

Prevention of Grounding at Mongla Port with Virtual AIS

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Abstract

About 90% of worldwide cargo transportation is performed by merchant ships. The trading is successfully completed only when the cargo is safely loaded, transported and safely delivered to the buyer. After loading vessels may navigate through channels, canals, rivers, bays, seas and oceans and carry the cargo to the destination. The navigation is done by ship's officers with the help of maps, charts and various navigation equipment available onboard. Ship's navigation is also helped from outside sources like the GPS satellites, communication satellites, lighthouses, light vessels, navigational buoys. By default, all systems must work perfectly otherwise ships may face trouble while underway. The Automatic Identification System (AIS) used by ships and ports for identification of ships. This can also be installed on light vessels and navigational buoys for identification with AIS equipment, RADAR (Radio Aid for Detection and Ranging) or ECDIS (Electronic Chart Display and Information System). Virtual AIS is a relatively new technology where no navigational buoys are placed on site but they can be detected by ships and this system will help the ships to navigate safely. Mongla Port is the second seaport of Bangladesh. It is situated in the Southern part of Khulna division and it is about 48 km south of Khulna city. Presently it has become a very busy port due to huge import of cement clinker, slag, gypsum, various fertilisers, coal, bulk edible oil, food grains, stone chips, heavy machinery and bulk LPG. Container and car carrier vessels also visit this port regularly. The introduction of Virtual AIS will help all the vessels to navigate safely throughout Pussur river, the risk of grounding will be minimised and hence there will not be any danger of oil pollution from grounded vessels and the ecological system of the Sundarbans will be preserved.

Keywords: AIS, ECDIS, RADAR, Grounding, Virtual AIS, Buoys, Pilot.

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Introduction

The Pussur river flows through the Sundarbans up to the Bay of Bengal and the Mongla port is situated on this river. Located in the delta of the three rivers, Ganges, Brahmaputra and Meghna, it is home to a significant portion of one of the world's largest contiguous blocks of mangrove forests and biodiversity (K. Mahadevia and M. Vikas, 2012). This port is mainly an anchorage port and many areas of this river are used for cargo work. There are few quays used by ocean-going vessels for container loading/unloading and LPG discharging. Few quays are also available for coastal vessels discharging imported Cement Clinker and Wheat.

For the identification of safer water, the whole river is marked with navigational buoys. They have specific colours and lights so that the vessels can identify them both in the day and at night. These buoys are fixed to the river bottom with anchors and the buoys float on the surface. Mongla port is a tidal port and sometimes the tides are very strong, especially during the rainy season. Strong tides can affect these floating buoys and shift their positions. The buoys are also shifted by cyclones and floods. Sometimes these buoys are damaged by cyclones and also due to contact with passing coastal or ocean-going vessels. Normally, the port authority transmits warning notices for shifted, damaged or unlit buoys. If a navigational buoy is shifted from its original position, ships can move near dangerous areas if not corrected the positions of buoys as required.

Virtual AIS is the solution to all these problems. If the transmitting stations are placed ashore secured and protected then it will always show the safe passage for the navigators. As the name suggests, this system uses a virtual means of navigation. It means the transmitting station is real and it will transmit real signals but the buoys are virtual. These virtual buoys will not be visible in the human eye but they will be detected well by RADAR, ECDIS and AIS and any vessel fitted with these equipment will be able to navigate safely through the Pussur river.

Background

In the year 1950, Chalna Port was established on the banks of river Pussur. It was known as Chalna port but in 1954 the port was shifted about 18 km south to a new place named Mongla. The Mongla port is approximately 48 km south of Khulna city and about 130 km northwards from the Bay of Bengal. From the very beginning, Mongla port was used for exporting jute, jute products, frozen fish and frozen shrimps. The jetty facilities were very limited and the vessels used to complete their cargo operation mostly in the anchorage areas specified in the Pussur river. A number of mooring buoys were available for loading jute cargo directly from coastal vessels by ship's cranes. Sadly, with the invasion of plastic and polythene products, the demand for jute goods has fallen sharply and the export of jute and jute products from Bangladesh reached the bottom. Once a busy loading port remained almost inactive for many years.

The port was initially designed for ships with 8.5 m draft but the depth of water is reduced at many places, presently vessels are allowed to enter the port with a maximum draft of

8.0 m. All the vessels with import cargo must discharge their cargo at Chittagong during monsoon. In winter vessels with more draft anchor near the Fairway Buoy of Mongla Port in the Bay of Bengal. A number of small coastal vessels are engaged to load the cargo from the vessel to reduce her draft. Once the draft of the vessel is reduced to the permissible draft which is normally close to 8 m. Then the vessel will be allowed to enter inside the port. If the channel is dredged and the draft of the river is increased, deep-draft vessels will be able to enter the port directly.

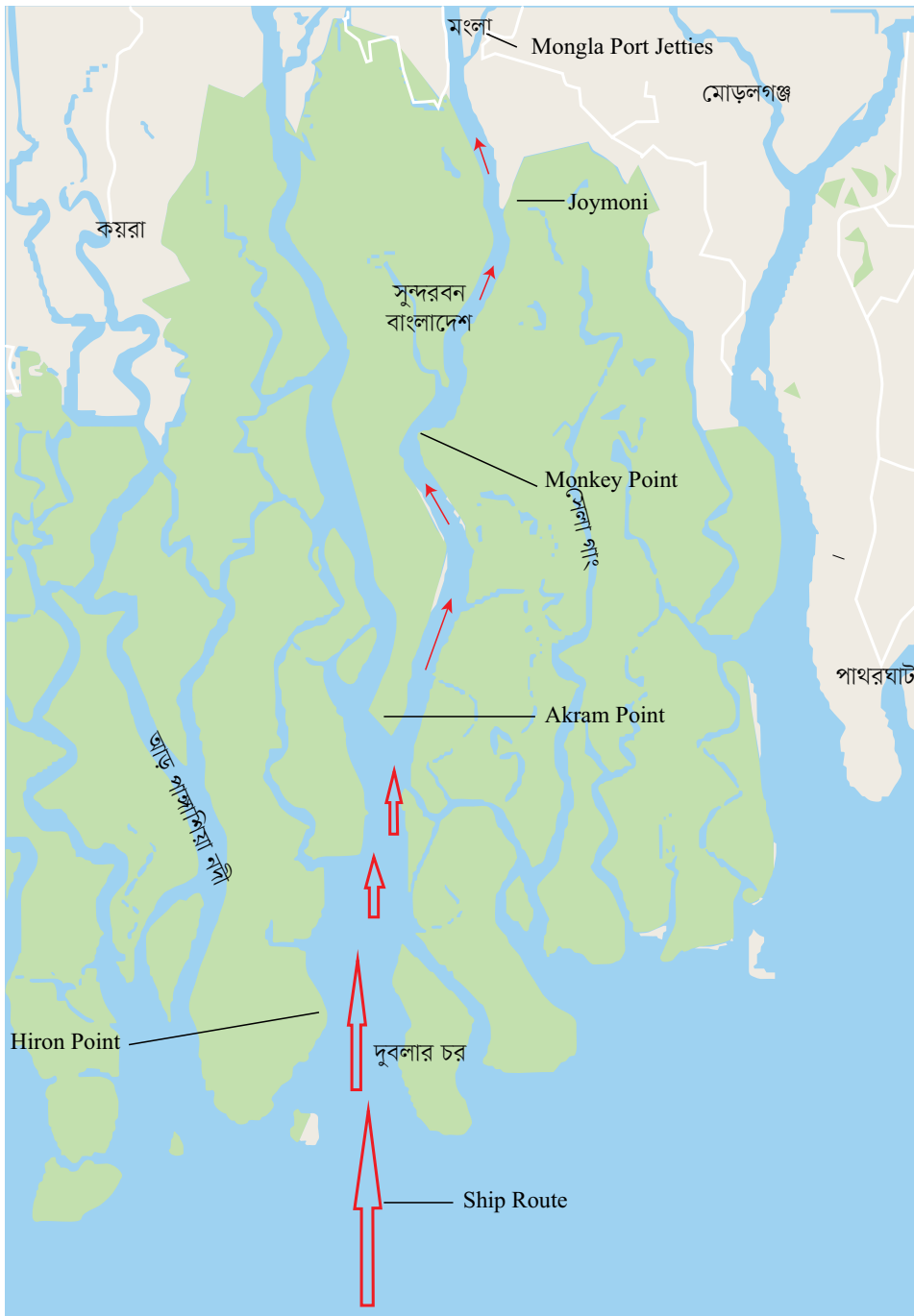
The vessels will move upstream through the Pussur river with the help of a pilot who is employed by the port and works as a local guide for the ship during navigation. The vessels must navigate on their own from the Bay of Bengal up to the Hiron Point to pick up the pilot. This passage from the Bay of Bengal up to Hiron Point consists of shallow-water patches, very strong tide, and sometimes misleading buoys. Some of the buoys are found to be out of position, unlit or damaged which are very dangerous for navigation if the updated status of each buoy is not known to the navigators.

The pilot guides the vessels up to a safe and available place in the Pussur river and drop anchor. The vessels normally maintain that position and arrange to discharge all their cargo in the coastal vessels. But the navigators are normally cautioned to keep sharp watch and check for anchor dragging and take immediate action, if necessary.

A total of 33 ships can berth in the Port (in quays, buoys, and anchorages) at a time. However, like other modern port of the world, the Mongla Port is keen to provide the highest port facilities, so that bigger draft ships can enter into the port-channel safely. (Motiur Rahman and Shahjahan Ali, 2018). The navigation channel from Fairway up to Hiron point is supposed to be marked with navigational buoys. As suggested by map and charts, buoys were placed along this channel but presently some buoys are missing, some are out of position, damaged or unlit. If all the buoys of a navigable channel maintain their specified positions and function properly, they will provide great help to the mariners for safe navigation.

The navigational buoys are big floating iron structure. They are kept in position with the help of anchors and chains which are laid on the river bottom. These buoys can be shifted by a strong tide, flood and cyclone. They can get damaged by cyclones and collisions. If a buoy is shifted, it will indicate a wrong way to the navigators and the ships may go in a dangerous area if a ship does not have up to date information about the buoys. If buoys are damaged, missing or unlit then they will not be able to show the safe way to the navigators.

Map of Pussur river



Picture no. 1: The shipping channel from Bay of Bengal towards Hiron Point and up to Mongla Port (Google Map, March 2019)

The Key Issue

Panama flagship 'MV Vinashin Iron' carrying 16,243 tons of urea fertiliser imported from China by Bangladesh Chemical Industries Corporation ran aground about 10 km away from Hiron Point near the Bay of Bengal on 2 September 2008. After receiving the information, Mongla Port Authority sent tugboat MV Shibsha to the spot but the ship could not be salvaged due to the ebb tide. "We are waiting for high tide to tug the ship in the river," said Capt Enam Ahmed, Harbour Master of Mongla Port Authority. The port authorities are monitoring the situation round-the-clock. (Source: The Daily Star, 04 September 2008).

Every year a number of ships go aground in the Pussur river. The most dangerous area is the length of the channel from the sea up to the Hiron Point. There are a number of causes for these accidents. The vessels have to go up to the Hiron Point to pick up the pilot on their own, the vessels have to cross the less depth areas in the highest possible tide. Sometimes the tide is very strong and vessels fail to navigate safely with a strong tide. As a result, vessels are drifted away from the safe water and pushed towards shallow water and if this type of movement is not controlled in proper time, vessels may end up getting aground. There are many wrecks in the Pussur river and these wrecks are causing siltation and making the channel shallower. Many places in the river need dredging.

The Pilot Boarding Station for Mongla Port is close to Hiron Point. The Pilots are local guides for vessels and they are employed by the port authority. From Hiron Point the pilots guide the vessels up to the port. From the Bay of Bengal up to the Hiron Point, which is about 46 km, the vessels are to navigate on their own and this is the most critical area of the Mongla Port. Over the years many vessels have been aground in this area and many ships have been abandoned as well.

During the Liberation War and thereafter, some local and foreign ships, (13 local and 5 foreign) sank at different reaches in the Pussur channel. Mongla Port Authority (MPA) has taken steps several times to remove the wrecks. The top portion of some wrecks have been removed but the bottom and sides of these wrecks still remain in the channel. MPA has difficulty in removing all the portions of the wrecks completely. Detail information of foreign wrecks are available in MPA. But information of local wrecks is not available. MPA only have the location of those local wrecks. For instance, one of the wrecks in the outer bar area (wreck ocean wave) causes siltation at its downstream. Thus, the existing navigation route at the downstream east side of the wreck is narrowing and swallowing and causes a threat to the existence of the route. (Md. Motiur Rahman and Md. Shahjahan Ali, 2018)

The passage from the Bay of Bengal up to the Hiron Point is supposed to be a buoyed channel. That means the total length of about 46 km of this passage is marked with green and red buoys. In normal circumstances, all the vessels can safely navigate through this channel and reach the destination. But there are many problems with the navigational buoys. The buoyed channel is currently not very safe because the buoys frequently get drifted by a strong tide, washed away by cyclones, sometimes hit and damaged by the

coastal and ocean-going vessels. The buoys act as guidance to the mariners if they are in proper position and functioning correctly but if the buoys are out of position or missing and do not show the proper colour, top mark or light, it may cause the vessels to move into the shallow water areas. The rate of siltation is very high around Hiron Point due to geographical position and presence of numerous wrecks underwater. Frequent dredging is required in the Hiron Point area to maintain the depth of water.

The Port Authority frequently gives navigational warnings about the latest status of the navigational buoys especially from the sea up to the Hiron Point. If the buoys are shifted, drifted or damaged, the port authority always tries to rectify the problems soonest. The location of Hiron Point is very far from the Mongla Port and there is always a delay for all these repair works. Again, once all the buoys are repaired and put in the right places there is no guarantee that those will maintain respective positions. Because every year some cyclones pass over Bangladesh and there is every chance to get the buoys damaged or shifted by the wind and tidal surge of the cyclones.

IMO Regulation

IMO regulation requires AIS to be fitted aboard all ships of 300 GT and upwards engaged on international voyages, cargo ships of 500 GT and upwards not engaged on international voyages and all passenger ships irrespective of size. The requirement became effective for all ships by 31 December 2004.

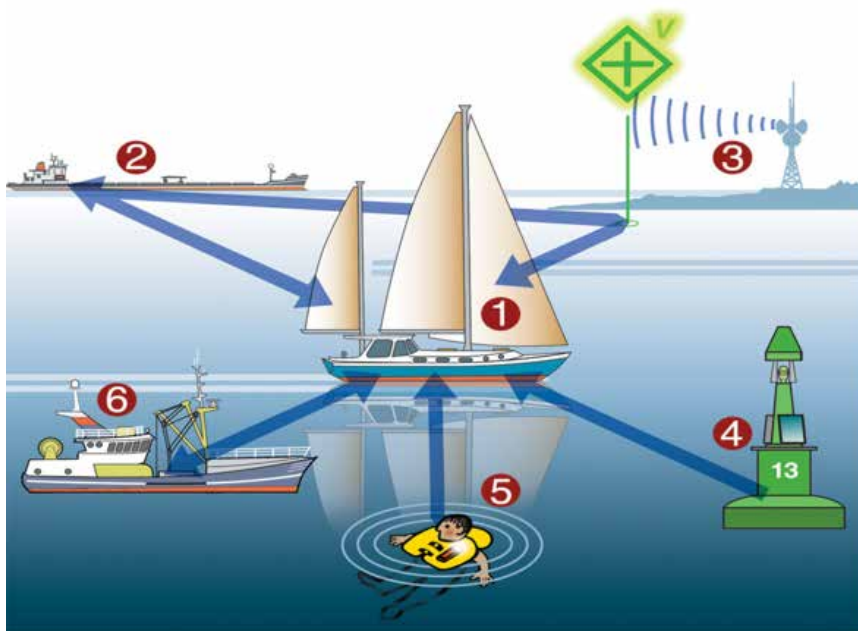
The regulation requires that AIS shall:

- Provide information - including the ship's identity, type, position, course, speed, navigational status, and other safety-related information - automatically to appropriately equipped shore stations, other ships and aircraft;
- Receive automatically such information from similarly fitted ships; • monitor and track ships;
- Exchange data with shore-based facilities.

(Source:<http://www.imo.org/en/OurWork/Safety/Navigation/Pages/AIS.aspx>)

The Automatic Identification System (AIS)

AIS is a system of data exchange between ships that was made mandatory by the International Maritime Organisation (IMO) in 2004. AIS presents advantages for maritime transportation actors: improvements in safety, improvements in the management of fleets and navigation. Its distribution also presents numerous advantages in seaway management. However, the generalisation of AIS poses problems of confidentiality for ship-owners, indeed for safety. In effect, the data transmitted by AIS are available to all ships, port authority and traffic control stations (Arnaud Serry, 2016).



Picture no. 2, the AIS network, (Picture Source, Duncan Kent, Sep 13, 2016, <https://www.sailmagazine.com/>)

The Picture no.2 shows, how AIS spreads the news of a sailing boat's crew in water: the sailing boat's AIS transceiver (1) is exchanging information with a vessel (2) receiving signals from a land-based station serving as a virtual AtoN (Aids to Navigation) (3) receiving a signal from a green buoy of the navigation channel (4) displaying the distance and bearing to an MOB (Man Over Board) via an AIS distress beacon (5) and calculating if it is on a collision course with a fishing boat (6).

As described before, the positions of buoys are always vulnerable. If the buoys are damaged or shifted then the AIS will totally ineffective. Moreover, the AIS can provide false information that may lead to the grounding of vessels. So, if the buoys do not maintain respective position then the AIS system will be very unreliable.

Virtual AIS at Haldia Port

Years ago, the navigation towards Haldia Port was very unsafe. When Virtual AIS was introduced, the passage from the sea up to Haldia Port has proved to be very safe.

Vessel Traffic Management System (VTMS) is a radar surveillance system operating on radars at strategic locations connected through microwave data link and communication system. With a view to providing more effective and safer guidance to ship from the Sandheads to Haldia through radar surveillance, the Vessel Traffic Management System (VTMS) was taken up in the first phase from the Sandheads to Haldia. The system was operational in April 1996. Further, for the requirement of ISPS code and

also for maintaining a back up to the VTMS system, a standalone VTS with Automatic Identification System (AIS) facility was established at the Saugar pilot station in May 2005. (Source: Kolkata Port Trust web site, 8 August 2019).

Use of Virtual AIS to Avoid Grounding

Every year many accidents are caused due to missing, misplaced or unlit navigational buoys and all these problems can be very effectively and efficiently eliminated by using modern technology. The Virtual AIS, which is already in existence and used by many ports of the world, is really a virtual system. The vessels will observe navigation buoys in RADAR, ECDIS or in AIS very accurately and can safely navigate by using this new technology. Ships will observe the accurate position of virtual buoys on their screen, while in reality the buoys are not fixed in the river or channel. Rather a virtual system is operating from shore which will transmit electronic signals to ships and this will show accurate position of navigation buoys on ship's RADAR, ECDIS or AIS. This system is very cheap in comparison to fixing real navigation buoys along the river. The port authority can save a lot of money and time which they may spend for fixing and maintaining all those navigation buoys.

For the Virtual AIS system, first ground stations are established and signals transmitted by these ground stations in such a way that all the ships around will find virtual Aids to Navigation (AtoN) or buoys on their ECDIS, RADAR and AIS. Navigators are trained to sail with buoys when those are visible on RADAR, ECDIS and AIS. So, it will not cause any discomfort for navigators. All the buoys will show their accurate position and the navigators will efficiently find the navigable channel and also the no-go areas.



Picture no. 3. A shore station transmitting AIS signal and a sailing vessel will find a virtual AtoNon RADAR/ECDIS/AIS receiver and avoid a submerged rock very efficiently. (Source: Peter Nielsen, www.sailmagazine.com, June 12, 2012)

Implementation of Virtual AIS in the Pussur River to Avoid Grounding

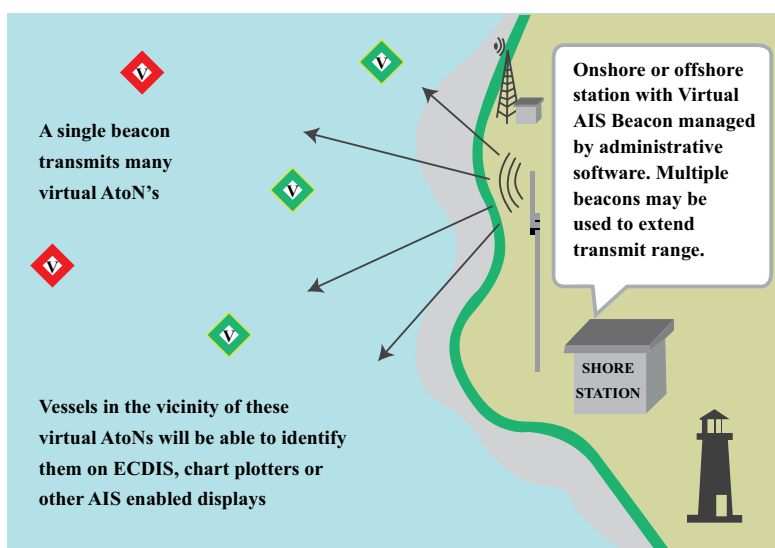
Multiple shore stations can be established along the Pussur river and ships can safely navigate by using Virtual Aids to Navigation (AtoN) or virtual buoys and safely navigate from the Bay of Bengal to the Mongla Port and vice-versa. One transmitter can generate 65 AtoNs. So only a few shore stations can cover the whole length of the Pussur river. Normally, the shore stations are fixed on land.

There is a manned harbour radio station for Mongla Port in the Hiron Point. The electricity is provided with the help of a generator. Moreover, solar panels can be fixed in this area as an alternative source of power. If a shore station is established and transmitter is fixed at Hiron Point, it can cover the dangerous area of the outer bar which is the place where the depth of water is very less, and ships go around frequently. Another transmitting station can be fixed at the Akram Point. With only two transmitting stations along the Pussur river, it is possible to maintain the virtual AIS coverage over the whole length of about 130 km of the river. All the ocean-going vessels have AIS, RADAR and ECDIS fitted and they can safely navigate from the sea up to Mongla Port jetty area.

If necessary, this system can be used in other rivers in Bangladesh. Coastal vessels with RADAR or AIS can utilise this system and perform safe navigation. When the coastal vessels use this system, they will always determine the safe navigable waterway and avoid going in dangerous areas. They will remain safe and will not cause any oil pollution.

Requirements for Virtual AIS

A ground station with continuous power supply. The minimum height for the AIS antenna is only 7 m. AIS uses VHF transmitters.



Picture no. 4, A ground station can transmit up to 65 virtual buoys or AtoNs, which can be detected by RADAR/ECDIS/AIS receivers. (Source: A. & Marine (THAI) Co., Ltd.)

AIS for Coastal Vessels

If AIS or virtual AIS buoys are fixed in the Pussur river and all other river routes of Bangladesh, it will be very beneficial for the coastal vessels. All the coastal vessels will be guided safely with the help of the AIS system. The coastal vessels will not be required to buy expensive AIS receivers. The AIS signals can be received by android mobile phones with the help of mobile apps like AIS Pilot, Easy AIS or my AIS which are available on the Google Play app store. So all the coastal vessels will be able to navigate safely through the rivers with AIS or a Virtual AIS system. Most of these apps work with internet connection but newly devised offline AIS apps are also available.

(Source:<http://allbestapps.net/android/easyais> , google play)

Conclusion and Recommendations

Mongla port has a great possibility to flourish in this region. To achieve that the authorities need to plan and execute it effectively. If the river is dredged at the entrance (the Outer Bar) then many vessels will be able to enter the port directly. Presently many ships cannot enter the Mongla Port on arrival. Part of cargo has to be discharged either at Chattogram or at Mongla Fairway which is in the Bay of Bengal and suitable only in the winter season.

The news of any accidents or grounding has a very bad effect on the shipping market. The charter hire and the insurance premiums get increased for ships going to relatively dangerous areas. If a ship remains aground for some days the shipowner will claim money for those days. Either the charterer or the insurance company will pay for all the money. The port will also charge money if a pilot and tug are employed by the port. Fortunately, the bottom of the Pussur river is soft mud and the ships do not suffer any damage but after grounding a ship is normally surveyed by classification surveyors. All the above-mentioned cost will be added on the cargo and the poor people of the country will ultimately have to pay for all these accidents and grounding of ships at Mongla Port.

Virtual AIS is very easy to maintain and it is very cost-effective. One ground station can generate 65 buoys. The AIS operates with Very High Frequency (VHF) so the range will be about 30/40 km. One station can provide coverage upstream 30 km and downstream 30 km and it means a minimum of 60 km coverage can be provided by one ground station. The virtual AIS buoys will not get damaged by cyclones or by-passing ships and also they will not be drifted or shifted by cyclones or tide. The positions of buoys or Aids to Navigation (AtoN) can be added, removed or updated easily.

When the draft of the river will be enough and the navigation channel will be safe then Mongla port will be the first choice for ship owners. Because it is always safe to perform the cargo work in the river rather than doing it in the open sea.

It is recommended that,

- a. The Virtual AIS may be established in the Mongla port and this system will help the vessels for safe navigation.

- b.** AIS system may be implemented in all other rivers which are used by coastal vessels as nowadays it is possible to receive AIS signal with android phones.
- c.** The shallow water areas of the Pussur river to be dredged as required and the draft to be maintained all over the river.
- d.** The old wrecks in the river to be removed soonest and make the river safe for navigation.

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