GNSS Applications for Safe Navigation in Egypt's Nile

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ABSTRACT

The Global Navigation Satellite Systems "GNSS" applications were broadly developed during the last 15 years, and were combined with many important events in that precise field. GNSS applications in different fields will play a key role in almost all sectors of human life activities moving its utilizations from the transportation to all domains due to their high-performance standards. GNSS provide the fastest and most accurate method for Position, Navigation and Time "PNT".

The uses of GNSS expanded particularly after the reconstruction and full operation of Russian Global Navigation Satellite System "GLONASS" in 2010, and the expected entry of European Satellite Navigation System "GALILEO" in operational phase in 2015, to represent integration and redundancy with American Satellite Navigation System "GPS".

In addition to the regional augmentation systems that cover wide areas of the world, which resulted in the development of modern navigation, positioning and tracking Systems, such as Electronic Chart Display and Information System "ECDIS" and Automatic Identification System "AIS". However, their uses are limited in North Africa in general and in Egypt in particular, despite the wide spreads of EGNOS services in North Africa.

The Nile River considered the main artery in Egypt, as it passes through the Egyptian land, it creates ports and cities on its both long sides, and it used to transport goods and tourists. Nevertheless, the Nile River has its great economic feasibility importance for Egyptian civilization; its passageways still have many small islands, shallow water, and rocks, which form dangerous obstacles to navigation by boats.

The paper reveals, the GNSS applications recommended for improving the safe navigation in the Nile River in Egypt, by using the modern navigational aids and tracking systems based on GNSS services. Moreover, it illustrates the extent of GNSS contribution for well monitoring the floating units and indicates, "Marking" the dangerous areas in the Nile river passageways.

KEYWORDS: GNSS – River Navigation – Tracking - Nile River

1 INTRODUCTION

This paper examines how Global Navigation Satellite Systems (GNSS) technology has evolved over the past years and allowed for expansion into a wide range of sectors, including inland water navigation. It analyses the factors that are driving of GNSS applications in inland water navigation and tracking.

The main outcome of this paper is that the demand on the GNSS applications is highly recommended in navigation and tracking in Egypt's Nile, representing a huge economic gain in terms of Nile transportation services provision; contribute to solving the problem of traffic congestion and reduce roads accidents and leaving the network of main roads for private cars and pick-ups.

In this context, the position and time accuracy provided by GPS after modernization, in addition to EGNOS contributions to augment GPS to meter-level accuracy, they will providing decisive positioning performance improvements and will secure safety applications, paving the way to use the electronic charts in Nile navigation, and use the AIS for well monitoring the floating units and indicates, “Marking” the dangerous areas in the Nile river passageways.

This paper illustrates, the importance of Egypt's Nile, Egypt's Nile ports including their cargo storage capacity, and the working Nile units fleet of different type and different operators are shown, and the navigation problems in the Nile River with recommended solution are presented.

2 CURRENT AND FUTURE GNSS AND THEIR AUGMENTATION SYSTEMS

GNSS is a space-based radio navigation system that achieves global coverage. GNSS allows their user's to perform wide range of applications, with small smart receivers on the ground, air, or water can calculate the precise position and time, which can be used as a reference for scientific experiments and many everyday applications.

As of 2014, the NAVSTAR Global Positioning System (GPS) of the United States and the Global Navigation Satellite System (GLONASS) of the Russian Federation are the only fully operational global GNSS. The European Union’s Galileo satellite navigation system is a GNSS in the initial deployment phase, scheduled to be operational in 2015. The China has planned to expand its regional navigation system (BeiDou/Compass) into a complete global navigation system by 2015.

The global coverage for each system is generally achieved by a constellation of minimum 24 Medium Earth Orbit (MEO) satellites distributed in 3 or 6 orbital planes, with orbit inclinations greater than 50° and orbital periods of approximately 12 hours.

These global systems are being combined with satellite-based augmentation systems (SBAs) that cover wide area, such is the United States Wide-Area Augmentation System (WASS), the Russian System for Differential Correction and Monitoring (SDCM), the European Geostationary Navigation Overlay Service (EGNOS), the Indian GPS and Geo-Augmented Navigation system (GAGAN), and the Japanese Multifunctional Transport Satellite (MTSAT), Satellite-based Augmentation System (MSAS).

In addition to regional satellite navigation system, such as the Regional Navigation Satellite System (IRNSS) of India and Quasi-Zenith Satellite System (QZZS) of Japan. So, by 2020 there will be more than 120 navigation and positioning satellites in orbit at any given time. As the user’s position and time increases with the number of satellites that can be observed by a receiver, it is possible that a user could receive signals from as many at ten satellites, leading to sub-meter level accuracy.

2.1 The NAVSTAR GPS System

The global positioning system (GPS) baseline constellation consists of 24 slots in six orbital planes, with four slots per plane. Three of the slots are expandable and can hold no more than two satellites. In June 2011, the Air Force successfully completed a GPS constellation expansion known as the "Expandable 24" configuration. Three of the 24 slots were expanded, and six satellites were repositioned, so that three of the extra satellites became part of the constellation baseline. As a result, GPS now effectively operates as a 27-slot constellation with improved coverage in most parts of the world.

Now days, the operational constellation had 31 operational satellites broadcasting healthy navigation signals including, 6 in Block IIA (2nd generation, "Advanced"), 12 in Block IIR ("Replenishment"), 7 in Block IIR(M) ("Modernized"), and 6 in Block IIF ("Follow-on"), in addition to GPS III, which planned to be launched in 2016. (Web-1

2.1.1 Current and Planned GPS Signals Structure

The L1 signal, transmitted by all GPS satellite generations, contains two codes ranging signal modulated with a navigation message; a Coarse/Acquisition (C/A) code that is available for many civilian uses, and a precision P(Y) code available to authorized users. GPS satellites also transmit the P(Y) code on the L2 signal.

The main focus of the GPS modernization programme is the addition of new civilian signals to the GPS signal structure: L2C, L5, and L1C. The legacy civil signal, C/A at L1, will continue broadcasting in the future, for a total of four civil GPS signals. The new signals are being added to the modernized generations of GPS satellites.

The second civil signal, known as “L2C”, has been designed specially to improve the position accuracy for civilian challenges, when combined with L1 C/A in a dual-frequency receiver enables ionospheric correction, the signal easier to receive under trees, and greater operating range in inland applications. The first GPS IIR-M satellite introducing L2C signal launched in 2005.

The third civil signal, known as “L5”, is designed to support safety-of-life service. The L5 signal has been designed to provide robustness via signal redundancy when combined with L1 C/A and L2C and will improve accuracy via ionospheric correction. The use of three GPS signals will enable sub-meter position accuracy without augmentation signal, and greater operating range with augmentations. The first GPS IIF satellite broadcasting L5 signal launched in 2010.

The fourth civil signal, known as “L1C”, designed to enable interoperability between GPS and others satellite navigation systems. It is designed to improve reception in cities and environmental applications. The first GPS III satellite featuring L1C signal will be launched in 2016 (Web-1). Figure 1; illustrates the accuracy of Standard Positioning Service (SPS) relative to Signal-In-Space.

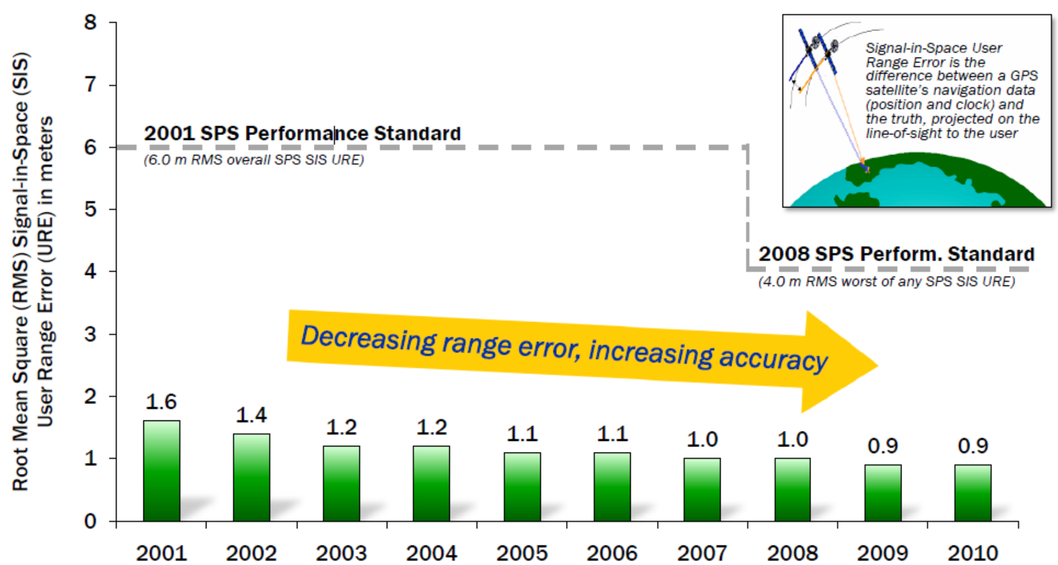

Figure 1: User Ranging Error (URE) in mater, RMS relative to Signal-In-Space (SIS)
Source: (Larry D. Hothem, 2012)

2.2 The GLONASS System

GLONASS, is a global satellite navigation system, developed and administrated by the Russian Military Space Forces at its Department of Defence, and has undertaken various reconstruction stages. The system was restored to its full operational capacity in late 2011, with space segment configuration of 24 satellites; these satellites are evenly spaced in three orbital planes, with target inclination of 64.8° to the equator. Such an orbital configuration enables continuous and global coverage of the Earth’s surface, as well as an optimal spatial location of the satellites that increases position determination accuracy. GLONASS provide two levels of positioning services the high precision to military and standard precision to civilian users. Like GPS, GLONASS satellite transmits two signals called L1 and L2.

2.2.1 Current and Planned GLONASS Signals Structure

GLONASS satellites transmit two types of signal: open standard-precision signal L1OF/L2OF, and obscured high-precision signal L1SF/L2SF. However, it utilizes Frequency Division Multiple Access (FDMA) to distinguish between satellite signals. The horizontal accuracy of standard-precision service within 5–10 meters, vertical accuracy within 15 meters, all based on measurements from four first-generation satellites simultaneously; newer satellites such as GLONASS-M improve on this.

Since 2008, new CDMA signals are being researched for use with GLONASS. According to preliminary statements from GLONASS developers, there will be three open and two restricted CDMA signals. The open signal L3OC is cantered at 1202.25 MHz; the ranging code transmits at 10.23 million chips per second.

According to Russian System of Differential Correction and Monitoring data, as of 2010, precisions of GLONASS navigation definitions (for p = 0.95) for two dimensions position accuracy were 4.46 -7.38 m with mean number of observed satellites equals 7 – 8. In comparison, the same time precisions of GPS navigation definitions were 2.00 – 8.76 m with number of observed satellites equals 6 – 11 (Web-2) and (Web-3).

As it is shown in the figure 2, in 2006 GLONASS accuracy at 1 sigma was in the order of 35 m, and in 2011 the accuracy of GLONASS reached less than 3 meters, hence similar to the GPS one.

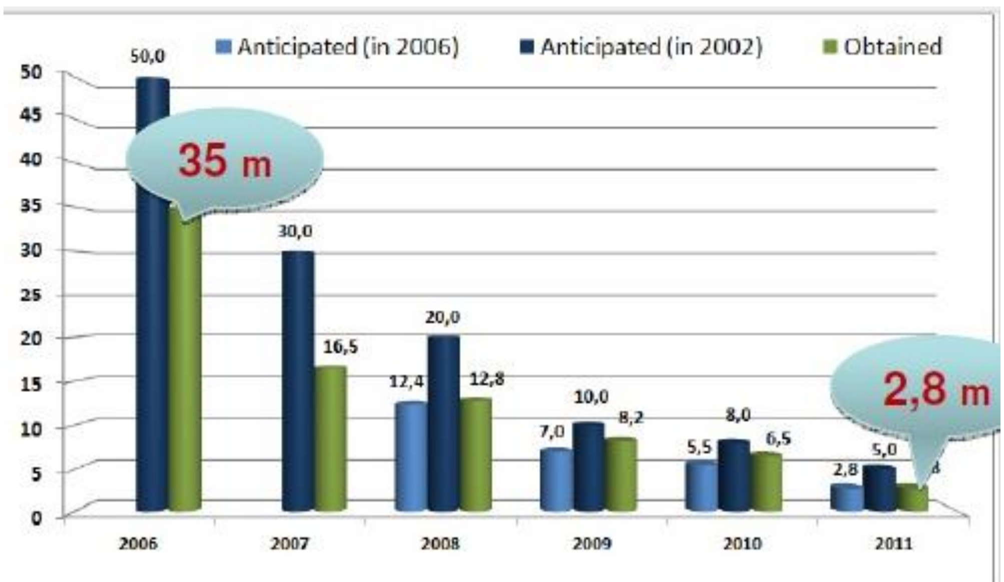

Figure 2: GLONASS User Positioning Error (1- σ), RMS relative to SIS
Source: (Oleynik, 2012)

2.3 The GALILEO System

Galileo is a global navigation satellite system (GNSS) built by the European Union (EU) and European Space Agency (ESA). Unlike GPS and GLONASS, it was considered and developed and will always remain under civilian control. Galileo is completely interoperable with GPS and GLONASS, making it a fully integrated new element in the worldwide GNSS, a powerful cornerstone that will allow more accurate and more reliable positioning, even in high-rise cities where buildings can obscure signals. In addition, Galileo will form an important element of MEOSAR, the Medium Earth Orbit Search and Rescue system, and thus a key contributor to COSPAS-SARSAT, the international satellite-based search and rescue distress alert detection and information distribution system (Web-4)

The space segment of Galileo consists of 27 satellites, which are equally distributed among three orbital planes inclined at 56º relative to the equator; in addition to three spare satellites (one per orbital plane) complement the nominal constellation configuration. Satellites are placed in altitude of about 23222 Km above the earth's surface, and an approximate revolution period of 14 hours.

2.3.1 Current and planned signals Structure

Galileo will transmit ranging signals in four different operating frequency bands: E1 (1559~1594 MHz), E6 (1260~1300 MHz), E5a (1164~1188 MHz) and E5b (1195~1219 MHz).

The Galileo E1 band is centered at 1575.42 MHz. It comprises two signals that can be used alone or in combination with signals in other frequency bands, depending on the performance demanded by the application. The signals are provided for the open service and the public regulated service, both of which include a navigation message. Moreover, an integrity message for the safety-of-life service is included in the open service signal.

The Galileo E6 signal is transmitted on a centre frequency of 1278.75 MHz and comprises commercial service and public regulated service signals, which are modulated with a navigation message and encrypted ranging codes.

The wideband Galileo E5 signal is centered on a frequency of 1191.795 MHz and is generated with an Alternative Binary Offset Carrier Signals (AltBOC) modulation of side-band sub-carrier rate of 15.345 MHz. This scheme provides two side lobes. The lower side lobe of E5 is called the Galileo E5a signal, which is centered on a frequency of 1176.45 MHz and provides a second signal (dual frequency reception) for the open service and safety-of-life services, both of which include navigation data messages. The upper side lobe of E5 is called the Galileo E5b signal, which is centered on a frequency of 1207.14 MHz and provides a safety-of-life service, including a navigation message with an integrity information message.

The search-and-rescue downlink signal is transmitted by the Galileo satellites in the frequency range of between 1544 and 1545 MHz (Pelton, Jr., Joseph N., et al, 2013)

2.4 Satellite Based Augmentation Systems (SBAS)

A satellite based augmentation system (SBAS) uses additional correction messages from satellite broadcasts to support GNSS signal augmentation. SBAS makes additional satellites and signal corrections available to end users therefore improving the accuracy, availability, integrity, of existing global navigation systems. SBAS, play important role in the applications that require precision and integrity service.

Several compatible systems have been deployed or are under deployment, which include WAAS in US, Mexico and Canada, MSAS in Japan, GAGAN in India, SDSM in Russia and EGNOS in Europe. The extension of EGNOS coverage to the whole African continent would make SBAS available around the world and having significant social and economic benefits in terms of reduced costs and improved accuracy in the transport sector and other domains.

2.4.1 The European Geostationary Navigation Overlay Service (EGNOS)

EGNOS is the first European SBAS, which enhances the performances of the existing satellite navigation systems (GPS and GLONASS). EGNOS is currently operational and provide signal to the users and entered into operation for Safety of Life in March 2011.

The EGNOS signal is transmitted on the same signal as the GPS L1 signal and provides correction and integrity information intended to improve positioning navigation services over Europe.

The system is based on three geostationary satellites and a network of ground stations in Europe and North Africa. Since the geostationary satellites already cover Europe and the entire African continent, EGNOS could simply extend the provision of its service to the African continent by installation of ground stations on the African territory. EGNOS allows users to determine their position within 1-2 meters accuracy, compared with the 5-10 meters presently available from any stand-alone Global Positioning System (Bosco, 2010).

2.4.1.1 Current and Planned EGNOS Services in Africa

The extension of the EGNOS coverage beyond European territory has started already with implementation activities specifically dedicated to the coverage of countries of the Mediterranean region. A set of stations have been deployed, providing an initial service in the coastal area of North Africa, Permanent stations in Mauritania, Egypt, Morocco, a Regional Plan for satellite navigation has been defined, and the services have been tested through real trials (including vessel remote tracking, rail wagon fleet localization, airport approach, and freight multimodal transportation). Further activities are now starting and will continue the effort with deployment of additional infrastructure in the same area.

Beside the coverage of North Africa and the Mediterranean area, cooperation is on-going with the Republic of South Africa, for the implementation of a system for the provision of SBAS services over Southern Africa, which would be a first module that, when integrated with others, would allow the provision of services over the entire continent. In this regards a temporary EGNOS reference stations installed in several African countries including Chad, Cameroon, Central African Republic, Congo, Ethiopia, Kenya, Zambia, Namibia and South Africa (Bosco, 2010).

2.4.1.2 Benefits of EGNOS in Africa in Maritime, and other user Domains

EGNOS services have positive impacts in maritime applications and other transport domains, such as in maritime navigation along the shores and in approaching ports, land surveying and mapping, rail transportation, inland waterways, and in the oil operations and mining industry.

The use of satellite navigation technology to support train transportation will lead to efficient operation, reduce the accidents in addition, important costs savings, mainly due to reduced maintenance of signaling and communications equipment in the rail network, and adjust the timing of the departure and the arrival of trains between stations, synchronizing the passage of trains in an automated manner. The implementation of GNSS in river transportation will also increase efficiency and safety with respect to the current situation by enabling RIS (River Information Systems)

2.5 GNSS Applications in Inland Waterways

2.5.1 River Information System (RIS)

RIS designed predominantly to ensure safe in inland waterways navigation and to offer the situation for safe and competent navigation along rivers. It facilitates inclusive planning of ship traffic in restrained waters, thereby contributing to a more efficient uses of inland waterways. Moreover, it supports the riverboat observing and Tracing on inland Electronic Chart Demonstration and Information System and Radar, by exchange hug amount of information between ship-to-ship, ship to shore, and shore to ship. RIS afford the following services:

- **Fairway Information Services (FIS)**

Fairway Information Services contain organizational information including geographical, hydrological data that are used by captains and fleet managers to plan, perform and monitor voyages. Fairway Information Services afford dynamic and static information about the usage and status of the inland waterway infrastructure, and support tactical and strategic navigation decision-making. Fairway Information Services contain data on the waterway infrastructure only and therefore consist of one-way information from shore to ship/office. Fairway Information Services mainly provided by standardized

Electronic Navigational Charts (ENC) and standardized Notices to Captains (NtS). Notices to Captains provided through internet.

- **Traffic Information Service**

There are two dissimilar types of traffic information: Tactical Traffic Image (TTI) and Strategic Traffic Image (STI)

A Tactical Traffic Image supports the ship's master in making immediate navigation decisions in an actual traffic situation, and allows captains to make navigational arrangements with other vessels, as it contains dynamic information such as the heading of vessels, speed, position and specific vessel information of all targets identified by radar and Automatic Identification System (AIS). TTI can be displayed on an ECDIS.

On the other hand, a Strategic Traffic Image affords an overview of the traffic situation over a relatively large area. It is used for planning and monitoring as it can provide the user with information about proposed voyages of vessels, dangerous cargo and requested times of arrival (RTA) at defined points such as locks and terminals (TRKC, 2010).

2.5.2 Inland ECDIS

It is a system for the presentation of electronic inland navigation charts and additional information. Its persistence is to contribute to the safety and efficiency of inland navigation and thus also to the protection of the environment. Inland ECDIS used simultaneously to decrease the workload when navigating the ship as compared to traditional navigation, and for information methods. It also provides the basis for other River Information Services (RIS), e.g. Inland AIS. It is either an autonomous device or a software running on a standard personal computer (PC). Its application conforms to this standard and used for the display of Inland ENCs. Inland ENCs (IENCs) means the electronic inland navigation chart issued for use with ECDIS. It contains all chart information necessary for safe navigation and additional supplementary information that may considered necessary for safe navigation.

In the information mode, Inland ECDIS equipment acts as an electronic chart and serves to guide and to provide information about the waterway. It is also possible to display other vessels, which are equipped with Inland AIS, if the ECDIS connected to an Inland AIS transponder. Moreover, Inland ECDIS used for conning the vessel by using radar and underlay ENC objects. The vessel's position must consequent from a continuous positioning system whose accuracy is consistent with the requirements of safe navigation.

2.5.3 Inland AIS

Inland AIS based on transponders located on vessels and other locations. Through radio signals AIS transponders, send out messages. These messages can be received by all other AIS stations, on ships and onshore, in vicinity of the sending station within VHF radio range. This happens automatically and periodically, with shorter or longer intervals. A fast-moving ship will send out AIS messages at shorter intervals than a ship that is travelling slower or moored. Two dedicated VHF radio channels reserved to exchange AIS messages. AIS consist of hardware and software, the hardware is an AIS station with built-in GPS.

Data in these messages includes Static, dynamic, and voyage related data, which contains the identity of the ship, the position, and other ship-related information. Some of the information, such as ship identity and position, automatically broadcast. Other information, such as navigation status, destination, and dangerous cargo category, can be input manually by the skipper. Dynamic information of a moving ship sent out and normally received at least every 12 seconds. Static and voyage information sent out and normally received only every 6 minutes. The quality of the received data is only as good as the quality of the data input on board the transmitting ship. This includes the quality of the manual input, the configuration, and input of the connected sensor(s). The data in an Inland AIS station should therefore kept accurate.

In addition to the main task of identifying other ships, AIS offers a means of exchanging safety-related information. Safety-related messages and important information such as water levels or calamity information regarding dangerous situations on the waterway are examples of this kind of information.

The collected information sent by the Inland AIS stations used for monitoring purposes. This information gives the authorities an overview of the situation on the waterways, ships heading towards their locks and bridges, and ships leaving their network.

2.5.4 Inland ECDIS/Inland AIS Overly

Inland AIS is only useful on board a ship when information of other ships displayed on an Inland ECDIS. Thus, it strongly recommended combining Inland AIS with Inland ECDIS. This permits AIS data of other ships and from shore to be displayed on the Inland Electronic Navigational Chart (IENC), and user-friendly presentation of the content of AIS messages, AIS technology will be therefore an effective supplementary aid of radar for collision avoidance in combination with the electronic chart.

2.5.5 Inland AIS on Aids to Navigation (AtoN)

AIS provide a suitable means for accentuating classic Aids to Navigation (A to N) for the marking of buoys, and wrecks. AIS A to N message transfers the position and the meaning of the Aids to Navigation as well as information if the buoy is on the required position or if it has been swept away. This AIS A to N message transmitted either by an AIS shore station or by a specific AIS A to N station mounted on a buoy or lighthouse. The AIS A to N message can represent a real buoy lying in the water or a position where no real buoy is present. In the latter example, this called a virtual A to N. Virtual A to N’s presented on an ECDIS chart and may be utilized to mark a wreck, or to mark a fairway in poor visibility circumstances, and to mark a prohibited or dangerous area.

3 NAVIGATION IN EGYPT’S NILE RIVER

Nile River is one of the oldest rivers in the history; the Nile receives its name from the Greek “Neilos”, which means a valley or river valley. The Nile is a major north-flowing river in north-eastern Africa, considered as the longest river in the world; Nile is actually longer than South America's Amazon. It is approximately 6,853 km (3700.32 N. miles) long.

The Nile is an "international" river as its water resources shared by eleven countries. Actual, the Nile is the primary water source of Egyptian citizen the river considers the principal artery of life in Egypt. Moreover, The Nile is the donor of life to Egypt as the Greek historian Herodotus wrote, "Egypt was the gift of the Nile". Most of the population and capitals of Egypt lie along the Nile valley north of Aswan, and nearly all the cultural and old sites of Ancient Egypt found along riverbanks. The Nile ends in a large delta that empties into the Mediterranean Sea.

3.1 The Nile River in Egypt

The river Nile is the main artery in Africa the length of river Nile passes through the Egyptian land is 3126 km, it divided to three navigational courses or passage categories, the first of length 2116 km the second categories is 121 km, the third, is 813 km.

At the northern limit of Lake Nasser below the Aswan High Dam, the Nile resumes its important course of 1743 km. North of Cairo, the Nile splits into two distributaries that feed the Mediterranean the

Rosetta Branch to the west and the Damietta to the east forming the Nile Delta. The Nile has long been used to transport goods along its length until the completion of the Aswan High Dam ended in 1970 fundamentally changing farming activities. The river's flow disturbed at several points by the Torrents of the Nile, which are sections of faster-flowing water with many small islands, shallow water, and rocks, which form an obstacle to navigation by boats. (Al Rasheedy, 2007)

The first cataract, the closest to the mouth of the river, is at Aswan, north of the Aswan Dam. This part of the river is a regular tourist route, with cruise ships and traditional sailing boats. Many cruise ships ply the route between Luxor and Aswan, stopping at Cities "Edfu and Kom Ombo" along the way. Security concerns have limited cruising on the northernmost portion for many years.

3.2 Egypt's Nile Ports, their Cargo Storage Capacity and Working Unit's Fleet

The Nile River considers not only the source of water required for irrigation and hydroelectric power production, but an important way of cargo transportation and tourism. The barges fleet uses in cargo transportation and the tourists through the river Nile. In less than a decade, approximately 600 million tons of goods will need to transport inside Egypt annually. (Younis, et al, 2011)

The country must cope with such a large rise in traffic of cargo transportation, which extremely increased from 82.6 million tons in the year 1979 to 570 million tons in the year 2007, and it expects to reach 872 million tons by the end of the current year 2014. Therefore, the development of navigation in Nile River has great importance because it will reduce the load on "road transportation" with the hugely increased of population, and to reduce the cumulative congestion on Egyptian motorways and a decrease in the air pollution and overall transport costs. (Saber, 2011)

Table 1: Working Nile's river units fleet of different type and different operators

Number of working units	**Type of Units**
2	Floating winches
2899	Passengers
48	Research units
1247	Single cargo units
111	Double cargo units
40	Service units
3	Sounding boats
296	Tourist Service boats
357	Towing units
5003	**Total units**

Source**:** (Saber, 2011)

Table 2: The Egyptian Nile River Ports from Aswan

Name of the Port	Position	Cargo Storage capacity/ Tone	Cargo	
	Km from Aswan		Import	Export
Iron and steel co	9	3000	Petroleum products	-
Abo sable for Fertilizer co	9	15000	Phosphate	-
Kima	10.5	2000	Fertilizer raw	Fertilizer
Tanash	10.5	2000	Aswan Tafla	Aswan Tafla
Algazirah	12	3000	-	Mud
Alshima	13	1000	-	Mud
Alnasrab	15	1500	Phosphate	Phosphate
Al aqbah	20	2000	-	Mud
Al aqbah	22	3000	-	Mud
Al bayarah	41	15000	Chemicals-sugar cane Others	Molasses
Adfu- sugar	106	2000	Diesel - Limestone	Molasses – sugar raw
Al mawardah	106	180	Phosphate	Phosphate
Ferrosilicon.co	115	500	coal	Ferrosilicon products
Al sebaeyah	143	30000	-	Phosphate
Sokar Armant	203	30000	Chemicals-sugar cane Diesel - Others	Molasses – sugar raw
Sokar Qaus	257	50000	Production raw materials	Molasses – sugar raw
Sokar Deshna	314	10000	Production raw materials	sugar
Sokar Naga Hammady	340	50000	Production raw materials	Molasses – sugar
Al aluminum Elnahry	347	60000	-Aluminum raw materials -Coal	Aluminum products
Al Balyana	391	10000	Cars & passengers	Cars & passengers
Sokar Gerga	394	?	Production raw materials and Fuel	Molasses
Assiut thermal station	456	35000	-Petroleum products - Production raw materials	-
Petroleum Port	456	Warehouses	-	Petroleum - kerosene - diesel
Assiut Cement 1	556	20000	Petroleum	-
Assiut Cement 2	556	60000	Petroleum	Fertilizers

Mnqbad Fertilizer factory	556	50000	Phosphate - sulfur	Fertilizers
Nile of pare Cotton.co	702	7000	Cotton	Cotton
Bani Khaled - Samalout	705	10000	-	Limestone
Al Tebbin Limestone	925	70000	Limestone	Iron products
Al Tebbin El nahry	925	17750	-	-
Al Tebbin Coal factory	927	125000	Coal Jerry	Coal
National cement Factory	930	7000	cement	Bagged cement
Portland cement factory	935	9000	-	Bagged cement
Samalouty Limestone	935	7000	-	Limestone
Al Hawamdiah sugar factory	940	1000	Spare parts, fuel, and Production raw materials	Sugar - Molasses
Equipment manufacturers	940	7000	Production materials	Equipments
Al maasarah	940	4000	Aluminum products	Aluminum products
Torrah	945	5000	-	cement
Athr Elnaby	952	20000	Stones - powder	-
Embaba Warehouses	960	60000	-	Wheat
Al kabreet	986	40000	-	Sulfur
Phosphate - Ismailia Canal	995	60000	Phosphate	-
Al nahdah- Nubarriya Canal	1136	80000	Sulfur	Sulfur
Al Metras - Iron and Steel Company	1152	5000	Production materials	Aluminum products
Al Metras- Egypt aluminum.co	1152	5000	Aluminum products	Aluminum products
Total storage capacity		**994930**		

Source: (Saber, 2011)

3.3 The Nile River Navigable Channels

The Nile familiar as a navigable channel throughout the history of Egypt, because of the Aswan High Dam and barrages the Nile in Egypt became under control and navigable more than before During the 20th century, dependence on the waterways as a sole source of transportation has been reduced as facilities for air, rail and highways have expanded.

The Nile extends about 950 km from Aswan High Dam to Cairo, and divided into two branches, the Rosetta branch and the Damietta branch each branch is about 200 km in length and finally reaches the Mediterranean Sea. Completed in 1971, the Aswan High Dam provides a great barrier of silt and a great control on the flow discharge.

There are four main barrages on the length of the river Nile from Aswan to Cairo, each barrages has a navigational lock control water level and discharge. The improvement of navigation in the river Nile is possible because Nile has a gentle slope, in addition to its low energy assets with a controlled discharge and water level. (Raslan, 2001)

3.4 Navigation Problems in the Nile River

At the recent time, Nile river transportation cannot participate with land transportation in solving the transportation requirements. The lack of enough water depth for navigation is a problem that threatens the navigation in the Nile River and the tourism industry as a result, since most of Nile water used for irrigation (about 85%), the water level in the Nile River affects by the irrigation supplies all over the year. During July and August, the irrigation water rations are high. While in December and January, the water requirements are low. As a result, water level in the Nile during December and January is the lowest throughout the year and navigation composes a real problem during this period unless additional water is released from Aswan High Dam.

On the other hand, Lack of experience among boat navigators, the absence of the suitable navigational aids and landmarks, change in the level of the river bed, the navigational information of the channels is not well defined, and continues change of the water level "the variation of water levels, along the River Nile from old Aswan Dam to Delta Barrages are the significance problems that faces the navigation in river Nile, those problems were evaluated during the period 1995 to 2009". (Raslan, 2001)

3.5 Towards Improvement of the Nile River Navigation

The development of navigation in the Nile River needs to modernization and reconstruction of the existing Nile ports facilities and services, which will create new jobs opportunities financed by new businesses based on rural cities. Nile River navigation will prosperous the business of hotel boats and increase the number of working units, which cruise extensively between Aswan and Luxor, and new routes will be planned reach to other places, and permanent navigation channel will be in place, that will growing the income of tourism industry, to accomplish such objective the river authority should execute the following projects:

- Defining the shore line of the river
- Production of River Navigational Charts
- Installation of aids to navigation, which includes; Watermarks and land mark
- Institution of control centres
- Establish continuous follow system up on the navigational channels (RIS) based on GNSS technology
- Creation of navigation traffic system
- Creation planes for the operation of the navigational channels.

4 CONCLUSION

The capacity of goods transported by Nile River is not comparable with that transported by Egyptian both, land-born truck and rail transport modes, which well expanded, and in a continuous improvement process. Since the storage, capacity of the existing ports on of the Nile River is not insignificant amount; so the Nile river ports and the infrastructure are essential to improve and develop for increasing the total cargo transporting by river mode. It will be interesting alternative to other transportation modes, and it will replicate great profits and outcomes on the Egyptian economy by increasing the investments, in addition to positive environmental impact. This development requires establishment of RIS for the river safety of navigation. Moreover, take the advantages of the utilization of existing Global satellite navigation systems "GNSS" and the available services of "EGNOS" to enhance the Nile River navigation.

A traffic management system based on GNSS rather than on radar or, even worst on visual aids only can guarantee a more secure navigation also in rather narrow areas. It should be considered that, providing RIS and enhanced security measures along the waterways would greatly help the development of Nile River Navigation.

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