



USING INTELLIGENT TOS PLUG-INS

TO INCREASE TERMINAL PERFORMANCE

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As volumes have found their way up again, and additional terminal capacity is not easily realized, terminals return to seeking improvements in their internal processes. Based on our experience, which covers over 50 terminals where we assisted in performance improvement programs, it is possible to make substantial performance gains for internal processes. This is also recognized by the terminals themselves. A recent survey by Navis indicates that 76% of the respondents put process improvement as a 'number one priority' for terminal operations.

Process improvements may be seen through productivity increases, gains in service levels, for example the reliability of port stay, capacity enhancement due to using space more effectively, and cost reductions. Without a doubt, double digit improvements can be attained in the performance-cost index.

Performance improvement needs to be a data-driven process, which means

that without in-depth knowledge of what is going on, any improvement measure is a wild guess. Lean Six Sigma theory, a methodology used to enhance productivity, provides a solid justification for such data driven improvement, which implies extensive data collection for initial and continued performance measurement as improvements are implemented.

Luckily, terminals collect heaps of data through their TOSs, although this data is often quite underutilized. Turning data into information and information into knowledge regularly fails with the implementation of a Business Intelligence (BI) system, or with the focused use of the output of such a system. Terminals that structurally link past performance to analysis of what went on, are still rare. Challenge yourself, dear Operations Director: how often is yesterday's performance analysed, and linked to the actual processes that occurred? How often is the planning beforehand analysed? So just implementing a BI system does not mean you

are actually gaining knowledge, nor does it mean you are improving performance.

ROOM FOR IMPROVEMENT

In a time where Artificial Intelligence (AI) is moving from scientific magazines into our daily lives, one would expect a lot of it in container terminal operations. The nature of operations is repetitive, the data overwhelming, and the control tasks relatively simple. Well, reality is very different. Even the largest terminals in the world practise manual vessel planning, yard planning and equipment dispatching. Most control strategies are reactive, rather than proactive, and there is little being done to understand the patterns underlying the container trade. Terminal operators are relying heavily in the TOS for data storage and order management, but for terminal planning and control, they are relying on people. Even in the most-robotized terminals, there is still a high degree of manual control, going way beyond exception handling.

At the same time, there is a widespread



TBA's Chimney app is used to prevent undesired situations, such as the above, from occurring in the yard.

understanding that these processes can be run more effectively, and even more so efficiently. The nature of these tasks is typically repetitive. At the same time, some of the tasks require that quite a large amount of information be used efficiently. These two characteristics make them quite suitable for automation.

In order to facilitate the automation of these repetitive tasks, we developed a toolkit to support terminals in this process. The toolkit consists of three main components:

1. Analysis of what's going on through detailed KPI analysis, using standardized tools linking into the TOS
2. A set of automation tools we call intelligent apps or plug-ins, building on-top of existing TOSs to automate and optimize today's processes
3. An implementation approach to ensure the integration of these new tools into the operational organization

KPI MEASUREMENT

What Key Performance Indicator (KPIs) should be monitored and on what basis? What does a weekly average STS productivity tell you? Barely anything. KPI measurement should reflect the effect of decisions taken. Such decisions range from the amount of equipment deployed, the locations in the yard used for stacking, the sequence of containers to be loaded, and many others. The level of detail here also means that the KPIs need to be at

micro level, which means disaggregation into individual hours or even less. We need to know how long prime movers are waiting for the yard crane to be served while loading, and while discharging, and we need the same for the STS. Often, this level of information is not available to the decision-makers, especially not in real-time. KPIs are aggregated, which make it hard to assess the quality of planning, dispatching, or equipment deployment strategies, those decisions that eventually make or break the cost-efficiency of operations.

INTELLIGENT PLUG-INS

In order to obviate the requirement for terminals to change their current TOS, the intelligent plug-ins link into the TOS without any change to the TOS itself. They retrieve information, push back actions, or updated information merely by operating in the background. A number of these plug-ins are in operation.

In this paper, we discuss several intelligent plug-ins. We also discuss how they are tested by means of emulation to ensure their contribution to performance, and validity in live operations. After all, they are aimed at performance enhancement. The plug-ins that we will discuss here are the following:

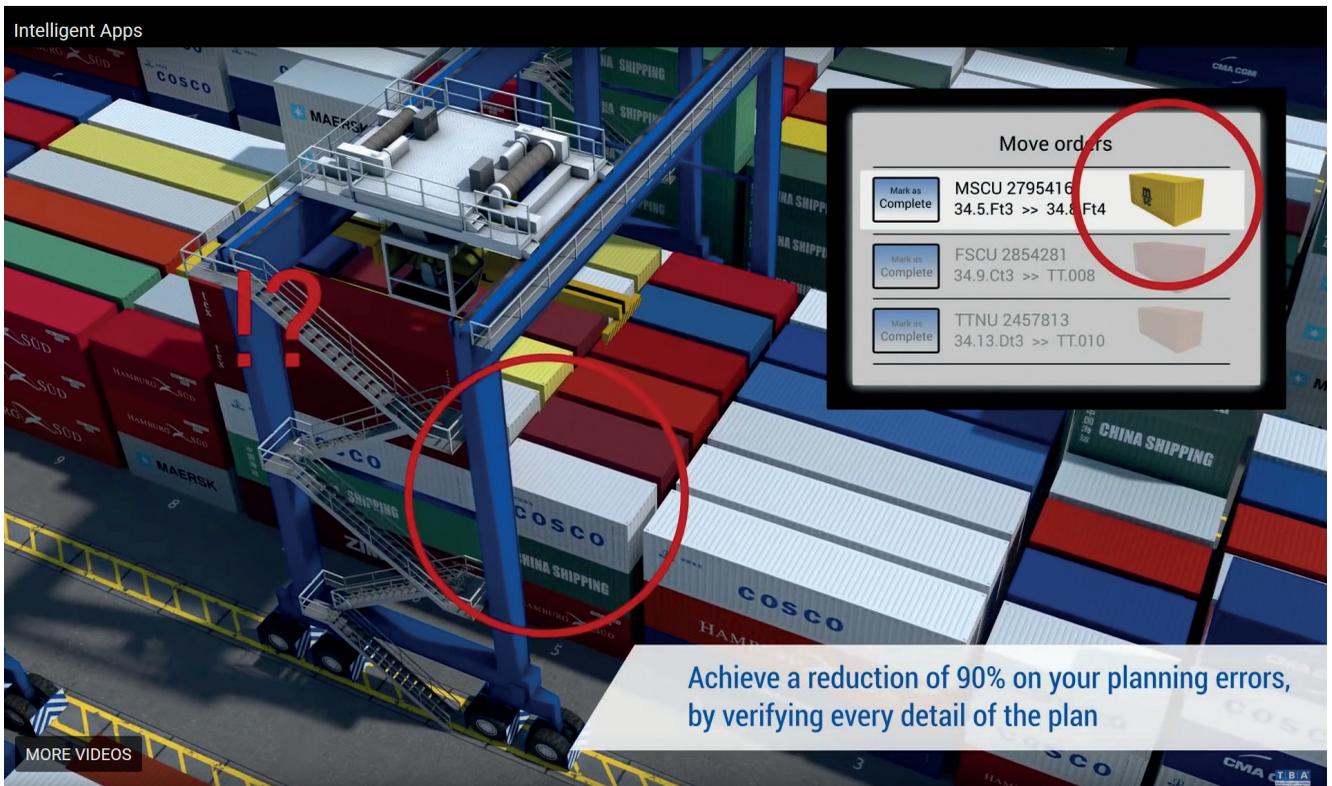
- Yard Crane Scheduling
- Plan Verification
- Chimney stack detection and avoidance

Currently, a set of TBA plug-ins is only available

for the TOS suite from Navis (SPARCS 3.7 or N4 2.x / 3.x). However, in principle they are built in a TOS-agnostic way, allowing integration with other TOSs as well.

YARD CRANE SCHEDULING

One of the most underutilized pieces of equipment in terminals is the RTG. Where 70% of terminals worldwide work with RTGs, the real productivity typically hovers between 6 and 10 moves per hour. This implies idleness in the range of 40–60%. The root cause can be found in the merely static way they are deployed across the terminal: the machines are positioned in a yard block, and handle the moves that actually are occurring in these blocks. Without going into the potential of improving this by more dynamic yard strategies, as you can read on further in two papers by De Waal and Saanen in *Port Technology International Journal's* Issues 31 and 32. The impact of dispatching the yard cranes in a more dynamic way can be huge. A recent deployment in a large RTG terminal showed a very rapid increase in RTG productivity by 10-15%. If we monetize this, the cost savings is obvious. Assuming an RTG is running 4,000 hours per year, costing some US\$60 per running hour (labour (\$20) + fuel (\$20) + maintenance (\$20)), we are saving at least \$24,000 per RTG per year. A terminal handling 1 million TEU easily has 20 RTGs or more, and would generate a savings of close to \$500,000 per year. If we project this to a West Coast US scenario, where the cost per RTG running hours are more like \$200



Achieve a reduction of 90% on your planning errors, by verifying every detail of the plan

TBA's Plan Verification Tool brings unproductive moves to the attention of the planner early on.

per hour due to the manning per RTG, the savings increase to \$80,000 per year per RTG.

PLAN VERIFICATION

Planning might be the most undervalued activity at container terminals, at least when we assess how the quality of planning is measured and evaluated: in principle, not at all. There is very little feedback to the planner on how the plan played out in live operations, preventing the planner from learning in any way. For this purpose, we developed the plan verification tool, basically analysing the plan, identifying errors, and identifying opportunities for efficiency improvement. Errors range from loading to occupied cells on-board, to wrong working patterns (e.g. discharging starting at the waterside of the vessel), to stacking 40 foot containers onto 20 foot containers. Efficiency improvement is recognized, for instance, in terms of missed twinning opportunities, or optimized loading sequences that minimize rehandling, avoiding peaks inside the yard.

The tool runs quickly after the plan has been finalized, and then allows for fixing errors and utilising the improvement potential.

CHIMNEY STACKS

Chimney stacks are an inevitable evil inside the container yard. However, by using clever stacking strategies they can be minimized, improving safety and avoiding containers being blown down in windy conditions.

The Chimney App prevents chimney stacks from being built, and may affect grounding decisions in real-time, allowing chimneys remaining as a result of load out to be re-organized to remove the chimneys.

Applications or plug-ins may address terminals' wish to improve cost-efficiency and performance. When implemented well, the tools provide a ROI within a few months, and increase a terminal's competitiveness.

ABOUT THE AUTHORS

Dr Yvo Saanen is Commercial Director and Founder of TBA, a leading terminal design and simulation company in the Netherlands. He is in charge of all port and terminal related projects all over the world in the planning and optimization process of container terminals by means of simulation and emulation. In this role, he has participated in various projects, ranging from long term development, process improvement, terminal extensions and redesign of handling systems to design of greenfield terminals. Dr Saanen holds an MSc in Systems Engineering and a PhD on the design and simulation of robotized container terminals, both from Delft University of Technology. He is a Professor at the Rotterdam School of Management.

Frieda Zutt-de Fockert is a Senior Consultant at TBA. She leads the optimization team that works on projects to optimize the performance at all types of terminals. One of her current projects is the Intelligent Apps platform. She holds an MSc in Operations Research.

ABOUT THE ORGANIZATION

TBA is a leading international provider of consultancy and software for ports and warehouses with over 150 live installations worldwide. Its product and service portfolio concentrates on marine, intermodal container and bulk terminals. Key services are terminal planning using simulation, support of complex software (TOS) implementations and TOS fine tuning using TBA's emulation tool CONTROLS, as well as the training of terminal planners. TBA is also a leader in equipment control software (ECS) for automated terminals, having supplied the Euromax, APMTMV2 and RWG in Rotterdam, CTA in Hamburg, Antwerp Gateway, and Long Beach Container Terminal with TEAMS - TBA's Equipment Control Software. TBA delivered Terminal Operating Systems (TOS) for container, bulk and general cargo terminals. TBA's clients include all major terminal operators worldwide and many local port operators.

ENQUIRIES

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