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Using Simulators in Crane & Rigging Training: It's Not Just for Beginners!

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About Bechtel

- founded in 1898
 - among the most respected engineering, project management, and construction companies in the world
 - more than 25,000 projects in 160 countries
 - South American office in Santiago, Chile
 - Bechtel Equipment Operations supplies all equipment, tools and rigging support to Bechtel projects from HQ in Sugarland, Texas
- « We do our best work when we have the best people. »



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Paul Freedman

President



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About Simlog

- founded in 1999
- *pioneer* of simulation for heavy equipment using *off-the-shelf* PCs
- global standard in cost-effective simulation
- thousands of software licenses sold in 60 countries
- five innovation awards
- headquartered in Montreal, Québec



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Presentation Context

How Bechtel and Simlog are working together

- to create a more knowledgeable and higher skilled crane and rigging workforce
- in a safe and cost effective manner for the future of our industry.



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Simlog Simulators at Bechtel



Mobile Crane



Tower Crane



Forklift



Hydraulic Excavator



Bulldozer



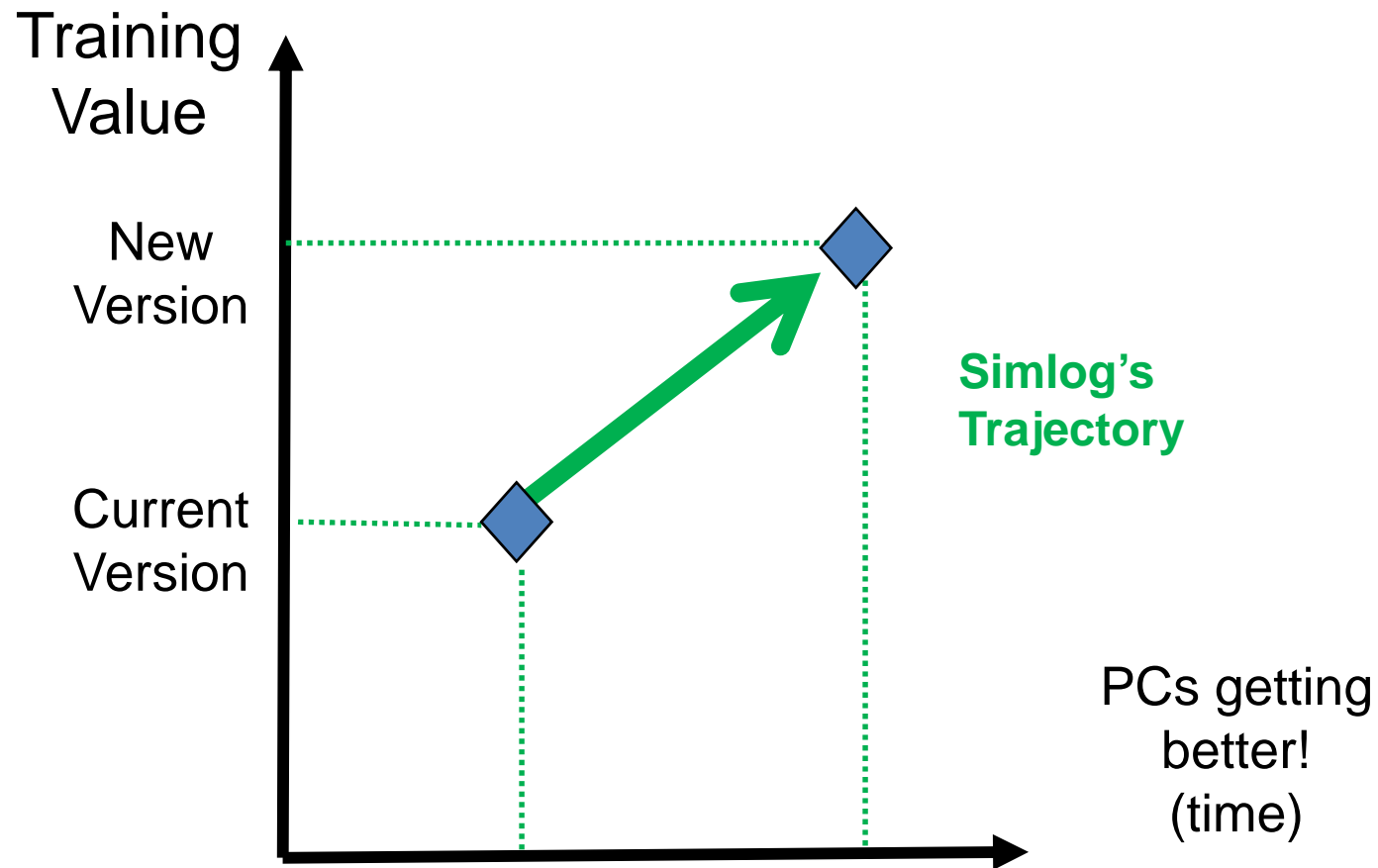
Wheel Loader



Off Highway Truck



Better PCs → Better Software



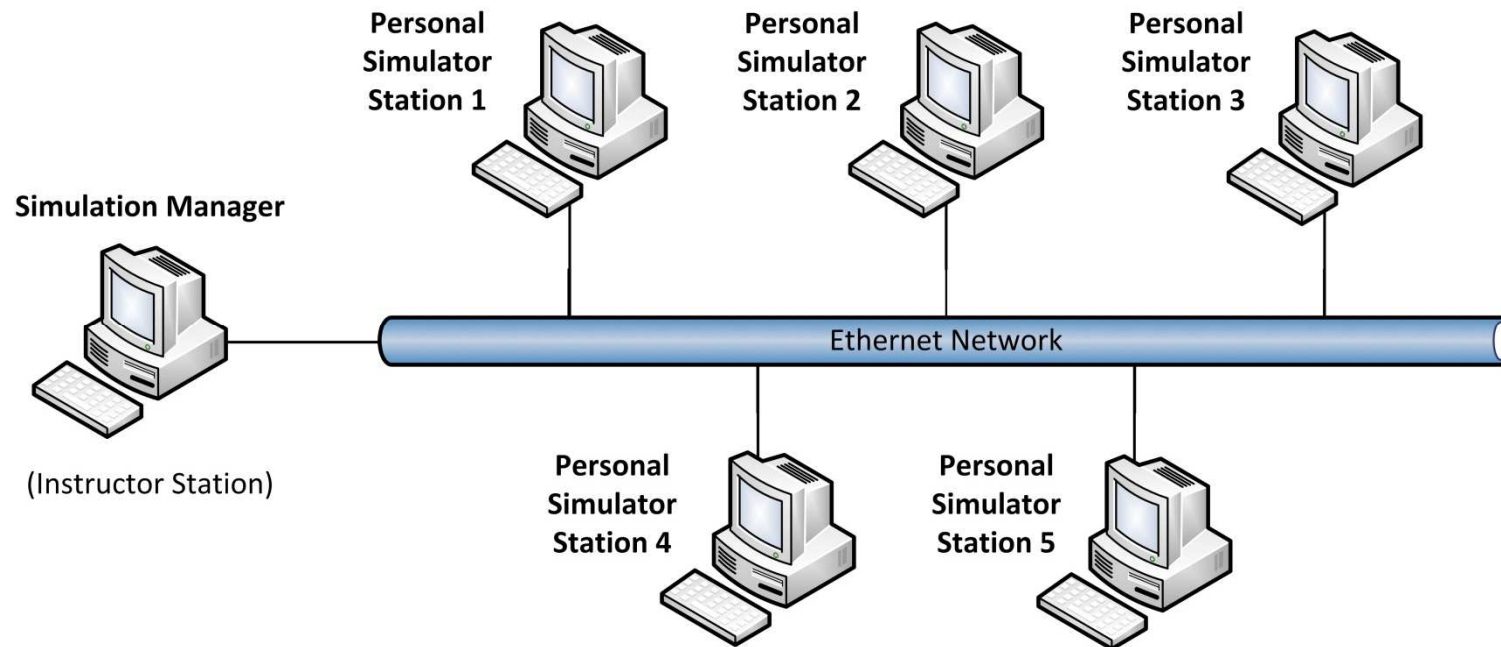


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Sample Mobile Crane Simulation Software Videos



Saving Results with “Simulation Manager”





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Monitor Progress, even *off-site*

Simlog's database is just a file so it can be easily forwarded to off-site locations e.g. via the company Intranet.

In that way, you can monitor training progress wherever it is taking place, using Simlog's *free* "Viewer".



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Simlog Measures, You Judge

Simulation results are measurements, not “grades”
(pass/fail, good/bad, etc.)

→ They must be interpreted by a human to properly
evaluate student performance.



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Mobile Crane Personal Simulator

Executing Lifts

Start of session: 17/09/2014 09:18:18
 End of session: 17/09/2014 10:32:43
 Session duration: 01:14:25

Session Characteristics	
Automatic Swing Brake	Enabled
Boom Deflection	Standard

Trial Summary	Count
Trials started	37
Trials completed	36
Trials restarted	0
Trials with a load-chart violation	1

Performance Indicator	Average	Minimum	Maximum
Execution time	01:48	00:28.7	02:58
Time spent in exterior view	00:00	00:00	00:00
Maximum sway (m)	2.63	0.76	4.61
Collisions: load/ground	0.14	0	3
Collision time: load/ground	00:07.43	00:00	00:24.8
Collisions: load/hookblock	0.00	0	0
Collision time: load/hookblock	00:00	00:00	00:00
Collisions: load/obstacle	3.00	0	7
Collision time: load/obstacle	00:01.76	00:00	00:09.50
Anti-two-blocks	0.00	0	0

Sample Simulation Results



About Benchmarks

Simlog provides a “starting point”

- target values developed by other customers that we can share (with their permission)

Bechtel’s “starting point”

- simulation results generated by staff



Putting Simulation To Work at Bechtel

- pre-employment skills “assessment”
- pre-screening for operator “aptitude”
- preparing new operators for real seat-time
- cross-training
- “revealing” operator weaknesses
- simulation for rigger training



Pre-Employment Skills “Assessment”

When hiring new operators, they need to:

- know enough → test with a “Written Exam”
- do enough → test with a “Practical Exam”



Evaluating Operator Skill with a “Practical Exam”

This is:

- costly
 - fuel, depreciation, insurance, etc.
 - supervisor’s time
 - “opportunity” cost: your crane is busy with the exam, instead of working to earn \$
- can be dangerous



Evaluating Operator Skill with a *Simulated* “Practical Exam”

- present *simulated* versions of the real work
- *measure more carefully* what the operator does



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About “Qualifying” the Operators of Partner Companies

On a Bechtel jobsite, the operators are often employees of partner companies.

→ Important for Bechtel to use the same skills assessment to ensure that those operators are “Bechtel qualified” (since Bechtel is responsible for jobsite safety and productivity).



Simulator-Based Pre-Screening

- We have all heard the statement “I can run anything”.
- Well pre-employment screening with a simulator can tell right away if a potential hire is competent. It can also be used to gauge a person’s aptitude and attitude for equipment operations.



Evaluate Operator *Aptitude*

When *choosing* people to train, make sure they have enough operator *aptitude*!

- up to 30% *don't*, so they
 - make too many mistakes
 - never acquire enough skill



Simulator-Based Training of Entry-Level Operators

Probably the most cost effective way of training entry level personnel is through simulation. And that is because developing the right habits takes more than just explaining things. Operators will try to remember, but simulation is “learning by doing”, and that is how everything becomes “automatic”.



First quality, then productivity

1. Learn how to do things *right*.
2. Come up to *speed*.
 - “deliberative practice”, at the heart of making real experts!



Anticipated Outcomes

- make operator training *safer*
 - accidents “happen” at the simulator
- reduce operator training *costs*
 - new operators “ramp up” faster and will meet production targets sooner
- improve operator training *quality*
 - everyone is taught the same things, and evaluated in the same way, with nothing lost in translation!



Hands-on Training is Essential (1)

- There is no substitute for hands on training (SEAT TIME). It is a necessary part of any well planned training agenda and should not be minimized or overlooked.
- But training on a machine is expensive, dangerous (especially at the start), and sometimes not feasible, because it's hard to take personnel and equipment away from productive work.

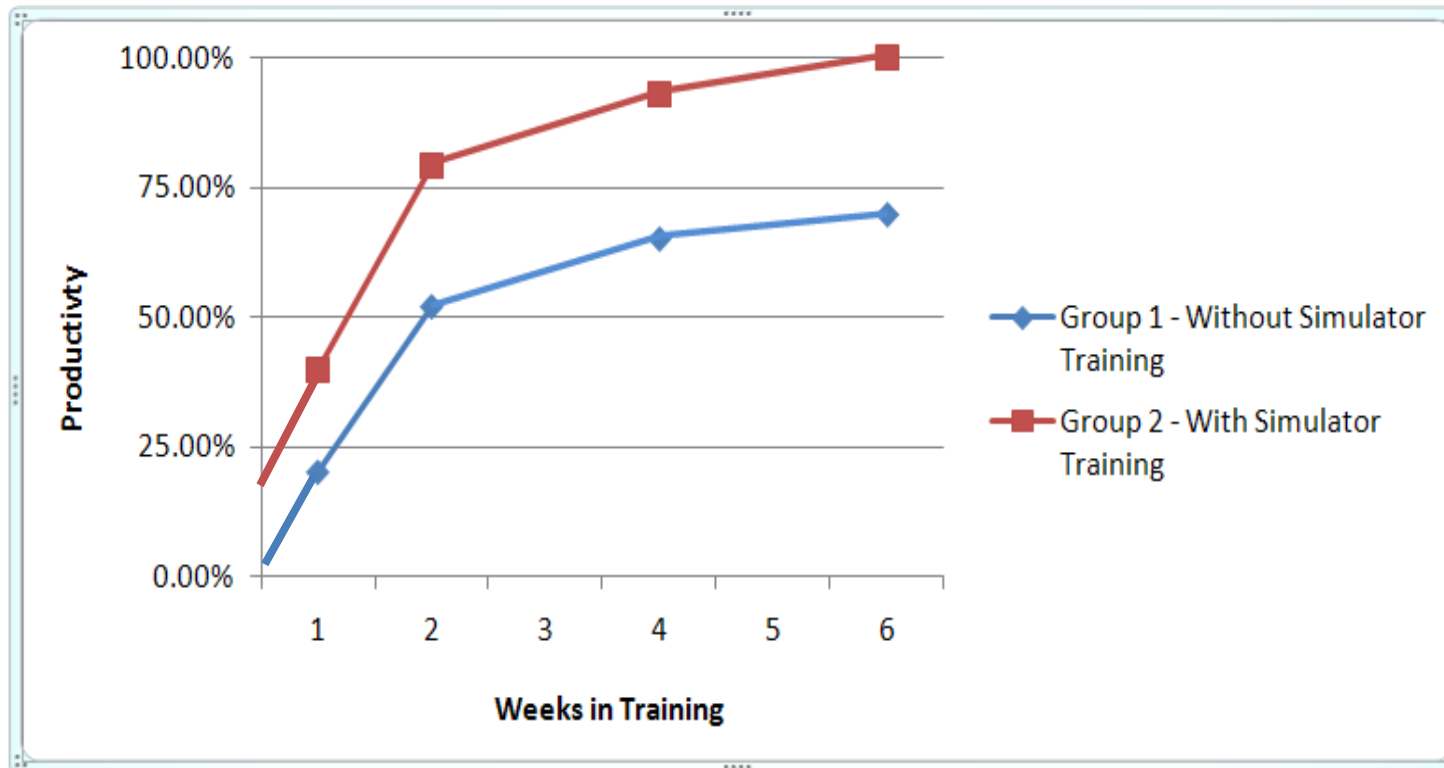


Hands-on Training is Essential (2)

- That is why simulation training can best be used to prepare new operators for real seat-time thanks to the “learning by doing” that teaches good habits.
- With that preparation, they will “ramp up” much faster at the controls of your real equipment and meet production targets much sooner.



“Ramp Up” Faster



Data from a study conducted by a Simlog customer in vocational education



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Training Earth-Moving Equipment Operators (1)

Bechtel trains earth-moving equipment operators
“in house”:

- target equipment: Hydraulic Excavator, Bulldozer, Wheel Loader, etc. (also Forklift)
- follows NCCER curricula



Training Earth-Moving Equipment Operators (2)

Now developing new Standard Work Processes and Procedures that includes simulation components

1. Theory, in the classroom
2. Simulation (must meet Bechtel benchmarks)
3. Hands-on training in the field, to include the NCCER Practical Exam



Teaching by Showing

Although simulation is primarily a “training by doing” tool, it is also a wonderful “teaching by showing” tool, to help training staff “present”

- what to do
- what not to do
- alternatives in different situations

to help operators improve their abilities, while improving the quality of the training program itself



About Crane Operators

- Bechtel always tries to hire experienced people
→ pre-employment skills “double checking”.
- After that, new hires typically require simulator-based “up skilling” to improve operating skills e.g. moving loads safely to minimize sway while avoiding collisions with obstacles.



Thinking, not just Doing

- Then comes decision-making skills, including understanding crane setup and the selection of boom length, outrigger spread, direction of movement, and how to avoid obstacles
- Simlog's "Advanced" software edition (availability 2015) will make this possible at the simulator.



About Cross-Training

- Through simulation we can now cross-train an operator in a cost-effective way e.g. forklift to dozer or excavator, or a lattice boom crawler operator to tower crane operations.
 - one example: Tower Crane operator “relief” at a Bechtel jobsite in Texas
- Also includes helping older crane operators accustomed to “friction” lever controls learn to master electric-over-hydraulic joystick controls for modern telescoping cranes.



Helping (Experienced) Operators Do Better

After an “incident”, having the operator spend time at the simulator can help “reveal”

- bad habits (poor skills)
- insufficient operating knowledge

that time at the simulator can help “correct”.



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Simulator Purchasing History at Bechtel

- 2008: Mobile Crane, Hydraulic Excavator
- 2012: Tower Crane, Wheel Loader, Off-Highway Truck
- 2014: Bulldozer, Forklift



Simulator Deployment at Bechtel

- Sugarland, Texas (headquarters)
- Gladstone, Australia
- Santiago, Chile
 - simulators are in containers that are sent to the various job sites



In Each Container

1 Operator Chair with joysticks, pedals, etc. for

- Mobile Crane
- Tower Crane
- Hydraulic Excavator
- Bulldozer

1 Operator Chair *with* steering wheel + other simulator controls for

- Wheel Loader
- Off-Highway Truck
- Forklift



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Five Simulator Containers at Bechtel Chile





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Multi-Purpose Operator Chairs without steering wheels





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Multi-Purpose Operator Chairs with steering wheels





Using Simulators at Bechtel Projects in Chili and Peru (1)

- Evaluate potential new hires, to gauge their knowledge and operating skills before contracted to work
- Cross train of existing operators: Dozer to Excavator, Tower Crane to Mobile Crane , etc.
- “Re-evaluate” existing and experienced operators on a yearly, or bi-yearly time basis.



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Using Simulators at Bechtel Projects in Chili and Peru (2)

“The Simlog Simulators are a great asset to the Bechtel/Chile Training program that I have been involved with and moved forward, from the time I arrived here almost two years ago.”

Raul Camacho

Rigging Operations Training Coordinator, Bechtel
Equipment Operations, South America.



Simulation for Training Riggers and Signal Persons (1)

- Bechtel has developed a special kind of simulation to help train riggers and signal persons.
- This allows the rigger to learn to make the proper crane placement, choose the proper rigging scheme and hardware, and also make better decisions about whether to continue with the lift if changes occur during the operation such as wind, lack of light, or availability of certain equipment.



Simulation for Training Riggers and Signal Persons (2)

- We can also teach lifting personnel about policies and procedures just by not letting the operation continue without all of the steps being completed.



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Conclusions (1)

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Conclusions (2)

- pre-employment skills “assessment”
- pre-screening for operator “aptitude”
- preparing new operators for real seat-time
- cross-training
- “revealing” operator weaknesses
- simulation for rigger training



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Thank You