Project Controls

The art of predicting project completion.
A good baseline schedule is not enough.

Patrick Weaver

PGCS 2016

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Outline

- The limitations of CPM
- The GAO Schedule Assessment Guide
- Building a GAO compliant schedule
- Managing the P80 time contingency.
- Dealing with actual progress & productivity.
- Monitoring ‘float burn’
- Dealing with other CPM limitations.
- The predictive value of Earned Schedule.
- Dealing with troubled projects,
  - ‘Tiger teams’ and SCRAM.

Predicting the future is impossible

- **Every estimate is wrong!**
  - Some are more accurate than others
- No one knows ‘how wrong’
  - Until after the work is completed
- But how many contracts require an ‘uncertainty assessment’ and contingencies?

Predicting the future is impossible

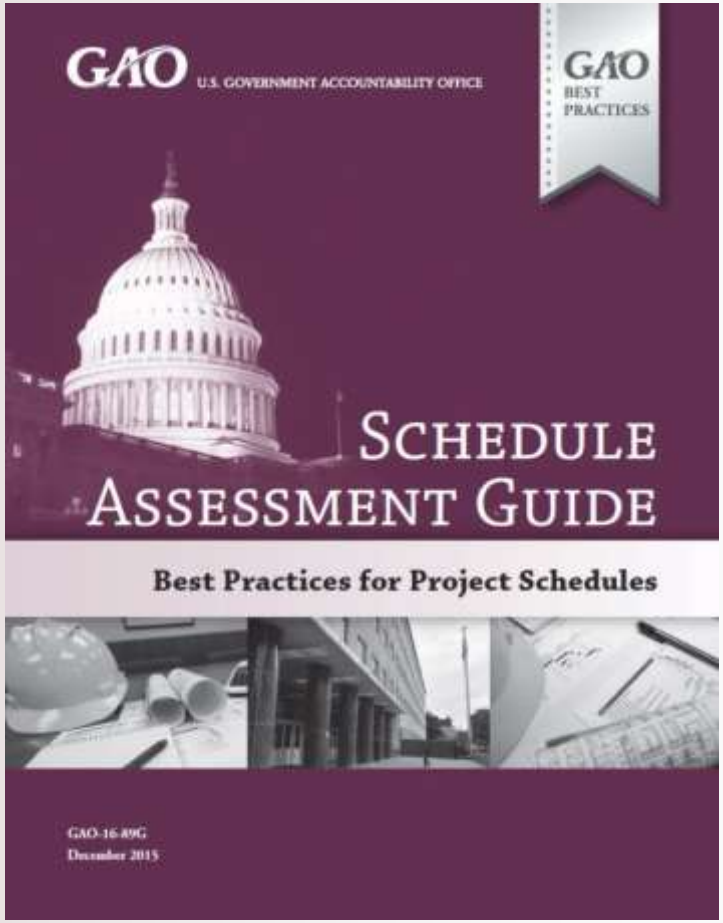
- Risk events:
  - Known knowns – in the PMP
  - Unknown knowns – errors in the PMP
  - Known unknowns – in the risk register
  - Knowable unknowns – learn!
  - Unknown unknowns (and *Black Swans*)
    - Resilience and reserves

Dealing with uncertainty

- The objective is to achieve an acceptable probability of completion
- But standard CPM fails to consider:
  - Variability in estimates
  - Identified risk events
  - Other uncertainties
  - The actual performance of the work

Schedule Assessment Guide

- USA Government Assessment Office
- Published Dec 2015
- 10 ‘best practices’
- Focus on usefulness of schedule to drive results



Best Practice #1

- **Capturing all activities.** The schedule should reflect all activities as defined in the program's work breakdown structure (WBS), which defines in detail the work necessary to accomplish a project's objectives, including activities both the owner and the contractors are to perform.

Best Practice #2

- **Sequencing all activities.** The schedule should be planned so that critical program dates can be met. To do this, activities must be logically sequenced and correctly linked. Date constraints and lags should be minimized and justified.

Best Practice #3

- **Assigning resources to all activities.** The schedule should reflect the resources (labor, materials, travel, facilities, equipment, and the like) needed to do the work, whether they will be available when needed, and any constraints on funding or time.

Best Practice #4

- **Establishing the duration of all activities.** The schedule should realistically reflect how long each activity will take, based on the same information used for cost estimating. Durations should be reasonably short. Schedules may contain planning and summary planning packages.

Best Practice #5

- **Verifying that the schedule can be traced horizontally and vertically.**
  - Horizontally traceable, “hand-offs” between schedules or phases.
  - Vertically traceable; lower-level schedules are clearly consistent with upper-level schedules

Best Practice #6

- **Confirming that the critical path is valid.** The schedule should identify a sensible critical path.

Best Practice #7

- **Ensuring reasonable total float.** The schedule should identify a reasonable amount of total float to allow resilience and flexibility. However, unreasonably high total float on an activity or path may indicate that schedule logic is missing or invalid.

Best Practice #8

- **Conducting a schedule risk analysis.** Using a statistical simulation to predict the level of confidence in meeting a program's completion date; to determine the contingency needed for a level of confidence; and to identify high-priority risks. Include the results of the schedule risk analysis in the baseline schedule.

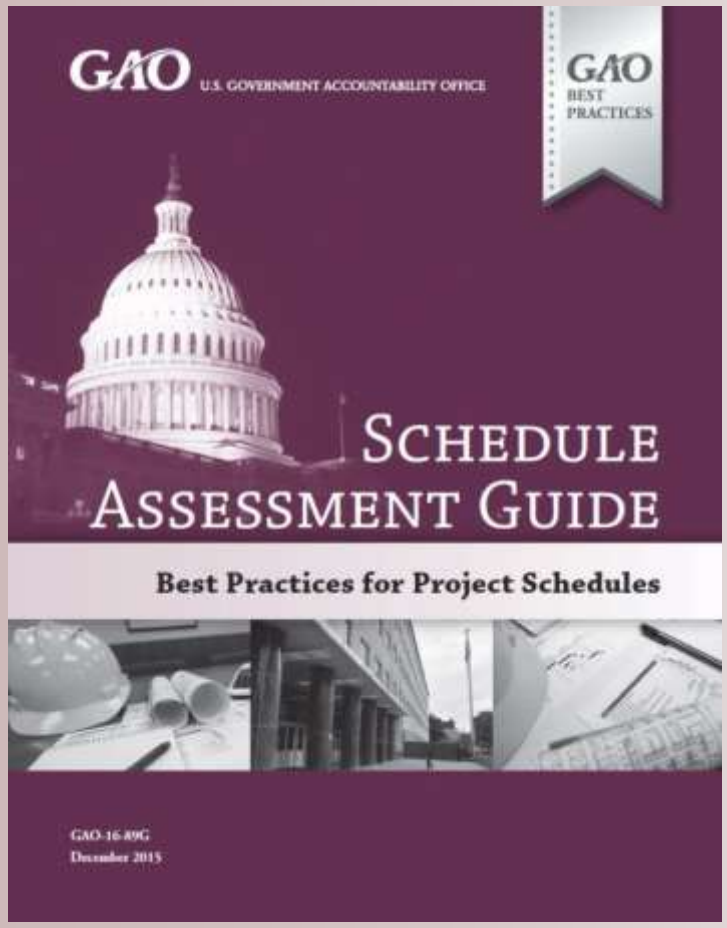
Best Practice #9

- **Updating the schedule using actual progress and logic.** Progress updates and logic provide a realistic forecast of start and completion dates for program activities. Maintaining the integrity of the schedule logic is necessary to reflect the true status of the program.

Best Practice #10

- **Maintaining a baseline schedule.** The baseline schedule is subjected to a configuration management control process. Program performance is measured, monitored, and reported against the baseline schedule.

Schedule Assessment Guide



1. A competent schedule
   - Technical
   - Practical
2. Fully resourced
3. Including adequate contingencies for risk

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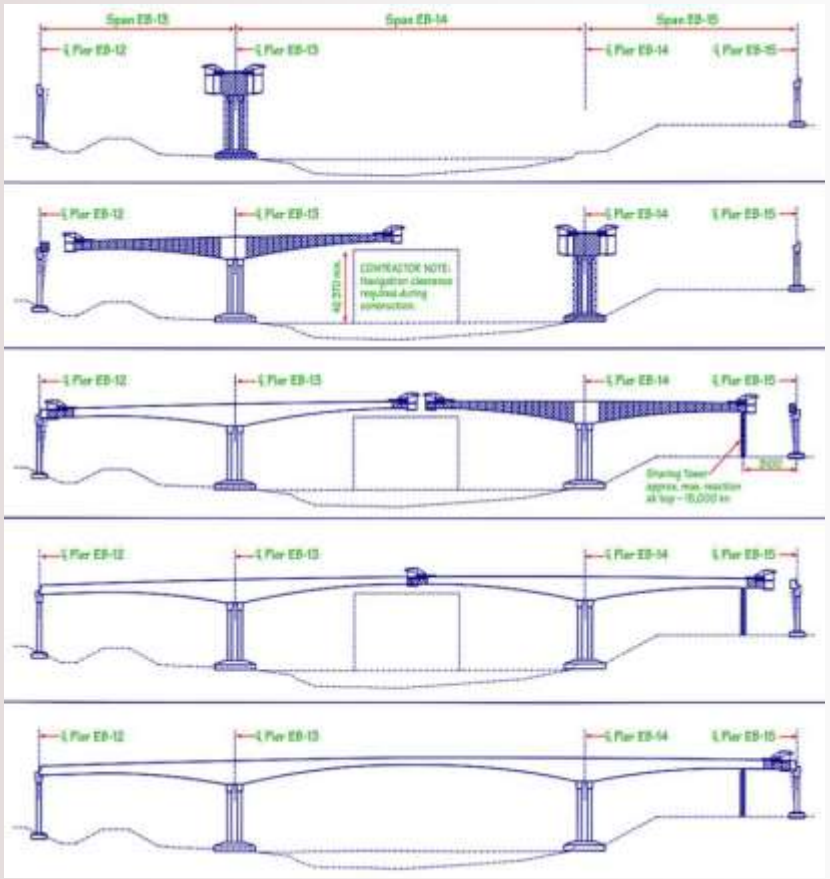
Stakeholder Involvement

- **Useful schedules are only useful if they are used** Stakeholders wont use someone else's schedule
- Key engagement points:
  - Strategy and methods
    Planning -v- Scheduling
  - Resource and duration estimating
  - Monitoring and controlling

Stakeholder Involvement

- Setting the right project strategy is the key
  - Waterfall -v- Agile
  - Contracting approaches
  - Method statements

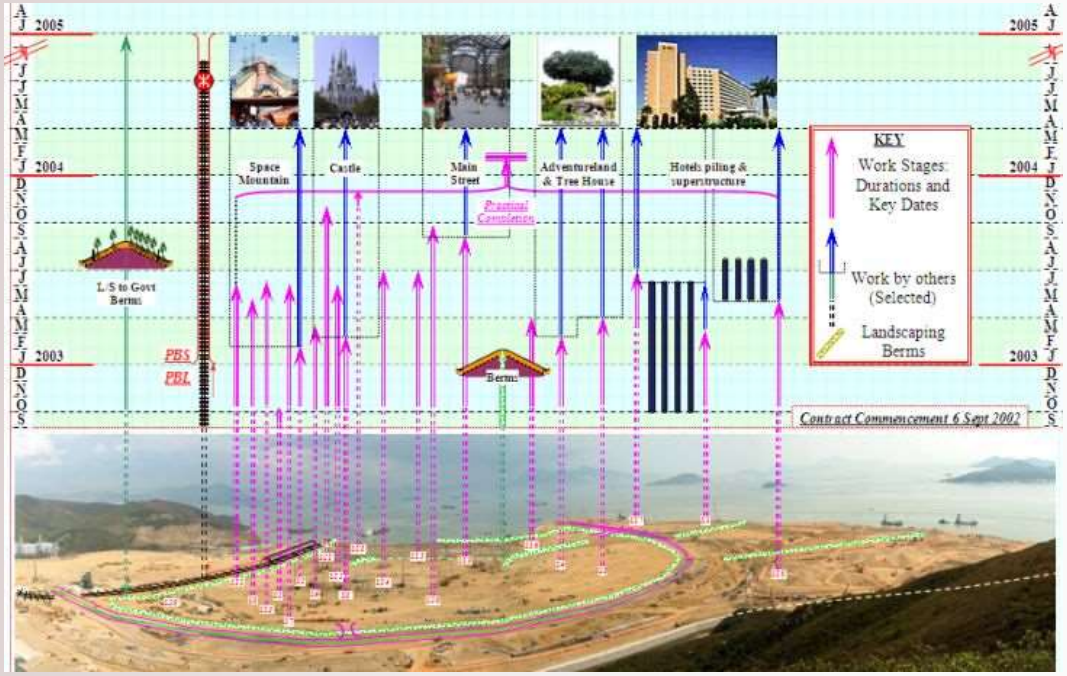


Schedule Format

- Things to consider:
  - Dynamic schedules (fully linked)
  - Schedule Levels (manage size & complexity)
  - Presentation (target your audience)
    - Output layouts
    - Coding to allow data extraction & focus
  - KISS !
- Most people **do not understand** schedule diagrams (but they won't tell you)

Reporting Options

- Executive Reports / Health reports
  - Dashboards



Time/Location images

Hong Kong's Disneyland Resort: the panorama with individual photos and a vertical timescale provide an excellent visual perspective to the project

These high level reports, should be supported by a Level 3 Master Schedule against which actual progress will be measured

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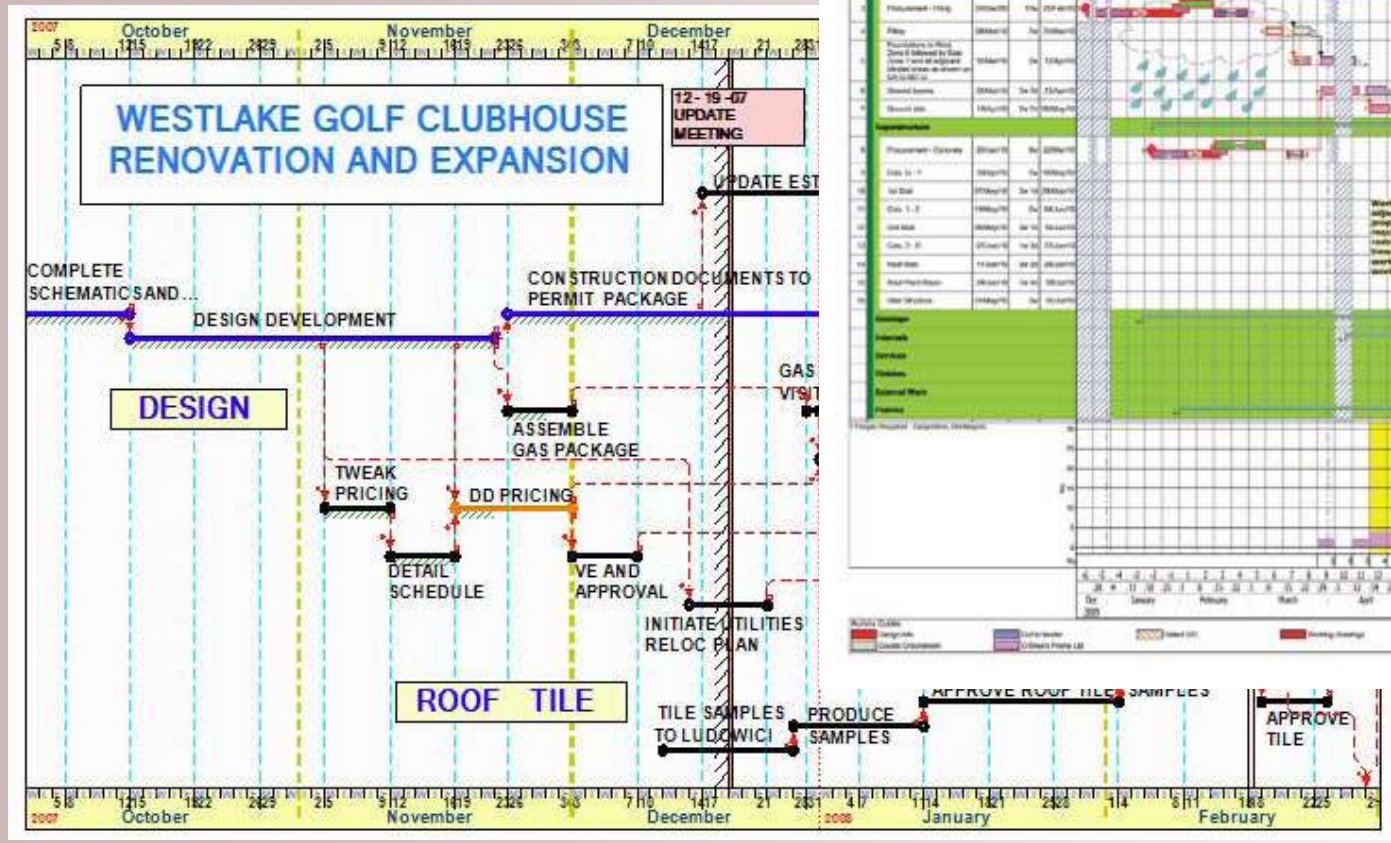
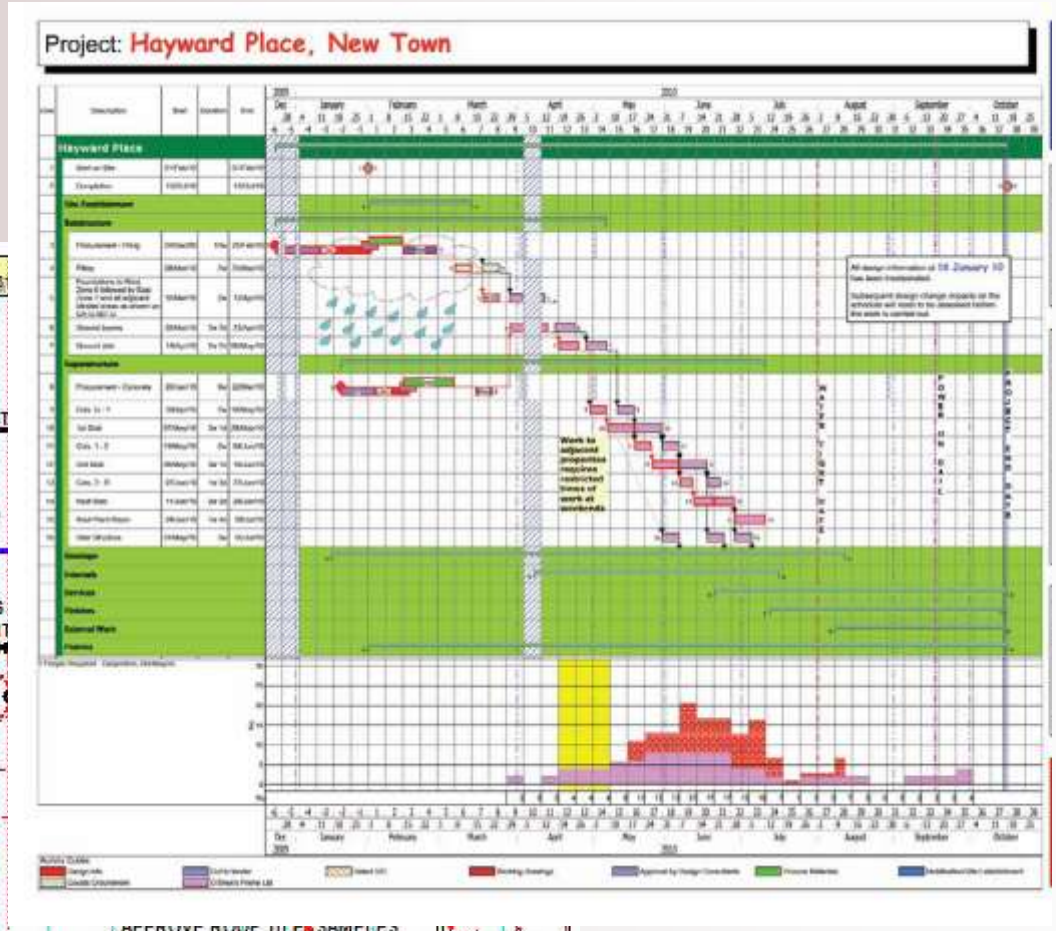
Reporting Options

- Graphical tools

CASCAD-e





Asta Powerproject

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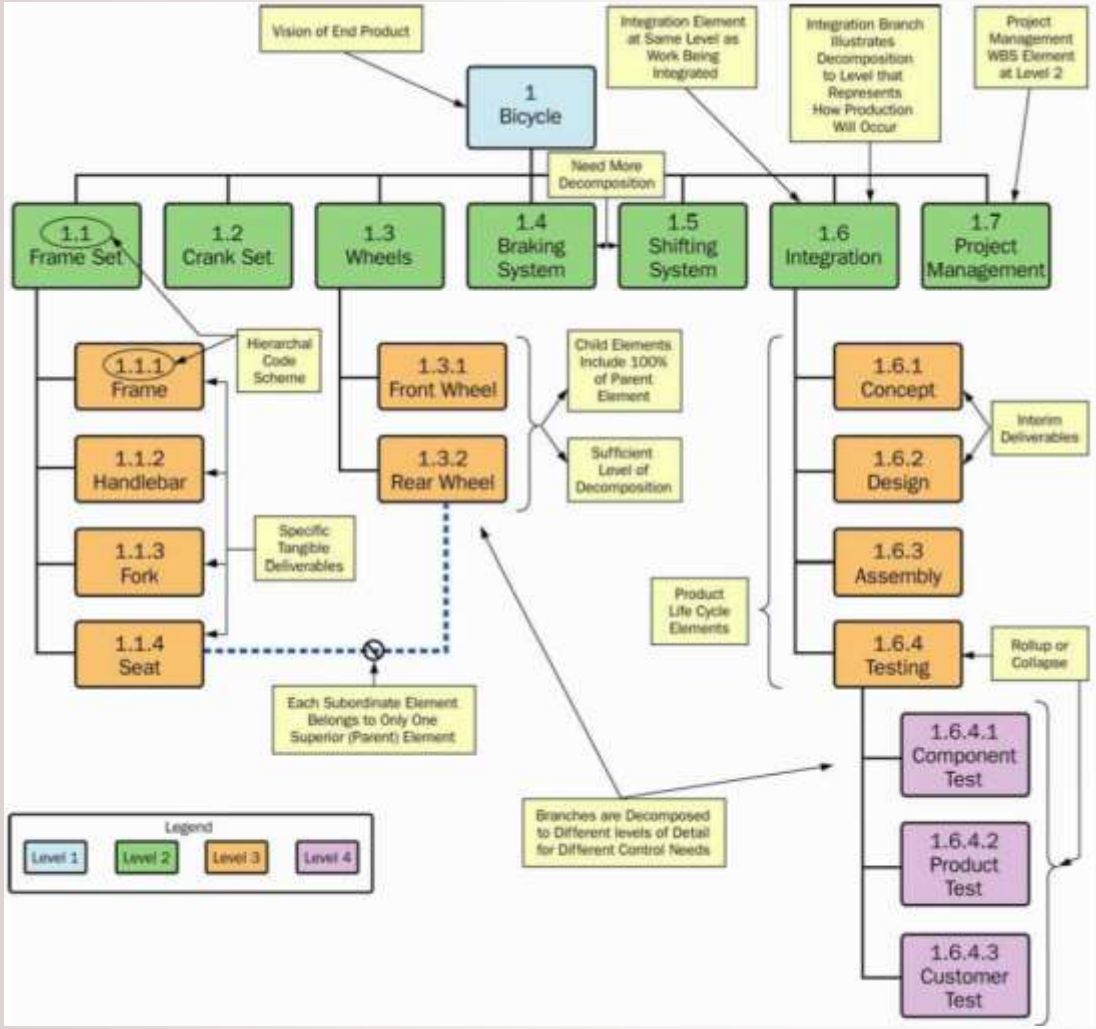
Software

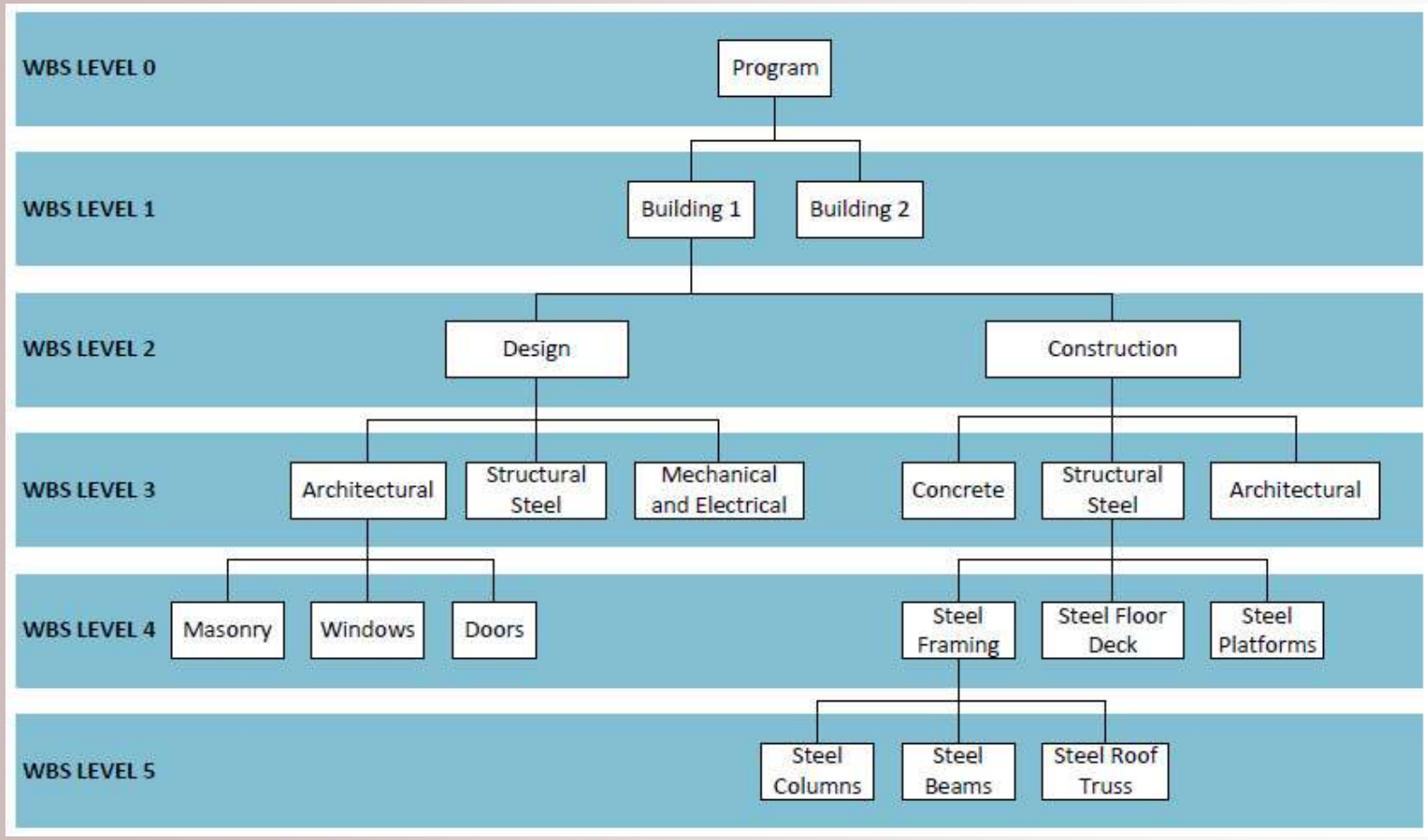
- Take your pick!
- Good software will
  - Allow 2 links between tasks
  - Automatically reschedule incomplete work
  - Allow scheduler to control
    - Retain or ignore sequence on partially complete activities
    - Contiguous / non-contiguous working
  - Correctly allocate calendars to links
  - Manage resource allocation & levelling

Work Breakdown Structure

- 100% Rule
- 1 : Many
- Planning packages & ‘Rolling Wave’

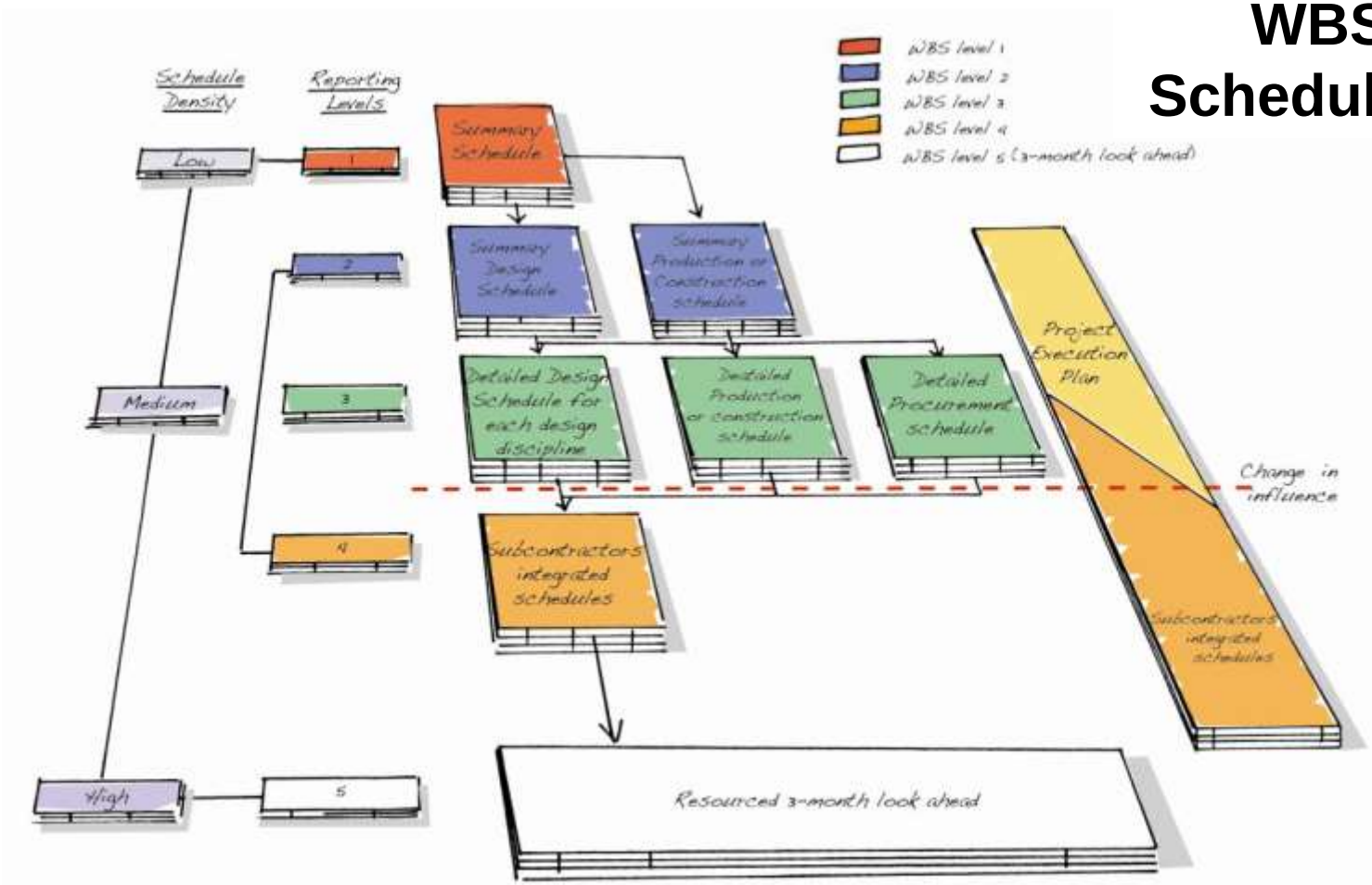


Work Breakdown Structure



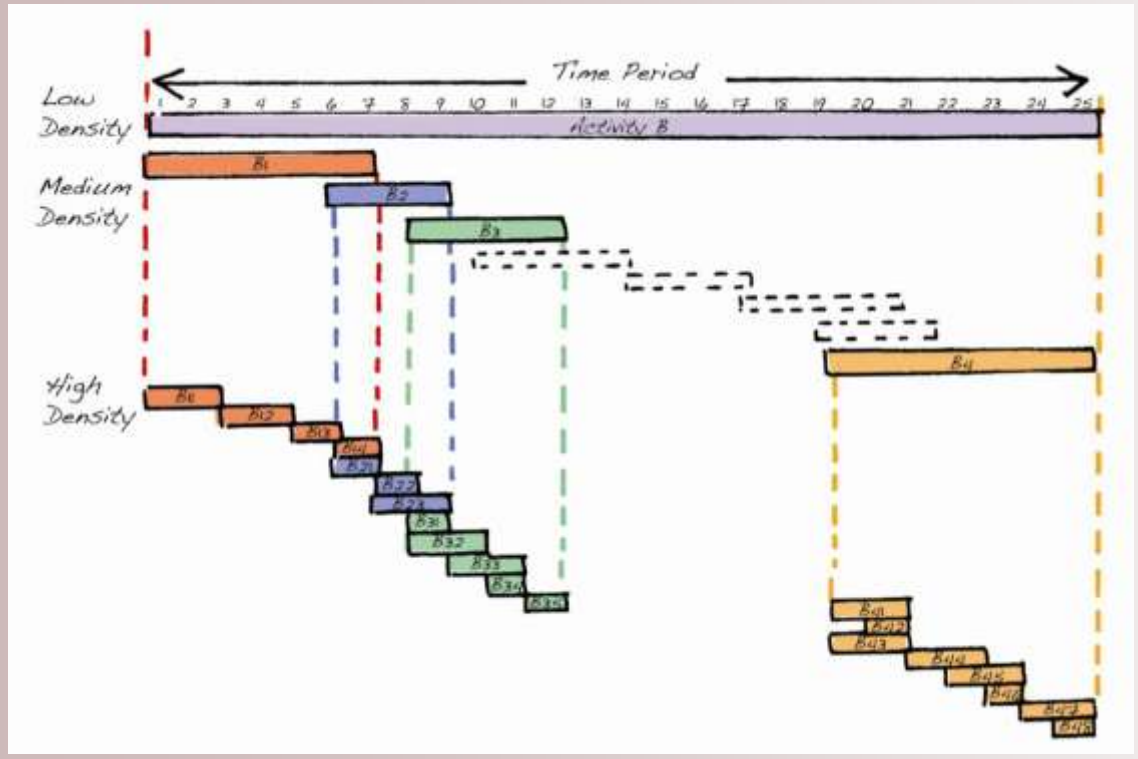
Work Breakdown Structure

Figure © Guide to Good Practice in the Management of Time in Complex Projects



Schedule Density

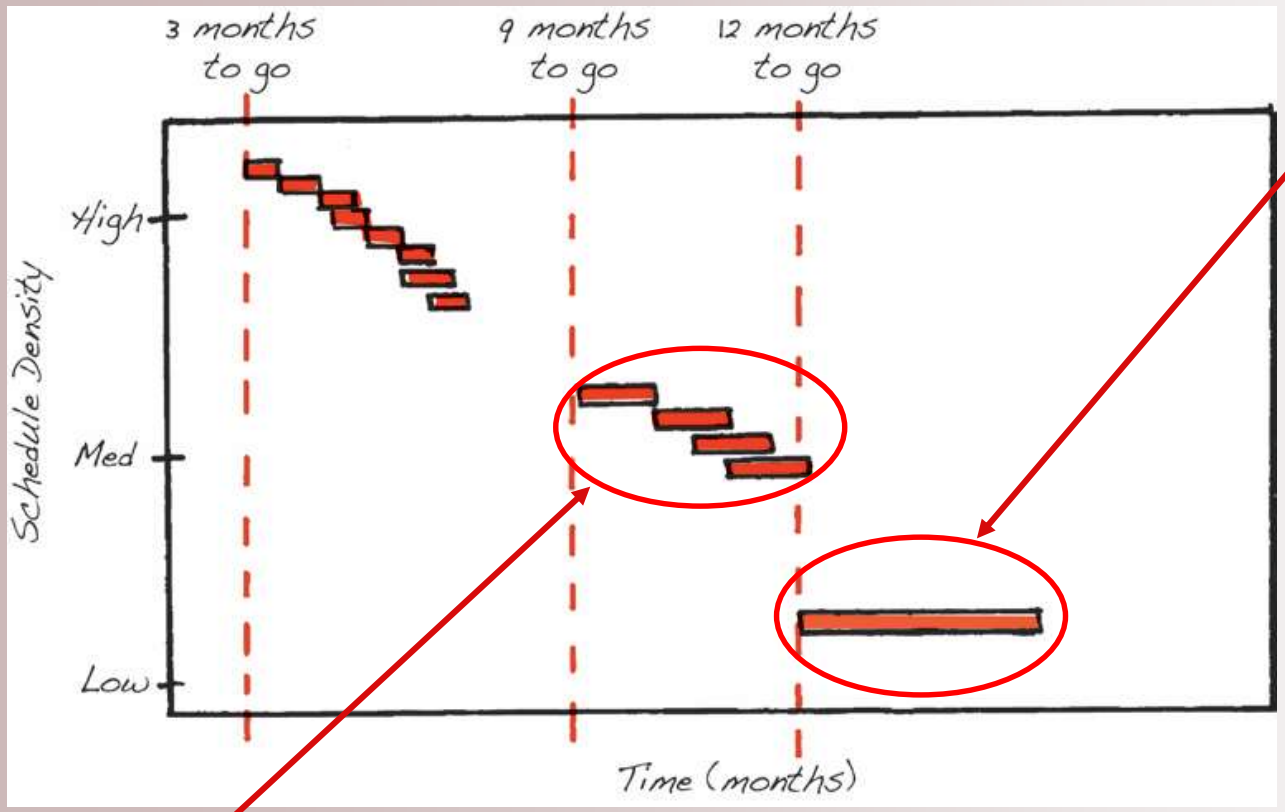
Figures © Guide to Good Practice in the Management of Time in Complex Projects



Activities are progressively expanded to greater levels of ‘density’ as more information becomes available

Unless the work is designed in its entirety and all subcontractors and specialists appointed before any work commences, it is impossible to plan the work in its entirety, in detail at the beginning of a project.

Schedule Density

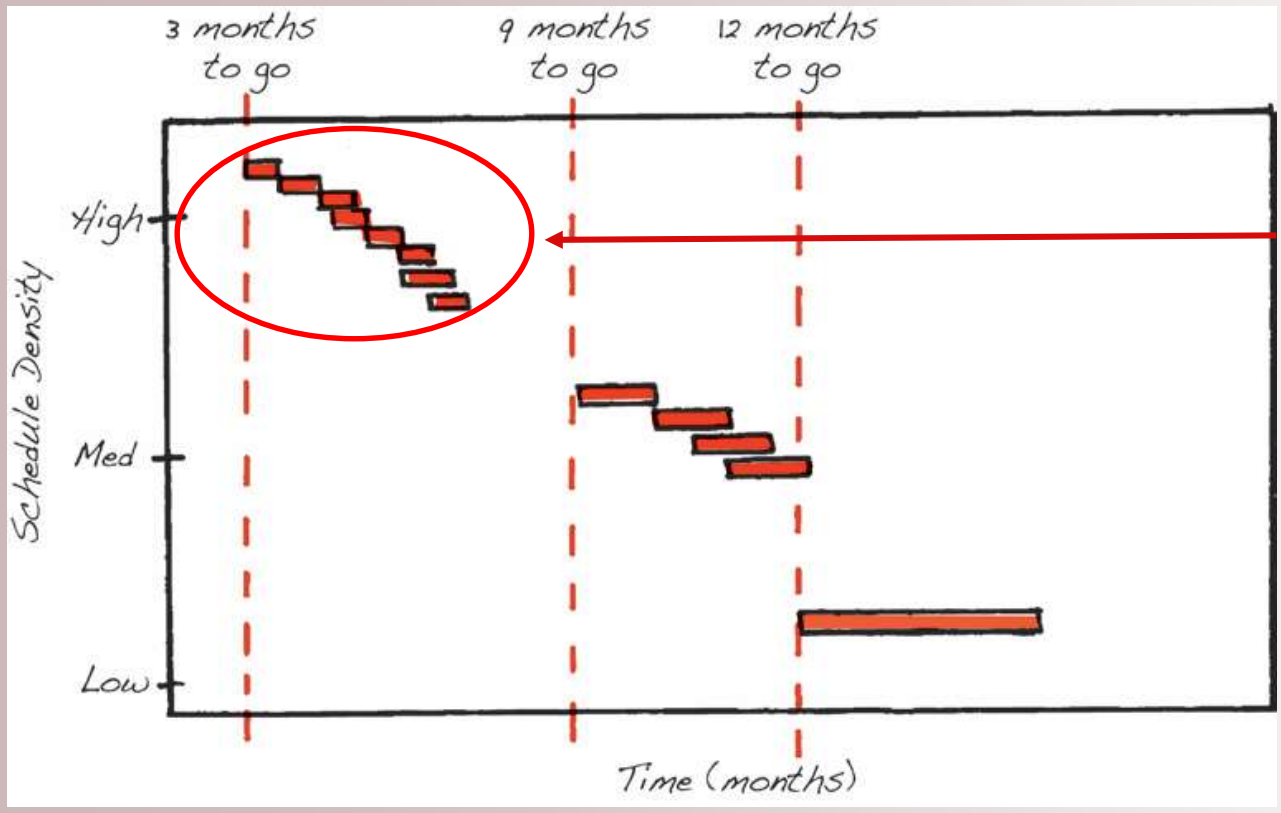


Low-density is appropriate for work, which is intended to take place 12 months, or more in the future.

Tasks may be several months in duration

Medium density is appropriate for work, which is intended to take place between 3 and 9 months after the schedule date. At this stage the work should be designed in sufficient detail to be allocated to contractors, or subcontractors. Task durations should not exceed 2 months.

Schedule Density



High-density scheduling is an essential prerequisite for undertaking work. The schedule is prepared with the people doing the work.

Task durations should be no more than the update cycle

As the density is increased, adjustments to the plan take into account actual performance to date, resources, work content, and other factors necessary to achieve the overall schedule objectives.

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Activity Definition

Activities should be **:**

- The responsibility of a single person or organisation.
- Not be too detailed. They describe the work to be done, not how to do the work
- Not too big. As a **rule of thumb** double the reporting period = maximum duration

Activity Definition

- Do not artificially break up activities;
- Capable of being worked on continuously from start to finish
- The completion of an activity should be obvious
- The scope of the work involved unambiguous.

Activity Definition

- Milestones are zero duration events that signify the start or end of something significant
  - Or an external constraint or deliverable
  - Milestones do not consume resources but may signify a payment point
- Every schedule should have a start and a finish milestone.

Resource & Duration Estimation

- The work involved in an activity is the constant
  - Resource availability and capability affect the duration
  - The required duration affects the resources needed

Resource & Duration Estimation

- The danger of effort driven durations
  - Brooks' Law: **Adding people to a bad project makes it worse!**

The Cost / Efficiency Curve

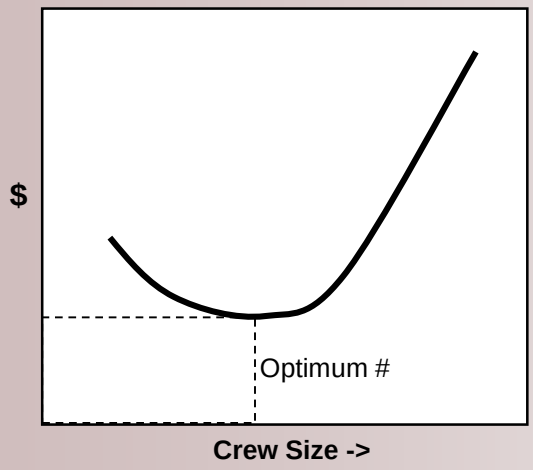


Fig. 1: Typical J-Curve

The Duration Curve

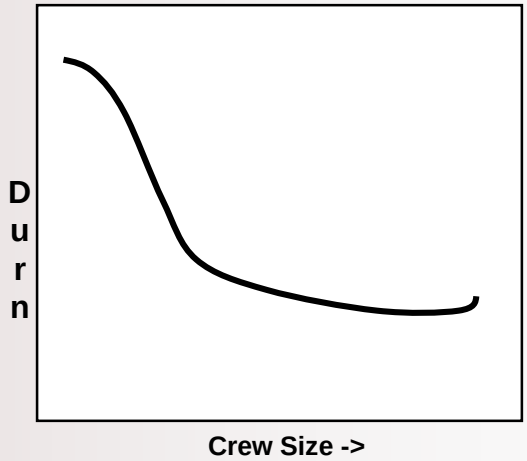
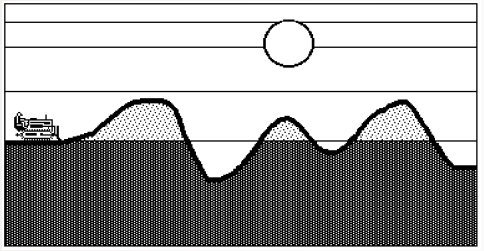


Fig. 2: Crew size -v- Duration

The Mythical Man Month,
Frederick P. Brooks Jr. - Addison-Wesley, Reading USA. 1975

Resource Analysis

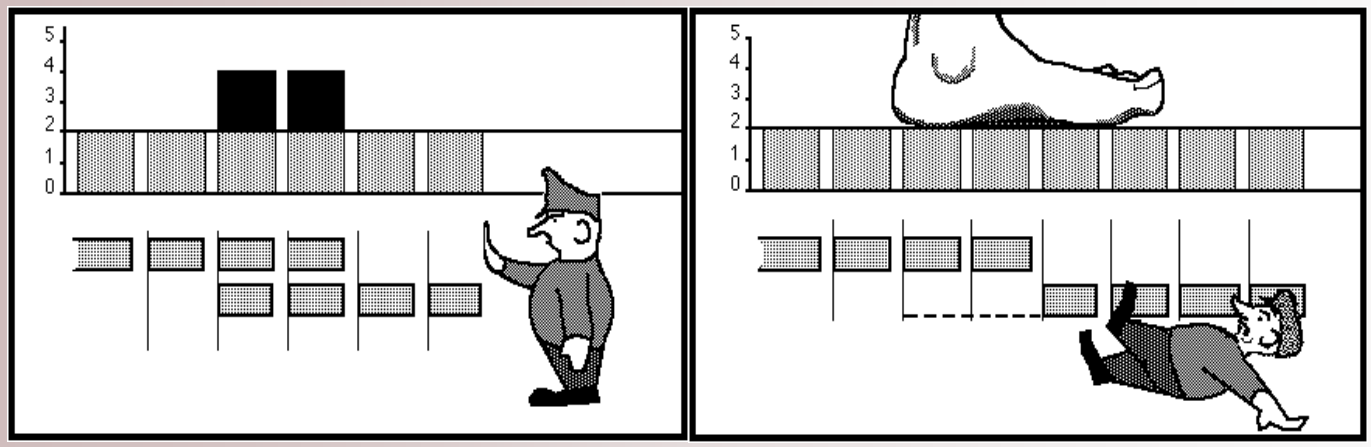
- Adjust demand profiles on tasks
  - Modify distribution curves
  - Extend duration of non critical tasks to lower demand



- Review schedule for inappropriate logic
- Negotiate for required levels of resources (to achieve Time Analysis)
- Agree actual resource allocation

Resource Analysis

Resource Levelling:



The application of rules to smooth out resource demand. Rules may be simple –
'allocate scarce resource to critical activities first'
or they may be complex decision tables

More sophisticated tools use optimisation based on multiple passes through the network

Dealing with uncertainty

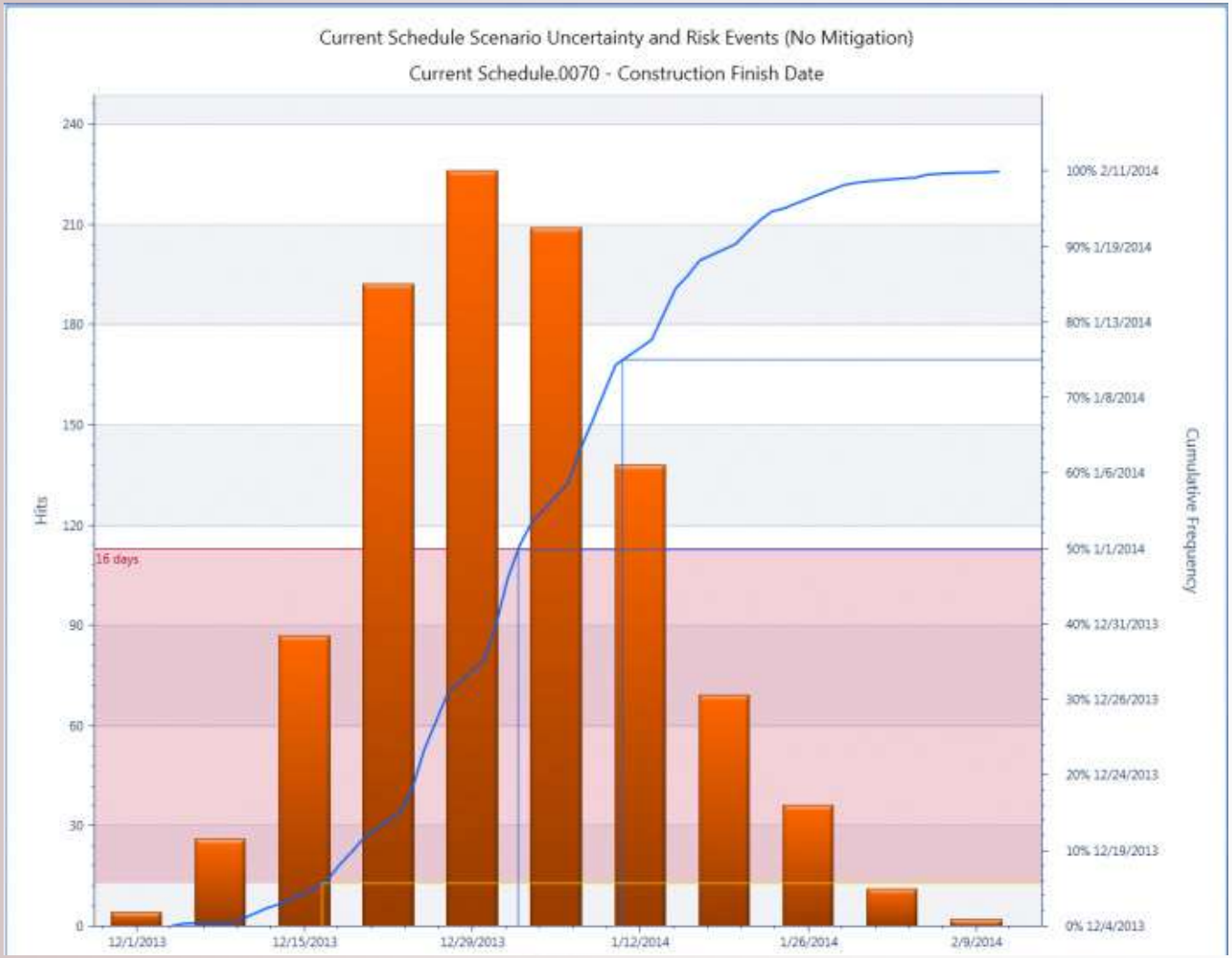
- Modelling uncertainty requires a schedule but the schedule needs to accommodate uncertainty!
- **Build the initial resource levelled schedule to complete in 80% of the contract period**
- Then model risk and contingency
- Then make the fine adjustments

Dealing with uncertainty

- What-if analysis
  - Changes the schedule to test various options
  - The best option is used as the basis for other processes
  - Used for both schedule compression and risk reduction
  - Requires imagination and skill

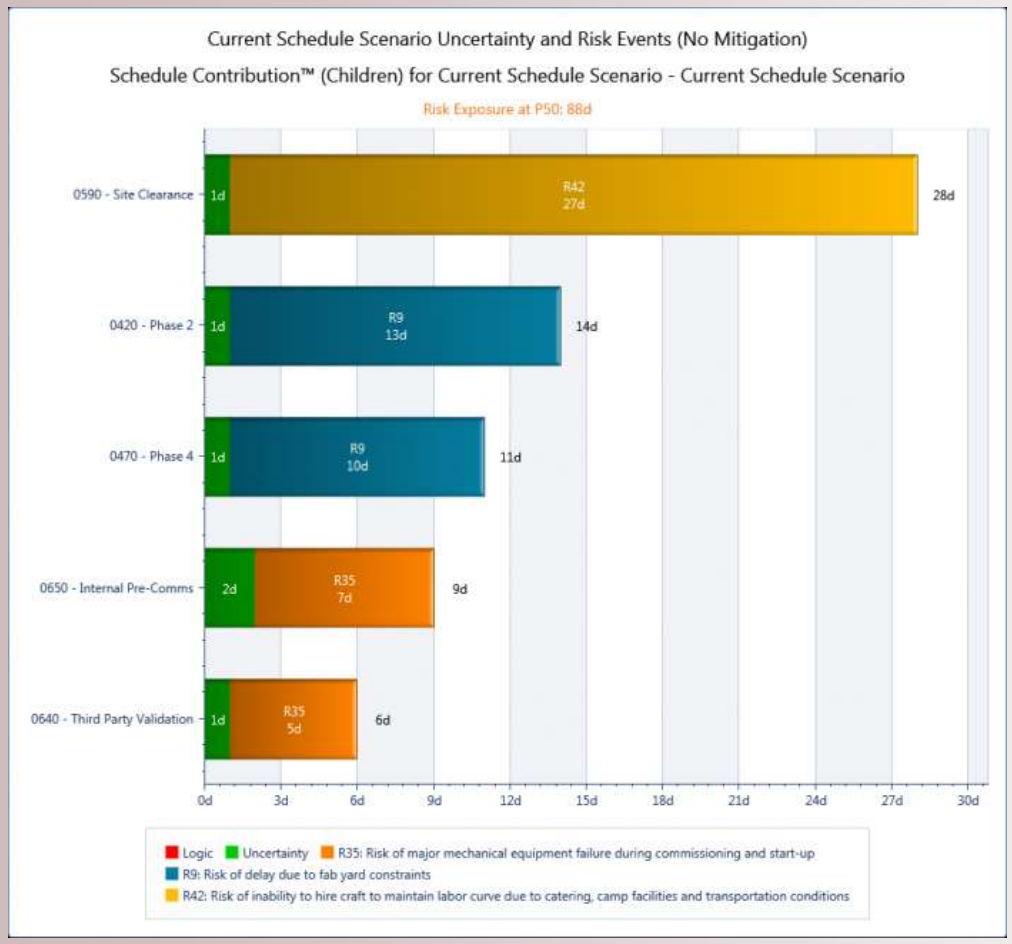
Dealing with uncertainty

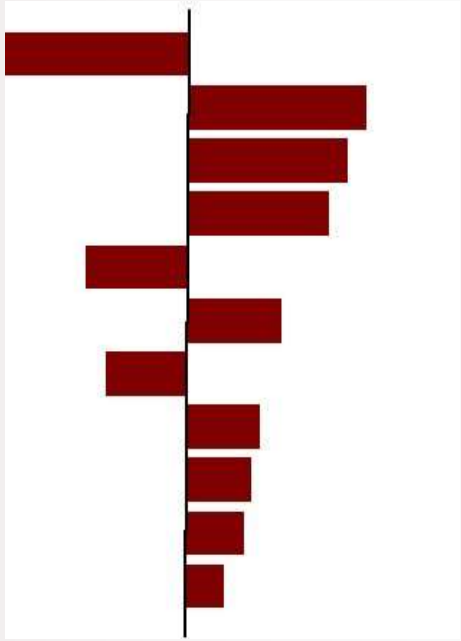
- Monte Carlo



Dealing with uncertainty

- Sensitivity analysis





What risks need to be removed from the schedule?

Problems with ‘crashing’ schedules

- Brooke’s Law: ***Throwing more people at a bad project makes it worse!***
  The Mythical Man-Month - 1975
- More resources need:
  - More workspace
  - More coordination and communication
- Additional resources increase costs and put more stress on management

Problems with ‘fast tracking’ schedules

- Fast tracking = overlapping phases of work that are normally done sequentially
- Increases risk:
  - Risk of rework / handover / freezes
  - More people involved on the work
  - Introduces merge bias (parallel working)
- Requires significantly more management

Stakeholder Approval

- Baseline the schedule
  - Buy-in from project team
  - Supplier / subcontractor agreement
  - Sponsor approval
  - Client approval
- Then set the baseline!

Set Baselines

- Project baselines represent the original commitments that should be honoured
  - May be included in the Contract at an appropriate level of detail
- Project baselines include:
  - Scope (the work to be achieved)
  - Cost (the contract price)
  - Time (the Low Density schedule)
- These are integrated and interdependent

Set Baselines

- Baselines are essential to understand variance!
  - Change from the original plan
  - Change in the recent past
- But the baseline is wrong!
  - It is a model of what might have happened
  - It was based on what is now ‘out of date’ information and assumptions

Set Baselines

- Baselines are valuable:
  - They indicate the expectation of the parties
  - They provide a framework for time management going ‘forward’
- Assessing the variance between the baseline and actual performance provides an indication to the degree of error in the future part of the schedule!

Set Baselines

- Rolling Wave Planning
  - Defined work packages are scheduled in detail (near term)
  - Planning packages are scheduled at a summary level for detailing later (long term / future)
  - Agreed process for updating baselines required

Baseline review

- Schedule quality maters
- Use automated tools
  - Acumen Fuse
  - Schedule Analyzer
  - Schedule Inspector
- Use defined criteria
  - DCMA 14 Points
  - GAO Schedule Assessment Guide

Schedule Quality Assessment

- Two parts of any assessment
  - Technical correctness (use the tools)
  - Relevance & usefulness (common sense)
- Don't schedule in detail what you don't know
  - Proper 'rolling wave' + risk management
- Require expertise at all levels
  - Subcontractor, contractor and client
  - Certifications can help

Schedule Quality Assessment

- Wide range of tests
  - DCMA 14 point assessment, etc
- Effective tools
- Technically correct schedules correlate to good project outcomes

Image: Acumen Fuse
http://www.mosaicprojects.com.au/Planning.html#Conformance

Communicate Schedules

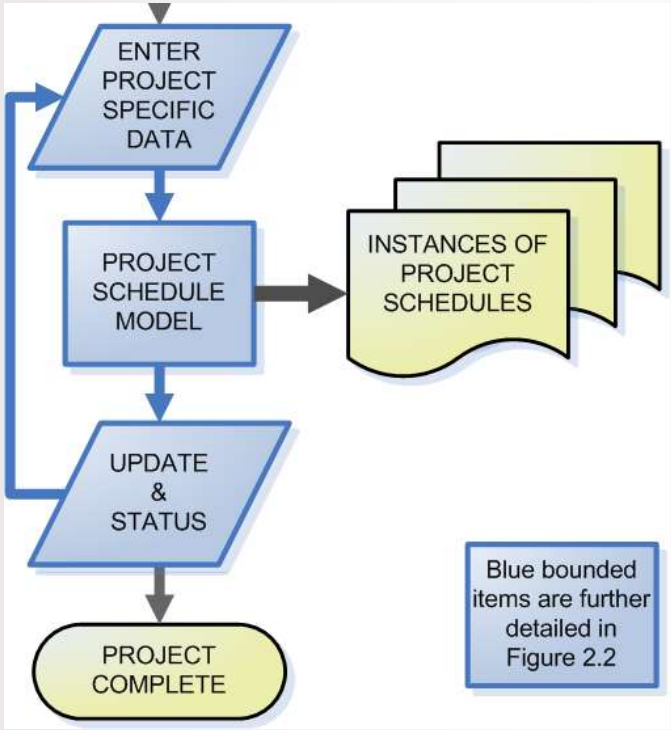
- Develop your communication plan
  - This is more than just reporting!
- Implement the plan
- Monitor its effectiveness

Maintaining the commitment

- All schedules are wrong!
- The key to successful delivery is routinely updating the schedule to:
  - Identify progress to date
  - Develop a realistic forward plan
  - Understand trends and variances
  - Implement preventative and corrective actions to achieve the target completion

Asses Impact of Progress

- Establish a baseline
  - At the development stage
  - As part of a re-baseline
- Record actual progress
- Reschedule from 'data date' (or Time Now)
- Edit for accuracy
  - No tool accurately manages all of the issues around partially complete tasks



Actual Progress data required

- Actual start date of tasks
- Actual finish date of tasks
- How long to finish ‘in progress’ tasks
- Possible additional information
  - Percent complete
  - Actual resource utilisation
  - Costs incurred
  - Problems / issues / road blocks

Monitoring and control

- The key questions to ask to identify delay
- Current variance? For each variance
  - Cause?
  - Trend?
  - Mitigation options / corrective actions?
- Emerging issues and ‘road blocks’
  - Preventative actions?

Monitoring and control

- Percent complete is not the question!
  - Historical view only
- How long to finish the activity defines the variance
  - With reasons for the time
- Information required from the ‘coal face’
  - First line supervisors - Not managers
- Careful observation helps: health checks

Statusing the Schedule

- Move incomplete work to ‘the future’ and adjust logic to maintain relevance
- Compare actual progress with baseline
  - Report variances on current tasks
  - Report variances on major milestones
- Prepare status reports for management review - ‘where we are now’
- Recommendations / scenarios help!

Updating the Schedule

- Seek management **action** to ‘lock in’ progress gains and to mitigate schedule slippages
- Edit schedule to incorporate authorised changes
  - Build the agreed actions into schedule to keep it relevant
- Agree and distribute the ‘update’

Schedule compression

- **What-if** – changing the schedule to test various alternatives
- **Crashing** - maximum compression for the minimum additional cost
- **Fast tracking** - overlapping tasks that would normally be done sequentially

Resource Usage & Forecasts

- Your resources are working at 110%
- They will not suddenly do more next week!
- Make sure the planned work is capable of being achieved by the current team
- Allow time and schedule actions to increase numbers or capabilities
  - This won't happen by accident

Limitations of CPM as a predictive tool

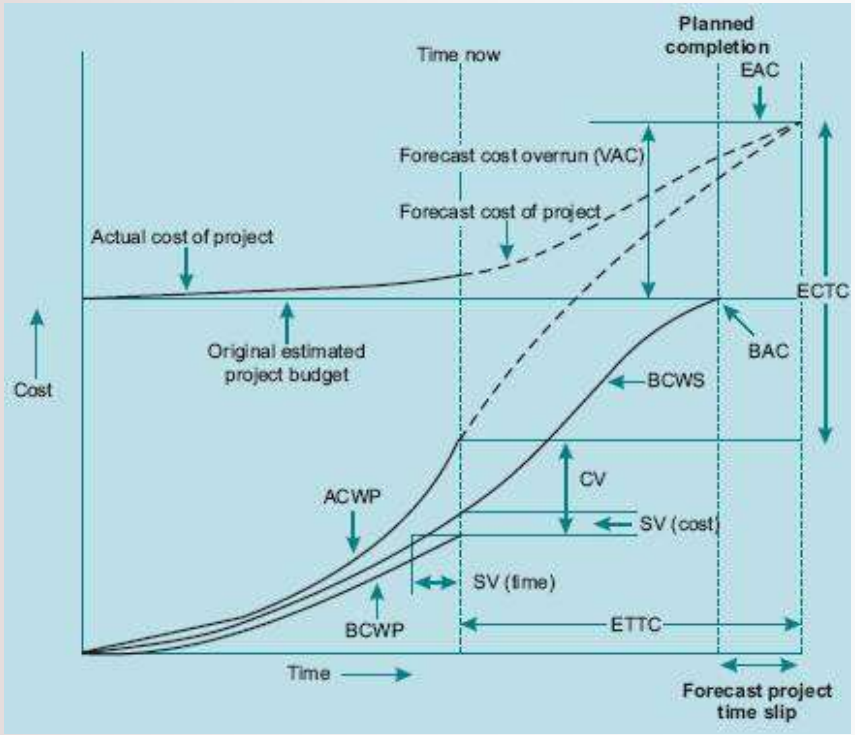
- CPM assumes all future activities will proceed exactly as planned
- CPM ignores:
  - Current productivity rates
  - Trends to date / ‘float burn’
  - Future risks and uncertainties
- This is good for motivating a workforce
- **A disaster for predicting outcomes!**

Forecasts at Completion

- CPM default assumes all future work will occur as planned – this is wildly optimistic!
- Current trends are the best indicator of future performance
- This can be assessed manually
- Earned Schedule is more accurate

Earned Schedule and Earned Value

- Earned Value proves the best predictor of future outcomes is past performance
  - But only works for costs
- EV predictions are based on scaling past performance



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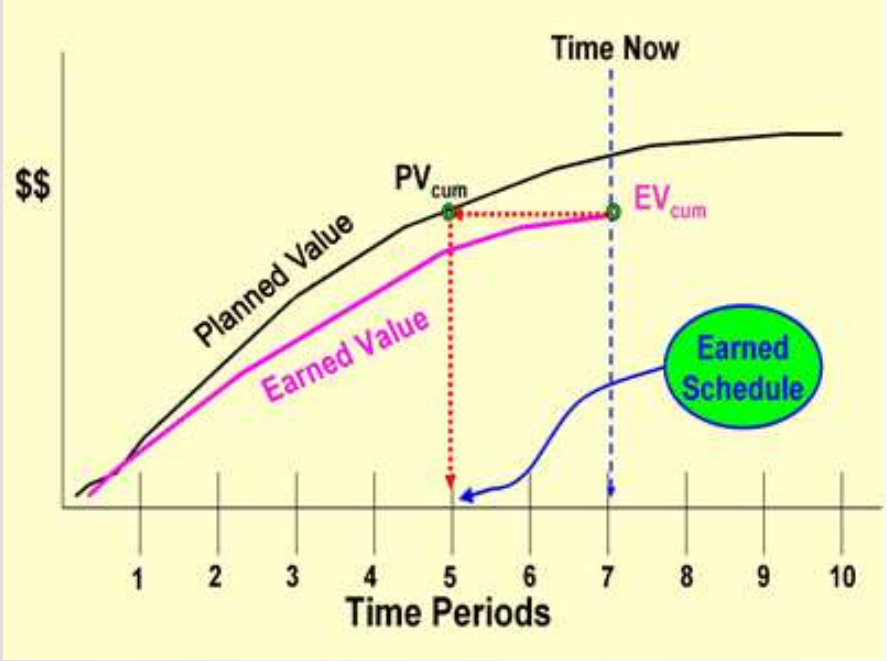
Earned Schedule and Earned Value

- Earned Schedule uses EV data to predict time outcomes
- Provides a ‘best case’ prediction
- Eliminates most of the CPM errors
- Does not include future risk



http://www.earnedschedule.com

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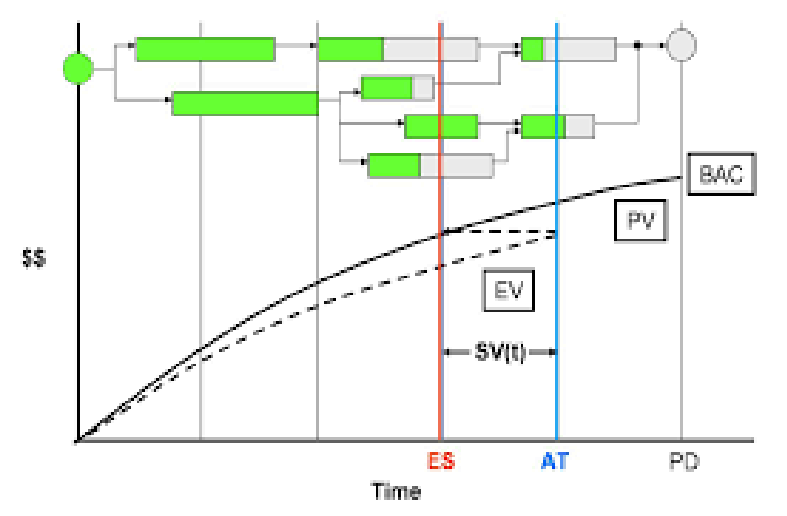
Don’t shoot the messenger

- Allowing ‘bad news’ to be discussed
  - You cant fix an unknown problem!
- Use problem solving where appropriate
  - Many issues are not ‘problems’
- Make sensible decisions to fix the problem not the symptom
  - Cost overruns are always a symptom!
  - Understand the decision framework

Proactive identification

- Early warning indicators:
  - 90% syndrome
  - Schedule adherence (the ‘P-Factor)
  - Inability to predict time to finish activities



Proactive identification

- Float burn
  - Plot the cumulative days of float remaining in the schedule using the baseline schedule
  - Calculate the cumulative days of float remaining after each update
  - Plot the remaining float against the planned float (cumulative)
- Shows if sufficient non-critical work is being achieved

Proactive identification

- Soft issues are more important
  - Error rate / accident rate
  - Staff turnover / sickies
  - Lack of role definition / leadership
  - Lack of team commitment – ‘them & us’
  - Lack of transparency
  - Watermelon reports
- Fixing low moral is a major problem

Work won't change simply by demanding 'better outcomes'

- Current performance is the best indicator of future performance unless something significant changes!
- Poor management is usually a key factor
- You need to support and improve management capabilities **first**
- Then deploy the additional resources to accelerate the work

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Developing a workable recovery plan

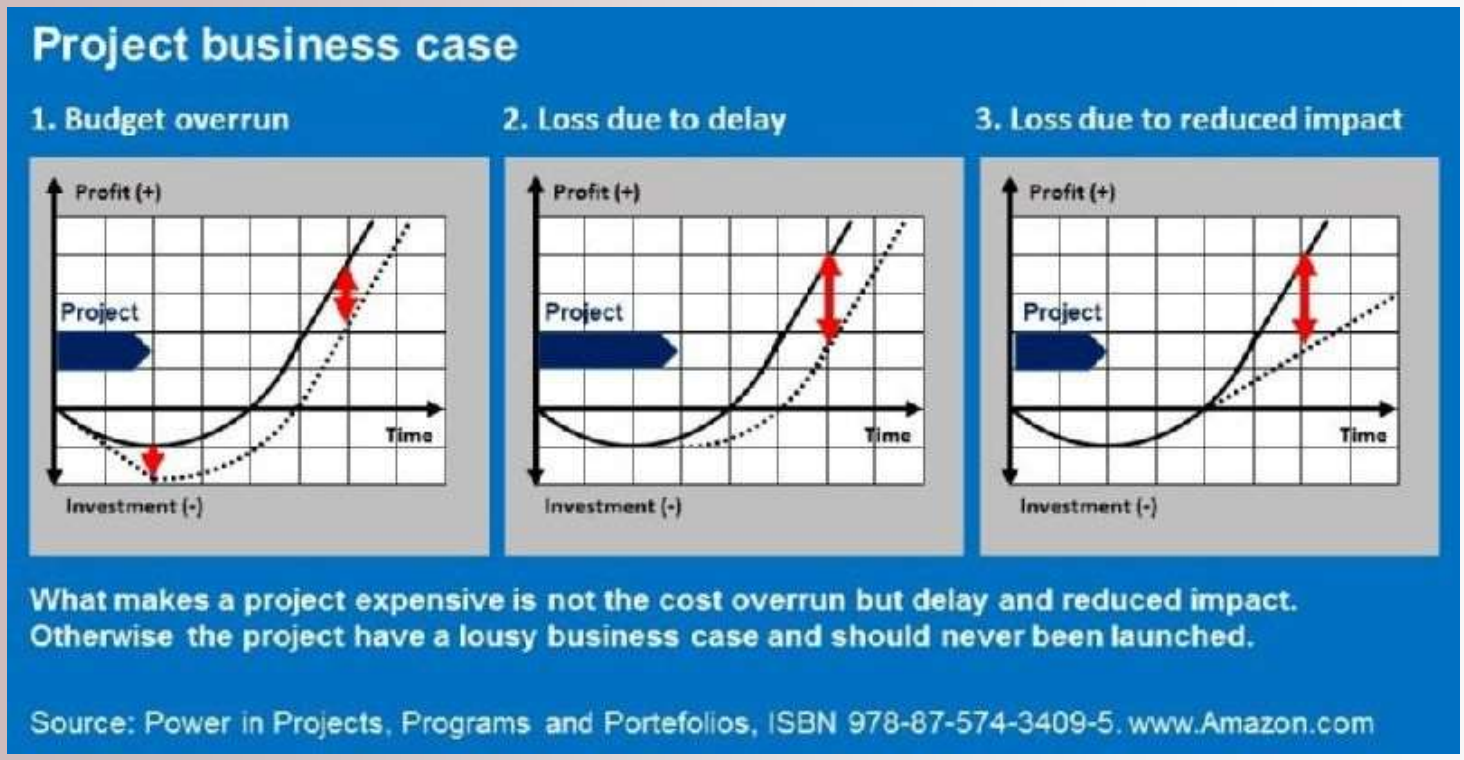
- Get real and accept the problems as-is
  - Delusional thinking will not help!
  - Deal with **all** of the risks
- Develop a realistic and agreed schedule based on current capabilities
- Allow time (months) to increase capabilities and plan the necessary actions with care

Developing a workable recovery plan

- Costs are an outcome not an input!
  - Cost overruns are the least detrimental aspect of a failing project
- Costs can only be reduced by
  - Buying more cheaply
  - Using resources more effectively (schedule)
- You need the people you are paying to collaborate in the solution

Developing a workable recovery plan

- 99% of attempts to ‘cut costs’ will make the situation worse



Developing a workable recovery plan

- Recognise the new level of risk and plan accordingly
  - Contingencies and reserves are essential
- Ensure ownership and buy-in from all of the resource suppliers
- Assign specific and measureable responsibilities for actions
- Prioritise goals – focus on what matters

Developing a workable recovery plan

- Add new capability before removing underperforming resources
- Recognise ‘good resources’ are never cheap (but may be cost effective)
- Don’t expect the people currently ‘fire fighting’ to also have time to work on the recovery plan – you need additional capabilities (short term)

Implementing the recovery plan

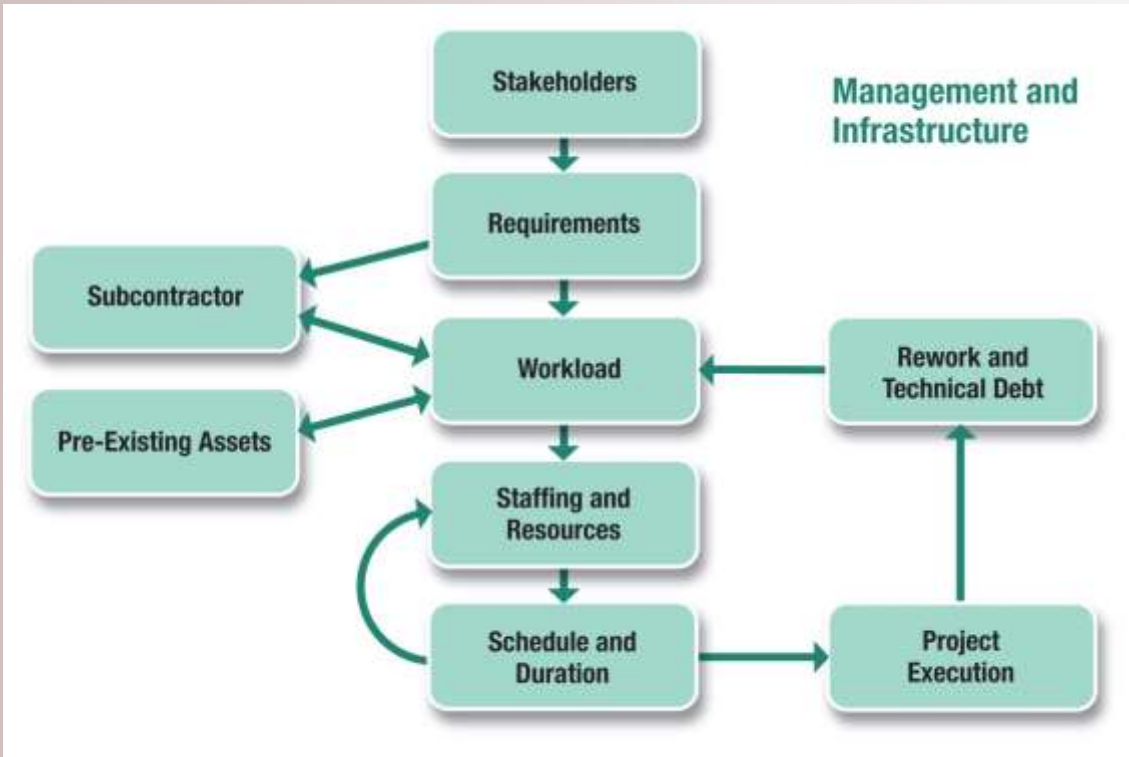
- Baseline the recovery plan
- Communicate the plan effectively to all involved
- Taylor information to people's needs
- Be open and transparent to maintain buy-in
- This is a social process – focus on building the 'team'

The SCRAM approach

- Schedule Compliance Risk Assessment Methodology (SCRAM)

The SCRAM approach

- Root Cause Analysis of Schedule Slippage Model



Closing remarks

- Don’t just knock out a schedule to win the bid (or get paid)
  - You may have to live with it
- Set up proper control systems and procedures before you need them!
  - It is too late when you are in trouble
- Don’t add scheduling and cost control to the project managers’ burden
  - These are specialist functions

Closing remarks

- Don’t shoot the messenger
  - Accurate information is vital
- Don’t arbitrarily slash budgets without proper analysis
  - ***"There is no situation where you can't make things worse"***
    Astronaut Robert Led Curbeam, Jr.
- Don’t wait until the end of the project to prepare claims or defence evidence

Thank You!

- For more resources and papers see:
  http://www.mosaicprojects.com.au/PM-Knowledge_Index.html

- My contact details:
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Questions???

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