Survey of Available Web Services for Maritime Tracking

Tatyana Dimitrova
Maritime Affairs,
Joint Research Center, EC
Ispra, Italy

Abstract—**In this paper we present a review of available web-services capable of tracking maritime vessels and containers. Many of the reviewed services are provided directly by the cargo carriers (with 57 such international carriers being catalogued here). They are analysed in-depth with the following criteria being used for evaluation purposes: type of tracking and useful information. We also review a range of services provided by non-carrier organizations specialising in maritime data. Reviewed services from non-carrier organizations are considered as belonging to either one of two broad categories: the ones providing container/vessel tracking and those that provide real time visualization of vessel/cargo position. Sixteen from the first category and 9 from the second are analysed in-depth with the following criteria being used for evaluation purposes: data source, type of tracking, type of access, geographical visualization, data coverage, provision of historical perspective, possibility of notifications and availability of other useful information.**

Keywords-web-based tracking, vessel tracking, container tracking, geographical visualization of itinerary of maritime object.

I. INTRODUCTION

With maritime transportation being responsible for around 90% of all external European trade and around 40% of internal trade [1] it is an integral component of the European economy. As the main vehicle for European imports and exports, maritime transportation enables trade and contacts between all the countries in the World and thus ensures the security of energy supply, food, commodities and provides. The quality of life on islands and in peripheral maritime regions directly depends on good maritime transport services. However, with over 200 million containers shipped between countries annually, only 2% are physically inspected by customs authorities [2]. Nevertheless, the immense number of containers handled (more than 20 million in circulation) and the operational pressures due to competition explain this low inspection rate. Such a low percentage of physical inspection opens a possibility for illicit activities, such as avoiding customs duties, circumventing quotas or smuggling nuclear materials and weapons [3].

All this makes the maritime vessel and container tracking a question of present interest. Such kind of tracking could have many benefits, for example, control and prevention of sub-standard shipping, reducing the risk of maritime accidents, minimizing the environmental impact from maritime transport, detection of piracy and terrorism threats, etc. With the most important benefit being the security of the citizens as benefactors of maritime transport services, and thus provision of safe and secure conditions and assurance of adequacy of the public maritime transport service for goods.

Objects of interest in the current survey are maritime containers and vessels (of the cargo type) and available websites for their tracking. Their tracking is essential also for any business that deals with buying or selling of goods from distant locations. Such maritime data could be useful also for any scientific research and analysis, which aims at creating of models for typical vessel trajectories, typical transit time between certain locations, etc. Such models, together with global disaster alerts and weather forecasts, can be used to warn vessels going to dangerous areas.

II. INTERNET WEBSITES OFFERING MARITIME TRACKING

There are many websites which offer cargo tracking and have maritime data gathered by different sources. Some offer this service via a web-based interactive application while others – via applications that have to be downloaded and installed on the local computer connected to Internet. The basic ways for trade tracking are by means of a container reference number, the bill of lading and the booking number from the shipping line. Many carriers offer additional vessel tracking which is usually performed by vessel name, but some carriers also require selection of the home port.

Some websites offer useful tools, like route finders, voyage finders or schedule finders. The route finder allows finding the possible routes between given loading and discharging locations. The voyage finder allows the user to check the status of a certain voyage by typing a voyage reference number or letters. The schedule finder allows the user to find the travel schedules between certain ports in a certain period.

Also, there are some websites that offer to the client container tracking by entering the vessel name the container is being shipped on. The result from the tracking gives to the client information for the next 10 ports of call as well as the entire vessel's statistics.

The websites for maritime track-and-trace services can be classified in two main categories – official websites of the carriers who provide tracking services for their own shipments and websites for tracking developed from different organizations which deal with maritime data and covering different carriers. These two categories will be discussed in more detail below.

A. *Official Cargo Websites*

Through the large number of existing cargo companies, we decided to include a limited number of carriers, including mostly the bigger international companies. We found in the Internet fifty-seven international carriers which have their own websites (in English) and offer some kind of tracking web service. List of these websites with the type of offered tracking can be seen in Table 1. In an additional column we marked what kind of additional useful data or tool can be found on the carrier website.

The cargo tracking is performed by Container Identity Number (CIN), Bill of Lading (BL), Booking Number (BN), Customer Reference Number (CRN), Tracking Number (TN), Voyage ID Number (VoIDN), Container Identity Number for Rail Transportation (CINforRT), Document Number (DN), Shipment Number (SN) and Purchase Order Number (PON). Some websites offer Port Tracking for date range (PT) and vessel tracking by Vessel Name (VN) or Vessel Identity number (VI). Many of the websites offer additional useful data, i.e. Port Information (PInf), Container Information (CInf), Vessel Information (VInf), Route Information (RInf), Port Codes (PC), Schedule (Sch), Schedule Finder (SchF), List of Used Ports from the carrier (UP), Vessel Finder (VF), Current Vessel Position (CVP), Transit Time (TT), Route Finder (RF) and Voyage Finder (VF).

According to the number of websites for each kind of tracking, the most offered service, is tracking by CIN - 89% of the websites provide this functionality, followed by BL - 79% and BN - 61% (Fig.1). Around 18% of the websites offer vessel tracking by VN and 9% - tracking by PON. The rest of tracking types are offered from only one website.

TABLE I. CARRIERS OFFERING WEB TRACKING

Carrier	Web Services	
	Tracking Type	***Add.Info***
ACL	CIN, SN	CInf, VInf, PC, Sch, RInf, TT, UP
ALIANCA	CIN, BL, BN	RInf, TT, CInf, VInf
ANL	CIN, BL	TT, RInf, CInf, UP
APL	CIN, BL, VN	TT, RInf, UP
CMACGM	CIN, BL, BN	TT, RF, VF, RInf, UP
COSCON	CIN, BL, BN	TT, RInf, Sch, CInf
CSAV	CIN, BL, BN, VN	SchF, RF
DAL	CIN, BL, BN	-
EMIRATES	CIN, BL, BN, VN	TT, SchF, RInf, UP
EVERGREEN	CIN, BL, BN	RInf, SchF, TT, VF
GOLDSTAR	CIN, BL	Sch, PC, VInf, CInf
FAR_EASTERN	CIN, BL	RInf, Sch
HAMBURG	CIN, BL, BN	SchF, Vinf, Cinf
HANJIN	CIN, BL, BN, VN, PON	SchF, UP, Rinf, Vinf, TT
HAPAG-LLOYD	CIN, BL, BN,VN	SchF, RInf, UP, TT
HORIZON	CIN	SchF, RF, VInf, TT, UP
HMM	CIN, BL, BN, PON	CInf, VInf, PInf, RInf, TT, SchF
MESSINA	CIN, VN	RInf, Sch
MARITTIMA	CIN, BL, BN	SchF, CInf, VInf
MAERSK	CIN, BN, DN	SchF, CInf, VInf
MSC	CIN, BL	SchF, TT, RInf, VInf, CInf
RCL	CIN, BL, BN	VInf, CInf, RF
OOCL	CIN, BL, BN, VN, CINforRT	Rinf, TT, Vinf, Cinf
NYK	CIN, BL, BN	RInf, TT, VInf, CInf
UACS	CIN, BL, BN	TT, RInf, SchF
YANG MING	CIN, BL, BN, PON, VN, PT	SchF, Rinf, PC, UP
ZIM	CIN, BL	SchF, VInf, RInf, PInf, PC
KMTC	CIN, BL, BN	SchF, RInf, TT, VInf, CInf, PInf, RF
DELMAS	CIN, BL, BN	Sch, TT, RInf, UP, RF, VF
Matson	CIN, BL, BN, VN	Sch,CInf, RF
MARFRET	CIN	Rinf, UP, Sch, RF, CInf
NAM SUNG	CIN, BL	Rinf, UP, Sch
MOL	CIN, BL, BN	Sch, Rinf, TT
NORDANA LINE	CIN, BL and BN	RF, Sch, UP, Rinf, Cinf
NSCSA	BL, VN	Rinf, UP, Sch, CVP
Tropical Shipping	SN, BL	Vinf, Cinf, Sch, TT, UP
DAL-Rantzau Shipping	CIN, BL, BN	Rinf, Sch, UP, Cinf, Vinf
SCI	CIN	Rinf, Sch. Vinf
Heung-A	CIN, BL, BN	SchF, RInf, VInf, UP, CInf
Seaboard Marine	CIN	Rinf, Vinf, Sch
Sinokor Merchant Marine	CIN, BL	SchF, Vinf, Cinf
TBS	VoIDN	Rinf, Vinf
Wallenius Wil-helmsen	BL, BN, VI, CRN	SchF, Pinf, Rinf, Cinf, Vinf
PIL	CIN, BL, BN, PON	SchF, VInf, CInf, TT, RInf

Carrier	Web Services	
	Tracking Type	*Add.Info*
CCNI	CIN, BL, BN	RInf, TT, SchF, RF, Sch, VInf
CHINA SHIPPING Australia	CIN, BL	Sch, TT, VInf, PC
K-LINE	CIN, BL, BN	RInf, Sch, SchF, VInf, CInf
MITSUI OSK	CIN, BL, BN	UP, RInf, TT, SchF, VInf
GRIMALDI	CIN	UP, Sch, RInf, VInf
MISC Agencies (Australia)	CIN, BL, BN	Sch, SchF, UP
Pacific Asia Ex-press	CIN, BL, BN, ON	Sch, RInf, VInf, CInf
Toll Shipping	TN	VInf, Sch, CInf, RInf
TRITON Overseas Transport	CIN, BN	SchF
Grieg Star Shipping	BL	UP, RInf, Sch, VInf, CInf
CNC LINE	CIN	Sch, VInf, UP, RInf, TT
LIBRA	CIN, BL, BN	CVP, SchF, CInf
CSAV NORASIA	CIN, BL, BN	TT, RInf, UP, PC, Sch, SchF, CVP, CInf

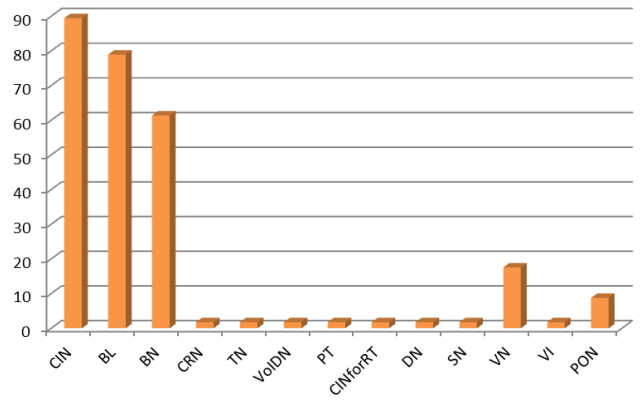

Figure 1. Percent of the websites offering certain type of tracking

As can be seen from Table I, almost all of the carriers publish some additional information. The most offered type of information (from 74% from the considered websites) is the RInf (Fig.2), including possible routes of the carriers, list and order of the ports of call. A little more than the half of the websites (56%) offer VInf which includes at least the name and type of the vessel, the flag, the year of built, the dimensions, the average speed and other. Some of the websites offer very detailed vessel information. With half of the websites (51%) CInf is offered. A similar percentage of websites (46%) offer information about the Sch and TT between the ports. In some of the websites concrete TT was marked for the travel between certain ports, in others it was possible to be calculated by the schedule data. As an additional tool (in 46% of the websites) a Schedule Finder is made available, this works by selection of ports of departure/arrival and date range. Some of the available schedules are valid for concrete dates and some are valid for certain days of the week or year (see Table III in the Annex). Some carriers use codes of the ports in their reports and for 5% of the considered carriers this data was possible to be found in the website. A few carriers offer also additional useful service - tracking by email. Registration on the website and selection of a certain container or vessel allows the user to receive email notifications for any changes to the status of the container or the vessel.

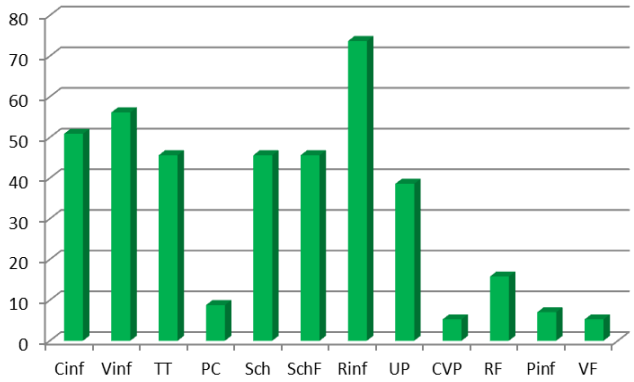

Figure 2. Percentage of the websites offering specific additional information

B. *Tracking Websites from Different Organizations*

By searching the Internet we found some organizations, which are specializing in maritime data. They collect data from different sources like Automatic Identification System (AIS – it is a ship-to-ship and ship-to-shore system for sending messages about the vessel position over marine VHF radio without human intervention [61]), GPS satellite systems, or just from the carrier's official websites, process and store it in their own data base. Based on their own data base, these websites offer different web services, like container/vessel tracking, real-time geographical visualization of vessel positions, web tools for calculation of distance, weather observation, port statistics and other. These services are provided by web-based server-side or client-side applications. In some cases, the organizations just offer special files containing vessel positions which need additional software for visualization. KMZ is such a file offered by Marine Traffic website, and which can be visualized by Google Earth. Some organizations offer their services free of charge, while others charge a fee. In most of the cases of paid access there is a possibility of trial or demo based access. The found websites will be considered in two categories:

- Websites for cargo/vessel tracking – these are "track and trace" websites which allow the user to make his/her own request for vessel/cargo history during specific period of time;

- Websites for real time geographical visualization of vessel positions – these are websites which offer maritime picture with geographical presentation of the known position of the vessels at the current moment.

- Websites for Cargo/Vessel Tracking

From this category we found 16 websites which offer cargo/vessel tracking. All of them offer quite different services, but the most provided services can be classified in three basic categories: vessel/cargo tracking, web tools and calculators and different additional information. We reviewed these websites according to 7 criteria – source of the data, type of tracking, type of access, geographical visualization, data coverage (ports, vessels, containers, and geographical zones), historical data and the possibility for notification of vessel/port events. The results of this comparison are summarized in Table III in Annex. In the table we also included an additional field for each of the websites where we noted additional useful information or interesting tools, for example LAD (information for last arrival and departure vessel at certain port) WInf (Weather Information, including information about the wind, temperature, humidity, weather forecast and other), Container Information (CInf), Vessel Information (VInf), Port Information (PInf) , Distance/port Calculator (DC), listing of Used Ports (UP), Filters of the tracking results, KML file with information about the vessel position.

According to the collected data in Table III, the tracking in the reviewed websites is realized mainly by vessel tracking (using Vessel Name (VN), IMO, Call Sign (CS) and MMSI. This can be seen in Fig.3 where the percent of the website offering different type of tracking is presented. The cargo tracking is performed mostly by CIN and BL. Only a few websites offer tracking by Port Name (PN) and Booking Number (BN).

Figure 3. Percentage of the websites offering certain type of tracking

Different web tools and calculators are provided from the websites. According to Fig.4 the most offered web tool is the Email or Phone (SMS) notification for port or change of vessel status. A registration was required for such services, where the user was able to create his/her own list of observed objects (e.g. vessels, ports or containers) .

Another web tool provided from quite big percent of websites is the Distance Calculator (DC). This tool allows the user to see the distance between certain sea ports and sometimes also to get information for the approximate time for travelling (option similar to the tool CTT - Calculator of the Transit Time).Other web tools provided from the websites are: Route Finder (find the carriers offering transshipments between certain ports), Port or Vessel Search (search detailed information for certain port or vessel), Filters, vessel Compass and web module which can be integrated in the user website and allows tracking on the user's website.

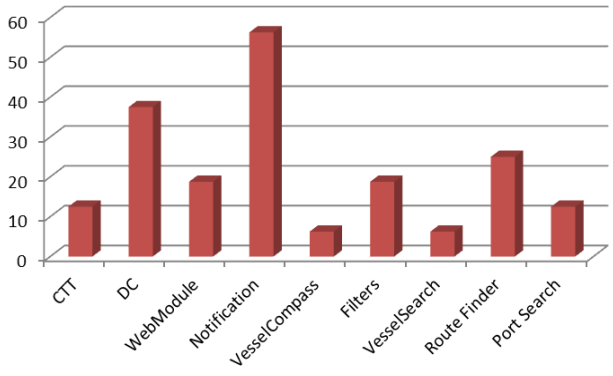

Figure 4. Percentage of the websites offering certain web tools

The additional information provided on the websites can be classified in two categories – pseudo-static and dynamic information. The information for the LAD and WInf can be considered as dynamic information, all the rest – as pseudo-static. According to Fig.5 the most offered pseudo-static information is VInf. It can include data like type of the vessel (cargo, fishing and other), length, name, breadth, max/average recorded speed, flag, Call Sign, IMO, MMSI, last received position and geographical coordinates, current port, time of the last message, itinerary history, voyage info, destination, estimated time of arrival, last received info, ex name of the vessel, etc. Other pseudo-static information offered quite frequently is the PInf. We noticed that the PInf provided on these websites is more complete than the PInf provided on the carrier's websites. Usually, it includes data like country, geographical coordinates, photos, list of the vessels currently in port, recent arrivals and departures, expected arrivals, port statistics and other.

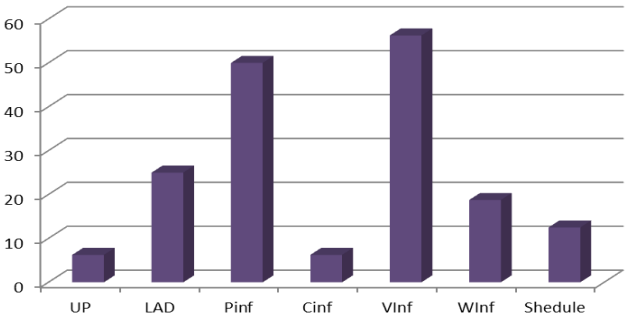

Figure 5. Percentage of the websites offering certain information

According to the type of access to the data, the majority of the websites considered offer tracking services free of charge (Fig.6). Some of them require free subscription. Some of the paid access gives possibility for trial or demo version which the user can try before buying the product.

Only three of the considered websites don't offer geographical visualization of the tracking results. Majority of the remaining websites offer geographical visualization by Google Maps (56% from the websites – Fig.7).

Figure 6. Percentage of the websites offering certain type of access

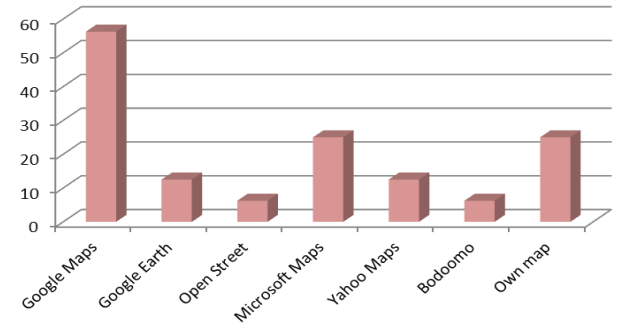

Figure 7. Percentage of the geographical visualization realized by specific map

Unfortunately, from the information on the websites it is not clear always what the source of the data is used (it could be the official carrier website). In any case, Fig.8 shows that the major part of the websites offering only vessel tracking service uses AIS source. Here, we would like to mention that, in spite of the primary goal for AIS - to assist the safety of navigation and to improve situational awareness of mariners for collision avoidance [61], research findings [78, 79] show that, in many cases, the data provided by AIS are still not reliable. Unfortunately, at the current research very little percent of the websites offers vessel tracking information by Satellite/GPS Tracking Systems (ST) – Fig.5 (usually this service is paid).

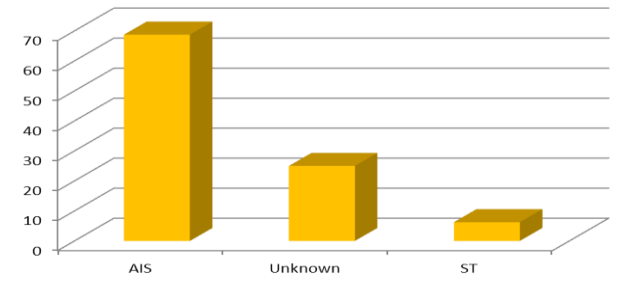

Figure 8. Percentage of the websites using certain source of data

As the source of the data is sometimes unknown, while in other cases – most probably a common source (AIS or ST), it was difficult to estimate and compare the coverage of data. In general, we can tell that the most covered zones by the considered websites in the current study are Europe, South Asia, America and Australia, where the biggest sea ports are positioned.

According to the historical view of the vessel trip, almost the same number of websites was found to provide short and long historical information. All of the websites offering long historical view of the vessel trip are paid websites and the user needs to make special request to access their long-term data.

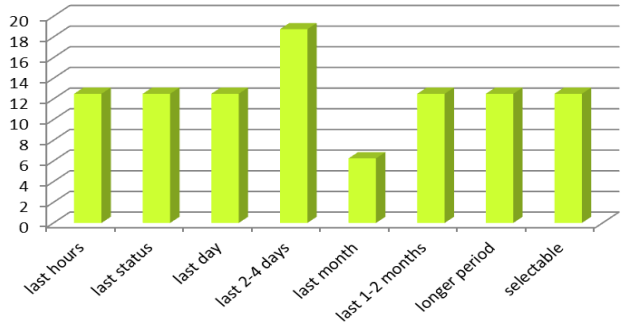

Figure 9. Percentage of the website offering different historical information for the vessel trip

- Websites for Real-Time Geographical Visualization of Vessel Position

Nine websites were found to offer geographical real-time visualization of vessel position according to AIS data. These websites were reviewed according two criteria – coverage of the data and geographical visualization. An additional field was added, where we noted some additional useful data or tool. The summary of this review is presented in Table II. It shows that the majority of this kind of websites (88%) uses Google Maps (GM) API for geographical visualization; two of the websites use Microsoft Maps (MM) and one – Virtual Earth (VE) or its own map (OM). Six of the websites cover only limited territories while the other – cover territories from all over the World. All the websites offer the similar information and tools like reviewed already tracking websites, for instance VInf, WInf, PInf, Email/SMS notifications, filters, CTT, DC and other.

TABLE II. WEBSITES FOR REAL-TIME VISUALIZATION OF VESSEL POSITION

Web site	Criteria for estimation:		
	Data Coverage	Geo Visualization	Add. Info
San Francisco Bay's AIS Stations	San Francisco Bay	GM	Live View realized by video Cameras
YachtMarine	Big part of the the World	GM, MM, VE	Weather Information Vessel Information

Web site	Criteria for estimation:		
	Data Coverage	Geo Visualization	Add. Info
Sannessjo	Norway – Bergen, Kristiansund, Northhern Norway, Scaderrak and Stavange	GM	V Inf
NorternBaltic	North Baltic sea	GM	V Inf
Bedanec	Mediterranean Sea and North Sea	GM	V Inf
John Ambler's web	Isle of Wight	GM	V Info
SiiTech	Big part of the World	MM, GM	Calculator of Transit Time, Filters, Alerting Notification by Email, SMS, AIS messages, free and paid access
AISLive	Big part of the World	OM	Port Info, Paid access, Email notifications

III. CONCLUSIONS

The survey presented in this paper reviews currently available maritime tracking websites. The websites were classified in two main categories – official websites of the carriers (which offer some kind of tracking service) and websites of different organizations (which are specializing in maritime data and sharing this data via the Internet).

Fifty-seven carriers were found from the first category. The review of these websites showed that the carriers offer two type of tracking – cargo tracking and vessel tracking. Cargo tracking is usually performed by Container Identity Number, Bill of Lading and Booking Number. The vessel tracking is usually performed by vessel name. The most offered additional information from the carriers is information for the carrier's routes, vessel information, container information, schedule and transit time between the ports. Some of the carriers also offer some useful tools, like route finder, voyage finder, schedule finder, etc.

The second category of websites was split in two subgroups – websites offering tracking and websites which visualize, in real-time, vessel position provided by AIS data. Sixteen websites were found from the first subgroup. Four of them offered container tracking, while the rest – vessel tracking.

In spite of the experimentally proved inaccuracy of the AIS data in some studies, the current survey shows that the main source of maritime data for the second subgroup of websites is still the AIS.

The current evaluation showed that the most used software for web-based geographical visualization of vessel positions and itinerary is Google Maps. Some websites also use Microsoft Maps, Yahoo maps or their own maps.

Vessel tracking is available mainly by vessel name, but also by IMO, Call Sign and MMSI number in the big percentage of reviewed websites. Availability of additional information, in most of the websites, was for vessels and ports, but information about the weather, carrier schedules, containers, last arrival and departure was available as well for some websites. Most of the websites, offer tracking registration, allowing the user to create a list of vessels or ports of interest, and subscribe for email or sms notification for any event connected with the selected ports or vessels.

The review of all the websites shows that vessel and cargo tracking is mostly oriented to visualization of the current position rather than the view of a historical itinerary. However, some of the websites offer a historical view of vessel itineraries, but, usually, the history is no longer than one month.

Theoretically, all commercial vessels beyond a certain size are obliged to send AIS messages, so that they can be detected free of charge from the closest AIS stations. Some of the stations are private supported from organizations, which are specializing in maritime data and share this data mostly commercially. However, there are websites, which offer AIS data free of charge, but this AIS data is not in raw format or a format that can be easily used for itinerary analysis. Most of these websites require a membership. Condition to become a member is the possession of AIS station and sharing of the gathered data. Finally, two websites were reviewed which share the maritime data obtained from AIS in KML-format.

REFERENCES

[1] Kallas S.: Challenges for Maritime Transport. Speech/11/356 of Vice-President of the European Commission responsible for mobility and transport. European Maritime Day. Gdansk. 19 May (2011)

[2] Harrison A., Holloway S.: Challenges for Customs. Centre for Customs and Excise Studies. University of Canberra. Secure Trade – The Impact of terrorism. Annual Conference of APEC Centres. Melbourne. Australia (2007)

[3] Bjorkholm P.: Detection of Weapons of Mass Destruction. Container Inspection and Secu-rity. Port Technology International. USA. PT18-5/1 (2004).

[4] Atlantic Container Line (ACL), www.aclcargo.com

[5] Alianca. www.alianca.com.br

[6] ANL. www.anl.com.au

[7] APL. www.apl.com

[8] CMACGM. www.cma-cgm.com

[9] COSCO Container Lines. www.coscon.com

[10] Compañía Sud Americana de Vapores (CSAV). www.csav.com; www.csav.cl

[11] Deutsche Africa Linien (DAL). http://map.rantzau.de

[12] EMIRATES Shipping Line (DMCEST). www.emiratesline.com

[13] EVERGREEN Marine corporation. www.evergreen-marine.com; www.evergreen-line.com

[14] GOLDSTAR Line LTD. www.gslltd.com.hk

[15] FESCO Transportation Group. www.fesco.ru

[16] HAMBURG SUD Group. www.hamburg-sued.com; www.hamburgsud.com

[17] HANJIN Shipping. www.hanjin.com

[18] HAPAG-LLOYD. www.hapag-lloyd.com

[19] HORIZON LINES. www.horizon-lines.com; www.horizonlines.com

[20] Global Hyunday Merchant Marine (HMM). http://www.hmm21.com/cms/business/ebiz/index.jsp.
[21] Ignazio MESSINA & C. www.messinaline.it
[22] Italia Marittima S.p.A. www.lloydtriestino.it
[23] MAERSK Line. www.maerskline.com
[24] Mediterranean Shipping Company (MSC). www.mscgva.ch; www.mscaustralia.com
[25] Regional Container Lines (RCL). www.rclgroup.com/
[26] Orient Overseas Container Line (OOCL). www.oocl.com/eng
[27] Nippon Yusen Kaisha Line (NYK). http://www2.nykline.com; www.nykline.com
[28] United Arab Shipping Company (UASC). www.uasc.net
[29] YANGMING Marine Transport Coorporation. www.yangming.com; www.yml.com.tw
[30] ZIM Integrated Shipping Services. www.zim.co.il; www.zim.com
[31] Korea Marine Transport Co. (KMTC). www.kmtc.co.kr
[32] DELMAS. www.delmas.com
[33] Matson Transportation. www.matson.com
[34] MARFRET Compagnie Maritime. www.marfret.fr/en/tracking
[35] NAM SUNG Shipping Coo. www.namsung.co.kr/eng
[36] MOL mitsui O.S.K. Lines. www.molpower.com
[37] NORDANA LINE. www.nordana.com
[38] The National Shipping Company of Saudi Arabia (NSCSA). www.nscsa.com
[39] Tropical Shipping. www.tropical.com
[40] DAL-Rantzau Shipping. http://www.dal.biz/dal/Containers.aspx
[41] The shipping Corporation of India Ltd. (SCI). www.shipindia.com
[42] Heung-A Shipping. https://www.heung-a.co.kr/eng/index.cfm
[43] Seaboard Marine. www.seaboardmarine.com/SML
[44] Sinokor Merchant Marine. www.sinokor.co.kr
[45] TBS International. Nasdaq-listed. www.tbsship.com
[46] Wallenius Wilhelmsen. www.2wglobal.com
[47] Pacific International Lines (PIL). www.pilship.com/
[48] CCNI Company. www.ccni.cl
[49] CHINA SHIPPING Australia. www.cnshipping.com.au
[50] K-LINE. www.kline.co.jp; www.k-line.com
[51] MITSU OSK Lines. www.molpower.com; www.mol.co.jp
[52] GRIMALDI Group. www.grimaldi.napoli.it
[53] MISC Agencies (Australia). www.miscaust.com.au
[54] Pacific Asia Express. www.pae.com.au
[55] Toll Shipping. www.tollshipping.com.au
[56] TRITON Overseas Transport. www.tritonovs.com
[57] Grieg Star Shipping. www.griegstar.com
[58] Cheng Lie Navigation Co., Ltd (CNC) LINE. www.cncline.com.tw
[59] LIBRA. http://www3.libra.com.br
[60] CSAV NORASIA liner Services. www.csavnorasia.com
[61] Schwehr K.: Vessel Tracking Using the Automatic Identification System (AIS) During Emergency Response. Lessons from the Deepwater Horizon Incident. US Hydro. Tampa Fl (2011)
[62] Sea Rates - Website for Container tracking. http://www.searates.com
[63] Track-Trace – Website for Cargo Tracking. http://track-trace.com
[64] Shipid – Website for container tracking. www.shipid.com/tracking
[65] Shippingline – Website for container tracking. http://www.shippingline.org/freight/pil/
[66] MarineTraffic – Website for real-time geographical visualization of vessel position and vessel tracking. http://www.marinetraffic.com
[67] VesselTracker – Website for Vessel Tracking. http://www.vesseltracker.com/app
[68] Digital Seas – Website for Vessel tracking. http://www.digital-seas.com
[69] MariWeb – Website for vessel tracking. http://www.mariweb.gr
[70] SailWX – Website for vessel tracking. http://www.sailwx.info
[71] Shipping Explorer – Website for vessel tracking. http://www.shippingexplorer.net
[72] VTExplorer – Website for real time geographical visualization of vessel position and ves-sel tracking. http://www.vtexplorer.com
[73] BLM Shipping – Website for real time geographical visualization of vessel position and vessel tracking. http://www.boloomo.com/shippingMain_en.html
[74] ATPosition – Website for satellite vessel tracking serviceshttp://www.atposition.com/atlanticsource/sat
[75] Vessel Finder – Website for vessel Tracking. http://vesselfinder.com
[76] Ship tracking – Website for vessel tracking. http://www.shiptracking.eu
[77] ShipAIS – Website for vessel tracking. http://www.shipais.com
[78] Harati-Mokhtari A., Wall A., Brooks P. Wang J.: Automatic Identification System (AIS). A Human Factors Approach (2008)
[79] Bailey N.: Training, Technology and AIS: Looking Beyond the Box. Proceeding of The Seafarers. International Research Centre's Fourth International Symposium. Cardiff Uni-versity. UK (2005)
[80] San Francisco Bay's AIS Stations. http://hd-sf.com/livemap.html
[81] Vessel tracking website. http://www.yachtmarine.com/AIS/THEWORLD.html

ANNEX

TABLE III. WEBSITES FOR CARGO/VESSEL TRACKING

WEB SITE	CRITERIA FOR ESTIMATION:																								
	Source of the Data *ST* - Satellite tracking system*	**Type of Tracking** *(X* - it is necessary also select Carrier's name)*								**Type of Access** F- free; P- Paid, NR – need of registration, T- Trial	**Geographical Visualization:** GM- Google Maps; Google Earth –GE; Yahoo Maps- YM; Microsoft Maps –MM; Open Street Maps - OM	**Coverage of the Data**	**Historical View**	**Notification**	**Available Information and Web-based Tools**										
		Vessel Name	Container Identity №	Bill of Lading	Booking №	Call Sign	Port Name	IMO	MMSI						Calculator of Transit time	Route Finder	Used Ports	Distance calculator	Port Search	Port Information, Statistics	Last Arrival /Departure	Container Information	Schedule	Container Information	Vessel Information	Other
Sea Rates	-		X *							F, P	GM	data for 17 shipping carriers	last 10 days	-	X	X	X	X	X	X	X	X				Available paid web module for container tracking
Track-Trace			X	X						NR	-	-	last few days	-										X		
Shipid			X *	X						F	-	data for 23 shipping carriers	-	-									X			Free available webmodule for container tracking
Shipping line			X	X	X					F	-	Data for 82 shipping carriers	latest container's status	-												Links to the carrier official web sites for tracking
Marine Traffic	AIS	X								F - GNU license	GM, GE	data for 1 566 int. ports, gathered from 855 AIS stations	last month	Email, SMS						X					X	Photos, KML-provider
Vessel Tracker	AIS	X				X	X	X	X	F, P	GM, GE	data for 1690 int. ports, observed 9 333 vessels, info for 40 000 vessels, 3 000 container vessel schedules and 900 port distances	last 24 hours, but possible also last years	Email SMS, wake up calls		X		X		X	X		X			LiveAIS Map View
Digital Seas	AIS	X				X		X	X	F, P	OM, MM	Antractica, Azia, Europa, South Africa, Oceania, America, North America, gathered data for 23 2019 vessels	long term only by request	Email							X				X	Available paid Web module for vessel tracking, widgets

MariWeb	AIS	X				X		X	X	F- only for real–time vessel position, NR	GM	-	history – only paid	Email, SMS		X		X		X				X	Weather Information,
SailWX	AIS	X				X				F	their own map	-	last hours	-						X				X	Weather Information
Shipping Explorer	AIS	X				X	X	X	X	F, P	GM YM, MM, their own map	56 countries over all the World	-	Email, SMS		X		X	X	X	X				Vessel Search, Weather Information, Filters
VTExplorer	AIS	X						X	X	P, T	their own map (JAVA application)	More than 70 000 vessels, gathered data from hundred AIS stations, 100 million new records monthly	last 72 hours	Email, SMS				X						X	Filters
BLM Shipping	AIS	X *				X *		X *	X *	free	Boloomo Maps, GM, MM, YM	More than 5 000 vessels positions gathered daily, data base with basic information of more than 390 000 ships and details of over 120 000 ships and 50 million port distances	selectable	Email, SMS				X		X				X	Filters, Weather Information
ATPosition	ST*	X								F - but need installing of transponder on the vessel	GM	17 vessels	last few months	SMS											Used mostly for private boats
Vessel Finder	AIS	X				X		X	X	F, NR	GM	-	last known position	-										X	
Ship Tracking	AIS	X						X		F	GM	Ship coverage – 11 210	last 1-2 months	Email	X					X				X	Vessel Compass
ShipAIS	AIS	X								F	their own maps	UK, Plymouth, Netherland, Failr, Ireland, Isle, Cromarty, Sea, Malin, Tyne, Thames, Irish Portland	last day	-										X	