



**Radio Technical Commission for Maritime Services**

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**Moving Forward with e-Navigation<sup>1</sup>**

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**ABSTRACT**

e-Navigation is a global effort led by the International Maritime Organization (IMO) and the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA). Its definition includes the “... *collection, integration, exchange, presentation and analysis of maritime information*” and expectations include the “*seamless information transfer on board ship, between ship and shore authorities and other parties...*” Traditionally, maritime navigation and communications standards have described stand-alone shipborne navigation and communications equipment. More recently, there has been movement toward integrated ship systems. The concept of e-Navigation broadens integration to include shore-based services, via more robust and efficient communications.

The U.S. “e-Navigation Strategic Action Plan” addresses a vision, an ultimate goal and focus areas for e-Navigation in the U.S. The U.S. strategy must provide for the inclusion of smaller vessels and recreational boats which are not directly governed by IMO and IALA, but which operate in U.S. waters.

The Radio Technical Commission for Maritime Services (RTCM) sees its role in contributing to e-Navigation and supporting the U.S. e-Navigation strategy as a developer of standards for navigation and communications equipment, with a focus on the integration of navigational and communications functions that have traditionally been performed separately. RTCM builds on the framework of international standards developed by the IMO, IALA, International Telecommunications Union (ITU), International Electrotechnical Commission (IEC), International Organization for Standardization (ISO), and International Hydrographic Organization (IHO) and develops standards that address the gaps in those international standards, particularly as they apply to smaller vessels and recreational boats. The work of several RTCM Special Committees (SCs) is related to e-Navigation.

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<sup>1</sup> This paper revises RTCM Paper 067-2012-eNav-026.r1

## INTRODUCTION

What do you see when you step onto the bridge of a modern ship or well-equipped boat? Chances are, standards published by the Radio Technical Commission for Maritime Services (RTCM)<sup>2</sup> and RTCM activities had something to do with the vessel's navigation and communication equipment. RTCM standards are used internationally<sup>3</sup> and have been used as a basis for international standards for radio systems, navigation systems and emergency beacons.<sup>4</sup> RTCM members also participate in the development of international standards.

## e-NAVIGATION

e-Navigation is a global effort led by the International Maritime Organization (IMO) and the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA). IMO's definition of e-Navigation includes the "... *collection, **integration, exchange, presentation and analysis of maritime information.***"<sup>5</sup> IMO further identified the expectation for communications in e-Navigation as the "*seamless information transfer on board ship, between ship and shore authorities and other parties...*"<sup>6</sup>

Maritime navigation and communications standards have traditionally described stand-alone shipborne navigation and communications equipment. More recently, there has been movement toward integrated shipborne systems.<sup>7</sup> The concept of e-Navigation broadens integration to include shore-based services (i.e., via communications), which explains IALA's involvement and their emphasis on its importance. In order to have a complete and integrated e-Navigation "architecture" that involves the exchange of information not only between ships, but also between ships and shore services, a robust and efficient communications and network infrastructure is required.

## U.S. e-NAVIGATION STRATEGY

The international e-Navigation efforts prompt a U.S. e-Navigation strategy to support those efforts. The U.S. strategy must provide for the inclusion of smaller vessels and recreational boats which operate in U.S. waters, but which are not directly governed by the SOLAS Convention. The U.S. Committee on the Marine Transportation System

<sup>2</sup> RTCM was founded in 1947 as a U.S. Government advisory committee. It is now an independent organization with an international membership of ship operators, manufacturers, service agents, consultants, educational institutions, and government agencies.

<sup>3</sup> RTCM standards are used internationally for Differential Global Navigation Satellite Systems (DGNSS) and Electronic Chart Systems (ECS).

<sup>4</sup> RTCM standards have been used as a basis for international standards for Digital Selective Calling (DSC), ECS, Electronic Position Indicating Radiobeacons (EPIRBs), radar for craft not required to comply with the International Convention for the Safety Of Life At Sea (SOLAS) and Very High Frequency (VHF) radio equipment operating in high-level electromagnetic environments.

<sup>5</sup> Reference: IMO NAV 53/22 § 13.15: "*the harmonised collection, **integration, exchange, presentation and analysis of maritime information onboard and ashore** by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment*"

<sup>6</sup> Reference: IMO NAV 53/22 § 13.17.3: "*an infrastructure providing authorized seamless information transfer onboard ship, between ships, between ship and shore and between shore authorities and other parties with many related benefits, including a reduction of single person error*"

<sup>7</sup> References: IMO SN/Circ.288, IMO SN/Circ.265, IMO MSC/Circ.982, IMO Res. MSC.191(79), IMO Res. MSC.252(83)

(CMTS) approved such a strategy in the “*e-Navigation Strategic Action Plan*” in July 2011.<sup>8</sup> The Strategic Action Plan addresses a **vision**, an **ultimate goal** and **focus areas** for U.S. e-Navigation:

**The vision for U.S. e-Navigation is:**

*“To establish a framework that enables the transfer of data between and among ships and shore facilities, and that integrates and transforms that data into decision and action information.”*

**The ultimate goal of U.S. e-Navigation efforts is to:**

*“Use timely and reliable information to make the U.S. Marine Transportation System operate better.”*

**The U.S. e-Navigation focus areas are:**

*“Improved connectivity”*

*“Seamless data exchange”*

*“System integration”*

*“Human-machine interface”*

*“Standards for components supporting the eNavigation framework”*

*“Position, Navigation and Timing”*

## **RTCM’S ROLE IN e-NAVIGATION and the U.S. e-NAVIGATION STRATEGY**

RTCM sees its role in contributing to e-Navigation and supporting the U.S. e-Navigation strategy as a developer of standards for navigation and communications equipment, with a focus on the integration of navigational and communications functions that have traditionally been performed separately. RTCM builds on the framework of international standards developed by the IMO, IALA, ITU, IEC, ISO, and International Hydrographic Organization (IHO) and develops standards that address the gaps in those international standards.

In 2007, RTCM established a Steering Committee to maintain general cognizance over government and non-government activities in area(s) of e-Navigation and to advise the Board of Directors and make recommendations for coordinating the work of certain SCs and to establish new projects and new SCs to support e-Navigation.<sup>9</sup>

RTCM’s e-Navigation SCs are:

### **SC 109 on Electronic Charting Technology**

This committee has published standards for ECS for vessels not required to carry the Electronic Chart Display and Information System (ECDIS). The most recent version of the ECS standard includes additional requirements for interfacing with the Automatic Identification System (AIS), including support for Application-Specific Messages (ASM) implemented for e-Navigation, as well as additional requirements for voyage data recording, which could eliminate the need for a separate Voyage Data Recorder (VDR).<sup>10</sup> The committee is also considering the future of ECS “software” operating in an e-Navigation environment, for example, using an integrated display along with radar, as well as direct integration with other navigation systems, such as

<sup>8</sup> Reference: The *U.S. e-Navigation Strategic Action Plan* (Strategic Action Plan)

<sup>9</sup> Reference: RTCM Paper 252-2007-BD-413 § 4.B

<sup>10</sup> Reference: RTCM 10900.6

Electro-Optical Imaging Systems (EOIS).

SC 109 contributes to the following U.S. e-Navigation focus areas:

- System Integration;
- Seamless Data Exchange;
- Human-focused Interface; and
- Decision-focused Information.

### **SC 112 on Ship Radar**

This committee has published standards for radar. They are working on a new standard for four classes of modern radar systems for vessels not required to comply with SOLAS. This standard includes requirements to support AIS ASM implemented for e-Navigation. The committee is also considering the future of radar operating in an e-Navigation environment, for example, using an integrated display along with ECS “software,” as well as direct integration with other navigation systems, such as EOIS.

The committee contributes to the following U.S. e-Navigation focus areas:

- System Integration;
- Seamless Data Exchange;
- Human-focused Interface; and
- Decision-focused Information.

### **Special Committee 121 on AIS and Digital Messaging**

The committee is finishing a new standard for the creation and qualification of Application Specific Messages (ASM) for use in AIS and other communications systems. ASM will provide information about such things as weather, hydrographic data and restricted areas for use on navigational displays such as ECS and radar.

The committee contributes to the following U.S. e-Navigation focus areas:

- System Integration;
- Seamless Data Exchange;
- Decision-focused Information;
- Improved Connectivity; and
- Inter-agency Information Coordination.

### **Special Committee 127 on Enhanced Loran (eLoran)**

This committee is working a new standard for eLoran receivers.

The committee contributes to the following U.S. e-Navigation focus areas:

- System Integration;
- Seamless Data Exchange;
- Human-focused Interface; and
- Decision-focused Information.

### **Special Committee 129 on the Portrayal of Navigation-Related Information on Shipboard Displays**

This committee is working on a new standard covering the portrayal of e-Navigation data that is not adequately addressed for presentation or display by international standards.

The committee contributes to the following U.S. e-Navigation focus areas:

- System Integration;
- Seamless Data Exchange;
- Human-focused Interface; and
- Decision-focused Information.

### **Special Committee 130 on Electro-Optical Imaging Systems (EOIS) for Maritime Applications**

The committee was working on a new standard addressing modern EOIS that use technologies such as thermal imaging or light amplification. The committee was also considering the direct integration of EOIS with other navigation systems, such as ECS and radar. It has been put on inactive status by the Board of Directors as a result of committee members being unable to support the work. The Board hopes that RTCM will be able to resume the project.

When reactivated, the committee will contribute to the following U.S. e-Navigation focus areas:

- System Integration;
- Seamless Data Exchange;
- Human-focused Interface; and
- Decision-focused Information.

### **Special Committee 131 on Multi-system Shipborne Navigation Receivers**

This committee is working on a new standard for navigation receivers, considering both integrated GNSS and terrestrial radionavigation systems (e.g., eLoran). An important part of the standard will be resistance to interference, spoofing, and jamming. The committee's initial work, performed in conjunction with IALA, has been adopted by the U.S. for submission to the IMO Sub-Committee on Navigation, Communications and Search and Rescue (NCSR) as a proposed performance standard.

The committee contributes to the following U.S. e-Navigation focus areas:

- System Integration;
- Seamless Data Exchange;
- Human-focused Interface; and
- Decision-focused Information.

Other existing RTCM committees, not officially part of the e-Navigation group, but essential to e-Navigation are:

### **Special Committee 104 on Differential Global Navigation Satellite Systems**

This committee developed the original differential technology that enabled improvement in the accuracy of GPS positioning through the use of reference stations and has published standards for differential positioning message protocols, reference stations and integrity monitors, and transmission of messages via the Internet. The committee is now working on even higher precision technologies and the next generation of GPS and other GNSS.

The committee contributes to the following U.S. e-Navigation focus areas:

- System Integration;

- Seamless Data Exchange; and
- Decision-focused Information.

### **Special Committee 123 on Digital Messaging over Maritime Frequencies**

The committee has published a standard for the transmission of data over VHF voice channels, which permit voice channels to be used for data without interfering with continued voice communications. The committee is currently working with IALA and International Telecommunications Union (ITU) pursuing new standards for a VHF Data Exchange System (VDES).

The committee contributes to the following U.S. e-Navigation focus areas:

- System Integration;
- Seamless Data Exchange;
- Human-focused Interface;
- Decision-focused Information;
- Improved Connectivity; and
- Inter-agency Information Coordination.

## **BIOGRAPHIES**

**Mr. Robert L. Markle** was elected President of the Radio Technical Commission for Maritime Services (RTCM) in 2002. RTCM is a non-profit scientific and educational organization, focusing on all aspects of maritime radiocommunications, radionavigation, and related technologies. RTCM standards for marine radio and electronic navigation equipment are incorporated by reference in regulations of the Federal Communications Commission and U.S. Coast Guard.

Prior to his position at RTCM, he spent 27 years working at U.S. Coast Guard Headquarters in Washington, DC, in various assignments related to maritime safety. He concluded his Coast Guard career in 2002, as Chief of the Lifesaving and Fire Safety Standards Division, where he administered U.S. programs on standards and enforcement for marine lifesaving, fire protection, and pollution prevention systems. He developed and implemented the Coast Guard's approval program on shipborne navigation equipment. His signature appears on virtually all Coast Guard approval certificates for lifesaving and fire safety equipment approved between 1982 and 2002.

Mr. Markle is a graduate of the Pennsylvania State University, with a Bachelor of Science in Mechanical Engineering. He also holds a Master of Business Administration degree from George Washington University. He is a Fellow of the Society of Naval Architects and Marine Engineers, and member of the Institute of Navigation, Royal Institute of Navigation, the Nautical Institute, the Marine Technology Society, SAE, and the Propeller Club of Washington.

**Captain Joseph F. Ryan** is 1983 graduate of the United States (US) Coast Guard Academy (CGA). He is a veteran US Coast Guard (USCG) and US Merchant Marine (USMM) officer. He sailed as Deck Watch Officer (DWO) aboard the USCG cutters *Biscayne Bay*, *Duane* and *Seneca*; and as Second Mate and Navigator aboard container ships for Lykes Brothers Steamship Company and Tri-Star Marine, Inc., for whom he also sailed as Master. Since 2001, Capt. Ryan has worked as an Independent Consultant to the maritime industry; trading as "*THE SKIP'R, LLC*". He supports and advises

government agencies and commercial clients as a Subject Matter Expert (SME) in the application of Computers and Information Technology (IT) to marine navigation, most notably with respect to electronic charting, the presentation of navigation-related information, and the interfacing and integration of navigational sensors, including the Automatic Identification System (AIS). He has been a member of the RTCM Board of Directors since 2004. He has chaired the RTCM Board's e-Navigation Steering Committee since its establishment. He also chairs RTCM Special Committee (SC) 121 on AIS and Digital Messaging, and SC 129 on the Portrayal of Navigation-Related Information on Shipboard Displays, and he participates in several other SCs. He is a member of the American National Standards Institute (ANSI) and the U.S. National Committee's (USNC) Technical Advisory Groups (TAGs) for the International Electrotechnical Commission's (IEC's) Technical Committee 80 (TC 80) on Maritime Radionavigation Equipment and Systems; and the International Organization for Standardization's (ISO's) Technical Committee 8 (TC 8) on Ships and Navigation; and he has participated in a number of Working Groups and Maintenance Teams. Capt. Ryan maintains his affiliation with the International Organization of Masters, Mates and Pilots (IOMM&P), and is a member of the Council of American Master Mariners (CAMM).