

Where did the Critical Path Go?

Carmelo Rodriguez, Director
and
Thomas Tasker, Program Controller
Advanced Arresting Gear Program
General Atomics

Presented at
Dekker Trakker Forum
San Diego, CA
23 May 2005

Two Defense Programs currently undergoing EVMS Certification

- **Advanced Arresting Gear**
- **Electromagnetic Aircraft Launch System**

Advanced Arresting Gear

Recover projected Air Wing well into 21st Century



Higher level of safety
Higher reliability
Lower loads
Reduced manning

Electromagnetic Aircraft Launch System



Launch projected Air Wing well into 21st Century

Higher level of safety
Higher reliability
Lower loads
Reduced manning



Scheduling Art and Science

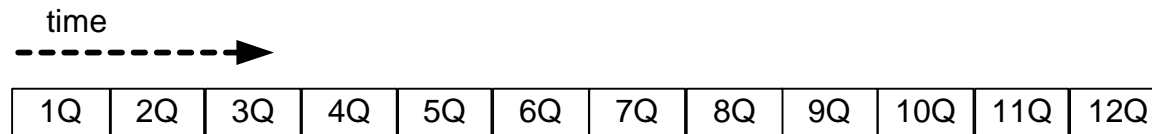
- Repetitive activities, such as those performed in manufacturing or production, have predictable durations and logical sequences.

adjustments normally require capital investment, i.e., machines

- Nonrecurring activities, such as those performed in development or in first-of-a-kind engineering, have less predictable durations.

adjustments sometimes possible by using temporary labor

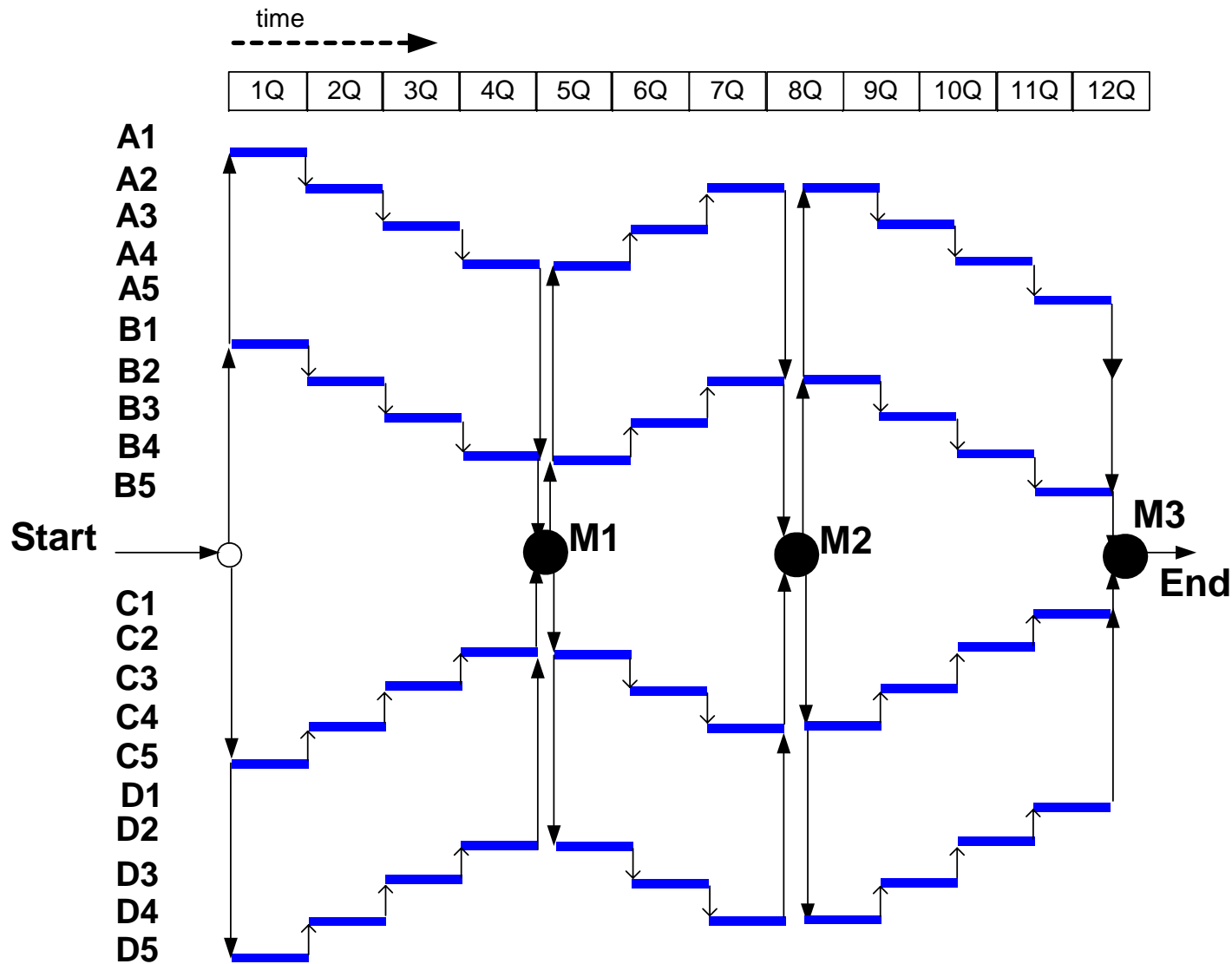
Projects normally have pre-specified starting and ending dates



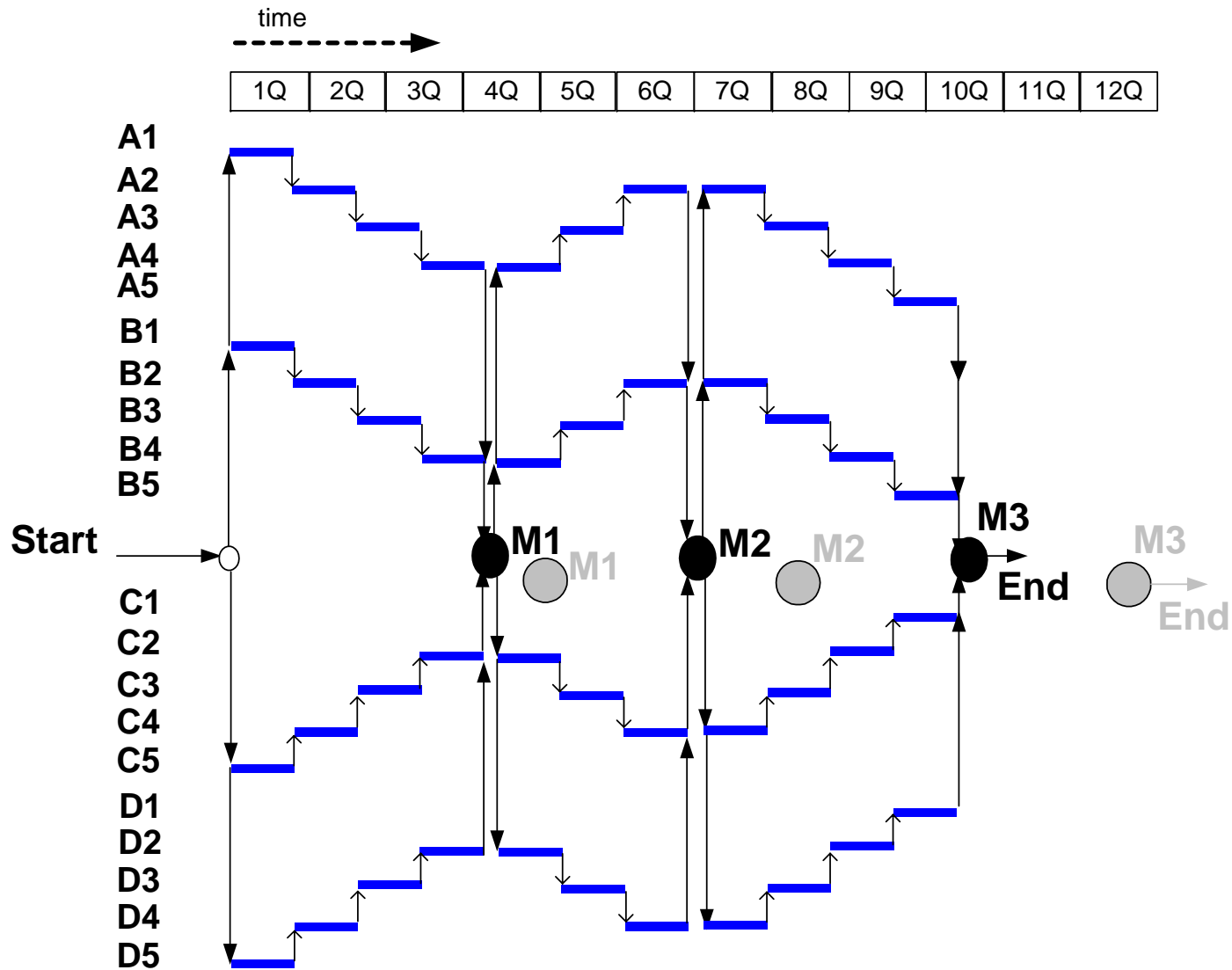
Non-recurring Activities tend to be scheduled to take up all available time

- Produces more stable staffing requirements
- Gives Cost Account Managers individual control of schedule risk
- Covers up Critical Path. Said differently, everything ends up in the critical path
- Problems cannot be anticipated until it normally is too late

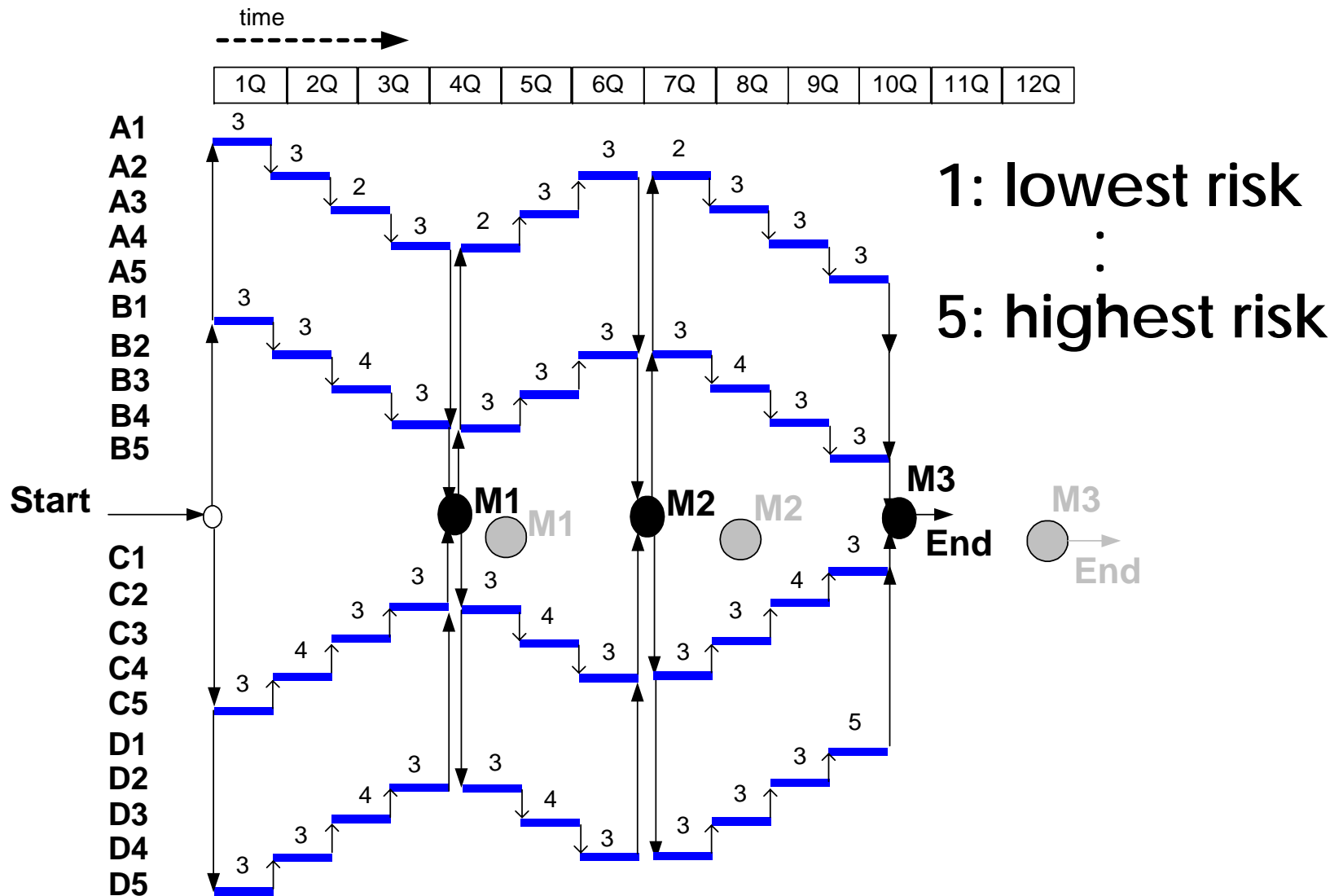
Activities taking up all available time cover up the critical path: everything is in the critical path



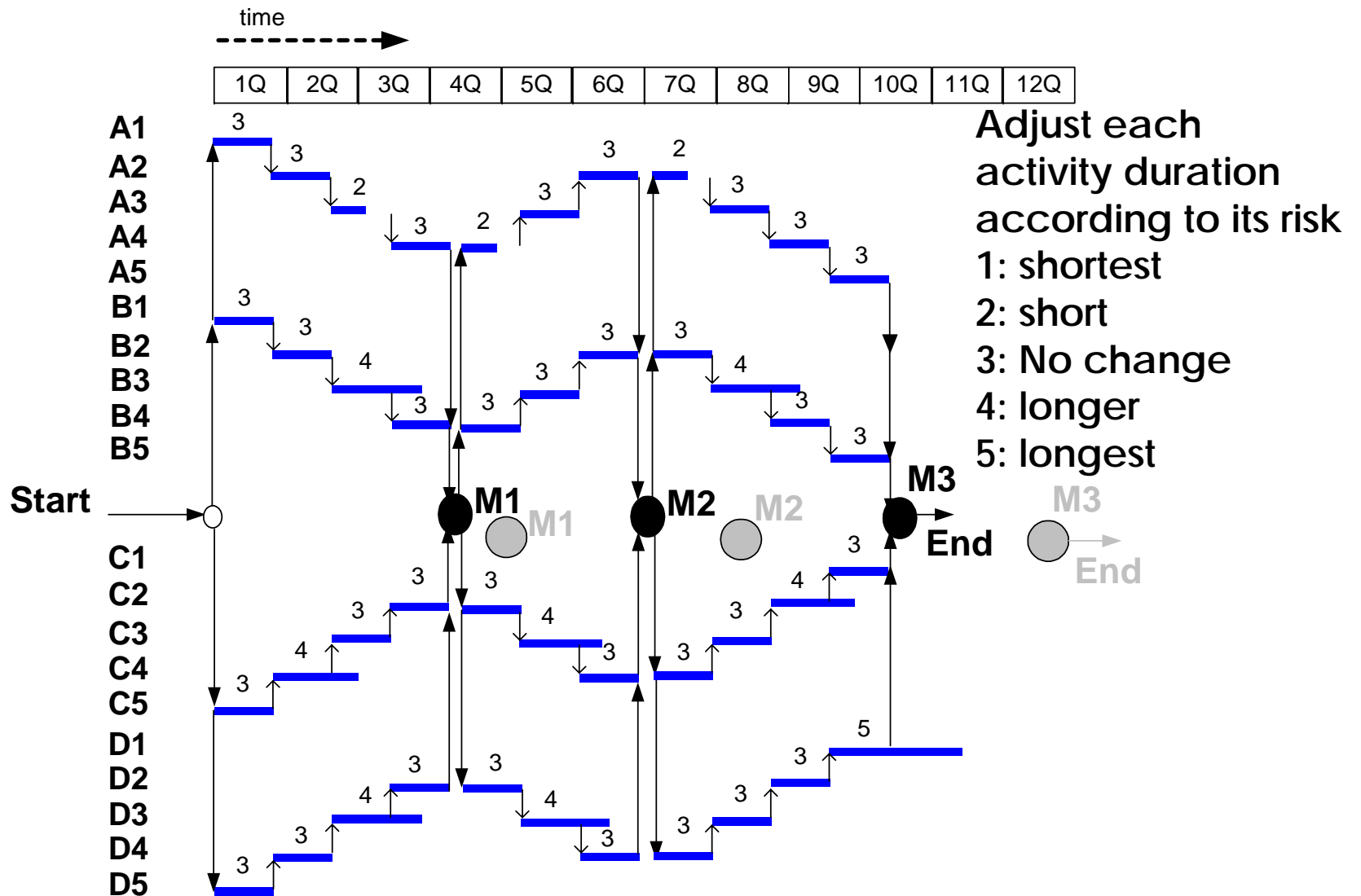
First step to uncover critical path: Compress time



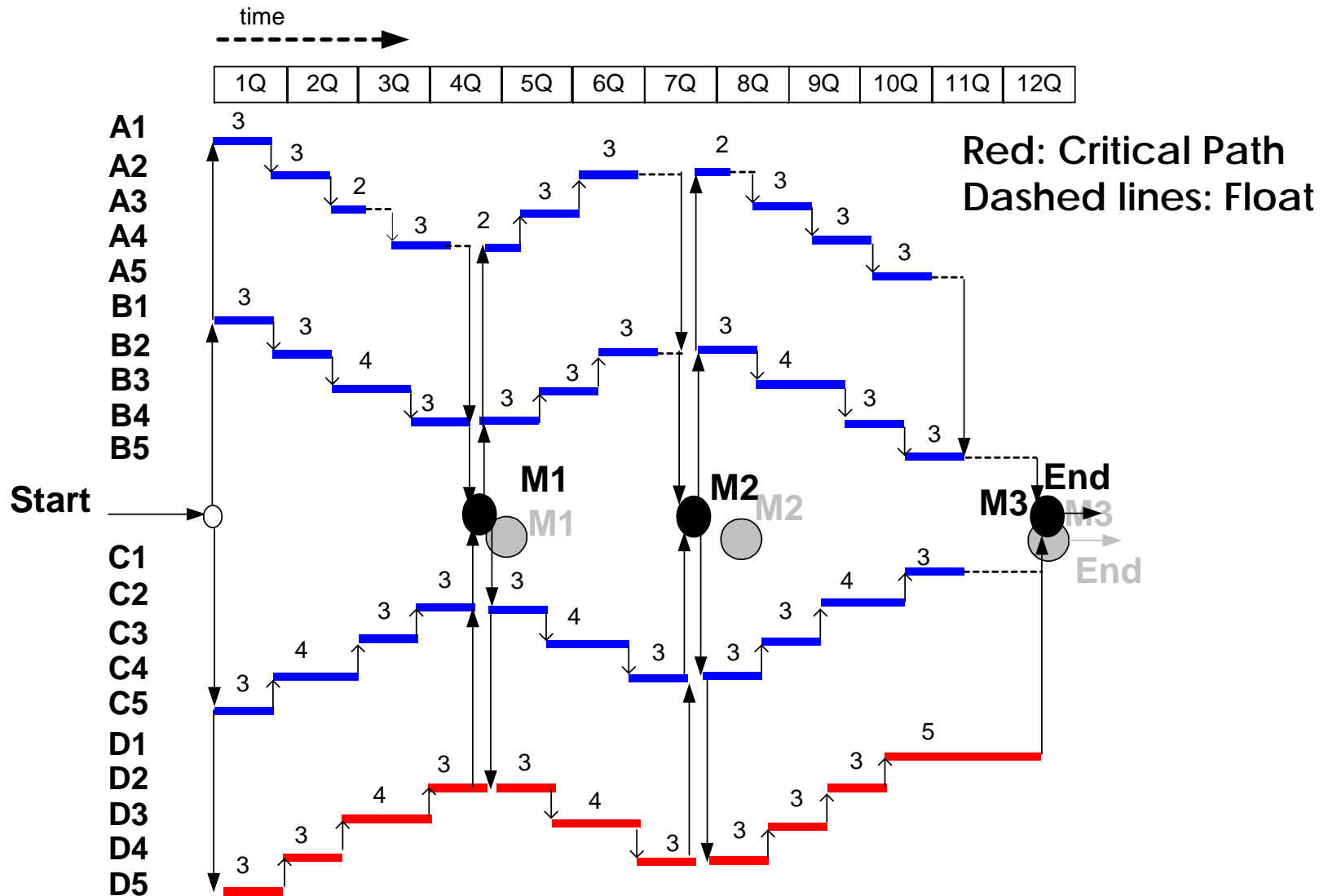
Second step: Quantify each activity's schedule risk



Third Step: Adjust each activity duration according to its risk



Fourth Step: Slide activities to the right to eliminate overlap



The Earned Value Process

- Develop Realistic Baseline
- Uncover Critical Path
- Use Objective Methods to Measure Performance

Baseline Development

- **Baseline consists of:**
 - Scope - defined in WBS Dictionary (derived from Statement of Work)
 - Schedule - Integrated Master Schedule (IMS) in TRAKKER
 - Budget - Resource Loaded IMS in TRAKKER

- **Integrated Master Schedule**
 - Structure follows Work Breakdown Structure
 - Levels established for management control are the Control Accounts. These are the lowest level of WBS in TRAKKER
 - Each Activity sums to a Control Account WBS in TRAKKER
 - Activities are resource loaded which sum to Control Account budgets

WBS Hierarchy Defines Scope of Work

XYZ Work Breakdown Structure (WBS)	
WBS #	WBS Description
1	Total Program
1.1	Task 1
1.1.1	Task 1.1
1.1.1.1	Task 1.1.1
1.1.1.1.1	Task 1.1.1.1
1.1.1.1.2	Task 1.1.1.2
1.1.1.1.2.1	Task 1.1.1.2.1
1.1.1.1.2.2	Task 1.1.1.2.2
1.1.1.1.3	Task 1.1.1.3
1.1.1.1.3.1	Task 1.1.1.3.1
1.1.1.1.3.2	Task 1.1.1.3.2
1.1.1.2	Task 1.1.2
1.1.1.2.1	Task 1.1.2.1
1.1.1.2.2	Task 1.1.2.2
1.1.1.2.3	Task 1.1.2.3
1.1.1.2.3.1	Task 1.1.2.3.1
1.1.1.2.3.2	Task 1.1.2.3.2
1.1.1.2.3.3	Task 1.1.2.3.3
1.1.1.2.4	Task 1.1.2.4
1.1.1.2.4.1	Task 1.1.2.4.1
1.1.1.2.4.2	Task 1.1.2.4.2

Establishment of Control Accounts

XYZ - Control Account Assignments					
WBS #	XYZ Work Breakdown Structure (WBS)		Control Acct.	Curr. Task	CAM/Org
1	Total Program				
1.1	Task 1				
1.1.1	Task 1.1				
1.1.1.1	Task 1.1.1				
1.1.1.1.1	Task 1.1.1.1		X	X	Doe/Org. 11
1.1.1.1.2	Task 1.1.1.2		X	X	Doe/Org. 11
1.1.1.1.2.1	Task 1.1.1.2.1				
1.1.1.1.2.2	Task 1.1.1.2.2				
1.1.1.1.3	Task 1.1.1.3				
1.1.1.1.3.1	Task 1.1.1.3.1		X		Doe/Org. 11
1.1.1.1.3.2	Task 1.1.1.3.2		X		Doe/Org. 11
1.1.1.2	Task 1.1.2				
1.1.1.2.1	Task 1.1.2.1		X	X	Smith/Org 12
1.1.1.2.2	Task 1.1.2.2		X	X	Smith/Org 12
1.1.1.2.3	Task 1.1.2.3		X	X	Smith/Org 12
1.1.1.2.3.1	Task 1.1.2.3.1				
1.1.1.2.3.2	Task 1.1.2.3.2				
1.1.1.2.3.3	Task 1.1.2.3.3				
1.1.1.2.4	Task 1.1.2.4				
1.1.1.2.4.1	Task 1.1.2.4.1		X		Smith/Org 12
1.1.1.2.4.2	Task 1.1.2.4.2		X		Smith/Org 12

Schedule Development Process

- **Bottom Up Schedule Developed by Leads/CAMs**
 - Integrated by Program Controls
 - Several Reviews to achieve Baseline Schedule
- **Develop Feasible Schedule with Compressed Time Span**
- **Identify and Reserve Float Between Major Milestones**
- **Push Major Milestones Out to Final Dates with High Risk Tasks**
- **High Risk Tasks Find Themselves on Critical Path**

Scheduling Ground Rules

- Link to Critical Milestones “fanning out and in” to avoid unnecessarily restrictive over-linking
- Contain Vertical & Horizontal Links
- Minimize Vertical Links to Few Program Milestones
- Majority of Tasks Start from these Milestones and Lead to tasks that complete at future Program Milestones (Fan out and in)
- Planning Package Duration driven by Time Between Key Program Milestones
- Detail Tasks planned at 60 day durations or less

Earned Value Measurement

- **Methods Used to Measure Work Performed**
 - 0/100 – One Month Activities
 - 50/50 – Two Month Activities
 - Interim Milestone Method
 - Use Intermediate Milestones in each Activity
 - Provides Objective Accomplishment as a measure
 - Level of Effort
 - Support Tasks, I.e. Management
 - Minimized with 10% or less of budgets/tasks
- **Status Schedule First**
 - Remaining Duration
 - Actual Start & Actual Completion
 - Updates Critical Path
 - Schedule Status Determines Majority of Earned Value

In Summary...

- Activities are planned at 60-day durations or less
- Activities are planned in a “fanning out and in”
- A risk-based method is used to uncover the critical path
- Status Schedule First
- 0-100% or 50%-50% earned value method is used
- Schedule evaluation includes
 - Actual Start and Completion
 - Remaining Duration
 - Updated Critical Path
- Schedule Status Determines Majority of Earned Value