

**THE INTERNATIONAL MARITIME TRANSPORT & LOGISTICS CONFERENCE
(MARLOG 4)
A SUSTAINABLE DEVELOPMENT PERSPECTIVE FOR MEGA PROJECTS
29 - 31 MARCH 2015**

**MONITOR AND TRACKING OF THE INLAND TRANSPORT USING
THE EUROPEAN GLOBAL NAVIGATION SATELLITE SYSTEM
(E-GNSS)**

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INTRODUCTION

The foreign and imported trade of Egypt is down from 101 billion USD to about 45 billion in the last 4 years with average of 80 billion USD worth transshipments are moving over the inland transportation systems in Egypt (Egyptian International Trade Point 2015). This trade is expected to expand in future in response to the natural increases in Egypt population and the sound increase of the role of the governmental investment policies, enhanced by the geographical location and the existence of the Suez canal. More than 90% of the cargo is transported by trucks in the Egyptian congested road network and to a certain extent by rail and minor percentage by river transportation. In order to establish a reliable and efficient monitor and tracking system in Egypt, the current situation of all the transport modes in this country need to be looked at, which could be summarized as follows;

MODE OF TRANSPORTATIONS IN EGYPT

Sea Transport

Since the very early eighties, the government of Arab Republic of Egypt set a provision of an integrated strategic policy for the development and expansion of the Egyptian merchant fleet in terms of size and type. The authorities are encouraging private sector to invest in owning and operating commercial fleet. The total number of ships hosting Egyptian flag is about 135, includes commercial cargo ships, tankers, service boats, fishing and dredgers. The overall holding capacity of the commercial fleet is about two million tons. This low number of ships and relatively small volume of tonnage are not in balance neither for the current international trade of the country nor for prospective increase in the population and economy.

Egypt has 40 seaports in all; 12 are commercial ports; 6 mining ports; 6 fishing ports; 5 marinas; and 10 oil-shipping ports. Overall seaport holding capacity has risen to about 66.8 million tons. Docks have also increased to 175, which has contributed in turn to increasing the number of passengers transported by sea-faring ships to 740,000.

The Egyptian ports play an important role in the country's economy; Egypt's geographical location lends an important aspect to the maritime transport sector. Overlooking both the Mediterranean and Red seas linked by the Suez Canal; Egypt realized its role at an international level. Recently, seaports, transport and logistics projects turned to be the most common mega projects. Moreover, investment in mega projects became a common criterion of economy boosting since the economic crisis in the thirties. The seaports effects were

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reflected on international trade in terms of increase of seaborne cargo and increase of the world maritime fleet, in addition to the great leap in ship size, especially container ships.

The Suez Canal is a major waterway of international commerce and navigation, linking the Mediterranean and Red Sea. The ministry of transportation along with other governmental bodies is responsible for transportation in Egypt. Major ports are Alexandria, Port Said, and Damietta in the Mediterranean Sea, Suez and Safaga on the Red Sea.

Road Transportation

Road transportation in Egypt constitute about 90% of the total trade, out of 80 billion tons cargo movement, there are about 70 billion tons are transported over the roads network every year. Currently the road network is very congested and already leads to some other serious problems like road safety, noise, and pollutions within cities; also, this mode of transportation has negatively affected on the road system by increasing the environmental pollution and the cost of transportation.

The road haulage sector is not optimally structured and organised; the fragmentation of operators dominates the market, the level of professionalism of the industry does not sufficiently match international standards, and roles governing international road transport need further improvements and fine-tuning. Egypt has one of the highest incidences rate of road fatalities per miles driven in the world. There are few, if any road markings. Most traffic lights signals appear not to function. Traffic rules are routinely ignored by impatient drivers: vehicles travel at high rates of speed or the wrong way on one-way streets. Road safety is not given sufficient attention, and the regulatory, enforcement and infrastructure dimensions pertaining to this issue are not developed enough.

Rail ways Transportation

An extensive rail network exists in Egypt; however a significant portion of it is not modern and non-interoperable. At the time being, enhancement of rail infrastructures is main issue in most of the countries,

The Egyptian railway system is the oldest railway network in Africa and the Middle East. The first line between Alexandria and KaferEassayat was opened in 1854. Today, the system is about 7,063 km long and is operated by the Egyptian National Railways, carries about 800 million passengers and 12 million tons of freight annually. A major investment scheme is planned to begin with the aim of modernizing the rail network and improving safety standards. Trains are usually a safe means of transportation in Egypt. The operational capacity is very limited due to the fact that in Egypt the priority of track use is given to passenger transport

River Transportation

In addition to the seaport there are a number of important inland water berths used in handling local river transportation and passenger ships. The Nile River system (about 1,600 km or 1,000 mi) and the principal canals (1,600 km.) are important locally for

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transportation. The Nile transportation contributes to about 2,590 million tons/km of goods and commodities.

EUROPEAN/EGYPT PARTNERSHIP

The bilateral relationship between Europe and Egypt has significantly improved the condition for trade between the EU and Egypt has more than doubled and reached its highest level ever in 2012 (from €11.8 billion in 2004 to €23.9 billion in 2012). The EU is traditionally Egypt's main trading partner, covering 22.9% of Egypt's trade volume in 2013 and ranking first both as Egypt's import and export partner.

A significant short straight maritime route between the Egyptian ports and the corresponding routes in Europe facilitates the handling and movements of cargo between both sides of the North-South of Mediterranean. Therefore, Egypt is a major trading partner for the EU in the Southern Mediterranean region. The Euro-Egypt trade partnership necessitates many obligations from both sides of the partnership frame.

The outcomes of this historical relation between Egypt with its remarkable population (87 million) and the Europe indispensable relationship between both sides of the Mediterranean will strengthen, grow and tighten over the years to come. There are tangible assistants made directly to Egypt from European funds are seen in every economical direction in Egypt, however in return the amount of the imports trade from Europe is in the ration of 10 times of European aids to Egypt.

THE EUROPEAN GEOSTATIONARY NAVIGATION SATELLITE SYSTEM EGNOS

EGNOS is a satellite-based augmentation system (SBAS), designed and developed to augment the open public service offered by the US Global Positioning System (GPS), by providing correction data that enables to improve GPS position accuracy, and integrity information about the GPS system. In future EGNOS will also augment the Galileo. EGNOS is capable to enhance the information provided by satellite navigation systems. EGNOS significantly contributed to the safety and efficiency of navigation, it can provide multi systems augmentation not only to the existing GPS and GLONASS systems but shortly will provide reliable and continuous augmentation and integrity to Galileo and the Chinese Satellite System Compass. EGNOS receivers are going to possess a tangible position in the marketplace contained in Euro-med countries. Such spreading of EGNOS service in the region will achieve a perfect interoperability between the operational satellites systems. This interoperability allows the manufacturers to develop terminals that operate with Galileo, GPS and GLONASS.

Both EGNOS and the European satellite navigation system, Galileo serve as the backbone for a wide-range of solutions tailored to navigation at sea and in inland waterways of commercial and leisure vessels, search and rescue activities, port operations and environmental protection. EGNOS can also provide Positioning, Navigation and Timing

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29 - 31 MARCH 2015**

PNT services for all sort of application including the most critical ones along many others stated as the multimodal transportation

Maritime activities will rely mainly for Positioning, Navigation and Timing PNT on the services provided by E-GNSS. The use of ground augmentation systems have many drawbacks and soon will be phased out for its insufficient coverage and shortcomings in precise positioning. EGNOS, is providing continuous availability, position reliability, and returns links for survivals at sea. Interoperability and system integrity are guaranteed through EGNOS receivers. New businesses will be developed in Middle East countries, such as services providers companies, positioning related insurance, EGNOS dealers and partial receivers manufacturing will add to the job creating everlasting issue.

Today global positioning and satellite navigation systems are already used in almost all modes of transport, and particularly in telematics and Intelligent Transport Systems (ITS) for land and freight transport and in logistics applications.

EGNOS and Galileo constitute the European Global Navigation Satellite System (E-GNSS). EGNOS, which is operational since 2009, Europe is first venture into satellite navigation and paves the way for Galileo, Europe's independent global satellite navigation system, Galileo presently under deployment. Galileo will provide further improvements on a global scale when it will become operational.

EGNOS proved its capabilities to improve the accuracy of the current GPS signals and provides integrity information, making it suitable for applications requiring accurate and reliable positioning. EGNOS is able to enhance today's operational ITS solutions based on GPS in Europe and in countries outside the European boundaries.

Promote EGNOS outside Europe particularly in neighboring areas. Among these many European awareness initiatives, targets the countries of the Euro-med region, namely Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia, preparing for an optimal adoption and exploitation of EGNOS services.

Tense of types of ships, multi thousands of them ranging from small crafts up to mega sizes ships trading every day around the Earth's oceans and seas, 99% of them are relying on GNSS for navigation. Specialized ships and ships navigating in navigational channels and narrow water ways are mostly relaying upon the enhanced positions provided by the ground or space augmentation systems. Global maritime traffic is increasing, specifically in the ports and the waterways in the Euromed Region are becoming more congested.

More than 82% of ships operating in Mediterranean and Red Sea are calling or register in one of the Euromed countries and relying upon GNSS for navigation. Such reliance has great concern upon the quality of the GNSS services provided by the existing GPS and GLONASS systems. EGNOS has been developed to augment and improve the accuracy and the reliability of both GPS and GLONASS information by correcting signal measurement errors and by providing information about the integrity of their signals.

Safety and security of freight transport operations are common concerns for involved players, and for this reason, the attention of industries and authorities is focused on finding solutions to increase effectiveness of security and trade compliance. As a fact, traceability and monitoring are key elements both for intelligent and efficient transport logistics. In this

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(MARLOG 4)
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29 - 31 MARCH 2015**

respect localisation and tracking technology can come to aid, by enabling: The continuous reliable control and monitoring of goods traffic during transport and the collection of data to be further analyzed for statistical reporting and incident prevention.

With the recent rapid development of information and wireless communication technologies, there is an increasing adoption of real time tracking also in the freight transport sector. The impact of such technologies on the supply chain structure and logistics performance is evident, and there are various examples of operational sustainable business cases in which tracking systems have been implemented, with great potential to grow in the future. As a fact, the use of real time tracking technology in logistics brings impact to both the shippers and the carriers, however there are some cases in which it is not only a matter of efficiency and commercial advantages while it is also for ensuring safety and security in the goods' supply chain. Tracking and tracing solutions (also classified under the category of ITS) are widely adopted for the transport of goods. These solutions are largely based on devices using satellite navigation technologies primarily GPS) for localization and different telecommunication means for data transmission (satellite and/or terrestrial). These devices are installed on board the freight truck or on the travelling asset (e.g. container), and can integrate sensors (mainly based on Radio Frequency Identification - RFID technologies) to enable the monitoring of the status of the goods. The more valuable the goods, the more economically justified the tracking & tracing.

Beyond that, users and authorities are increasing their requirements for position accuracy and reliability, and that is why the industry is exploring the use of technologies enabling to cope with such needs. This is where EGNOS, comes to an aid.

EGNOS Data Access Service (EDAS) launched in 2012, delivers a terrestrial commercial data service. It consists of a server that gets the data directly from EGNOS system and disseminates it via terrestrial networks in real time, within guaranteed maximum delay, security and performance. EDAS is particularly suitable for professional applications. It provides EGNOS raw data and corrections enabling software solutions that implement products and value added services built on them (for example they can deliver EGNOS data via different telecommunication means and/or process them to provide added value services). In this way, EDAS enables to augment the performances of the EGNOS Open Service, OS by improving its availability and further enhancing GPS position accuracy. Besides, EDAS enables to qualify and guarantee the GPS position information by exploiting the EGNOS integrity.

EGNOS infrastructure consists of three geostationary satellites over Europe and a network of ground stations (Ranging and Integrity Monitoring Station - RIMS) located to provide services with a Euro-Mediterranean coverage that includes southern Europe, North Africa and some Middle East countries. The EGNOS RIMS network supports a flexible network geometry that gradually adapts to service coverage requirements evolution. From the originally envisaged coverage over European countries, the EGNOS RIMS network has been expanded over Europe's neighboring areas, thus increasing the number of beneficiary countries.

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29 - 31 MARCH 2015**

- A tracking device to be installed on the object (land, sea, and river vehicles) and able to provide the relevant position by means of GPS+EGNOS; the tracking device integrates a GPS/EGNOS chipset and it is configured to use EGNOS OS and EDAS. Detailed information about the characteristics of the devices and how it can be mounted.
- A software solution named LCS (Location Server) running on a server; LCS enables the chipset of the tracking device to use EDAS and provides value added services built on it. Basically, LCS is the elements of the tracking and tracing system that enables the use of EGNOS and the exploitation of the relevant features (i.e. corrections and integrity information).

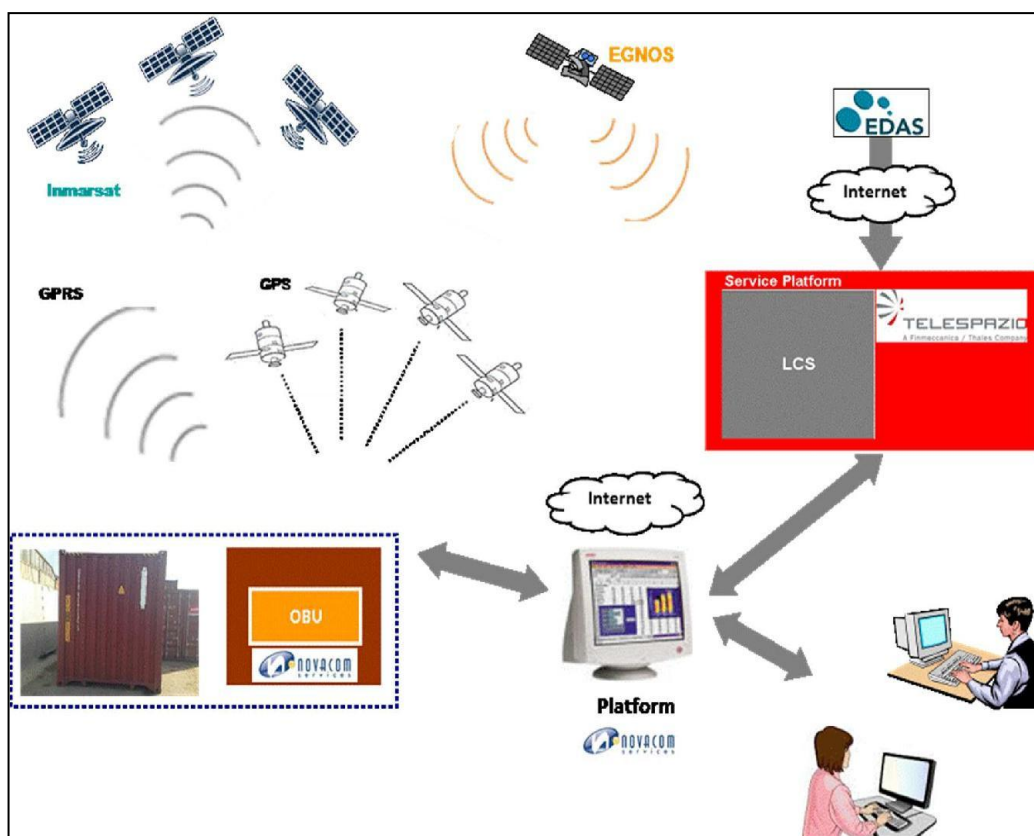


Figure 1 ITS solution for tracking and tracing containers

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A SUSTAINABLE DEVELOPMENT PERSPECTIVE FOR MEGA PROJECTS
29 - 31 MARCH 2015**

The tracking design and dimensions are driven by the need to cope with the stringent requirements and the harsh operating conditions, posed by the transshipment in different environments (inland and overseas), and unpowered for long periods.

The tracking device can be installed and removed by means of strong magnets so that to avoid fixing by means of screws/holes. Moreover, the long-life rechargeable batteries enable 6 months autonomy, to overcome the absence of any available external power source in containers, and the long hauls involved. The batteries can be recharged by plugging the tracking device to a standard adaptor.

In applications where reliability is a key feature, the use of EGNOS OS and EDAS could be of interest. The most relevant benefits are enhanced security and commercial interests.

The use of EGNOS-based services needs to include an imperative step: to have a solid programme of international collaboration available to foster support for the necessary infrastructure, and for enablers to be in place as soon as possible and covering the greatest area. The limited investment required and the high return makes the following regions the most interesting in the short and long term: the Mediterranean coast, the Arabian Peninsula and Africa. GNSS service promotion in the region is as important as creating the appropriate framework for the necessary infrastructure for operations, starting with the required steps to set up local EGNOS operator institutions for each of the sub-regions.

EGNOS provides certified signal in space for safety-of-life service for the European continent, whereas a potential extension to other areas, such as the Mediterranean, most of Africa and the Arabian Peninsula, is currently being studied by several European and local institutions.

MONITORING AND TRACKING

Monitoring and tracking in the maritime domain and other transport systems in Egypt are considered, includes regulated marine navigation (Automatic Identification system AIS). The institutional framework governing radio navigation and positioning in the maritime sector include AIS and Voyage Data Recording VDR, both of them acquire the electronic positioning based on satellite navigation system GPS.

Implementation of a harmonised legal and regulatory framework regarding the liability of multimodal carriers sector should be maintained. National and regional sharing of AIS data is developing fast, and Egyptian Maritime-wide sharing of vessel traffic data is progressing under maritime authorities based on the community vessel traffic monitoring and information system.

The Automatic Identification System (AIS) consists of a transponder unit including GPS, VHF transmitter / receiver and display / terminal. The unit broadcasts a message at regular intervals containing its identification, position, speed, course plus a number of detailed items about the ship and its cargo such as ship length, draft, cargo type, ports of provenance and destination. AIS is ship-borne transponder system designed in the first instance for maritime safety and in particular collision avoidance, the system can equally be used for all Nile River's units include passenger hotel vessels cargo, barges tugs, fishing boat and service

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(MARLOG 4)
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29 - 31 MARCH 2015**

boats. The navigational buoys along the navigational route in the river can be monitored or their correct position and assure that they are transmitting the right navigation signals. Monitoring the Navigational buoys can reduce the incidents of theft and speed up the processing of repairs in case of signal outage.

The carriage of AIS is mandatory on the basis of IMO's SOLAS convention⁷, the carriage requirements are for ships of 300 gross tonnage and up on international voyages, passenger ships, tankers on international voyages, and cargo ships of 500 gross tonnage AIS messages from ships also reach coastal receivers. In this way, authorities can obtain a continuous, real-time overview of the ship traffic in front of the coast.

The international maritime organization (IMO), defining the national obligations for the safety of navigation. The International Association of Marine Aids and Lighthouses Authorities (IALA) are responsible for setting the standard for provision of marine navigation services.

The current requirements for navigation in harbor entrances, harbor approach channels with high volume of traffic and significant degree of risk. According to IMO safety regulations, accuracy should be better than 10 m. to 95% probability, coverage should be adequate throughout the phase of navigation, and signals available should be 99.8%, and the time alarm should be better than once every 10 seconds.

Trucks and fleet management system cannot be effectively operated without a mean of tracking and monitoring system. To fulfill the monitoring and tracking of the road transportation an extra service is required providing information affiliated to the satellite system. Fleet management operations in developed countries are based mainly on the Monitoring and tracking systems, Europe in particular utilizes the European EGNOS for its indispensable accurate positioning and navigation services

There is no clear plan on the Electronic Fee Collection for road transportation. Egypt, have implemented the payment of a charge for road usage as a means of motorway financing and operation - by paying a road charge. However, identification sensors impeded into the the Monitoring and Tracking System, would facilitate the collection of the road and tolls charges without delaying the traffic flow.

Train transportation safety and operation efficiency can be achieved and improved to high degree of confidence by implementing the Monitor and Tracking System.

CONCLUSIONS

Considerations about applications as input to the plan

Concerning freight trade, in order to provide a successful multimodal/intermodal system, it is fundamental to ensure that the various transport modes and legs involved in the transport chain and interoperable and well connected. It appears these issues are not fully achieved within or among MEDA countries and transport logistics in the MEDA region can be described as relatively underdeveloped.

However, it is clear that the Mediterranean basin constitutes a priority area for the development of the Motorways of the sea and for the enhancement of trade. With respect to

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(MARLOG 4)
A SUSTAINABLE DEVELOPMENT PERSPECTIVE FOR MEGA PROJECTS
29 - 31 MARCH 2015**

the freight trade, the Blue Paper clearly proposes recommendations for applications that can benefit for introduction of GNSS:

- Companies can take a number of actions to improve facility and vehicle security. From implementing security devices and technologies to creating common-sense security practices, the following tips from Bill Anderson, group director, global security, for Ryder Systems Inc., can help prevent and mitigate losses associated with cargo theft.
- Newly introduction or further enhancement of the automation of customs declaration and clearing procedures
- Conducts customized training to achieve increased regional awareness and demonstration of new GNSS applications for the specific needs of partner countries.
- Develops service enablers for the introduction of safety critical applications, including guidance material to be applied by national authorities and service providers.
- Elaborates initiatives towards the harmonization of GNSS safety regulations.
- Achieves improved regional cooperation on GNSS issues, including enhanced links with European GNSS operators and service providers.
- Extends the Trans-European navigation and positioning network to the region and achieves GNSS interconnection at European safety standards.

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