

Implementation and Operation of a Vehicle Location System

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NCS operates a security vehicle licensed for the transport of category I nuclear material. Main application is the transport of fresh MOX fuel assemblies to nuclear power plants.

In early 1989, authorities requested the installation of a position finding system which should make use of modern navigation techniques and should automatically transmit the respective position to the control center. A high precision of the location data and a high frequency of data transmission were specified. These requirements were far beyond the needs of normal traffic control of trucking companies.

At the date when the request was formulated there was no system available on the market which would have met the stringent requirements. NCS therefore had to design and/or select subsystems and to implement the complete system itself.

For the location sensors two redundant methods were selected: Satellite navigation by "GPS" (Global Positioning System) and by "dead reckoning". GPS today has outstanding service availability and precision of the location information. Dead reckoning means a system by which the location of the vehicle is calculated from distance and direction with equipment installed in the vehicle. This is done completely independent from the environment and therefore adds to the reliability of the overall system.

Data transmission was initially planned to be by HF. Due to problems with the availability of frequencies to be expected in future we switched to cellular radio telephone (in Germany called C-Netz). However the existing network is overloaded and sometimes it is difficult to maintain data transmission. Therefore we will use satellite communication type Inmarsat C in the very near future as soon as the German Inmarsat station will be fully operative. With Inmarsat we will also be in a position to locate the vehicle during international transports.

Based on the positive experience NCS is considering installing its location system (called CARGOLOC) in more vehicles of its fleet and to continuously check their location independent of information transmitted by the drivers. The existing control center equipment is already designed for a large number of vehicles.

An important aspect of the system is the display and documentation of the location data in the control center. We decided to use pixel graphic maps which are generated by scanning existing paper maps. A computer program for the generation of maps was developed which applies a unique procedure to minimize the errors associated with scanning maps. In addition the system has user friendly features such as automatic search of the proper map. In this way it is not necessary to have additional staff in the control center.

Whereas the computer software of the system was working well from the beginning there were initial problems with the performance of hardware components such as sensors, board computers and modems under field conditions. The lesson we learned is that a highly modular systems approach is necessary to enable easy replacement of components if defective or in order to benefit from technical improvements.