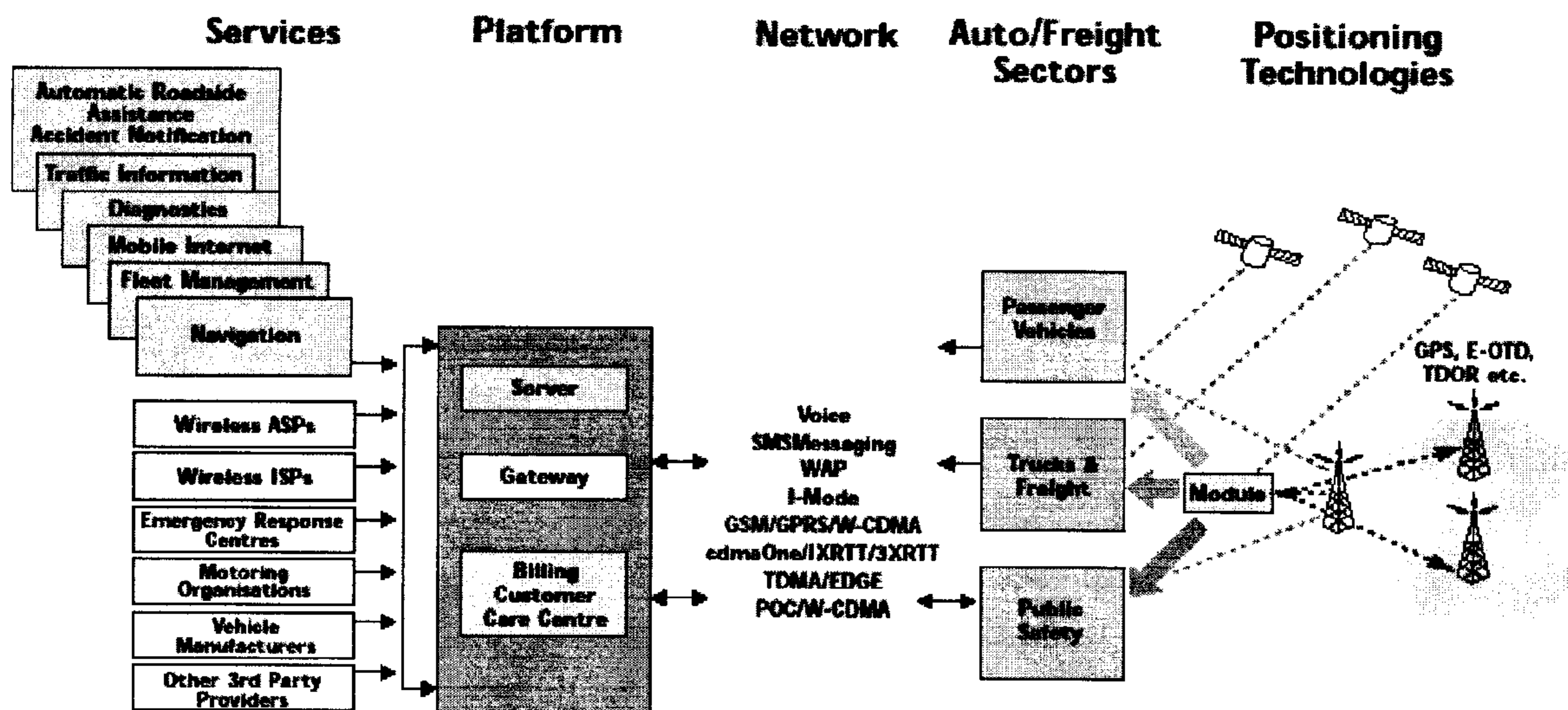




(22) Date de dépôt/Filing Date: 2001/08/17  
(41) Mise à la disp. pub./Open to Public Insp.: 2003/02/17

(51) Cl.Int.<sup>7</sup>/Int.Cl.<sup>7</sup> G08B 13/00, B60R 25/10, G08C 17/02, G01S 5/14, H04Q 7/22  
(71) Demandeurs/Applicants:  
HAAVE, LUTHER, CA;  
DAVIES, RIC, CA;  
HAAVE, KRISTOFFER, CA  
(72) Inventeurs/Inventors:  
HAAVE, LUTHER, CA;  
DAVIES, RIC, CA;  
HAAVE, KRISTOFFER, CA  
(74) Agent: FASKEN MARTINEAU DUMOULIN LLP

(54) Titre : SYSTEME ET METHODE DE SUIVI DES BIENS  
(54) Title: A SYSTEM AND METHOD FOR ASSET TRACKING



## A SYSTEM AND METHOD FOR ASSET TRACKING

The present invention relates to a system and method for tracking assets for enabling a speedy recovery if they are misplaced or stolen.

5

### BACKGROUND OF THE INVENTION

Telematics is traditionally defined as the convergence of mobile telecommunications and information processing. The term is often used to refer to automobile systems that combine GPS satellite tracking and wireless communications for automatic roadside assistance and remote diagnostics. General Motors was the first to popularize this service with its OnStar system. The Strategis Group projects that 17 million consumer autos will be equipped with a telematics product by the end of 2005. The location, theft detection and retrieval portion of this industry is relatively new and is only beginning to show its financial potential.

15

The telematics industry can be analyzed in five segments: services, platforms, networks, clients and positioning technologies. Referring to figure 1 the interaction of these segments is reflected.

20 Four applications are currently being used in the telematics industry:

#### 1. Vehicle or Equipment Location

25 The reception and accuracy of GPS receivers as well as the signal strength and cost of cellular service have historically been hurdles to using these technologies in this marketplace. New opportunities have arisen through the use of both new GPS technology to determine location and a cellular telephone network to transmit the location information. For example, the vShepherd™ device will work using the Advanced Mobile Phone System or "AMPS" analogue cellular network which currently has the most ubiquitous coverage throughout North America. The two main competitors in this market presently use radio frequencies, not GPS, to triangulate location, and have been constrained by radio infrastructure limitations.

30

#### 2. Driver Concierge

35

Currently, the General Motors "OnStar" product has this market to itself. It combines sophisticated global positioning with wireless technology to deliver attentive, personal service. Concierge services include: emergency assistance, automatic crash notification, destination directions, weather forecasts, location determination and remote door unlocking. The OnStar device costs approximately \$1,400 with up to one year of free service with service costs of approximately \$26 a month after the first year. Ford Motors has announced that its similar Wingcast project is being delayed.

40

#### 3. Fleet Management

45 This application involves gathering and transmitting data from vehicles to a central location. Functions include:

- Tracking delivery vehicles for when and where they are stopped and for what duration.
- Detecting theft of merchandise inside vehicles - tracking systems monitor discrete information - when and where cargo doors were opened.
- 5 • Detecting excessive speed and erratic or dangerous driver behavior.
- Gathering and calculating information for complex gas tax determinations.
- Remote vehicle diagnostics.
- Fleet reassignment.

#### 10 4. Navigation/Traffic Information

15 This system guides motorists to their destination and the plan is to add real-time traffic congestion and construction updates to their route choice criteria. An example of such a system is the Hertz "NeverLost" system, which costs \$9 Canadian (\$6 US) a day and is available in Montreal, Toronto, Vancouver and many major USA cities. Neverlost uses GPS with smart sensors to achieve the accuracy needed for true turn-by-turn guidance

20 A number of technologies and their development and enhancement are impacting the Telematics industry. These technologies are described as follows.

##### **Global Positioning System ("GPS")**

25 Historically, GPS has been funded and controlled by the United States Department of Defense and was designed for and operated by the U.S. military. GPS gained widespread acceptance for civilian applications when Preseident Clinton signed the order in the summer of 2000 to remove SA (selective availability) which resulted in improved accuracy for standard GPS receivers. There are now thousands of non-military users worldwide. GPS provides specially coded satellite signals that can be processed in a GPS receiver that enables the receiver to compute position, velocity and direction. A  
30 minimum of four of the twenty-four GPS satellite signals are normally required to compute positions in three dimensions. The main problem with current GPS technology is the requirement for an unobstructed view of the sky for communication with GPS satellites. Its advantage is that is can provide a location anywhere in the world without any additional infrastructure on the ground. Improved receiver performance and signal  
35 processing and new technologies, like "Enhanced GPS", will provide locations where traditional GPS would fail.

##### **Time Difference of Arrival ("TDOA")**

40 TDOA uses the existing cellular network infrastructure to determine location. The technique requires signal timing information from at least three different antenna sites, as illustrated in figure 2.

##### **Cellular Networks**

45 Network providers, such as Aeris.net<sup>TM</sup> ("Aeris"), and Cellemetry® make use of the AMPS control channel frequencies, to allow for the relatively economical and efficient transfer of small data packets. These providers or "virtual carriers" have entered into

agreements with either the "A" or "B" analogue cellular service providers in MSAs (metropolitan service areas) and RSAs (rural service areas) throughout North America to use spare capacity on the AMPS control channel to transmit and/or receive very small data packets. The use of the cellular network control channel provides more robust communication than cellular voice traffic so that it is possible to communicate with devices located in places where ordinary cell phones have marginal or intermittent voice coverage. The control channel is used by the cellular carrier to manage their network and set-up the circuit switched calls and must therefore be more robust than the rf channels used to carry the voice associated with a normal call. Clients of these virtual carriers can make use of a TCP/IP data link to connect their operations centre to the virtual carrier network which then provides continent wide coverage through cellular partners in Canada, the United States and Mexico. For example, Aeris has formal agreements with cellular carriers that support the deployment of its MicroBurst<sup>®</sup> technology which defines the parameters of the data that can be sent over the control channel. Aeris cellular partners provide MicroBurst<sup>®</sup> service in 98% of the territory in the U.S. where analogue cellular service is available and in 100% of the territory where this service is available in Canada and Mexico. The agreements between the virtual carriers and the cellular service providers allow for the "roaming" of these wireless devices throughout any areas in North America where an "A" or "B" cellular partner provides analogue cellular coverage. In all three of these countries, analogue cellular service is available everywhere except where population is sparse.

More common applications using MicroBurst<sup>®</sup> technology are remote utility meter reading and equipment monitoring.

### **Third-Generation ("3G") Cellular**

3G cellular will provide the ability to send relatively large amounts of data over the cellular network quickly; email and web data will be sent to cell phones. Upgrading existing cellular networks to 3G technologies will be expensive and carriers are promoting their favorite system. No universal standard has emerged yet. A new industry, "m-commerce", has emerged that can send location sensitive information to individuals over wireless devices. Although 3G cellular will have a significant impact on the telematics industry, its widespread use appears to be farther off than originally thought.

### **FCC "e-911" initiative**

The Federal Communications Commission ("FCC") requires that 25% of cell phones activated after December 31, 2001, will automatically provide latitude and longitude coordinates to a 911 dispatcher. This has caused a major race to provide the enabling technology. The proposed TDOA cellular network solutions require significant infrastructure investments and, so far, no network solution has proven economically feasible. As a result, TDOA systems are fragmented and have no broad geographic application outside of targeted large centers. As well, strong cellular signals are required to accurately triangulate location

## Other Players in the Asset Tracking Industry

Numerous competitors, at various stages of development and using a combination of the different technologies, are emerging in the location and tracking industry. The two most established competitors are LoJack Corporation and Boomerang Tracking Inc., both of which have successfully rolled out products for the automotive industry.

### **Boomerang<sup>®</sup> Tracking Inc. (“Boomerang<sup>®</sup>”)**

The vehicle location market in Canada is currently dominated by Boomerang<sup>®</sup>. Boomerang<sup>®</sup> (TSE:BMG) is a publicly traded company headquartered in Montreal, Quebec. Boomerang<sup>®</sup> locates stolen vehicles using TDOA technology. The owner of a stolen vehicle must immediately call the 24-hour hot line and report the theft. The nearest tracking vehicle is then sent out to locate the Boomerang<sup>®</sup> unit and recover the vehicle. Recovery time of a stolen vehicle averages one and a half hours.

Installation of the Boomerang<sup>®</sup> is in a different location on every vehicle and that location is unknown even to the owner. It is sold and distributed through electronic, car audio and cellular communication stores in the provinces of Quebec, Ontario, British Columbia and in the Dominican Republic.

In Ontario and Quebec, Boomerang<sup>®</sup> has aligned itself with 29 different insurance companies and up to 40% of those companies are offering reductions in premiums and other rebates for individuals who have a Boomerang<sup>®</sup> on their vehicles. As of June 2001, Boomerang<sup>®</sup> has helped recover over 970 vehicles and heavy equipment worth more than \$52.4 million.

As shown below, the company has seen significant growth over the last four years:

	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>
Units installed and activated	678	3,745	13,863	39,064

*(Boomerang<sup>®</sup> 2001 Year end results press release, July 5, 2001)*

### **LoJack Corporation (“LoJack”)**

LoJack (NASDAQ:LOJN) is the “grandfather” of the asset location industry. Its patented technology was introduced to the public in 1986 in Massachusetts. LoJack has since expanded to eighteen other states and is in operation under licensing agreements in seventeen international markets. The FCC allocated a police radio band for the “Stolen Vehicle Recovery Network”, allowing the LoJack technology to operate nationwide in the United States.

Although LoJack’s patented system requires significant infrastructure and law enforcement support, it is presently the most widely used stolen vehicle recovery technology, due to its wide acceptance in the United States. It uses a radio frequency based system for its technology. Over 40,000 stolen vehicles equipped with the LoJack System have been recovered by U.S. law enforcement agencies.

Although Lojack's corporate growth has slowed in recent years it is still by far the largest company in the location telematics business, with revenues of just under US\$100,000,000. Lojack has announced that it is moving away from its patented Stolen Vehicle Network to develop a GPS based system.

5

While there are several technologies currently available in the marketplace for asset tracking devices, it can be seen that the industry is still in its infancy and many useful features for improving customer convenience and confidence in the products and services provided by the industry have yet to be developed. It is an object of the present invention to obviate or mitigate at least some of the above mentioned disadvantages.

10

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

15 The tracking services provider performs the role of technology integrator and solutions provider. The tracking service provider utilizes the most effective technology to manufacture, market and sell the tracking devices and also provides the location solutions and other services to its target customer markets.

20 Referring to figure 3, a block diagram of the system is illustrated. A small, easily hidden, tracking device communicates with the tracking service provider's Call Center through a "virtual carrier" network. This communication platform is selected because it offers a robust means of communication over a network that today provides ubiquitous cellular coverage in North America. Other platforms will be apparent to a person skilled  
 25 in the art and as digital cellular coverage begins to equal the current analogue coverage, future versions of the tracking device will be enabled to make use of these networks. The tracking device is capable of accurately determining the location of any asset and relaying this information to the owners of the asset or to the appropriate authorities. In most cases, the location of the asset can be determined within a matter of meters. In addition,  
 30 the tracking device can be set to automatically and immediately alert the owner, or the proper authorities, if the device leaves a pre-determined area, if the external 12/24 volt in the vehicle the unit is installed in has dropped below a prescribed level, or if the unit has been disconnected from an external 12/24 volt power supply of the vehicle. These features make the tracking device a highly desirable theft detection and asset recovery  
 35 tool.

The tracking device utilizes a GPS device, cellular communication provided by a virtual carrier, a micro-controller for managing the features of the GPS module, the cellular phone modem and the device functionality, along with an internet interface for  
 40 configuring the device and communicating with it. Communication with the device to configure various features or to locate and track the device will be initiated through either the tracking service provider's Call Center or a private web portal managed by the tracking service provider. This approach provides appropriate means for addressing privacy concerns. The tracking device is connected to the protected asset's power supply  
 45 but the units also have internal backup power to ensure continued operation even after the external power source has been either disconnected or discharged. Sophisticated motion

detection and other advanced power saving techniques ensure that the tracking service provider can communicate with the tracking device for an extended period of time even if the main battery of the protected asset has been disconnected or depleted.

- 5 The tracking device is preferably packaged in a small aluminium box or a box made of plastic or some other appropriate material with a cellular antenna at one end and connectors for the GPS antenna, diagnostic device and power cable at the other, as illustrated in figure 4. In future versions it is intended to place both the cellular and GPS antennas inside the box. The package is designed to be as small and durable as current  
10 technology will allow.

The device comprises three modules:

- GPS receiver - to allow the unit to determine the coordinates of the device.
- Cellular modem - to communicate with the Tracking Service Provider's server.
- 15 • Micro-controller - the programmed controller of the device that manages all of the modules and associated circuitry, i.e. the other two modules, overall power requirements, alarms, motion detector and the unit reporting schedule.

- 20 To maximize its effectiveness as both a theft detection and asset location device, the tracking device has a number of key features that differentiate it from state of the art products, including the following.

<b>Motion detection</b>	- The GPS receiver and cellular modem turn on immediately upon detection of movement and the GPS module proceeds to obtain a location.
<b>vFence violation alarm*</b>	- The user is able to set a virtual fence ("vFence") for the asset to be protected. If the asset moves beyond this user-defined distance, between 100 meters and 100 kilometers, a vFence violation alarm is reported to the Tracking Service Provider's Call Center.
<b>Locate*</b>	- The user is able to locate the protected asset using the mapping services resident on the Tracking Service Provider's server.
<b>Low power alarm</b>	- If external power drops below 80% of its nominal input for longer than three minutes an alarm is sent to the Tracking Service Provider's Call Center.
<b>Power Cut Alarm</b>	- If external power is cut for longer than 15 seconds an alarm is sent to the Tracking Service Provider's Call Center.
<b>Restored Power Alarm</b>	- When power is restored after being cut, the device will transmit a power restore message to the Tracking Service Provider's server.
<b>Panic Alarm</b>	- For VIP and personal security markets, a button on a

	personal panic device can initiate an alarm to the call center.
<b>Power Save mode</b>	- In order to reduce power consumption, the unit can be programmed to "sleep" and will consume minimal power if no movement has occurred for a customer preset time from 0 hour to 999 hours and "awaken" when motion is detected by the micro-controller. (If value is set to "0", the device enters Power Save mode after 5 minutes.)
<b>Daily network listening</b>	- Regardless of whether "awake" or "asleep", the unit will turn on the cellular modem at a pre-defined time to be available for communications.
<b>Monthly heartbeat</b>	- Once a month the unit calls the Tracking Service Provider's server and reports its current position.

\*Settings are done over the Internet.

### **Motion Detection**

- 5 The tracking device has two sensitive motion sensors that are configured to report if motion occurs. The "damping" settings of these devices are configured such that a vehicle being moved by a gust of wind will not trigger the motion sensor but genuine "motion" must be established by a certain number of "movements" that happen over a period of a few seconds. This definition of motion determines a number of the Power Saving characteristics of the device. First, if no motion is sensed for 5 minutes, whether or not
- 10 the vehicle is being operated and just parked, the GPS module stops getting power to begin saving power. The theory is that since when the unit is powered and in motion, it is constantly writing new location fixes to the micro-controller and if there is no motion, the last fix stored there will still be accurate. Second, there is a parameter (Power Save Delay) that is set in the configuration of the device that determines how long after motion
- 15 ceases that the unit goes into "Power Save" mode. This can be changed from the factory default setting of 0 hours to up to 999 hours. After whatever length of time that is called for has elapsed, the entire unit will go into Power Save mode, which is essentially a "deep sleep" mode that uses minimal power. (If the value of "0" is entered, the unit will enter the Power save mode after only 5 minutes after motion has stopped.) When it is in the
- 20 Power Save mode, it cannot be contacted or interrogated. When motion is sensed, the unit immediately awakens and determines if it has experienced any conditions that should be reported as an alarm and stays on again until the expiry of the Power Save Delay setting time in its memory. The customer can set this time to reflect the external battery capacity of the vehicle in which the unit is installed. If the vehicle has a small battery that may be
- 25 depleted quickly, they may want the unit to sleep after only one hour of no motion. If the external battery is more robust, they may wish to set it for 999 hours so that it will stay on and available for interrogation for essentially 1000 hours from the last time motion was sensed.
- 30 If the unit has gone into Power Save mode, only the cellular module (not the GPS module) awakens for a defined period every 24 hours. During that period, the tracking device "listens" to the cellular network for a "page" so it can be sent a locate command to

determine where it is or to transmit changes in device configuration that the user may wish to implement. The Tracking Service Provider's system controls and changes the time of the daily reporting but it is typically in the early hours of the morning.

5 The tracking device's internal battery life after the external power source (12/24v) from the vehicle has been interrupted for any reason is currently being tested. It is not expected to be a concern because as soon as the external voltage is lost, an alarm message is received by the tracking service provider, indicating that the situation should be investigated. Therefore, the internal battery needs to last long enough to get a fix on  
10 where the unit is and alert the owner who can choose to dispatch police to retrieve it. As long as the unit is connected to the vehicle battery, the power consumption of the device is essentially trivial to such a large battery. Typically, it is equivalent to slightly more than a clock in a car. The internal batteries have currently been selected to keep the entire device down to a small size of 2" x 4" x 4". If tests reveal that more battery life is  
15 required to support the operational requirements of certain customers in the event of the removal of external power supply, the size of the box can be increased to include more back-up battery life. The batteries are maintained at a full charge as long as the external voltage supply is present. Future versions of the device will use less power through the use of fewer and more efficient chipsets and components. These developments will make  
20 it possible for smaller versions of the device, with similar features, to be installed in smaller and valuable assets such as computers, or pumps, or any other asset that is worth protecting from theft. Smaller versions of the device will also make it possible to use such a device for monitoring children, Alzheimer's patients, criminals, or pets. Devices could eventually become so small that they could be implanted in animals or humans.

25

### **Panic Alarm Function**

The panic alarm function is sent from the tracking device if a contact closure is made between two select pins on the connector. The panic alarm could be used, for example, in  
30 a taxi for a secret under the seat switch that is activated by the driver to summon help if he is attacked or hi-jacked. Another important use of this feature provides customers with the option of purchasing an additional unit that could be installed in a car. The additional unit acts as the "receiver end" of one of the "pendant" type of devices that is used for "medical alert" or other systems that are often used by seniors to summon help if they have "fallen and can't get up". The pendant devices comprise a small RF transmitter  
35 in the pendant. The receiver picks up the signal and normally initiates an auto-dialer that calls an alarm-monitoring centre. In the current embodiment, the RF receiver is modified to run on vehicle's power supply and fit in the vehicle. If the user pushes the panic alarm button while they are within the radius in which the receiver can pick up the signal from the pendant, the received signal is used to make the contact closure between the two pins  
40 on the tracking device connector. The Panic Alarm function is relayed by the device to the tracking service provider's Call Center which automatically forwards the received location data for the vehicle to the appropriate authorities. This function allows the vShepherd device, in addition to providing all of the features described earlier, to act as a form of security "base station" for an individual. While the location information  
45 identifies the precise location of the security base station, the information that the user of

the Panic Device is within the defined RF reception area for the pendant device provides the appropriate authorities invaluable information on the location of the individual and the ability to dispatch the appropriate assistance.

**Functionality of the Tracking Device:**

- 5 A. Commands that only the Tracking Service Provider can send to the tracking device
- i) **Deactivate Device** – this command can be sent by the Tracking Service Provider to deactivate a device if a customer’s account is delinquent or some such reason. The unit would no longer respond to any customer instructions through the web interface but, provided that the unit is still  
10 connected to external 12/24 volt power (or the backup battery is still operational) the unit would continue to monitor the cellular network and would accept an Activate Device command initiated by the Tracking Service Provider to re-activate the device so it would accept all of the other Tracking Service Provider or customer commands;
- 15 ii) **Activate Device** – this command can be sent by the Tracking Service Provider to re-activate a device that has previously been sent a De-activate Device command in order to reactivate a customer’s device after a delinquent account has been brought current;
- i) **Change Report Day** – each tracking device is pre-programmed at the factory to  
20 send a “heartbeat” command to the Tracking Service Provider’s server on a particular day of each month. This command can be used to cause a device to send this heartbeat report on a different day of the month;
- ii) **Change Report Time** - each tracking device is pre-programmed at the factory  
25 to send the “heartbeat” command to the Tracking Service Provider’s server at a particular time, on the selected “Report Day” of each month. This command can be used to cause a device to send this heartbeat report at a different time on the selected “Report Day”;
- iii) **Wakeup and Locate** – each tracking device is pre-programmed at the factory  
30 so that even if the unit is in the Power Save mode, the unit will be fully “awake” and ready to accept commands for one hour out of every 24 hours. During this one hour awake period, the Tracking Service Provider can send any device a locate diagnostic command which causes the device to attempt to obtain a GPS measurement for four minutes and forward the location data to Tracking Service Provider’s server, thereby confirming that all GPS and communication  
35 functions are working properly;
- iv) **Track Unit For “x” Minutes** – sending this command (accompanied by a certain number of minutes) to a tracking device causes the unit to report to the Tracking Service Provider’s server, every fifteen seconds. The tracking device alternately reports either a geographic position or the speed and heading data for

the number of minutes that has been specified in order to permit “live” tracking of an asset in motion.

B. Commands that the Tracking Service Provider or customers can send to the tracking device

- 5      i)      **Power Save Delay** – in order to conserve the power of the external battery providing the 12/24 volts to the unit, a motion detector causes the tracking device to power down. Therefore, the unit does not monitor the cellular network and cannot accept incoming calls (except for the one hour (or other time determined by the Tracking Service Provider) per day when the device is programmed to wake up and monitor the network.) With this command customers can set the number of hours after any motion stops before the unit will go into this Power Save mode. The default value for this parameter for tracking devices leaving the factory is 1 hour. This feature allows customers to manage the power consumption of the tracking device and appropriately match this consumption to the capacity and circumstances of the supplied external 12/24 volts;
- 10
- 15
- 20      ii)      **Activate Power Save Report Mode** - If for any reason (such as fleet management applications) the customer should wish to take advantage of this feature, this command will cause the tracking device to report a location to the Tracking Service Provider’s Call Center on every occasion just before the unit goes into Power Save mode. Such a series of reports could provide a customer with a list of locations where the unit had ceased to move for the period of time selected on the Power Save Delay command. This could, for example, provide a record or log for the customer of any stops of greater than 5 minutes or greater than 1 hour etc. This function ensures that, at all times, the Tracking Service Provider either has an accurate location for the unit, (if the unit is in Power Save mode) or can obtain an accurate location (if the unit is moving.);
- 25
- 30      iii)      **Deactivate Power Save Report Mode** - If the customer has activated the Power Save Report Mode in a tracking device, it can be deactivated with this command;
- 35      iv)      **Activate Power Alarms** – If this command is sent to a tracking device, the unit will contact the Tracking Service Provider’s server with a message indicating that one of the Power Alarm conditions (detailed in the Alarms and Reports section below) has occurred. Configuration settings chosen by the customer will determine who should be immediately and automatically contacted by the tracking service provider. When a tracking device is shipped from the factory the default position for the Power Alarms is “on”;
- 40      v)      **Deactivate Power Alarms** – If the Power Alarms in a tracking device have been activated, sending this command instructs the device to not contact the Tracking Service Provider’s server when a Power Alarm condition occurs;

- 5 vi) **Set vFence Radius** – If this command is sent to a tracking device, the unit will build a mathematically calculated distance (fence) around the device (from the device’s position when the “Turn vFence ON” command is sent), ranging from 100 meters to 100 kilometres. If the device moves outside of the set parameter, the device will communicate back to the Tracking Service Provider’s server that the device has left the permitted area.
- 10 vii) **Turn vFence ON** – If this command has been sent to a tracking device, the centre of the permitted area (defined by the “vFence Radius”) is reset to the current location of the device, and from then on, the unit will send a message to the Tracking Service Provider’s server if the unit moves outside of the permitted zone. Before sending this alarm message, the vFence function is turned off. After this alarm has been received, the customer may choose to re-activate (and re-centre) the vFence, or continue to monitor the location of the asset. When a tracking device is shipped from the factory the default position for the vFence is “off”;
- 15 viii) **Turn vFence Off** – If the vFence function has been activated, sending this command deactivates the vFence function;
- 20 ix) **Locate** – Sending this command causes a device to report to the Tracking Service Provider’s Call Center the location as being one of four possible options, depending on the conditions at the time of the request
- 25 - if the unit has not moved for a period greater than the Power Save Delay time that has been set in the device, the customer would be advised by the Tracking Service Provider’s server that the unit is in Power Save mode and the most recent location data in the Tracking Service Provider’s database would be provided to the customer. The customer would also be given the option of having the system interrogate the device during the next daily time period when the device will be awake and “listening” to the cellular network, if the device has not already reported a new location to the server by that time. A message advises the customer of the time when updated location data will be
- 30 available. If the Power Save Report Mode is enabled, the reported position will be the current position of the unit;
- 35 - if the unit is not in Power Save Report Mode but the unit has not moved for 5 minutes, most recent location stored in the tracking device memory will be reported (which will, by definition be the current location of the unit);
- if the unit is not in Power Save Report Mode and has moved within the last 5 minutes, but is currently not moving, the current location will be reported;
- if the unit is not in Power Save Report Mode and because it is in motion, the current location and fact that it is in motion will be reported.
- 40 x) **Power Down Device** – this command can be sent to a tracking device to shut the unit down entirely so that it is not even capable of monitoring the cellular phone

network or registering on the network. Typically, units are shipped from the factory in the Power Down mode. Once entering this mode, the tracking device can only be turned on by connecting (or removing and re-connecting) an external 12/24 volt supply to the device;

5 -

### C. Alarms and Reports

- 10 i) **External Power Low Warning** – If the Power Alarm function has been activated in a tracking device, the unit will send an alarm to the Tracking Service Provider’s server indicating that the external 12/24 volts has dropped below 80% of its normal value;
- 15 ii) **External Power Lost Alarm** - If the Power Alarm function has been activated in a tracking device, the unit will send an alarm to the Tracking Service Provider’s server indicating that the external 12/24 volts has been lost. The Tracking Service Provider’s server will send a confirming message to the device indicating that the alarm message has been received. If the device does not receive a confirmation of the receipt of the alarm message within 5 minutes, the unit will attempt to re-send the alarm message for up to 5 times and if no receipt is received, it will attempt the same sequence 24 hours later;
- 20 iii) **External Power Restored** - if the Power Alarm function has been activated in a tracking device, the unit will send an alarm to the Tracking Service Provider’s server indicating that the external 12/24 volts has been restored.
- 25 iv) **Panic Alarm** – Some units may be configured to make use of a “Panic Alarm” feature that is triggered as the result of a contact closure between two pins on the multi-pin device connector. If there is a contact closure between these two pins, the unit will send the “Panic Alarm” report indicating immediate assistance is requested at the reported location of the unit. The “Panic Alarm” message sent by the device contains the current location information for the device. The Tracking Service Provider’s server will send a confirming message to the device indicating that the alarm message has been received. If the device does not receive a confirmation of the receipt of the alarm message within 5 minutes, the unit will attempt to re-send the alarm message for up to 5 times and if no receipt is received, it will attempt the same sequence 24 hours later;
- 35 v) **vFence Violation Alarm** - if the vFence function has been activated in a tracking device, and the device moves to a location that is outside of the permitted area (defined by the vFence radius) the unit will first deactivate the vFence and send an alarm to the Tracking Service Provider’s server indicating that the unit has travelled a distance greater than the allowed vFence Radius from the point that the unit was at when the vFence was activated. The Tracking Service Provider’s server will send a confirming message to the device
- 40

indicating that the alarm message has been received. If the device does not receive a confirmation of the receipt of the alarm message within 5 minutes, the unit will attempt to re-send the alarm message for up to 5 times and if no receipt is received, it will attempt the same sequence 24 hours later;

- 5 vi) **Power Save Mode Report** – if the customer has chosen to have the tracking device report its location prior to going into Power Save Mode, this report provides the location of each such occurrence. This location is stored in the Tracking Service Provider’s server for later customer reports and/or use;
- 10 vii) **Heartbeat** – this report goes only to the Tracking Service Provider’s server and is the monthly confirmation (at the “Report Time” on the “Report Day”) that the unit is functioning properly;
- viii) **Antenna Sense Alarm** this report is sent if the antenna for the GPS module has been tampered with or is not functioning properly.
- 15 D. Other features of the tracking device
- i) **Battery Back Up** – The device has a re-chargeable, internal back up battery that will be recharged whenever external 12/24 volts is supplied to the device.
- 20 ii) **Diagnostic Device** – The Tracking Service Provider offers to its customers the opportunity to purchase a diagnostic device that connects into the DB-9 connector on the vShepherd device and provides an LCD on which key parameters are displayed allowing the user to determine if the GPS module, the cellular modem and the micro-controller are operating properly. Specifications for the Diagnostic Device are contained in Appendix B.
- 25 E. The vShepherd Device Management System

30 There are five primary components to the Tracking Service Provider’s system that stores data and communicates with vShepherd devices through the cellular phone network and via the web interface. These are the virtual carrier bridge server, the database server, the alarm server, the Tracking Service Provider’s Call Centre and the webserver.

- 35 - **The Virtual Carrier Bridge Server** – This server processes and formats all of the commands and data to be sent via a TCP/IP connection to the operations centre of the virtual carrier where they can be relayed to the vShepherd device over the North American AMPS cellular phone network. Similarly, this server receives and processes data and reports that have been received from the vShepherd device at the virtual carrier’s operation centre and relayed to the Tracking Service Provider’s call centre via the TCP/IP connection.

- **The Database Server** – This server stores all relevant data about the vShepherd device, the customer, users, alarms and reports, billing information and the like.

5        - **The Alarm Server** – All alarms and reports that arrive at the Tracking Service  
 Provider's Call Centre (after being relayed from a vShepherd device, through the  
 AMPS cellular network and the virtual carrier's operation centre) are processed  
 10        by the alarm server and, as required, are written to the Tracking Service  
 Provider's database. Parameters chosen by the customer and stored in the  
 Tracking Service Provider's database determine who should be automatically  
 15        advised of the occurrence of the alarm at the particular day and time that the alarm  
 has occurred. Power Restored Alarms are not routinely passed on to the customer  
 but are used by the Tracking Service Provider to monitor the status of deployed  
 devices. For example, the receipt of a Power Restored Alarm could be of  
 20        assistance in locating a missing asset that had not been recovered. If an asset was  
 stolen from a location, (such as in a remote mountainous area) where there was no  
 cellular service, and the vehicle battery had been disconnected for a period of time  
 so that even the internal back-up battery in the device was depleted, then if the  
 vehicle was ever moved into an area with cellular coverage, and the vehicle  
 25        battery was re-connected (before the vShepherd device was discovered or  
 destroyed), this alarm message would signal to the Call Centre that the asset had  
 re-surfaced in an area where a Locate command could now be performed.

25        - **The Tracking Service Provider's Call Centre** – The Tracking Service  
 Provider's Call Centre provides staffing 24 hours per day to monitor all  
 components of the vShepherd Management System. In addition, customers that  
 may not have access to the internet can call a toll free number to have Call Centre  
 staff manage their account or to make inquiries about alarms that they have  
 received notification of via the automated alarm notification system.

30

- **The Tracking Service Provider's Web Server** – The web server provides the means for customers to communicate with and control their vShepherd devices. The operation of the web portal is described as follows:

35

#### F. The vShepherd Device Management Web Interface

40        Users will visit the website home page of the Tracking Service Provider that has been  
 established. When the Tracking Service Provider's login page is completed, and  
 submitted, the Tracking Service Provider's system checks to determine that the  
 customer number, username and password are valid. It also checks an access level  
 assigned to the user for determining what screens to display to the user and what  
 functions the user is authorized to perform with respect to vShepherd devices  
 registered to the customer with whom this user has been authorized. The access level  
 45        field is presently a two character field with the letters A through J being assigned for  
 various access levels for the Tracking Service Provider's clients/customers and K

through ZZ being reserved for the Tracking Service Provider administrator and staff access levels and for future use.

5 An example outline of a flow of web pages presented to a user with a higher access level is presented in Appendix C. Users with a lower level of authorization would not be presented with buttons or messages concerning functions that are not permitted at that lower access level.

The current access level definitions are defined as:

10

A – (Customer Administrator)

- Can perform any permitted customer functionality

15

B - Can review database of all devices in permitted groups that are registered to this customer

- Can locate any vShepherd device registered to this customer
- Can change their own username and password

20

C - Functions of B plus:

- Can alter Fence, Power Alarm and Alert settings of devices in permitted groups that are registered to this customer

25

D - Functions of C plus:

- Can alter customer asset data fields for devices in permitted groups that are registered to this customer

30

E - Functions of D plus:

- Can Create and edit customer groups
- Can add or delete users with access to this customer's vShepherd devices

35

Immediately after a successful login by an authorized user, the Tracking Service Provider's system checks the database to determine if any alarms have been reported by any of the devices registered to this customer. Before the user is allowed to proceed to perform other tasks, they are presented with any such alarms and they are required to either clear the alarms as being caused by an event or circumstance known to the customer, or confirm to the Tracking Service Provider that the unit is to be reported to police authorities as stolen. If the user determines that the alarm is the result of a theft, selecting this option will take the user to the Report a Theft functionality described in a below section. In the case of Power Cut alarms and vFence violation alarms, the Locate function is not available to the user for a period of hours determined by the Tracking Service Provider. Following the receipt of either of these two types of alarms, and for this period of time, the Locate and Tracking functions are only available to the Tracking Service Provider or the police investigating a reported theft.

40

45

### **Processing of Alarms**

An alarm server at the Tracking Service Provider receives all tracking device alarms/reports (Low Power, Power Cut, vFence Violation, Antenna sense, or Power Save Location Report) that are generated. The alarm server writes the time stamped alarm/report to a database and issues all of the notifications the customer has chosen in the customer configuration portion of the database which correspond to the customer's instructions for processing alarms that occur at that particular time. The text, voice, fax, e-mail, sms etc. messages all advise the recipient of the nature and time of the alarm and request the person to either: a) log on the Tracking Service Provider's website to further investigate the nature of the alarm, or b) to call the Tracking Service Provider's Call Centre at toll free number (1-888-yyyy) to provide instructions.

The alarm server generates an alarm at the Tracking Service Provider's Call Centre and if there has been no response from any of the parties that have been automatically alerted by the alarm server (within, for example, 10 minutes), the Call Centre operator will begin to make manual decisions. These decisions typically follow an Tracking Service Provider's Procedure Manual for contacting the customer at other numbers. Alternately, if it can be seen from interrogation of the tracking device that an asset that should not be on the move, is actually moving, the Tracking Service Provider will have a procedure for contacting police to advise that the Tracking Service Provider has identified unauthorized activity - but that so far they have been unable to make contact with the owner. If the customer chooses to call the 1-800 number in response to an alert (because he is on the golf course) the Tracking Service Provider Call Centre operator will use the web interface described below (on behalf of the customer). The Call Centre operator will provide over the phone the Tracking Service Provider's Incident Report Number (referenced below) and the instructions advising the customer to contact the police to make a stolen property report and providing the police with the Tracking Service Provider's 1-800 number and other relevant information.

In the current iteration of the web interface, after successfully logging in, and processing of any unprocessed alarms that have occurred, a customer with the highest access level authorization is presented with a screen with the following options: Report a Theft, Locate a vShepherd device, Last Known Location, vShepherd Device Settings, Customer/User Settings, Add a New vShepherd Device, Contact Us, Tracking Service Provider's Privacy Statement, Log Off, and Tracking Service Provider Functions. These options function as follows.

### **Report a Theft**

A "picklist" allows the user to select one of the vShepherd devices registered to that customer and confirm to the Tracking Service Provider that the unit is to be reported stolen. This function is available to a user at anytime so that in a case where the user has not had the vFence activated for any reason, but they have visually determined that their vehicle is missing, the Tracking Service Provider can respond with the same tracking and location services that would be used if a theft had been detected by the arrival of a vFence or Power Cut alarm. As soon as the user confirms that the asset is to be reported stolen, the Tracking Service Provider's system responds by providing the user with an Incident

Report Number that can be provided to the investigating police authorities. The user is also provided with a toll free number that they are instructed give to the investigating police authorities. When the police contact the Tracking Service Provider with the Incident Report Number, the police can be given a temporary password that will allow them to perform locate and tracking functions over the web interface to assist them in locating and recovering the asset and hopefully apprehending the parties responsible. Alternatively, staff at the Tracking Service Provider's Call Centre can provide location and tracking assistance to the police over the telephone.

## 10 **Locate a vShepherd device**

Clicking on this button brings up a screen that allows the user to select from a "picklist" of all of the devices that this user is authorized to access. The page also has search capability in case the user has a large number of devices from which to select. Once the desired device has been highlighted in the picklist, the locate button can be clicked.

The user confirms that a vShepherd location is desired, and that the customer accepts the charge identified on the screen, (which is extracted from the billing database for the particular customer). This action will cause the application to attempt to communicate with the device. If the attempt to get a current location is not successful, the application will access the last known location (and time) from the database and will display a map (as described below) with a message indicating that "The current location is not available at this time. The unit is likely in Power Save mode because it is not currently in motion or may be outside of cellular coverage." The customer will be given the option of having the system obtain an updated location from the device, even if it continues to remain stationary, during the next daily "window" when the device awakens from the Power Save mode. If the user selects this option and accepts the charge for this service, the user will be advised when they can expect updated location data to be available.

If the unit is not in Power Save mode, and is activated and available, the application will bring up a map with a scale of approximately 5 kms square. The map can be zoomed out from this point for the user to confirm the area, region, or state/province etc. that is being displayed or zoom in for increased detail on the location of the device.

35

### **Last Known Location -**

The user can use this function to query the system database for the last reported location of the device. The system will respond with a map and the most recent location coordinates that have been reported and stored in the database along with the date and time of that report. The user is then given the option of attempting to locate the device or to have the device store updated location data in the system database during the next scheduled daily listening "window" when the unit comes out of Power Save mode to monitor the cellular network and respond to commands. If the user selects this option, and accepts the charge for this service, the user will be advised when they can expect updated location data to be available.

### **Change the vShepherd device settings -**

5 This series of screens allows the user to alter the vFence, Power Alarm, Power Save  
 Delay, Power Save Report Mode, and Power Down functions. The system provides  
 information to the user on the current settings and if the user accepts any charges  
 associated with altering any of the device settings, the changes are sent to the device and  
 are written to the database when the unit responds confirming that the changes have been  
 10 made. If the device is currently in the Power Save mode (because it is not in motion) the  
 user can choose to have the new settings sent to the device during the next daily window  
 when the unit comes out of Power Save mode to monitor the cellular network and  
 respond to commands. If the user selects this option, and accepts the charge for this  
 service, the user will be advised when they can expect the revised settings to be available  
 in the database.

15

This series of screens also allows the user to perform functions such as moving a  
 vShepherd device. This function includes requiring the user to enter new information on  
 the characteristics of the protected asset to the database before the system temporarily  
 suspends the automated notifications that the Tracking Service Provider's system sends to  
 20 the persons that have been identified by the customer. Once the user has completed these  
 screens and accepted the charge for moving a vShepherd device, the automated  
 notifications are suspended until the system receives a Power Restored alarm that  
 indicates the unit has been disconnected from the external 12/24 volt power supply in one  
 asset, and re-connected to the external 12/24 volts supply in the new asset that has been  
 25 registered in the database. Other functions that are available to the user include editing  
 the description of the protected asset, (in case, for example, its color has been altered), or  
 assigning the device to a Group established by the customer. Groups allow the user to  
 alter the settings of a number of devices (such as turning the vFence or Power Alarms on  
 or off, or resetting the vfence radius) without having to select each device individually to  
 30 make the change. If device settings for Groups are altered using the screens available  
 under the Customer/User settings, the total cost for initiating that change for all the  
 devices assigned to that group is calculated and the user must confirm that they accept the  
 resulting charge before the Group device settings are altered.

35 This series of screens also provides the option for the user to send a Power Down  
 command to a device. This command puts the unit into the state in which it is shipped  
 from the factory and could be used to de-activate a device that is being shipped to a new  
 location or is being temporarily "retired" due to the seasonal nature of the customer's  
 business. After this command has been sent to a device and the external power has been  
 40 removed, the unit is re-activated from this mode as soon as external 12/24 volts is once  
 again re-applied to the device. The unit awakens from this mode with the factory default  
 settings so the user may need to re-configure the device settings.

### **Customer/User Settings -**

45

This series of screens allows an authorized user to perform functions such as changing passwords, changing customer data (such as address, telephone etc.), set alarm notifications that are to be used by the system when the Tracking Service Provider receives any of the possible alarms that have been activated for the customers devices.

5 The customer can establish different periods of the day, weekends, holidays etc, when alarms are to be routed to different individuals. The system allows the user to provide a number of telephone, pager, fax, or e-mail coordinates that can be selected as the appropriate means of contacting the person(s) to be notified of the arrival of an alarm.

10 Users with higher levels of authorization are able to manage the privileges of other users for that customer. Other screens allow an authorized user to establish and manage Groups to which individual devices can be assigned so that the user can alter the settings of a number of devices without having to individually select and change settings for each device. Still other screens allow an authorized user to review and process any received  
15 alarms, review all location reports stored in the database for a device, and review that status of charges made to the account as a result of transactions that have been accepted by an authorized user.

#### **Add a New vShepherd Device -**

20

This series of screens allows an authorized user to add a new vShepherd device to the customer profile. The user is prompted to enter the number found on the label of the new device that they wish to add. The system checks the database to determine that the submitted number is a valid unit recorded in the database and that it is not already  
25 associated with another customer. If the unit is available, the user is prompted to fill in the required information about the asset in which this device is installed before the unit is associated with the customer profile and the information is saved in the database.

#### **Tracking Service Provider Functions –**

30

A separate and unique Customer Number allows Tracking Service Provider Call Centre staff (and other authorized Tracking Service Provider personnel) to access the site and the menus. The access levels of authorization for these users would allow staff to handle customer requests to the 1-800 number to have this data altered on their behalf or to  
35 perform other customer functions. Customers calling in to the Tracking Service Provider Call Centre would be required to provide some form of “challenge word” stored in the database and may be required to accept charges, including an additional service charge as a result of requiring the services of the Call Center staff rather than using the web interface directly. Of course additional “Tracking Service Provider only” commands  
40 such as Activate and Deactivate Device, Change Report Day etc. would also be available to staff with the appropriate authorization.

#### **Police Login –**

45 If a customer has reported a theft of an asset protected with a vShepherd device to police, the user should also have advised the police that the Tracking Service Provider can

provide assistance to the police in locating the protected asset. The customer should also provide the investigating police authorities with the toll free number for contacting the Tracking Service Provider Call Centre and the Incident Report Number provided by the Tracking Service Provider.

5

Once the police contact the Tracking Service Provider, Call Centre staff can provide locate or tracking services to the police over the phone. Alternatively a temporary password can be given, over the phone, to the police so that they can log on to the Tracking Service Provider website, enter the Incident Report Number, and perform

10

Locate and Tracking functions that will provide the maps and location data directly to the police.

#### **Open New Account –**

15

This function appears on the home page of the website to allow new customers that have not yet registered with the Tracking Service Provider to establish and set up a new account. Users that select this option will be prompted to fill in all of the required information to establish an account with the Tracking Service Provider. Once this process has been completed and the data written to the Tracking Service Provider

20

database, the new user would be asked if they wished to configure an initial vShepherd device and the user would then be prompted to again provide all of the information required to activate a new device – as described in an earlier section.

#### **Espanol -**

25

Users that select this screen are provided with Spanish language versions of all of the above pages described in English.

#### **Francais –**

30

Users that select this screen are provided with French language versions of all of the above pages described in English.

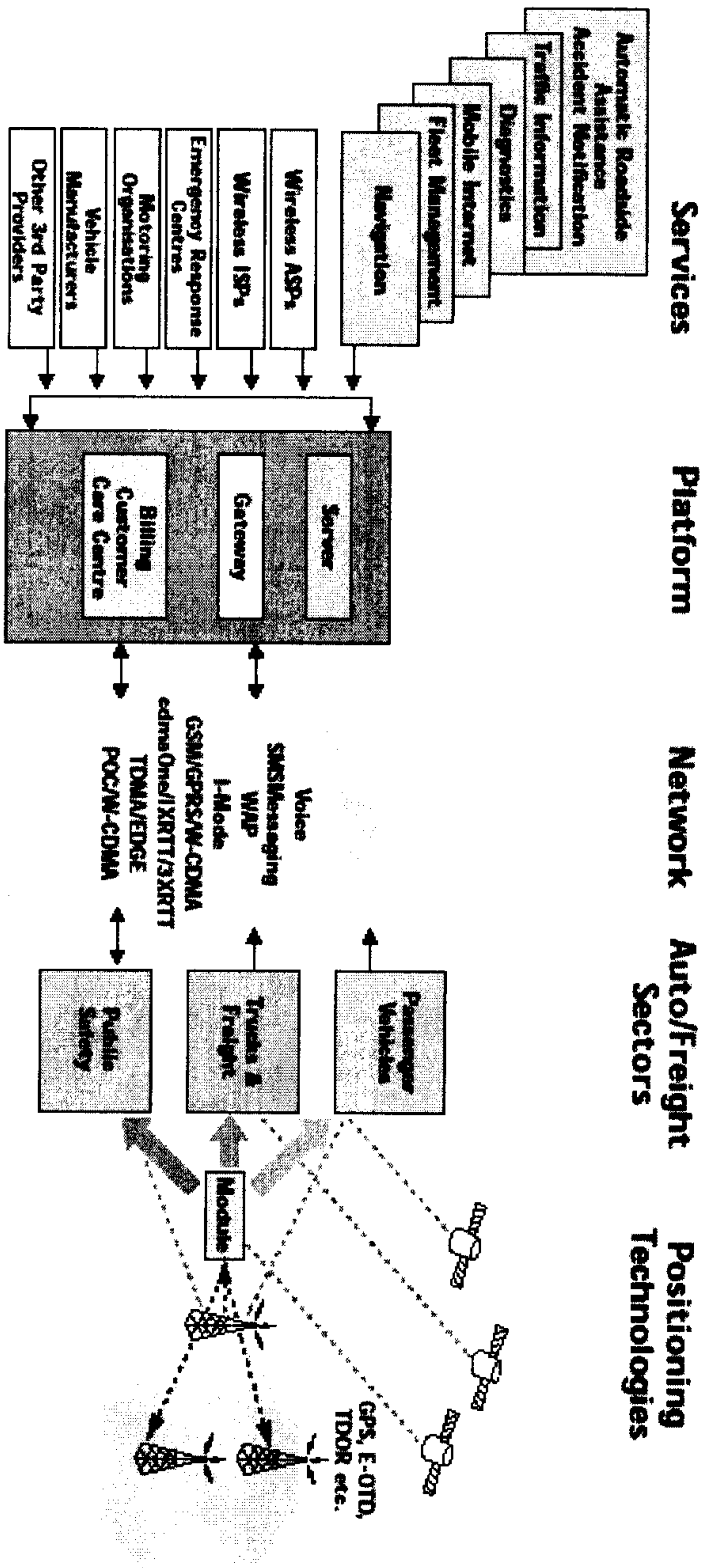


Figure 1

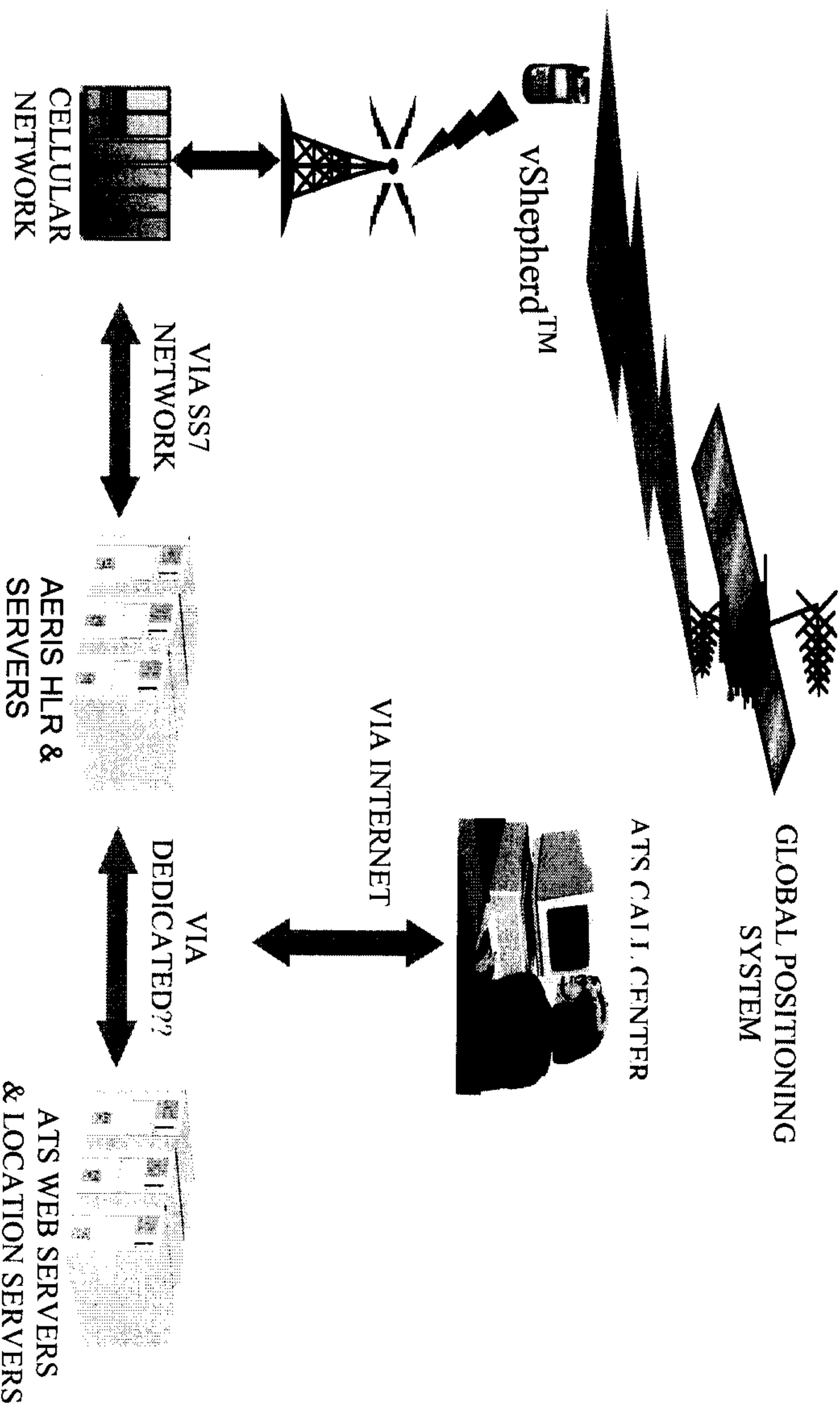


Figure 3

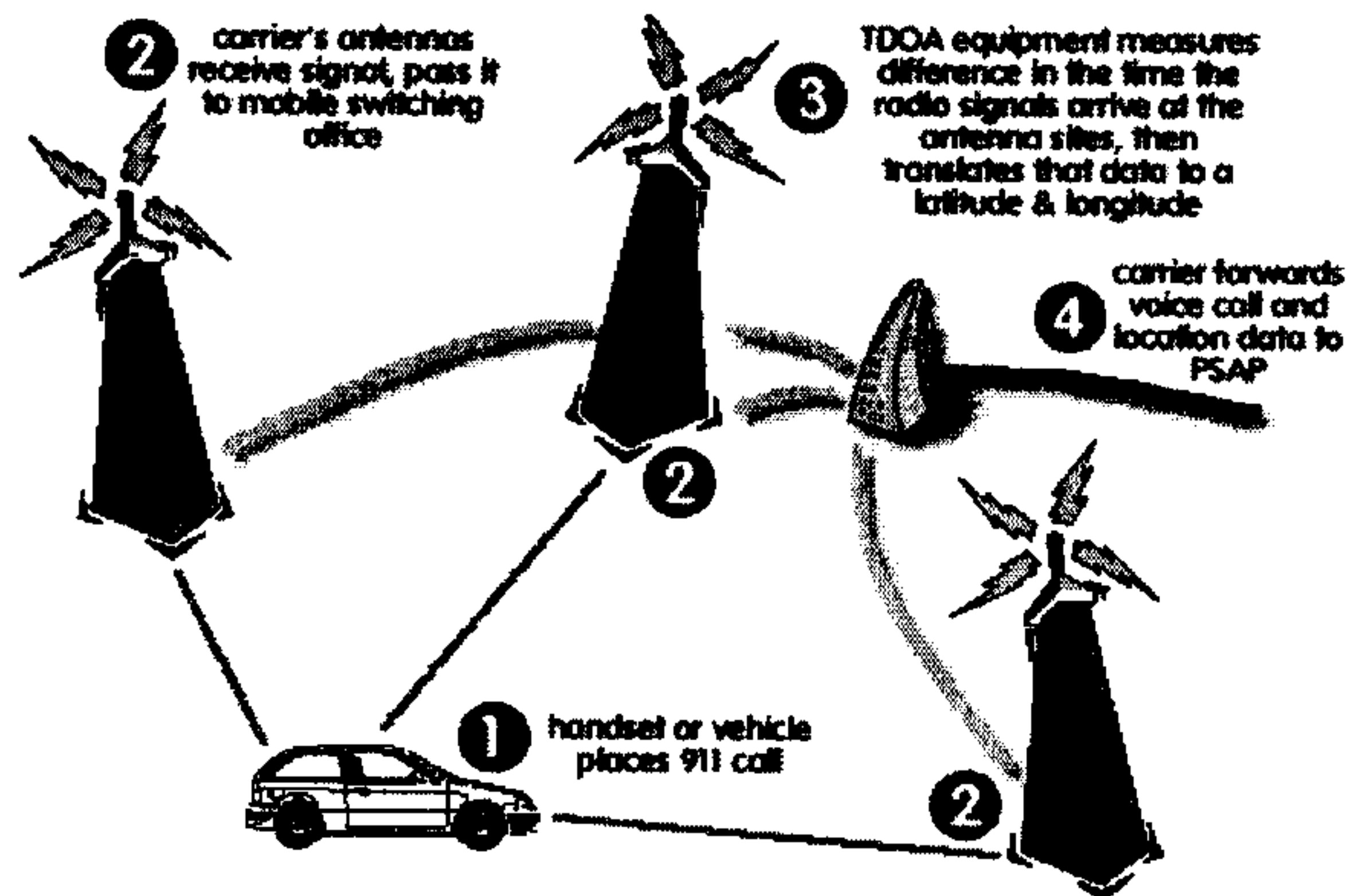


Figure 2

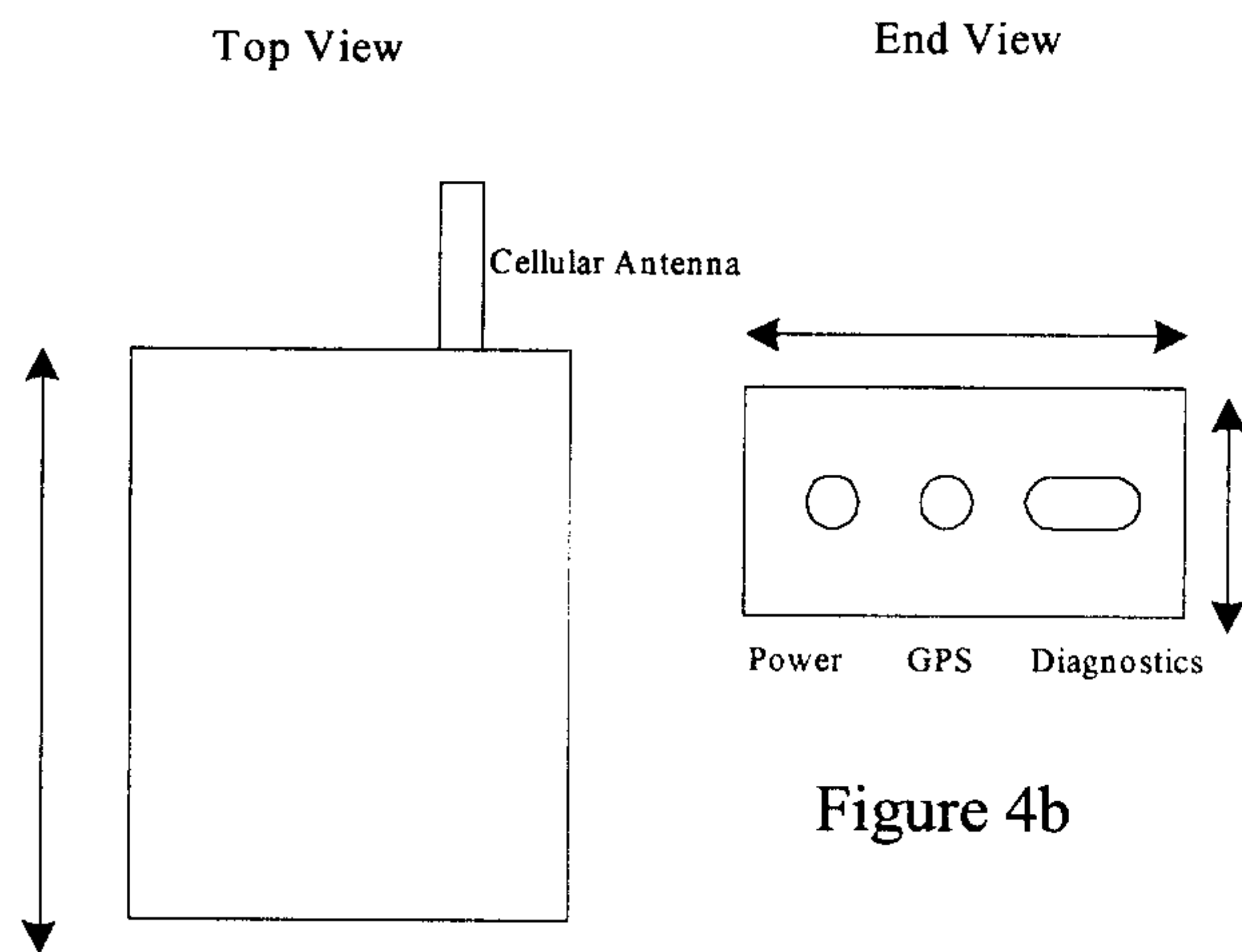


Figure 4a

Figure 4b

