

# Advanced Gantry Crane Sensor Suite

## Fast, accurate and reliable measurement

- High-speed 3D laser scanner determines load position, sway and skew with 10 Hz update rate
- Physical model for smooth trajectory control input data
- The same sensor can control the load movement and scan the entire environment
- Approved and used for fully autonomous operation in ship-to-shore cranes in Rotterdam and Hamburg



### The Task

In an increasingly competitive environment, all manufacturers and operators of large gantry cranes have been tasked with providing a higher level of automation to provide additional value and reduce the cost of operation.

As a key function, the accurate control of the load is critical. This applies not only to fully autonomous cranes, a reliable and accurate sway control helps also to reduce damages and improve performance in remote-controlled or conventional cranes.

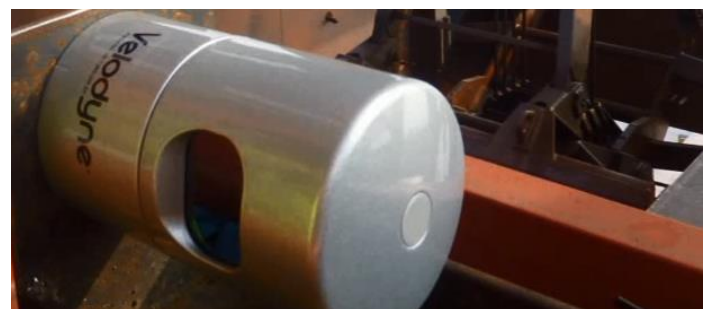
When moving forward to a partly or fully autonomous operation, the control system needs additional input about its surroundings, be it the distribution of iron ore in a bulk carrier's hatch or an accurate mapping of container positions.

iSAM's crane sensor suite delivers all this information in an easy-to-use package integrating the most advanced sensor systems via a dedicated evaluation unit with direct interfaces to all major PLC control systems. Thus the crane manufacturers and electrical solution providers can focus on their core business without spending years to develop complex software for sensor data processing.

### The Solution

The development of the crane sensor suite started when iSAM was tasked with the full automation of 4 large ship-to-shore grab unloaders in the port of Hamburg. From the beginning, it was obvious that an entirely new sensor concept would be needed which became a combination of a newly developed 3D laser scanner, field-proven RTK GPS positioning solutions and leading-edge processing technology.

One of the key components of the automation system was the intelligent grab tracking system based on a new 3D real time laser scanner which had been developed by a US company, Velodyne. This new high-tech scanner was for the first time fast enough to track the crane ropes and the grab itself in real time to measure sway and grab attitude.

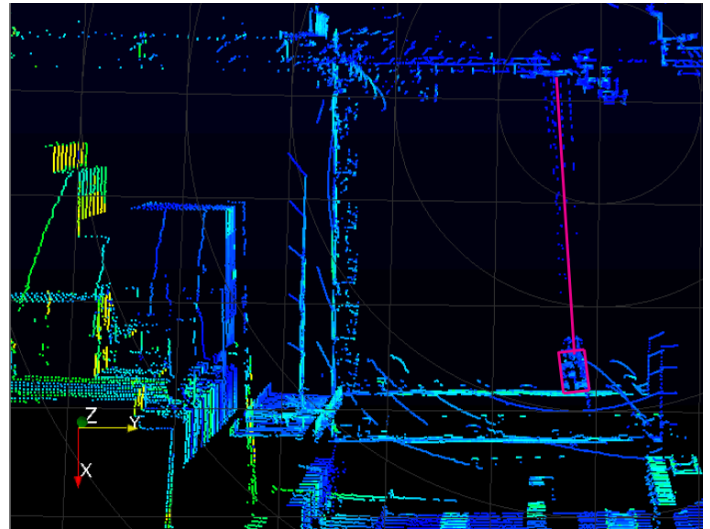


In most installations – with the exception of the largest cranes and special crane geometries – the same sensor can be used to track the load and scan the environment on the ship's deck as well as inside the hatches.

# we deliver solutions ...



Grab 3D live tracking, hatch and bulk material scan



Spreader 3D live tracking, container and ship superstructure scan

Whereas the 3D scanner is the **“eye”** of the automation system, a high-performance evaluation unit is mounted on the crane and connected with the PLC – the **“brain”**.

In this evaluation unit, data from the real-time sensors ensures a continuous update of the energy and position model for the load along its trajectory. At the same time, all scan data is geo-referenced and pre-processed to allow further handling by standard PLC systems.

Together, this information allows a precise “landing” of the load at any given point – nearly independent of weather conditions, at low tide and high tide.

In contrast to a human operator, the sensor system is not only able to calculate the current position, but also the **kinetic energy of the load at any point along the trajectory**. This makes sure that the load does **not collide with the ship, any obstacles on the deck or the crane structure** during the whole cycle – not even in case of “hard” stops, for instance when an emergency stop is pushed.

## Highlights

- Real-time actual measurement of load position and attitude, including skew.
- Permanent update of energy and position model along the load’s trajectory.
- Load control and ship scan with one sensor.
- Easy integration in existing PLC control systems.

## Competitive Advantages

The use of iSAM’s crane sensor suite means a significant **reduction in development cost and project risk** for the OEM and the port operator by

- using tried and tested technology which is in daily use in Europe’s largest sea ports
- pre-processing complex sensor data so that it can be easily used in standard PLCs
- providing a fully modular system architecture – you buy only, what you need
- making certification easier by referring to already fully certified and operational installations



## Facts

References: Port of Hamburg, Germany  
Port of Rotterdam, Netherlands

Key functions:

- Real-time load tracking
- Sway and skew control
- Ship superstructure and load (container/hatch) scan
- 3D environment model for collision prevention and situational awareness

Sensors:

- Velodyne high-speed 3D laser scanner
- RTK-GPS receiver for scan data geo-referencing (not required in all applications)

Interfaces :

- TCP/IP, Profibus, Modbus etc.