The Last Planner System of Production Planning & Control

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Outline

- Peculiarities of ETO projects
- Characteristics of construction and shipbuilding
- Last Planner system
- Mini-cases
  - Construction
  - Oil field development

Peculiarities of ETO Projects

Its customers are individuals, not types.

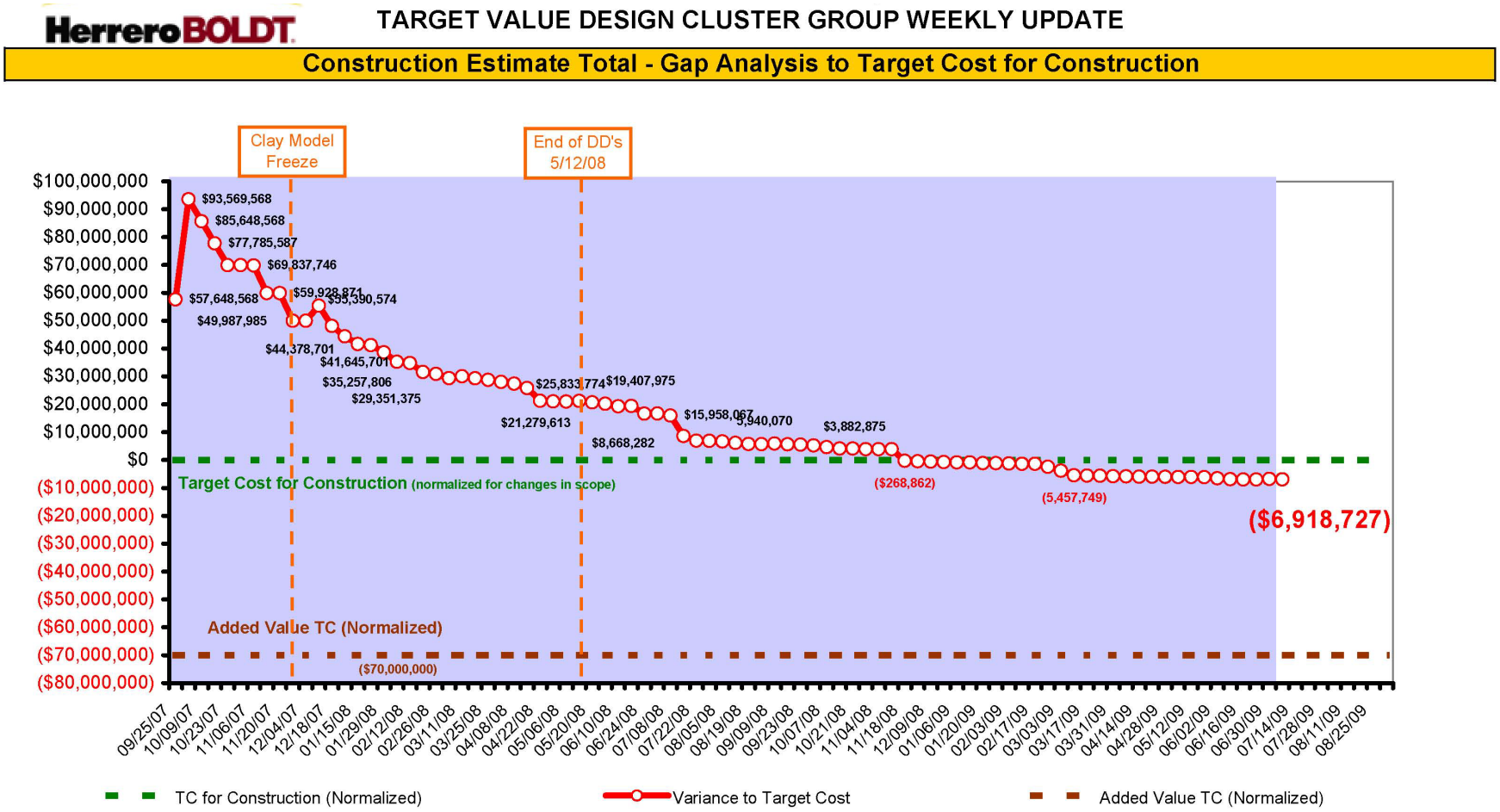
One consequence is the need to understand exactly what this customer wants, what constraints define the design space in which to search, and what preferences should be used to select from design alternatives within the constrained space.

A second consequence is the customer's active role during the production (designing and making) process, ranging at minimum from approval of design as it develops through stages; beyond that to direct participation in generation, evaluation and selection from design alternatives when projects are more complex and uncertain; and to evaluation and acceptance of the constructed asset.

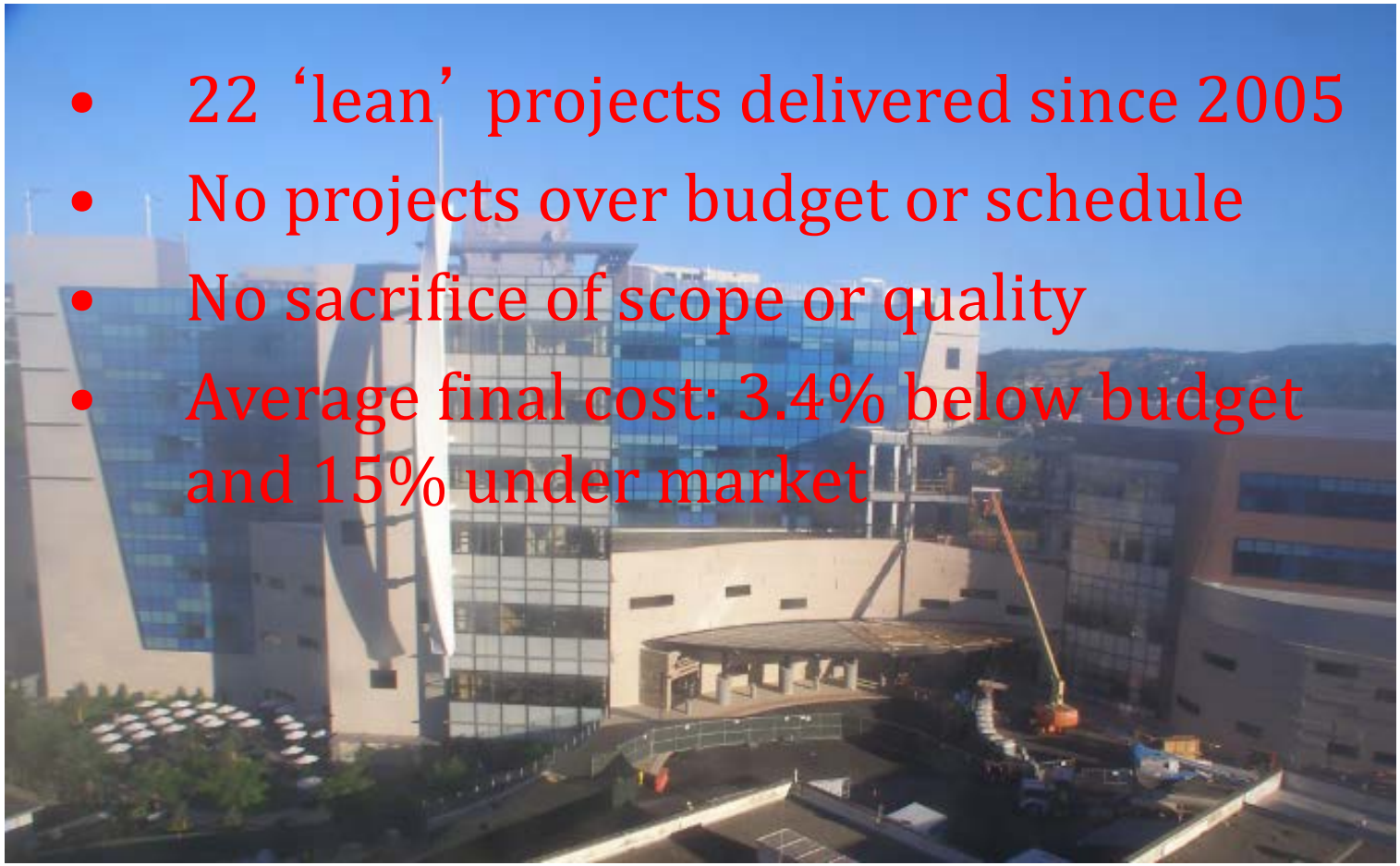
Target Value Delivery

- A method of project delivery for ETO Projects adapted from manufacturing's product development
- Assesses project viability; i.e., the probability of aligning ends, constraints, and means
- If viable, targets are set and the project is proactively steered to those targets
- Supported by aligning commercial interests of project team members and integrating them organizationally

Target Value Delivery



Sutter Health



Characteristics of Construction

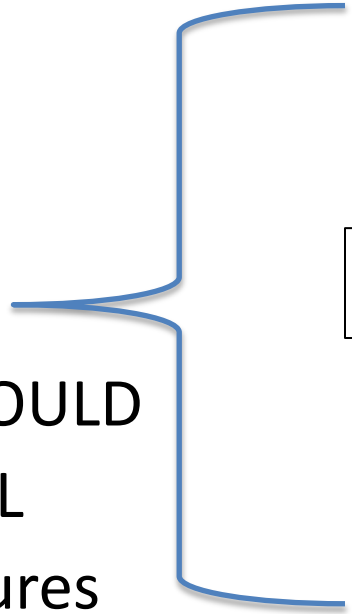
1. When construction's customers are individuals, construction is a type of ETO manufacturing.
2. Construction's products are rooted in the earth.
3. Construction is a type of fixed position manufacturing.
4. Construction is highly specialized and involves numerous specialists in designing and making its products.
5. Construction's projects are temporary organizations; typically with different participating companies from one project to the next.

Characteristics of Shipbuilding

1. When shipbuilding's customers are individuals, customers are involved in the production process.
2. Shipbuilding's ***products are mobile***.
3. Shipbuilding is a type of fixed position manufacturing.
4. Shipbuilding is highly specialized and involves numerous specialists in designing and making its products.
5. Shipbuilding projects are temporary organizations, but ***usually with the same participant companies from project to project***.

Functions of Project Planning & Control

- Prior to Execution:
  - Risk Evaluation & Mitigation
  - Resource Acquisition/Allocation
  - Execution Strategies
  - Master Scheduling
- During Execution
  - Detailed Scheduling
  - Matching CAN with SHOULD
  - Matching DID with WILL
  - Learning from plan failures



Last Planner

Execution Strategy

- In what chunks will work be assigned to specialist production units (PUs)?
- How will work chunks be sequenced through various PUs?
- In what chunks will work be released from one PU to the next?
- Where will decoupling buffers be needed and how should they be sized?
- When will the different chunks of work be done?

“Chunk” is preferred to “batch” because the latter is commonly used to indicate multiples of an identical unit.

The Last Planner system of project planning & control

- Starting Points
- Functions
- Principles
- Metrics

Starting Points for Last Planner

- Stabilizing work processes is a prerequisite for continuous improvement.
- All plans are forecasts and all forecasts are wrong. The further into the future we try to forecast, the more wrong we will be. The greater the level of detail we try to forecast, the more wrong we will be.
- The norm in construction is highly detailed master schedules designed to limit discretion.
- Research on construction projects in the early 1990's found that only half the tasks on weekly work plans were completed.

Construction Weekly Work Plan

1 WEEK PLAN

PROJECT: Pilot **FOREMAN: PHILLIP**

ACTIVITY **DATE: 9/20/96**

	Est	Act	Mon	Tu	Wed	Thurs	Fri	Sat	Sun	PPC	REASON FOR VARIANCES
Gas/F.O. hangers O/H "K" (48 hangers)			xxxx Sylvano, Modesto, Terry	xxxx						No	Owner stopped work (changing elevations)
Gas/F.O. risers to O/H "K" (3 risers)					xxxx Sylvano, Mdesto, Terry	xxxx	xxxx	xxxx		No	Same as above-worked on backlog & boiler blowdown
36" cond water "K" 42' 2-45 deg 1-90 deg			xxxx Charlie, Rick, Ben	xxxx	xxxx					Yes	
Chiller risers (2 chillers wk.)						xxxx Charlie, Rick, Ben	xxxx	xxxx		No	Matl from shop rcvd late Thurs. Grooved couplings shipped late.
Hang H/W O/H "J" (240'-14")			xxxx Mark M., Mike	xxxx	xxxx	xxxx	xxxx	xxxx		Yes	
Cooling Tower 10" tie-ins (steel) (2 towers per day)			xxxx Steve, Chris, Mark W.	xxxx	xxxx	xxxx	xxxx	xxxx		Yes	
Weld out CHW pump headers "J" mezz. (18)			xxxx Luke	xxxx	xxxx	xxxx	xxxx	xxxx		Yes	
Weld out cooling towers (12 towers)			xxxx Jeff	xxxx	xxxx	xxxx	xxxx	xxxx		No	Eye injury. Lost 2 days welding time
F.R.P. tie-in to E.T. (9 towers) 50%			xxxx Firt, Packy, Tom	xxxx	xxxx	xxxx	xxxx	xxxx		Yes	
WORKABLE BACKLOG Boiler blowdown-gas vents -rupture disks											

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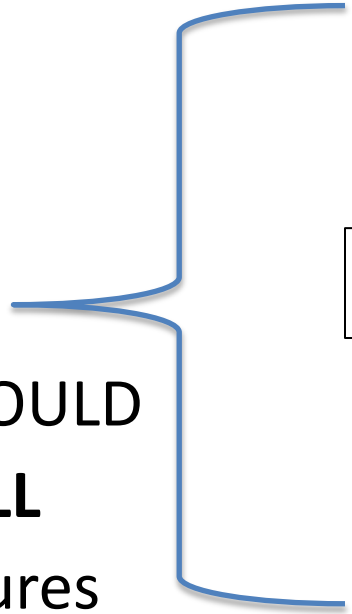


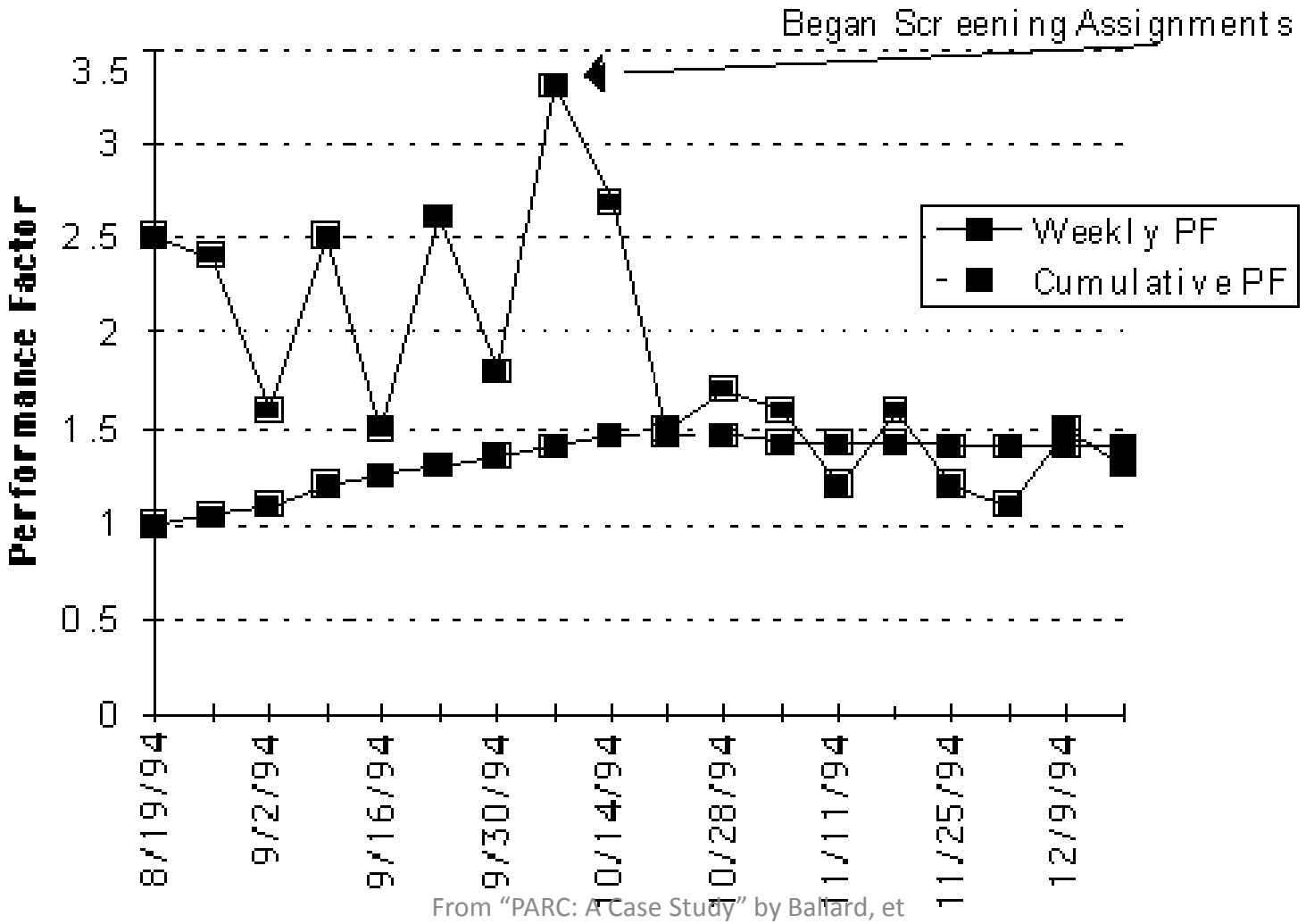
Last Planner

Matching DID with WILL

Rule: Include in daily work plans only tasks that are:

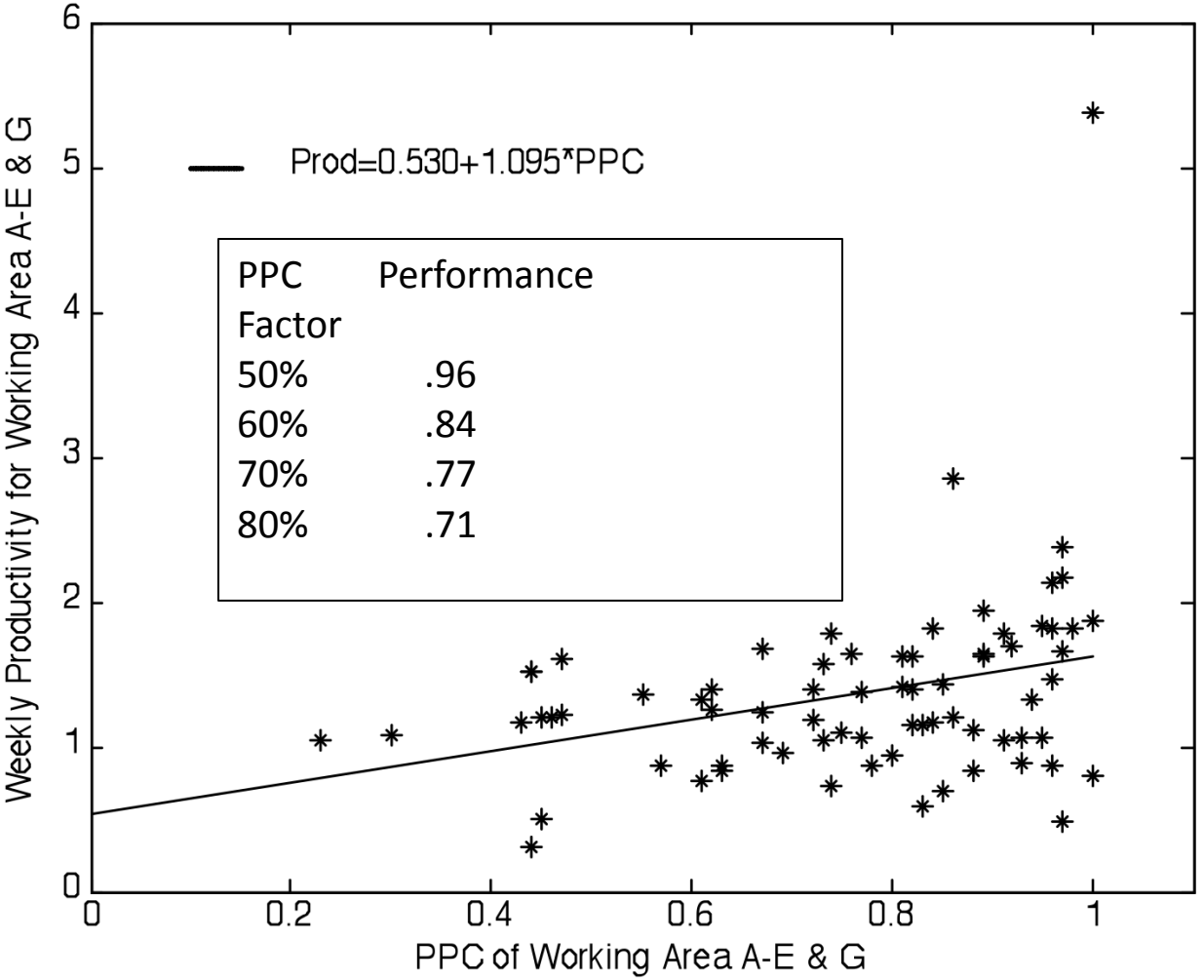
- Defined to convey what performers need to understand
- Sound
- Sequenced
- Sized to the capacity of performers

Impact of Last Planner on Formiconi's Productivity



From "PARC: A Case Study" by Ballard, et al., IGLC1996

Impact of PPC on Productivity



Matching CAN with SHOULD

Project name:_____

Last Planner-Lookahead

Constraints Analysis

Prepared by: _____
Run Date:

Activity ID	Activity Description	Planned Start Date	Responsible Party	Contract / Change Orders	Design			Materials	Labor	Equipment	Prereq Work	Space	Sound?	Comments
					AE Complete	Submittals	RFI's							
11	Rebar erection for 1st floor columns 5,6,7,8	1/15/2007	Rebar-sub	X	X	X	X	Delivery Mon AM	X	X	X	X		
12	Electrical inserts/rough-in for 1st floor wall w1	1/15/2007	Electrical Sub	X	X	X	X	X	X	X	X	X		
13	Formwork for 1st side for 1st floor wall w1	1/15/2007	GC	X	X	X	X	X	X	X	X	X		
14	Mechanical penetrations in 1st floor wall w1	1/15/2007	Mechanical	X	Shop Dwg approval	Puddle flange (Seal)	X	X	X	X	X	X		
15	Strip formwork for columns 1,2,3,4	1/15/2007	GC	X	X	X	X	X	X	X	X	X		
16	Electrical inserts/rough-in for columns 5,6,7,8	1/16/2007	Electrical Sub	X	X	X	X	GI couplers	X	X	X	X		
17	Formwork for 1st floor columns 5,6,7,8	1/17/2007	GC	X	X	X	X	X	X	X	Inspection	X		
18	Formwork for 2nd side for 1st floor wall w1	1/16/2007	GC	X	X	X	X	X	X	X	Inspection	X		

Pull Planning: Detailed Planning

Courtesy of Alan Mossman

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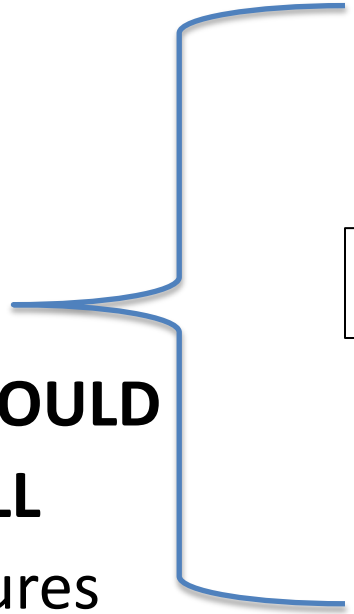
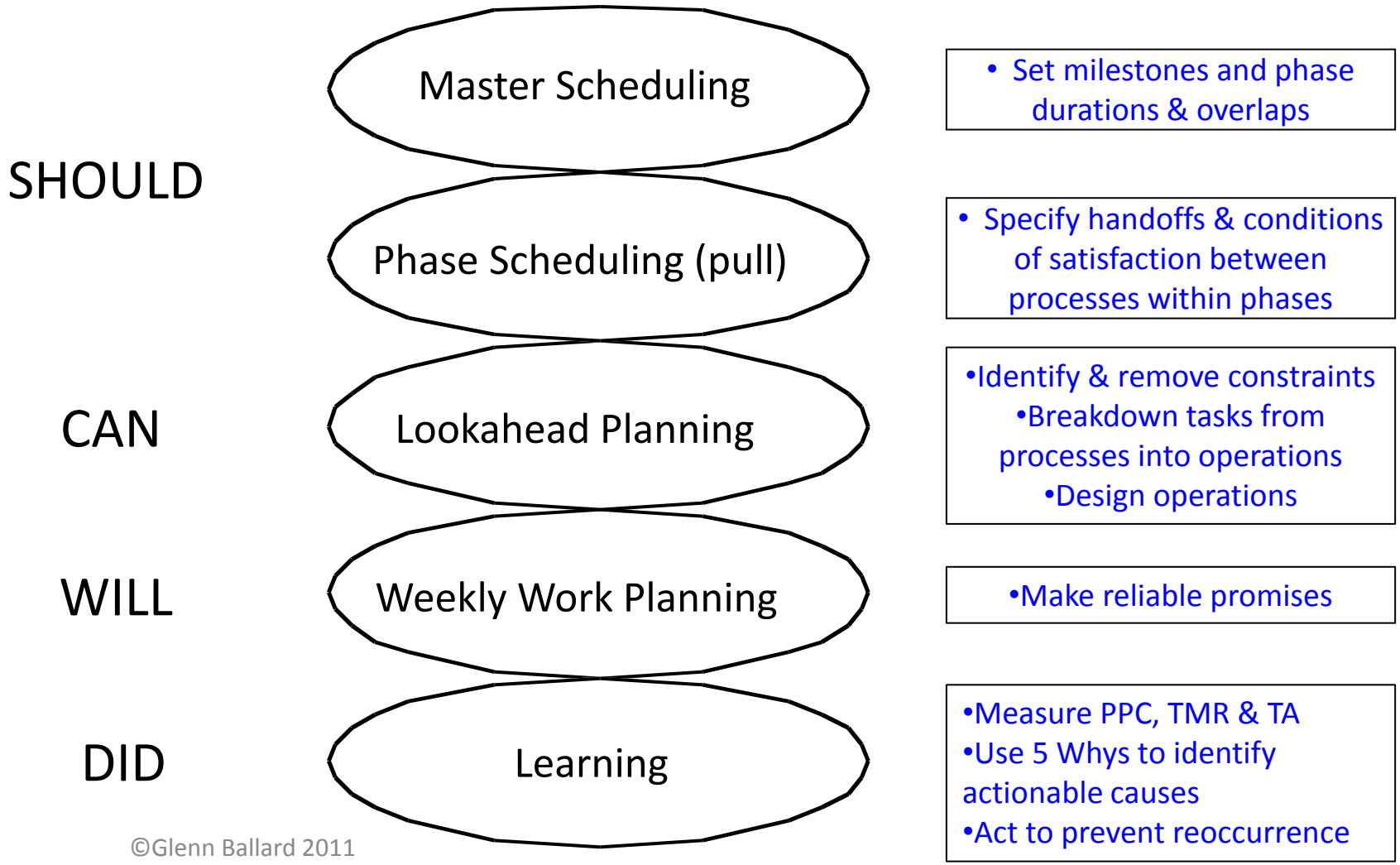


Last Planner

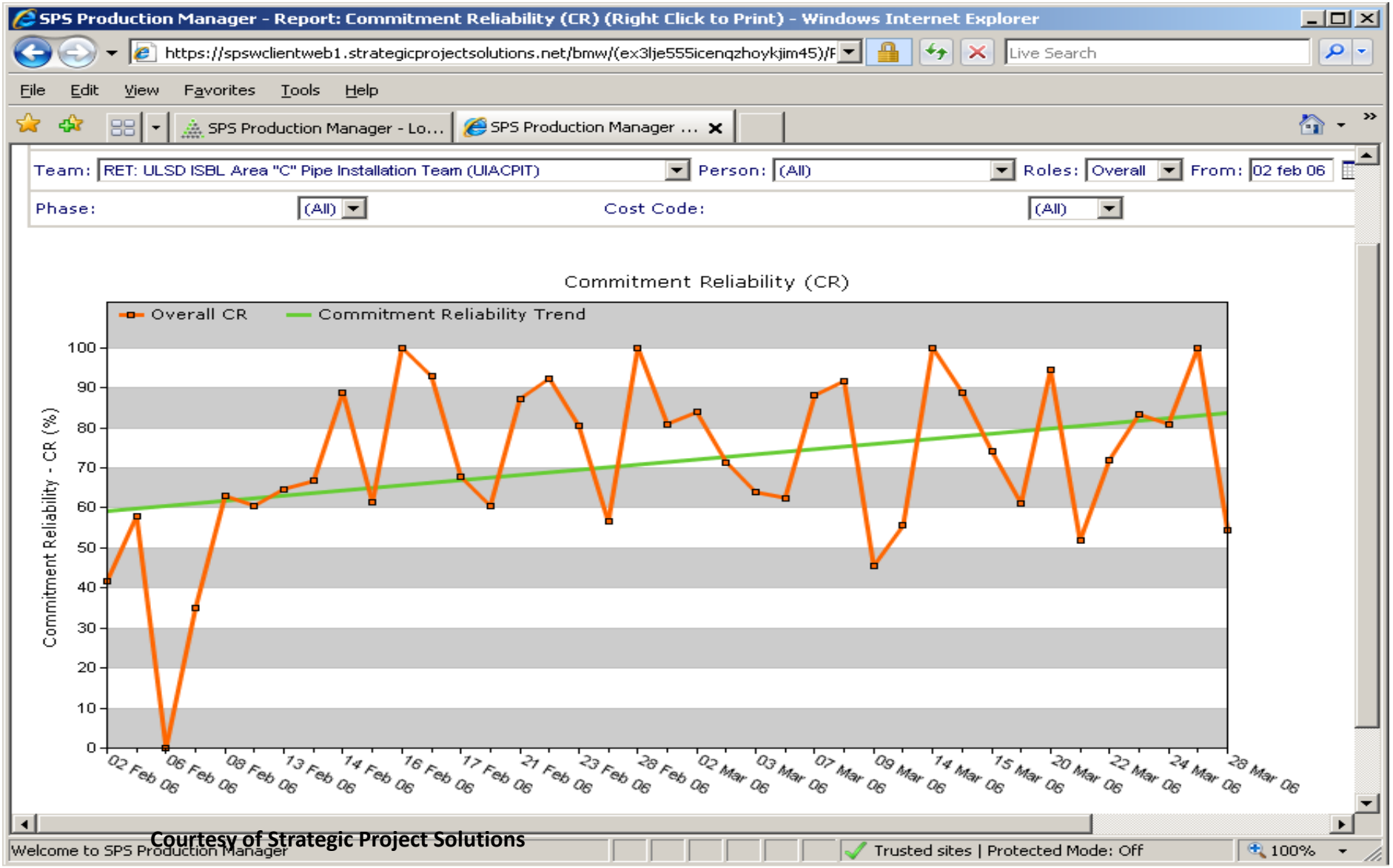
The Last Planner® System of Production Control



Last Planner Principles

1. Plan in greater detail as you get closer to doing the work – project/phases/processes/operations.
2. Produce plans collaboratively with those who will do the work.
3. Reveal and remove constraints on planned tasks as a team. Assume that constraints exist until you ‘know’ they don’t.
4. Make reliable promises.
5. When you don’t keep your promises, find root causes and preventions—learn from those breakdowns.

Daily & Weekly Workflow Planning & Coordination
Measuring & Improving Performance – PPC Trend

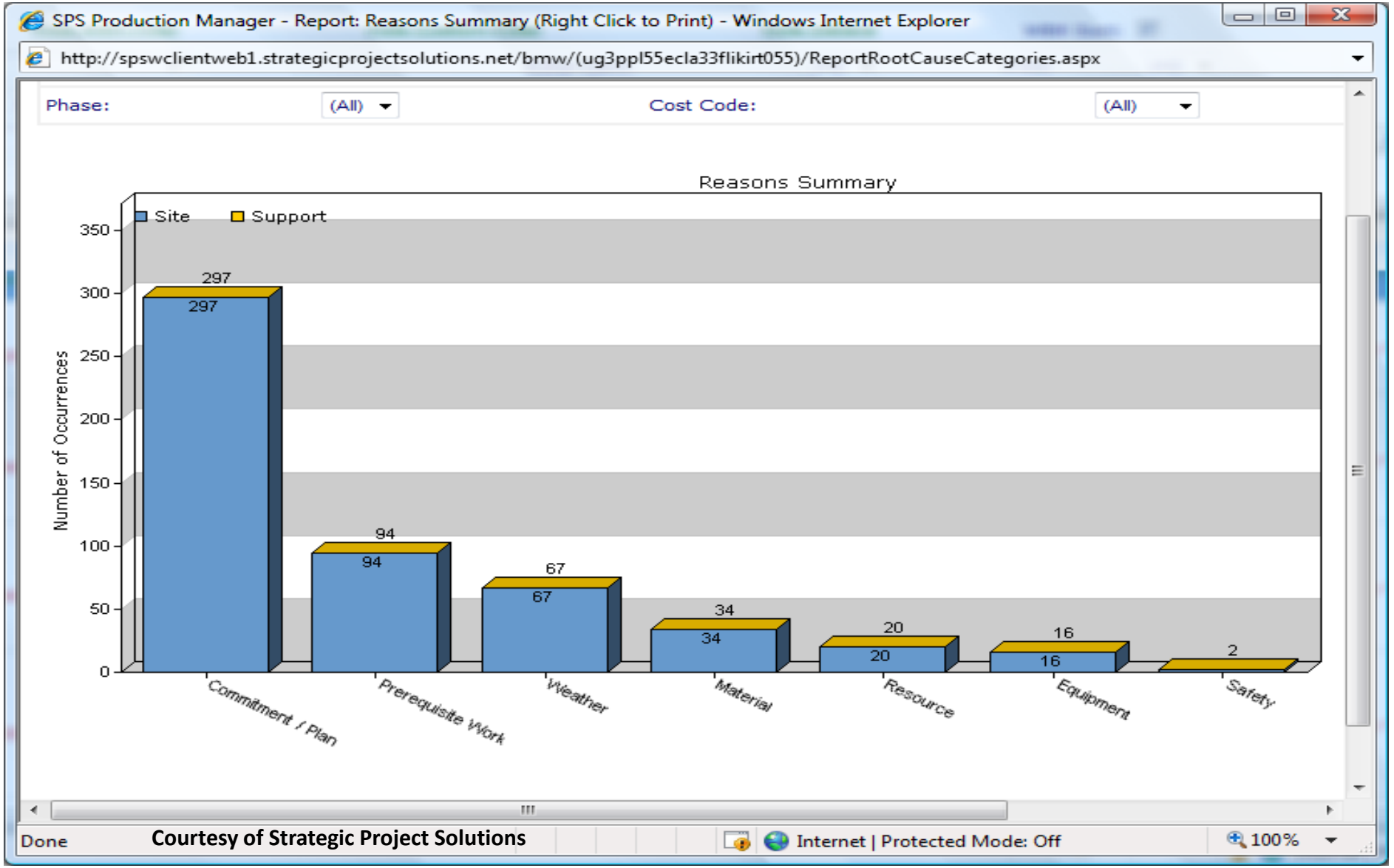


Courtesy of Strategic Project Solutions

Lookahead Metrics

- Tasks Anticipated (TA): What percentage of tasks in a plan for a day or week were anticipated in an earlier plan for that day or week?
- Tasks Made Ready (TMR): What percentage of tasks in an earlier plan for a day or week were included in a later plan for that day or week?

Daily & Weekly Workflow Planning & Coordination
Measuring & Improving Performance – Root Cause Reasons Summary

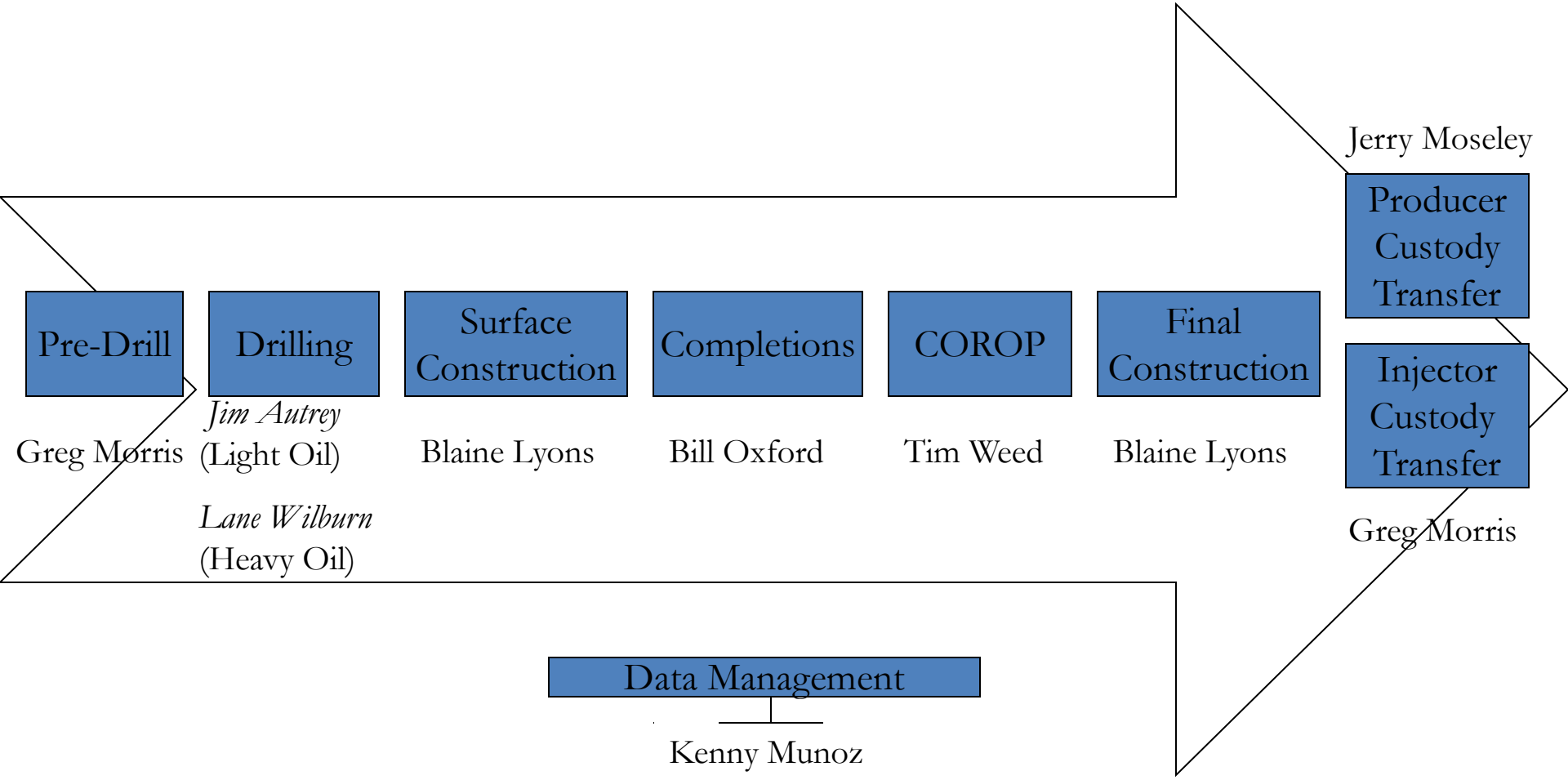


Courtesy of Strategic Project Solutions

How Oil Field Development is Different

1. Oil field development's customers are types, not individuals.
2. Oil field development can be understood as a multi-project processing system in which each well is a project, and each well has its own individual design and its specific route through the 'workstations' that constitute the system.
3. Oil field development is extractive, hence is location specific and involves processing but not assembly.
4. Oil field development is highly specialized and involves numerous specialists in designing and making its products, but typically with the same participating companies from well to well.

VSC Structure

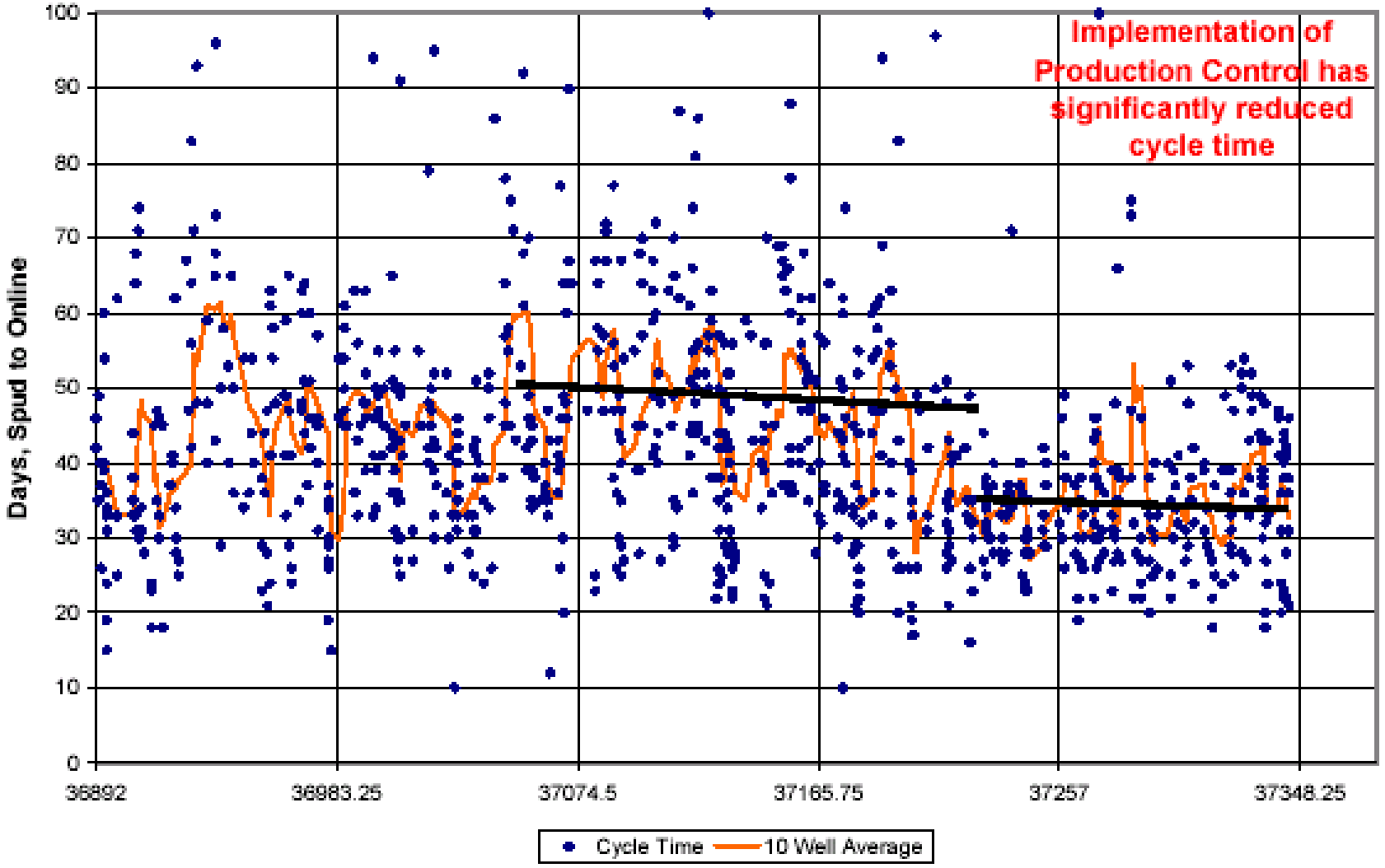


Mark Bledsoe – Process Supervisor

Managing the Entire Development Process

- Changes
  - Reduced batch sizes: financial packages (projects) & fracturing were reduced from 52 wells to 8
  - Last Planner
  - Well Mix: to approximate 2.3 wells/day takt time
  - Decoupling (Inventory) Buffer of drilled wells
  - Capacity Buffer (reduced regularly scheduled hours)
  - Substituted driller's estimate of completion for drilling engineer's after approx. 25% drilling duration
  - Learning from breakdowns through root cause analysis to reduce variation
- How did it work?
  - Release rate: PPC increased to 80-85%
  - WIP: reduced with smaller batch sizes
  - Cycle Time: reduced by 32% from spud to pipeline
  - Cost: reduced by 25%

Cycle Time for Wells online 1/1/2001 - 03/29/02



Thank you for your attention