POWER TO STAKEHOLDERS:
THE GPM PLANNERS' CREDO

GUI PONCE DE LEON, PhD, PE, PMP, LEED AP

PRESENTATION DECK



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San Diego Marriott Marquis & Marina

PMATechnologies, LLC



Dr. Gui Ponce de Leon

Chief Executive Officer
PMA Consultants, LLC

Dr. Gui's career in project management spans four decades. Since 2004, he has led the development of PMA's groundbreaking graphical path method (GPM) of planning/scheduling and its software embodiments, NetPoint® and NetRisk™. With GPM, Dr. Gui is on a quest to transform project scheduling from a task performed by specialists using a "black box" to a stakeholder-centric process that relies on visual, graphical, sufficiently simple, kinetic, and cognitively responsive decision support tools that promote collaboration and enhance stakeholder interaction

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STEPPING BACK TO MAY 2008

To frame the conversation, allow me to quote from the Preface to the paper introducing GPM presented at the 2008 PMI College of Scheduling 5th Annual Conference in Chicago:

2008 PMICOS 5th ANNUAL CONFERENCE, CHICAGO, IL

"This new process, GPM, better facilitates planning and scheduling by making it a hands-on, planning-dominated process. GPM allows project managers, superintendents, key subcontractors and other stakeholders to collaboratively, in one session, network a project by graphically positioning activities on a time scale, using a variety of simple and intuitive logic ties to convey activity relationships."

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STEPPING BACK TO MAY 2008 *(CONT'D)*

2008 PMICOS 5th ANNUAL CONFERENCE, CHICAGO, IL

The Preface continues…

"If resources are associated with activities as added or repositioned, GPM continuously displays the evolving resource profile(s). Combining the best of precedence diagramming and arrow diagramming into a new diagramming paradigm, GPM emphasizes the planning process for stakeholders charged with delivering the project but who are not professional schedulers."

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THE METHOD AS APPLIED IN PLANNING/SCHEDULING

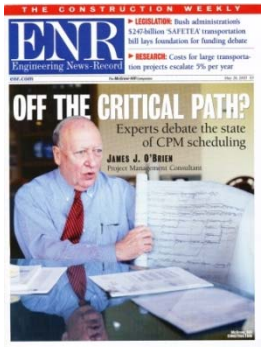
The *engine* behind digital graphical and visualization tools that kinetically calculate and display the schedule as stakeholders physically manipulate activities, milestones, and benchmarks

- Activities may be on planned dates without date constraints or preferential logic
- An activity on planned dates can *drift* back and may *float* forward
- As an activity is manipulated, GPM algorithms kinetically reposition impacted activities without invoking the CPM forward pass or backward pass
- Both *forward* planning and *backward* planning are allowed
- For every data date, total floats left of the data date are calculated, which allows algorithmic identification of the *then-existing* as-built critical path

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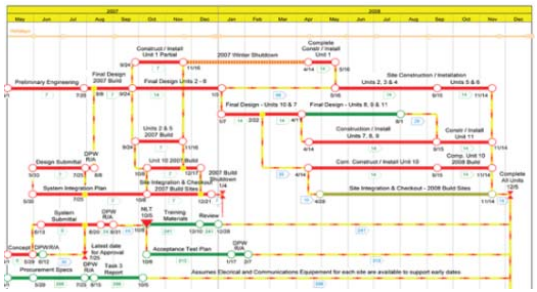
GPM TIMELINE–2004 TO 2011

2003 2004 2006 2007 2008 2009 2011



2003–May 26 ENR Article "Critics Can't Find the Logic in Many of Today's CPM Schedules"

2004–The seminal May 2003 ENR article spurs the development within PMA of a computer graphics, event-driven planning and scheduling application rooted in algorithmic & planned dates, total floats, & the critical path



2006–In October, PMA internal document discloses graphical method for simultaneously planning, scheduling and presenting activities, events, and their relationships in a hybrid arrow and precedence network format in a manner easily understandable to schedulers, other professionals, and even laymen

2007–PMA files first patent application for a new network-based planning/scheduling process, which came to be known as the graphical path method or GPM

2008–GPM self-healing algorithms enabling a kinetic planning/scheduling user interface are developed by Dr. Ponce de Leon

2008–Dr. Ponce de Leon introduces the basic GPM planning/scheduling scheme of thought at the PMICOS 5th Annual Conference in Chicago

2008–Email conveying Jim O'Brien's favorable peer review of the initial academic paper on GPM states: "To me, the loss of the logic diagram has been the unrecognized tragedy in the evolution of CPM scheduling and your GPM brings it back full circle."

2009–GPM forensic total float is introduced at the PMICOS Annual Conference in Boston



2009–In the first quarter, a Top 20 Contractor in the ENR Top 400 Contractor's List licenses 12 copies of NetPoint



2011–PMA Technologies holds the First NetPoint User Conference in Orlando, FL



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GPM TIMELINE–2011 TO 2017

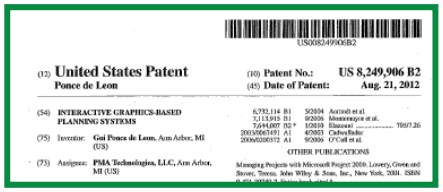
2010 2011 2012 2013 2014 2015 2016 2017 2018



2010–O'Brien & Plotnick's 7th ed. of *CPM in Construction Management* cites NetPoint as providing "superior graphics for managing a project"

2011–NetPoint Version 4 is introduced at the First NetPoint User Conference in Orlando, FL

2012–First GPM patent is awarded by the USPTO in August



US008249906B2

(12) **United States Patent**
Ponce de Leon

(10) **Patent No.: US 8,249,906 B2**
(45) **Date of Patent: Aug. 21, 2012**

(54) **INTERACTIVE GRAPHICS-BASED PLANNING SYSTEMS**

(75) Inventor: **Gui Ponce de Leon**, Ann Arbor, MI (US)

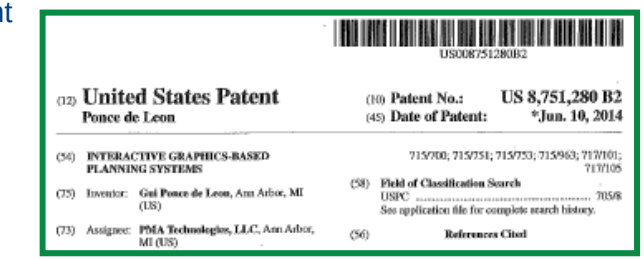
(73) Assignee: **PMA Technologies, LLC**, Ann Arbor, MI (US)

OTHER PUBLICATIONS

2013–GPM Risk and its software embodiment NetRisk are introduced at the NetPoint & GPM Conference

2014–AutoGRAPH, NetPoint's constraint-based network layout authoring method, is introduced at the NetPoint & GPM Conference

2014– 4th GPM patent is awarded by the USPTO in June



US008751280B2

(12) **United States Patent**
Ponce de Leon

(10) **Patent No.: US 8,751,280 B2**
(45) **Date of Patent: *Jun. 10, 2014**

(54) **INTERACTIVE GRAPHICS-BASED PLANNING SYSTEMS**

715/700; 715/751; 715/753; 715/963; 717/101; 717/105

(75) Inventor: **Gui Ponce de Leon**, Ann Arbor, MI (US)

(58) **Field of Classification Search**
USPC 705/8
See application file for complete search history.

(73) Assignee: **PMA Technologies, LLC**, Ann Arbor, MI (US)

(56) **References Cited**

2014–In April, a top 10 EPC contractor on the ENR Top 400 Contractors List orders its 37th license of NetPoint

2015–NetPoint Version 5 and NetRisk cost risk assessment are unveiled at the NetPoint & GPM Conference

2015–First *GPM Innovation Roundtable* to be held in November in Denver, CO

2017–Anticipated commercial release of NetPoint Version 6 and NetRisk featuring a more cognitively powerful, yet even easier-to-grasp user interface

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POWER TO STAKEHOLDERS: *THE GPM PLANNERS' CREDO*

Management of the project relies on visual, collaborative, transparent, and sufficiently simple processes that fully engage stakeholders and engender ownership of and commitment to the plan and the schedule

Our Credo states…

Stakeholder collaboration improves *where level of detail encourages participation*

Stakeholder interaction is best *when the schedule is built both forward and backward*

Stakeholder agreement on a workable plan *is more important than fictive precision*

Stakeholders more fluently process *graphical, visual, and sufficiently simple schedules*

Stakeholders favor practical schedules *that use planned dates vs. all-early dates*

Stakeholders favor resource leveling *protocols that synergize man/machine interaction*

Stakeholder-centric contingency estimating methods *yield more reliable contingencies*

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ACHIEVING STAKEHOLDER COLLABORATION

Strategic level 1 and level 2 planning sessions as well as level 4 and level 5 planning sessions occur with key stakeholders as active participants (given: planning sessions are properly organized)

- Collaboration, interaction, and commitment to the plan are achievable when stakeholders are allowed to directly interact with the model
- In planning sessions, NetPoint's graphical, kinetic interface and visual network schedule display are stakeholder friendly and more effective in plan development than spreadsheets and butcher block paper

LEVEL 1/2 Level 1 and level 2 planning are the domain of executive managers, senior managers, and functional leads

LEVEL 4/5 Level 4 and level 5 planning are the domain of line supervision, e.g., in construction, foremen and trade superintendents

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FUELING STAKEHOLDER INTERACTION

Plan development and analysis are carried out directly on the model (e.g., the schedule) by the responsible stakeholders

GPM planning protocol: the scheduling software allows stakeholders to set milestones and strategies first, and then proceed to build the network/schedule forward (push planning) and backward (pull planning), as appropriate to the phase*



*For an explanation of "pull" and "push" planning, see Last Planner™ System of Production Control

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FUELING STAKEHOLDER INTERACTION *(CONT'D)*



Communal work on the schedule is better achieved where:

1. The schedule is presented as a *network diagram* on a time scale
2. The diagram is visual in the sense that action and the display of the action's impact on the schedule are one and the same
3. The scheduler controls what/how information is displayed so the visual remains intuitive and simple to understand

> *A sufficiently simple ethos that results in the schedule being fluently processed by schedulers and non-scheduling stakeholders alike*

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ATTAINING STAKEHOLDER AGREEMENT IS A NEW ETHOS

Command-and-control, overly detailed schedules are *the mission* at any cost	***A collective commitment to the plan and schedule reflecting all key stakeholder information***
Emphasis is on scheduling and rescheduling, as needed	***Emphasis is on collaborative planning***
Goal is to nail down far in advance start/finish dates of small-duration activities	***Goal is to set milestones and to strategically sequence items of work that drive progress and completion***
Accumulate scheduling software gurus	***Growing a cadre of planners who facilitate stakeholder sessions***
If it ain't broke, don't fix it	***If it ain't broke, break it!***

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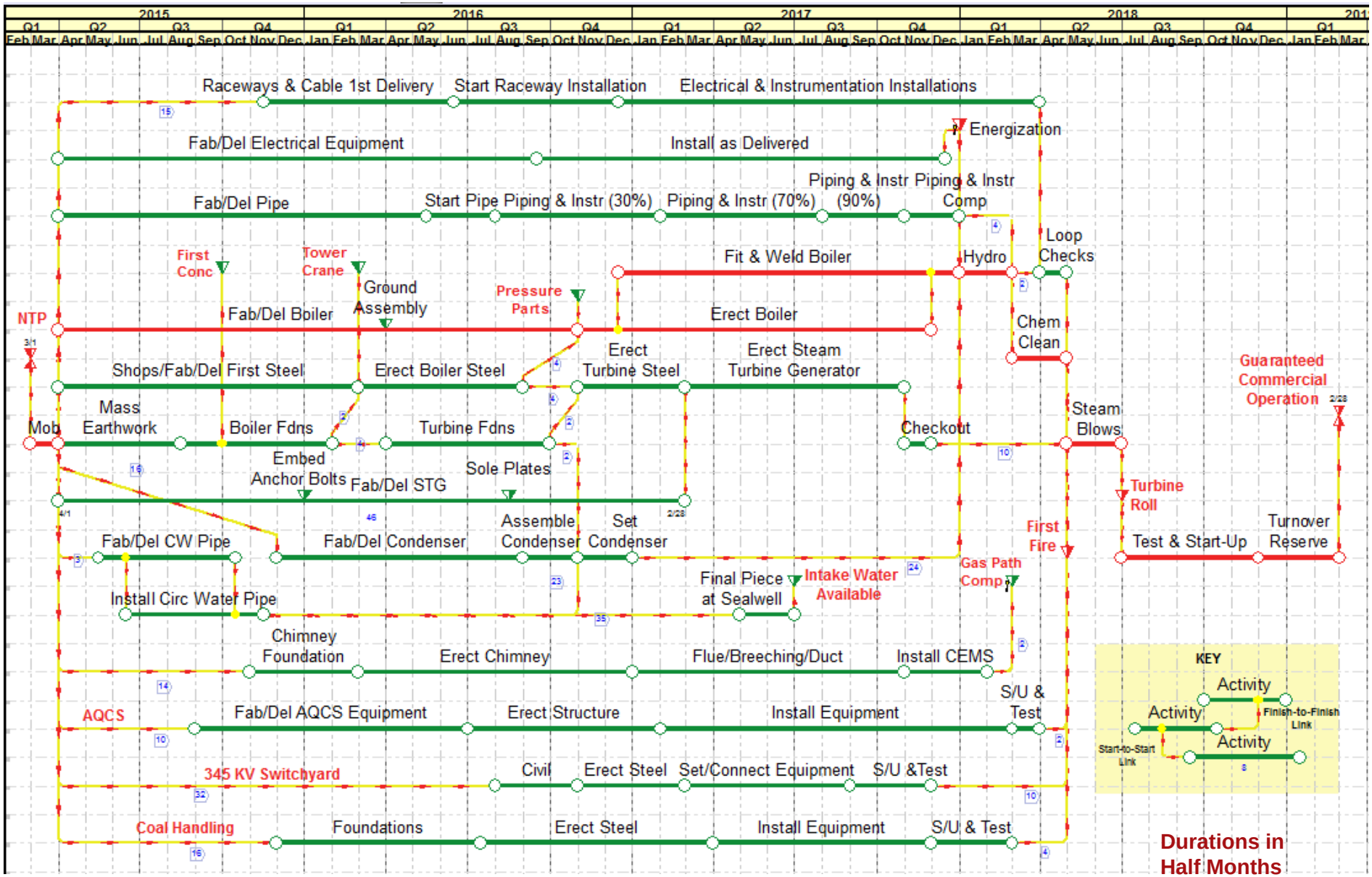
Stakeholders favor practical schedules *that use planned dates vs. all-early dates*

Stakeholders favor resource leveling *protocols that synergize man/machine interaction*

Stakeholder-centric contingency estimating methods *yield more reliable contingencies*

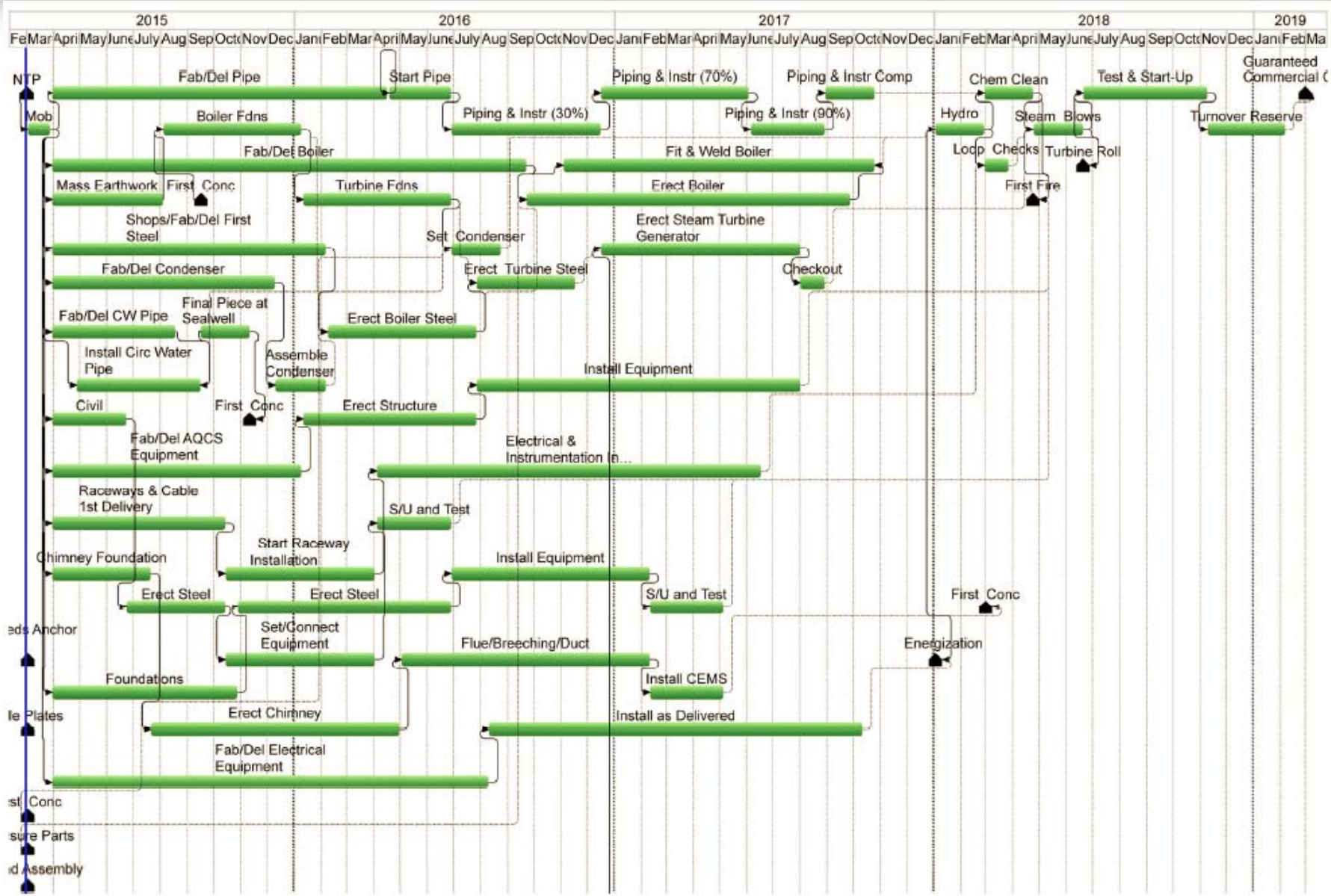
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A SUFFICIENTLY SIMPLE SCHEDULE PRESENTATION



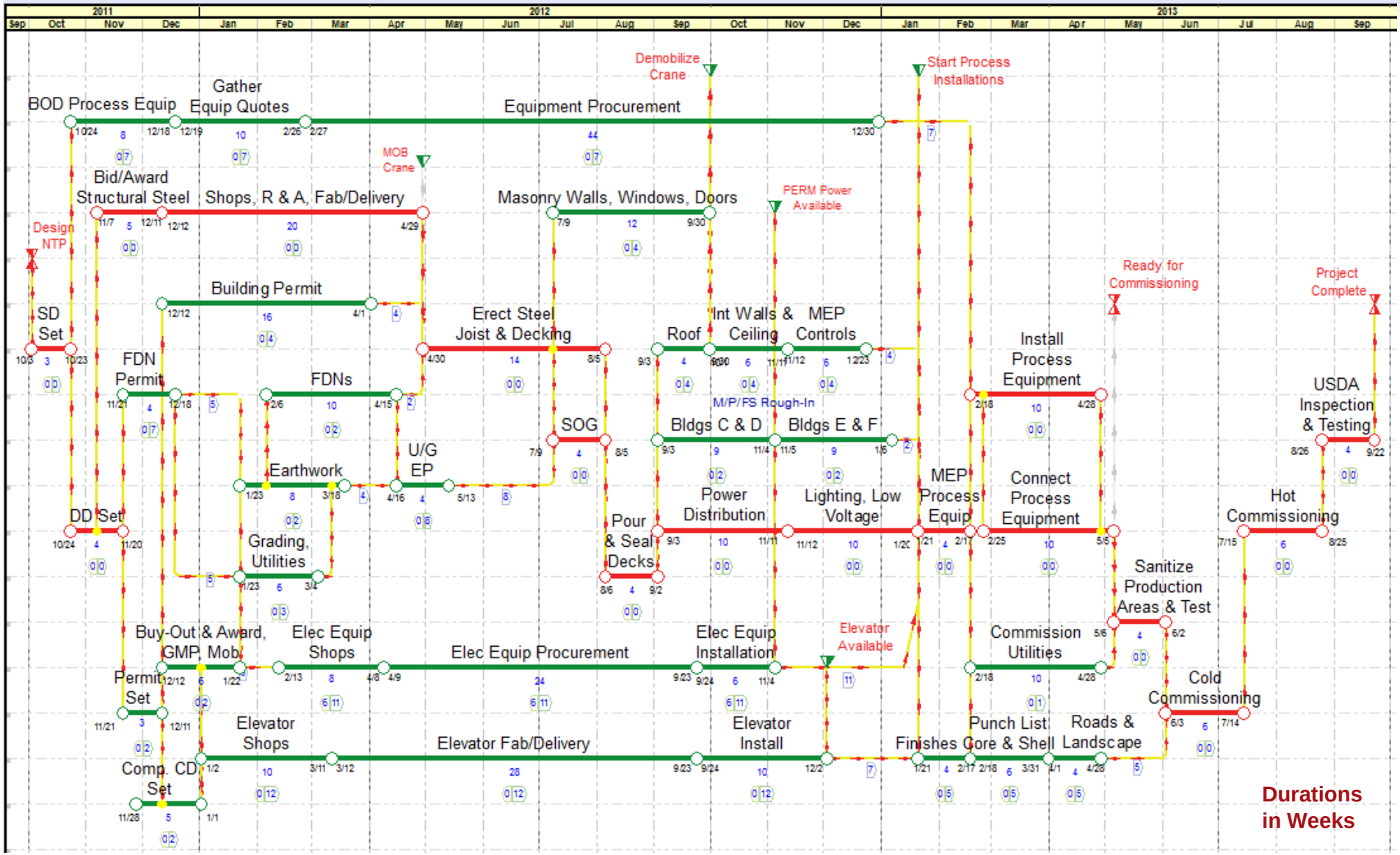
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A SCHEDULE ONLY A TRAINED EYE CAN FOLLOW



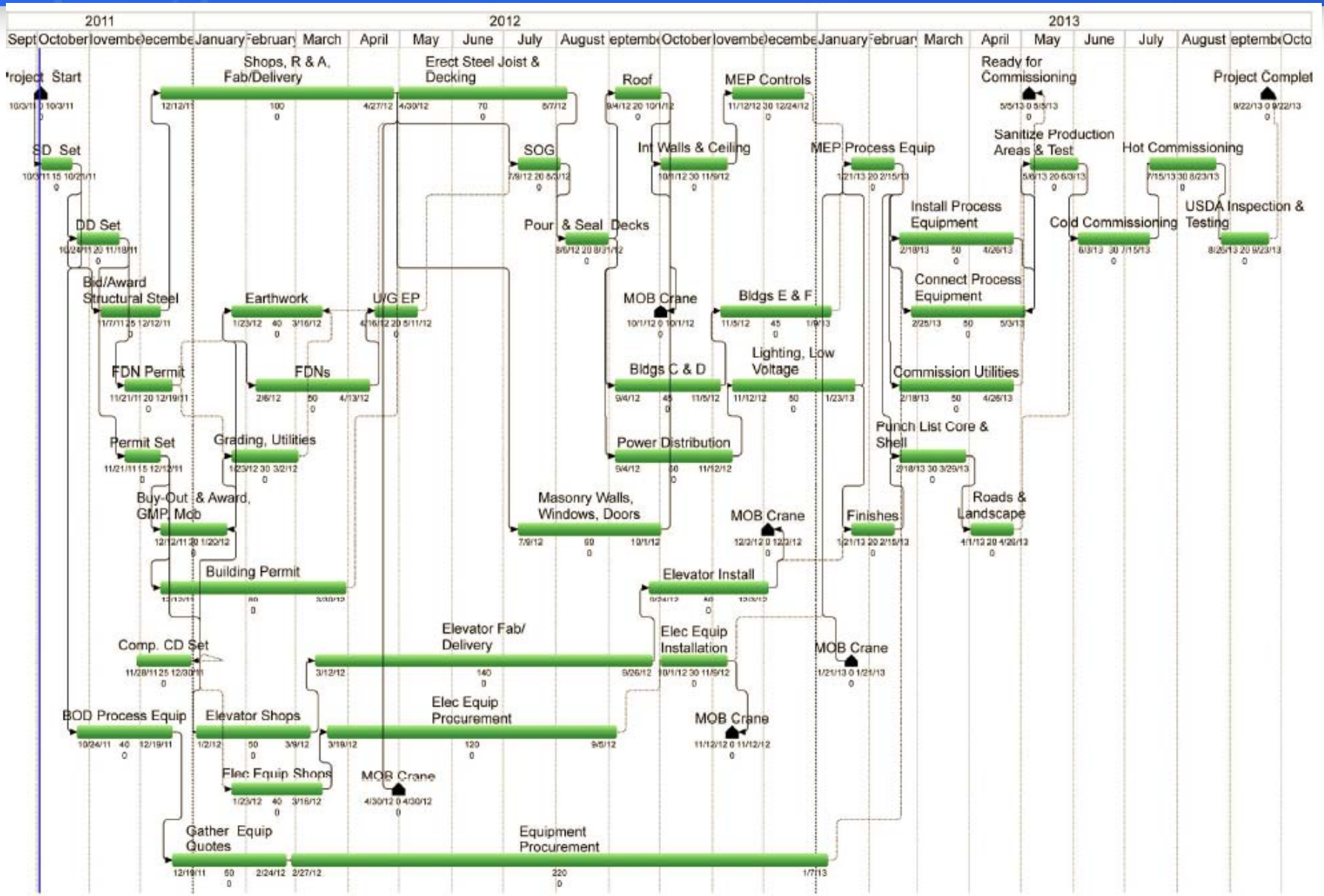
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ANOTHER SUFFICIENTLY SIMPLE SCHEDULE DISPLAY



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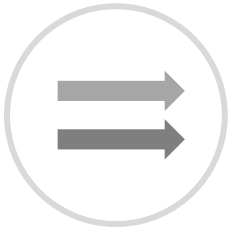
AN EQUIVALENT TIME-SCALED PRECEDENCE DIAGRAM



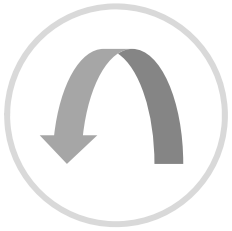
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SUFFICIENTLY SIMPLE SCHEDULE MANIPULATION

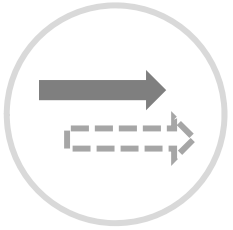
A software application provides a kinetic interface when the digital model behaves as an algorithmic working surface during external physical manipulation because the model objects encapsulate algorithmic rules and interact via message passing



Kinetic interfaces provide a cognitively enhanced platform because stakeholders' physical manipulation of the model and the derived impact elsewhere on the model are visualized simultaneously



An unlimited UNDO/REDO feature is a given



The dynamic nature of the interface stimulates cognitive skills in what-if analyses

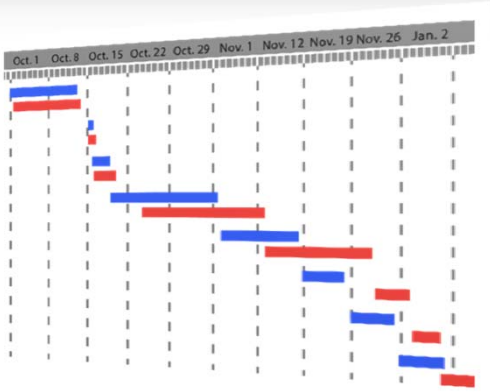
Kinetic software tools use *self-healing algorithms* that automatically and instantaneously ensure that the model, when disrupted through physical manipulation, remains in a mathematically correct state

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SUFFICIENTLY SIMPLE TARGET SCHEDULE PRESENTATION

Saving a baseline, prior update, or schedule as a *target* has been a protocol since the early 1970s

Lacking an artful way to portray current and target networks in the same display, practitioners, when comparing current and target activity dates, have resorted to Gantt charts for decades

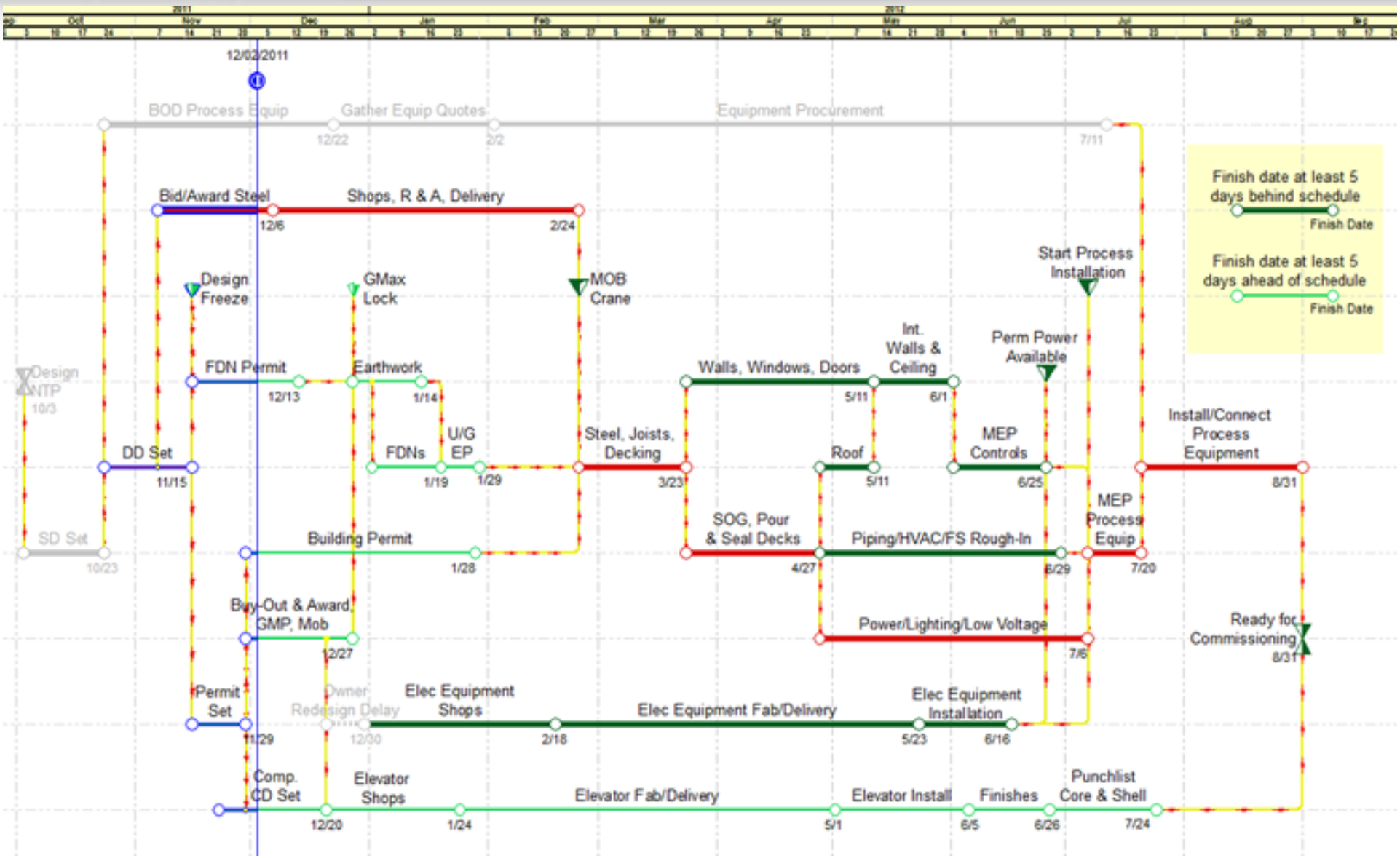


This Gantt chart dependency is overcome in NetPoint® v5 by a visual target mode that graphically highlights variances between current and target schedule parameters right on the time-scaled network display

- ✓ If activities ahead of target are graphically deemphasized, then activities behind target are overemphasized
- ✓ Variances recalculate as the current schedule is being revised, which provides a target visual that refreshes instantly as ahead and behind graphical notations react to revisions

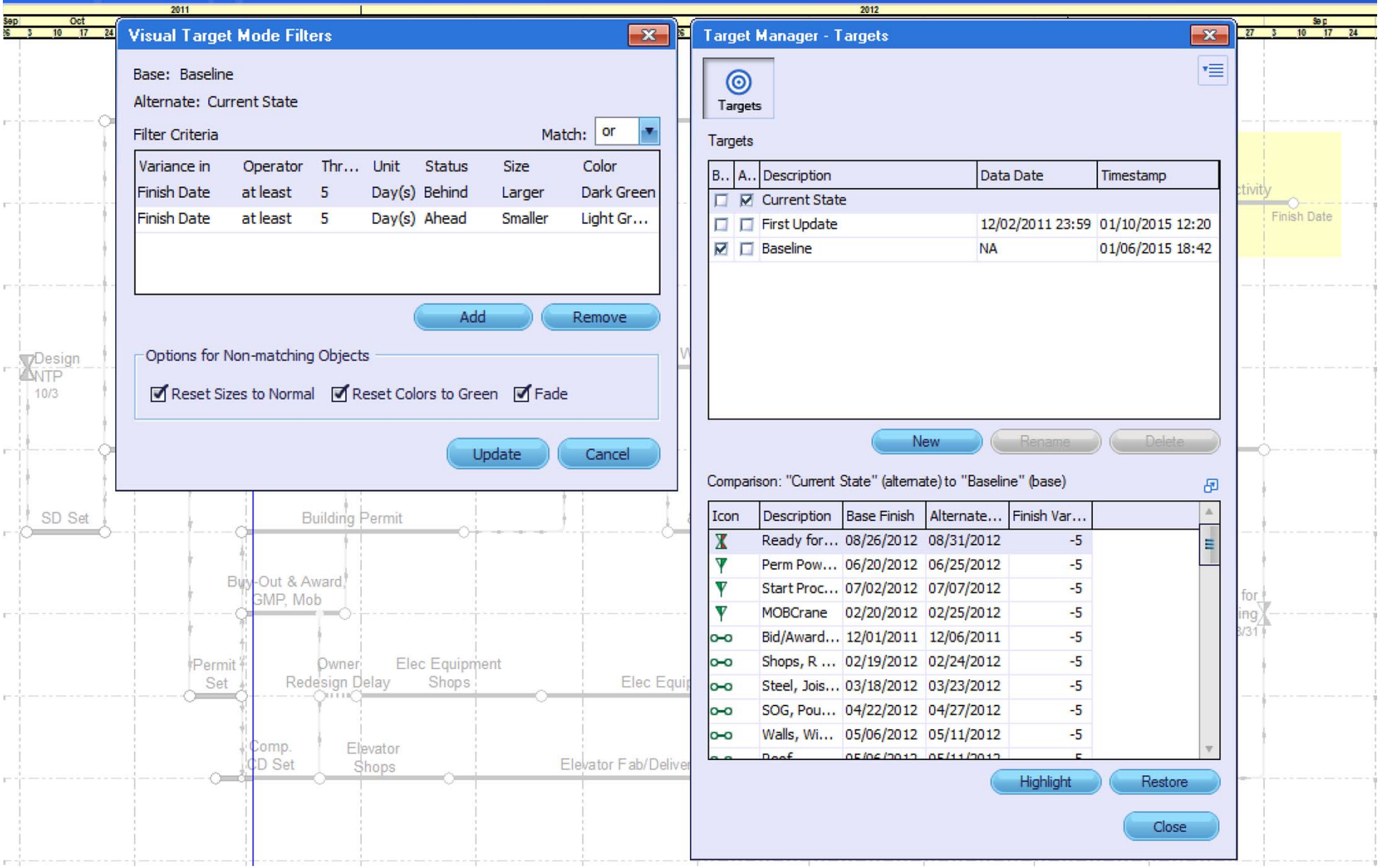
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NETPOINT VISUAL TARGET DEMONSTRATIVE



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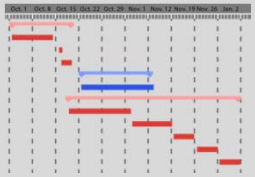
NETPOINT VISUAL TARGET INTERFACE



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STAKEHOLDERS' ISSUE WITH ALL-EARLY-DATE SCHEDULES

Problem: A schedule chock-full of early dates that neglects making use of total floats is seemingly unrealistic to non-scheduling stakeholders responsible for delivering the project



Aspiring to more realistic working schedules, stakeholders resort to bar charts, often disconnected from the CPM schedule

Solution: Stakeholders schedule selected activities between early and late dates

GPM

In the GPM world, planned dates are used without overriding early dates, thereby preserving total float as derived from network logic; activities are scheduled on realistic dates while knowing the extent that activities can drift and float to the algorithmic early and late dates

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THE *GPM PLANNED* DATES PRECEPT IN SCHEDULING

The scheduler may manually override activity dates

Activities placed between early and late dates are on GPM planned dates; the GPM algorithm retains the algorithmic early dates

Because planned dates do not override early dates, GPM detects that an activity retains the ability to *drift back* without forcing an earlier project start and that it may float forward as much as the late dates permit

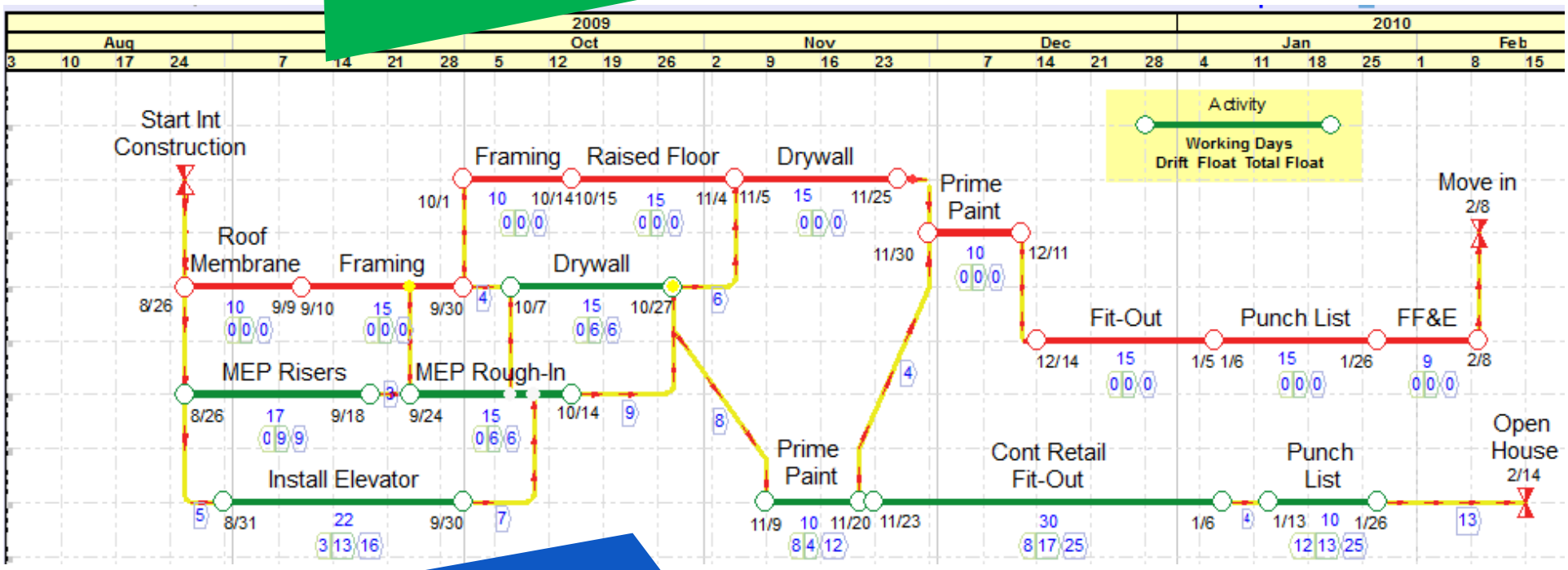
The combination of planned dates/drift/float represents a paradigm shift from the CPM early-date bias, one-directional float protocol

DRIFT + **FLOAT** = **TOTAL FLOAT**

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WORKING WITH GPM PLANNED DATES

GPM was conceived so that placing an activity (i.e., start date) between the early start and late start is a natural proposition



Because GPM allows scheduling activities between early and late dates without resorting to SNE constraints or preferential logic ties, drift is preserved and, therefore, total float is not sacrificed

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Stakeholder interaction is best *when the schedule is built both forward and backward*

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Stakeholder-centric contingency estimating methods *yield more reliable contingencies*

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THE *SORT OF* 40-YEAR RESOURCE LEVELING SOLUTION

Starting with the early schedule, through opaque heuristics, CPM software calculates alternate activity start dates by delaying activities, if the early dates cause overruns in resource limits

A black-box operation that involves entering leveling criteria and pushing a button, followed by calculations and activity rescheduling on the whole, in one fell swoop. Very complex interface with lots of different options and toggles to check

Dystopia rather than Utopia

Black-box, automated solutions are not context-specific and produce unrealistic and usually very inefficient results

Upshot

It wasn't too long before software-driven resource leveling fell by the wayside

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THE CPM RESOURCE LEVELING PREDICAMENT



Murray Woolf
Author of *Faster Construction Projects with CPM Scheduling*

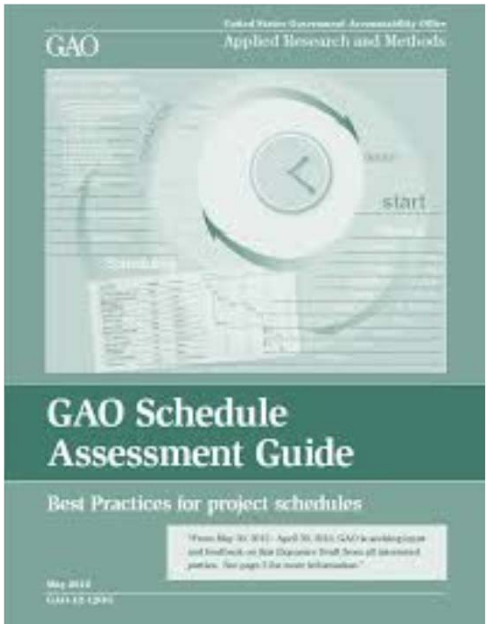
"In general, I discourage the use of any button that, once pushed, takes the decision-making out of the minds of those who are charged with managing the project and instead delegates it to a softly hissing microchip."

"…If you give this power to the computer (software), no human will thereafter be able to (easily) identify or understand the total-float of activities because it obscures the various paths and, hence, one will not be able to exploit activities according to available total-float. Do you really want to surrender such power to the computer?"

So, what's a stakeholder to do?

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THE CPM RESOURCE LEVELING PREDICAMENT *(CONT'D)*



Woolf's views are echoed in the GAO *Schedule Assessment Guide*:

"Automated leveling may produce inefficient output, such as delaying activities if resources are partially available and, thus, prevent activities from being partially accomplished while the project waits for the full complement of resources to become available."

The GAO guide further posits that:

"Resource leveling can be performed automatically with scheduling software or *manually by management and planners* or both" *(italics mine)*

So, what's a stakeholder to do?

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SYNERGIZING STAKEHOLDER/MACHINE INTERACTION

GPM resource-constrained scheduling is a *transparent, hybrid, stakeholder-driven/software-aided* process that amalgamates schedule context and stakeholders' judgment

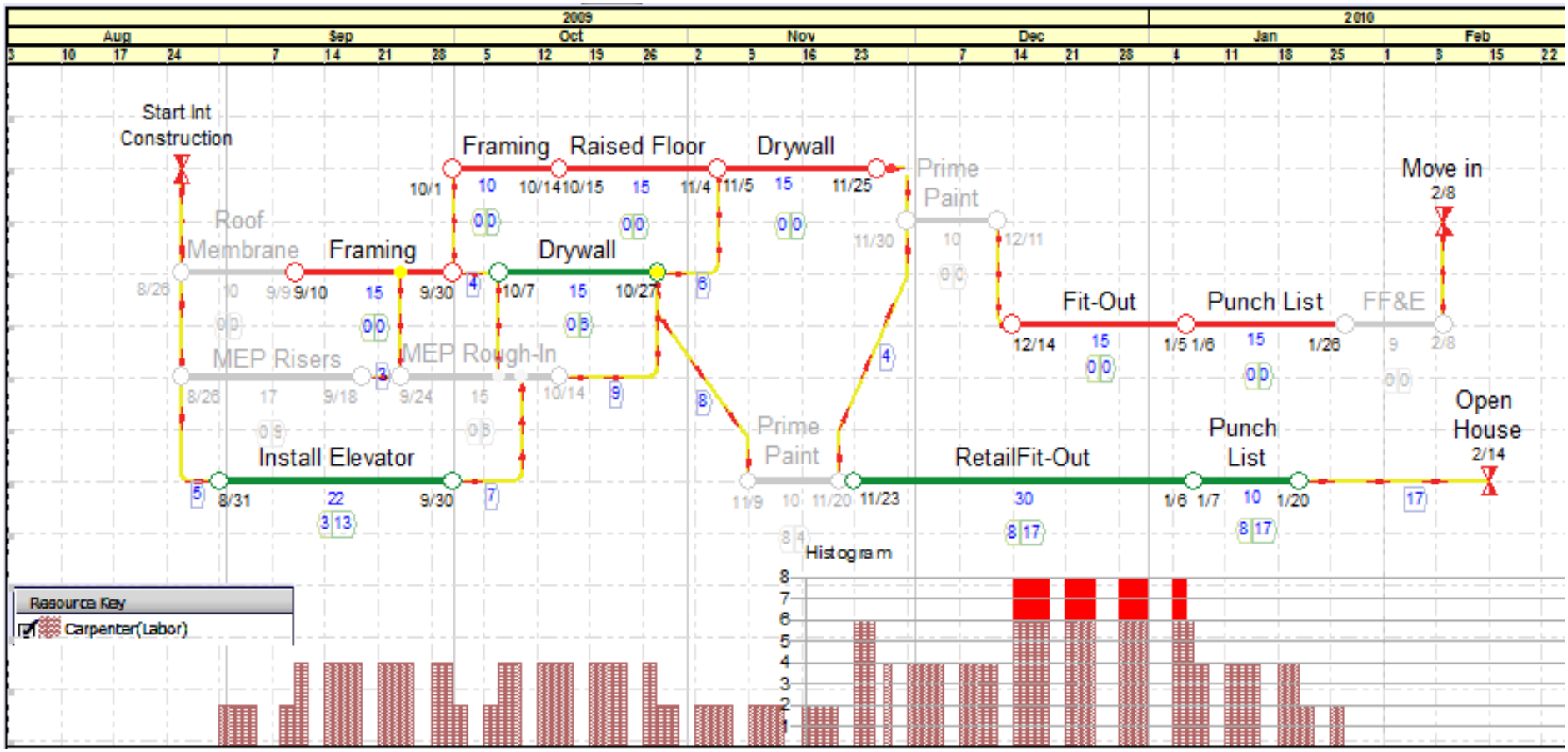
To improve resource histograms, stakeholders, considering float and drift, may in every possible way shift a selected activity, crash or extend the activity, split the activity, and/or push UNDO to return to any prior state

- ✓ *As an activity is manipulated, other preceding and/or succeeding activities that are impacted based on network logic are correspondingly repositioned along the time scale*
- ✓ *The GPM algorithms also synchronously refresh the evolving resource histograms*

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SIMPLE GPM RESOURCE ALLOCATION DEMONSTRATIVE

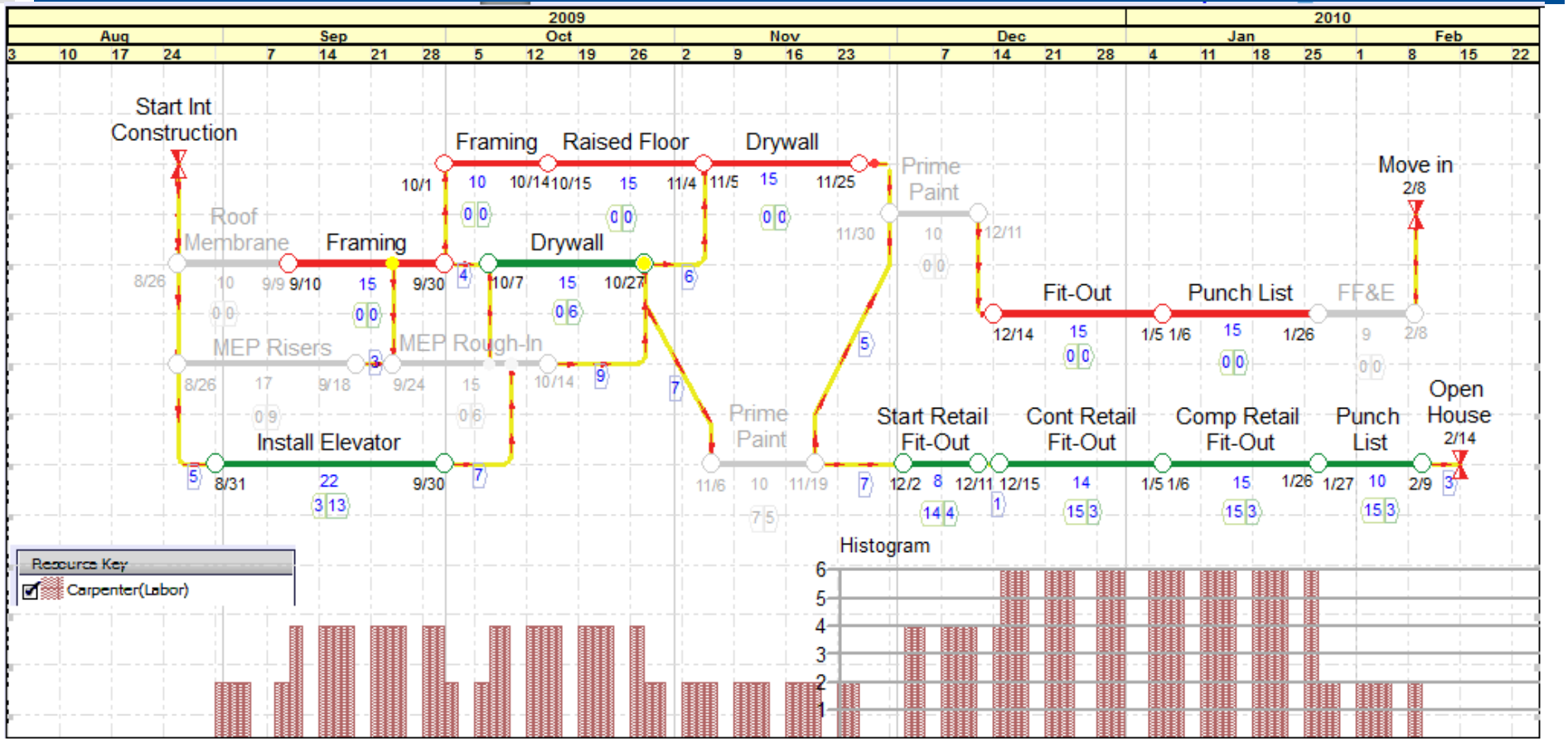
The objective is to eliminate the carpenter limit (6 carpenters) overrun between Dec 14 & Jan 5; the selected activity is Retail Fit-Out because it contributes to the overrun, is noncritical, and uses carpenters



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GPM RESOURCE LEVELING IS BIDIRECTIONAL

As activities shift into *planned dates* and drift is generated, total float, except where an activity is crashed or extended, is unaffected by the resulting planned dates, which maintains total float traceability



The 6 steps involved in this demonstrative are detailed in the presentation [Logic Gantt Chart RIP]

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RESOURCE LEVELING GOING FORWARD

1	Conventional, automated leveling via software-controlled heuristics	Softly hissing black box
2	Automated manual leveling as promoted by the GAO guide	Impractical in most scenarios
3	Hybrid, stakeholder-driven/software-aided leveling using GPM software	Computer-aided leveling

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COST & SCHEDULE CONTINGENCY ESTIMATING

Contingency: amount that experience indicates should be added to the budget estimate and schedule forecast so that…

1. The schedule has a target probability of completing on or before the required completion date
2. The budget has a target probability of falling above actual cost

Methods for estimating contingencies are based on a structured evaluation of uninsured project risks

"Stand-alone" methods evaluate cost risk independently from schedule risk

"Integrative cost/schedule" methods integrate the impact of schedule risk on cost risk

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COMMONLY USED CONTINGENCY ESTIMATING METHODS

1. Expert judgment aka well-reasoned heuristics

   *For example, increasing forecasted completion by 4%-8% of the length of the critical path, but by no less than one week**

2. Predetermined guidelines involving varying degrees of expert judgment and empirical rules

3. Parametric modeling involving an empirically based algorithm, usually derived through regression analysis with varying degrees of expert judgment or empirical rules**

4. Probabilistic risk assessment aka simulation analysis comprising expert judgment incorporated into a stochastic model

*This scheduling contingency heuristic is from Core Traits of a Reliable Schedule

**AACE International Recommended Practice No. 42R-08

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THE CASE FOR CONTINGENCY VIA RISK ASSESSMENT

Kahneman, as well as Flyvjberg, posits that algorithmic predictions are significantly more accurate than expert judgment predictions

1 *Humans are incorrigibly inconsistent in making summary judgments of complex information*

2 *When asked to evaluate the same information twice, they frequently give different answers*



Brainstorming, Delphi, and other information gathering techniques done properly improve the accuracy of expert judgment because, where exercised at the cost item or activity level, it can be better related to experience in context

Particularly effective when risk assessment sessions include experts from outside the project

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COST & SCHEDULE CONTINGENCY VIA RISK ASSESSMENT

Stand-alone methods are predominant
Cost and schedule risk are combined by manually converting project schedule duration variability into a risked cost item

Integrated cost/schedule risk assessment is an integrative method favored by Hulett and other risk practitioners because it incorporates the impact of schedule risk on cost risk when the duration of activities using labor-type/time-dependent resources is risked

Integrated cost/schedule risk methods are questionable where the schedule level of detail renders activity cost loading a prohibitive exercise

**Refer to Hulett's Practical schedule risk analysis.*

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RELATED COST/SCHEDULE RISK ASSESSMENT



A less complex *integrative* method than integrated cost/schedule risk assessment in that cost items behave as hammocks and acquire start/finish dates from their related schedule fragnets

*Where schedule activities are more detailed than cost items, the related method avoids the laborious step of allocating cost items to detailed activities**

For a position on the issue with activity cost loading, see The great divorce: cost loaded schedule updating.

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TAKE-AWAYS

1. *Valid* schedules are generated via stakeholder-centric processes
2. GPM software enhances the cognitive skills of schedulers and non-scheduling stakeholders because it kinetically conveys impact as stakeholders manipulate activities, logic ties, milestones, and benchmarks
3. GPM networks, due to their sufficiently simple visuals, are intuitive and more fluently processed by schedulers and non-scheduling stakeholders alike
4. GPM planned dates, which generate drift, not only render resource leveling practical, at last, but also preserve total float traceability
5. Stakeholder interaction improves when both *push* planning and *pull* planning are used interchangeably when developing the network and the schedule
6. *Integrative* risk assessments that employ sufficiently simple schedules and engage stakeholders as active participants yield more reliable contingencies
7. With GPM *returning* stakeholders managing the project to the main stage, welcome to the era of *Stakeholder-Centric Project Management*

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THE JOURNEY BACK TO *STAKEHOLDER-CENTRIC* SCHEDULING

1960s

Stakeholders engage via collaborative processes. Focus is on neat logic diagram, often time-scaled. "Logic rules, dates serve" paradigm.



1970s

Increased reliance on mainframe computing and Gantt charts, less on logic diagrams. CPM takes hold. The rise of the *CPM guru.*

2011 - Beyond

Emergence of symbiotic partnership between stakeholders' thinking and objectbase graphics computing brings back the planning-centric process of the 1960s.

1980 - 2010

Planning takes a back seat to the calculation power of the PC. "Dates rule, logic serves" paradigm. Stakeholders disengage.

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POWER TO STAKEHOLDERS