### Supporting a Terminal Operation System including Crane Automation via Emulation

An optimisation of the control system of an automated crane has been developed. The whole terminal has been rebuild using device emulators to test the terminal operating system (TOS) and to fine-tune the parameter based strategies within the TOS. The emulation system is based on the CHESSCON VIRTUAL TERMINAL.

### Study about the Remote Controlled Automatic Twistlock (RAT)

The Remote Controlled Twistlock has been developed by the customer (Loxystem, Sweden) to rise productivity and improve safety of container logistics in the port. The study investigates vessel service to evaluate the possible savings during container operation and lashing activities. It is based on real stow plans from various vessels serving Bremerhaven terminals. The savings based on reduced lashing activities as well as the increase of productivity due to the feasibility of save vertical tandem lifts (regarding the locking status of the twistlock) have been evaluated. Furthermore ISL's 3D-Animation tool has been used to produce a visualisation of these benefits.

### Automation study

An overview about actual trends and coming technologies in container handling regarding especially the automation of processes has been issued. Customers role in this field has been evaluated and recommendations have been made and is revised continuously.

### TOS Optimization and new kind of Terminal Operator Training using Virtual Terminals

A terminal operator group purchased the CHESSCON VIRTUAL TERMINAL . They will use the software inhouse for testing and fine-tuning of TOS strategies as well as for a new kind of training their control staff. Thus the control staff may become "grandmasters" of terminal operation.

CHESSCON VIRTUAL TERMINAL is coupled to the inhouse TOS as well as to Navis' N4. Base models of the terminals have been developed by ISL Applications but will be applied to new demands by the customer themselves.
As known from CHESSCON SIMULATION (former ISL's SCUSY product) the client may define new terminals from the scratch, as long as the TOS interface does not change. Layout changes defined in the TOS may be imported directly to the Virtual Terminal software.

## TOP 10 Global Terminal Operators

(based on throughput 2008, Source: Drewry)

1. **HPH**
2. **APM Terminals**
3. **PSA**
4. **DP World**
5. **Cosco Group**
6. **MSC**
7. **EUROGATE**
8. **Evergreen**
9. **HHLA**
10. **SSA Marine**

Marked:
ISL customers in the field of optimisation and simulation

**ISL APPLICATIONS GMBH**
Barkhausenstrasse 2
27568 Bremerhaven
Germany
Tel. +49(0)471 30 98 38-38
Fax +49(0)471 30 98 38-55
info@isl-applications.com

# References

APM Terminals
ASEAN Terminals, Philippines
Bejaia Mediterranean Terminal, Algeria
Centerm Terminal, Vancouver, Canada
Contship, La Spezia, Italy
CSX, Jacksonville, USA
DP World, Antwerp, Europe
DP World, Australia
EUROGATE, Bremerhaven, Germany
EUROGATE, Hamburg, Germany
HHLA, Hamburg , Germany
HIT, Hong Kong
HPA Hamburg Port Authority, Germany
JadeWeserPort, Germany
Kalmar Industries, Finland
MCT, Gioia Tauro, Italy
MTL, Hong Kong
Nhava Sheva Terminal, India
Noell Crane Systems, Germany
NTB, Bremerhaven, Germany
P&O Headquarter , London, Europe
Port of Odessa, Ukraine
Port of Tacoma, USA
PORTEK International Ltd., Singapore
Ports America, North America
Red Sea Gateway Terminal, Jeddah, UAE
Sandwell Engineering Inc., Vancouver, Canada
SCT, Southampton, U.K.
TPT, Durban, South Africa
TRP, Buenos Aires, Argentina
TSB, Busan, Korea
VTE, Genoa, Italy
Warsteiner Brewery, Germany

# References

## Terminal Optimisation and Planning

**Analysis of rubber tired gantry operation**

Objective of the project was an increased throughput capacity by use of a new terminal operation system. The new operation system must also have the ability to handle an arising container volume during peak times. Instead of the existing fork lift truck system an RTG (Rubber Tired Gantry) system with a stacking height of 1 over 5 containers had to be used for the forecasted container throughput operation.

The two alternatives a) 6-wide RTGs 1over5 and b) 7-wide RTGs 1over5 has been simulated and analysed. Empty containers have been handled with the fork lift truck system as hitherto.

**Rail operation analysis - layout alternatives**

Modelling, analysis and comparison of various layout alternatives of the rail operation in consideration of the terminal operation system. With the objective to dimension the intermodal yard for future requirements five scenarios of the rail operation were modelled and simulated.

**Appraisal of terminal operation systems by extended berth length**

By extending the berth length and enlarging the backreach area the handling facilities of a container terminal should be expanded. By using CHESSCON SIMULATION ISL investigated and compared the operation of the following systems regarding performance and costs:

a) straddle carrier system 1over2,
b) rubber tired gantry system 1over5 with conventional truck/ chassis units
c) rubber tired gantry system 1over5 with shuttle carriers.

**Stacking area analysis**

For an existing straddle carrier terminal ISL determined the optimal arrangement and dimensioning of stacking areas for import, export, reefer, empty and dangerous goods containers with the help of simulation technique. Furthermore the influence of block size on the operation was analysed.

**Feeder handling strategies**

In terminal operation feeder vessels are frequently handled with lower priority than main vessels. In addition to the so called transhipment containers for the feeder vessels these containers are mostly scattered over the total import and export area. With the arrangement of special blocks for the transhipment container stacking an improved feeder handling was aspired. With CHESSCON SIMULATION the effects of number and arrangement of the transhipment blocks on the main vessel handling has been analysed. Further the effects of special feeder blocks are investigated regarding the total handling situation.

**Development of a traffic model for novel equipment types**

Upgrading CHESSCON SIMULATION with a detailed traffic network model including flexible interchanges between transport and stacking equipment to model and simulate automatic operation systems.

## Capacity & Benchmarking

**Benchmarking terminal operation systems**

During investigation various terminal operation systems have been analysed and compared regarding key figures and critical points. By means of CHESSCON SIMULATION the investigation analysed

a) pure straddle carrier systems (in combination with terminal chassis or straddle carrier sprinter),
b) rubber tired gantry systems (in combination with terminal chassis or straddle carrier sprinter) as well as
c) rail mounted gantry systems (in combination with terminal chassis or automatically guided vehicles or straddle carrier sprinter).

**Analyse capacity of container terminals by simulation**

The quayside capacity is limited by its quay length and berth draught as well as number and performance of ship to shore container cranes deployed. The capacity of the stacking area is determined by the number of container slots available and the dwell time of container. The simulation system CHESSCON CAPACITY calculates the maximum throughput of a terminal based on both the capacity at quayside and stacking area available.

As a result among others the simulation provided the percentage utilisation at quay side over the year, the number and utilisation of ship to shore container cranes necessary and the percentage utilisation of the stacking area. The detailed evaluation identified bottlenecks of the terminal at the quay side and in the stacking area respectively.

**Capacity determination for a planned container terminal**

In a simulation study ISL determined the maximum possible capacity of a planned container terminal with the simulation tool CHESSCON CAPACITY. Derived from the maximum capacity conclusions are drawn about the amount of container slots needed, the number of ship to shore container cranes needed as well as type and amount of seaside traffic. Afterwards, based on the simulation results, the total area needed for the two terminal operation systems

a) manned Straddle Carrier system (1over3) as stacking and transport equipment and
b) automatic Overhead Bridge Cranes (1over4) as stacking equipment and Automated Guided Vehicles as transport system has been determined and evaluated.

## Environmental Impacts

**Acoustic noise emission and transmission analysis of a container terminal**

This project covers an approach (EPSIC – Enhanced Planning System for Immission Control) to combine an approved simulation tool for container terminal planning with the emission, transmission and immission of acoustic noise using standardised computation formulas. The simulated movement of all devices at the terminal as well as single events are multiplied with their emission parameters using a specific equipment database. The transmission of acoustic noise is calculated using formulas according to German DIN-standard. Using this the immission of noise at each point in or near the terminal can be evaluated.

Furthermore the effects of single types of equipment may be stated. In this way the terminal planner – using a tool which uses his customary terminology – is able to analyse the impact of different noise reduction alternatives in a very early planning phase.

**Pollutant emission on port waterways**

The rapid growth in worldwide container handling will not only effect the terminals, but will lead to congestion on the regional waterways. Furthermore the pollutant emission will increase. By order of a port authority the vessel traffic is forecasted until 2025 and the resulting emission is calculated by regarding vessel's machine technology and fuel consumption.