

4D CAD: Learning from your virtual mistakes

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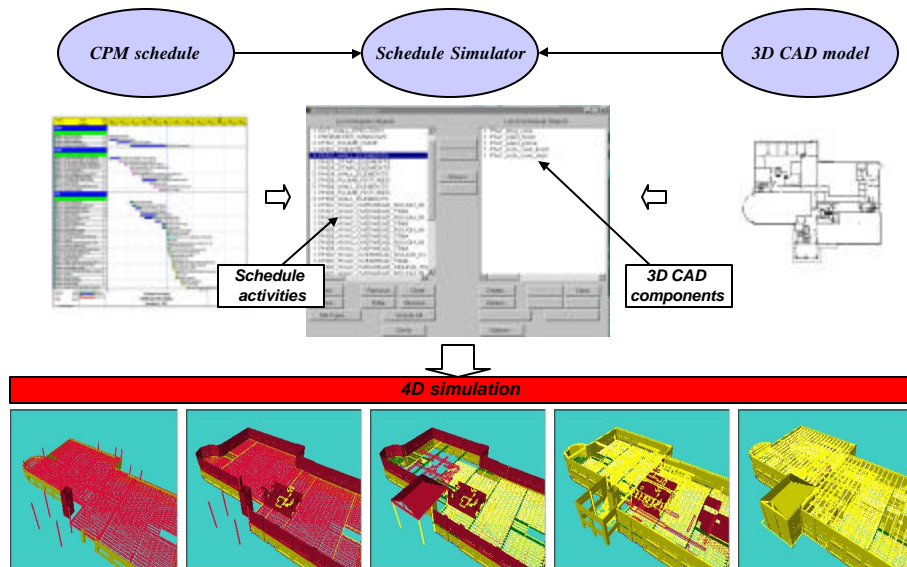
3D and 4D Models ...

- Reduce life-cycle costs
- Reduce wasted materials during construction
- Reduce project management costs
- Reduce interest costs
- Reduce rework
- Increase productivity of crews
- Reduce design time
- Shorten design and construction period
- Verify executability of GC, sub schedules
- Maximize value to owner
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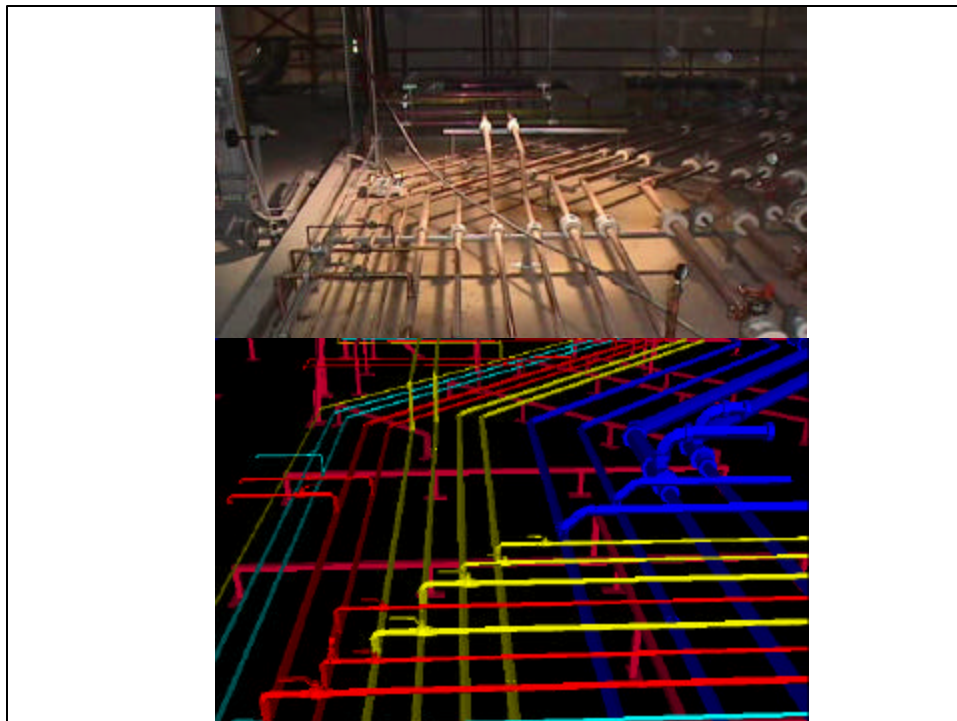
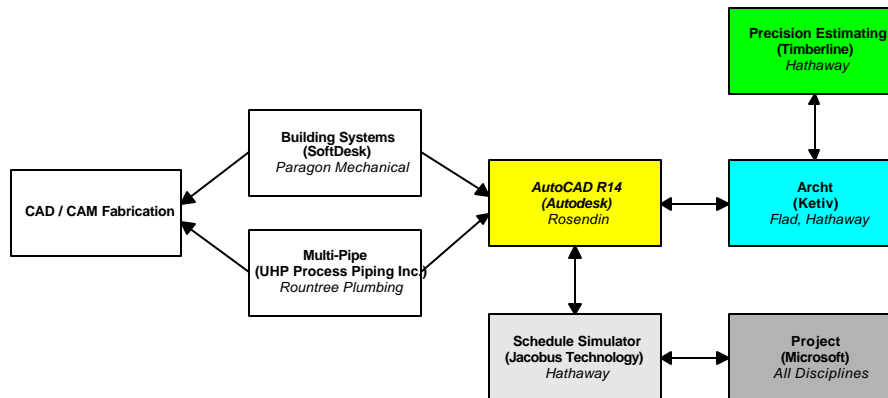
Case Examples

- Haas School of Business
 - save \$200k
- Sequus Pharmaceuticals Pilot Plant
 - no rework, no field interferences, 1 CO, RFI @ 40%, productivity up, prefabrication from 3D
- McWhinney Building
 - use junior engineers, save 2 weeks
- Paradise Pier, Disney California Adventure
 - bid on budget, input from 400 people

4D Tools: Plantspace Schedule Simulator



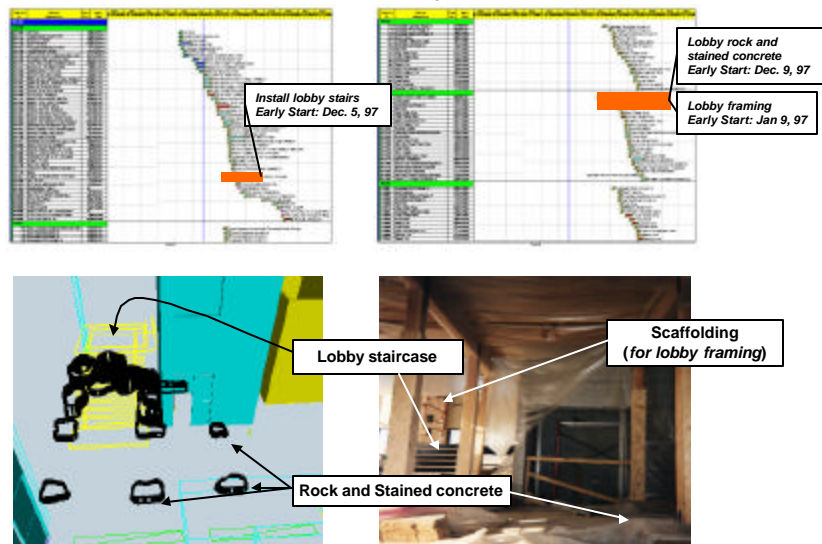
Suite of Software used on Sequus Pharmaceuticals Pilot Plant



Post-Construction Analysis

	Rountree Plumbing	Paragon Mechanical	Rosendin Electric
	Process Piping/HVAC Wet	HVAC Dry	Electrical
Contract Value	\$2,018,937	\$1,071,237	\$488,414
Increased Design Costs	30%	20-30%	20-30%
Number of Change Orders	6	1	3
Reason for Change Orders	4 - Owner Requested 1 - Value Engineering 1 - Unforeseen Condition	1 - Owner Requested	3 - Owner Requested
Percentage of Total Cost	-1.0028%	0.9958%	0.9746%
Number of RFI's	40	23	-
Expected RFI's	100	50	-
Productivity	Significantly increased	Much more Productive	No Difference
Rework	Dramatically reduced	Minimal	No Difference
Profitability	Same <i>Expects greater return with increased use</i>	Same <i>Expects greater return with increased use</i>	Less <i>Increased design time with less benefit from coordination</i>

Conflict in Lobby Area



4D model shows accessibility and congestion problems due to early installation of rock and stained concrete and scaffolding

Barriers to the Use of 3D/4D Models

- Today's tools document data
- Difficult to measure benefits
- Extra work
- Many project participants and stakeholders
- Silos of information and knowledge
- Need to build new 3D/4D models for each new situation
- Project information is not available early enough or even missing
- Training costs
- Development and maintenance of (integration) software is expensive
- No standard data models
- File-based information exchange
- Fragmented user base

How to get involved?

- CIFE Summer Program
 - <http://www.stanford.edu/group/CIFE>
- 3D/4D Workshops
 - <http://www.stanford.edu/group/4D/4d-workshop-main.htm>
- Construction Research Agenda Workshop (Aug. 26 to 28, 1999 at Stanford)
 - <http://www.ce.berkeley.edu/~tommelein/CEMworkshop.htm>