# Project Management for Scientists

## Project Organization & Control

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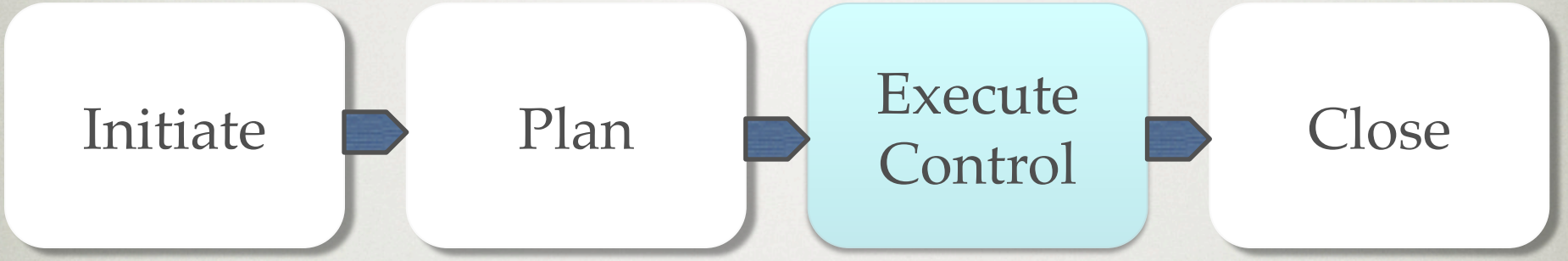
# Outline

- Recap
- Resource Allocation
- Balancing
- Control Activities
- Change Management

# Where We Are in the Cycle




- Project life cycle
- Linear progression with decision points at boundaries
- Each box has a given set of inputs and outputs

# Project Plan Approved

# What We Have: project Plans

- (Science) requirements
- Work Breakdown Structure (WBS)
- Baseline schedule
- Baseline budget
- Resource plan (this lecture)
- Communication plan (future lecture)
- Risk analysis and mitigation plan (future lecture)
- Change control plan (this lecture)

# What We Have: Project Team

- Enthusiastic and well-informed sponsor
- Project team with roles, authorities, and responsibilities

# Resource Allocation

- After initial resource assignment and scheduling, many resources used >100%
- Avoid by changing resource assignments and/or changing schedule (leveling)
- Resource leveling is last step in making realistic schedule
- Resource leveling: optimize the use of people and equipment assigned to project
- Some of it can be made automatically
- Also avoid under-allocation (people become inefficient)

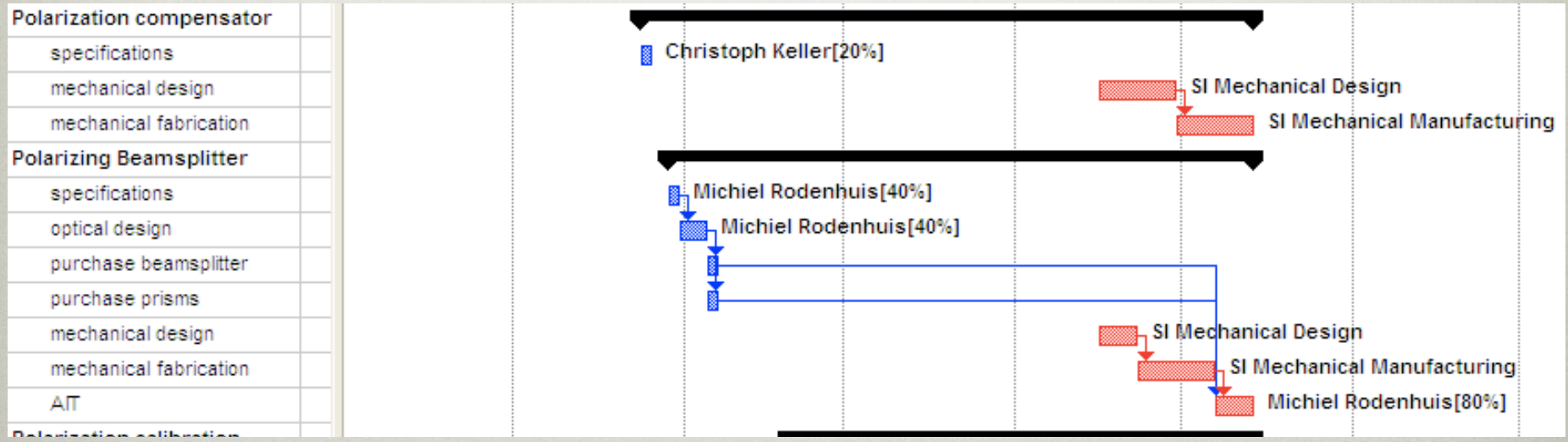
# Project Management Triangle


- Scope = science requirements, performance
- Resources = cost, budget
- Time (to completion) = schedule

One side cannot be changed without affecting the others!

# Critical Path

- Consecutive tasks where delay in any of those tasks delays whole project
- Typically shown in red in Gantt chart software
- Look at critical paths



# Balancing Act

- Balance project scope against 3 constraints
  1. Time: will not get project done within time allotted by project (baseline) plan
  2. Money: can deliver desired outcome on schedule, but will cost too much
  3. Resources: project cost is ok, but schedule calls for people, equipment that are not available, even though the money is there to hire/buy
- Balancing required if one or several constraints are violated

# Balancing

- Balance at project level
  - Make changes that will deliver on time, within budget, and all requirements fulfilled
  - Authority to do that within project
- Balance project constraints
  - Change requirements, budget, and/or schedule
  - Requires agreement of all stakeholders
- Balance at sponsor level
  - Choice of which projects to pursue, how to spread limited resources
  - Requires sponsor agreement or above

# Balancing at Project Level

- Reestimate Project
- Change Task Assignments
- Add People to Project
- Increase Productivity
- Outsource
- Overtime

# Reestimating Budget

- Optimist's choice
- Potential to reduce pessimistic estimates
- Positive: legitimately reduced estimates make project cheaper and/or faster
- Negative: Wishful thinking since estimates are not better
- Best: always check estimates, check estimating assumptions; do not reduce to please; increase facts supporting cost and schedule

# Change Task Assignments

- Straightforward resource allocation maneuver
- Add resources to tasks on critical path
- Positive: reduced project duration at the same cost
- Negative: Too many cooks as too many people on a single task work less efficiently, therefore increased cost
- Best: 3 things to consider when moving resources:
  - Both tasks need the same resource type
  - Critical path may change after resource change
  - Not all task durations are reduced by adding people

# Add People to Project

- Obvious approach to reducing project duration
- Either increase number of simultaneous tasks or number of people per task
- Positive: reduced project duration
- Negative: increase in cost of coordination and communication, requires (rare) qualified resources
- Best: some tasks are suitable to be done by more people; other concurrent tasks are very independent and can be done by different people

# Increased Productivity

- Some people are more productive than others
- High performers can reduce schedule and cost
- Positive: highly cost and schedule effective, better results
- Negative: other projects will suffer, team is overqualified
- Best: mix top and average people
  - Create experts by putting same people on similar tasks
  - Use WBS to identify tasks that benefit most from top talent
  - Involve top people in project management tasks

# Outsource project (Parts)

- Part of project handed over to outside company
- Good when required skills are not available within team
- Positive: greater experience increases productivity, schedule
- Negative: moving responsibility increases risk
- Best: high risk, high return
  - Find qualified company
  - Clear agreements before work starts using project management approaches

# Overtime

- Easiest way to add more labor to project
- More efficient than adding more people
- Positive: no additional coordination, communication required, less distractions in workplace
- Negative: overtime costs more, less efficient, burnout
- Best: overtime is perceived as above and beyond normal
  - Apply sparingly and show benefits to project
  - Only when leading to big paybacks

# Dilbert on Overtime

# Balancing Project Constraints

- Reduce project scope (reduce low-priority science)
- Fixed-phase scheduling (always meet schedule)
- Fast-tracking (non-traditional task overlapping)
- Phased product delivery (early, partially useful product, full product later)
- Do it twice (quick-and-dirty first, then solid product)

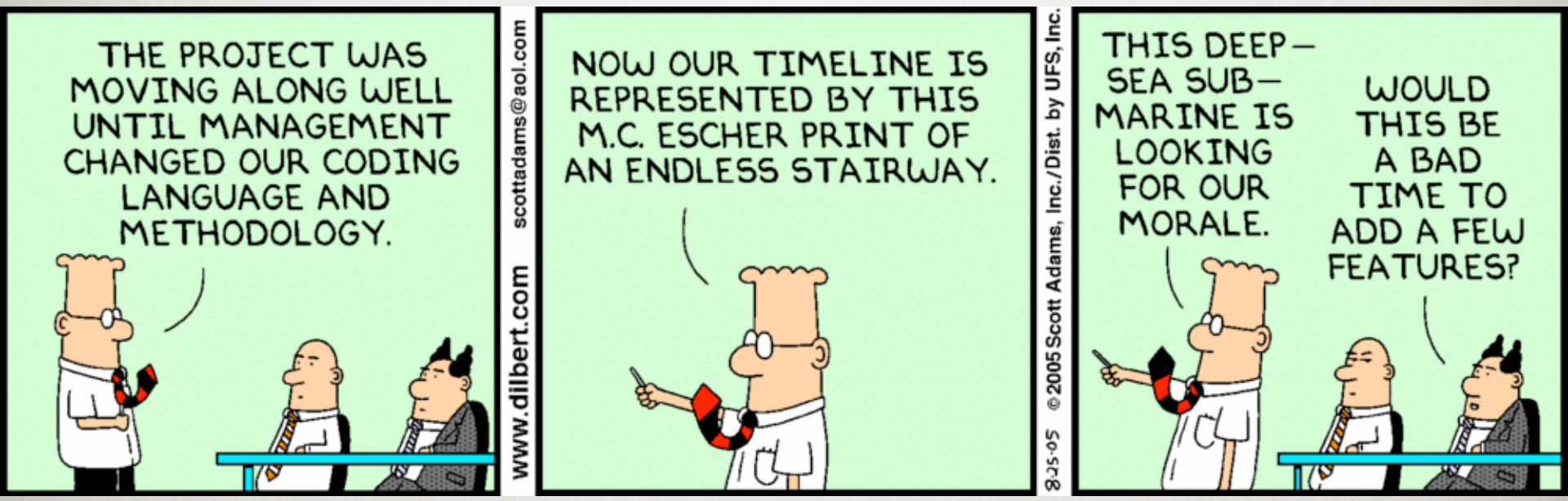
# Controlling Projects

- Plan is clear, thought-out, manageable
- Execution means
  - Work is being done
  - Problems arise
  - Constraints are violated
  - Information deluge
  - Not enough time to get everything done
  - Changes occur
- Challenge to stay in control

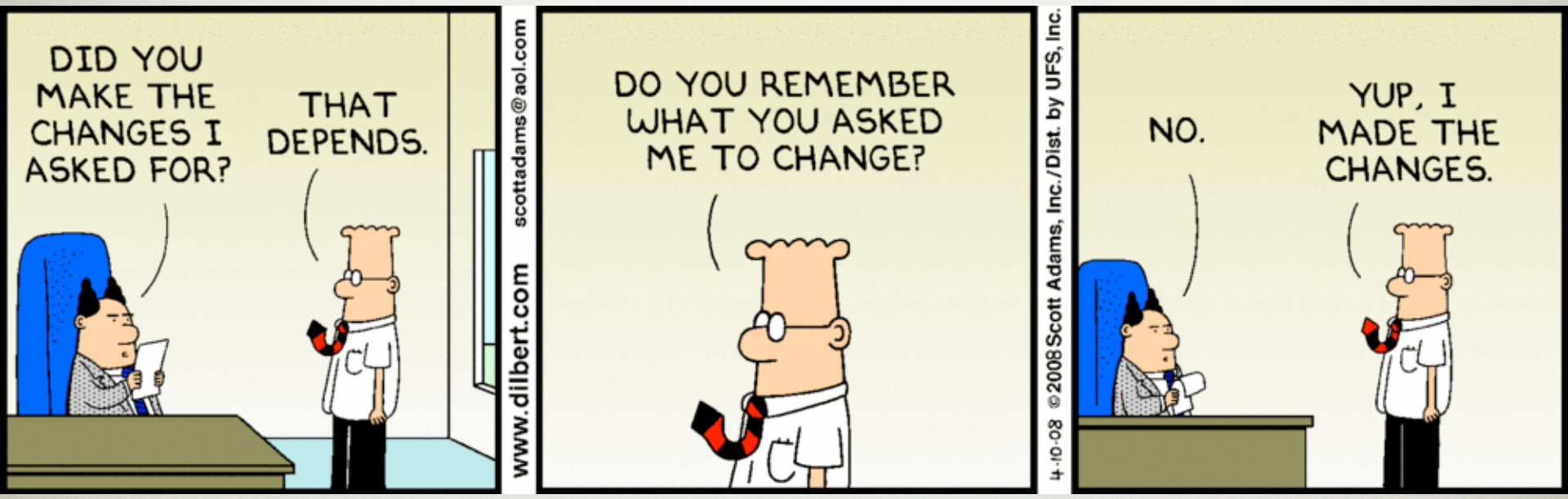
# Control Activities

- Manage scientific/technical performance
- Manage cost, schedule, resources
- Control changes
- Manage risks and problems
- Manage project team
- Communicate achievements and project status

# Project Changes



# Change Management?



# Change Control

- Every project changes requirements, cost, schedule, resources
- If not carefully controlled, project goes out of control
- Once approved, requirements, cost, schedule, etc. become controlled
- Changes to ‘controlled’ requirements etc. must pass through change management process

# Change Management Process

- Identify potential change, submit change request
- Document and analyze change request
- Evaluate change and impact on project plan
- Obtain formal approval on change
- Implement and document change
- Review and close change

# Configuration Management

- Subset of change management
- Makes sure everybody uses the same version of documents, plans etc.
- Configuration management for any project part where different versions occur during life of project
  - Project control documents
  - Electronic files
  - Prototypes, experiments