

The logo features a yellow ladder with lit candles on top. Below the ladder is a white box with the text "CPM SCHEDULING TURNS 50 A BIRTHDAY CELEBRATION" and a graphic of a red pencil writing on a blue "50" with a birthday cake at the base.

The Origins of Modern Project Management

Patrick Weaver PMP

'An old school scheduler'

VPUG 3rd July 2007

April 15-18, 2007
Vancouver Marriott Pinnacle
Vancouver, British Columbia

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The logo is identical to the one on the first slide, featuring a yellow ladder with lit candles and a white box with the text "CPM SCHEDULING TURNS 50 A BIRTHDAY CELEBRATION" and a graphic of a red pencil writing on a blue "50" with a birthday cake at the base.

Agenda

- Introduction
- Tools of the Profession
- Evolving Theories of Management
- Creating Our Profession
- Conclusions
- Challenges for Schedulers

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Introduction

- Projects are not new
 - Pyramids were built 4500 years ago
 - Sun Tzu wrote 2500 years ago
 - Railways and Canals 18th & 19th Centuries
 - Building 5000+ years of history
- Project Management is different!
 - 'Programs' date from the 1940s
 - 'Project Management' is a creation of the 1960s (or 1970s)

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Introduction

- There is a distinction to be drawn between:
- **Projects** – 'a temporary endeavour undertaken to create a unique product service or result' and
- **'Modern Project Management'** as defined in the PMBOK Guide and similar publications.

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Introduction

- The profession of 'Modern Project Management' exists through, and is defined by:
- Its tools, techniques and processes
- Its underlying management knowhow
- Its 'professional organisations'
 - PMI, AIPM, IPMA, and others
- All three components are necessary for a 'profession' to exist
- This paper will track the evolution of each component

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Tools of the Profession

- Early days
 - Early Tools
 - Operations Research
- CPM at du Pont
- Other 'CPM Like' systems
- Invention of the 'Iron Triangle'
- Project Management 'Scope Creep'
- Tools Conclusion

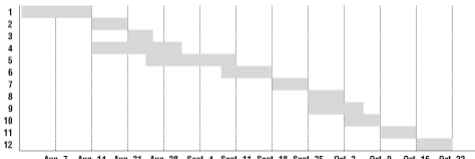
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Tools – Early Tools

- Henry Gantt developed the bar chart in 1917
- Flow-Line evolved in the 1930s
- Line-of-Balance in the 1940s
- Milestone Charts in the 1940s and 50s
- These are all static representations of time



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Tools – Early Tools

- Even before Gantt, some buildings were built remarkably quickly


The **Crystal Palace**, a building the size of a modern shopping mall:

- 1,848 feet [563.3 m] long,
- 408 feet [124.4 m] wide and
- 108 feet [32.9 m] high.

Was built in 8.5 months

- starting on 15 July 1850,
- opening on 1st May 1851.

Erecting a main roof truss, 1851



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Tools – Operations Research

- CPM seems to have evolved from Operations Research (OR)
- Parallel CPM developments occurred in:
 - Europe - Method of Potentials
 - UK CEGB Operational Research Section
 - Du Pont (Kelley and Walker)
 - Polaris SPO (PERT)
- A common link is through Operations Research (& particularly Linear Programming)

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Tools – Operations Research

- OR was invented in the UK in 1938
- The original project was to conduct research into the 'operational' aspects of managing the air warfare space over and around the UK
- By the end of WW2 OR was established in both the UK and USA military
- Following the war OR moved into the US University mainstream and continues as an important branch of applied science through to today

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Tools – Operations Research

- OR uses mathematical (computer) modeling to optimize and improve a complete system
- One of the specific techniques used in OR is Linear Programming
- Mathematically, Linear Programming is the foundation of CPM (Kelley)
- More importantly, the established OR community would have provided the conduit for transferring the idea of CPM around the world.

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Tools – CPM at du Pont

- Critical Path scheduling was 50 years old on the 7th May 2007
- On the 7th May 1957 a meeting in Newark Delaware committed US\$226,400 to a project to develop CPM
 - E.I. duPont's share was \$167,700
 - Remington Rand Univac contributed \$58,700
- Key players
 - From du Pont were lead by Morgan R. Walker
 - From Univac
 - James E. Kelley
 - John Mauchly

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Tools – CPM at du Pont

- But to begin....
- Operations Research and Linear Programming had been going on for years
- Du Pont had been looking for useful things to do with its 'UNIVAC1' computer since mid 1956
- Du Pont's management thought: **Planning, estimating and scheduling seemed like a good idea!**

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Tools – CPM at du Pont

- Walker was given the job
- but others had started studying the problem...
- Univac decided to help 'to keep IBM at bay' – competition can be useful.....
- Kelley was the mathematician and computer expert nominated by Mauchly to 'solve the problem'

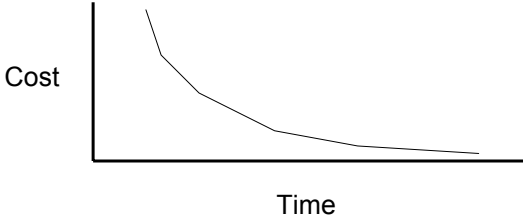
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Tools – CPM at du Pont

- The challenge was to solve the time-cost conundrum
- Working on the 'right' tasks can reduce time without significantly increasing cost




Cost

Time

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Tools – CPM at du Pont

- Kelley borrowed from 'linear programming' and used the i-j notation to describe the relationship between activities.....
- But.....
- Unless you were a mathematician the concept of i-j was meaningless!

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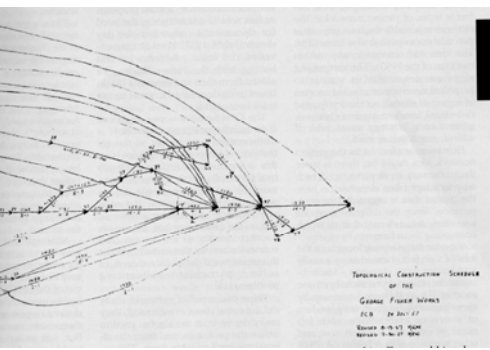
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Tools – CPM at du Pont


- The 'Activity-on-Arrow' diagram was developed to explain the mathematics to management!

Section of the first CPM network for the 'Fisher' works – July 1957. Interestingly, the idea of writing descriptions on the network did not come until much later.....



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Tools – CPM at du Pont

- Fast forward.....
- CPM saved duPont 25% on their shutdowns
- But they dropped the system
- So did RemRand....
- Mauchly & Associates (including Kelley) commercialised CPM in the 1960s
- And nothing has been the same since!

For more on this story see: '**A Brief History of Scheduling**' at www.mosaicprojects.com.au/Resources_Papers.html

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Tools – Other Systems

- The late 1950s saw a rash of scheduling systems developed in parallel
- We will look briefly at two:
- PERT
- Precedence Networking

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Other Systems – PERT

- PERT was developed independently
- The system was always 6 months to a year behind du Pont
- But the PERT team invented the term 'critical path'
- CPM was popular but expensive – solving scheduling problems (eg loops) could cost the price of a small car!

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Other Systems – Precedence

- In 1961 Dr. John Fondahl published a report entitled.....
- ‘A Non-computer Approach to Critical Path Methods for the Construction Industry’
- The methodology was developed between 1958 and 1961
- It described the PDM system of scheduling which is now used by every scheduling system!

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Other Systems – Precedence

- H.B. Zachry Co (Texas) seem to be responsible.....
- They were using CPM from 1959 onwards
- By 1962 they had developed a program running on their IBM 1620 mainframe using the new ‘precedence’ or ‘sequence’ methodology
- In 1963 Zachry and IBM entered into a JV to develop and market the system
- IBM's PCS* was borne and proceeded to take over the world!

PCS = Project Control system

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The PCs

- In 1979 the Apple PC was developed and 'Micro Planning Services' was started in the UK
- 'Micro Planner' was launched for the Apple II in 1980
- By 1982 IBM had entered the PC market and an explosion of PC based planning systems occurred

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Origins of Primavera

- May 1983 saw the start of Primavera by:
 - Dick Faris
 - Joel Koppelman and
 - Les Seskin (who owned a mainframe scheduling system)
- Les's system was converted to the IBM PC and the rest is history
- But where did the name come from?

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Loss of Control

- Prior to the 1980s
 - Planning was a serious business
 - Used very expensive assets
 - Required significant training and skill
 - Was largely centralised and ‘visible’
- But from the earliest days Kelley noticed considerable variation in results from students on his courses

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Loss of Control

- Since the 1980s
 - Planning has migrated to the desktop
 - ‘Anyone’ can schedule
 - There is no training or oversight
 - The average schedule is littered with ‘fixes’ allowed or encouraged by the tool
- Many people learn ‘scheduling’ from using tools like MS Project!

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Loss of Control

- As a consequence, the importance of scheduling has dropped in most organisations
- And most projects run late!
- But the tide is turning.....

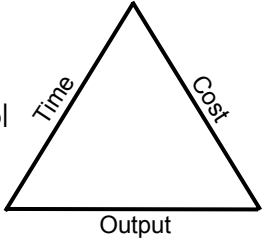
We will come back to this later.....

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Tools – The ‘Iron Triangle’

- First described by Dr. Martin Barnes in 1969 (we think)
- The ‘Iron Triangle’ is central to project management (time - cost - scope)
- Scientific methods of cost control date from the 14th century*
- Scope and quality control from even earlier, with steady innovation**



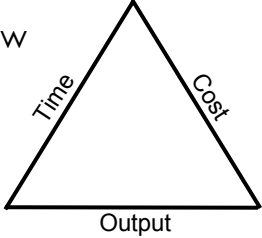
* Double entry bookkeeping
** Eg the development of engineering drawings in the 18thC

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Tools – The ‘Iron Triangle’


- Prior to CPM, time control lacked any form of ‘scientific process’
- Time control was still ‘important’
- And was the subject of numerous ‘disputes*’
- But it was a subjective view
- CPM introduced calculations and process
- Martin Barnes did the connecting



* Eg Wells -v- Army & Navy Cooperative Society 1903

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Tools - ‘Scope Creep’

- From ‘time, cost and output’ Project management has:
- Expanded to the 9 areas of the PMBOK (Many more if using the APM BoK – UK)
- Divided into Project, Program and Portfolio management
- Shifted focus from ‘hard skills’ to ‘soft skills’
- And continues to evolve

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Tools – Conclusion

- Modern Project Management has its special tool – CPM Scheduling
- It has also borrowed and adapted other tools to the project environment
- But possessing tools alone will not create a profession.

The development of CPM is discussed in detail in:
'A Brief History of Scheduling' at
www.mosaicprojects.com.au/Resources_Papers.html



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Evolving Theories of Management

- Introduction
- Pre-classical (Industrial Revolution)
- Classical School
 - Scientific Management
 - Bureaucracy & Administrative Management
- Human Relations School
- Human Resources School
- Systems Theory & Contingency View
- Emerging Management Positions
- Management Theories - Conclusion



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Theories of Management - Introduction

- Project management is a 'modern management theory'
- 'Projects' do not exist in nature, they are created by people (stakeholders) for their convenience and to help understanding and control
- The product of a project may be:
 - Tangible (eg a building) or
 - Intangible (eg a 'culture change')
- Its scope is determined by the project stakeholders (customer)

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Theories of Management - Introduction

- A building is tangible (defined)
- The project to 'build the building' may be BOOT / PPP / D&C / Trad. Tender / ????
- The project's scope parameters, within which the Project Manager manages, vary and are created by the project stakeholders choice of procurement
- Modern project management is relatively new and has developed to deal with this type of variability
- But where did the ideas originate?

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Pre-classical Theories

- The underpinning ideas that allowed the development of 'Western' management can be traced back to the Protestant reformation of the 15th century
- Key elements dating from this time include:
 - Reductionism
 - Individualism
 - The 'PWE'
- These ideas were incorporated into the two key philosophies that support classical 'Scientific Management'

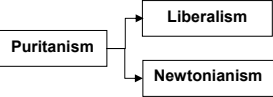
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Pre-classical Theories

- The Protestant reformation gave rise to the Puritan Movement
- Liberalism includes the ideas of capitalism and the division of labor
- Newtonianism marks the era of scientific enquiry




```

graph LR
  A[Puritanism] --> B[Liberalism]
  A --> C[Newtonianism]
  
```

For a full discussion of this diagram see 'The impact of Puritan ideology on aspects of project management'. International Journal of Project Management 25 (2007) 10-2015

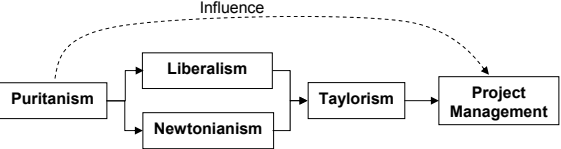
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Pre-classical Theories

- ‘Scientific Management’ builds on these ideas and focuses on increased productivity
- The ideas from ‘Scientific Management’ underpin most of the ‘hard skills’ of modern project management




```

graph LR
    Puritanism -- Influence --> Liberalism
    Puritanism -- Influence --> Newtonianism
    Liberalism --> Taylorism
    Newtonianism --> Taylorism
    Taylorism --> ProjectManagement[Project Management]
            
```

For a full discussion of this diagram see ‘The impact of Puritan ideology on aspects of project management’. International Journal of Project Management 25 (2007) 10-2015

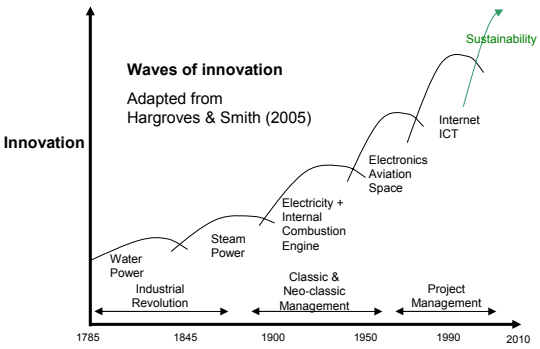
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Pre-classical Theories

- Management theory and practice developed in response to changes in the business world driven by innovation




Waves of innovation
Adapted from Hargroves & Smith (2005)

The graph plots Innovation on the y-axis against time on the x-axis (1785 to 2010). It shows a series of waves representing different eras of innovation: Water Power (1785-1845), Industrial Revolution (1845-1900), Steam Power (1845-1900), Electricity + Internal Combustion Engine (1900-1950), Classic & Neo-classic Management (1900-1950), Electronics Aviation Space (1950-1990), Internet ICT (1990-2010), and Sustainability (2010 onwards). Project Management is shown as a period spanning from the Industrial Revolution to the end of the 20th century.

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Scientific Management

- Part of the 'classical school' of management
- Focuses on:
 - Discovering the 'best way' to do a job
 - Breaking the job into its constituent parts
 - Studying and timing the 'parts'
 - Designing the most efficient way to do the job
- Henry Gantt was a member of this 'Classic School' of management thinking

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Classical School (Other theories)

- Bureaucratic Management
 - Clearly defined, specialized functions
 - Hierarchical form
 - Written rules and procedures
- Administrative Management
 - The 'functions of management'
Plan, Organize, Command, Coordinate, Control
 - Fourteen principles including
 - Authority and responsibility
 - Unity of command
 - Centralization

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Human Relations School & Human Resources School

- Neo-classical schools
- Motivation theories
- Communications systems
- Acceptance of authority
- Leadership

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Systems Theory & Contingency View

- Systems Theory:
 - A system is an interrelated and interdependent set of elements functioning as a whole
 - Synergy allows the 'system' to produce more than the sum of its parts
- Contingency View
 - There is no 'one right way'
 - Different situations and conditions require the application of different management techniques

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Emerging Management Positions

- Quality management (customer satisfaction)
- Reengineering
- Project, Program, Portfolio Management
- Chaos Theory
 - The corporation is a complex adaptive system that interacts and evolves with its surroundings
 - Systems operate best in the narrow space between stability and disorder – poised at ‘the edge of chaos.’

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Management Theories Conclusion

- The development of general management theory created the conditions that allowed modern project management to develop
- Modern project management has borrowed and adapted many aspects of general management theory
- The ‘roots’ of modern project management can be traced to the Protestant reformation of the 15th century

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Management Theories Conclusion

- Project management has evolved from 'classic / scientific' to a 'neo-classic / human' focus in its short existence
- Are we now heading into 'Chaos'
- Or have we already arrived?

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Creating Our Profession

- Definition of a Profession
- The Profession of Modern Project Management
- The Role of the 'Associations' in creating the profession:
 - INTERNET / IPMA
 - PMI
 - AIPM
- Profession - Conclusion

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Definition of a Profession

- Practitioners are required to meet formal educational and entry requirements ✗
- Autonomy over the terms and conditions of practice ?
- A code of ethics ✓
- A commitment to service ideals ✓
- A monopoly over a discrete body of knowledge and related skills ✓

Modern Project Management is probably best Described as an 'emerging profession'

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The Profession of Modern Project Management

- The term 'project management' is a creation of the last 30 years
- The catalyst for its spread was the creation of 'Project Management Associations'
- The key players involved in establishing the 'Associations' were schedulers
- And the 'Associations' created the 'profession'
- They have.....

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The Role of the 'Associations'

- Developed a generally consistent view of 'project management'
- Encoded these views into 'Bodies of Knowledge' (BoKs)
- Described competent behaviours and are now certifying knowledgeable and/or competent 'Project Managers'
- Sponsored conferences and research into project management
- Worked to create a global community of 'project managers'

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INTERNET / IPMA

- Formed in 1965 as INTERNET
- Remained focused on 'network analysis' through to the 1970s
- Was the catalyst for the formation of the APM in the UK in 1972
- APM also focused on scheduling for several years
- Changed its name to IPMA after the emergence of the other 'internet'

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PMI

- Founded in 1969
- The founding group had a 'significant majority' of schedulers in its number
- Formed around a 'common interest in scheduling'
- But recognized there was more to 'PM' than construction scheduling

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AIPM

- Founded in 1976
- The first 'Association' to formally focus on 'project management' from its inception
- The majority of the people in the founding group were project schedulers and cost engineers.

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Profession - Conclusion

- Most of the attributes of a profession are present for 'project management'
- The 'weak areas' are progressively being improved
- The 'profession' was created by the Associations
- The 'associations' were largely created by schedulers
- Their focus on special techniques rather than 'products' allowed PM to develop separately from other industries such as construction or engineering

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Conclusions

- The 50th Anniversary of the beginning of CPM was the 7th May 2007
- This date also marks the start of the processes that led to the creation of 'modern project management'
- Therefore, it definitely looks like 'modern project management' as we know it is all our fault!

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The Challenge for Schedulers

- The focus on ever increasing levels of detail to 'gain control' of schedules is based on 'Classical' command and control management theory – the world has changed!
- Control is impossible – guidance, collaboration, teams, flexibility are what's needed
- How can we adapt CPM to be relevant?

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The Challenge for Schedulers

- Some answers:
 - 2 planned papers....
 - PMOZ (Aug): **Trends in Modern Project Management - Past, Present and Future**
 - PMI Congress Atlanta (Oct): **Getting the 'soft stuff' right - Effective communication is the key to successful project outcomes!**
- Available from www.mosaicprojects.com.au/Resources_Papers.html (after presentation)

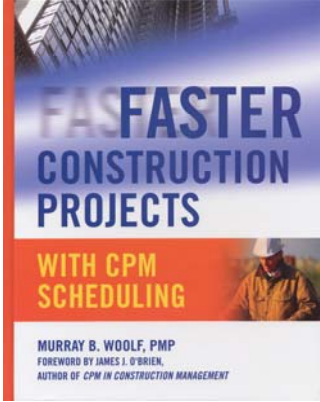
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The Challenge for Schedulers

- A challenging new book:
 - 'Momentology'
 - 'Dilemmas'
 - Most delays are 'between tasks'




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The Origins of Modern Project Management



Questions Please

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