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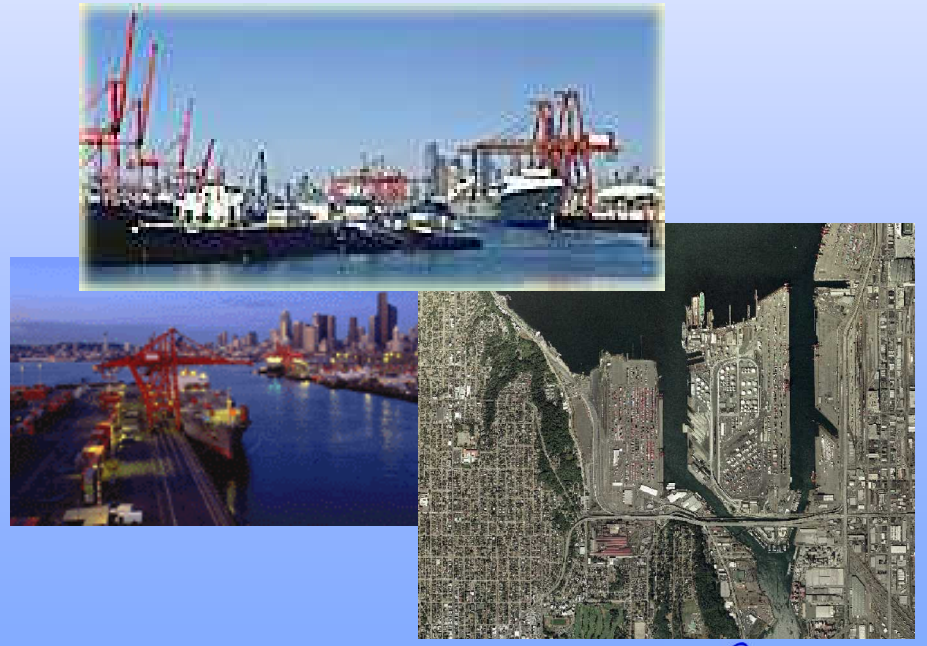
Simulating Port Security and the impact on Maritime Commerce

National Infrastructure Simulation & Analysis Center

Modeling and Analysis Team
Steve Conrad
Walt Beyeler
Dick Thomas
Tom Corbet
Theresa Brown
Gary Hirsch
Chris Hatzi



Sandia National Laboratories

Los Alamos

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Port Operations Simulator

Security solutions to the container shipping challenge should recognize that, in many cases, commerce, including essential national security materials, must continue to flow…

Stifling commerce to meet security needs simply swaps one consequence of a security threat for another – The National Strategy for the Protection of Critical Infrastructures and Key Assets, *February 2003*

Our Goal

- Build a computer model to facilitate finding the right balance between security and economic interests.
- We track:
  - Cargo
  - Costs
- Understanding the robustness of port to disruptions.

NISAC

Pacific Northwest Collaborations

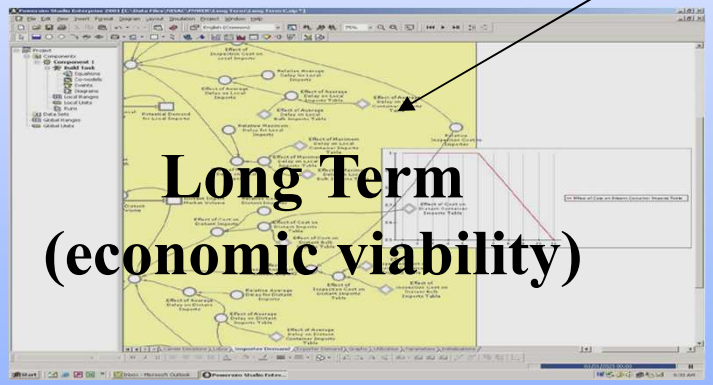
- Worked with numerous individuals to design and parameterize the port models, identify analyses and workshop content:
  - Pacific Northwest Economic Region,
  - Regional Maritime Security Coalition,
  - US Coast Guard,
  - Bonneville Power,
  - Ports of Seattle and Portland,
  - Cities of Seattle and Portland
  - University of Washington,
  - Lucent,
  - Transportation Strategies International and
  - Creative Learning Environments
- Initial iteration of model development culminated in workshops in Portland and Seattle

NISAC Pacific Northwest Port Simulators

Two time scales of interest
- short term (several months)
- long term (several years)

Security Enhancement

Policy

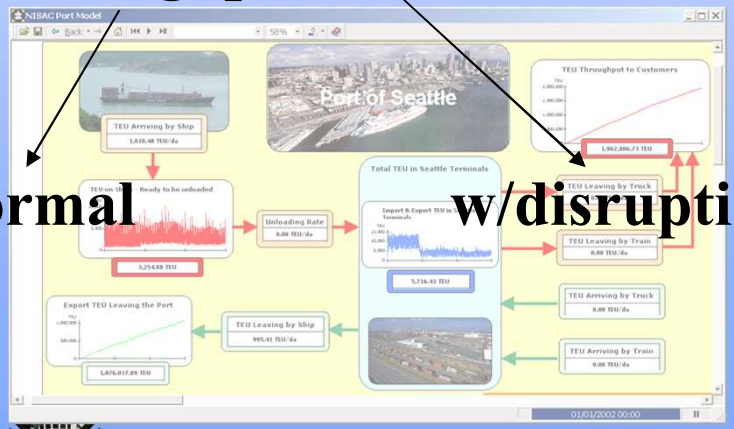


Long Term (economic viability)

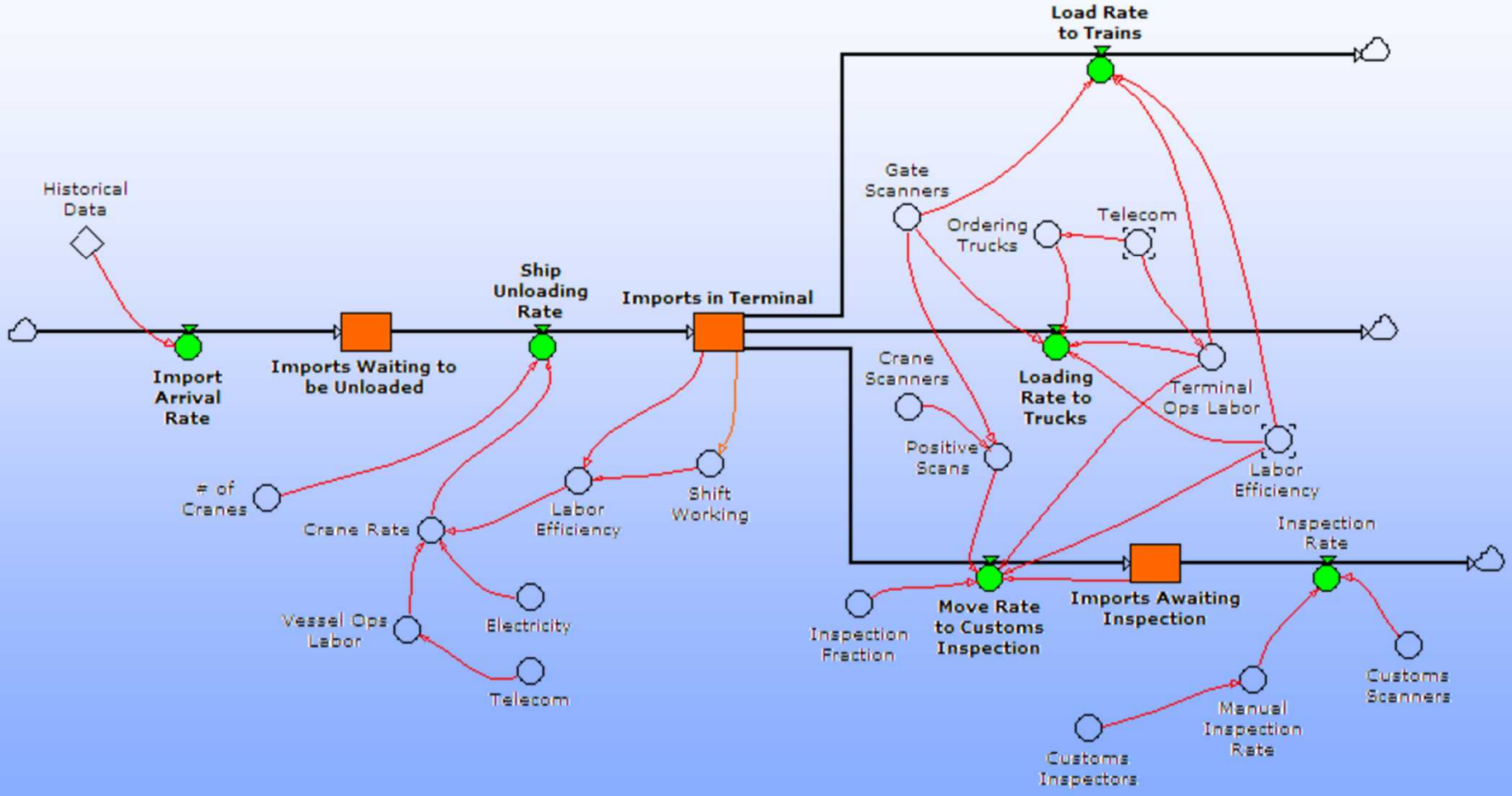
Short Term (throughput & costs)

normal

w/disruption



Short Term Cargo Flow Model



Port Operations Model for a Port like Seattle

To operate this model, click on the "Model Overview" button and then use the model operations buttons to start and stop the model or to run it on a step-by-step basis. The "Model Overview" screen should be used as the home base for running the model, but the model can be run from any screen. Click the help button on menu bar the to get more info on running models.

The model must be started before any parameters can be changed. Parameters can be changed anytime the model is running. To make a change for the whole model run, click the single step control, make the changes, and then click the run control. On most of the graphs, a mouse click will "drill down" to a more detailed screen

Model Controls

Model Overview | Labor | Port Logistics | Infrastructure Disruptions | Security | Costs

About this Model

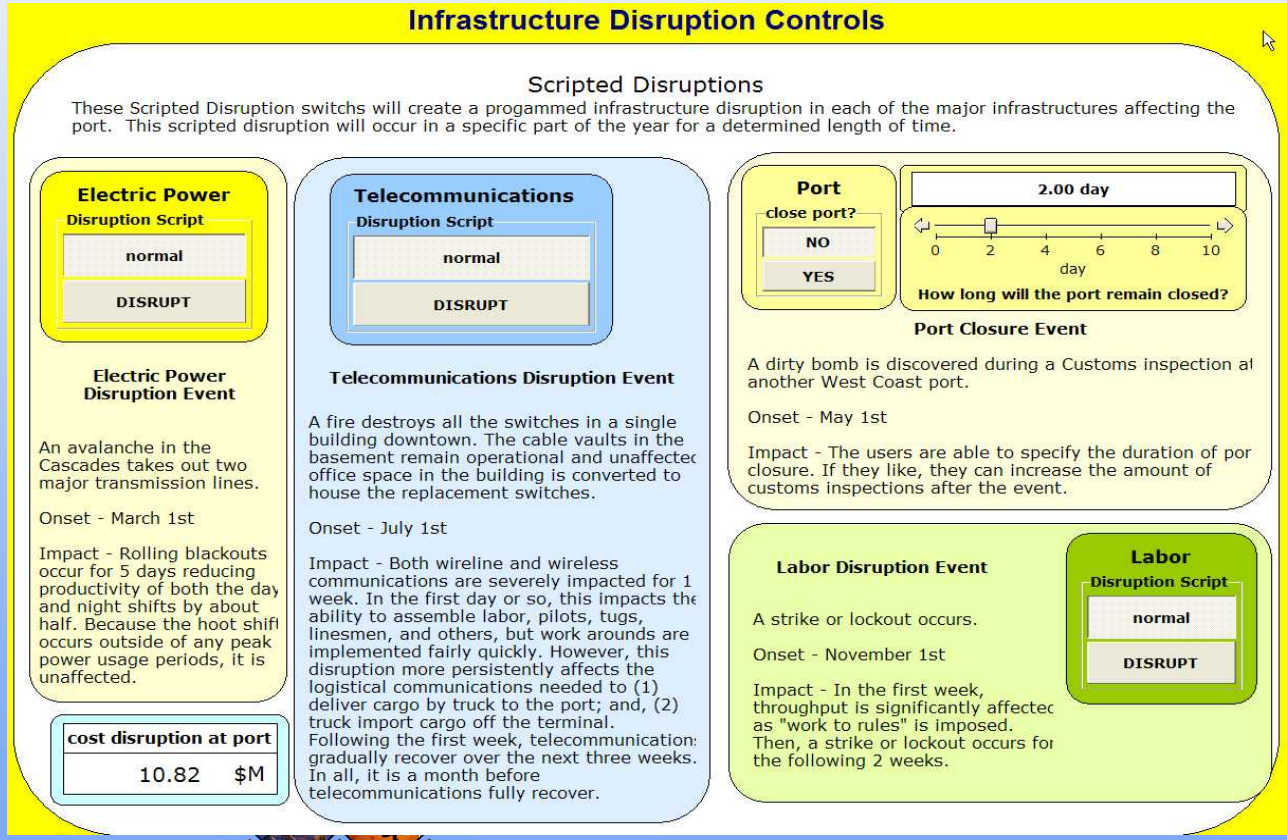
About NISAC

Long Term Model Inputs

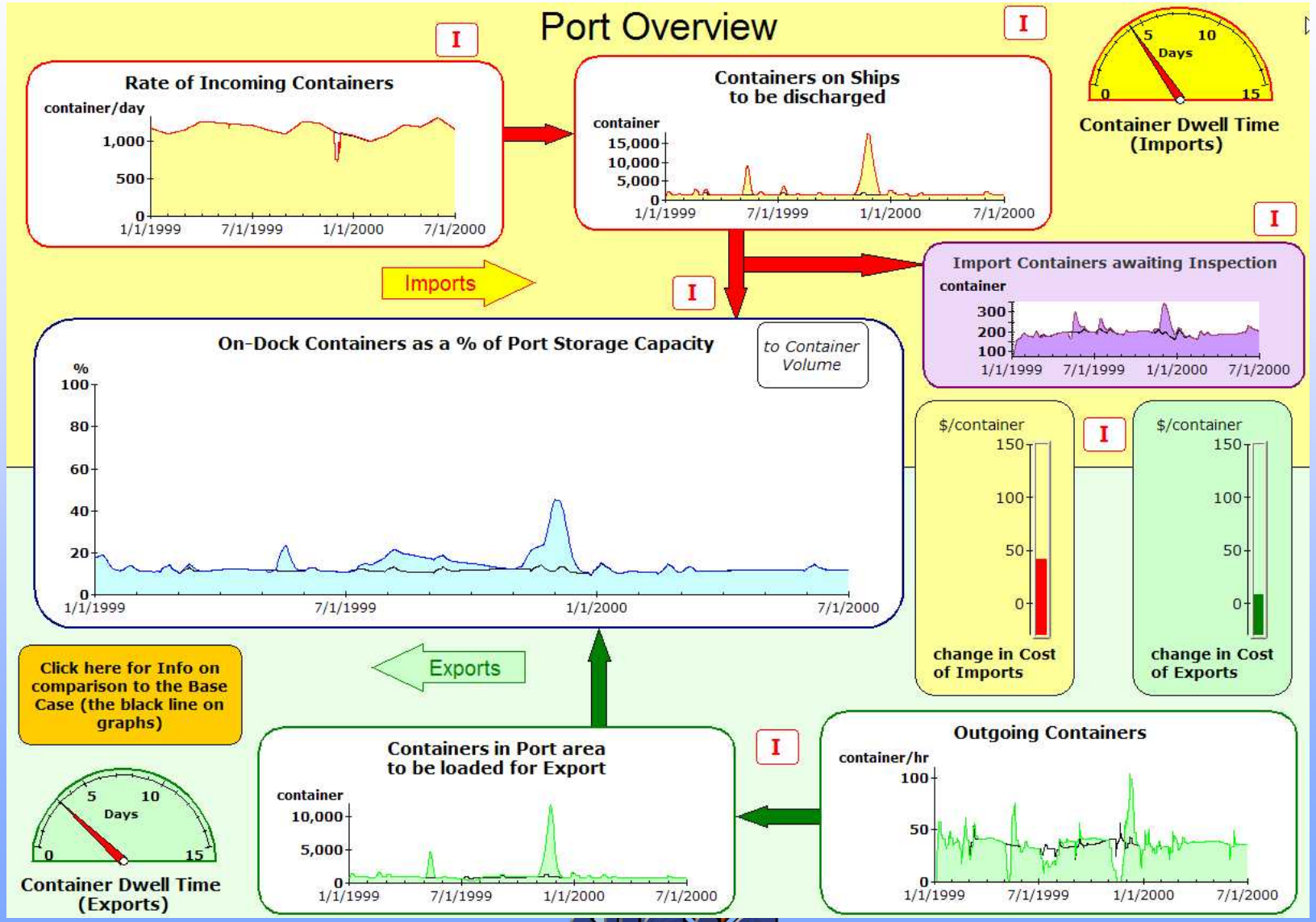
Disruptions

Four canned disruptions

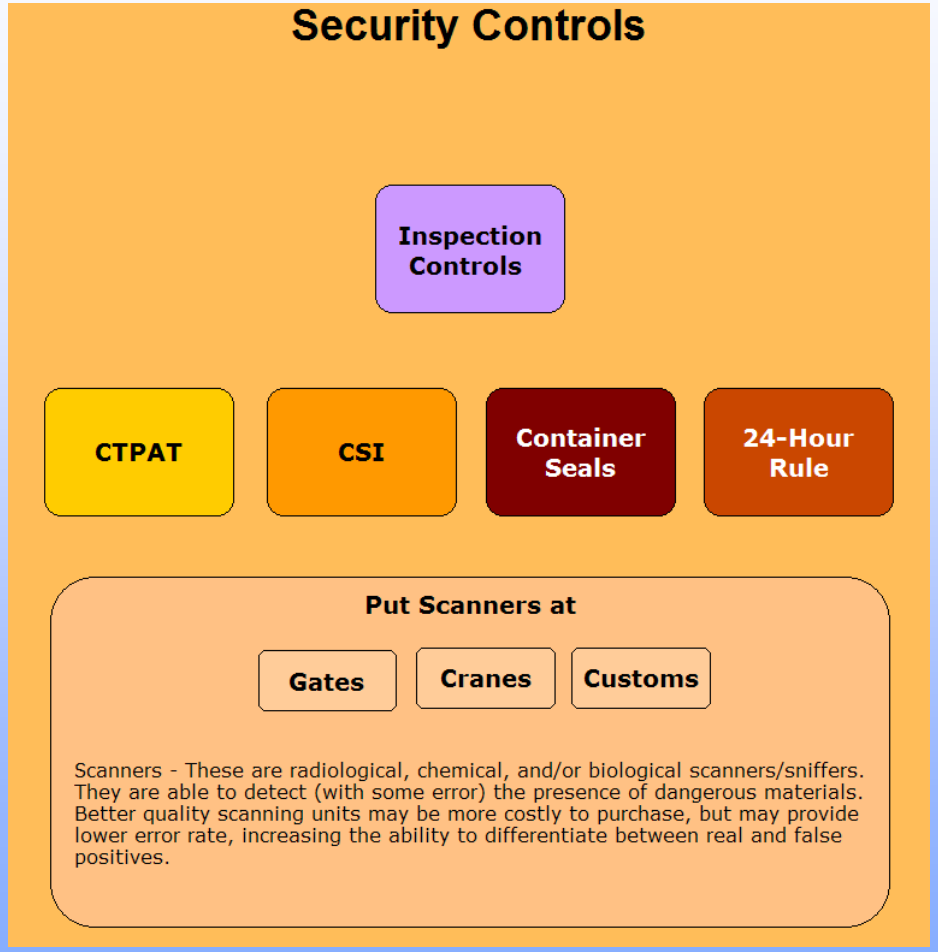
- Electric Power
- Telecommunications
- Port Security Threat/shutdown
- Labor



Effects of Disruptions



Some Example Security Screens



Scanners at Gates

Scan Trucks at Gates? I

yes

no

Scanners - These are radiological, chemical, and/or biological scanners/sniffers. They are able to detect (with some error) the presence of dangerous materials. Better quality scanning units may be more costly to purchase, but may provide a lower error rate, increasing the ability to differentiate between real and false positives. We have assumed that all containers having a positive result are sent to customs for more intensive inspection.

Scan Rail Cargo?

Scan Rail Cargo?

NO

YES

I

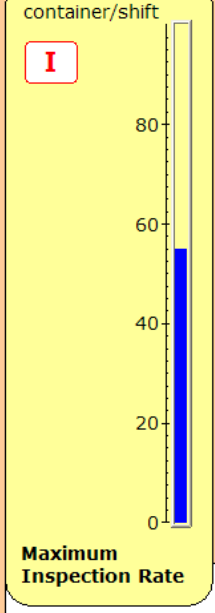
Click here to set Costs for Container Scanners, Radiation Sensors, and Explosives Detectors

I

55.00 container/shift

container/shift

I

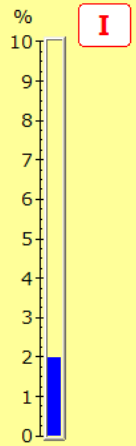


Maximum Inspection Rate

2.00 %

%

I



% of Containers Inspected (domestic)

5.00

0 10 20 30 40

Number of Scanning Units Required to Handle Rail Cargo

I

900.00 $K/yr

0 500 1,000 1,500 2,000

$K/yr

Aggregate Annual O&M Costs for Gate Scanners

I

55.00 container/shift

0 50 100 150 200

container/shift

Manual Inspection Rate

I

1.00 (container/hr)/gate lane

0 1 2 3 4 5

(container/hr)/gate lane

Reduction in Gate moves/hr

I

The effect of Gate Scans is a reduction in the number of gate moves per hour per lane

For every 1% of containers to be inspected at this port, the capacity to inspect at least 26 TEU per shift is required.

0.10 %

0 1 2 3 4 5

%

Percent Positives for Gate Scanners (includes both real and false positives)

I

Put Scanners at

Customs | Cranes

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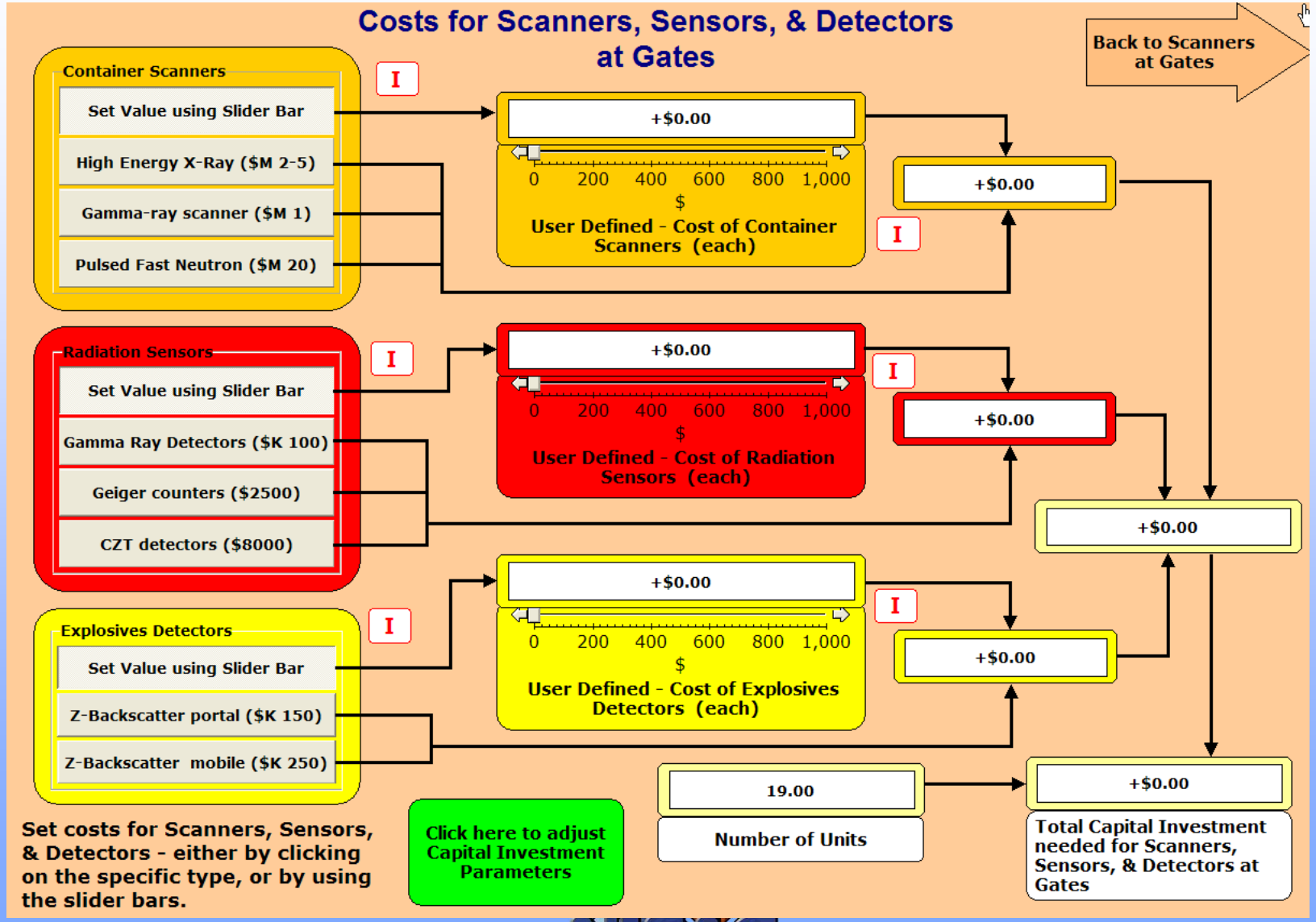
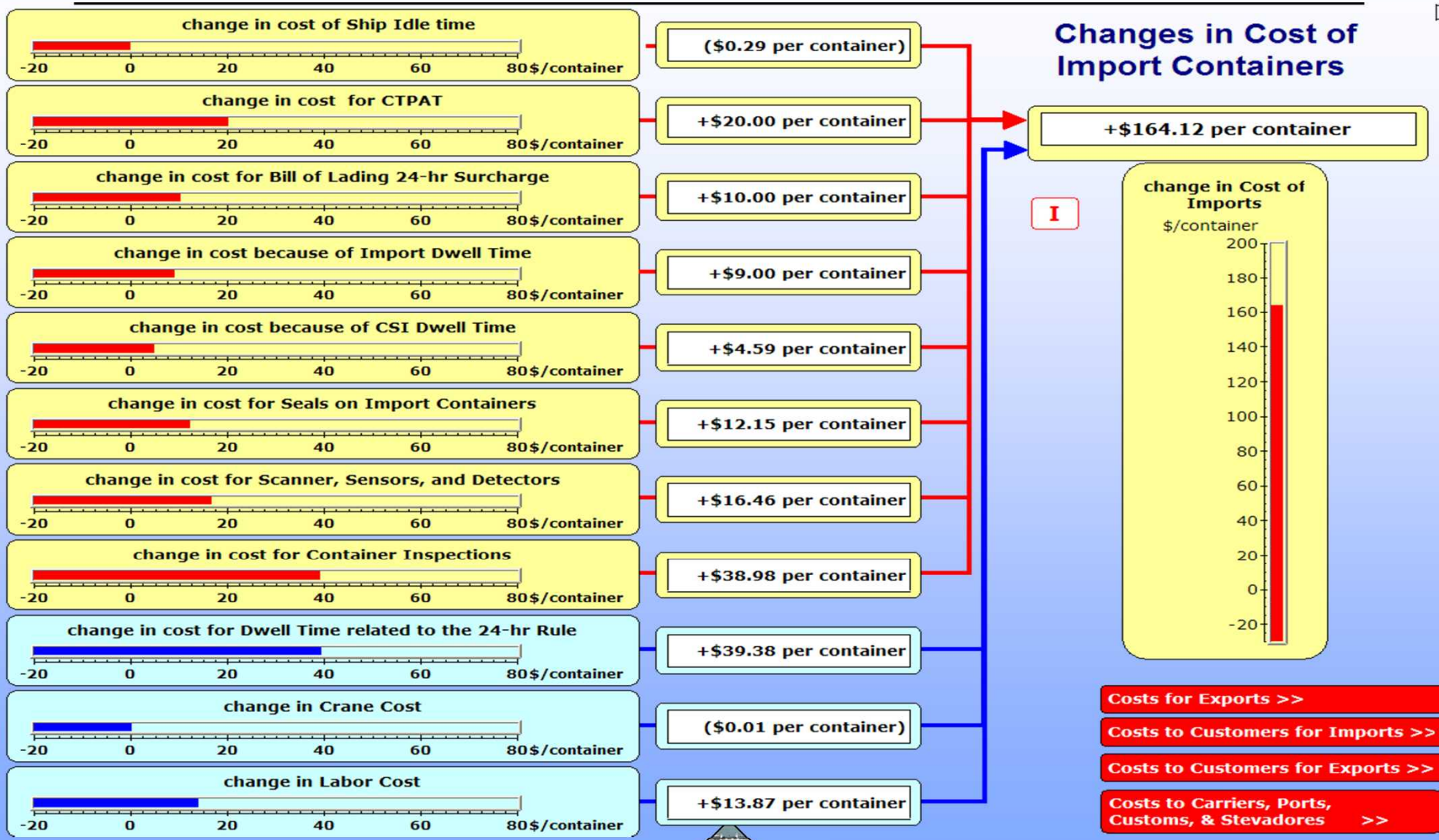

Costs for Scanners, Sensors, & Detectors at Gates
Back to Scanners at Gates
Container Scanners
Set Value using Slider Bar
High Energy X-Ray ($M 2-5)
Gamma-ray scanner ($M 1)
Pulsed Fast Neutron ($M 20)
I
+$0.00
0 200 400 600 800 1,000
$
User Defined - Cost of Container Scanners (each)
+$0.00
Radiation Sensors
Set Value using Slider Bar
Gamma Ray Detectors ($K 100)
Geiger counters ($2500)
CZT detectors ($8000)
+$0.00
0 200 400 600 800 1,000
$
User Defined - Cost of Radiation Sensors (each)
+$0.00
Explosives Detectors
Set Value using Slider Bar
Z-Backscatter portal ($K 150)
Z-Backscatter mobile ($K 250)
+$0.00
0 200 400 600 800 1,000
$
User Defined - Cost of Explosives Detectors (each)
+$0.00
+$0.00
19.00
Number of Units
+$0.00
Total Capital Investment needed for Scanners, Sensors, & Detectors at Gates
Set costs for Scanners, Sensors, & Detectors - either by clicking on the specific type, or by using the slider bars.
Click here to adjust Capital Investment Parameters

Example Results

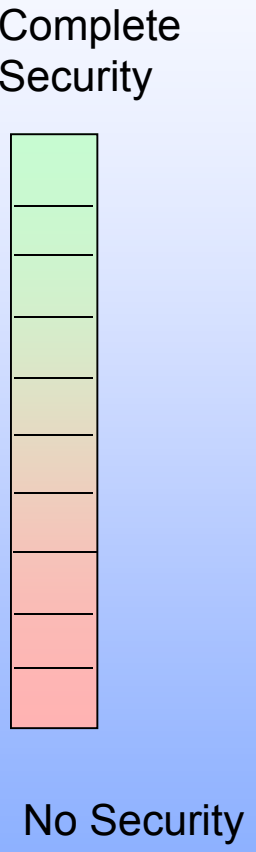


The Seattle and Portland Workshops

Some Workshop Observations

- The short-term operations model provided a tangible grounding for many of the participants.
- Some workshop groups developed novel, insightful, dynamic inspection strategies (that we'd have never come up with).
- There is no consensus about what constitutes adequate security. The workshop groups:
  - Produced a very wide range of comprehensive security policies.
  - Resisted qualitatively ranking security policies.

  Security upgrade decisions seem to be being made without analyses. Nobody really knows how much security they are buying.



Conclusions

- Security costs did not have the large negative impact they anticipated. Volume grew over time, but growth rates can be retarded by differential security effects.
- Scanners can impede operations relative to ports without them. This can impose significant competitive costs.
  - Subsidizing capital costs makes little difference – important effect is the additional time/labor caused by operating scanners at the gate and by inspection of detects.
- Imposing uniform measures help maintain balance among ports.
- An effective strategy for ports in the current environment
  - Accept security measures that are imposed across all ports
  - Resist any proposals to add security measures that are over and above the lowest common denominator
- An effective strategy for homeland security
  - Explicitly show the benefits to adding security
  - Add security evenly across ports
  - Be prepared to handle logistical side effects BEFORE imposing new security measures