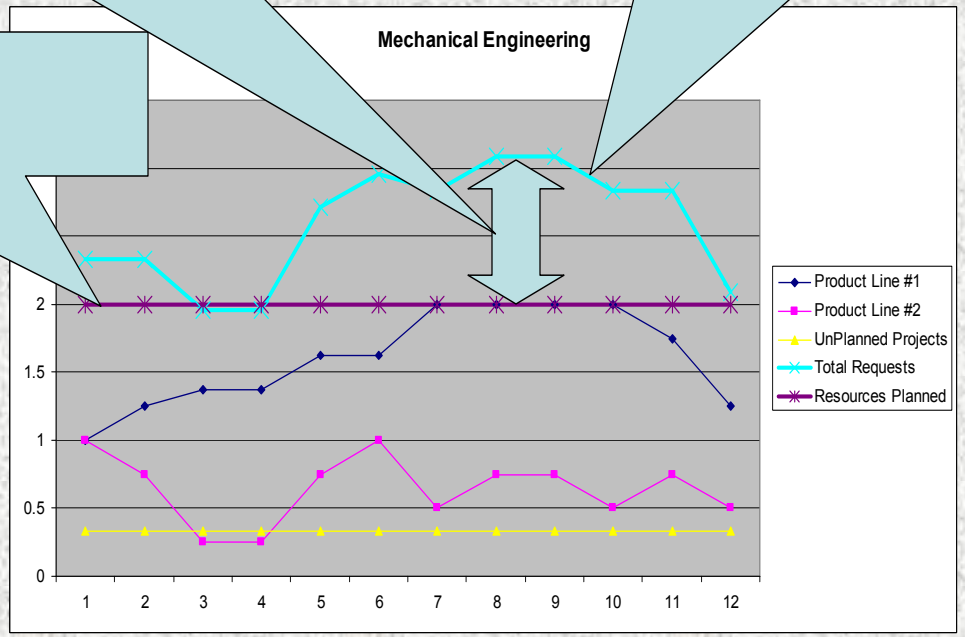
- Resolving Over-commitment

Resources required determined by integrating:
- Roadmap
- Resource Models
- Priority List

NEGOTIATE

Current Headcount

- Ad
- Adjust the Roadmap
  - Remove Projects
  - Remove Features
  - Change Deadlines
- Outsource
- Adjust Models



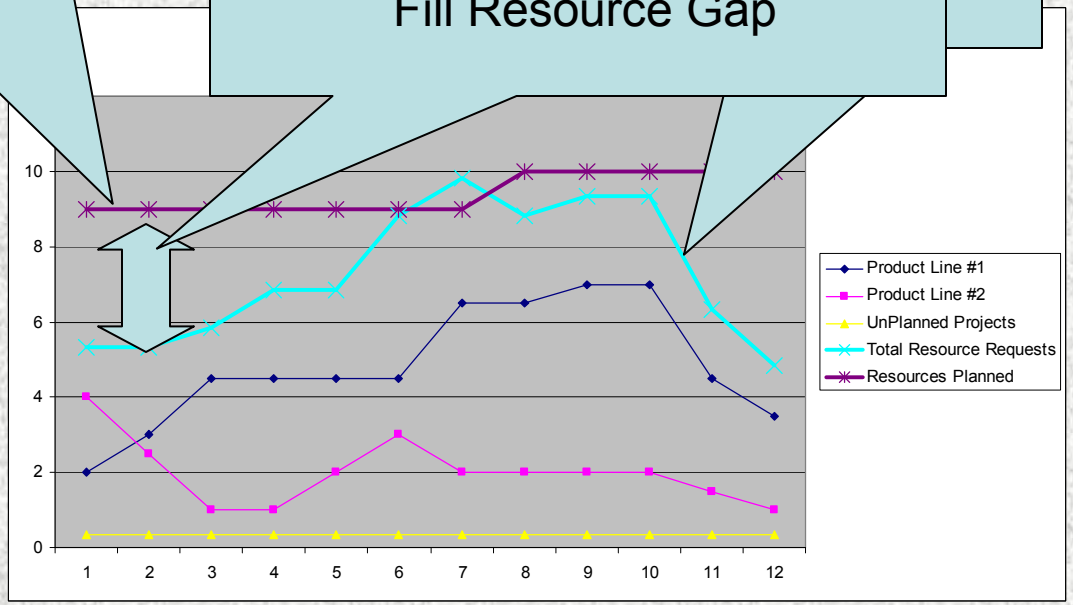
Analyzing the Roadmap

- Resolving Under-Utilization
  - rs
- Add Projects
  - New Features
  - New Products
- Training
- Process Improvements
- Adjust Models

Resources required determined by integrating:
- Roadmap
- Resource Models
- Priority List

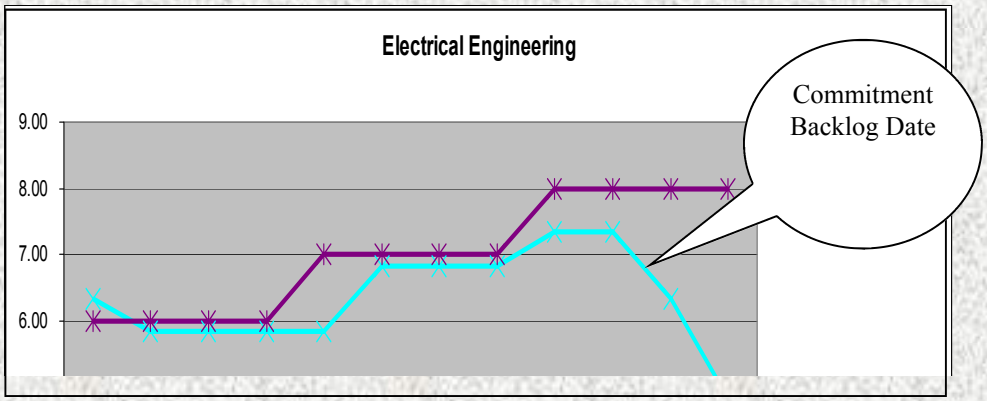
Current Staffing Plan

Fill Resource Gap



Analyzing the Roadmap

- Validate Commitments
  - Determine the Backlog
  - Determine the “Commitment Backlog Date (CBD)”
  - Convey “CBD” on a regular basis



Project Summaries

- Roll-up of all resources by project

Product Line #1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Project A	2.00	2.00	2.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Project B	0.00	0.00	2.00	2.00	2.00	2.00	6.00	6.00	8.00	8.00	8.00	8.00
Project C	0.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	2.00	2.00
Project D	0.00	0.00	4.00	4.00	4.50	4.50	5.00	5.00	5.00	5.00	4.00	2.00
Project E	0.00	0.00	4.00	4.00	4.50	4.50	5.00	5.00	5.00	5.00	4.00	2.00
Project F	2.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Product #1 Resources	4	8	16	16	15	15	20	20	22	22	18	14

Develop a Resource Plan

- Develop Job Descriptions
- Develop a Skills Inventory List
- Develop Performance Models
- Assign Names to the Roadmap
- Analyze and Validate the Resource Plan

Develop a Resource Plan

- Develop Job Descriptions
  - Develop Job Titles
    - Engineer 1, 2, 3, 4
    - Associate, Engineer, Sr. Engineer, Principal
  - Develop Requirements for each Engineering Level
  - Assign a Job Title to each Resource

Develop a Resource Plan

- Develop a Skills Inventory List
  - Define a skills list for each discipline
  - Identify the skills of each Engineer (X)
  - Rate the Engineer's skill level (1-4)
  - Evaluate each Engineer's skill with respect to their job title
- Set Expectations and Career Growth

Develop a Resource Plan

Skills Inventory List Example

	Systems Engineer III	Electrical Engineer III	Electrical Engineer II	Electrical Engineer II	Mechanical Engineer II	Firmware Engineer II	PCB Designer II
Requirements Development	3	2	2	2	2	3	2
Design Spec Development	3	3	3	2	2	3	2
System Architecture	3	2	2	2	1	2	1
Single Processor Design	4	3	3	3	1	4	2
Multiprocessor Design	3	2	2	2	1	1	1
PLD (ABEL)	2	3	2	2	1	1	1
FPGA/CPLD (Schematics)	2	3	3	3	1	1	1
FPGA/CPLD (Verilog)	1	1	1	1	1	1	1
Digital Design	3	4	3	2	1	3	3

Develop the Resource Plan

- Assign Names to the Project Roadmap to create a Resource Plan
  - Use the Skills Inventory List to Assign Alternate Resources to the Resource Plan
  - Evaluate the resource assignments with the resource requirements of the Roadmap

Using EXCEL to Develop a Resource Plan

EXCEL Resource Plan

- An EXCEL spreadsheet should be developed for each discipline
- Recommended Tabs
  - Resource Requests (Targets)
  - Resource 1 through “n”
  - Staffing Plan
  - Project Assignments

Resource Requests

- Links to the Resource Targets from the Roadmap

Product Line #1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Project A	2.00	2.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Project B	0.00	0.00	0.50	0.50	0.50	0.50	1.50	1.50	2.00	2.00	2.00	2.00	
Project C	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.50	
Project D	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	
Project E	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	
Project F	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Resource Requests | Project Assignments | Resource 1 | Resource 2 | Resource 3 | Resource n

Resource 1 through “n” Worksheet

- A Separate Tab for Each Resource that includes:
  - Resource Assignment Table
    - Table to indicate whether the resource has been assigned to the Roadmap Projects
  - Individual Performance Model
    - Models the individual skills to each project phase
    - Can be Job Title based or unique for each Engineer

Resource 1 Worksheet

Project A starts at Phase 4

Assign This resource to a Project by entering a "1"

Resource Assi

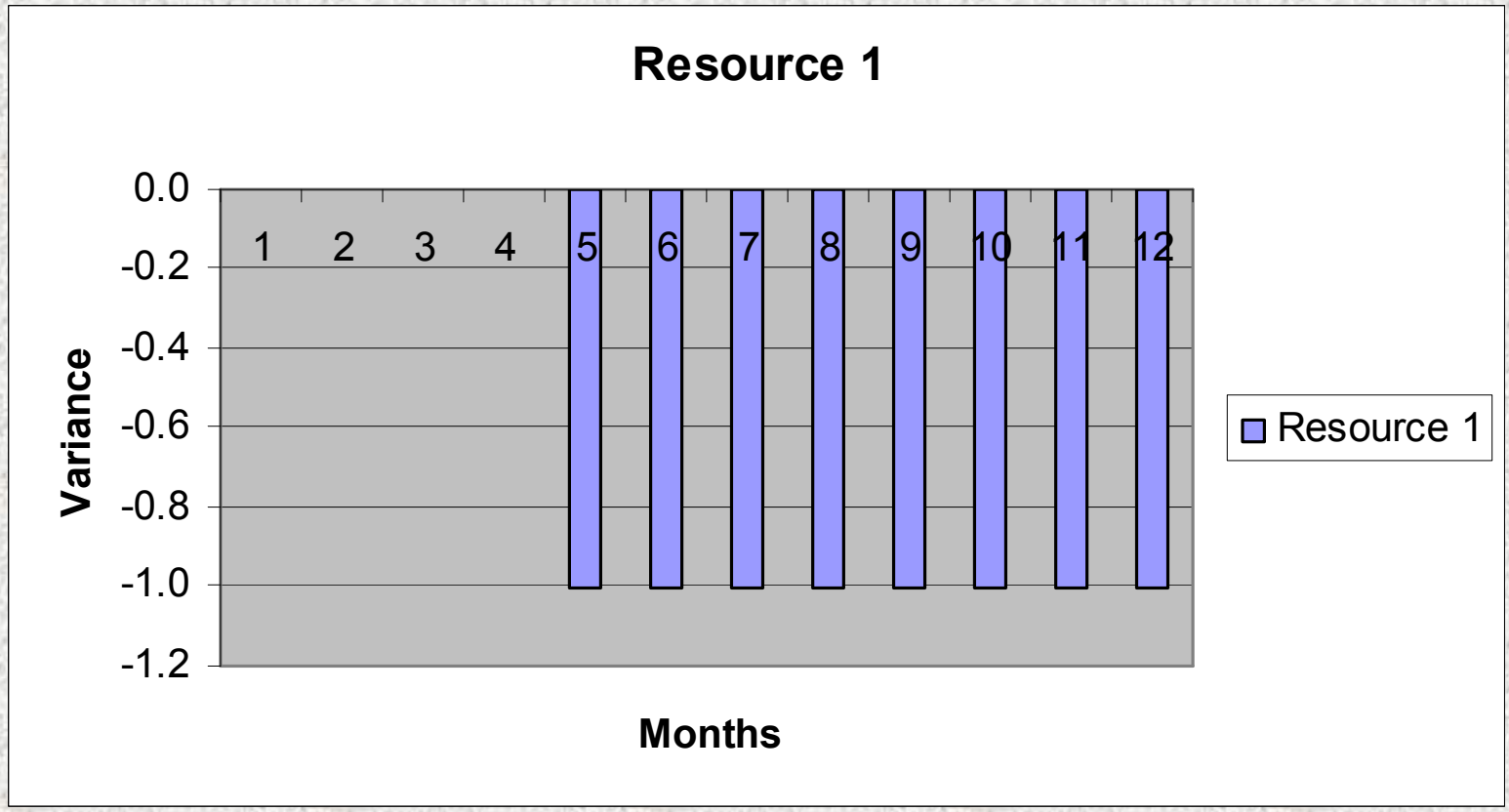
Product Line #1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Assigned	Perf Model
Project A	1	1	1	1	0	0	0	0	0	0	0	0	1	2
Project B	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Project C	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Project D	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Project E	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Project F	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Project G	0	0	0	0	0	0	0	0	0	0	0	0	0	2

Individual Performance Model

Model	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Engineer 1	0.00	0.00	1.00	1.00	1.00	1.00
Engineer 2	1.00	1.00	1.00	1.00	1.00	1.00
Engineer 3	1.00	1.00	0.25	0.25	0.25	0.10
Engineer 4	0.10	0.10	0.10	0.10	0.10	0.10

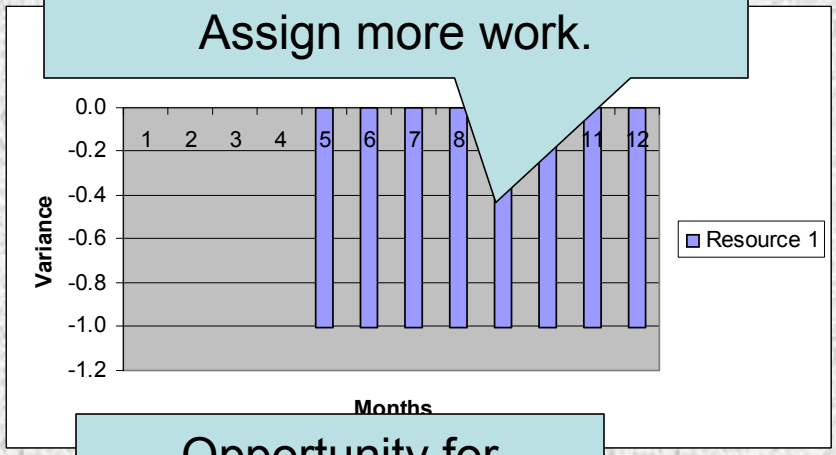
Resource 1 Worksheet

- Use EXCEL Chart Wizard to Level Resources

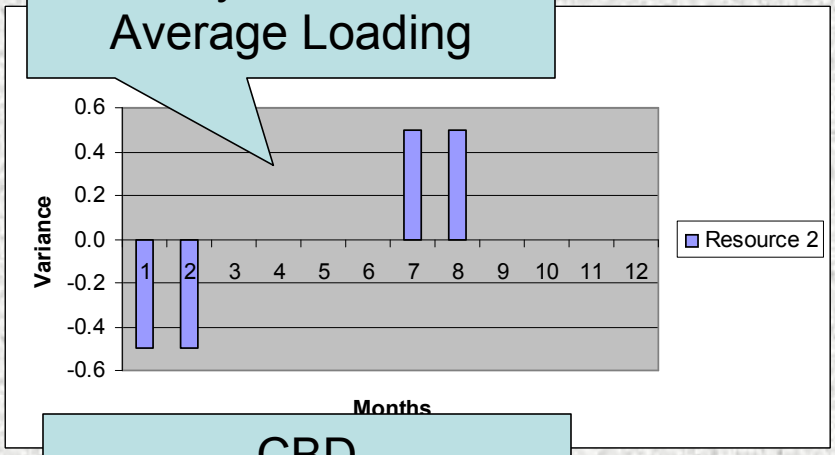


Analyze Loading on each Resource

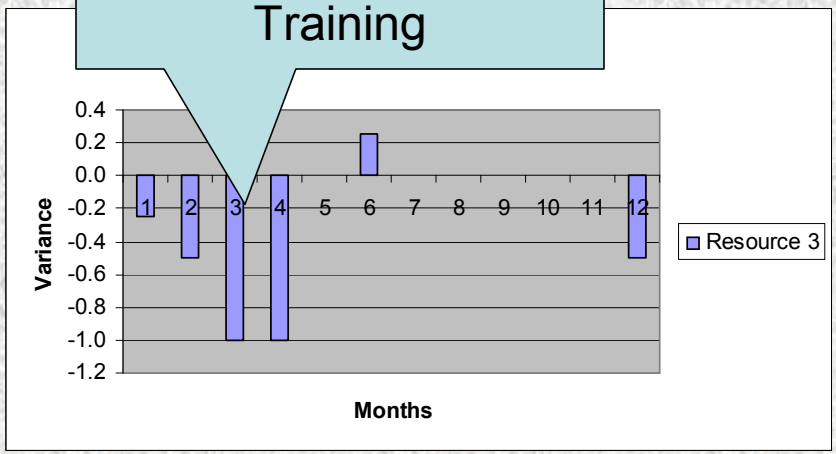
Under-utilized
Assign more work.



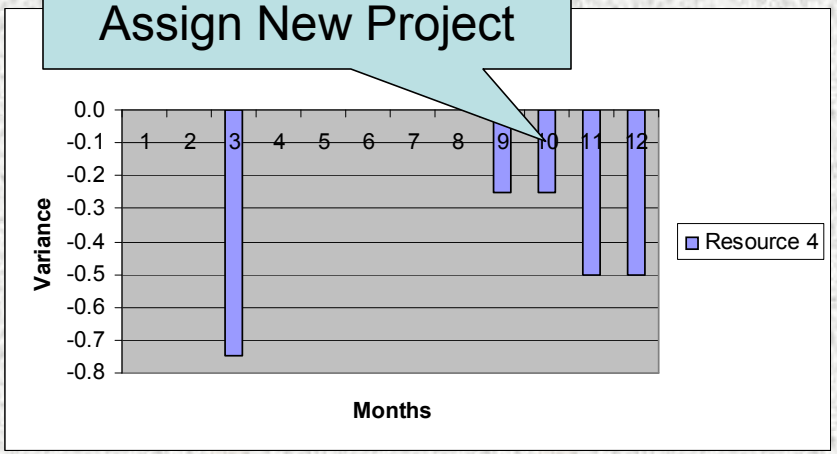
Probably OK based on
Average Loading



Opportunity for
Training



CBD
Assign New Project



Staffing Plan

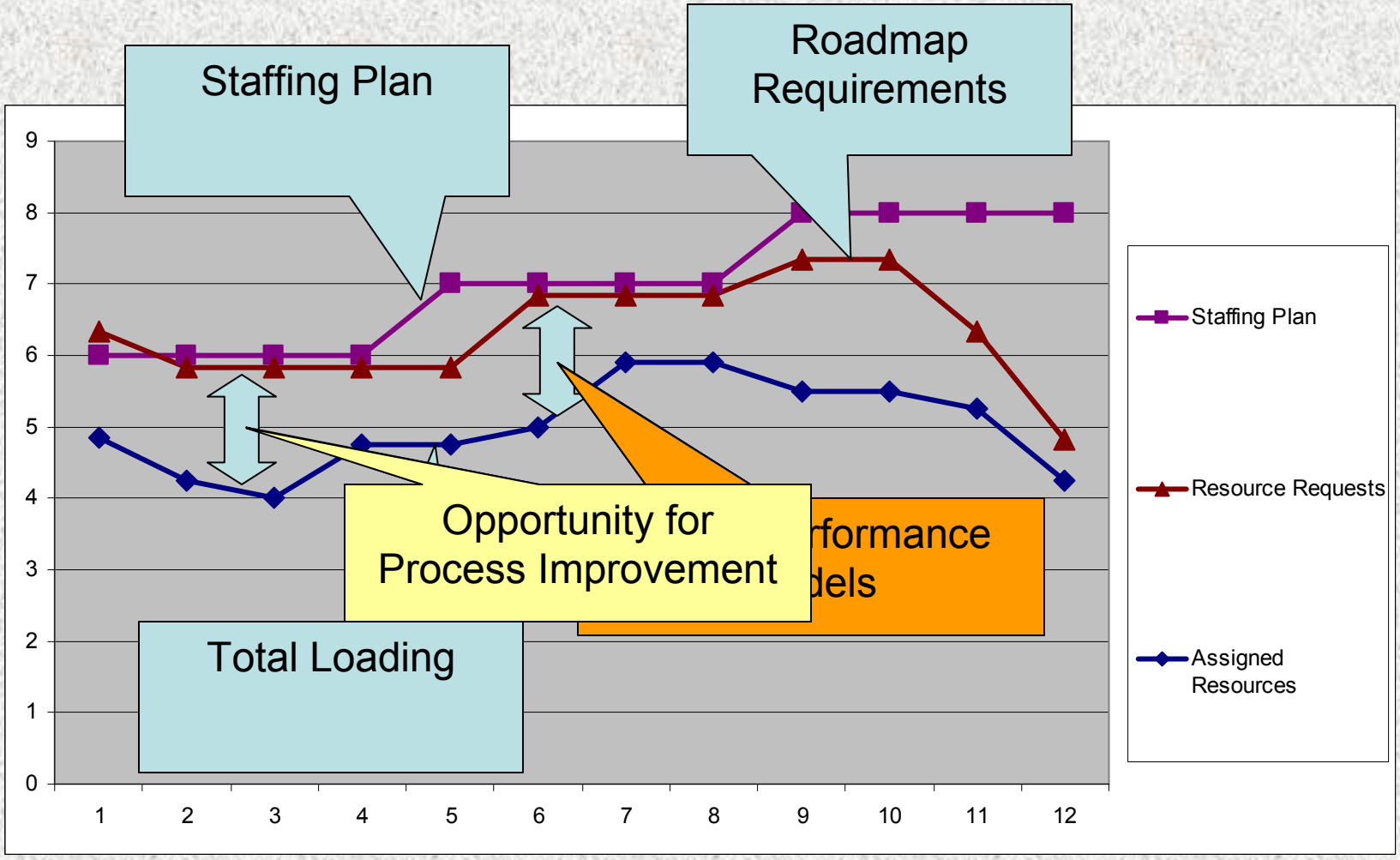
- This is the Current Headcount and Hiring Plan for the Year
- Can be linked to the Roadmap when leveling

						Jun	Jul	Aug	Sep	Oct	Nov	Dec
Resource 1					1	1	1	1	1	1	1	1
Resource 2	1	1			1							1
Resource 3	1	1	1		1							1
Resource 4	1	1	1		1							1
Resource 5	1	1	1		1	1	1	1		1	1	1
Resource 6	1	1	1	1	1	1	1	1		1	1	1
Resource 7	0	0	0	0	1	1	1	1	1	1	1	1
Resource 8	0	0	0	0	0	0	0	0	1	1	1	1
Resource 9	0	0	0	0	0	0	0	0	0	0	0	0
Resource “n”	0	0	0	0	0	0	0	0	0	0	0	0
Staffing Plan	**6**	**6**	**6**	**6**	**7**	**7**	**7**	**7**	**8**	**8**	**8**	**8**

Hire a new Engineer in May

Hire a new Engineer in September

Analyze Loading to the Roadmap



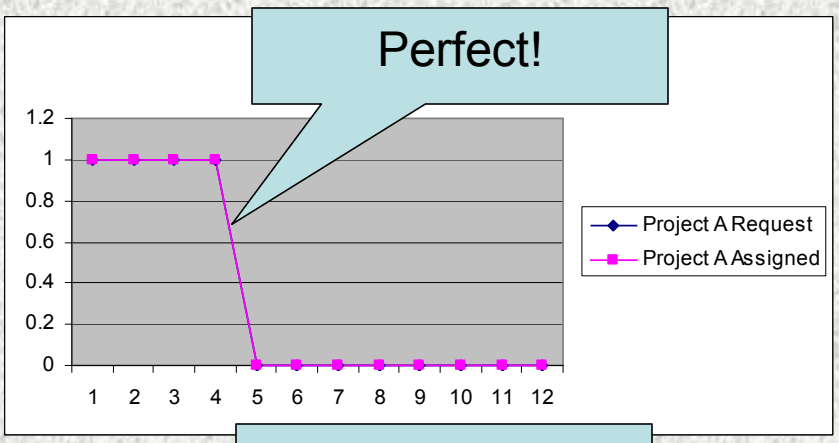
Project Assignments

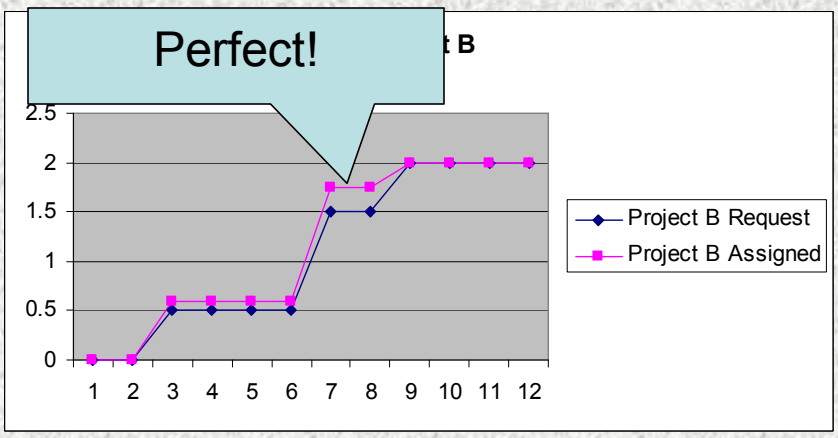
- Summary of the total resources assigned to the project

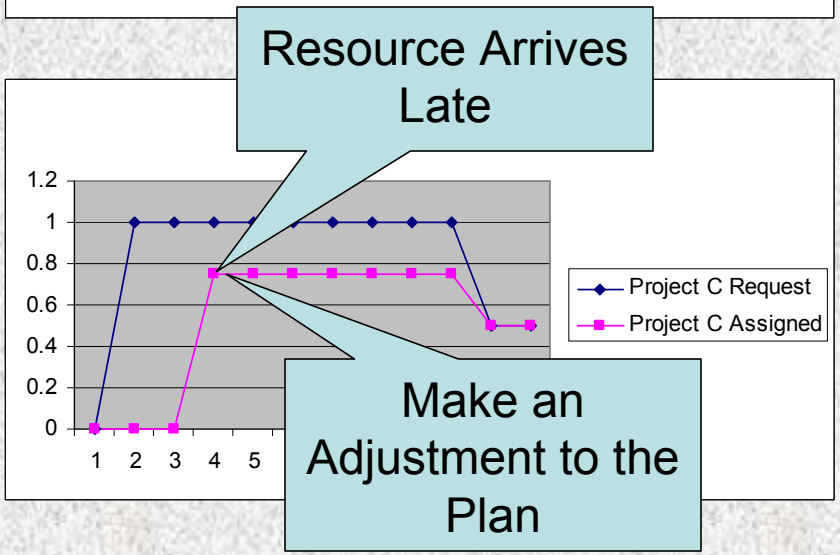
Resource 1

Product Line #1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Project A	1	1	1	1	0	0	0	0	0	0	0	0
Project B	0	0	0.6	0.6	0.6	0.6	1.75	1.75	2	2	2	2
Project C	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.5	0.5
Project D	0	0	1	1	1	1	1	1	1	1	1	0.5
Project E	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.5
Project F	1.25	1.25	0	0	0	0	0	0	0	0	0	0
Total	**2**	**3**	**4.5**	**4.5**	**3.5**	**3.5**	**4.5**	**4.5**	**5**	**5**	**4.5**	**3.5**

Analyze Project Coverage







Monitoring the Resource Plan

- Maintain the Resource Plan based upon Project Execution
  - Resource Plan should drive Projects
  - Real-time Feedback
- Frequency
  - Monthly Goals (ACTIVE)
  - Weekly Progress Reviews (PASSIVE)
  - Quarterly Updates and Management Reviews

Monthly Goals

Review Progress and Update Roadmap - MARCH

Product Line #1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Project A	4	4	4	5	6	0	0	0	0	0	0	0
Project B	0	0	1	1	1	1	2	2	3	3	4	4
Project C	0	1	1	2	2	3	3	4	4	5	6	6
Project D	0	0	1	1	2	2	3	3	4	4	5	6
Project E	0	0	1	1	2	2	3	3	4	4	5	6
Project F	5	5	5	0	0	0	0	0	0	0	0	0

Setup	
Start	Phase
1	4
3	1
2	1
3	1
3	1
1	5

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

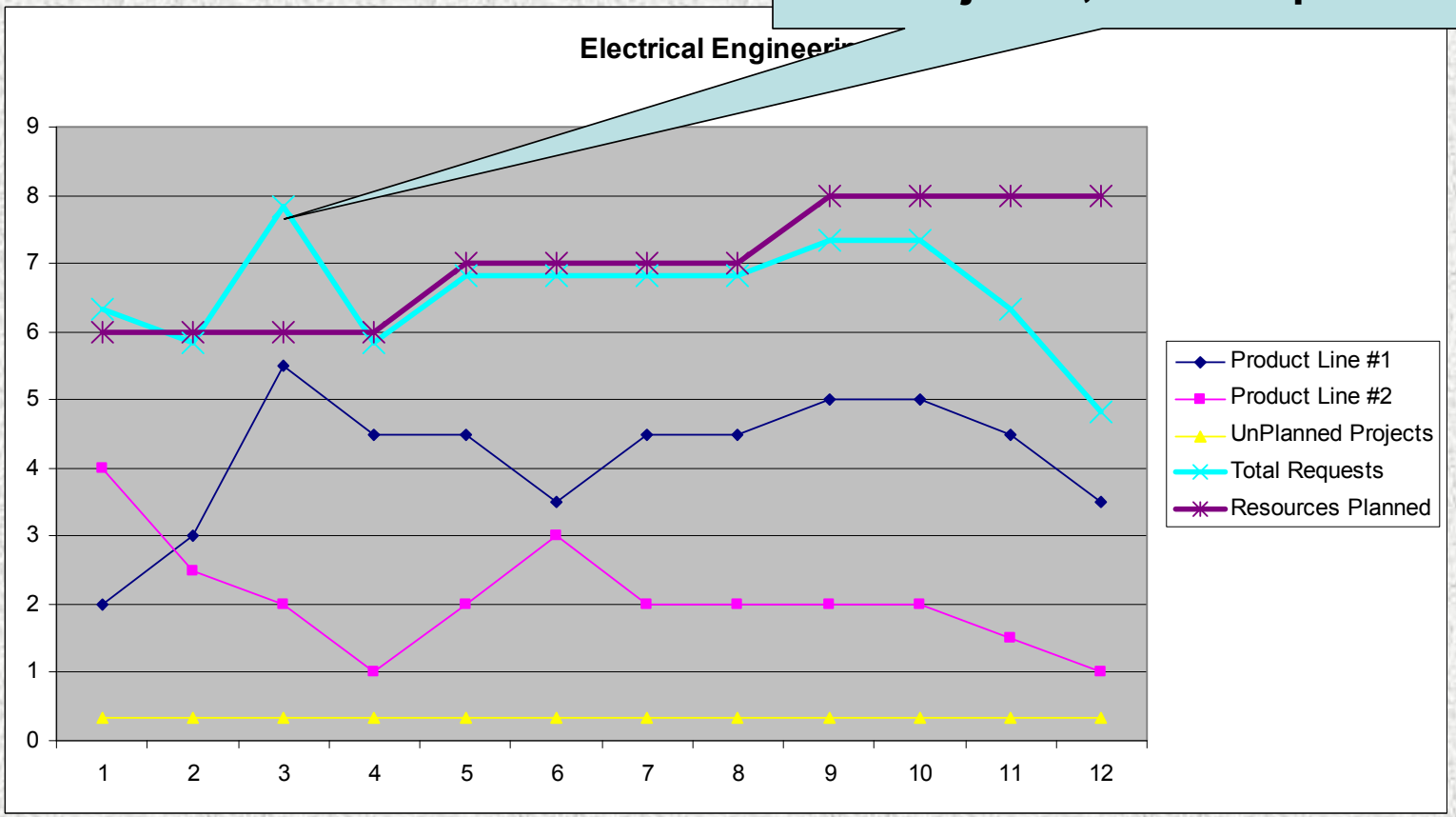
Project A, Phase 4 does not wrap up
Incremented from 2 to 3 months

Project F, Phase 5 does not wrap up
Incremented from 2 to 3 months

Monthly Goals

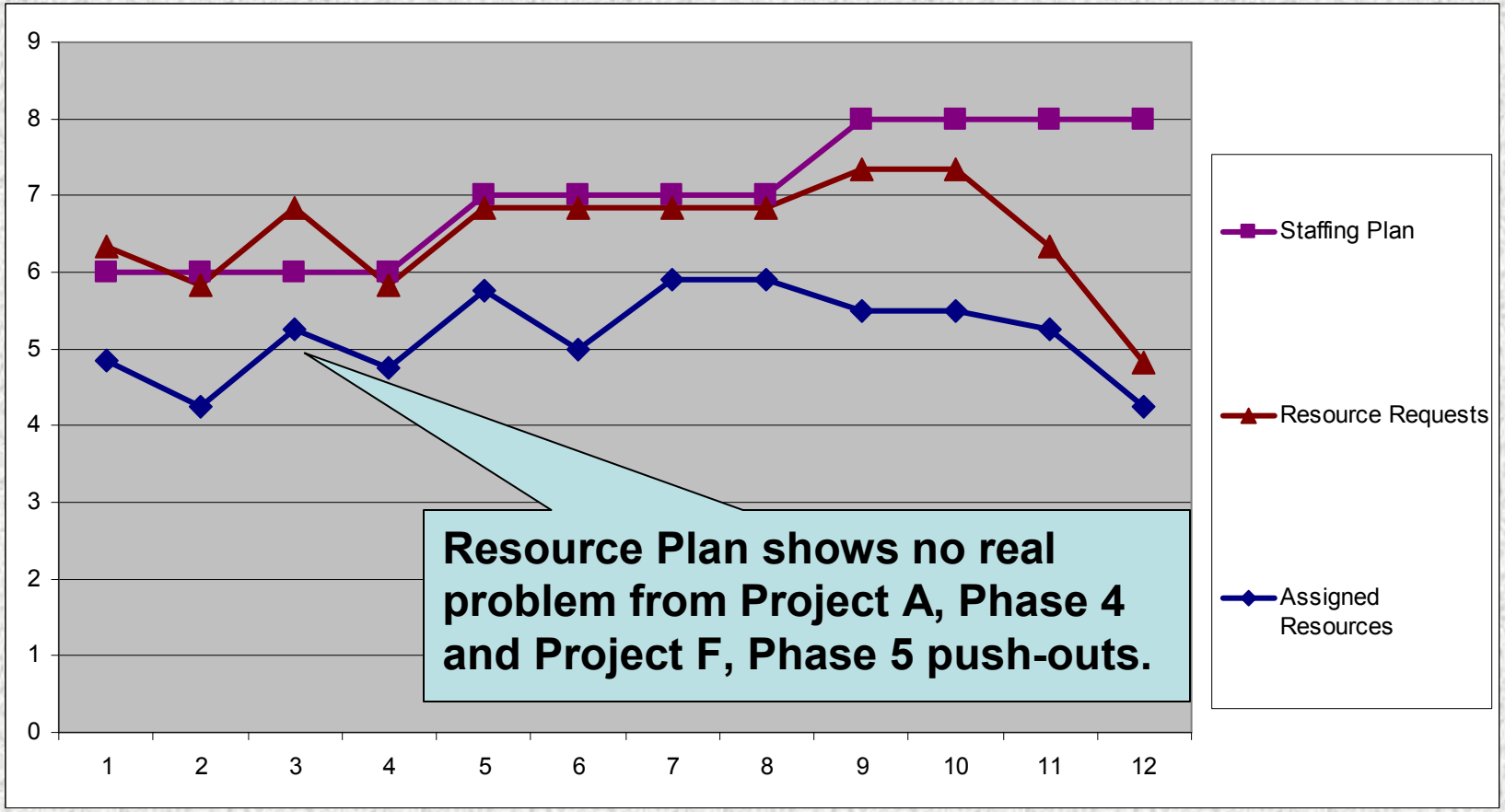
Impact of Schedule Push-outs On Roadmap

Increased resources required to recover from Project A, Phase 4 and Project F, Phase 5 push-outs.



Monthly Goals

Impact of Schedule Push-outs on Resource Plan



Monthly Goals

- Review progress against the previous monthly goals
- Identify the task and activities for the upcoming month and update goals.
- Identify the probability of completion.
- If probability of completion is low (<75%), identify roadblocks that cause low confidence.
- Proactively address roadblocks for low the confidence tasks/goals
- Save, Publish and Communicate the Monthly Plan

Weekly Meetings

- Review Progress with respect to the Monthly Plan and Goals
- Identify gaps and outline an Action Plan
- Follow through on the Plan

Quarterly Management Review

- Update the Roadmap and Level the Resource Plan
- Review changes and impact of the updated Resource Plan
- Review Project Backlog
- Review “Commitment Backlog Date”
- Identify concerns with the new plan
- Develop Action Plan

Conclusions

- An automated Roadmap, tied to resources, creates a viable plan before asking Vertical Managers to staff the Roadmap
- An automated Resource Plan allows Vertical Managers assign and level resources before resources are assigned to development projects.
- The Roadmap and Resource Plans can be proactively managed with traditional project management techniques.

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