Electronic Seals in Container Logistics

As maritime containers are very popular transport units in the system of global trade, more and more international governments and container service providers are concerned about the safety and security of container flows. Events of September 11th changed the view on the security of container trans-portation. Improvement of the container security in supply chains became a global task. U.S. Customs and Border Protection (CBP) created the Container Security Initiative (CSI) and Customs Trade

to identify high-risk containers. The next step is the GreenLane Maritime Cargo Security Act, which contains stringent requirements for shipments and seaports.

The attention of many container service providers is focused now on the problem of finding a solution how to enhance the security of container transportation – without at the same time overloading the international transport systems with additional operational costs. The electronic seal or eSeal poses such a solution for

The simplest type of electronic seals contains only a seal ID number. The most common technology for such an eSeal is passive RFID (Radio Frequency Identification), which requires an appropriate reading device and software.

More advanced reusable or permanent active RFID eSeals also include a seal ID number, and a container ID number, and can initiate alarm calls and record time/date of container tampering. Smart eSeal or "Container Security Device" (CSD) contains a seal ID number, a container ID number, and additional sensors to indicate the environmental status of container content, an alarm function to inform in real time and satellite communication via GPS/INMARSAT systems. With the ability to provide real-time global visibility for the container supply chain, CSD has the highest level of costs for its use as well as more attractive and useful functions for the largest container logistics providers such as port operators, shipping companies, and forwarders.
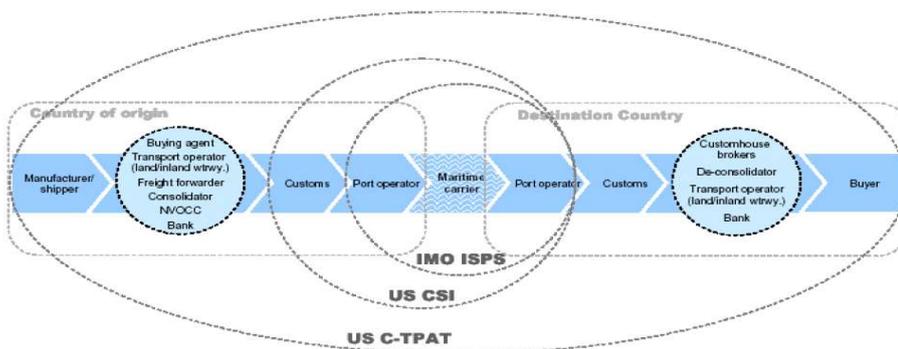
Source: OECD 2003

Partnership Against Terrorism (C-TPAT) to protect the global container trading system and the trade lanes between CSI ports and the U.S. A requirement for these programs is the "24-Hour Rule" which means manifest infor-mation must be provided 24 hours prior to the container being loaded onto the vessel in the foreign port. It provides CBP with more time

container logistics. According to the current ISO 18185 definition, an eSeal is a "Read-only, non-reusable freight container seal conforming to the high security seal defined in ISO/PAS 17712 and conforming to electronically evidences tampering or ISO 18185 or revision thereof that intrusion through the container door".

Dr.-Ing. Kateryna Daschkovska M.Sc.
Faculty of Production Engineering
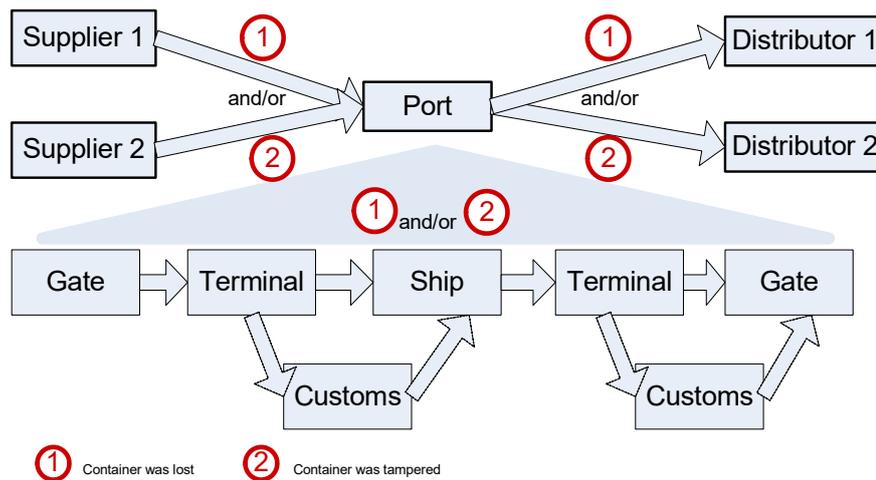
Odessa, Ukraine
daschkovska@isl.org

An electronic seal is an important part of this multi-layered security system that protects against theft, smuggling and terrorism. With the various types of electronic seals combined with RFID it is possible to enhance container security as well as to

operations for individual ports and on the global container supply chain.

Another aim is to evaluate the increase in global container throughput and savings in time with use of eSeal technology. In the thesis a simplified model for container terminal trans-

and the global container supply chain will be described.

An electronic seal is very simple and at the same time a very strong defence against various vulnerable aspects of container safety in worldwide trade. This new technology is only in its first stage of implementation in the real world of logistics. The research focuses on the defining of different benefits of eSeals for service logistics pro- viders, ports, container terminals, container shippers etc. such as automation of containers entering into the territory of maritime terminals or ports, security and safety of containers, control of access to the containers' contents, identification of containers and their locations and monitoring of containers' moves.

One other important part of the thesis is the defining of the influence of electronic seals on the logistics costs and the evaluation of investment costs in these container security devices. The first results showed that direct impact of "secure" container trade coming from avoiding customs inspections alone can result in monetary benefits for shippers in less than one year. Considering the positive tendency of investing in security devices on the efficiency of container business, the next step of research will entail a more detailed analysis of investment for reusable RFID eSeals. They provide more possibilities to be used for logistics purposes and new benefits for improving container shipping processes. It will be analyzed the advantages of investing in CSD due to more visibility benefits for the container supply chains.

Supplier 1 — ① — and/or — Port — and/or — ① — Distributor 1
Supplier 2 — ② — ② — Distributor 2
① and/or ②
Gate → Terminal → Ship → Terminal → Gate
Terminal → Customs → Ship   Terminal → Customs → Gate

① Container was lost   ② Container was tampered

improve container visibility and transportation efficiency throughout the whole supply chain.

Active RFID eSeals have the potential for improving logistics operations at maritime terminals of ports as huge nodes of cargo transshipment. The thesis is based on the assumption that the typical electronic seal with a small chip and some sensors inside can contain some logistic data which can be used during the transportation of a cargo. With the aid of an RFID chip a container can transmit and receive information. The electronic seal can be read at key checkpoints (terminal gates, quay container loaders). The read information can be sent via the Internet or some other networks direct to container operators. A goal of the research work is to identify the influence of container secure devices on logistics terminal

shipment and for the global container chain will be simulated with discrete-event method by means of Matlab software. The simulation is for two alternatives: when transshipped containers are equipped with electronic seals; and when containers are equipped only with mechanical seals. It is assumed that containers equipped with electronic seals can use the GreenLane advantage (free movement through the ports or border crossing with minimum stops for security checks by customs).The developed model will present the impact of active RFID eSeals on the dynamics of container logistics pro-cesses at the container terminal and enable the evaluation of changes in dynamics of physical container flows through the global container supply chain. Finally, the possible influence of enhanced security measures on container transportation processes