Chapter 3.9
Mobile Batch Tracking:
A Breakthrough in Supply Chain Management

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INTRODUCTION AND BACKGROUND

Traditional problems of managing resources and the flow of material appear to have been solved by enterprise resource planning (ERP) systems as well supply chain management (SCM). This is true of the stationary case of an isolated factory and of the goods that form part of its inventory. However, with the increasing movement of goods, a new dimension of problems has arisen that makes it inevitable to consider transport status itself—particularly to improve the supply chain planning and the execution process. This chapter is an attempt to cope with the new challenges that result from a higher degree of mobility, a higher percentage of the mobility phase with respect to the total lifecycle, and a higher flexibility with respect to transport media and changes of the transport mode within one single transaction, such as conveying a pallet from A to B (where A and B may be located anywhere on the surface of the earth, thus indicating that also increasing distances have to be bridged).

Goods, spare parts, and assembly components are no longer kept in storage for long periods of time, but are fed in when needed. This is the effect of the popular just-in-time (JIT) approach to inventory management. Thus, managing the supply chain effectively means managing more and more of the transportation chain.

Successful attempts have been made to manage the internal transport at a factory site by means of new technologies, such as radio frequency identification (RFID) tagging or other auto ID technologies (ten Hompel & Lange, 2005). Within this context, a new class of middleware is emerging, acting as a platform for managing the data and routing them between tag readers and enterprise systems (Leaver, 2004). However, a huge gap of information exists for the increasing time of external transportation—either between two factory sites for a semi-product or between factory site and end user location for a final product.

THE CORE CHALLENGE IN SUPPLY CHAIN MANAGEMENT

In order to obtain an exact overview at any time, it is essential to track the flow of goods on batch level at least, if not on item level (for larger items). This requires acquiring knowledge about the geographical position whenever needed plus detailed information about the goods—that is, batch identification and batch description, including information about origin and destination, plus all intermediate agents involved in the process. Regulation (EC) No. 178/2002 of the European Parliament and of the Council of January 28, 2002, as an example, is laying down the general principles and requirements of food law and at the same time the procedures in matters of food safety. This includes strong implications with respect to downstream trackability (from origin to destination), as well as upstream traceability (from end user back to the production site). In the case of non-preservative food, it is of essential importance to monitor and to record the environmental data of the transport—for example, to ensure that the refrigerating chain has not been interrupted (or only for a very short period of time and within a certain temperature range). The big challenge therefore consists of getting all the required information while the goods are on their way on a transport medium in motion.

THE SOLUTION TO THE CHALLENGE

The requirements mentioned above directly lead to the way of finding an appropriate solution by a decomposition of the system into its two basic components:

a. Subsystem to determine the geographical position of the transport medium (container, lorry, trailer, wagon, ship, aircraft, etc.).
b. Subsystem to gain information about the goods transported by that medium—that is, batch identification and batch description (plus additional environmental parameters).

The first subsystem (a) preferably consists of a GPS antenna and a GPS receiver to obtain the geographical position. For the second subsystem (b), an advanced approach would be to use RFID technology—that is, RFID tags affixed to the packaging units and RFID readers installed on the transport medium to read the tags. An example is shown in Figure 1 (for the case of a trailer/lorry configuration).

The trailer contains the GPS equipment plus RFID reader(s) to identify and to read the tags which are fixed at the package units. A great advantage of RFID vs. other auto ID technologies is due to the fact that no direct geometrical line-of-sight between tag and reader is required—that is, the packages may be oriented in any arbitrary way and do not have to be aligned or rotated in a specific manner. Additional environmental parameters, such as temperature, acceleration (shock), door status, and so on (including intrusion alarm) are polled from adequate sensors by a so-called reefer and are stored locally on a data logger. All data are collected online by a telematic unit (TU) and are transmitted instantaneously or at given time intervals to a Transport Tracking Center (TTC), preferably by means of GSM or by using satellite communication (depending on the coverage and