Innovative Navigation Role of ECDIS as a Decision Support System

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INTRODUCTION

- Navigational decision making in maritime transport becomes important, as it causes a direct increase in marine traffic.
- To increase the accuracy of decision-making process, a qualified information should be obtained through a model structure.
- A series of electronic technologies, both ship and shore based, are used to improve the situational-awareness and decision making of navigation officers

INTRODUCTION

##An integrated system is required would help to collect, integrate, exchange, present, and analyse marine information on ships and at shore using electronic systems. This would help to improve ship navigation, operations, and safety, along with protecting marine environment.

##This needs highly customized and developed model software to be able to possess the right data and reach the best decision which can improve and enhance maritime safety and decrease human errors.

E-Navigation

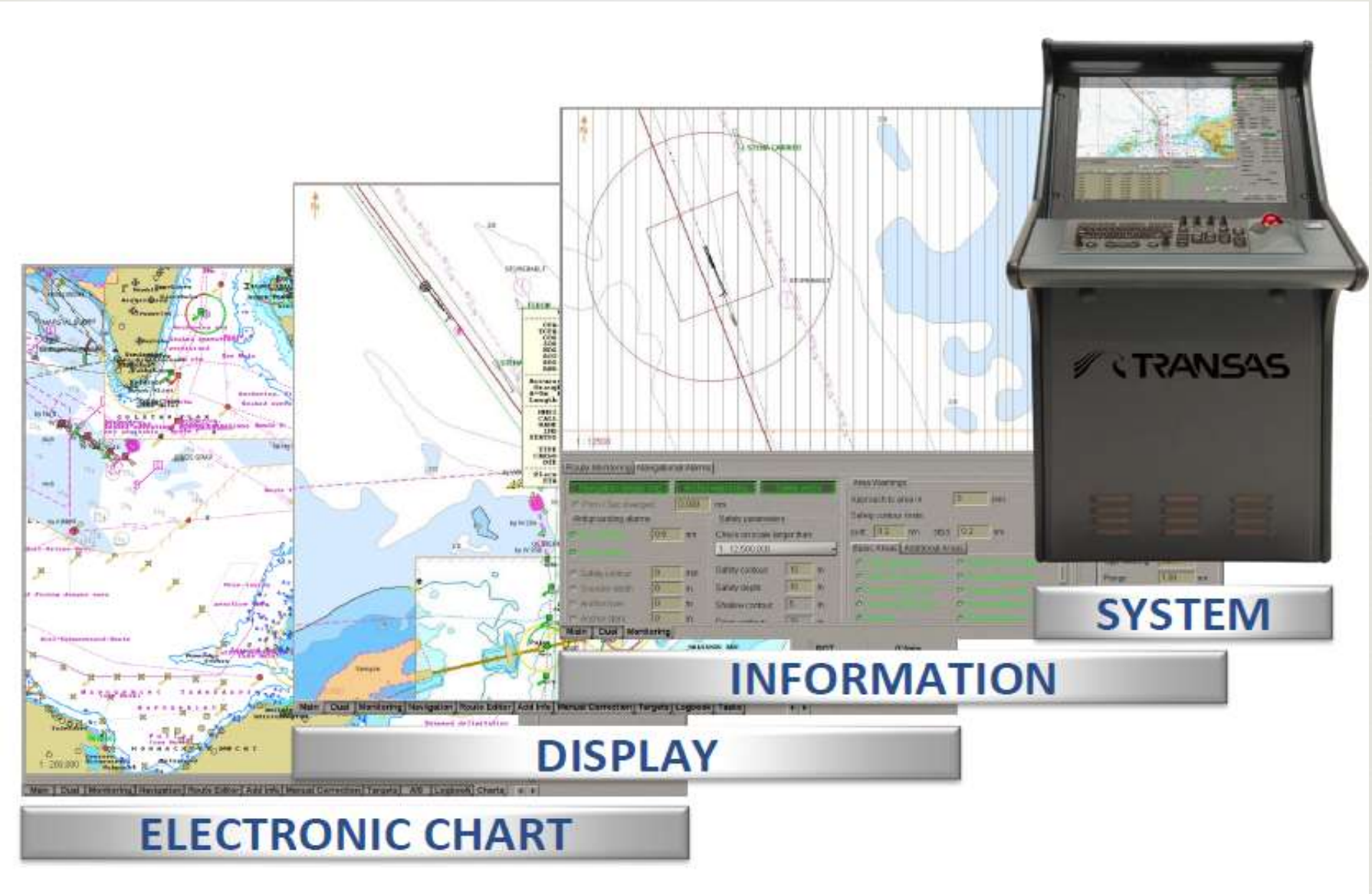
E-Navigation concept took place way back in the year 2006, when the IMO decided to include a well-defined strategy to integrate new and existing navigational tools

#E-navigation is one of the main topics in recent years is not a standalone solution, but a complex of several trends in the digitalization of a shipping industry.

#The main aim of e-Navigation is to enhance navigation safety and increase the efficiency of the ship, not only at the sea but also at ports

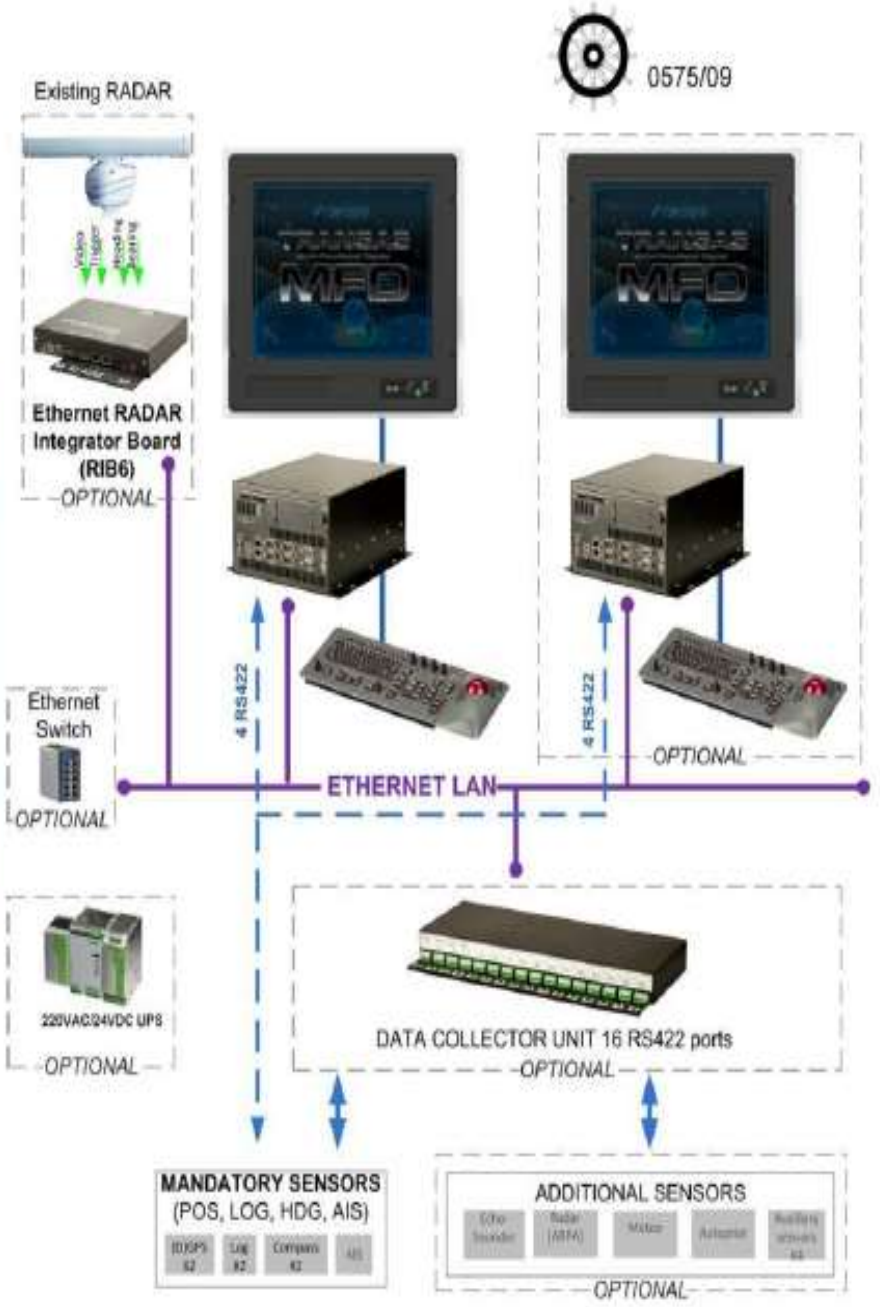
#E-navigation is allowed when the type approved ECDIS with official electronic navigation charts acts as the primary system

What is ECDIS ?



- A typical System Layout and minimum sensor connections
- Approved Hardware meeting IEC 60945.
- Minimum sensors*
- EPFS
- Gyro
- Log

*Minimum sensors are required to be connected directly to both stations in order to comply with the ECDIS performance standard requiring a safe take over between main and back-up solution.



Timetable for ECDIS carriage requirements

ship type	size	new ship	existing ship
passenger ships	500gt or over	1 July 2012	not later than first survey after 1 July 2014
tankers	3.000gt or over	1 July 2012	not later than first survey after 1 July 2015
dry cargo ships	50.000gt or over	1 July 2013	not later than first survey after 1 July 2016
	20.000gt or over (new ships) Over 20.000gt but less than 50.000gt (exisiting ships)	1 July 2013	not later than first survey after 1 July 2017
	10.000gt or over (new ships) Over 10.000gt but less than 20.000gt (exisiting ships)	1 July 2013	not later than first survey after 1 July 2018
	Over 3.000gt but less than 10.000gt	1 July 2014	No retrofit requirements to existing ships less than 10.000gt

ECDIS

Benefits of ECDIS

1- increasing situational awareness

2-Easy route monitoring

3-Access to additional information resources

4-Easy Correction of charts and publications

5-Navigation in real time

6- Prediction of special manoeuvres

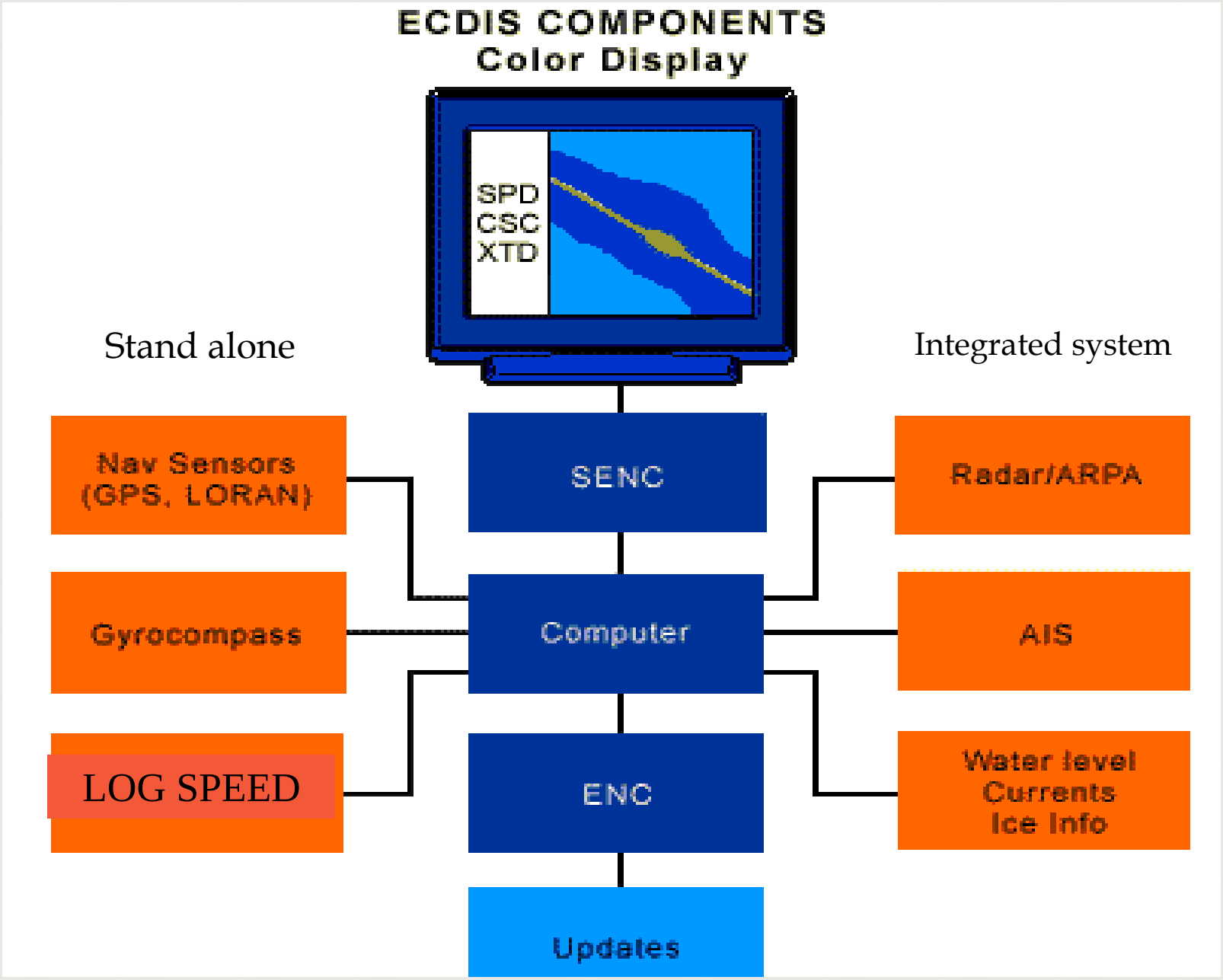
7-Reduce workload for the navigator

ECDIS

- ECDIS can be used as a primary mean to navigation (replace Traditional paper chart),or AID to navigation beside the traditional paper charts it depend on electronic chart used and flag state requirement
- ECDIS contains all the data on the chart that are used for the safety of navigation. It can receive the information issued by the navigational devices.
- IHO has identified defects in electronic charts systems including:
  1. Complete illumination features of the navigation aids are not apparent
  2. It does not have the ability to display some warnings in the correct way that maintains the safety of Navigation.

Research Objectives

- ECDIS can be considered as a tool of navigational decision making. There are several challenges that are still facing it.
- This research aims to develop an ECDIS-based DSS to determine the best modes of ECDIS operation.
- ECDIS will be a central system that would enable integration with devices and information sharing to improve maritime safety
- The developed DSS integrates data from AIS, ARPA, NAVTEX, and Tide and Sailing Direction.

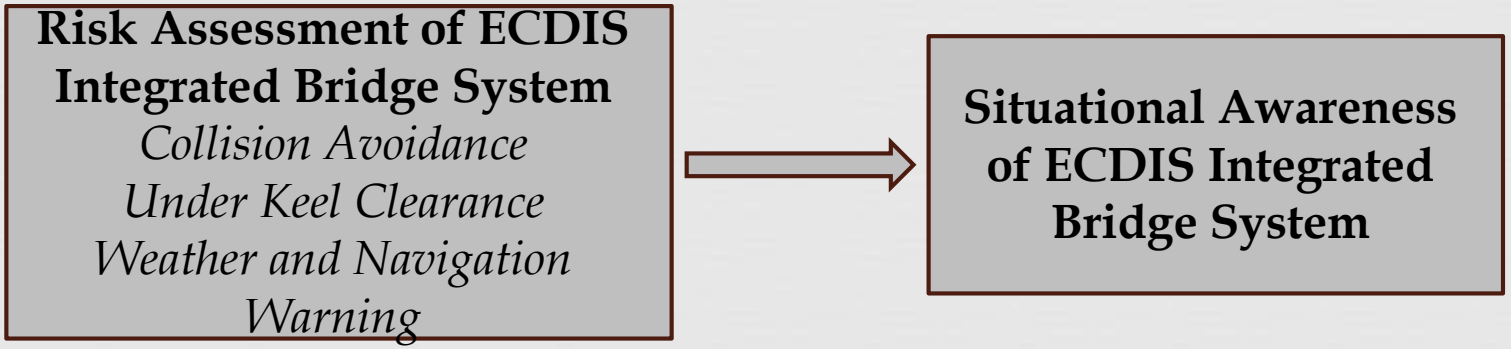

ECDIS COMPONENTS
Color Display
SPD
CSC
XTD
Stand alone
Integrated system
Nav Sensors
(GPS, LORAN)
Gyrocompass
LOG SPEED
SENC
Computer
ENC
Updates
Radar/ARPA
AIS
Water level
Currents
Ice Info

RESEARCH METHODOLOGY

- It is aimed to develop a new decision support system for maritime navigation to determine the best modes of ECDIS through an optimum model structure.
- This model structure should be capable of achieving an adequate level of ECDIS performance through model software. Thus, the best modes are defined, which are useful for different onboard cases and scenarios.
- The current paper is an explanatory research with quantitative approach using unstructured questionnaire survey (quantitative tool) to collect data from officers to examine the impact of such challenges and propose solutions for solving them.

ECDIS-BASED DSS FRAMEWORK

- There is a significant positive relationship between Risk Assessment Parameters and Situational Awareness in case of ECDIS as a decision support system.



Descriptive Analysis

- Descriptive analysis of the system variables:

	N	Mean	Std. Dev.	Frequency				
				1	2	3	4	5
Collision Avoidance	454	3.7401	.68945	0	0	182	208	64
Under Keel Clearance	454	3.5573	.76342	0	0	277	101	76
Weather and Navigation Warning	454	3.8414	.76712	0	0	175	176	103
Situational Awareness	454	3.5683	.73599	0	0	263	124	67

shows the descriptive analysis for the 4 research variables, including the mean, and standard deviations, This means that the average values of research values are above average

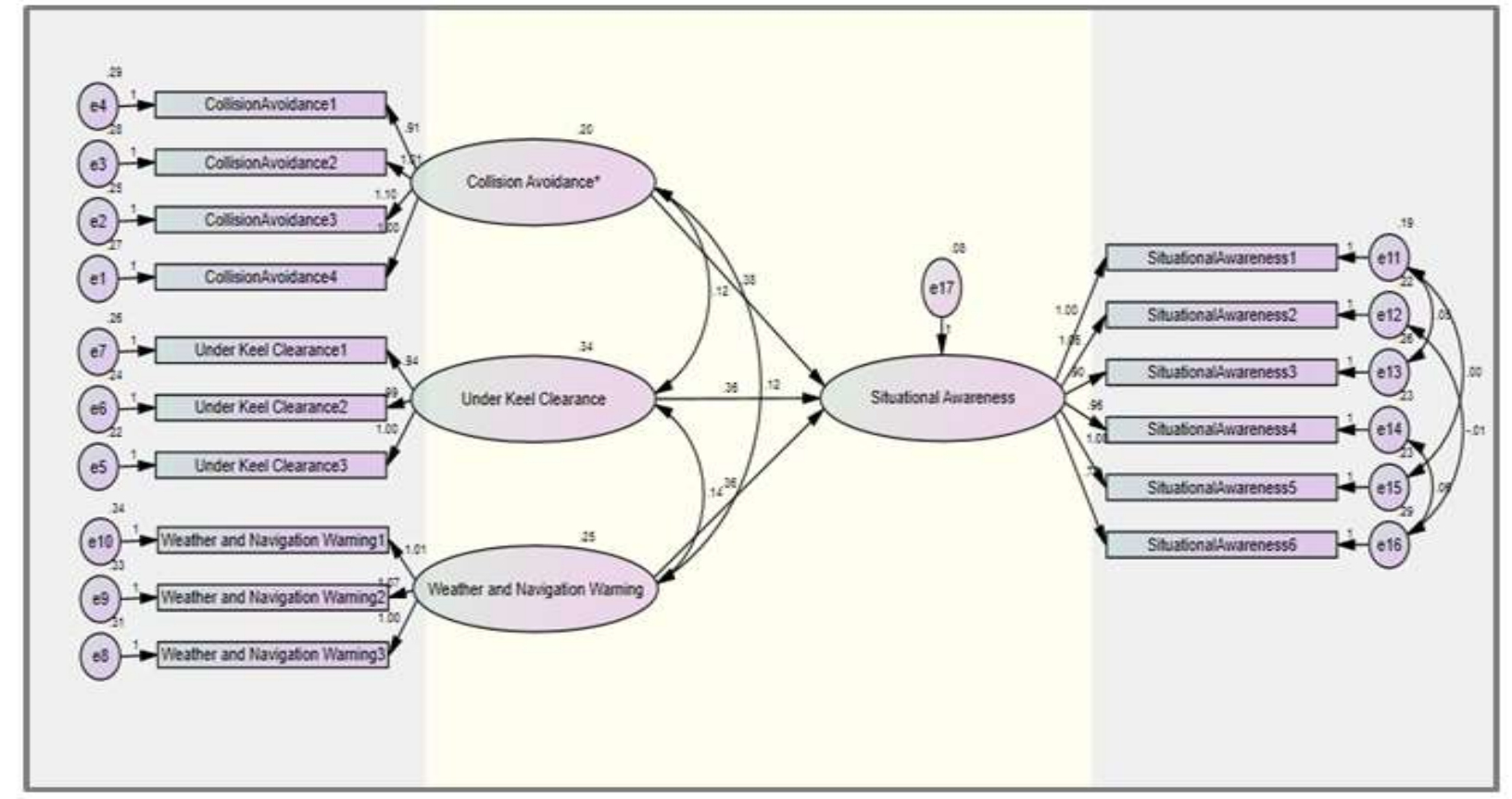
EMPRICAL STUDIES and FINDINGS

SEM Analysis of Risk Assessment on Situational Awareness

			Estimate	P-value	R square
Situational Awareness	<---	Collision Avoidance	.379	***	0.728
Situational Awareness	<---	Under Keel Clearance	.355	***	
Situational Awareness	<---	Weather and Navigation Warning	.362	***	

R square is 0.728, which means that 4 Risk Assessment dimensions; CA,UKC, Weather and Navigation Warning explain 72.8% of the variation in Situational Awareness

SEM Model
AMOS: Analysis of a Moment Structures



The SEM (structural Equation Modeling) model conducted for the effect of Risk Assessment dimensions; CA,UKC, Weather and Navigation Warning on Officers Situational Awareness, are all within their acceptable levels in case of ECDIS integrated bridge system

CONCLUSION

- There is a significant impact of CA ,UKC, weather and navigation warning on officers' situational awareness in case of ECDIS integrated bridge system.
- There is an urgent need to upgrade hardware and software systems of AIS, ARPA and NAVTEX , and programs of Tide and Sailing Direction.
- The officers must be aware of the Risk assessment themes in order to avoid the challenges faced on board.
- Sensors connected to ECDIS, primary for navigation, should not be viewed as an option but rather a necessity.
- Moreover, officers should be aware of the ECDIS system they are using and whether it is stand alone or integrated system, as this directly affect their situational awareness.

THANK YOU.