TOS: key asset for terminals
The Terminal Operating System (TOS) of a container terminal forms the heart of the terminal operation. It keeps track of all container positions in the stack and it handles large quantities of information. It decides, using a number of control strategies, on container grounding locations and equipment deployment and dispatching. Implementing a new TOS is a high impact activity for any terminal and, as the system change happens while the terminal is in operation and needs to continue performing, it is essential that problems are kept to an absolute minimum.

CONTROLS Emulation tool
TBA has developed a methodology in which the TOS is tested before it is actually deployed using advanced simulation models. This approach is addressed as “emulation”. TBA’s CONTROLS (CONtainer TeRminal Optimised Logistics Simulation) is an innovative emulation tool. It is designed for the testing and tuning of a TOS, as well as for the training of the human operators of the TOS. The emulation is realised by linking the TOS to a simulation model of the real terminal that comprises all relevant terminal processes. As such, the TOS is controlling a virtual terminal as if it were controlling a real one. The TOS operators, like yard planners, dispatchers or vessel planners, use the normal user interface of the TOS, and can perform his work as if controlling an actual operation, therefore rendering the tests as realistic as possible. The simulation model of the terminal operations is comprehensive and includes regular as well as special operations, such as reefer handling, empty handling, traffic to customs inspection or the CFS, and so on.

CONTROLS aims to achieve three different objectives:
- Testing and validating the TOS functionality, thus ensuring error free operations by extensively assessing the complex conditions before going live
- Tuning the TOS parameter settings (yard and equipment control settings) in order to get the highest possible performance
Training the human TOS operators without hindering live operations, and allow the operators to prepare for all kinds of irregular operations.

**Testing of a new TOS**

When a terminal operator acquires a new TOS, he needs to ensure that it is bug-free and performs smoothly during live operations, under all possible circumstances. In current practice, it is very difficult to test the TOS when the terminal is in operation. However, without thorough testing beforehand only a part of the potential problems that may arise at implementation are found. Issues may then surface just after the go-live date, or even following a longer period. As a consequence, operations are disrupted, resulting in high costs and a considerable loss of time and effort. The CONTROLS emulation set-up allows for extensive detailed testing under all kinds of circumstances without influencing the actual operation and long before go-live.

The emulation approach has proven to accomplish the following aims:

- Shorter lead times while implementing a TOS and a reduction in the need for testing with real equipment
- Higher performance at commencement of operations
- A significant reduction in errors while operating the TOS, leading to an equal reduction in the disturbance of terminal operations
- An ability to take endeavours to the next level by focussing efforts on optimizing performance, rather than by necessity directing them solely on getting the TOS to function at its basic level.

**Tuning day to day operations**

Besides testing, the link between TOS and CONTROLS allows for:

- The running of future operations (“the next shift”) in order to validate the planning results, and compare various options, such as crane splits or equipment deployment (“2 or 3 straddle carriers per crane”)
- The replay of past operations in order to review experiences and compare different system settings (expert decking, equipment control and deployment, crane split)
- The creation of (fictitious) future terminal operation scenarios in order to check the operating strategies under higher densities and/or volumes.

**Training TOS operators**

The staff in the control room forms a critical part of today’s terminal operations. It is therefore advisable, if not essential, to train staff members in vessel and yard planning, as well as equipment deployment and dispatching. Particularly in dense operations, the risk of deploying untrained staff can lead to serious errors, with a resulting loss of productivity, and is therefore unacceptable. CONTROLS allows for training and preparation for even the most complicated and rare situations, without the risk of mistakes and the resulting negative impact on the real operation. It immediately provides visual feedback, demonstrating the effect on the achieved productivity level.

**Features of CONTROLS**

- Faster than real-time testing, thus allowing for error detection months in advance
- Detailed on-line visualisation of equipment and container movements, both in actual as well as in replay mode.
- Detailed on-line and off-line statistics regarding equipment and equipment status
- Creation of future scenarios, using the scenario management capability
- Loading and reloading real data from past operations, allowing for testing and tuning based on the terminal’s needs

CONTROLS has been implemented at about 15 terminals and linked to five different TOS, including SPARCS and N4 (NAVIS), SPACE (COSMOS) and CATOS (TSB).