

Tanker Truck Monitoring System

TTMS

Improved Security & Management Solution

June 2005

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Introduction to the TTMS Security and Management system

Providing complete visibility into every single aspect of the TTMS tanker truck fuel delivery and management process

This document provides a thorough understanding of the TTMS security and management system, with a full explanation of the system features, and how the entire system is operated. With an understanding of our TTMS Security System, you will see how Starcom with Hi-G-Tek services clients' needs for an effective, efficient, and easy-to-use security solution.

The TTMS solution not only protects the tanker trucks and their respective fuel cargoes, but also protects the fueling stations from "cocktailing", the mishap of mixing different fuels into the wrong storage tanks whether accidentally done or deliberately conducted in a malicious act.

The TTMS security and protection system seamlessly integrates into the existing work procedures of the company.

Protection starts with the valves and hatches

Millions of tons of cargo on today's highways and railways are exposed to risk from theft or terrorism. Sophisticated systems exist to protect those cargoes, yet, until Starcom Systems with Hi-G-Tek, there has been no complete solution providing full end-to-end visibility into every single aspect of the tanker truck cargo delivery and management process.

The system gives tanker truck operators a new level of protection against theft and improved efficiency. It provides continuous monitoring of loads such as valuable fluids and dry bulk from initial dispatch until final delivery.

The principal components are custom designed DataSeal-lock units fitted to each tank valve and hatch, the Tracking DataReader located in the tanker truck's cabin, and sophisticated control center application software to track and monitor vehicles and their corresponding DataSeal-locks.

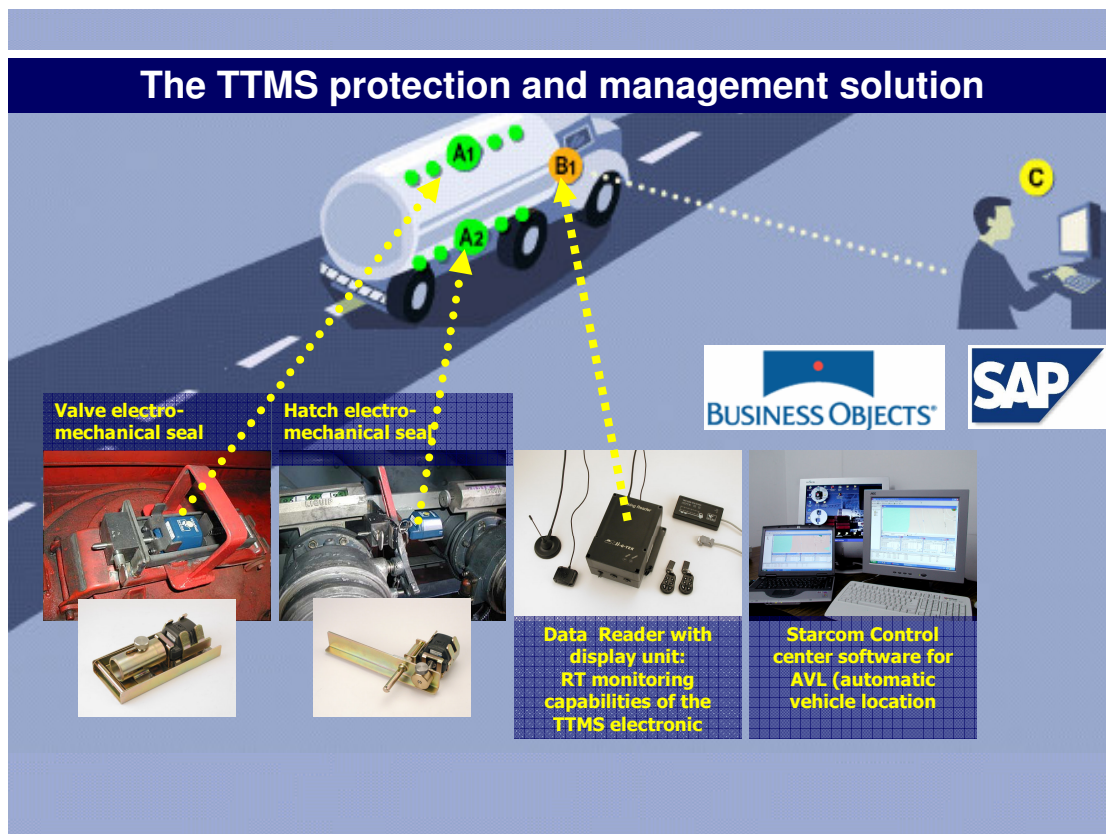
The Starcom and Hi-G-Tek solution protects tanker trucks at their most critical points – the hatches and valves. This unique and patented solution crosses the final bridge toward full security coverage. By providing inexpensive, reliable and easily-applied electronic locking seals on all outlets, the system allows tanker owners to take immediate action in upgrading their security measures.

Overview of the TTMS system and its main components:

- a. **Control Center:** The control center with AVL(Automatic Vehicle Location) manages and controls the TTMS system, receiving alerts and status reports in real-time concerning the electronic hatch and valve sealing mechanisms and implementing all system operations
- b. **Tracking DataReaders:** The Tracking DataReaders, incorporating with Starcom LCU500 (GPS and GPRS/1x), "interrogate" in real-time the hatch and valve seals for their current state.

- c. **Display unit in the truck's cabin:** The display unit, located in the truck's cabin, provides all hatch and valve status indications to the driver, informing as to whether the seals are open or have remained closed.
- d. **Electro mechanical hatch and valve seals:** the TTMS electronic Hatch and valve mechanisms are responsive end-devices that provide real-time indication as to the current status of the hatches and valves and immediate alerts to any attempt at interference.

Figure 1:



The system ensures the safe transport of hazardous materials by allowing the tank owners and tank drivers to constantly monitor the status of each hatch and valve. From the moment each seal is secured at the loading terminal until the truck's return, every seal is monitored for attempts at opening or tampering with the valves and hatches. Such level of security assures not only the truck owners, but also the fuel station managers who will have the ability to confirm the arrival of a secure load or reject the arrival of a tampered load.

What makes our TTMS system unique?

Different from other solutions, this system reusable seals provide the same magnitude of protection and monitoring for unloaded, returning tankers as they do for loaded, outgoing tankers. This comprehensive feature addresses the fleet owner's need for

complete and reliable security of every tank from initial dispatch to final destination, and back to the loading terminal.

What other benefits does this new system have to offer?

Additional special features include real-time reports, enhanced reliability of control over objects for areas up to a few hundred meters, and the use of long-life internal batteries. The TTMS remote reader uniquely performs two functions: it receives and transmits information from end devices to and from remote control centers. It also offers continuous monitoring, which allows users to check their locks locally or remotely, and to log when such checks have been made.

Operating the System

Overview

From initial dispatch to the tanker's return at the loading terminal, the activity and location of the truck, and the status of the seals, are monitored at a remote control center to provide real-time monitoring and security. At the loading terminal, the tanker truck's cabin is equipped with a DataReader, modem, and a Display Unit, and each hatch and valve is secured with a DataSeal. Once the tanker is fully equipped, the truck owner defines the system parameters, the seals are then locked and the system is set. From the moment the system is set, the DataSeals and DataReader begin to routinely communicate with the driver and control center, reporting any activity involving the hatches, valves, and seals, as well as the status of the truck, for complete monitoring and security.

Figure2: The Starcom fleet management and control software:

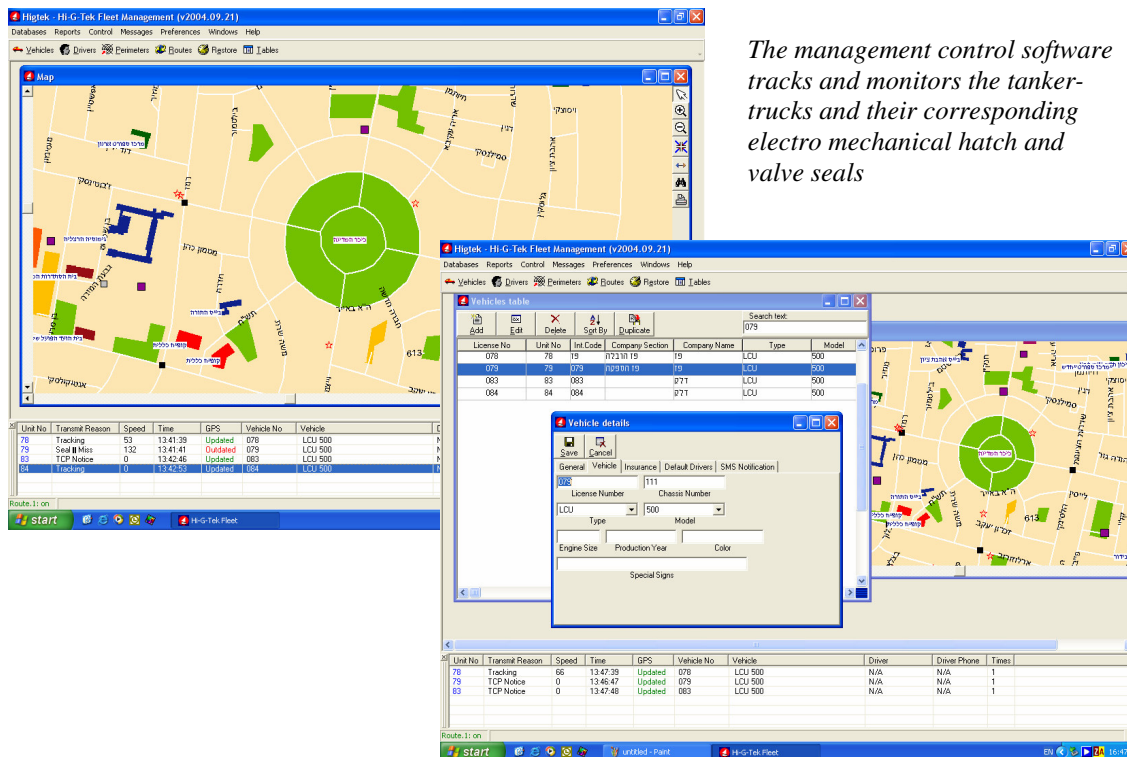
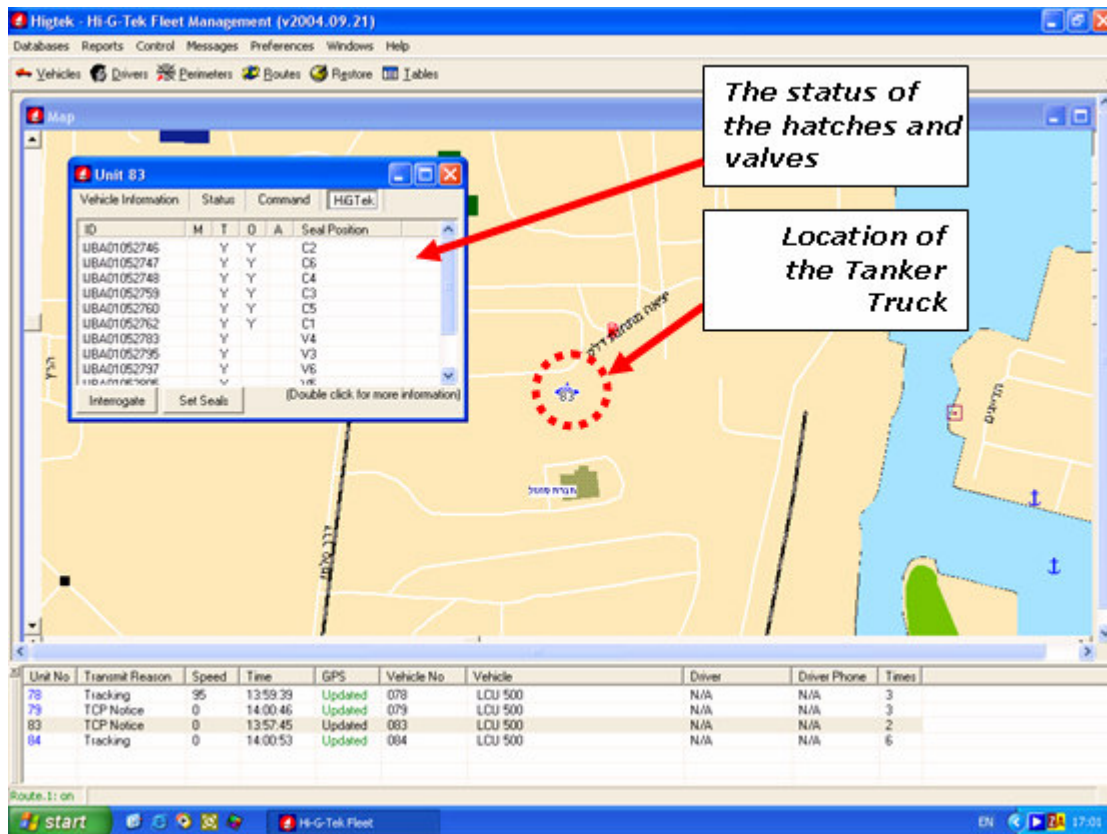


Figure 3: Fleet management and control



The control center/fleet management application produces an array of reports and is integrated with the company's ERP system and report generator tools. In addition to the scope of the fleet management reports, the TTMS system will produce 2 additional reports to the ERP, an alerts report that will be produced every 15-minutes and a daily report at the day's end that will cover all openings and closings of the hatches and valves. This information will be provided as raw data to the ERP system for processing by the customer.

Prior to tanker truck fueling, the ERP system provides the system with tanker truck information regarding destination and the fuel compartments and corresponding stations to which the fuel will be offloaded.

Activating the system

Before the initial dispatch of the tanker from the loading terminal, the truck owner must choose between an automatic or manual application for activating the system. In either system, the owner must first determine the following parameters for the DataReader:

- Whether all, or only selected tank compartments will be full
- Which refueling stations in the country will be designated for loading fuel
- The GPS within the LCU500 coordinates where the system can be reset

- How frequently the truck will send status reports and receive interrogations from the control center are designated to which customer. This information will allow the system to assure that the supplied fuels are properly destined to the correct station

By determining these parameters, which can only be modified by the remote control center, the owner can prevent the risks of error, contamination, theft, or terror threats. By automatic application, then the system will be automatically set at the moment that all seals are closed and the GPS coordinates are correct. If the owner chooses a manual application, then an authorized person will use a Microreader to set the system after closing all the seals. With the system set, the truck is ready for dispatch.

Securing the tanker in transit

En route to the final destination, the DataReader communicates with every seal at times that have been pre-defined by the owner in the system parameters. In addition, the GPS coordinates of the truck's location will also be reported at pre-defined times. The results of these interrogations by the DataReader are both automatically stored in the DataReader and reported to the control center by the Starcom LCU500.

At the control center, the operator is informed of the status of every seal, as well as the status of the truck. They can see if the truck has stopped, and for how long, and even if the door of the truck cabin is ajar. In monitoring the seals, the control center receives reports that the seals have been either tampered or opened, or that they are missing. When a seal is reported as missing more than it is permitted by the parameters, it can imply any of four possibilities:

- a. there is an RF interference
- b. the seal is broken
- c. someone tried to shield the seal
- d. the seal is not working

In the event that one or more of the seals are reported as open or tampered, the control center will only receive an alert if the "tampering" or opening of the seal occurred at an unauthorized GPS coordinate. The system determines whether a location is authorized by referencing the parameters that were established by the owner before the truck left the loading terminal. If the seals are opened or tampered in an unauthorized location, the control center will receive an alert and decide on the course of action to take.

Arriving at the final destination

Upon arrival at the station where the tank is unloaded, the gas station manager will follow the subsequent procedure:

- a. The station manager will check the Display Unit for any red lights, signaling that a seal was opened or tampered with at some point between the truck's dispatch and arrival.

- b. If the Display Unit reports that the seals are secure, the manager will go on the trailer, open the hatches and check that the gas level is where it is expected to be. (This step, involving the opening of seals, will be automatically reported to the control center, yet no alarm will signal if the GPS coordinates of the station are authorized).
- c. If the tank does not appear to have been tampered with, the station manager will give the driver permission to open the valves and unload the fuel into the designated place(s).

When the driver has finished unloading the tank, the system will be reset (only if the GPS coordinates of the station have been authorized for such an event), and the truck will return to the loading terminal, continually sending routine reports of the truck's status and of the DataReader/DataSeal communication.

Upon completion of the tanker truck's mission, a final report of ALL activities will be composed at the control center.

Figure 4: Starcom Wireless monitoring platform for fuel delivery and gas stations:



System Components

Overview

The TTMS Security System equips tanker trucks with active wireless-technology hardware to provide critical protection and monitoring of the load, and implements fleet management application software for organizational control over its fleet and drivers. This system provides

- Fluid DataSeals for every hatch and valve on the tank.
- Starcom LCU500 Tracking AND DataReader inside the truck's cabin.
- Display Unit in the truck's cabin.
- Starcom Fleet Management Application Software.

DataSeal

The DataSeal is a portable, reusable electronic seal that provides robust physical security, automatic processing and real-time monitoring of secured tanks with the use of active wireless technology. Separate sets of DataSeals are used for hatches and valves, and detect any attempts at opening, bypassing or tampering with the seal. If such detection occurs, the DataSeal responds by sending an alert and recording the event. The DataSeal can operate in both a low frequency short-range mode for local management, as well as a high frequency long-range mode that has full read/write capabilities at distances of several hundred meters.

Tracking unit (the LCU500) AND DataReader

The Tracking unit (LCU500) connecting with the DataReader is a component that combines the technological and operational advantages of low-frequency close-range data management with high-frequency long-range monitoring and automatic data collection. In long-range application the DataReader interrogates the sensors over the high frequency RF channel for their ID, status and user data. The Tracking DataReader can work in two operational modes: 1) Slave mode, in which the DataReader performs interrogation cycles upon receiving a command from the control center, and 2) Stand Alone Mode, in which the Tracking DataReader executes a script of commands, controlling a group of sensors, and reports their status to the control center. The Tracking DataReader enables real-time monitoring of cargos during transit.

It has a modem (GSM or CDM1x) for acquiring location information and a communication module communicating status and location information to the control center. The Tracking DataReader can communicate with sensors at distances up to 50 meters. The Tracking DataReader also has vehicle security sensors such as volume sensing and hood opening to provide vehicle protection.

Display Unit

The Display Unit communicates with the DataReader to allow for real-time monitoring of the DataSeals by the driver and the station manager. This Display Unit consists of 12 LEDs that correspond with each DataSeal, informing the driver whether the seals

have been opened or remain closed. A green light signals that the seals are locked and secured, and a red light signals that any hatch or valve has been opened.

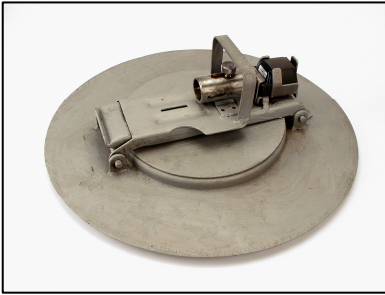
Starcom Application Software

The fleet management application has 2 main tasks: to track and monitor vehicles, and to track and monitor the status of every seal on the trucks. This requires that every truck have a LCU500, DataReader and 12 seals for each hatch and valve. The DataReader is connected to Starcom LCU500, which it employs to both interrogate the seals about their status and to send a report of the results to the fleet application software at the control center.

The interface of the fleet application consists of 3 main parts: a map, list of vehicles, and a window for alerts. On the map, the user can identify the position of the truck at every given moment. From the vehicles list, the user can select and observe the current status of selected seals on a particular vehicle—whether they are Opened/Closed, Tampered/Armed, Missing/Present. In the "alerts" window, any opening of a seal in an unauthorized location is displayed. These authorized or unauthorized locations are recognized by the parameters that have been predefined in the application by the fleet owner. For fuel trucks, authorized locations may only be fuel stations where driver's normally need to open the seals for emptying tanks. However, if the driver opens a seal beyond such a location, the seal will appear "Tampered" on the application, and the alert window will display a signal of this event.

Furthermore, the fleet owner/fleet application user can manage the parameters of the Tracking DataReaders, both sending commands to them and writing/reading data from seals.

Figure 6: Illustration of the TTMS components



Electronic security upper hatch mechanism



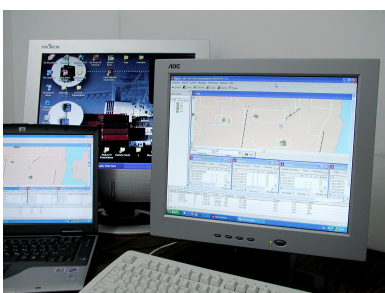
Electronic security lower valve mechanism



Starcom LCU500



Display unit for the tanker-truck cabin



Starcom Control center management system