• Why Simulation
• How Ports Use Simulation
• Types of Simulators
• Demonstration
• Questions & Answers
WHY SIMULATION?
Reduced training on live equipment

- Opportunity cost of taking live equipment off-line
- Operating, maintenance & environmental costs
- Accident/liability costs of novice operators operating expensive/complex equipment
- Instructor works with more than one student at a time
More Effective Training

Reduced overall training time

Ability to **repetitively** practice complex and difficult scenarios (dangerous and impractical to practice live)

Increased new operator productivity

Ability to **objectively** screen/assess operators
History of Simulation in Training

- **Distant Past**
  - Simulation utilized only when operational errors meant certain loss-of-life and/or total-loss of expensive equipment.
    - Military Driven

- **Recent Past**
  - Simulation utilized to reduce risk and increase efficiency
    - *Adoption by most Commercial Airline Fleet*
    - FAA qualifies ALL pilots using Simulator Aided Training
    - Simulation primarily trained functional skills (what levers, knobs, buttons to push & when)

- **Now (Present)**
  - Many industries use simulation training as a tool to drive cost reduction and operational efficiencies.
    - *Planes, cranes, trains, ships, earth moving, mining equipment, research, etc.*
    - *High fidelity simulation allow for both procedural and skills training.*
Past Impediments to Simulation

**THEN:**
1) System Costs (Millions of $$$)
2) Questionable Fidelity
3) Delivery Schedules (System Usually Obsolete Before It Was Delivered)
4) Expensive to Maintain and Difficult to Upgrade
5) Extremely Technical to Operate

**NOW:**
1) PC-Based—Pricing continually declining as tech improves
2) Vastly Improved Realism
3) Quicker Turn Around
4) Reliable & upgradeable off-the-shelf subcomponents
5) Point and Click intuitive operability
Results of Improper Training
Crane operator learning curve

Learning curve

Proficiency vs. Training days
Actual Simulation Results

- **Case Study #1 (Port of Antwerp)** –
  - Reduction in Training Time of 20%
  - Increased Student Efficiency 25% during first 30 days

- **Case Study #2 (Port of Hamburg)** –
  - Decreased Training on Live Equipment >50%
  - Increased Instructor/Student Ratio 1:1 to 1:3

- **Case Study #3 (US Army)** –
  - 95% Reduction in Property Damage & Personnel Injuries
  - 400% Reduction in Time to Perform Complex Operations
Actual Simulator Results

Case Study #4 –

• Annual Recurring Cost to Train on Real Equipment - $1,144,609
• Annual Recurring Cost to Train on Simulator - $281,784
• Annual Training Cost Savings - $862,825
HOW PORTS USE SIMULATION
(CURRICULUM DEVELOPMENT
STUDENT ASSESSMENT)
Benefits of Computer-Based Curriculum

- Ability to modify curriculum in real time based on immediate empirical feedback
  - Some ports’ trainee failure rate is as high as 50%
- Customize exercises for a specific trainee or issue
- Full automation of:
  - Trainee progress
  - Trainee evaluation
    - Automatically compared against a set of criteria
  - Data collection
  - Trainee can learn crane basics on the computer

Curriculum Is Built Into Simulator
Optimal Path—STS Crane
Most Recent Path—Straddle Carrier
Control Stick Analysis Tool
Joystick Analysis tool

Joystick Efficiency per second

Seconds

% Joystick Movement from previous position

Novice
Expert

Joystick-Bewegungen

Übungszeit

Bewegungen
Analysis Tools

1) Container Path optimization
2) Timed Performance/Efficiency
3) # of Major/Minor collisions
4) Control Stick Analysis (Operational skills)
5) Instructor Assessment (requires Instructors Presence)
TYPES OF SIMULATORS
**No Limit to Simulated Equipment**

- **MasterLift™ Product Line**
  - ML1000 (Portable)
  - ML2000 (Midsize)
  - ML4000 (Reconfigurable)
  - ML5000 (Straddle Carrier)
  - ML6000 (Combination)

- **Container & Cargo Crane Types**
  - Dock Gantry (STS) Crane
  - RTG Crane
  - RMG Crane
  - Mobile Harbor Crane
  - Ship Pedestal Crane
  - Reach Stacker
  - Mobile Jib & Jib-Boom Cranes
  - Ship Gantry Crane

- **Cargo-only Crane Types**
  - Mobile Lattice Crane
  - Hydraulic Telescopic Crane
  - Tower Crane
Portable “Suitcase” Simulator

- Ideal for introductory training
- Ideal as a complimentary training system for other MasterLift products.
- Rugged aluminum Case with Generic Crane Controls
- Available in Multiple Crane Configurations
- Models all Crane Movement and Load Interactions
- Models Environmental Effects
- Full Collision Detection and Response
Mid-Sized Simulator

- Specific Crane Controls
- Available in Multiple Crane Configurations
- Models all Crane Movement, Load Interactions, and Environmental Effects
- Full Collision Detection and Response

- Single Channel Visual System
- 3 Degree-of-Freedom Electric Motion Platform
- Full Feature Instructor Station
- Instructor Control and Monitoring
- Instructor Induced Malfunctions
- Instructor Controlled Animated Signalman
Mobile Simulator Configurations
Simulator/Classroom Combination
Fully Enclosed Cab

- Specific Crane Controls
- Available in Multiple Crane Configurations
- Models all Crane Movement, Load Interactions, and Environmental Effects
- Autonomous, Path-Driven Traffic
- Full Collision Detection and Response

- Four (4) Channel Visual System
- 4 Degree-of-Freedom Electric Motion Platform
- Full Feature Instructor Station
- Instructor Control and Monitoring
- Instructor Induced Malfunctions
- Instructor Controlled Animated Signalman
Types of Simulators

Port of Marseille, France

Port of New York/New Jersey

Port of Hamburg, Germany

Port of L.A./Long Beach
Full Immersion—Dome
Full Immersion—Dome
Full Immersion--Dome
Typical Student Controls
Mobile Jib Crane with Clamshell
Mobile Jib Crane with Cargo
Full Immersion—Flat Panels

- Specific Straddle Carrier Controls
- Models all Straddle Carrier Movement, Load Interactions, Surface Interactions, and Environmental Effects
- Full Collision Detection and Response
- Autonomous, Path-Driven Traffic

- Six (6) Channel Visual System
- 6 Degree-of-Freedom Electric Motion Platform
- Full Feature Instructor Station
- Instructor Control and Monitoring
- Instructor Induced Malfunctions
- Instructor Controlled Dispatching
Straddle Carrier Operator’s View
Typical Student Controls
Full Immersion
STS Crane Operator’s View
SIMULATOR FEATURES
Mobile Harbor Crane (Gottwald)
Reach Stacker
Cargo Selection

Containers

General Cargo
Multiple Container Types

- 20 ft. Container
- 20 ft. Open Container
- 20 ft. Tank Container
- 20 ft. Stack Flat Container
- 40 ft. Container
- 40 ft. High Container
- 40 ft. Stack Flat Container
- 40 ft. Open Container
- 40 ft. Reefer Container
- 20 ft. Reefer Container
- 45 ft. High Container
Multiple Ship Types

- Container Feeder Ship
- Super Post Panamax Ship
- Multiple Post-Panamax Ships
- Barge
Yard Traffic Options

- Stationary Bomb Cart Trailer
- Truck
- Truck and Skeleton Trailer
- Empty Container Handler
- Straddle Carrier
- Off Road Pin Trailer
- Off Road Keyed Trailer
- Train Cart
Sample of Available Traffic Models
Typical Visual Scene
Typical Control Panel
(Mimic Screen)
Typical Control Panel
(Situational Awareness Display)
Instructor Operator Station (Environmental Page)
Instructor Operator Station
(Statistics Page)
Instructor-Induced Malfunctions

Straddle Carrier Malfunctions
- Engine Stoppage
- Engine RPM Imbalance
- Brake Fault
- Broken Hoist Chain
- Punctured Tire
- Broken Drive Chain

Description: Click the Fault Type button to enable or disable the fault. The status indicator lights up while the fault is active in the simulator.

STS Crane Malfunctions
- Hoist Cable Slack
- Twistlock Activation Failure
- Twistlock Stuck Failure
- Twistlock Indicator Failure
- Twinlift Sensor Failure
- Stuck on Truck
- Mooring Rope Failure
- Machinery Malfunction
- Lifting or Steering Cable Break
- Flipper Failure

Container Problems:
Select the Override button to allow the simulator to ignore any container problems such as container malfunctions or weight or off balance problems.

Override
SimFusion™ Option

- Fully Integrated Training Environment
- Scalable
  - Individual Operator Training
  - Full Team Training
- Simultaneous Simulator Controlled and Computer Controlled Traffic
- Full Collision Detection and Response

- Local Area Networking (LAN)
- Home Port Specific Virtual Environment
- Multiple Student Stations Controlled by a Single Instructor Station
SCENARIO CREATION
Scenario Creation

Container ship choices

Super Post Panamax ship

Container Barge, adjacent to Feeder Ship

Feeder Ship, adjacent to Post Panamax vessel
Scenario Creation

Adjustable Way Points

Choice of Way Point actions

Single truck routed to transport containers between QC/RTG QC
More Complex Scenario Creation

More complex scenario with 4 trucks servicing the QC and RTG
Straddle Carrier Move Order Display

**Enter Move Order**

- **Command**: MOVE
- **From**: row 3
- **To**: row 7
- **Container 1**: EMCU 185125.4 40F 3.7
- **Container 2**: [Blank]

**Display**

FROM
block 1, row 3
TO
block 5, row 8
CONTAINER
EMCU 476638.4 20 F 2.1
UGMU 600573.9

MOVE ORDER DISPLAY
Largest Maritime Customers

- Port of Hamburg, Germany
- Port of Antwerp, Belgium
- Port of Le Havre, France
- Port of Marseille, France
- Port of Los Angeles / Long Beach, U.S.
- Port of New York/New Jersey
- Port of Oakland, U.S.
- Port of Tacoma, U.S.
- Port of Durban, South Africa
- Port of Colombo, Sri Lanka
Local Installations

- ML2000—Int’l Union of Operating Eng. (IUOE)
  - Local 406—New Orleans, LA*
  - Local 178—Fort Worth, TX
  - Local 487—Miami, FL
  - Local 181—Henderson, KY
  - Southern Apprenticeship Training—Iuka, MS

- ML2000—U.S. Naval Reserves
  - NCHB 13—Gulfport, MS
  - NCHB 12—Bessemer, AL
  - NCHB 11—Jacksonville, FL
  - NCHB 4—Charleston, SC
  - NCHB 9—Columbus, OH
  - NCHB 1—Williamsburg, VA

- ML4000—U.S. Army T-School Ft. Eustis, VA

- ML4000/5000 N.Y. Shipping Ass.—Port Elizabeth NJ
Custom Experience

- Aviation Training Systems
  - US Navy SH-2G Helicopter WST Development Program
  - US Navy SH-60B/SH-60F WST Upgrade Program
  - USMC CH-46E/HH-46D OFT Upgrade Program
  - USMC AH-1W WST Upgrade Program
  - Pilot Communication & Navigation Training System
  - S-3 Aircraft Weapon System Trainer
  - F-14D WST Upgrade Program
  - F-15D/E Maintenance Trainer
Custom Experience (Cont)

- **Maritime Training Systems**
  - US Coast Guard Z-Drive Ship Control Training System
  - US Coast Guard Buoy Tender Integrated Ship Bridge Control Training System (ISCTS)
  - US Navy Barge Ferry Training System
  - US Army Dock Gantry/Ship Pedestal Crane Trainer
    - Full-Size & Portable
  - US Army Barge Derrick Crane Training System
Driver Training Systems

HyperDrive™ Authoring Suite
- Creates Virtual Environment
- Standard & Customizable Drop-&-Drag Tiles

Vection™ Driving Simulators
- Vehicle Cab, Dynamics
- Virtual Driving Environment
- Image Generator(s) and Display System
Select Customers (Custom)

- Military
  - U.S. Army
  - U.S. Navy
  - U.S. Air Force
  - U.S. Coast Guard

- DriveSafety
  - General Motors
  - Ford
  - Motorola
  - Batelle
  - Stanford
  - U. of Michigan
  - U. of Iowa
Deliverable System Includes

- All Trainer Hardware and Software (Executable only)
- Factory Acceptance Test and Site Acceptance Test
- Installation at User Facility
- Train the Trainer Course (Up to 8 Individuals)
- One (1) Year Warranty
- After Delivery Support. Including:
  - Hardware Maintenance and Repair
  - Software Trouble Shooting
  - Software Updates
  - Training Support
Trainer Support Requirements

- Operational Personnel Requirements
  - No Dedicated Operational Personnel are Required
  - Instructors Operate Training System
  - Non Simulator Training Requires 1 Instructor to 1 Student
  - We Recommend 1 Instructor per 3 Students

- Maintenance Personnel Requirements
  - No Dedicated Maintenance Personnel are Required
  - Part-time Maintenance Support

- Maintenance Support & Upgrade Program (MSUP)
  - Full Hardware Repair Support
  - Annual Preventative Maintenance
  - Annual Software Updates
Company History

- Company Started in 1993
- Acquired by Kongsberg Maritime (Norway) in February 2008
- Headquarters in Salt Lake City, Utah, USA
- Delivered Systems Worldwide
- GlobalSim is a Simulation Engineering Company
- Average Engineer Simulation Experience – 19 Years
- Expertise Includes:
  - Fixed Wing and Rotor Wing Aircraft Simulation
  - MasterLift™ Product Line (108 Systems Delivered)
  - Custom Simulator Design and Development
  - Driving Simulation (48 Systems Delivered)
GlobalSim

Custom Simulator Development

MasterLift Training Systems

Driver Training Services

MasterLift Crane Simulation Accounts for >50% of GlobalSim’s overall Business
SUMMARY
MasterLift™ Product Line

Staged Training Continuum

Entry/Basic Training

Integrated Training

Hands-on Training
The Simulation Advantage

**Classroom + Simulator + OJT**

- Improved Instructor - Trainee Ratio
- Realistic Training Experience in a Controlled Environment
- Reduced equipment and logistical cost, reduced training time
- Non-Threatening Environment for Emergency Action Training
- Repetitive/Objective Training Capability
- Crawl (Class Room), Walk (Simulator), Run (OJT) Training Process

**Result:**

*More Fully Trained Operators*
Summary

• Simulation Training has been Around Since WWII

• Measurable Results from the Use of Simulator Aided Training:
  ○ Increased Productivity
  ○ Increased Safety
  ○ Decreased Liability
  ○ Increased Skills

• Technology Breakthroughs have Enabled High Fidelity Training Systems at an Affordable Price

• Actual Experience Show that Simulation Aided Training is the Best Solution Available to Provide Qualified Crane Operators

• GlobalSim Provides the Best and Most Cost Effective Crane Training Simulators Available in the Market Today
Results of Improper Training (Cont.)
Case Study

A single Antwerp instructor can effectively work with multiple students inside and outside the simulator.

The U.S. Army reduced accidents among 1st year crane operators by 45%. The Army also conducted a formal study showing a simulator-trained operator completing a complex maneuver 4x faster than a veteran operator.

Port of Antwerp has reduced overall training time by >20%. Hamburg's limited access to live training cranes was remedied by GlobalSim's technology, which has currently replaced 60% of their need for real cranes.

• Most commonly overlooked
• Intermodal demand is outpacing supply
• If crews are unmanned, what is the cost of lost revenue (LA/Long Beach)?
• If lack of well trained operators is a damming factor, how much revenue can be realized by filling vacant equipment 20% faster?
• How much more revenue can be realized by more productive operators in their first 30 days of employment?

• First-year operators are 2x as likely to cause an accident than operators with >1yr experience
• Trainers agree that an operator's first 200 hrs pose the greatest risk to expensive equipment and employees.
• GlobalSim's technology allows operators to gain experience in a non-threatening environment when an operator's risk is greatest.

- 3 - 4 STS Gantry Cranes
- 9 – 12 RTG cranes
- Usually 3 shifts; or 3 operators per crane
- 36 to 48 new operators need training
- Training usually requires 24 to 30 shifts;
- 36 operators X 24 Shifts X 8 hours = 6,212 crane hrs.
- STS crane with 60% utilization = 5,250 hrs ($1 million/year)
- Total HR expense = Salary, taxes, & benefits
- 24 training shifts are roughly equivalent to 1 month's HR expenses
- 1:1 training also includes the trainer's HR expenses
- 1 Berth with 36 new operators training 24 shifts on live equipment 1:1 = 72 months of HR expenses
- Improving ratio to 1:2 + 20% reduction in training time = cost savings of 28 months of HR related expenses.

Simulator Return on Investment

- Decrease training time on live equipment 60%
- Decreased overall training time 20%
- Decreased New Operator accident rates 45%
- Increased efficiency during first 30 days.
- Improve Instructor/student ratio from 1:1 to 1:2-3

- Crane operating cost savings
- Accident & insurance cost savings
- Human resources costs savings
- Opportunity Cost savings

- Decreased New Operator accident rates 45%
- Increased efficiency during first 30 days
- Improve Instructor/student ratio from 1:1 to 1:2-3

Simulator Induced Effects

Areas of Cost Savings

New Berth Example For:
Crane Models

- **Ship-to-Shore Cranes**
  - Reggiane
  - Kone
  - Paceco
  - Nelcon
  - ZPMC
  - Liebherr

- **Jib & Jib-Boom Cranes**
  - Gottwald
  - Potain

- **Portainer Cranes (RTG & RMG)**
  - ZPMC
  - Morris
  - Kone

- **Pedestal Cranes**
  - Hagglund

- **Ship Gantry Cranes**
  - Morgan

- **Straddle Carrier MHE**
  - Kalmar
  - Noell

- **Reach Stacker MHE**
  - Kalmar

- **Construction Cranes**
  - Manitowoc (Mobile Lattice)
  - Link Belt (Hydraulic Telescopic)