CEN / TC278

Road Transport and Telematics

Working Group 14

After Theft Systems for Vehicle Recovery

prENVxxxx-1

Reference Architecture & Terminology

Document Reference 14.7 / 300703

Date of Issue 1 August 2003

Amendment Record title page amended 12/09/02 A. McInnes
Format and grammatical changes 30/7/03 WG14 Co-ordinators.

1 Introduction

This family of documents was developed by CEN TC 278 Road Transport & Traffic Telematics Working Group 14 (WG14) on the subject of After Theft Systems for Vehicle Recovery (ATSVR).

WG14 comprised representatives and experts from police, insurance associations (CEA), car manufacturers, transport associations, vehicle rental associations and ATSVR system and product providers. The work was also in cooperation with Europol and the European Police Cooperation Working Group (EPCWG).
The standard was developed to define an architecture within guidelines from CEN TC 278 through which a level of interoperability can be achieved between Systems Operating Centres (SOC) and law enforcement agencies (LEA), both nationally and internationally.
This will provide minimum standards of information and assurance to users as to the functionality of systems, thereby enabling the recovery of vehicles, detection of offenders and a reduction in crime.
The other documents in the series (PrENVXXX to PrENVXXXX) should be read in conjunction with this document that distils the architecture and terminology profile generated by the internal technical reports of WG14.

2 Scope

For many years, consumers, law enforcement agencies and insurers have been confronted with an ever-increasing number of vehicle thefts, both genuine thefts and insurance frauds, as well as the growing problem of increasing violence and threats against vehicle drivers.

Manufacturers have and will continue to introduce after-theft systems that will enable the police to recover stolen vehicles. Different techniques are being used for that purpose. This document refers to them by the generic name of After Theft Systems for Vehicle Recovery (ATSVR).

Certain specialised terms and definitions have been used in writing the ATSVR standards. This preliminary standard aims to provide the preliminary framework of ATSVR concepts and definitions for the purpose of following ones.
It will therefore:

- Define the concepts and global architecture models for ATSVR and the appropriate terminology.
- Identify the various elements that may comprise an ATSVR.

The events and associated information that are relevant to the situation prior to the registration of the theft are relevant to the total process, but may be subject to the laws of individual countries. Such events and associated information may be described in the standards to give clarity to the technical processes identified, which obviously does not presume on the prevailing legal conditions.

3 References

3.1 WG14 Documents

BN96070	28 Nov 96	Task Force ATSVR Investigation into Standardisation requirements.
14N903E2	Jun 99	Work Item 14.2 "Summary of Users Requirements"
		14.3 Common Status Message Elements
		14.4 Short Range Interface/System Requirements
		14.5 Long Range Interface/Systems Requirements.
14N009E		14.6 "Messaging Interface"
		14.7 Reference Architecture & Terminology
		14.8 Test Requirements (not published as at 2003)

3.2 Normative References

ENV12253	OSI Layer 1 - Physical (Open Systems Interconnections)
ENV12795	OSI Layer 2 - Link
ENV12834	OSI Layer 7 - Applications
ENV13372	Profiles

4 Definitions

4.1 After Theft System for Vehicle Recovery

An After Theft System for Vehicle Recovery (ATSVR) is a system that comprises various technical elements that communicate and interact through various interfaces in accordance with standard procedures and transmission protocols in order to facilitate the recovery of a Registered Stolen Vehicle.
An ATSVR necessarily includes various human elements. For clarity, this standard will identify interactions and interfaces that exist amongst the equipment and human elements operating within the system.

4.2 General Definitions

4.2.1 ATSVR User

An individual, group or organisation that directly uses or interacts with an ATSVR. The main users could be : Law Enforcement Agencies, Insurers, Car Manufacturers, System Service Providers and Vehicle Service Providers such as Car Rental and Transport Companies.

4.2.2 ATSVR Detection Equipment User

Personnel who operate the *ATSVR Detection Equipment*.

4.2.3 ATSVR Information User

Personnel who use the ATSVR data and information.

4.2.4 ATSVR Service Provider

An organisation that provides ATSVR Services for ATSVR Users. An ATSVR Service Provider can operate all or part of the functions of an ATSVR. It will usually be distinct from a Law Enforcement Agency. It may also be known as a Private Security Company or ATSVR operator.

4.2.5 ATSVR Equipment

Equipment that either, individually or in combination with other equipment, performs one or more functions of an ATSVR or facilitates interfaces between the various elements of an ATSVR.

4.2.6 ATSVR On-Board Equipment (OBE)

Equipment installed in or on the vehicle whose primary purpose is to allow that vehicle to be recovered in the event of theft. It may also indicate theft and record activity relevant to that detection.

4.2.7 ATSVR Detection Equipment (DE)

Equipment used to perform various functions of an ATSVR. This equipment may be stationary, portable or mobile.

4.2.8 ATSVR System Operating Centre (SOC)

A System Operating Centre (SOC) functions as a control and management centre for an ATSVR. It may, for example, be a commercial bureau; a government facility or law

enforcement agency office. An SOC is distinct from the communications infrastructure, detection equipment and On-Board Equipment.

4.2.9 Law Enforcement Agency (LEA)

An Agency or Organisation approved or appointed to have jurisdiction in a territory over the recovery of stolen vehicles. It will usually refer to an official authority such as the Police Force or Customs Service.

4.2.10 The ATSVR Human Interactions

The recovery process cannot be fully automatic. Human interactions are required to link different stages of the process, these human interactions obviously being outside the scope of standards.

4.2.11 The ATSVR "Human Machine Interface"

The interaction mechanism between the user and the equipment, including the set of inputs, outputs and dialogue procedures (that concern all display, sound signals and command user). As technical supports of the Human Interaction, the HMIs are subject to standardisation.

4.2.12 Vehicle Operators

Individuals legally operating or driving a vehicle, not necessarily the vehicle's legal owner or registered keeper.

4.2.13 Unauthorised Vehicle Operators

Individuals operating or driving a vehicle who have NOT been authorised by the registered owner or authorised agent of the vehicle to operate or drive the vehicle. Individuals whose legal authority to use the vehicle has been withdrawn.

4.2.14 Vehicles

Wheeled or tracked conveyances including cars, motorcycles, trucks, trailers, heavy construction vehicles and agricultural plant.

4.2.15 Target Vehicle

A registered stolen vehicle fitted with ATSVR OBE that is being sought.

4.2.16 Registered Stolen Vehicle

A vehicle fitted with ATSVR OBE that has been reported as stolen or being used by an Unauthorised Vehicle Operator to a Law Enforcement Agency by the Vehicle Owner, by an Authorised Vehicle Operator, or by an ATSVR Service and that report having been accepted by the LEA caused the LEA to register the vehicle as stolen or as being used by an Unauthorised Vehicle Operator. This is the official theft registration.

4.2.17 Detected Vehicle.

A Registered Stolen vehicle fitted with an ATSVR OBE that has been detected by an item of DE.

4.2.18 Telecom Operator

A provider of telecommunications services not dedicated exclusively for an ATSVR System, but used in many application areas (e.g. Network Operator of a GSM, RDS, communication satellite, optical cable, PSTN network).

4.3 Basic ATSVR Functions

There are three basic ATSVR functions of **detection**, **location** and **identification** of a Registered Stolen Vehicle.

4.3.1 Detection Function

Automatically or semi-automatically to detect the location of a Registered Stolen Vehicle. This may be done by Signalling or by Consulting.
Detection by Signalling is where the OBE has been activated by a signal from an external source. This activation may come from a mobile or stationary source, which may be local to the vehicle (Short Range) or at a distance from the vehicle (Long Range). Once activated the OBE will transmit a signal that is capable of being picked up by ATSVR Detection Equipment located locally to the vehicle or at a distance from the vehicle. The transmitted signal may contain other relevant information.
Detection by Consulting is where an external item of Detection Equipment interrogates the OBE and the OBE responds by transmitting data to the DE. The DE then compares the received data with a database of Registered Stolen Vehicles, a data match confirms that a Registered Stolen vehicle is present and further action can take place.

4.3.2 Location Function

Once the Registered Stolen vehicle has been detected its location can be established by one of the following functions: by using direct or indirect geographic co-ordinates or by using homing techniques.
Location by direct or indirect geographic co-ordinates is the process that establishes the general or precise location of the vehicle at a given point in time. This allows entitled persons to carry out their defined tasks of recovering.
Homing (also known as Tracing or Relative Positioning) is the process that periodically updates the range and direction of the detected vehicle from an intercepting vehicle over a period of time. Thus allowing entitled personnel to approach or intercept the detected vehicle without the necessary use of landmarks or absolute geographic references.
Tracking is the process that periodically updates location and other information on the detected vehicle over a period of time and allows entitled personnel to monitor location of the detected vehicle, approach or intercept it.

4.3.3 Identification Function

This function allows the unequivocal identification of a vehicle as being the Registered Stolen Vehicle. This may be by means of a secure process that allows the unique vehicle data to be read. e.g. VIN, registration number, and other data, e.g. theft status, model, colour and if relevant, position.
Discrimination is the process that enables entitled personnel unambiguously to differentiate the detected vehicle from other surrounding vehicles.
Recognition is the process that enables entitled personnel correctly to select the detected vehicle through visual observation based on knowledge of the vehicle particulars such as make, model, colour and other specific observable features.

Indirect Identification results from data coming from a central or remote data bank, whilst **Direct Identification** is that resulting from data coming from the OBE itself.

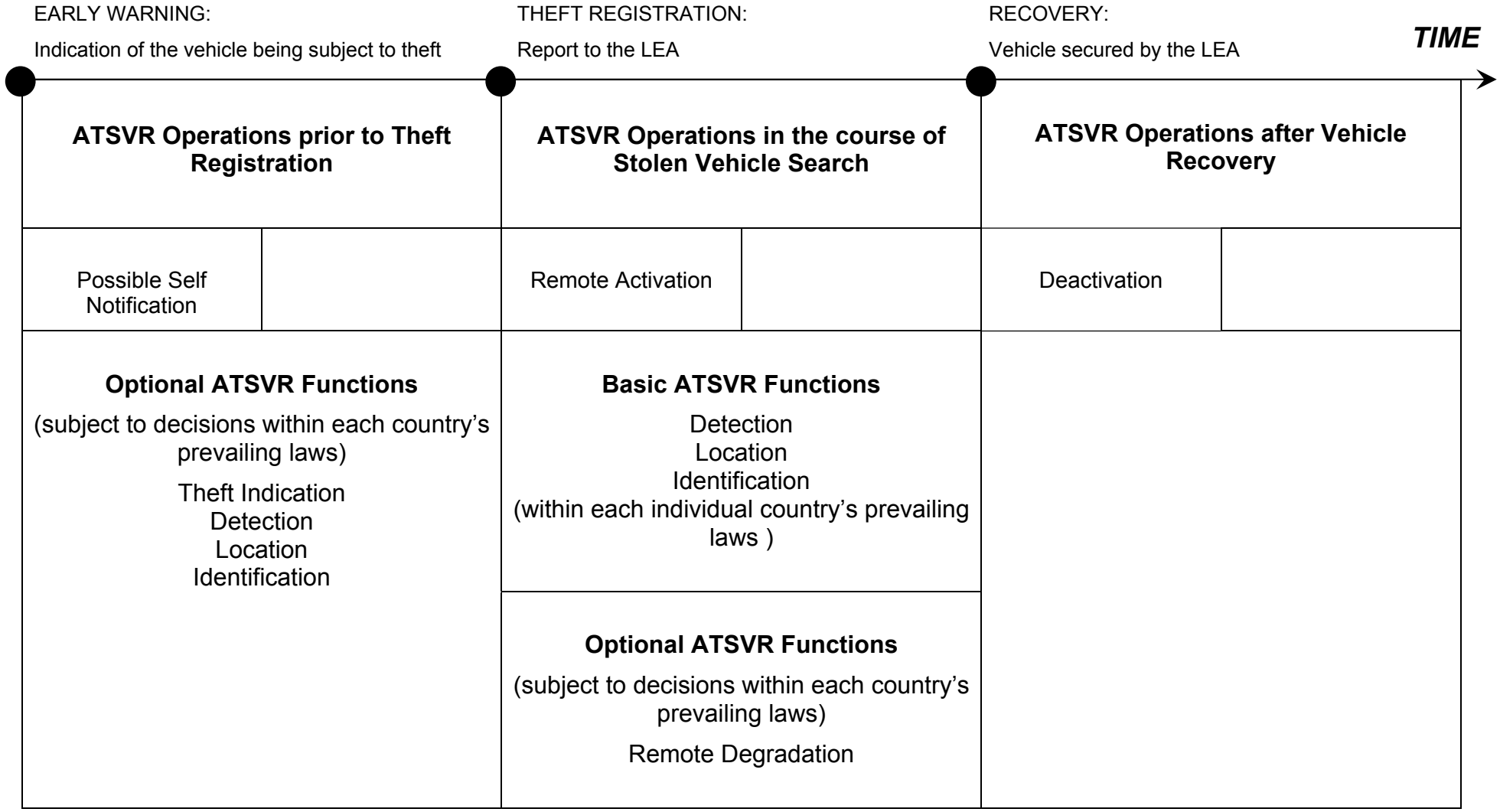
4.4 Optional ATSVR Functions

4.4.1 Remote Degradation Function

The function of remotely degrading vehicle performance. This is dealt with in prENV XXX Short Range System / Interface Requirements and prENVXXX Messaging Interface.

4.4.2 Theft Indication Function

The transmission of a warning or alert from the OBE to an SOC or item of DE that the transmitting vehicle may have been stolen.
The following diagram aims to show how these functions chain together in the course of operations:


EARLY WARNING:
Indication of the vehicle being subject to theft
THEFT REGISTRATION:
Report to the LEA
RECOVERY:
Vehicle secured by the LEA
TIME
ATSVR Operations prior to Theft Registration
ATSVR Operations in the course of Stolen Vehicle Search
ATSVR Operations after Vehicle Recovery
Possible Self Notification
Remote Activation
Deactivation
Optional ATSVR Functions
(subject to decisions within each country's prevailing laws)
Theft Indication
Detection
Location
Identification
Basic ATSVR Functions
Detection
Location
Identification
(within each individual country's prevailing laws)
Optional ATSVR Functions
(subject to decisions within each country's prevailing laws)
Remote Degradation
FUNCTIONS CHAINING UP

4.5 ATSVR Services

4.5.1 ATSVR Commercial Services

The supply of discrete services such as product delivery, product installation, setting up of ATSVR components and ATSVR service assistance.

4.5.2 ATSVR Monitoring Services

The supply of continuous services required in running an ATSVR service.

4.6 ATSVR Communications

4.6.1 ATSVR Interface

A generic term covering connections between all the ATSVR elements enabling them to interact. They include, but are not exclusively, fixed or radio interfaces, physical and display interfaces.

4.6.2 OBE Air Interface

The interface that facilitates the passing of information to and from the OBE, either to an item of Detection Equipment or to an infrastructure network. It allows the ATSVR to interface with an OBE.

4.6.3 Long Range Interface

The interface between the OBE and other ATSVR equipment over extended distances, typically more than 100 m.

4.6.4 Short Range Interface

The interface between the OBE and other ATSVR equipment over short distances, typically less than 100 metres.

4.6.5 Infrastructure Network

One or more communications systems or networks that may be ground based or space based that facilitate the transmission of information.

4.6.6 Communications Network

The totality of communications between the OBE and other items of the ATSVR. This includes the Infrastructure Network and all the interfaces defined above.

4.6.7 ATSVR Interactions

Communications, data exchanges, and actions that take place between elements of the ATSVR through ATSVR Interfaces.

4.7 ATSVR Status

4.7.1 OBE Theft Status

The OBE internal status of "Stolen/Not Stolen" is used by the OBE to modify its response to Detection Equipment and may be included in other information being transmitted to and from the OBE.

4.7.2 OBE Performance Degradation Status - Option

The status invoked by the Remote Degradation Function. It will have at least two states of Degradation ON and Degradation OFF, but may have more states to define the degree of degradation or functions to degrade.
This status can be altered directly or remotely via an air interface.

4.7.3 OBE Theft Warning or Alert Status - Option

An internal state invoked when the OBE detects that it may be stolen. This status can be used to modify the transmitted information or undertake other functions.

4.7.4 OBE Activation Status

This status ON is invoked via an external signal into the OBE, causing it to perform as a Stolen Vehicle. It can also be set to OFF, causing the OBE to perform as vehicle that has not been stolen.
This status can be altered directly or remotely via an air interface.

4.8 Interoperability and Compatibility

4.8.1 Interoperability

The ability of systems to provide services to and accept services from other systems and to use the services so exchanged to enable them to operate effectively together.
The word "services" used in the previous paragraph is taken to mean the "functions", identified in this document, which combine to recover a vehicle. This concerns ATSVRs in regard to their processes and in regard to the information that passes between the defined elements of an ATSVR.
Specifically, two sorts of interfaces and hence two sorts of questions have to be considered:
HMI (Human-Machine Interface). At the HMI, a number of ATSVR functions are available for the User to interpret. Those pieces of information that are common to the different functions require a common method of communication or display.
MMI (Machine-Machine Interface). The techniques implemented to meet the specific requirements of every function inevitably means that different types of MMIs will continue to coexist. Thus Interoperability must be considered at the scale of a given type.

4.8.2 Compatibility for ATSVR applications

The ability of any (sub)-system to interact with another (sub)-system according to a set of predefined rules in the form of interface specification and protocol definition.

Quite obviously, the ATSVR constituents must be compliant with the environment standards. In this regard, the different systems must be mutually compatible; i.e. must not interfere with one another.

Regarding communication ability, a given piece of equipment will be said to be compatible with different MMIs when able to communicate with the range of objects (networks, DE, Position Reference Sources) sharing these MMIs. Compatibility comprises working within the set of rules applying to a given type of MMI.
Note: Two pieces of equipment are said to be interchangeable, from the viewpoint of an interface, when they are both compatible with this interface.

5 ABBREVIATIONS

1. ATSVR After Theft Systems for Vehicle Recovery
2. LEA Law Enforcement Agency
3. SOC System Operating Centre
4. OBE On Board Equipment
5. DE Detection Equipment
6. LR Long Range (Communications Interface)
7. SR Short Range (Communications Interface)

6 ATSVR CONCEPTUAL ARCHITECTURE MODEL.

6.1 Overview

The following ATSVR Conceptual Architecture Model provides an overview of the concepts and main interfaces of each function of a generic ATSVR. The model architecture is descriptive rather than prescriptive, and is independent of the various technologies, configurations and organisations that might be implemented in each country. Figure 5.4 provides a conceptual representation of a generic ATSVR.
The architecture concept consists of three main components:

- The Vehicle, with On-Board Equipment, sensors and actuators as appropriate
- The Communications Network, with Positioning Reference, infrastructure network and detection equipment as appropriate
- The System Operating Centres for the LEA and Service Provider

The main interfaces between these components are detailed below.
The process necessarily begins with the theft of the vehicle. Following theft or suspected theft, the first possible function is to **indicate** that a theft of a vehicle has occurred. Following this, the status of the target vehicle, i.e., whether the target vehicle has been stolen or not, shall be confirmed by the user or by other appropriate personnel and this status shall then be **acknowledged** by a Law Enforcement Agency. This then becomes a Registered Stolen Vehicle.
The vehicle should then be **located** by the ATSVR, and if moving, **tracked** or homed onto by the system in order to facilitate LEA or ATSVR service personnel to close range with the target vehicle. By closing range with the target vehicle, they will more easily be able to **recognise** the vehicle. Once recognised, the target vehicle shall be accurately **discriminated as the target vehicle** from other surrounding vehicles.
This process facilitates the selection of the target vehicle for closer examination by LEA or ATSVR personnel in order to confirm the **identity** of the target vehicle as the stolen vehicle. The process of establishing **identity** may require an additional query and response through ATSVR databases.
This process can, under controlled circumstances, be assisted by the degradation of the performance capabilities of the target vehicle. This excludes safety critical functions.

6.2 Functions within the process

Following Theft Registration and, as appropriate to the ATSVR system and function operated, the SOC may activate or re-activate the OBE and / or the DE via an Infrastructure Network at Long Range or at Short Range.
Using the ATSVR DE or OBE, the system can detect, discriminate and recognise the Registered Stolen Vehicles at Short or Long Range from Vehicles.
During this detection phase and according to the ATSVR Function operated, some ATSVR Interactions are processed between the OBE and the Communications Network and between the Communication Network and the SOC.
Concerning the optional Degradation Function, the OBE Activation/Deactivation signal interfaces with electronic actuators in the specific Registered Stolen Vehicle.
The ATSVR Identification Function usually operates only between the OBE and the DE, thus allowing an unequivocal identification of the Detected Vehicle.
The optional Theft Indication function will alert the SOC of the vehicle theft status.

6.3 Short and Long Range Concepts

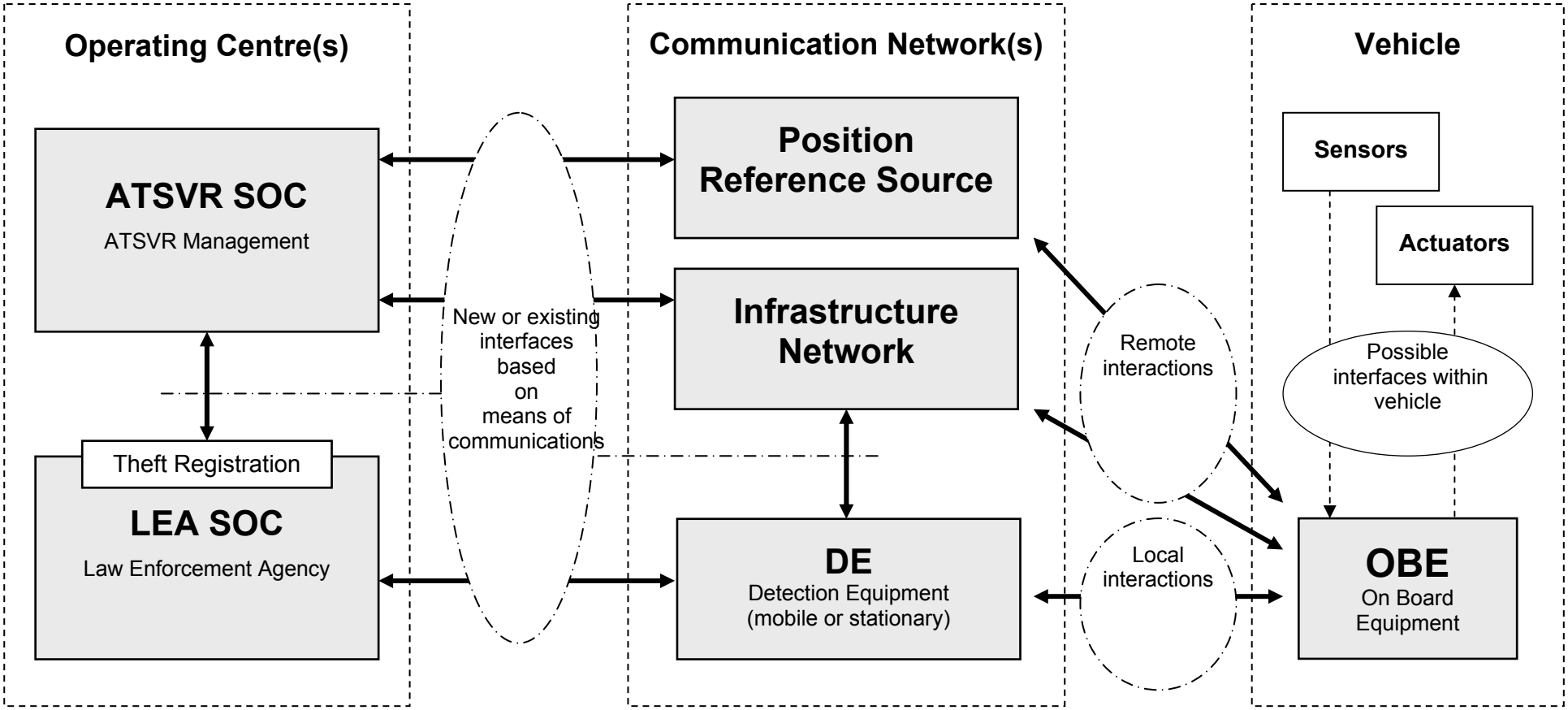
6.3.1 ATSVR Operations - Short Range Concept

The SR Concept uses an interface, which allows the Detection Equipment to operate some ATSVR Functions in vicinity of vehicles (i.e. in direct line of sight). The SR Concept allows LEAs, where it is necessary for them, to restrict their actions to ATSVR Operations located in their immediate vicinity.

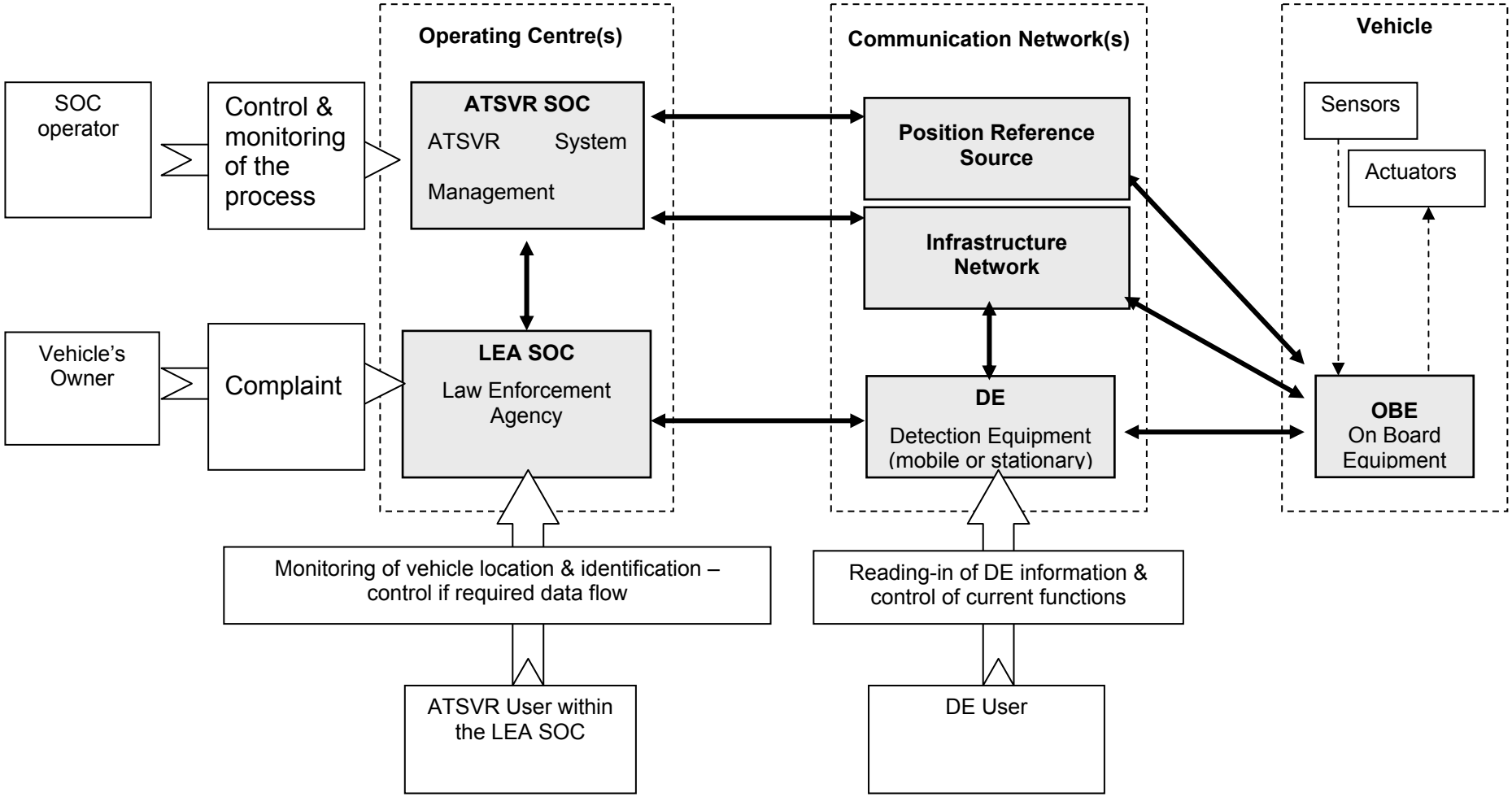
6.3.2 ATSVR Operations with Long Range Concept

The LR Concept uses an interface, which allows the Detection Equipment to operate some ATSVR Functions at distances normally greater than direct line of sight. This LR Concept is generally operated with ATSVR Location Functions.

6.4 Conceptual Architecture Model For ATSVR Functions



6.5 Human Interactions onto the ATSVR Model



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