TRANSNAV International Journal on Marine Navigation and Safety of Sea Transportation
Volume 5 Number 4 December 2011

Ships Monitoring System

L. V. Popa
Navigation and Maritime Transport, Constanta Maritime University, Romania

ABSTRACT: Due to the increasing of the piracy attacks all over the world, the maritime transport is now facing increased risk and security problems. To prevent and minimize the impact of the piracy, the owners and the maritime administrations must take preventive actions/measures. One of these actions is the implementation at a global level of the Long Range Identification and Tracking system (LRIT). The system, mandatory under SOLAS Chapter V, Regulation 19-1, is now operational since one year and proved to be a useful security tool against piracy.

1 INTRODUCTION

Maritime piracy has been on the rise for years, according to the International Maritime Bureau's (IMB) Piracy Reporting Center. But until 2008, when pirates operating off the coast of Somalia hijacked a ship full of Russian war-tanks and an oil supertanker, the crime drew limited international attention. By early 2009, more than a dozen countries had deployed their navies to the Gulf of Aden to counter piracy, and the United Nations passed four resolutions in 2008 on the issue. In April 2009, stakes grew higher after the U.S. Navy killed three Somali pirates, and took one captive in the rescue operation of a U.S. cargo ship captain taken hostage. There are a range of measures available to combat piracy--from onboard defense systems to naval deployments to preemptive strikes. Pirate attacks are largely confined to four major areas:

- The Gulf of Aden, near Somalia and the southern entrance to the Red Sea;
- The Gulf of Guinea, near Nigeria and the Niger River delta;
- The Malacca Strait between Indonesia and Malaysia;
- The Indian subcontinent, particularly between India and Sri Lanka.

In 2008, maritime piracy reached its highest level since the International Maritime Bureau's Piracy Reporting Center began tracking piracy incidents in 1992. Global piracy increased 11 percent, with piracy in East Africa up a stunning 200 percent. Of the forty-nine successful hijackings, forty-two occurred off the coast of Somalia, including the capture of an oil supertanker, the Sirius Star. Five hijackings were off the Nigerian coast, though the IMB suggests attacks in that area are underreported. In other areas of the world, including Indonesia, piracy dropped.

The shipping industry has urged greater action on the part of the world's navies. But many ships are not even using basic deterrents.

There is no quantitative research available on the total cost of global piracy. Estimates vary widely because of disagreement over whether insurance premiums, freight rates, and the cost of re-routings should be included with, for instance, the cost of ransoms. Some analysts suggest the cost is close to $1 billion a year, while others claim losses could range as high as $16 billion. Some experts such as Martin N. Murphy, author of a 2007 study on piracy and terrorism, warn against exaggerating the threat posed by maritime pirates. He notes that even $16 billion in losses is a small sum in comparison to annual global maritime commerce, which is in the trillions of dollars.

2 MECHANISMS FOR COMBATING PIRACY

A range of options exists for combating maritime piracy, but experts stress that most of the current tactics are defensive in nature, and do not address the state instability that allows piracy to flourish. The mechanisms used or under consideration in the most

prevalent piracy area, the Gulf of Aden, can be classified as follows:

2.1 *Onboard deterrents*

Individual ships have adopted different onboard deterrents. Some use rudimentary measures such as fire hoses, deck patrols, or even carpet tacks to repel pirates. Others use a nonlethal electric screen with a loudspeaker system that emits a pitch so painful it keeps pirates away. Most do not arm their crews, both because ship workers tend to be unskilled and because many do not want to carry weapons, fearing that pirates will target them if they are armed. The shipping industry has urged greater action on the part of the world's navies. But many ships are not even using basic deterrents, writes retired U.S. Navy Commander John Patch in *Proceedings* magazine. [6]

2.2 *Naval deployments*

By January 2009, an estimated thirty ships were patrolling an area of about 2.5 million square miles. More than a dozen countries--including Russia, France, the United Kingdom, India, China, and the United States--had sent warships to the Gulf of Aden to deter pirates. There were also two multinational anti-piracy patrols in the area: the European Union's military operation, called EU NAVFOR, which began in December 2008; and a multinational contingent, known as Combined Task Force 150, which was originally tasked with counterterrorism efforts off the Horn of Africa. The United States announced a new task force, CTF-151, in January 2009. Some analysts, including a blogger for the U.S. Naval Institute, suggest that the new task force will allow the United States to seek a non-Western approach to counter piracy by partnering with Eastern navies. [6]

2.3 *Long Range Identification and Tracking*

Experts unanimously stress that the only effective long-term piracy deterrent is a stable state. When Somalia was briefly under the control of the Islamic Courts Union in 2006, the piracy acts stopped completely. Until recently, sovereignty has prevented outside states from targeting inland pirate infrastructure. A UN resolution passed on December 2, 2008, allows states to enter Somalia's territorial waters in pursuit of pirates, and another resolution passed on December 16, 2008, implicitly authorizes land pursuit.

On 19 May 2006, the International Maritime Organization (IMO) adopted Resolutions of the Marine Safety Committee MSC 202 (81) and MSC 211 (81) which states amendments to the International Convention of Safety of Life At Sea, 1974 (SOLAS) and introduces the timely establishment of the Long-Range Identification and Tracking system (LRIT). [4]

A robust international scheme for long-range identification and tracking of ships is an important and integral element of maritime security. An active and accurate long-range identification and tracking system also has potential safety benefits, most notably for maritime search and rescue. Accurate information on the location of the ship in distress as well as ships in the vicinity that could lend assistance will save valuable response time to affect a timely rescue.

At the 83rd Maritime Safety Committee the purpose and scope of LRIT was extended ultimately to include safety and environmental protection applications.

The requirements concerning LRIT have been introduced into SOLAS, Chapter V ("Safety of Navigation"), Regulation 19-1. In accordance with Paragraph 8.1 of Regulation 19-1, "Contracting Governments shall be able to receive long-range identification and tracking information about ships for security and other purposes as agreed by the Organization". Such "other purposes" would for instance include Search and Rescue (SAR), as explicitly mentioned in the new SOLAS provisions, as well as maritime safety in general and marine environment protection purposes as agreed by Resolution MSC 242(83) adopted on 12 October 2007. The IMO LRIT requires that all passenger ships including high speed craft, cargo ships of 300 gross tonnage and above, mobile offshore drilling units should automatically transmit every 6 hours the identity of the ship, the position report and time of the position. [4]

Furthermore, IMO also adopted on 19 May 2006, Resolution MSC 210 (81) amended and modified by MSC 254 (83) which establishes performance standards and functional requirements for the LRIT of ships. This states that all LRIT Data Centers and the International LRIT Data Exchange should conform to functional requirements not inferior to those specified in the Annex to the Resolution. [4]

The performance standards were then revised through Resolution MSC 263(84) adopted on May 2008 - Revised performance Standards and functional requirements for the LRIT of ships (this revokes MSC 210(81), MSC 254(83)). The system specifies that 4 position messages per day are stored and available for those actors entitled to access the LRIT information. The international LRIT system receives, stores and disseminates LRIT information on behalf of all Contracting SOLAS Governments.

The LRIT system consists of the ship borne LRIT information transmitting equipment, the Communication Service Provider(s), the Application Service Provider(s), the LRIT Data Centre(s), including any related Vessel Monitoring System(s), the LRIT Data Distribution Plan and the International LRIT Data Exchange. [1]

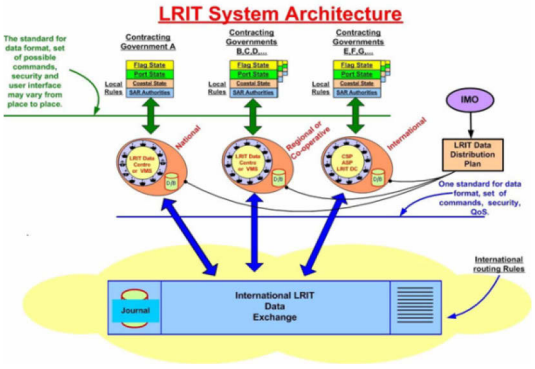

Fig.1. LRIT System Architecture

Certain aspects of the performance of the LRIT system are reviewed or audited by the International Mobile Satellite Organization (IMSO) appointed as LRIT Coordinator in December 2008 [MSC 275(85)].

Each Administration should provide to the LRIT Data Centre it has selected, a list of the ships entitled to fly its flag, which are required to transmit LRIT information, together with other salient details and should update, without undue delay, such lists as and when changes occur.

The obligations of ships to transmit LRIT information and the rights and obligations of Contracting Governments and of Search and rescue services to receive LRIT information are established in regulation V/19-1 of the 1974 SOLAS Convention.

It should be noted that regulation V/19-1.1 provides that:

Nothing in this regulation or the provisions performance standards and functional requirements adopted by the Organization in relation to the long-range identification and tracking of ships shall prejudice the rights, jurisdiction or obligations of States under international law, in particular, the legal regimes of the high seas, the exclusive economic zone, the contiguous zone, the territorial seas or the straits used for international navigation and archipelagic sea lanes.

3 SYSTEM ARCHITECTURE

3.1 *LRIT components*

The international LRIT system consists of:

- ship borne LRIT information transmitting equipment;
- Application System Provider(s) – ASP;
- Communication Service Provider(s) – CSP;
- National, Regional, Co-operative and International Data Centre(s) including related Ship Monitoring System(s) – SMS(s) and Vessel Traffic Service(s) – VTS(s); [1]
- International Data Exchange – IDE;
- the Data Distribution Plan - DDP; and
- LRIT Co-ordinator.

3.2 *Ship borne equipment*

Ship borne LRIT equipment should be capable to automatically transmit LRIT data to the selected LRIT Data Centre at 6-hour intervals and to be configured remotely to transmit data at variable intervals ranging from 15 minutes to 6 hours, following receipt of polling commands.

3.3 *Application and Communication Service Providers*

Application Service Providers (ASPs) provide services to the selected LRIT Data Centres and should:

- be recognized by the contracting governments of the associated Data Centre;
- provide a communication protocol interface between Communication Service Providers (CSPs) and Data Centres to enable remote integration of ship equipment into selected LRIT Data Centre and automatic management, configuration, modification, suspension and recovery of LRIT data transmissions;
- add defined set of data to each transmission of the LRIT information;
- provide an integrated transaction management system for the monitoring of LRIT data throughput and routine; and
- ensure that LRIT data is collected, stored and routed in a reliable and secured manner.

Communication Service Providers (CSPs) connect the ship-borne equipment with the ASP in order to ensure the end-to-end reliable, timely and secure transfer of LRIT data. Communication between ships and Data Centers may be secured by different Satellite and Terrestrial CSPs.

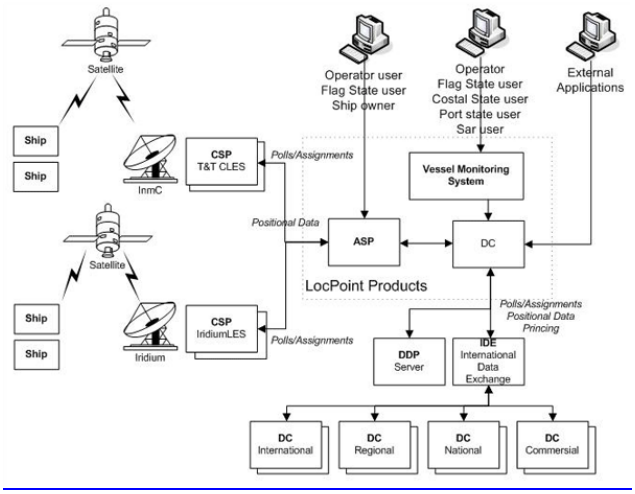

Fig.3. Global Ships Monitoring System

3.4 *International Data Exchange (IDE)*

The International LRIT Data Exchange is a message handling service that connects all LRIT Data Centres and route LRIT data between particular Data Centres using a standard agreed protocol, secure access and routing table to establish the correct distribution of the reports. Additionally it should:

- use a store and foreword-buffer to ensure LRIT data is received;
- automatically maintain journal containing headers of all routed messages;
- archive journal for at least one year for invoicing and audit purposes; and
- not store or archive LRIT data.

3.5 *Data Distribution Plan (DDP)*

The DDP is the set of rules governing the distribution of the LRIT reports between the users of the system. The rules are established by each Contracting Government and uploaded accordingly on the DDP server hosted and maintained by the IMO.

3.6 *LRIT Data Centre (DC)*

Each SOLAS Contracting Government (CG) is required to establish or participate in a National/Regional/Cooperative Data Centre. Once the DC was established, all SOLAS ships under the flag of the relevant CG will report to the nominated DC.

The appointed DC / ASP will undertake in general the following tasks: integration of ship equipment into the designated DC, initial terminal compliance testing and certification in conjunction with the Ship Operator (or nominated regulatory representatives), management of the DC activities, connection of the DC to the wider international LRIT network via the International Data Exchange (IDE), and coordination of Data Centre-to-Data Centre billing arrangements.

4 THE EU LRIT DATA CENTRE

In line with IMO requirements, the European Member States have decided to establish an European Union Cooperative Data Centre (EU LRIT CDC).The objective of the EU LRIT CDC is the identification and tracking of EU Flagged ships and the integration in the wider International LRIT system. The main advantage is that all Member States can share a LRIT information repository, a common interface to the International Data Exchange (IDE) for requesting LRIT information on ships flying non-EU flags, and a common interface to LRIT information eventually via the Safe Sea Net system.

According to paragraph 1 of the Council Resolution, the Commission is in charge of managing the EU LRIT CDC, in cooperation with Member States, through the European Maritime Safety Agency (EMSA). The Agency is more particularly in charge of the technical development, operation and maintenance of the EU LRIT CDC. It also "stresses that the objective of the EU LRIT CDC should include maritime security, Search and Rescue (SAR), maritime safety and protection of the marine environment, taking into consideration respective developments within the IMO context."

The EU LRIT CDC is operational since June 2009 in accordance with all IMO performance standards and requirements.

The general architecture of the EU LRIT system and the links between the EU LRIT Data Centre and other components of the system such as the links with the IDE, DDP, and EU LRIT Ship database are shown in the figure below. The components are similar to the International LRIT system and the EU Data Centre links with the IDE to obtain information from non-EU flagged ships.

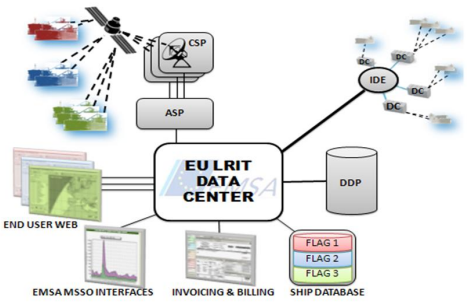

Fig.2. EU LRIT Data Centre

4.1 *EU LRIT CDC and piracy*

In order to assist the EU NAVFOR efforts in fighting the piracy acts off Somalia coastal area, the EU LRIT CDC has developed a specific anti-piracy

tool based on the Flag State LRIT reports. The tool consists of a defined polygon off Somalia coastline where all EU ships entering the polygon automatically send an alert to EU NAVFOR and changed their reporting rate from the default 6 hrs to 1 hr (see Fig. 3). The EU NAVFOR has direct access to this tool and they can visualise and closely track each EU ships navigating in the area. The close monitoring rate provides a better coordination for the EU NAVFOR escorting ships in the area.

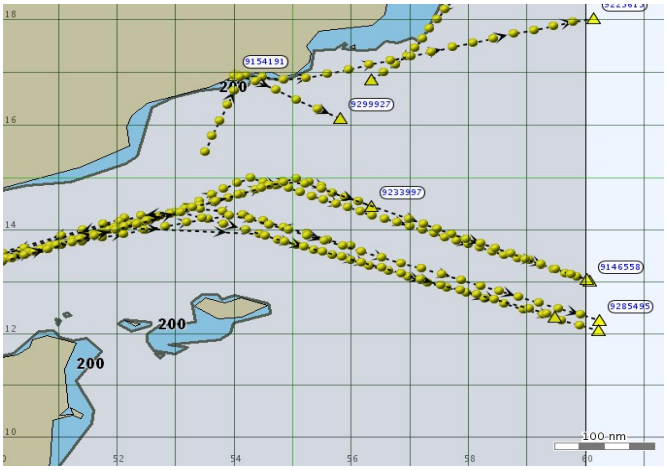

Fig. 3 – EU CDC anti-piracy tool

Based on the EU LRIT CDC and as requested by EU NAVFOR, the IMO has decided to extend the LRIT anti-piracy tool at international level in order to provide the navy forces in the area with a complete LRIT picture. Therefore the MSC .87 (May 2010) has agreed on the setting-up of a dedicated IMO LRIT anti-piracy facility which will provide LRIT reports of all ships transiting the area. This facility has become operational since July 2010 and all SOLAS CG can join the tool on a voluntary basis and provide the ship position of their ships to the navy forces patrolling the area.

This is one of the best positive examples on how the international cooperation can assist better implementation of the maritime security rules in high risk areas.

5 CONCLUSIONS

Worldwide sea traffic is increasing and security, safety and environmental risks are increasing too. Establishment of the LRIT system shall increase level of ships, coastal states and port states security and improve environmental protection, safety of navigation and efficiency of the search and rescue operations at high seas. It will increase the range of reporting requirements already imposed on ships engaged on international voyages by regulations either international (conventional) or regional and national introduced in a variety of places. International service providers should work on the basis of contracts (Public Service Agreements) signed between each one of them and IMSO or IMO. It is possible that particular flag states will reserve the right to approve service providers acceptable for their vessels.

It shall be stressed that LRIT system as described in this paper is technically operational at this stage.

Technologies are available to provide cost effective solution. Additionally according to the information presented by IMSO there is now about 45 000 ships which should participate in the LRIT system.

If all of them will send daily four reports for 20 cents, the total global cost will be around 13140000 USD per year. That is the reason that IMO and IMSO do not suspect any problems with finding the service providers. There are a number of parties with a legitimate interest in receiving LRIT data from ships:

- search and rescue, immigration, customs, quarantine and navigational services,
- security, environmental protection and Port State Control agencies,
- port authorities and ships' agents,
- commercial bodies (ships owners, cargo forwarders, charterers, etc); and
- fisheries management authorities.

Many different commercial and government owned and operated systems have been developed and introduced to cater for these interests. They vary in the type of technology used and costs of reporting a ship's position and related information. All existing conventional vessels engaged on voyages outside A1 sea areas are fitted and will be fitted with the terminals of the global satellite radio communication system Inmarsat-C for reception of Maritime Safety Information (MSI) and to meet other requirements of the Global Maritime Distress and Safety System (GMDSS). Those terminals can be used to transmit reports required by LRIT service without extra cost to the ship. Other ships may have to be fitted with additional equipment, but will be able to choose from a range of Communication System Providers.

Since 1st December 2004 the mandatory ship reporting system in the Great Barrier Reef and Torres Strait Vessel Traffic Service (REEFVTS) has been upgraded by introducing obligatory so called Pre-Entry Report and 15 minutes position updates transmitted via Inmarsat. It means REEFVTS creates already first in the world obligatory LRIT system for conventional vessels.

Experts unanimously stress that the only effective long-term piracy deterrent is a stable state. When Somalia was briefly under the control of the Islamic

Courts Union in 2006, the piracy acts stopped completely.

Until recently, sovereignty has prevented outside states from targeting inland pirate infrastructure. A UN resolution passed on December 2, 2008, allows states to enter Somalia's territorial waters in pursuit of pirates, and another resolution passed on December 16, 2008, implicitly authorizes land pursuit.

REFERENCES:

[1] Wawruch R.: Conception of the Polish national ships monitoring system based on AIS technique. Zeszyty Naukowe Politechniki Śląskiej, seria Transport, z. 51, Gliwice, 2003, s. 543-549.

[2] Wawruch R.: Global ships monitoring system. Zeszyty Naukowe Politechniki Śląskiej, seria Transport, z. 59, 2005, s. 487-493. 66 R. Wawruch

[3] Wawruch R.: Global ships monitoring system – structure and principle of work. Monograph „Advances in Transport Systems Telematics", Section III „Systems in Maritime Transport", Chapter 4 "Global ships' monitoring system – structure and principle of work", Katowie, 2006, s. 307-312.

[4] MSC 81/25/Add.1, IMO, London, 2005.

[5] VTS 22/4/6, IALA, Saint Germain en Laye, 2005.

[6] Combating Maritime Piracy**,** Stephanie Hanson 2009