

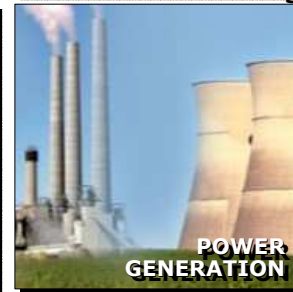
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Construction Simulation An Introduction

Tim O'Leary
Construction Solutions Europe & Africa



Solutions



Construction Simulation

CONSTRUCTION TODAY

Best practices and the challenges in applying them

BENTLEY'S CONSTRUCTSIM OVERVIEW

Proven solution to plan, process and status construction

USING CONSTRUCTSIM

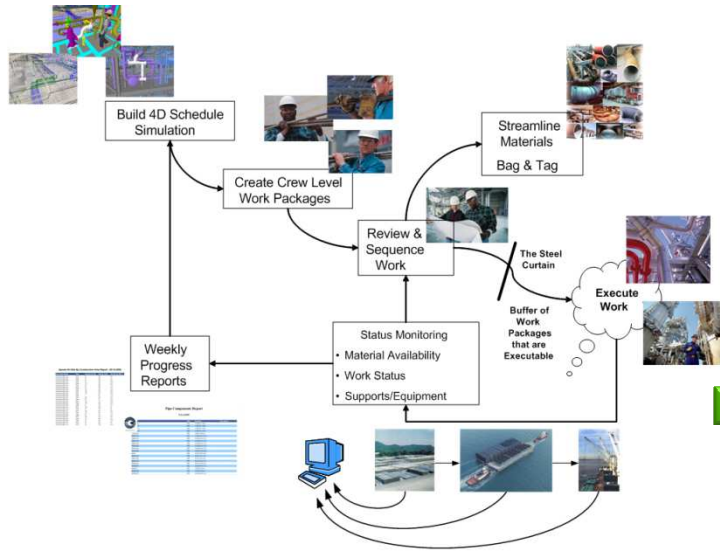
- VPM
- Data Reorganisation
- 4D playback
- Status tracking
- Work Packs
- Look ahead planning

BENEFITS

- Greater workforce productivity
- Shorter project time
- Substantial cost savings



Overview



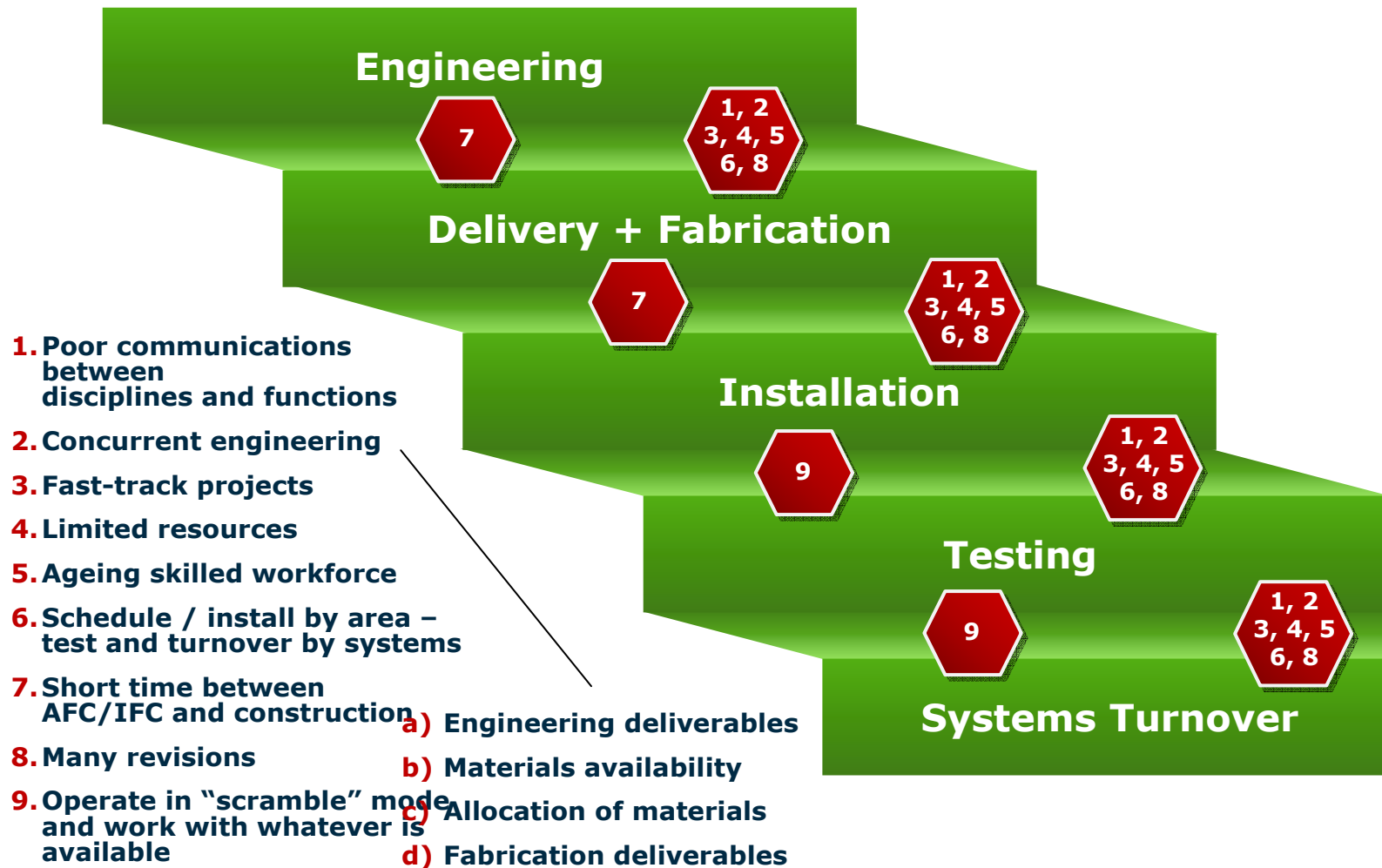
Construction Best Practices



Software Technology



Current Major Issues



Common Questions

Is the planned schedule achievable?



What is the exact progress to date?

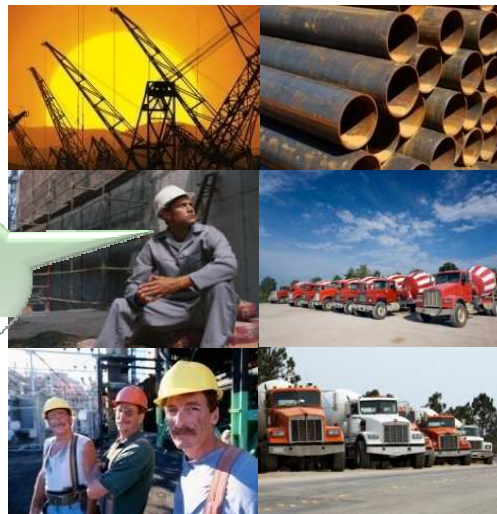
How will the schedule be kept given the changing circumstances?



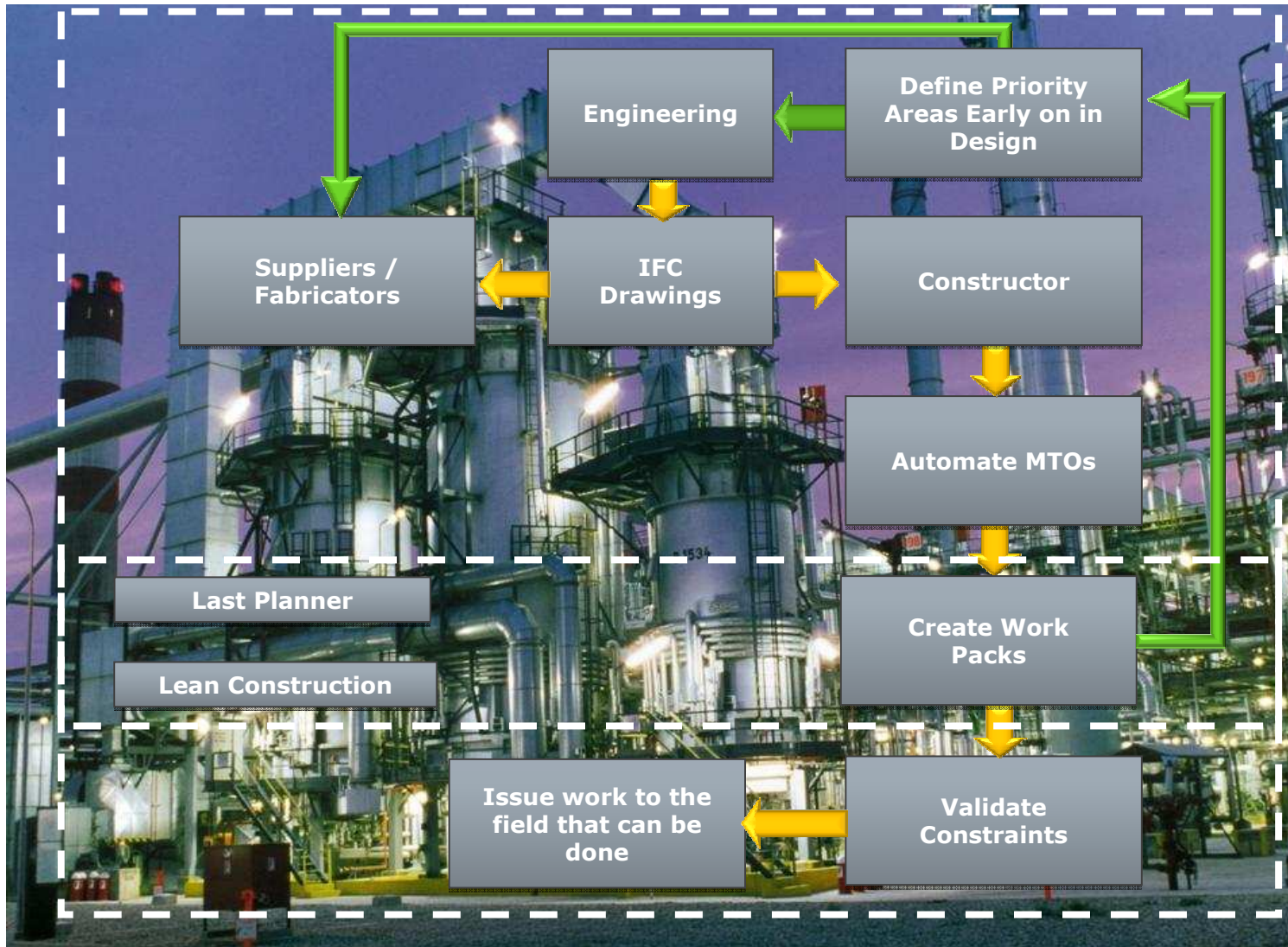
How will engineering changes affect work content, cost and schedule?

What effort is needed to complete?

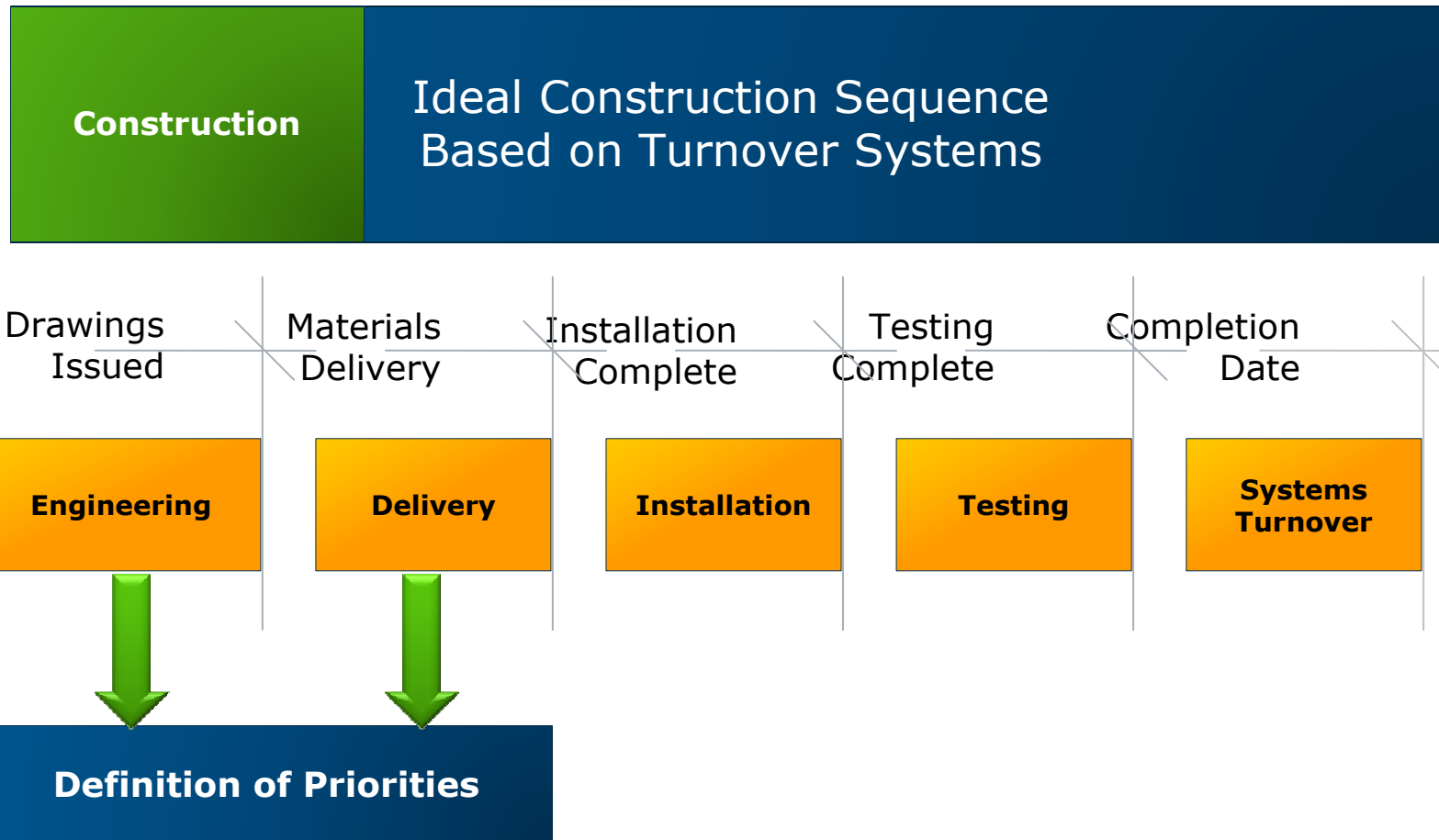
What will be the project impact be if materials are delayed?



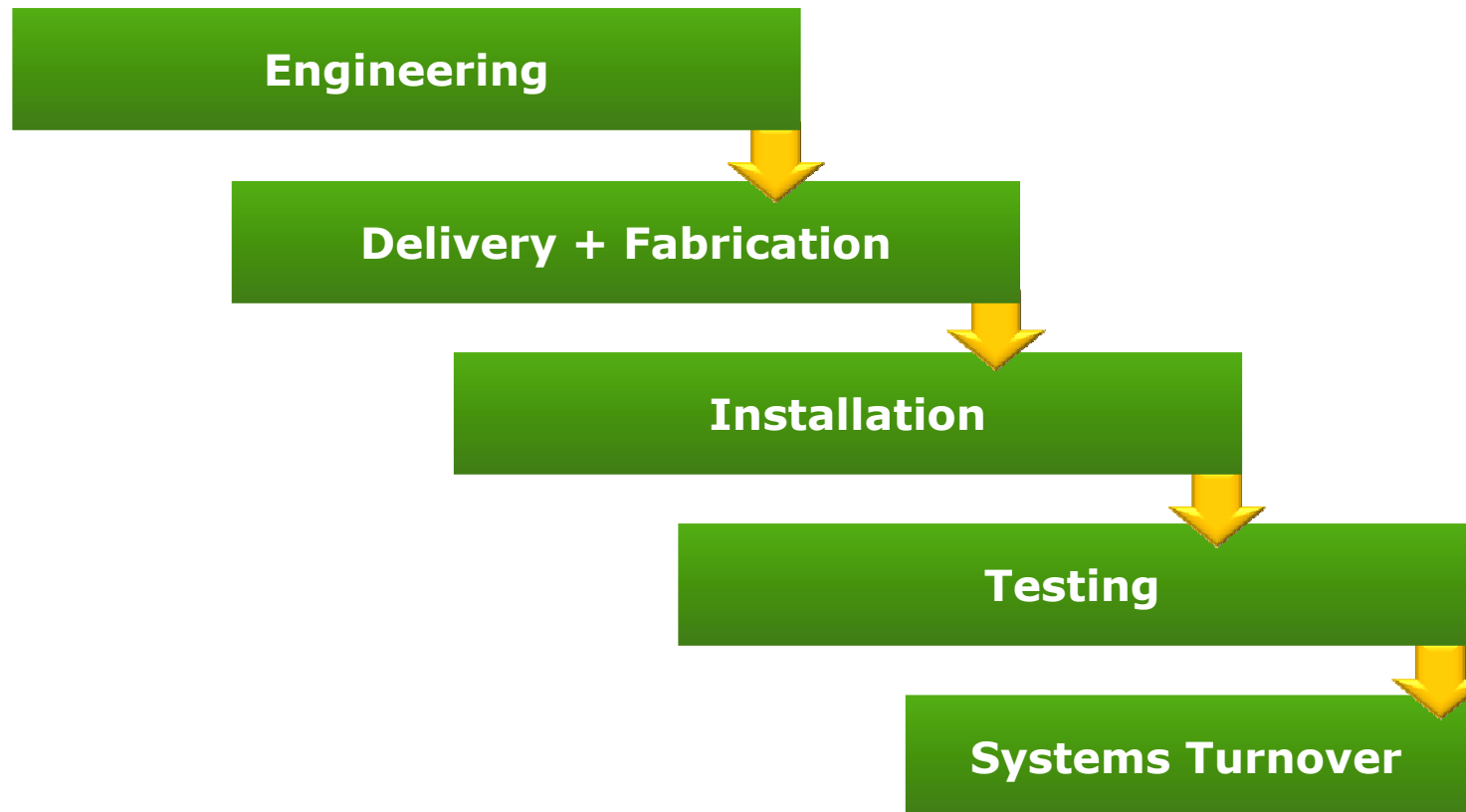
Workflow Planning



Linear Definition of Priorities



Managing Work Buffers to Speed Projects



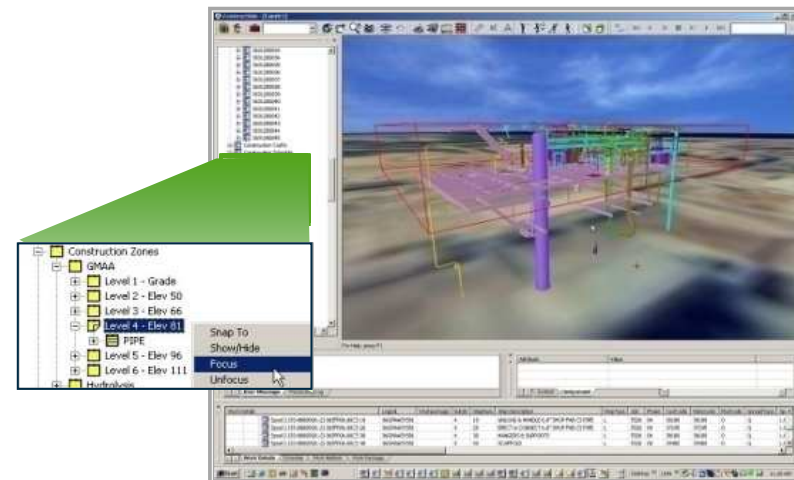
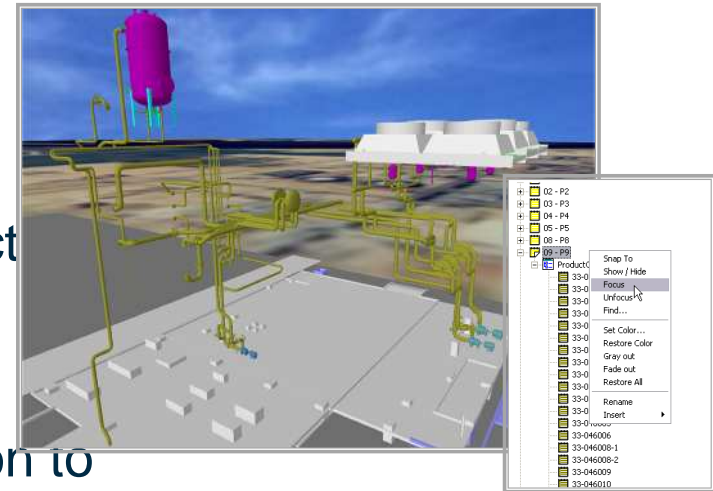
Construction Simulation

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ConstructSim Approach

- Drive priorities based on “ideal” construction sequence based on turnover systems
- Expedite both engineering and fabrication to deliver against ideal plan
- Allocate materials based on priorities
- Accurately track effort for completion
- Manage work-fronts effectively as constraints change on site



Client Feedback

Increase field productivity 7 – 25%

- Streamline sequencing
- Reduced rework
- Automated production of work packages
- Work packages are executable

Save time and cost on Brownfield projects

- TIC \$50M – Savings \$1M
- Completed 1 month ahead of schedule

ConstructSim

Piping
2x faster

Welding
1.8x faster



Diesel Refinery: \$2M Savings in Mechanical Sub Change Orders



" ConstructSim enabled us to recover project schedule losses, and complete on time - without paying for unwarranted change orders."

Claim: \$2.5M

Settled: \$0.5M

Background

- New Refinery Unit - TIC \$320M
- Lump Sum Contract with Mechanical Sub
- ConstructSim Pipe purchased by Owner and utilized by Construction Management firm

ConstructSim Use Case

- Excessive change order submitted by Mechanical Sub
- Actual progress not in alignment with progress reported
- ConstructSim used to analyze change order and update progress reporting system

Offshore Platform: Saved \$17M, Reduced Schedule 3 Months



" The labour efficiency we obtained using ConstructSim enabled us to save 3 months and U.S.\$17M, as well as reduce the punch list items by over 99%."

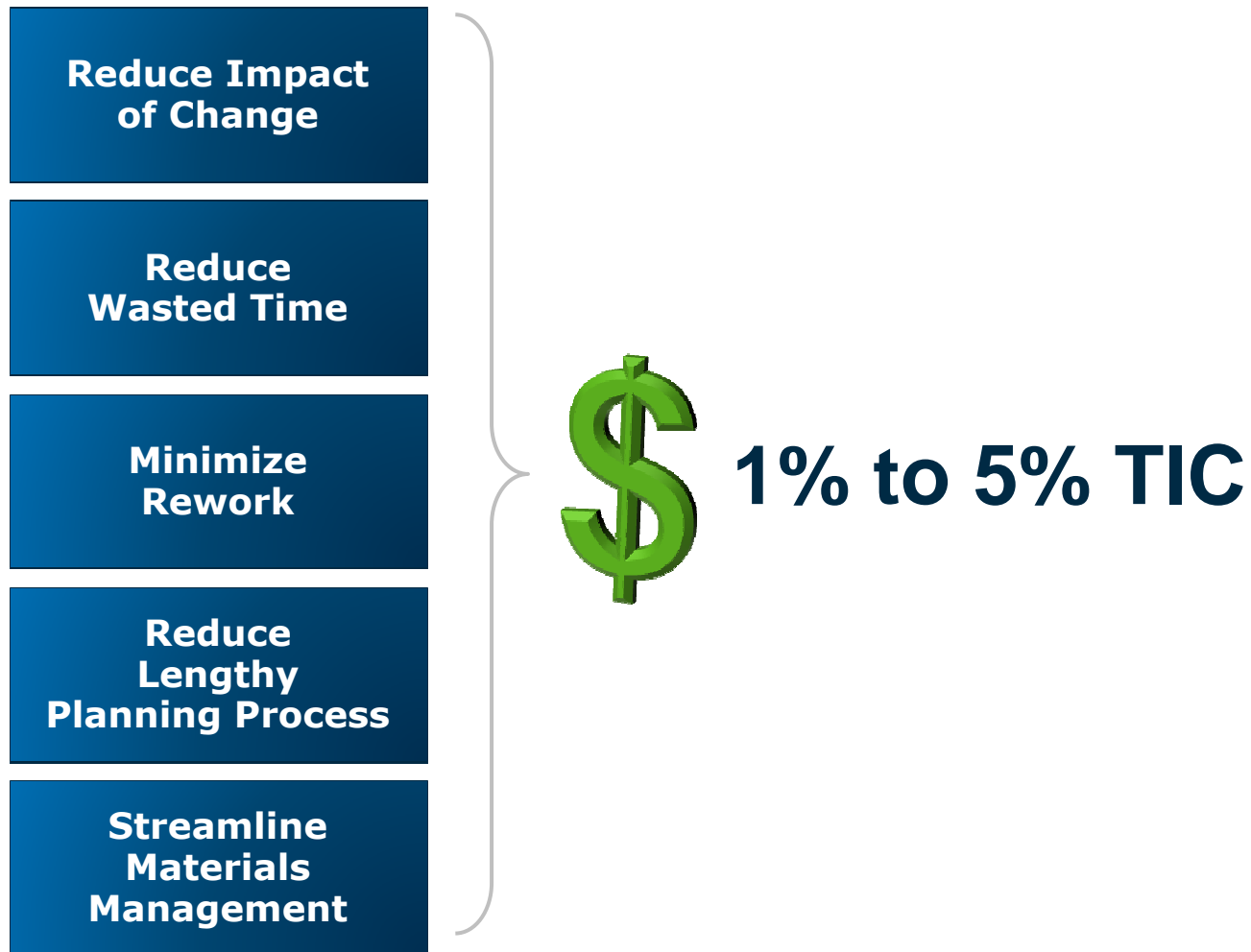
Background

- Deepwater Offshore Platform - \$150M
- Time and materials contract with Fab Yard
- ConstructSim Pipe purchased by Owner and utilized by module Fab Yard contractor

ConstructSim Use Case

- ConstructSim used to re-baseline project schedule
- Development of crew-level work face plans with ConstructSim
- Project completes on time, under budget, and sails away with only 7 punch list items (compared to 1000's for other projects)

ConstructSim Provides Measureable Savings



Who Uses ConstructSim?



BANTREL



CIANBRO

ExxonMobil



FLUOR ConocoPhillips



JE JACOBS



nexen



Engineers and Constructors, Ltd.

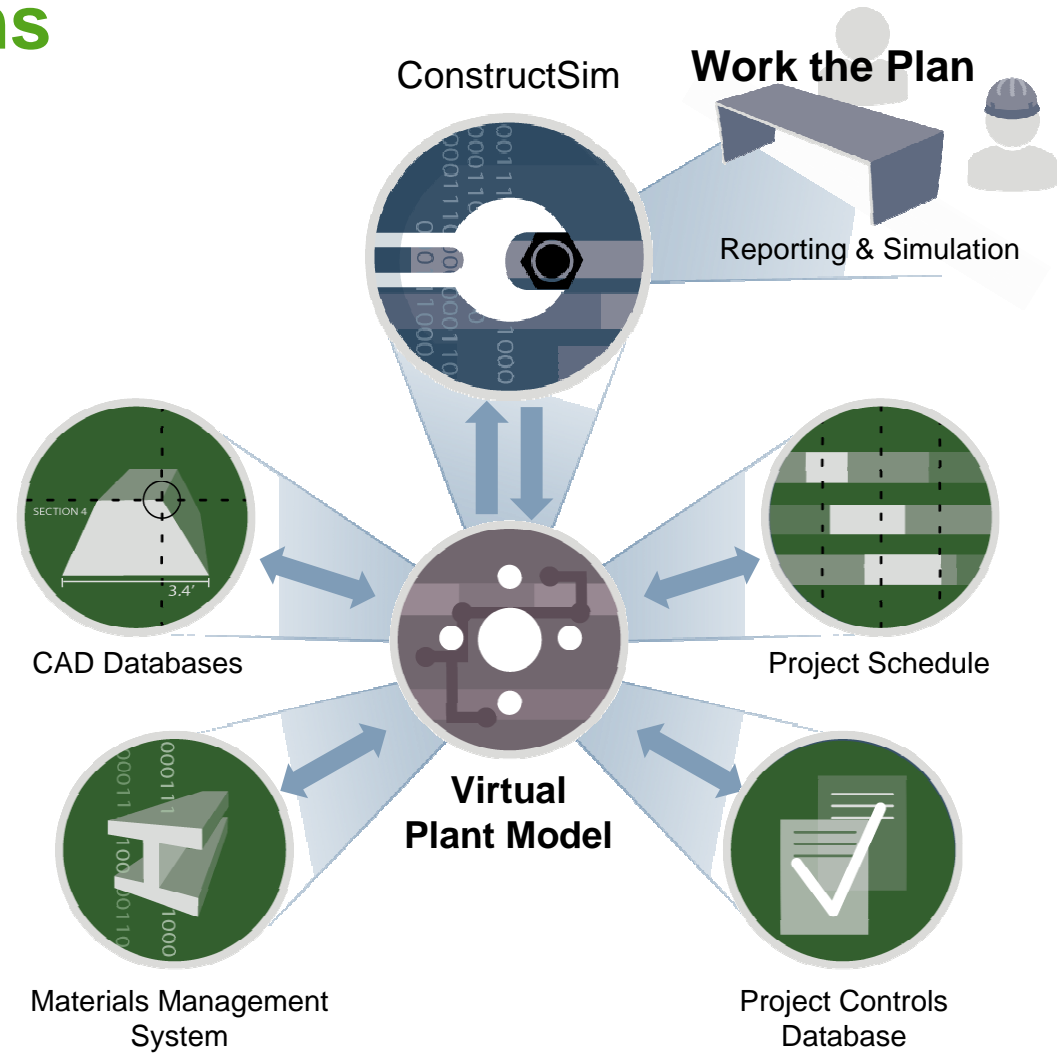


ZACHRY



ConstructSim Solves Complex Planning and Execution Problems

- Owners
- Construction Managers
- Constructors

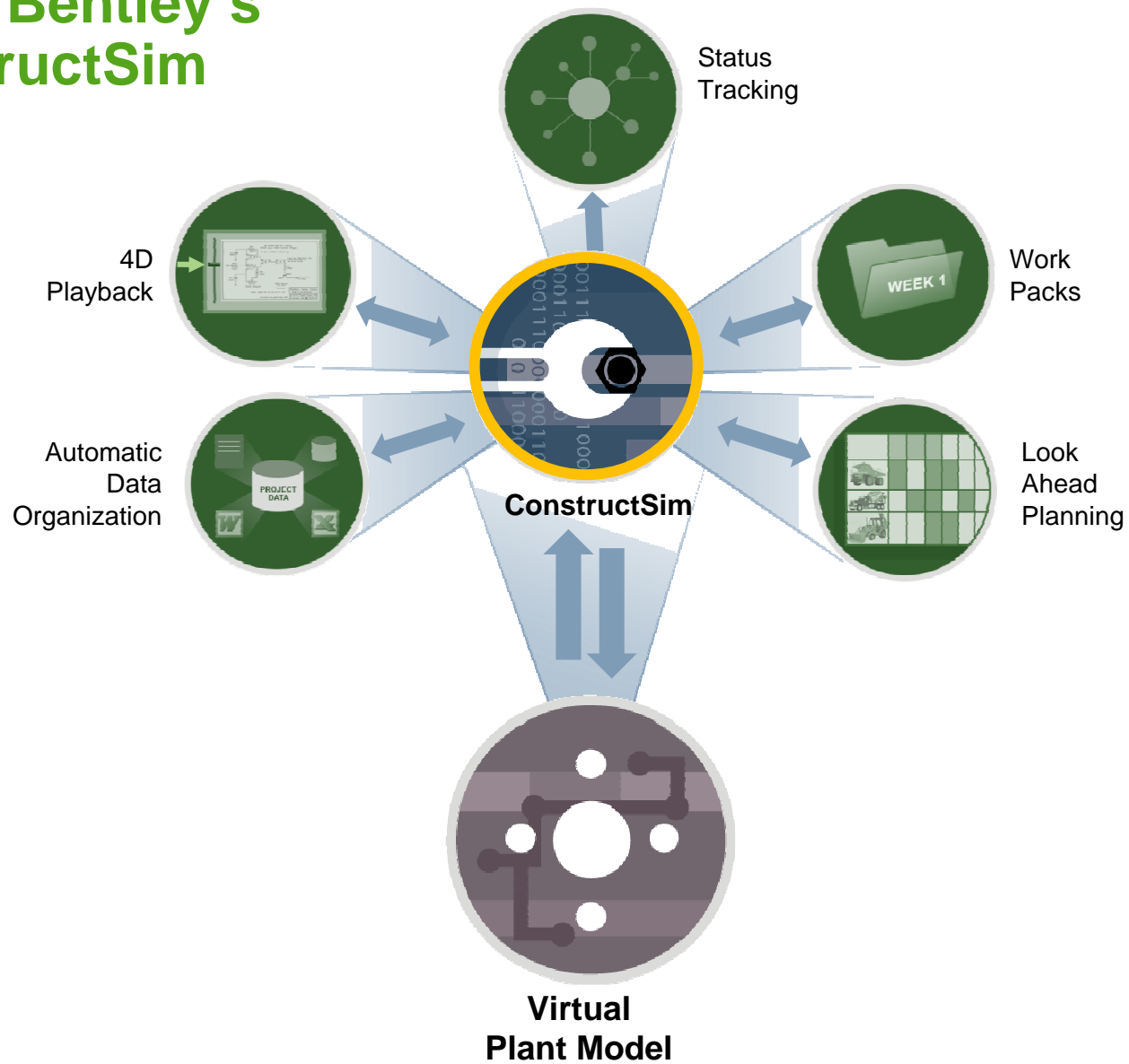


Construction Simulation

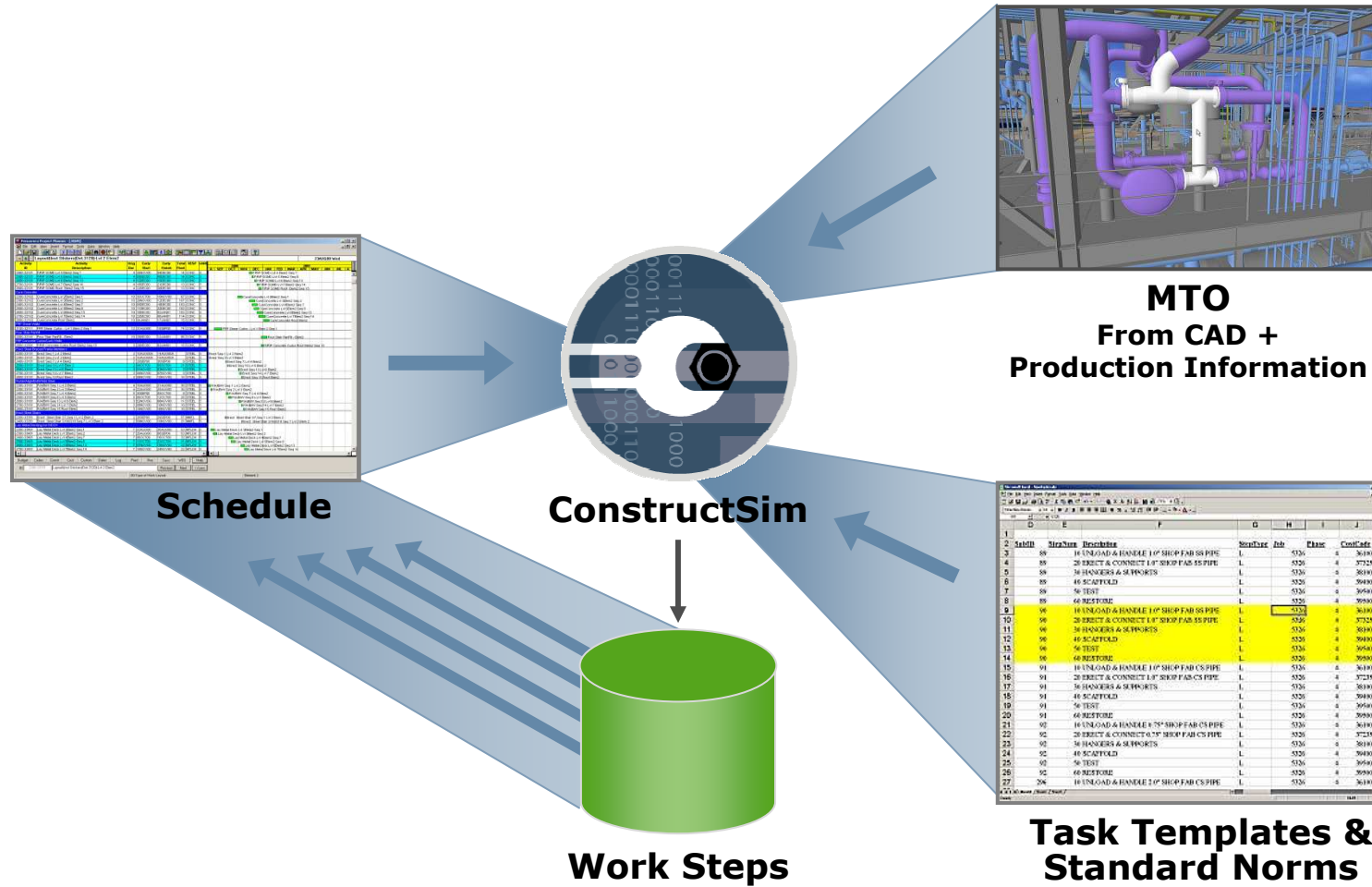
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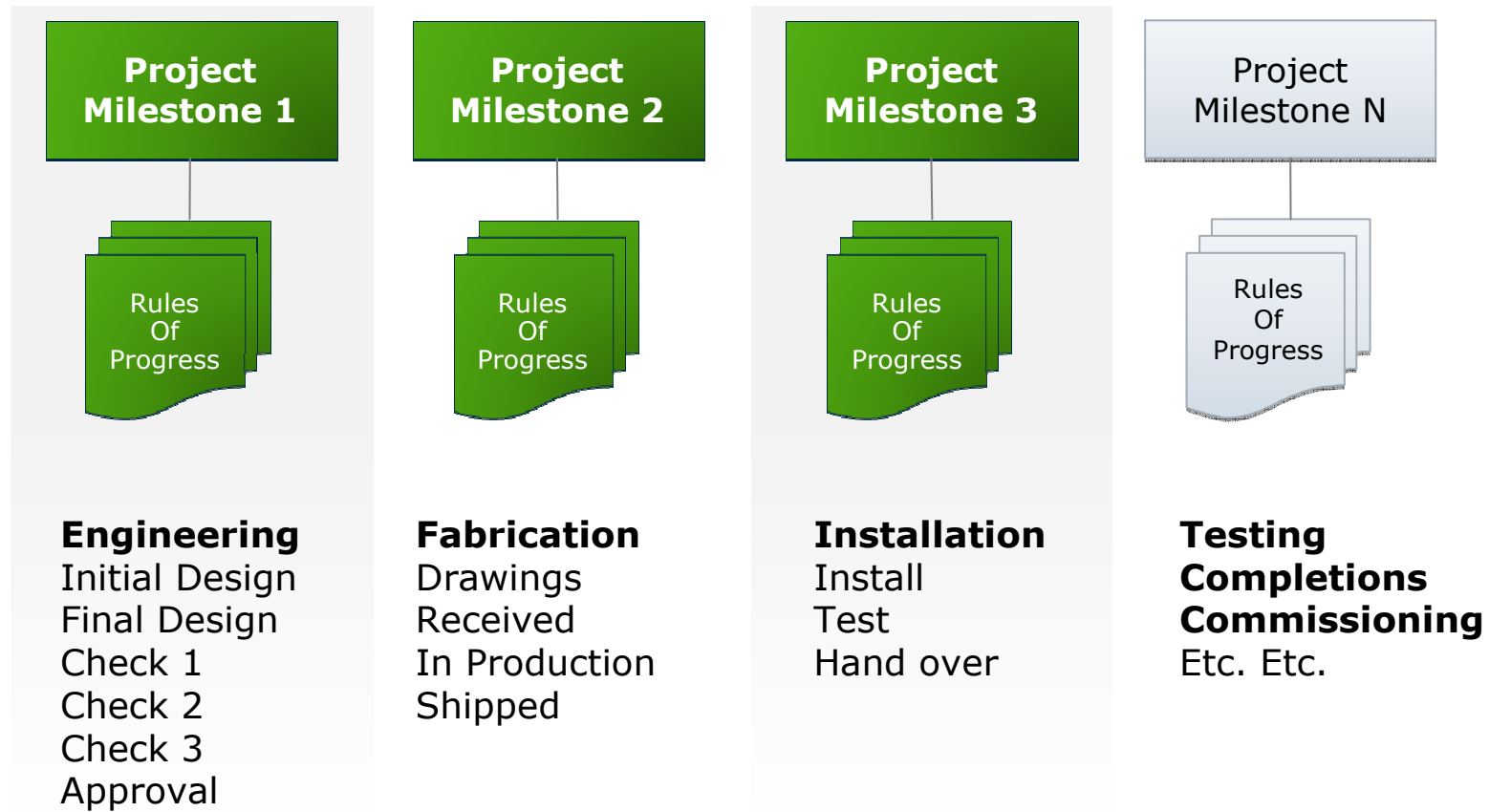
Using Bentley's ConstructSim



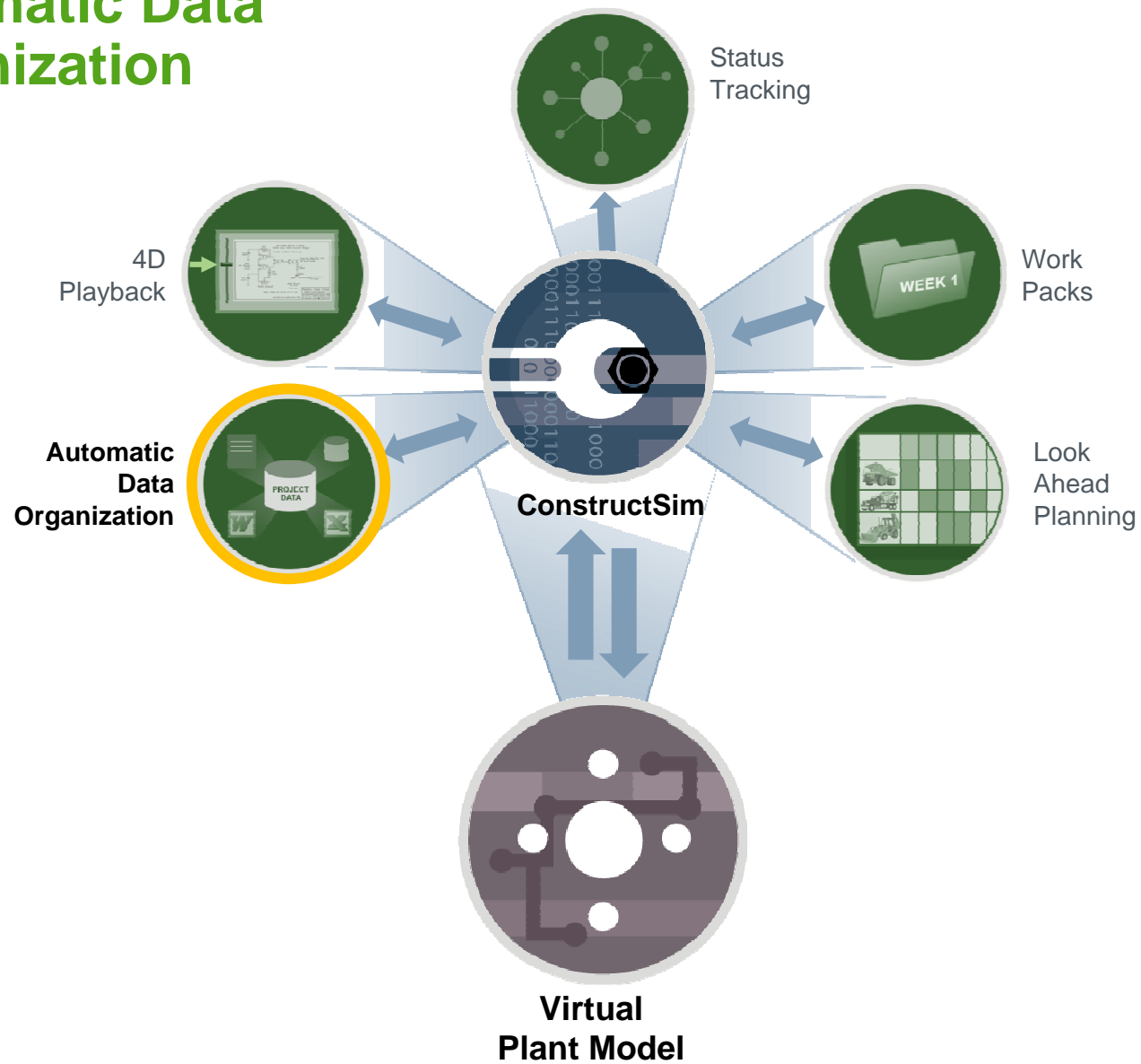
Project Schedule Integration



Project Milestones



Automatic Data Organization

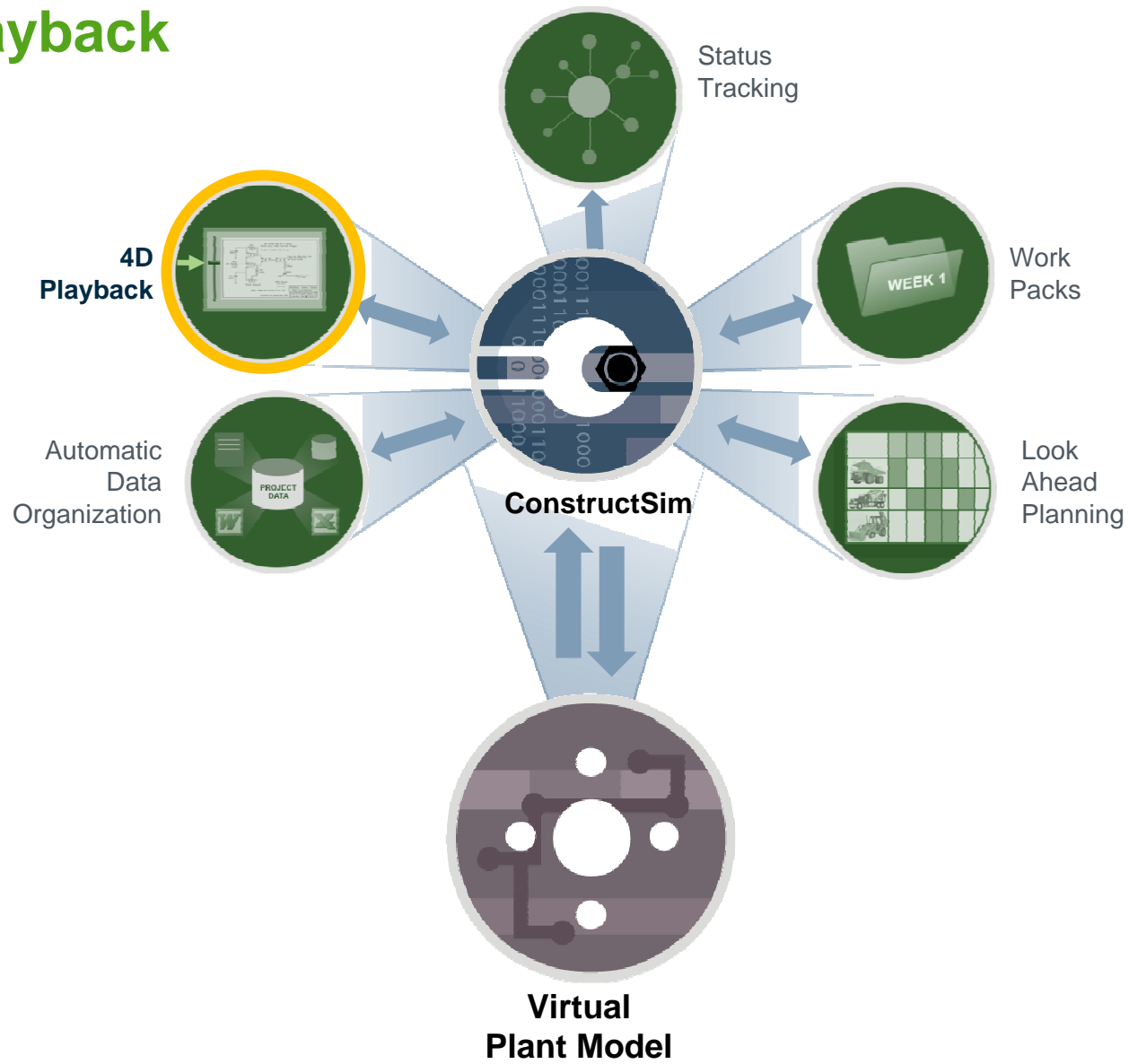


ConstructSim Automatic Data Reorganization for Construction Tasks

The screenshot displays the ConstructSim software interface for a project named "BlackGoldRefinery". The main window shows a 3D model of a refinery structure. On the left, a "Components" tree lists various equipment and piping items, including a hierarchy for "PPF203801" with sub-items like "03B-29-C47" and "03B-45414-01". Below the model is a "Schedule" window with a table of activities.

Activity Name	Activity Type	Activity Description	Early Start	Early Finish	Late Start	Late Finish	Schedule Start	Schedule Finish	Actual Start	Actual Finish
010	4D Reference	Start	14/07/2008	29/01/2009						
070	Construction	FRP_Area_03_Foundations	25/08/2008	03/10/2008						
120	Construction	Install_Exch_29E-4A	24/10/2008	24/10/2008						
130	Construction	Install_Exch_29E-4B	27/10/2008	27/10/2008						
140	Construction	Install_Exch_29E-4C	28/10/2008	28/10/2008						

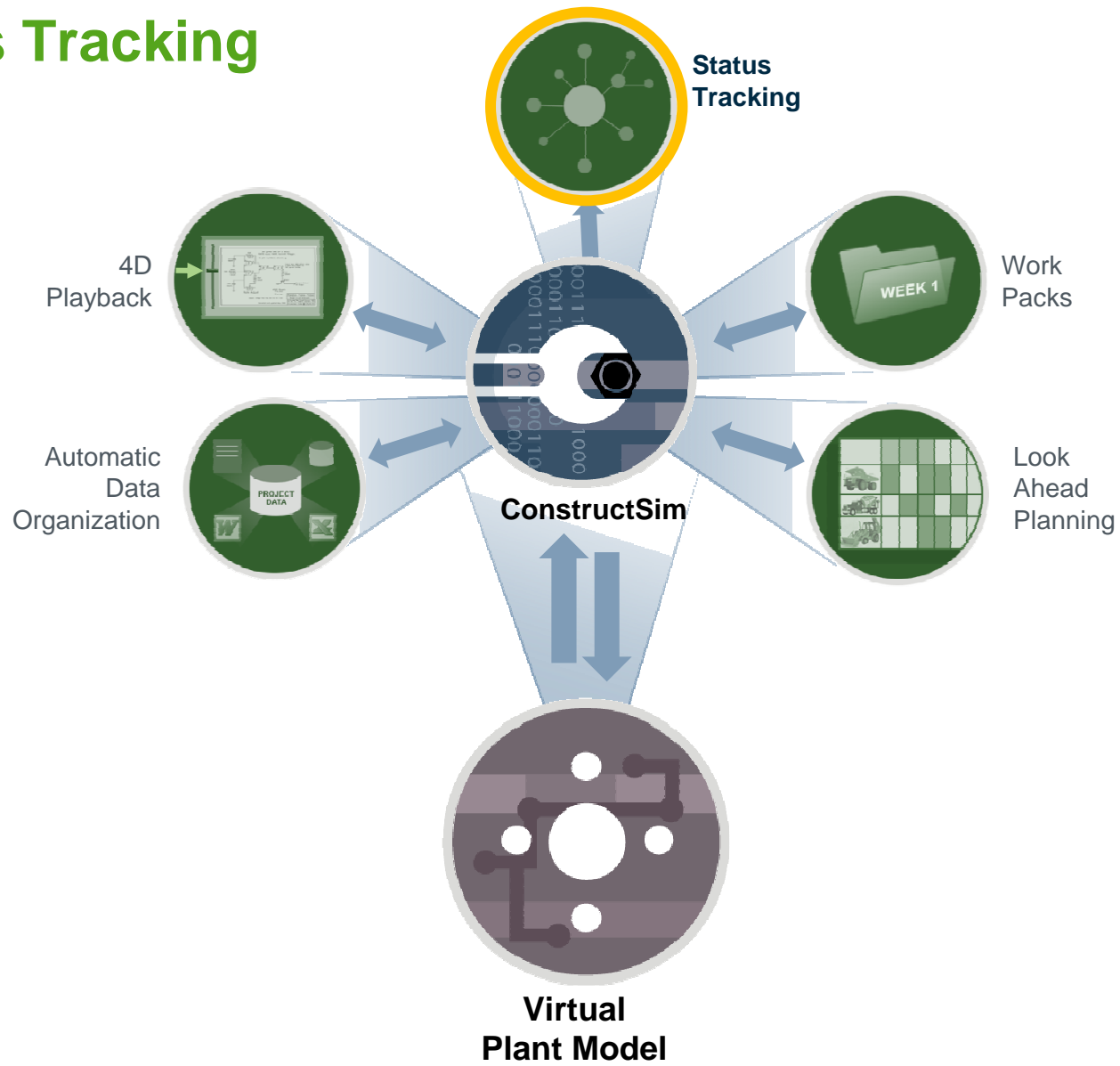
4D Playback



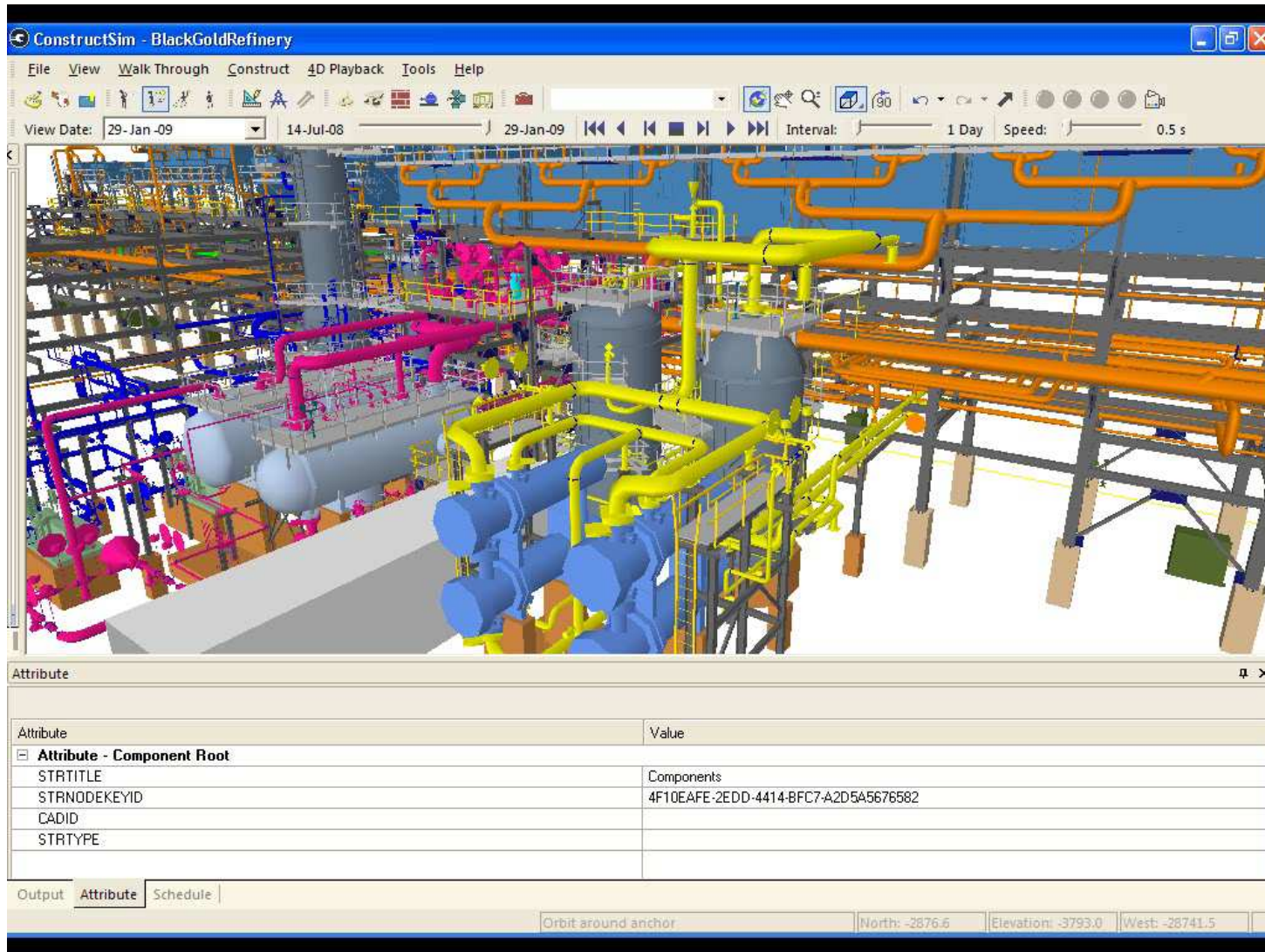
4D Playback to Optimize and Communicate the Construction Sequence



Status Tracking



On-Demand Status Tracking and Visualisation



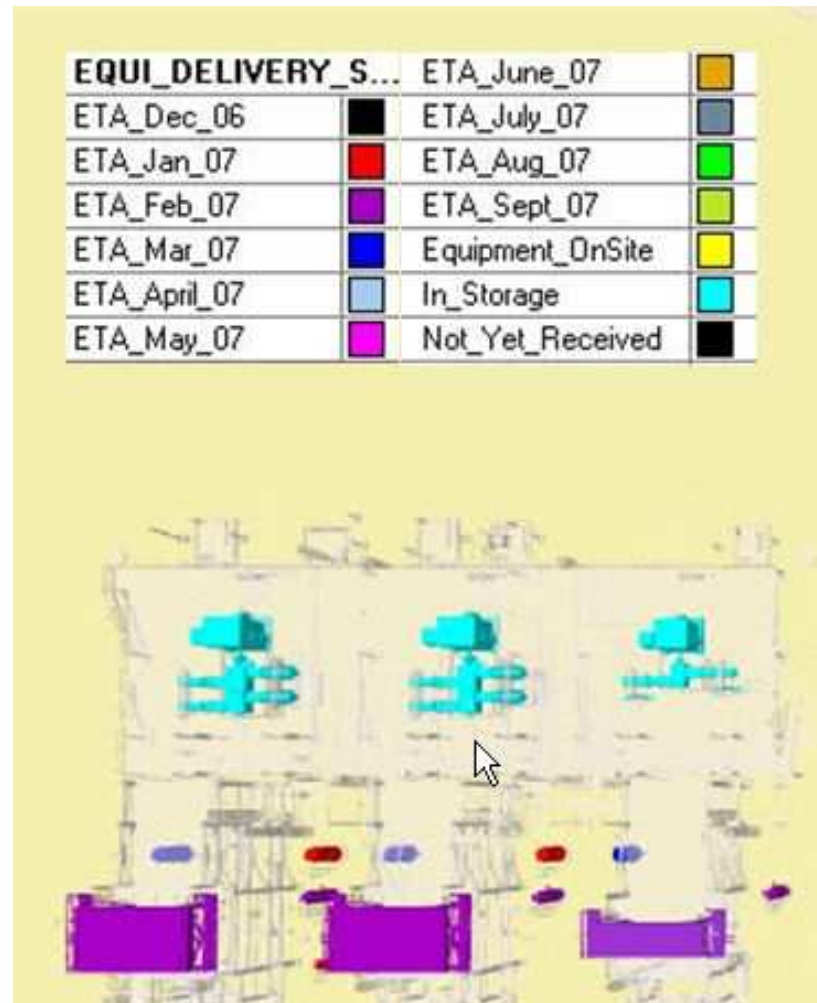
The screenshot displays the ConstructSim software interface for a refinery project. The main window shows a 3D perspective view of a complex industrial facility with numerous pipes, tanks, and structural steel. The interface includes a menu bar (File, View, Walk Through, Construct, 4D Playback, Tools, Help), a toolbar with various navigation and manipulation tools, and a timeline at the top with dates (29-Jan-09, 14-Jul-08, 29-Jan-09) and controls for Interval (1 Day) and Speed (0.5 s).

Below the 3D view is an 'Attribute' panel with a table of component data:

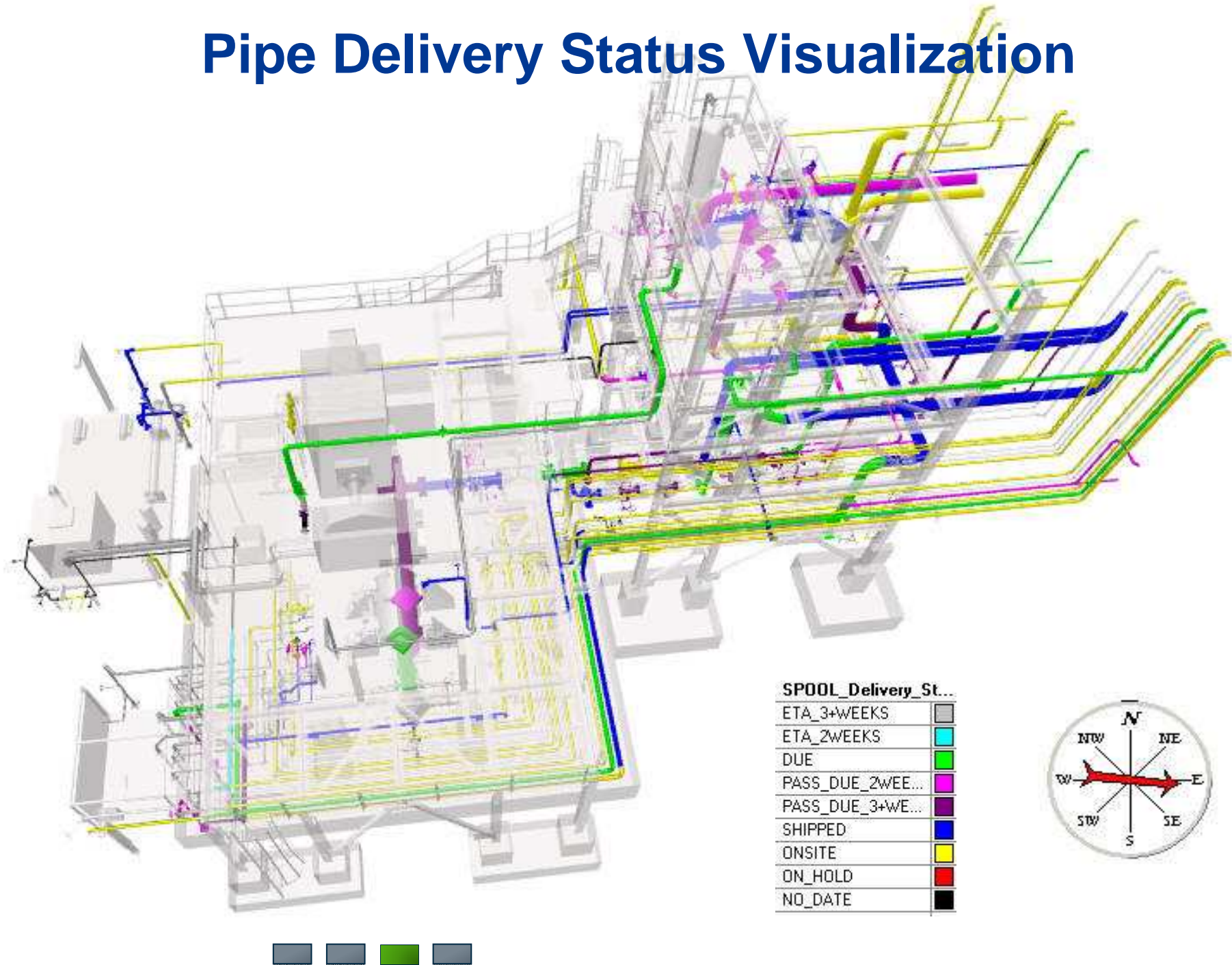
Attribute	Value
Attribute - Component Root	
STRTITLE	Components
STRNODEKEYID	4F10EAFE-2EDD-4414-BFC7-A2D5A5676582
CADID	
STRTYPE	

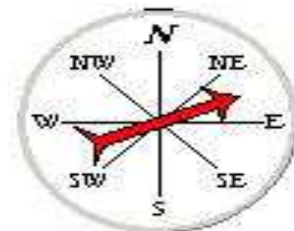
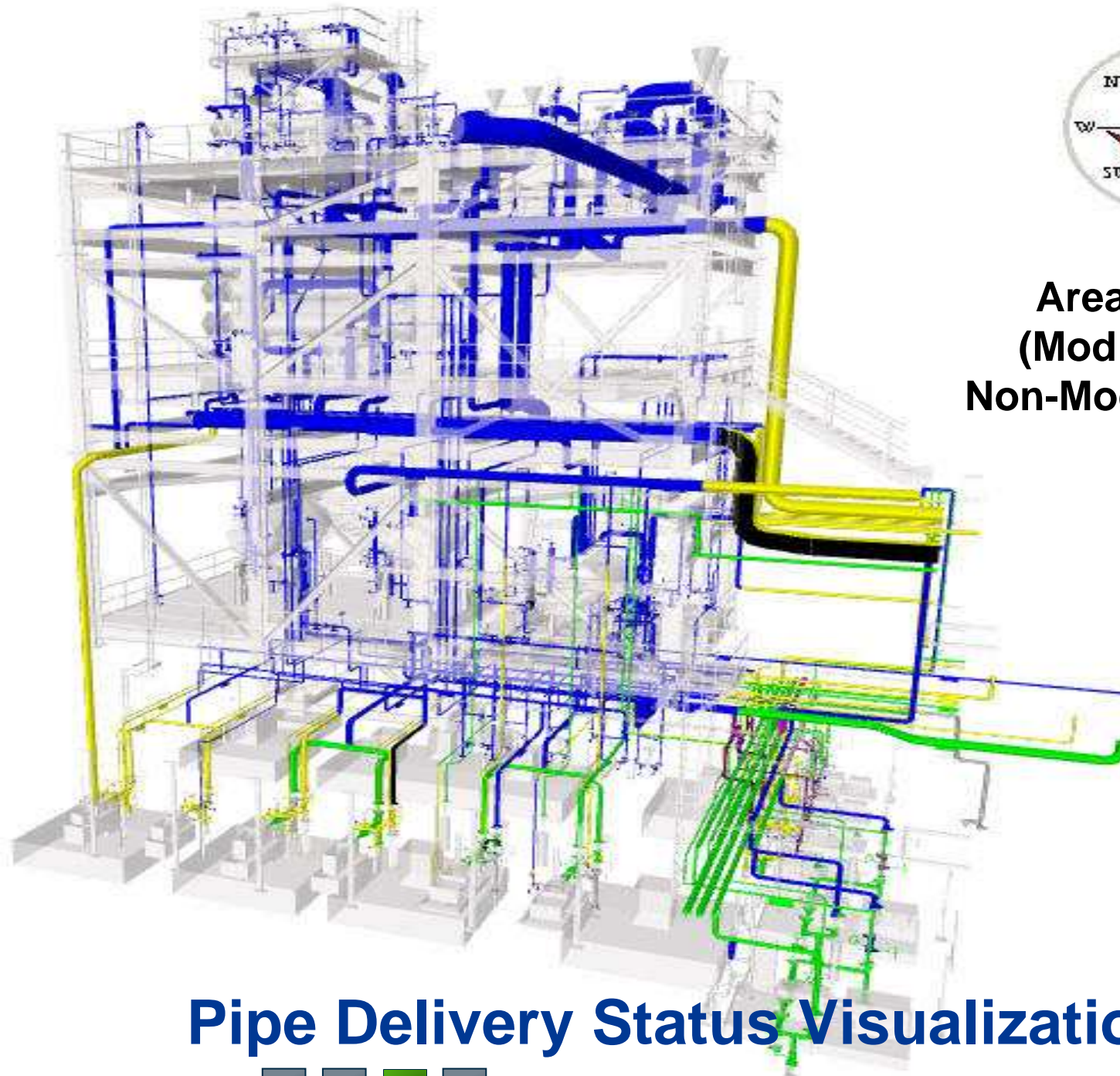
At the bottom of the attribute panel, there are tabs for 'Output', 'Attribute', and 'Schedule'. Below the table, there are fields for 'Orbit around anchor', 'North: -2676.6', 'Elevation: -3793.0', and 'West: -26741.5'.

Tracking Equipment Delivery



Pipe Delivery Status Visualization



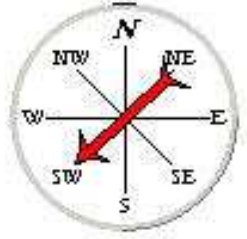
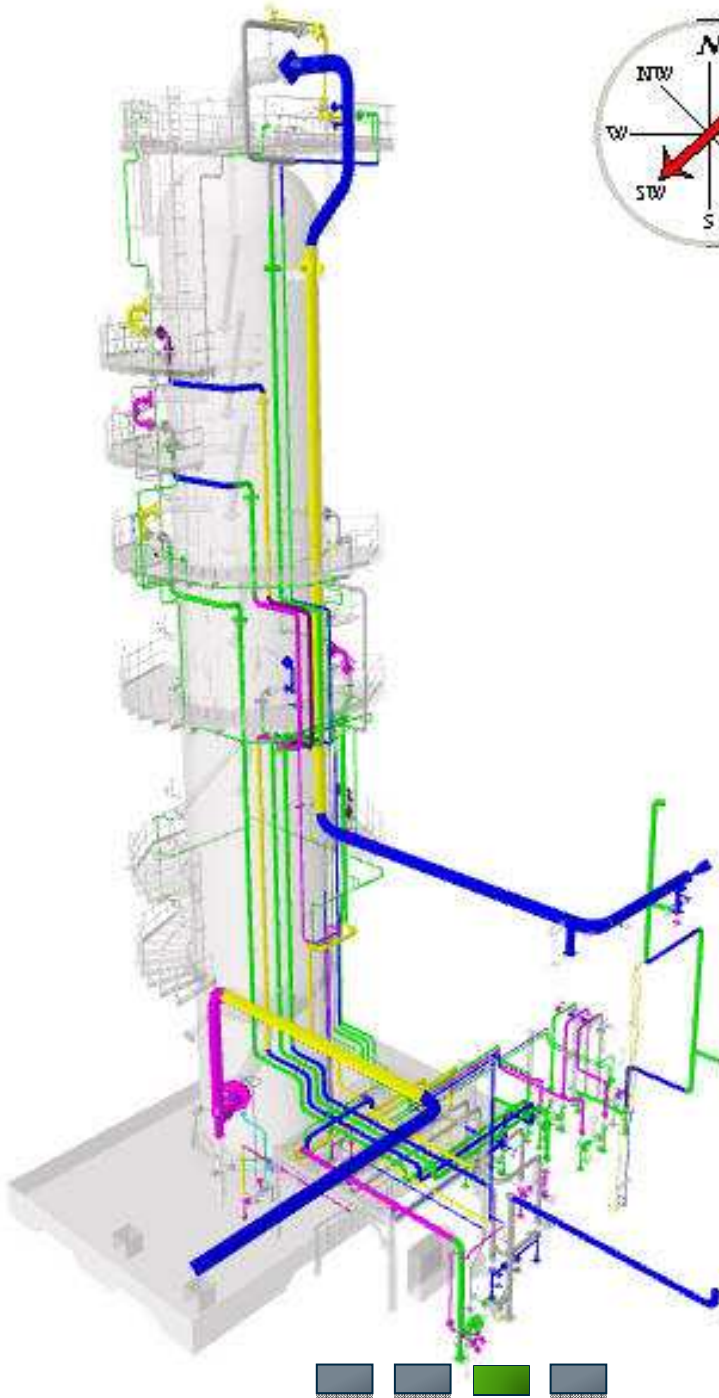


**Area 08
(Mod and
Non-Mod Pipe)**

SPOOL_Delivery_St...	
ETA_3+WEEKS	Grey
ETA_2WEEKS	Cyan
DUE	Green
PASS_DUE_2WEE...	Magenta
PASS_DUE_3+WE...	Purple
SHIPPED	Blue
ONSITE	Yellow
ON_HOLD	Red
NO_DATE	Black

Pipe Delivery Status Visualization





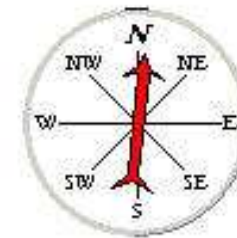
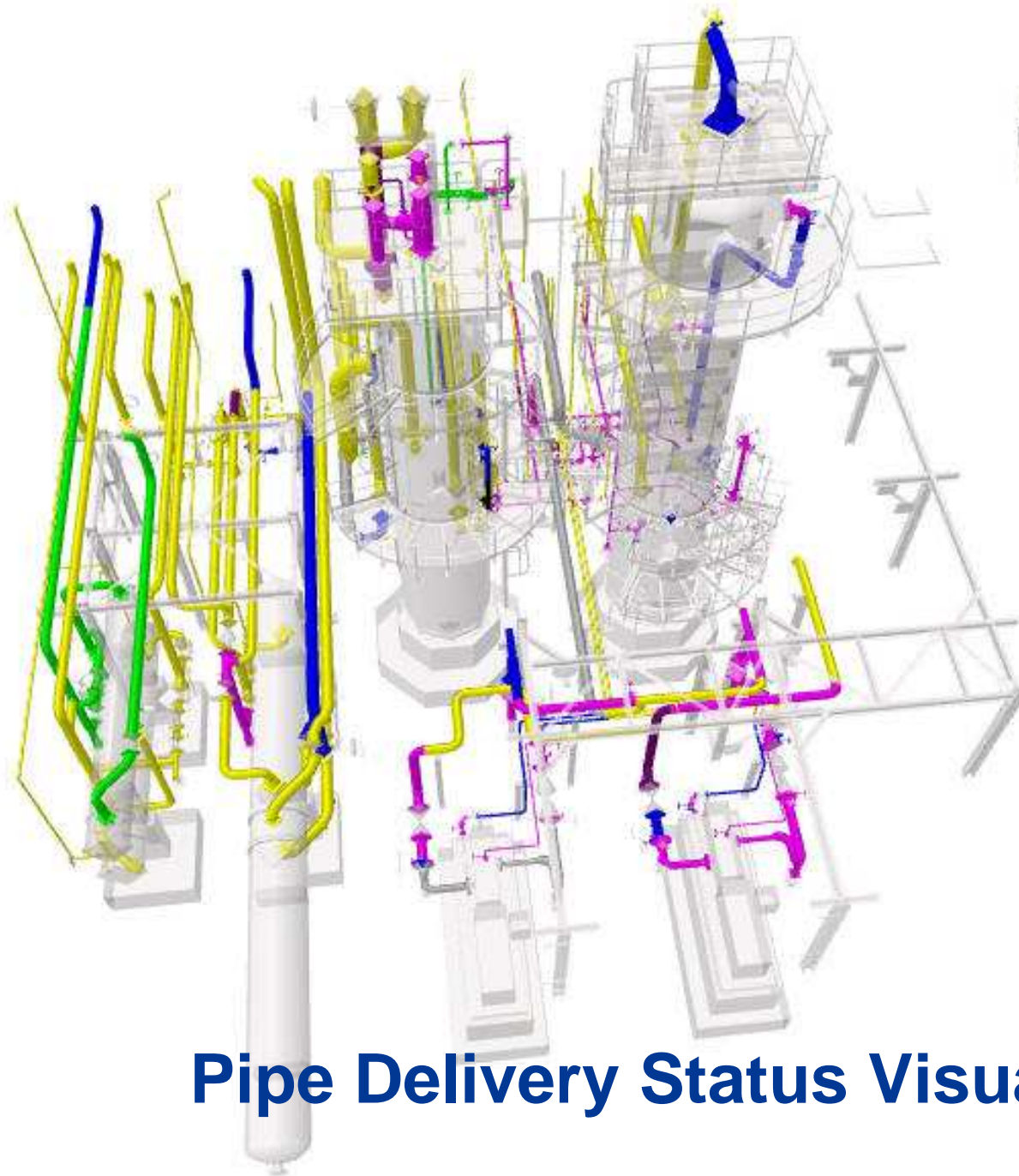
Pipe Delivery Status Visualization

Area 11

SPOOL_Delivery_St...

ETA_3+WEEKS	Grey
ETA_2WEEKS	Cyan
DUE	Green
PASS_DUE_2WEE...	Magenta
PASS_DUE_3+WE...	Dark Purple
SHIPPED	Blue
ONSITE	Yellow
ON_HOLD	Red
NO_DATE	Black





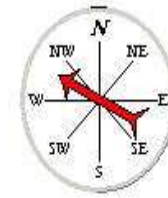
Area 15

SPOOL_Delivery_St...	
ETA_3+WEEKS	Grey
ETA_2WEEKS	Cyan
DUE	Green
PASS_DUE_2WEE...	Magenta
PASS_DUE_3+WE...	Purple
SHIPPED	Blue
ONSITE	Yellow
ON_HOLD	Red
NO_DATE	Black

Pipe Delivery Status Visualization



Area 02



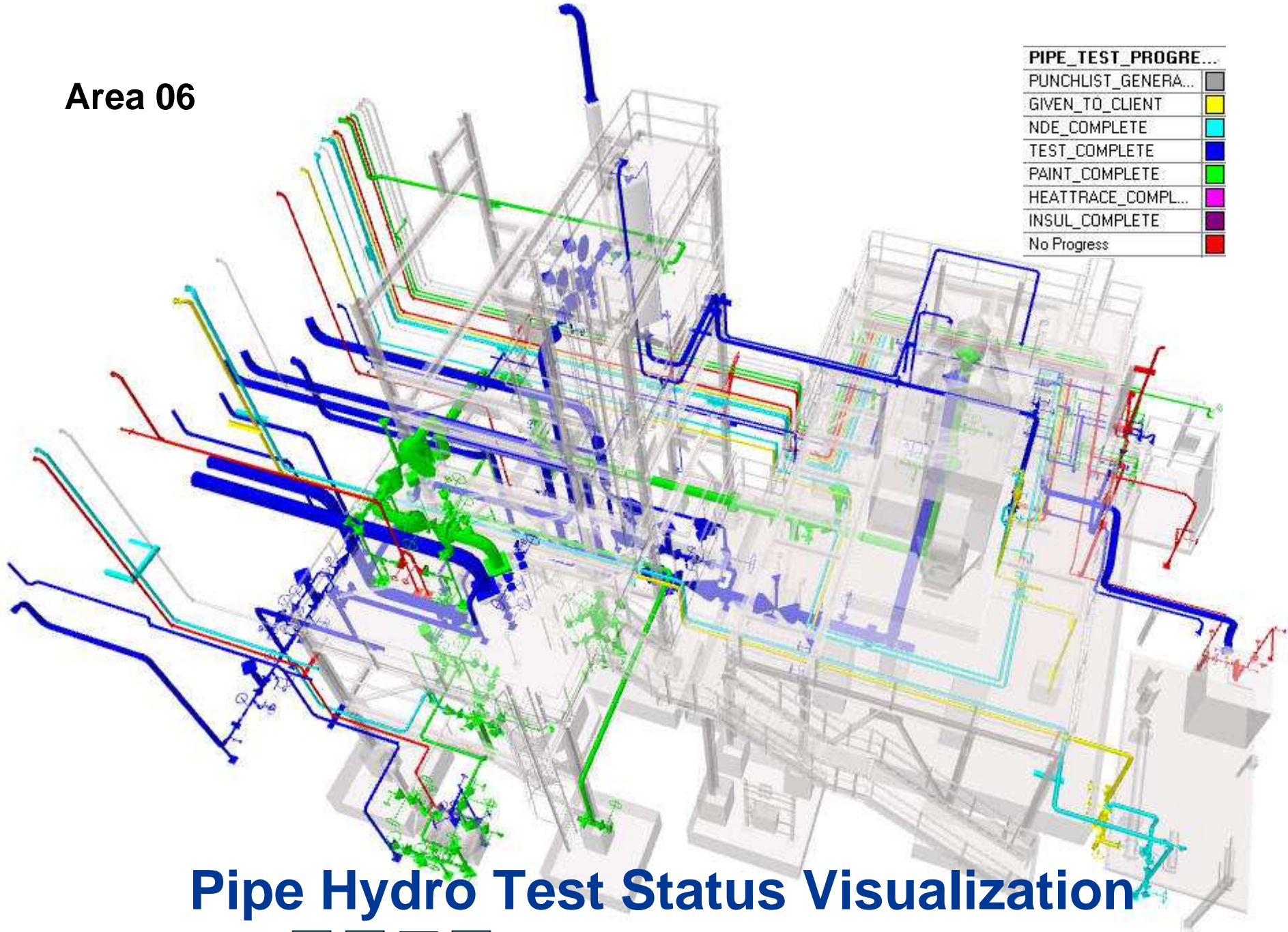
PIPE_TEST_PROGRE...	
PUNCHLIST_GENERA...	Grey
GIVEN_TO_CLIENT	Yellow
NDE_COMPLETE	Cyan
TEST_COMPLETE	Blue
PAINT_COMPLETE	Green
HEATTRACE_COMPL...	Magenta
INSUL_COMPLETE	Purple
No Progress	Red

Pipe Hydro Test Status Visualization



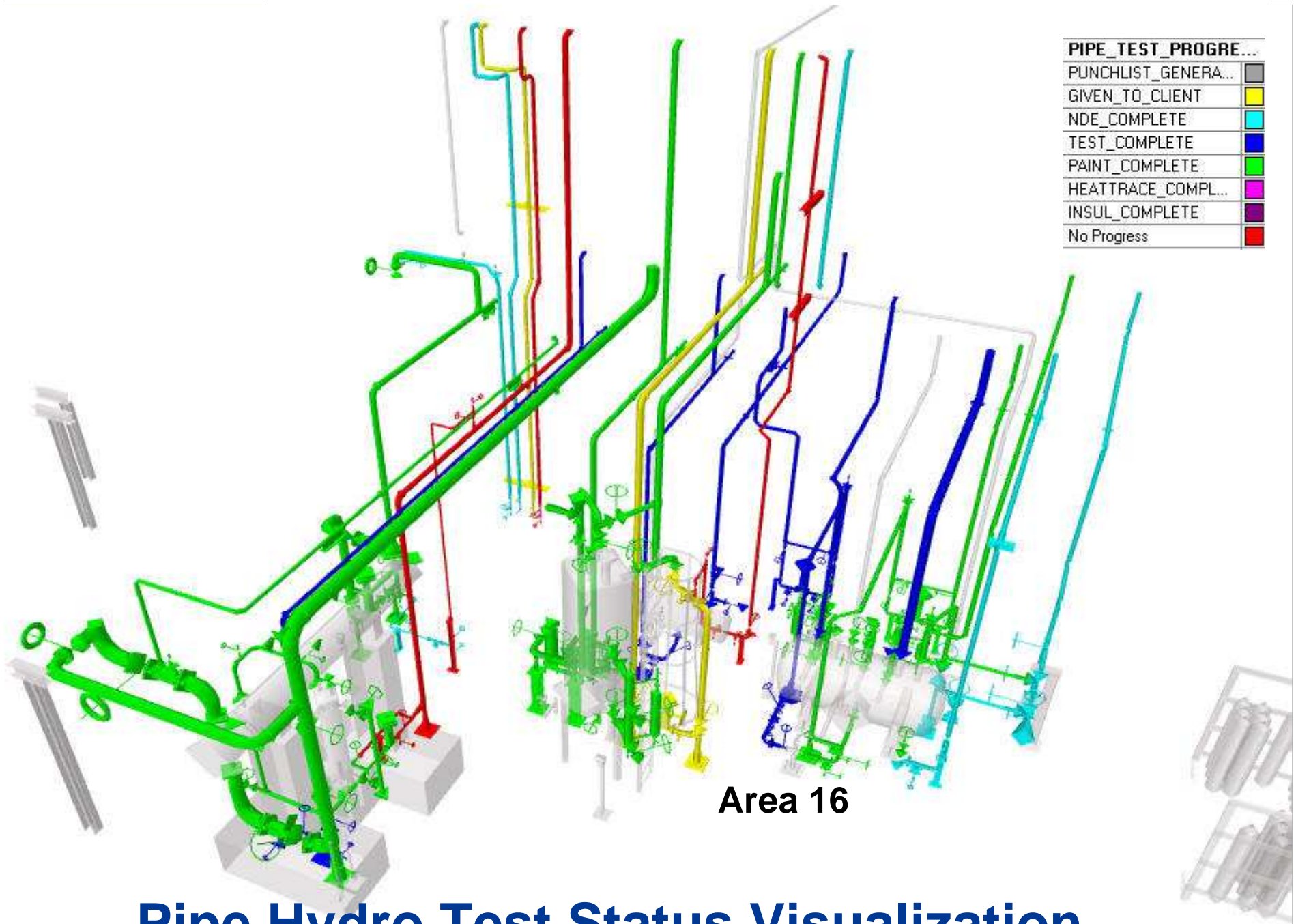
Area 06

PIPE_TEST_PROGRE...	
PUNCHLIST_GENERA...	Grey
GIVEN_TO_CLIENT	Yellow
NDE_COMPLETE	Cyan
TEST_COMPLETE	Blue
PAINT_COMPLETE	Green
HEATTRACE_COMPL...	Magenta
INSUL_COMPLETE	Purple
No Progress	Red



Pipe Hydro Test Status Visualization

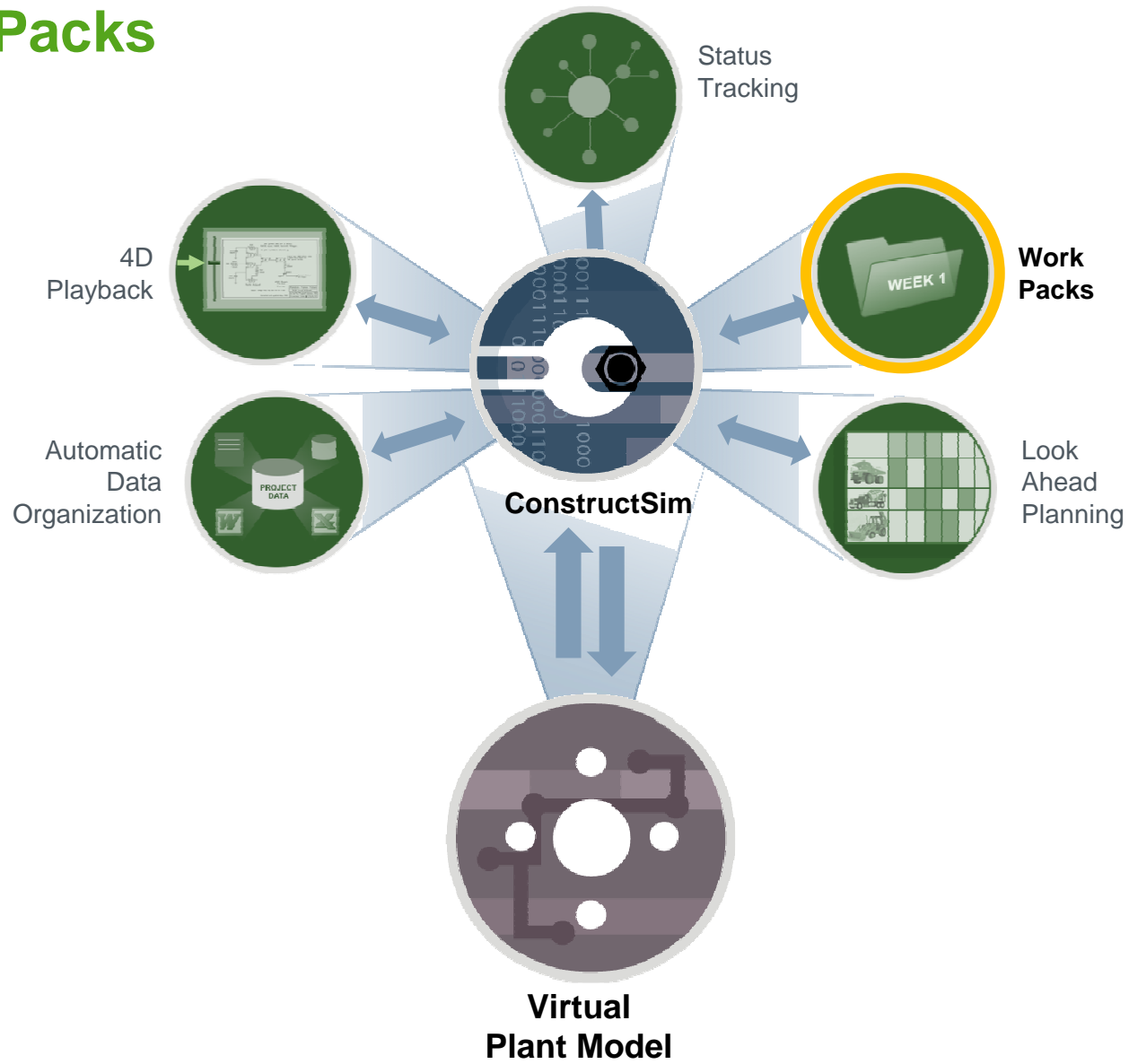




Pipe Hydro Test Status Visualization



Work Packs



Fast, Easy Work Pack Creation

The screenshot displays the ConstructSim interface for a refinery project. The main window shows a 3D model of the refinery with various pipes and structures. A 'Work Package' list is visible on the left, and a 'Schedule' table is shown at the bottom.

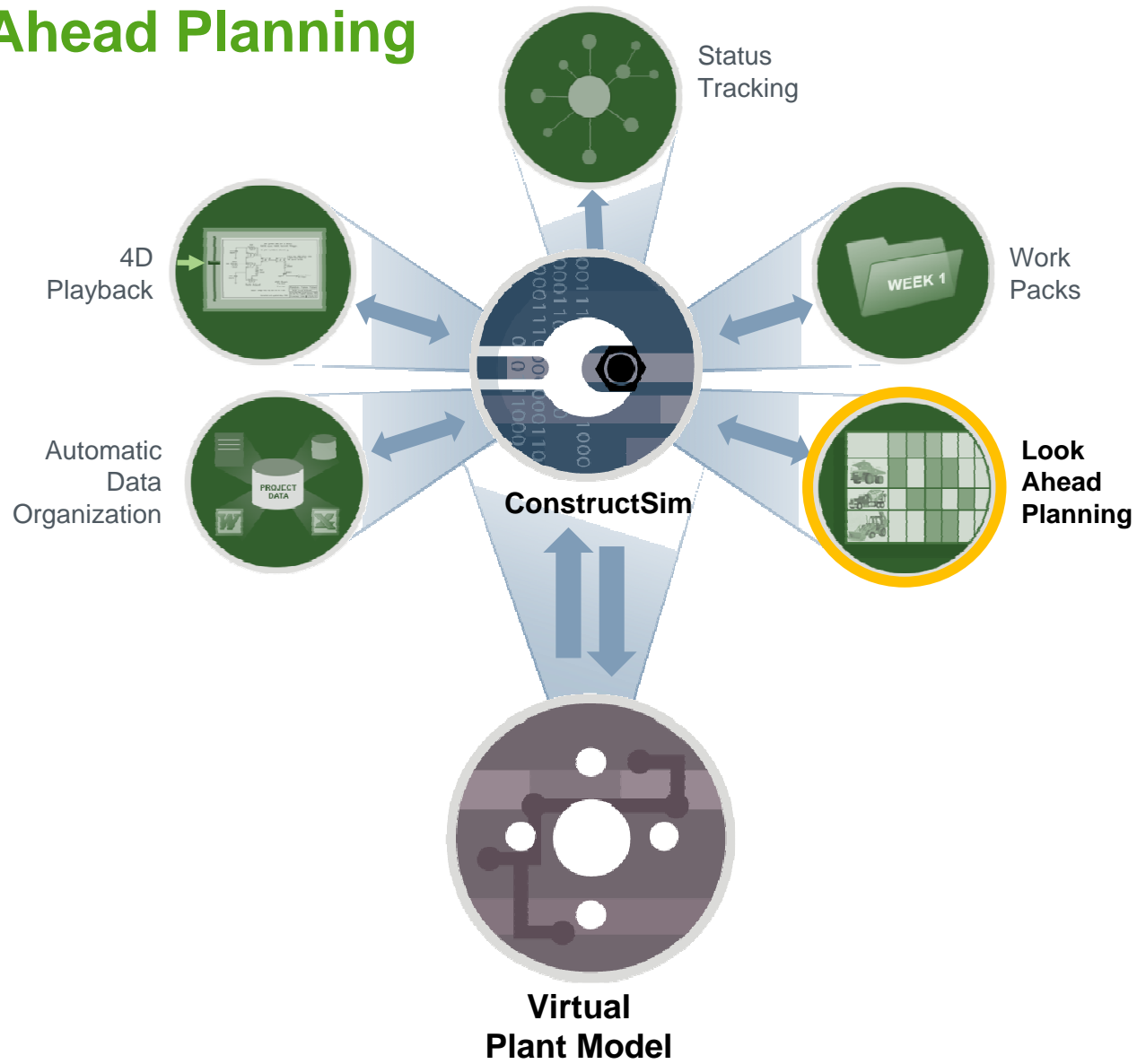
Work Package List:

- P-IWP-Area03A-01
- P-IWP-Area03A-02
- P-IWP-Area03A-03
- P-IWP-Area03A-04
- P-IWP-Area03A-05
- P-IWP-Area03A-06
- P-IWP-Area03A-07
- P-IWP-Area03A-08
- P-IWP-Area03A-09
- P-IWP-Area03A-10
- P-IWP-Area03A-11
- P-IWP-Area03A-12
- P-IWP-Area03A-13
- P-IWP-Area03A-14
- P-IWP-Area03B-001
- P-IWP-Area03B-002
- P-TP-Sys-AM-001

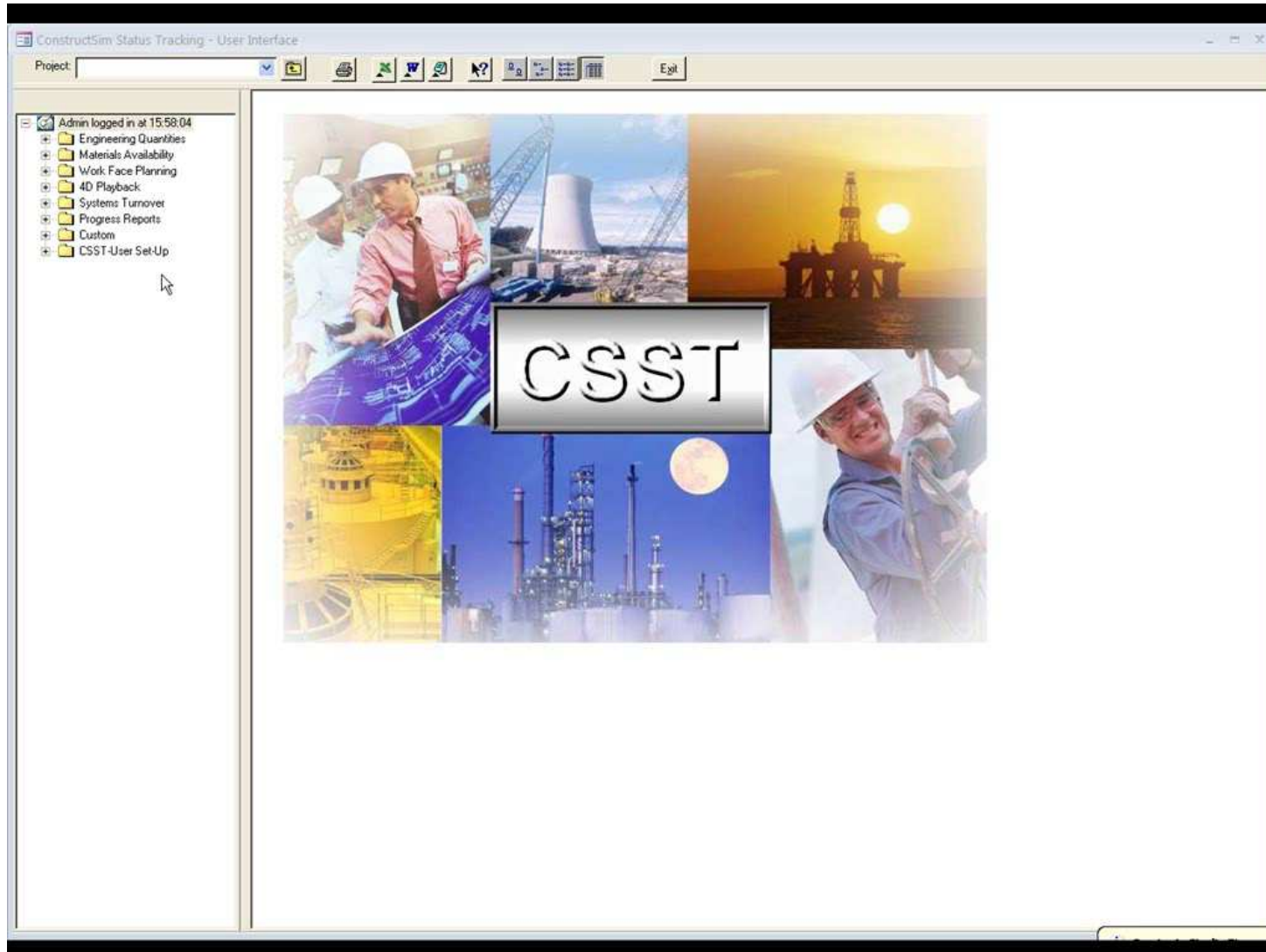
Schedule Table:

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130	Construction	Install_Exch_29E-4B	27/10/2008	27/10/2008						
140	Construction	Install_Exch_29E-4C	28/10/2008	28/10/2008						

Look Ahead Planning



Work Pack Reports and Look Ahead Planning to Streamline Scheduling



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ConstructSim Benefits for Owner Operator

- Enables schedule date to be met
- Reduces costs
- Provides an insight to project progress
- Potential to shorten schedule and achieve additional production



ConstructSim Benefits for Construction Managers

- Saves 1-5% TIC or 7 – 25% of field man-hours
- Reduced claims litigation
- Greater control and visibility of project
- Start up date controlled / compressed
- Know where you are at and what needs to be completed



ConstructSim Benefits for Direct Hire Contractors

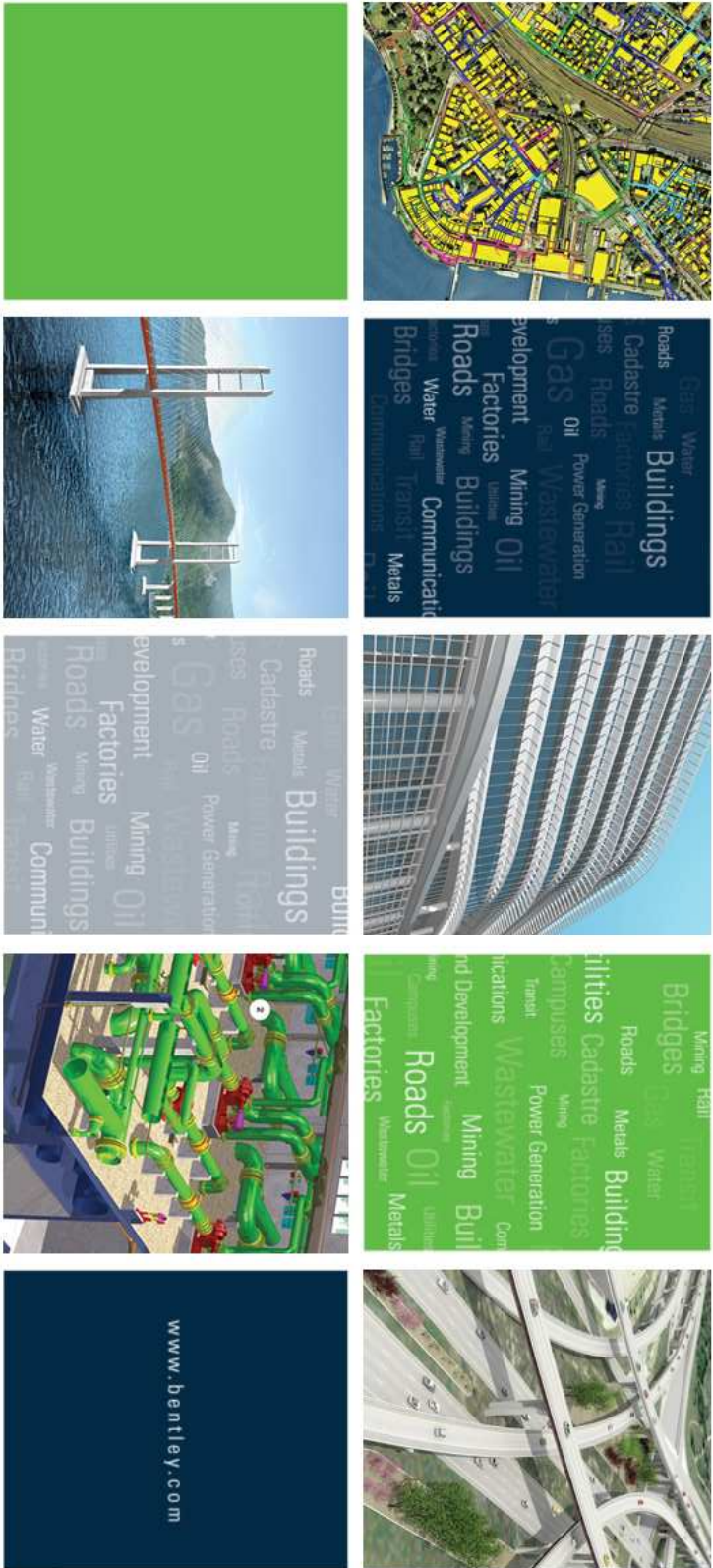
- Reduces wasted time on-site
- Improves field productivity by 7 - 25%
- Reduces rework and out of sequence work
- Maximises productivity of on-site equipment e.g. cranes / scaffold
- Improves co-ordination between disciplines



Cost Savings

Co-ordination between disciplines to maximise effectiveness of resources such as scaffolding / cranes

REDUCE	Work pack planning man-hours Wasted field man-hours Rework “Punch list” items
REMOVE	“Out of sequence” work
SAVE	Between 1% - 5% of TIC
ACHIEVE	On-time project completion



Sustaining Infrastructure

Thank you

Additional Information

- [Streamlining Materials](#)
- [Planning Levels](#)
- [Additional Details](#)
- [Electrical / Instrumentation](#)