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Submission by LASE GmbH

for the ICHCA International “Innovation in Safety Award”

Product innovation:

LaseSCP-3D/2D – Stack Collision Prevention and soft-landing system to improve safety around RTG and RMG machines

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Herewith we like to submit the LASE'S advanced driver assistance systems for container cranes called LaseSCP-3D/2D – a Stack Collision Prevention System to prevent that containers falling from the stacking area into the truck lane on RTGs or RMGs. The following sections should give you a brief overview about the technology, functionality and the need to have this solution in ports and terminals worldwide.

- **Product innovation:**

The LaseSCP-3D/2D – Stack Collision Prevention System is a unique system developed by LASE in cooperation for/with the biggest Port Operator (APMT, PSA and DP World) in several projects. Special is, that it is a holistic solution by usage of 3D-laser scanner that can cover the operation bay and also the adjacent bays of a stack.

Additional features are:

- soft-landing
- reduces spreader wear
- noise reduction
- energy saving by optimised curve of travel

- **General background:**

The level of automation and safety in container handling has increased significantly in the last years. Many Greenfield projects target a full automation of the ports. Still most of the existing ports have manual machine operations. Since the beginning the port itself is a dangerous workplace where accidents often are deadly. This is why it is necessary to provide assistance to the crane driver in order to ensure the safest working conditions for him and the people working around the cranes.

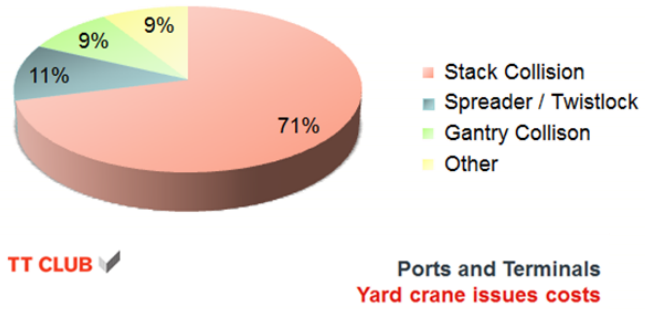
For this purpose laser-based measurement systems have been developed by LASE, which scan the environment and allow crane movements without any accident or collision.

The LaseSCP-3D/2D System is focusing on the collision free transport of the load.

- **Initial facts**

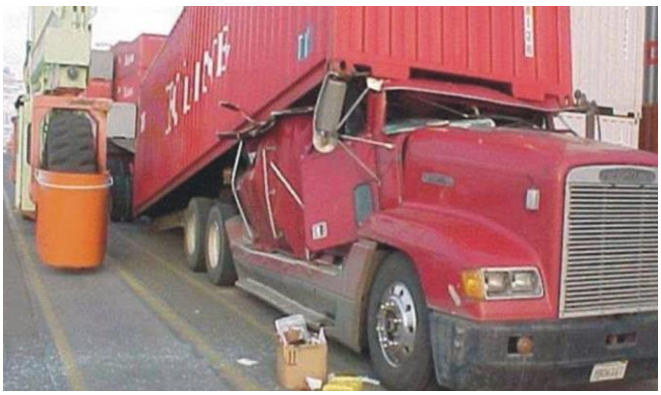
One of the world's biggest port operators has over 600 x RTGs in use in its container yards. For instance in 2014 8 deadly accidents happened by containers falling off the stacking area into the truck lane and killing the truck drivers. These kinds of accidents are caused by loads that are not being lifted high enough and touching other containers in the stacking area.

Concerning this you can find a statistics about those issue costs at RTGs/RMGs by TT Club:



Graphic 1: Issue costs at RTGs/RMGs (Source: TT Club, 2015)

Thereby it has to be distinguished, if containers fall off either from the “operation bay” or from adjacent bays. Nearly 75% of these collision types happen in the operation bay and 25% with containers in adjacent stacks.

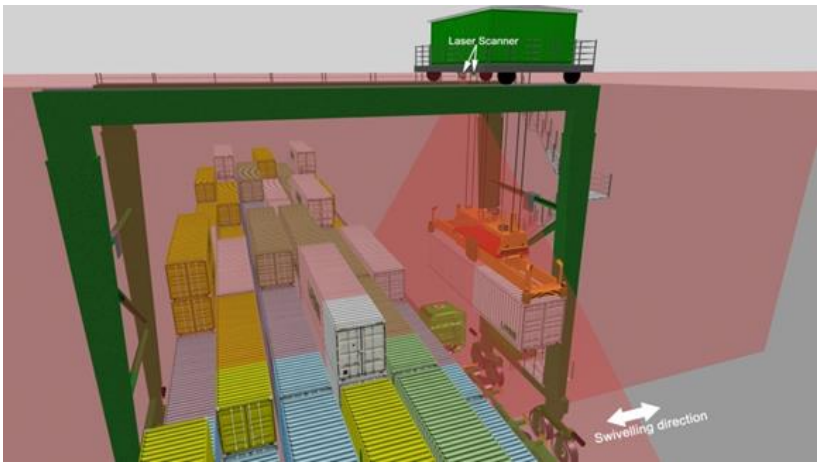


Graphic 2 & 3: Containers fell off onto trucks in the stacking area

- **Product development and description**

The need was to develop measurement system, which can detect the container profiles in the stacking area by having a complete 3D-image of the yard and to determine the load position simultaneously to prevent the collision. How is the system build?

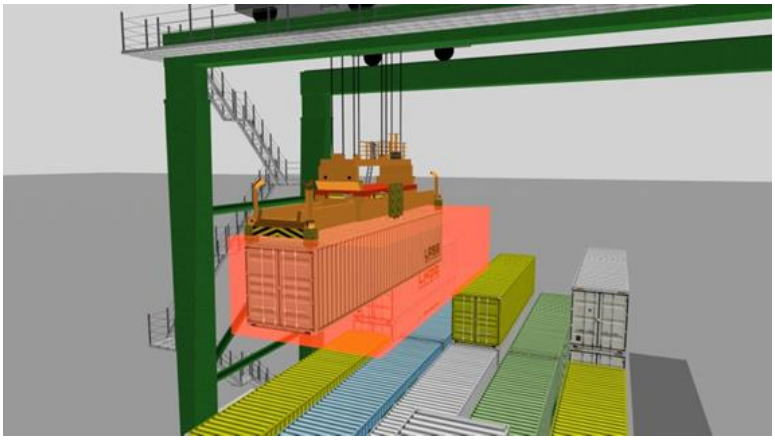
The measurement system consists of one 3D laser scanner und one 2D laser scanner, which are mounted at the crane trolley under the trolley platform.



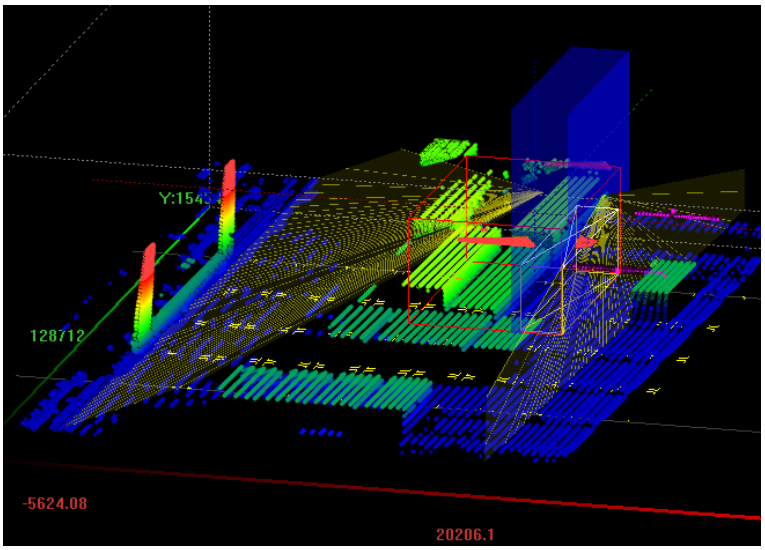
Graphic 4: Crane with scan planes of 2D and 3D laser scanners

Before trolley travel from the truck lane into the stacking area, the 3D laser scanner measures the stack profile. The 3D profile of the stacking area is stored by the measuring system. The 2D laser scanner measures the trolley and also the load position permanently.

A so called “surveillance cube” is built around the load. The size of the cube vary by the factors: load position, trolley travel and crane lift direction, trolley and crane lift velocity, trolley braking behaviour as well as the load’s pendulum movement during reducing/stop motion.



Graphic 5: Animated surveillance cube around the load



Graphic 6: Real software screenshot of the red surveillance cube around the load

The figure above shows a 3D-image of the measurement points. The blue and the green lines are representing the containers. The small yellow box is the spreader/container. The larger red cube is indicating the surveillance cube. It is shown in red because this is a collision prevention case.

In case of an overlap between the surveillance cube around the load and the profile of the stacking area, the velocity of the load will be reduced automatically. Thus the load cannot collide with the stacks anymore. Additionally the measurement system is also used for soft-landings of the load (container or spreader) onto other containers. As a consequence spreader wear is reduced significantly – and noise reduction likewise.

- **Beneficial summarized**

The main benefits and system features of this application can be summarized as follows:

- Prevent collisions between load and stack in operation bay
- Prevent collisions between load and stack in adjacent bays
- Stack height information for path optimization (energy saving and reducing rope wear)
- Gentle container handling trough soft landings & less spreader wear
- Driver assistance

- **Conclusion and future prospect**

The LaseSCP-3D/2D System is highly requested by the market, as shown latest by ICHCA Technical Adviser and Observer Richard Brough during the PEMA meeting in Amsterdam. After launching the product in 2014 it is set in operation in several terminals worldwide (user are already APM, DPworld and PSA Terminals). The crane drivers see it as a real help and certainly no accident has been happened after deploying the systems on the cranes. A similar System (LaseCPV) for STS cranes is already in usage, based on these developments for RTGs/RMGs.

About LASE GmbH:

LASE is the leading company for laser-based system solutions in the field of container ports. We offer innovative and productive solutions by combining state-of-the-art laser hardware technology and sophisticated software applications. The broad range of precise and reliable 1D, 2D and 3D laser systems can be used for several measurement tasks in numerous kinds of industries. Our product range for the port industry mainly cover systems for collision prevention, stack profiling, container or vehicle recognition as well as automated stacking.

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LaseSCP-2D and LaseSCP-3D are Laser Measurement Solutions to prevent collisions between the load and the stacks for RTG and RMG.

Feature / Benefits / Comparison of LaseSCP-2D and LaseSCP-3D

	LaseSCP-2D	LaseSCP-3D
Hardware		
LASE2000D-118	2	
LASE3000D-C2-118		2
LASE Control Unit	1	1
Accessories	1	1
Software		
LASE CEWS Basic	1	1
LASE CEWS Application Stack Collision Prevention 2D	1	
LASE CEWS Application Stack Collision Prevention 3D		1
Feature / Benefits		
Collision Prevention in the operating bay	🟢	🟢
Collision Prevention with the adjacent bays	🔴	🟢
Collision Prevention with other obstacles in the operation area	🟡	🟢
Soft-landing in the stack	🟢	🟢
Soft-landing on the trailer	🟡	🟢
Reducing operating noise	🟢	🟢
Truck Position Verification in Gantry and Trolley drive direction	🔴	🟢
Reducing spreader wear	🟢	🟢
Driver assistance	🟡	🟢
Reduce Container Damage Claims	🟡	🟢
Definition colours	🟢	Full applicable
	🟡	Limited applicable
	🔴	No Feature

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