

# Software Quality Assurance guidelines for e-navigation systems



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# Agenda

- ▶ SQA needs of e-navigation systems
- ▶ IMO progress
  - ▶ NAV58, NAV59 and SIP
- ▶ Scope of SQA
- ▶ Considerations to be improved
- ▶ Expectations
- ▶ Conclusions

# SQA needs of e-navigation systems

- ▶ Properties of e-navigation systems
  - ▶ **Information system** composed of **software** components, **data/information** and its structure, network **protocol** as well as hardware components
- ▶ Qualified e-navigation software service for all stakeholders
  - ▶ Onboard as well as shore-side users - Masters, pilots, fishermen and recreational boaters, ports
  - ▶ Federal, government partners, maritime user community, private companies

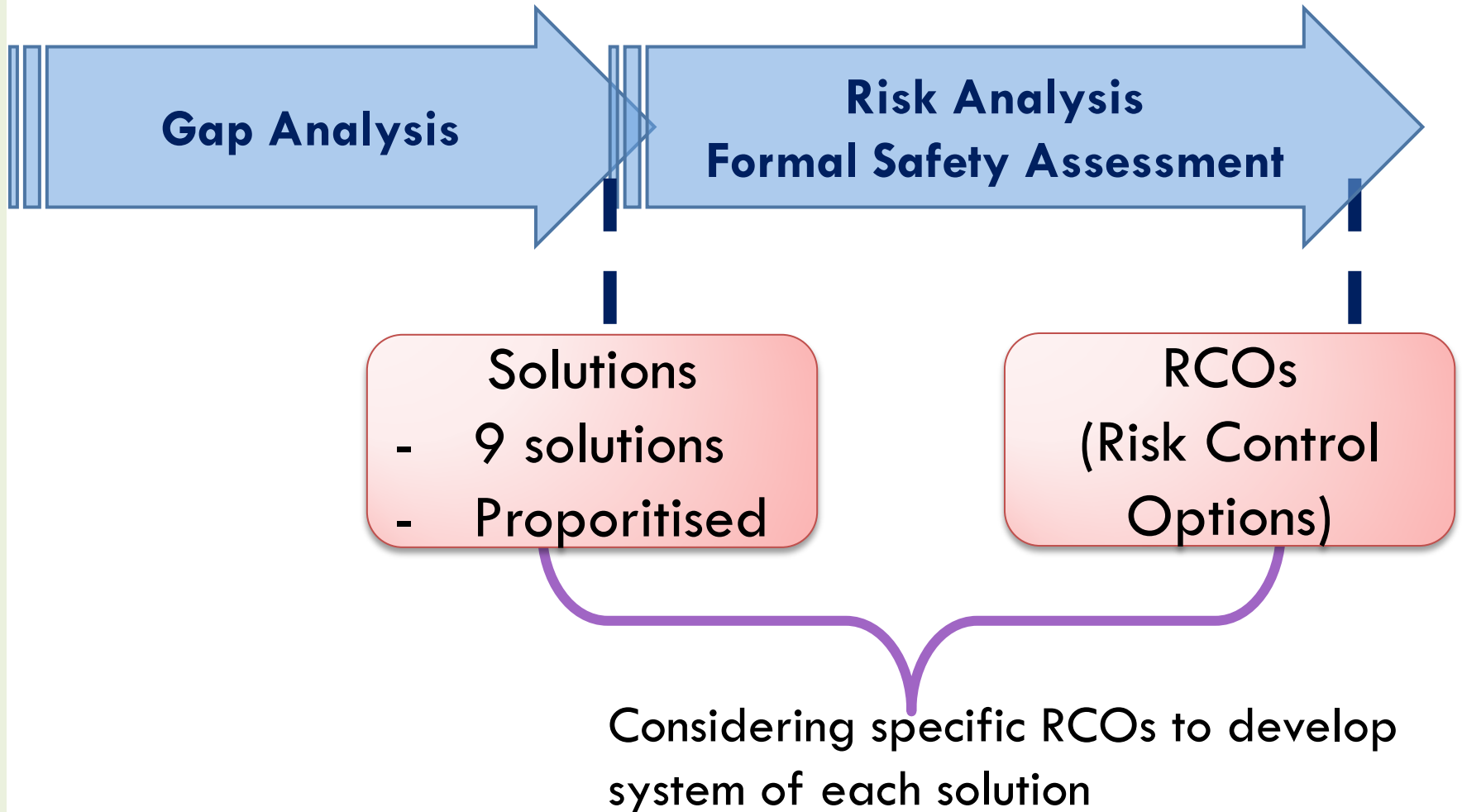
# IMO NAV 58<sup>th</sup> meeting (2012)

- ▶ NAV58/6/4 (Considerations on Software Quality Assurance issues for e-navigation development)
  - ▶ Outlining the need to include software quality assurance as part of the ongoing e-navigation gap and cost-benefit analysis process that has to be conducted.
  - ▶ Covering the concept of SQA, the reason why e-navigation considers SQA and practices in other area such as military and automobile.

# IMO NAV 59<sup>th</sup> meeting (2013)

- ▶ NAV59/6/2 (Development of draft SQA guidelines for e-navigation)
  - ▶ Safety and SQA
  - ▶ Scope of specification
  - ▶ Definition of e-navigation SQA
  - ▶ Means for application of ISO standards
  - ▶ Relationship with HCD, Usability and CMDS
  - ▶ Means for certification of SQA

# SIP progress -deliverables



# SIP progress – RCOs

- ▶ During the FSA, a number of Risk Control Options (RCOs) in order to assess safety
  - ▶ RCO 1: Integration of navigation information and equipment including improved **software quality assurance**
  - ▶ RCO 2: Bridge alert management
  - ▶ RCO 3: Standardized mode(s) for navigation equipment
  - ▶ RCO 4: Automated and standardized ship-shore reporting
  - ▶ RCO 5: Improved reliability and resilience of onboard PNT systems
  - ▶ RCO 6: Improved shore-based services
  - ▶ RCO 7: Bridge and workstation layout standardization

# SIP progress – Solutions

- ▶ Five e-navigation solutions have been prioritized as part of the present SIP (Strategy Implementation Plan)
  - ▶ S1: **improved, harmonized** and user-friendly bridge design;
  - ▶ S2: means for standardized and automated reporting;
  - ▶ S3: improved reliability, resilience and integrity of bridge equipment and **navigation information**;
  - ▶ S4: **integration and presentation of available information** in graphical displays received via communication equipment;
  - ▶ S9: improved Communication of VTS Service Portfolio



# SIP progress-Solution to RCO

Solution	Sub-Solution	RCO
S1 Improved, harmonized and user-friendly bridge design	S1.1 Ergonomically improved and harmonized bridge and workstation layout.	RCO 7 Bridge and work station lay-out standardization
	S1.4 Standard default settings, save/recall settings, and S-mode functionalities on relevant equipment.	RCO3 Standardized mode(s) for navigation equipment
	S1.5 All bridge equipment to follow IMO BAM (Bridge Alert Management) performance standard	RCO2 Bridge alert management
	<b>S1.6 Information accuracy/reliability indication functionality for relevant equipment</b>	<b>RCO1 Integration of navigation information and equipment including improved software quality assurance</b>
	<b>S1.7 Integrated bridge display system (INS) for improved access to shipboard information</b>	

# SIP progress-Solution to RCO

Solution	Sub-Solution	RCO
S3 Improved reliability, resilience and integrity of bridge equipment and navigation information	S3.1 Standardized self-check/built-in integrity test with interface for relevant equipment (ex.: bridge equipment)	<b>RCO1</b> <b>Integration of navigation information and equipment including improved software quality assurance</b>
	S3.2 Standard endurance, quality and integrity verification testing for relevant bridge equipment, including software	
	S3.3 Perform information integrity tests based on integration of navigational equipment – application of INS integrity monitoring concept	
	S3.4 Improved reliability and resilience of on-board PNT information by integration with internal and external systems	RCO5 Improved reliability and resilience of onboard PNT systems

# SIP progress-Solution to RCO

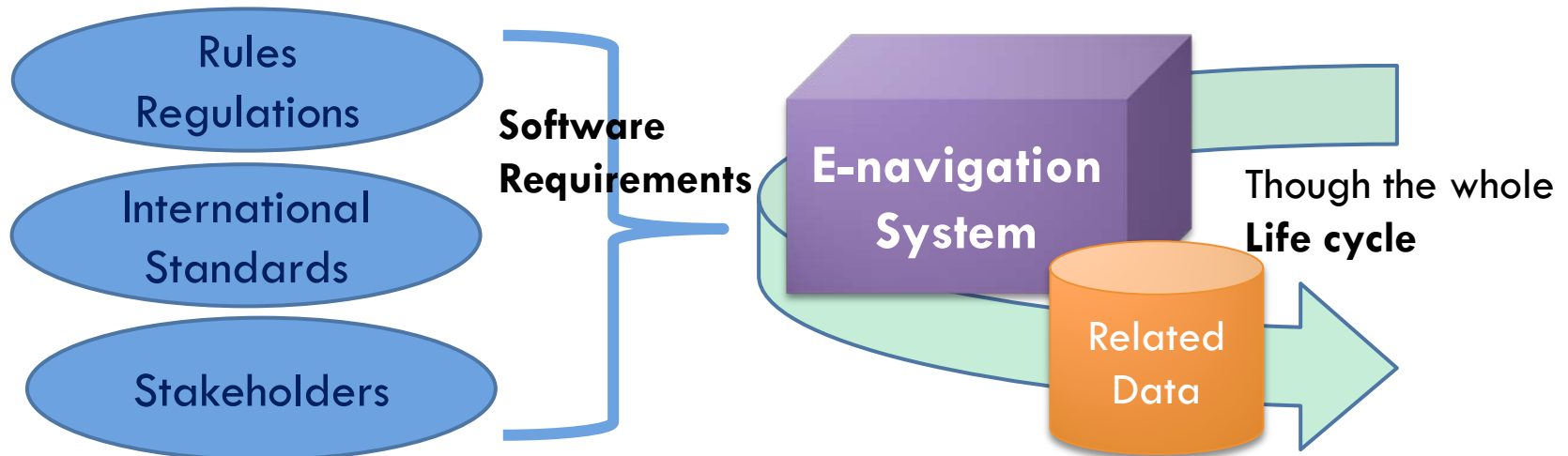
Solution	Sub-Solution	RCO
S4 Integration and presentation of available information in graphical displays received via communication equipment	S4.1.2 Standardized interfaces for data exchange should be developed to support transfer of information from communication equipment to navigational systems (INS)	RCO1 Integration of navigation information and equipment including <b>improved software quality assurance</b>
	S4.1.3 Provide mapping of specific services (information available) to specific regions (e.g. maritime service portfolios) with status and access requirements.	RCO6 Improved shore-based services
	S4.1.6 Provide quality assurance process to ensure that all data is reliable and is based on a consistent common reference system (CCRS) or converted to such before integration and display.	RCO1 Integration of navigation information and equipment including improved software quality assurance

# Current status

- ▶ SQA guidelines for e-navigation systems
  - ▶ Submitted to
    - ▶ NAV correspondence group report
    - ▶ Annex 6
    - ▶ NCSR 1<sup>st</sup> (30.June~4.July)

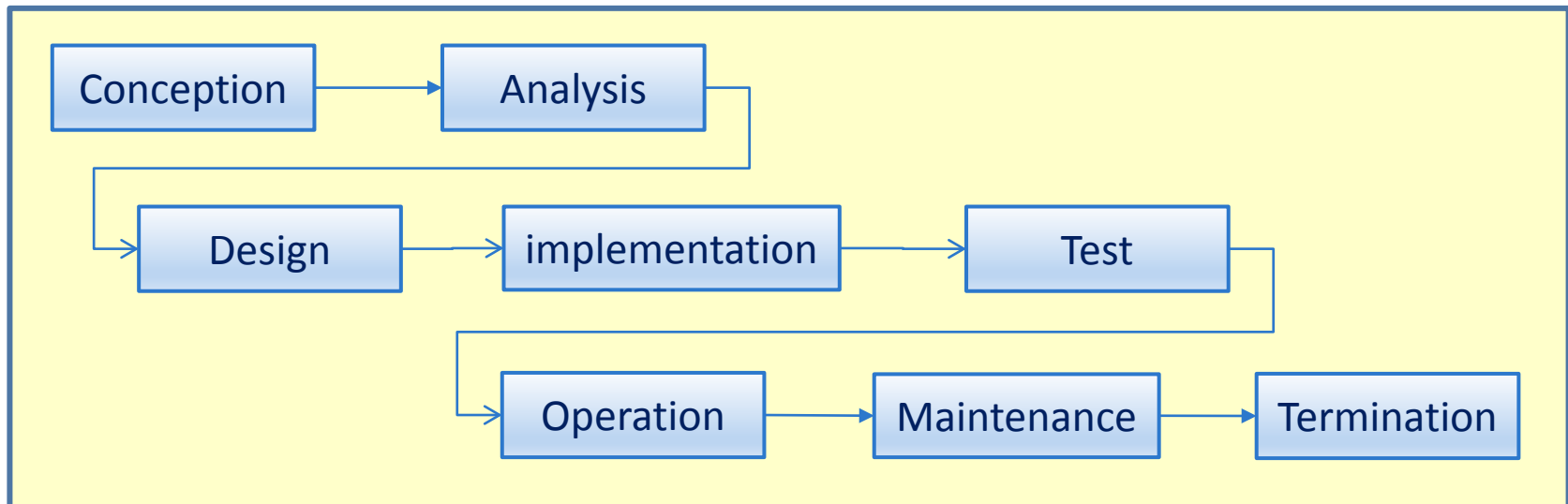
# The scope of SQA

- ▶ To ensure that **software requirements** from relevant **regulations**, from applicable **standards**, and from **stakeholders** are fulfilled throughout the **life cycle** of an **e-navigation system** and the life cycle of any **related data** used within software.



# Software/Data Life cycle

- ▶ the stages and activities spanning the life of the software/data product - **from the conception** of its requirements **to the termination** of its use;
- ▶ The life cycle covers the stages of conception, analysis, design, operation, maintenance and termination.



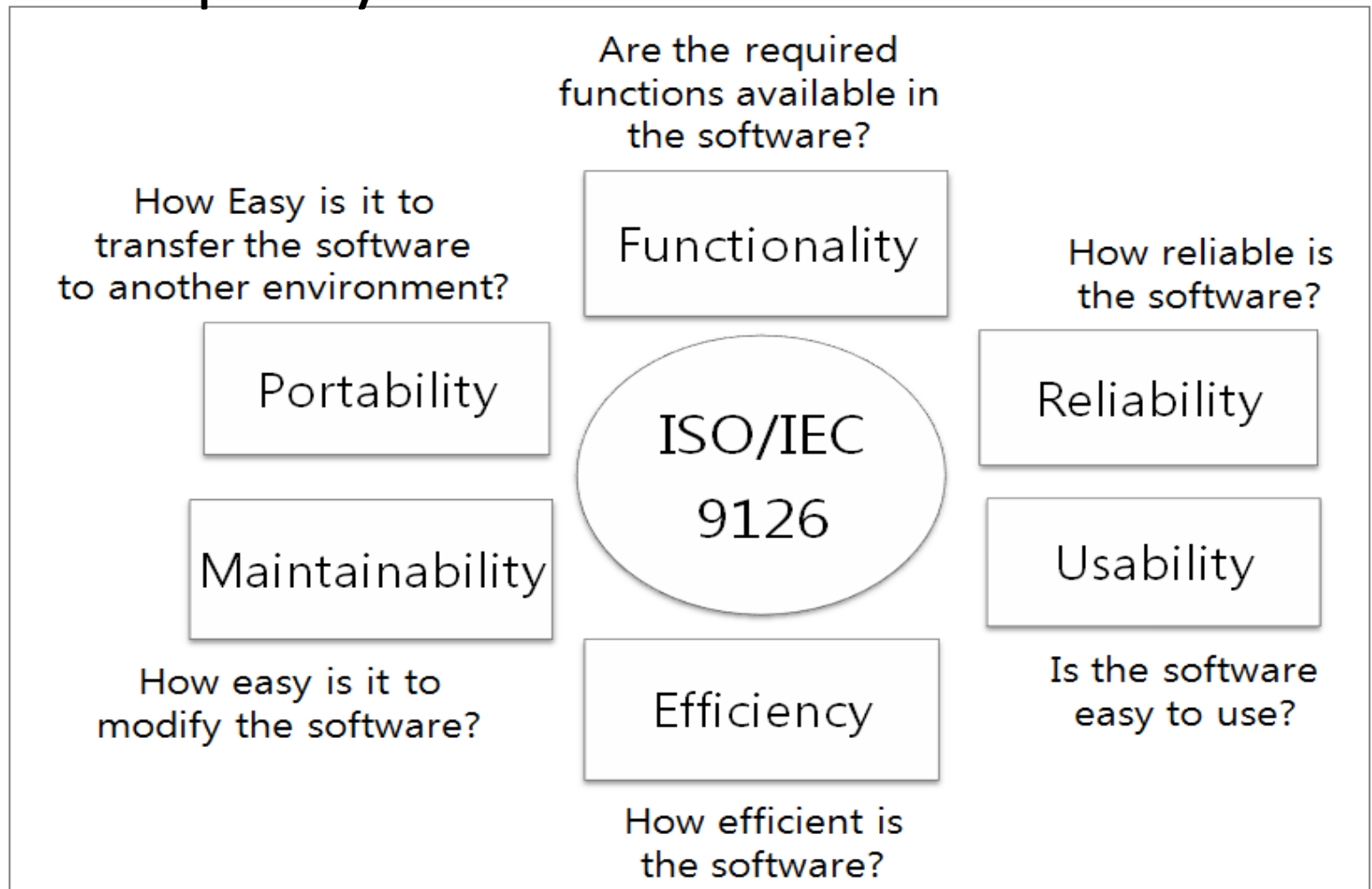
# Software Quality Models

- ▶ Product Quality
  - ▶ ISO/IEC 9126-4, ISO/IEC 25010
  - ▶ GS (Rep. of Korea)
- ▶ Data Quality
  - ▶ ISO/IEC 25012, ISO/IEC 25024
- ▶ Quality in Use
  - ▶ ISO/IEC 25060
- ▶ Process Quality
  - ▶ ISO/IEC 12207, CMMI, SPICE
  - ▶ SP (Rep. of Korea)

*Life cycle related:*  
*ISO/IEC 15288*  
*ISO/IEC 15026*

# Software Quality Models

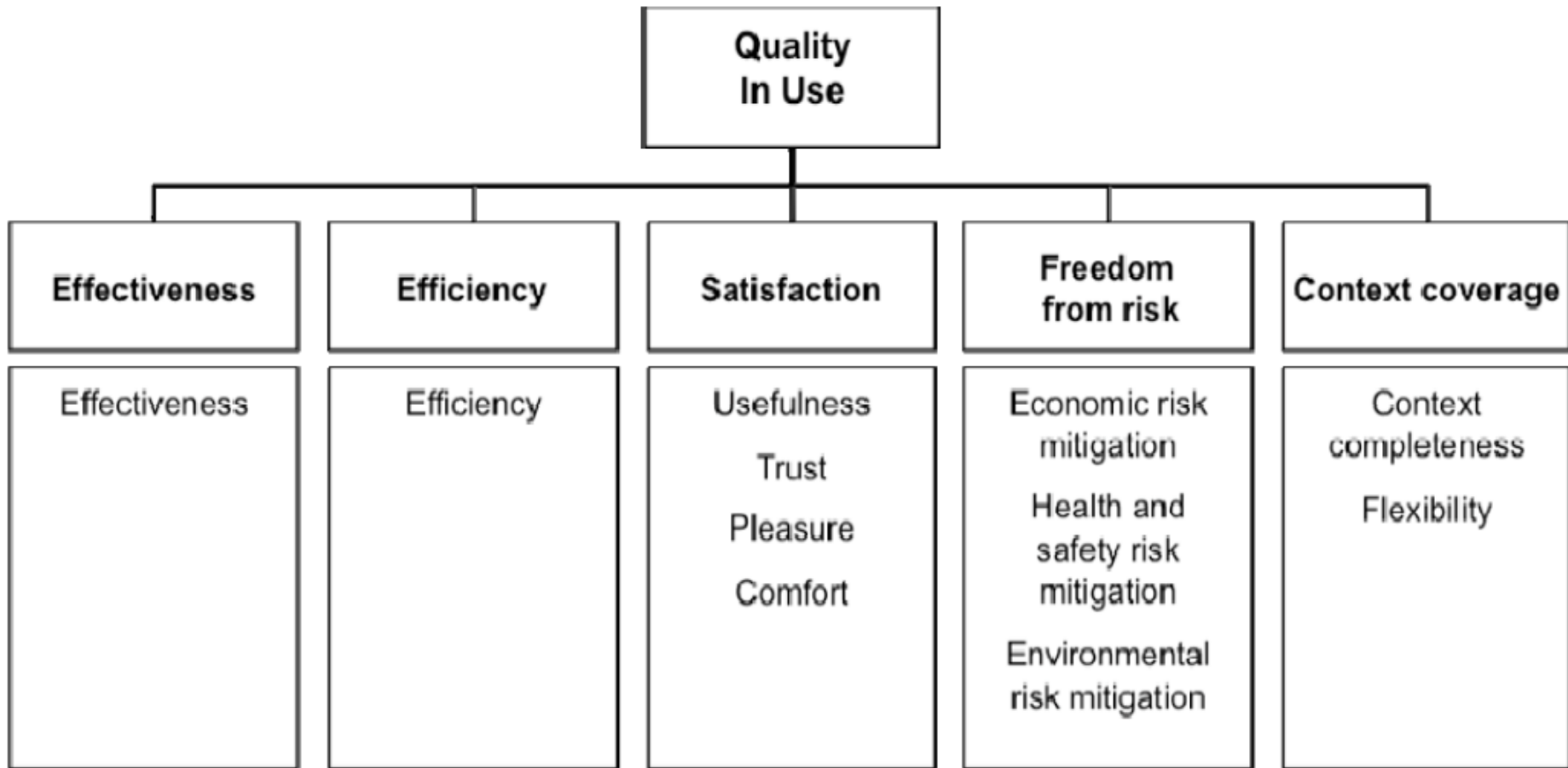
## ▶ Product quality model





# Software Quality Models

## ► Quality-in-use model



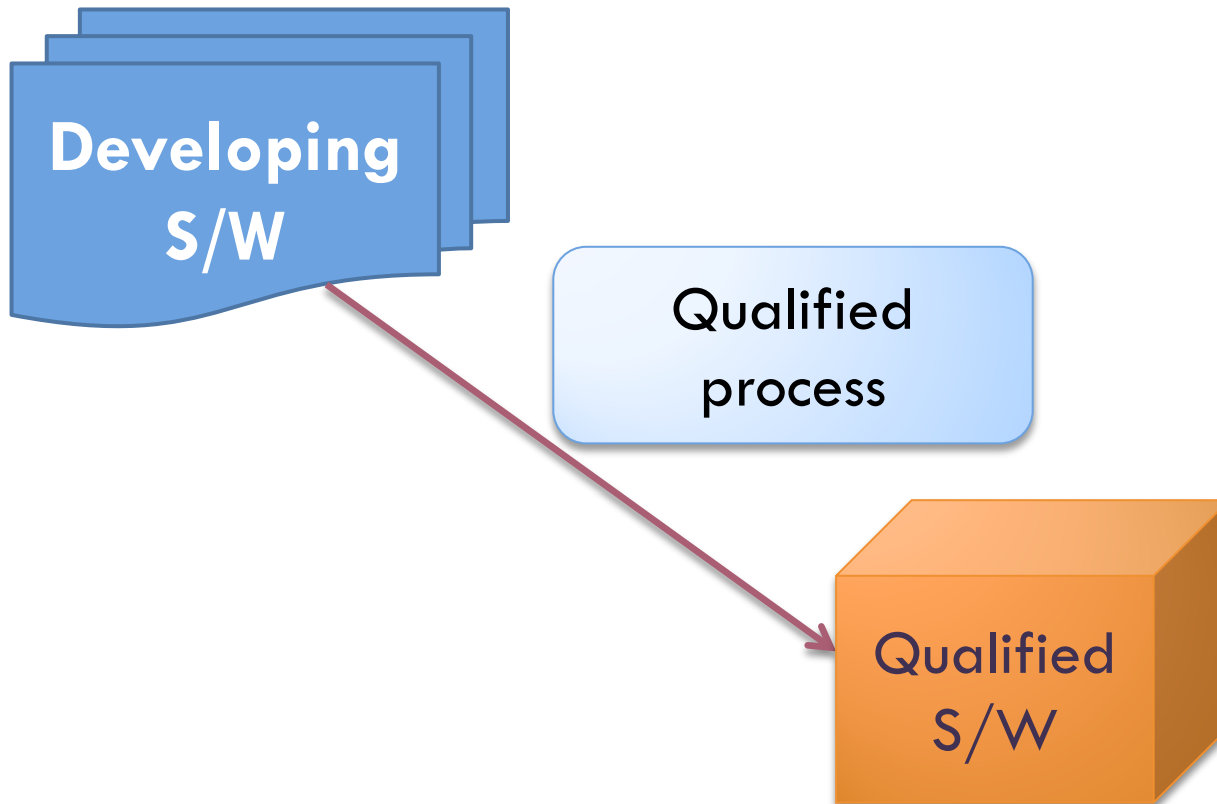
# Software Quality Models

## ▶ Data quality

- ▶ Applied to ensure the qualified data involved in software
  - ▶ used by software
  - ▶ software produces
- ▶ Depending on the specialties of e-navigation systems, data quality might be important issue.
  - ▶ Some of software problems caused by data issue

# Software Quality Models

## ► Process quality



# Considerations to be improved

## ▶ Applying Quality Models

### ▶ Specific SQA guidelines

- ▶ For onboard/shore-based
- ▶ For Specific equipment

### ▶ Sustainable amendments

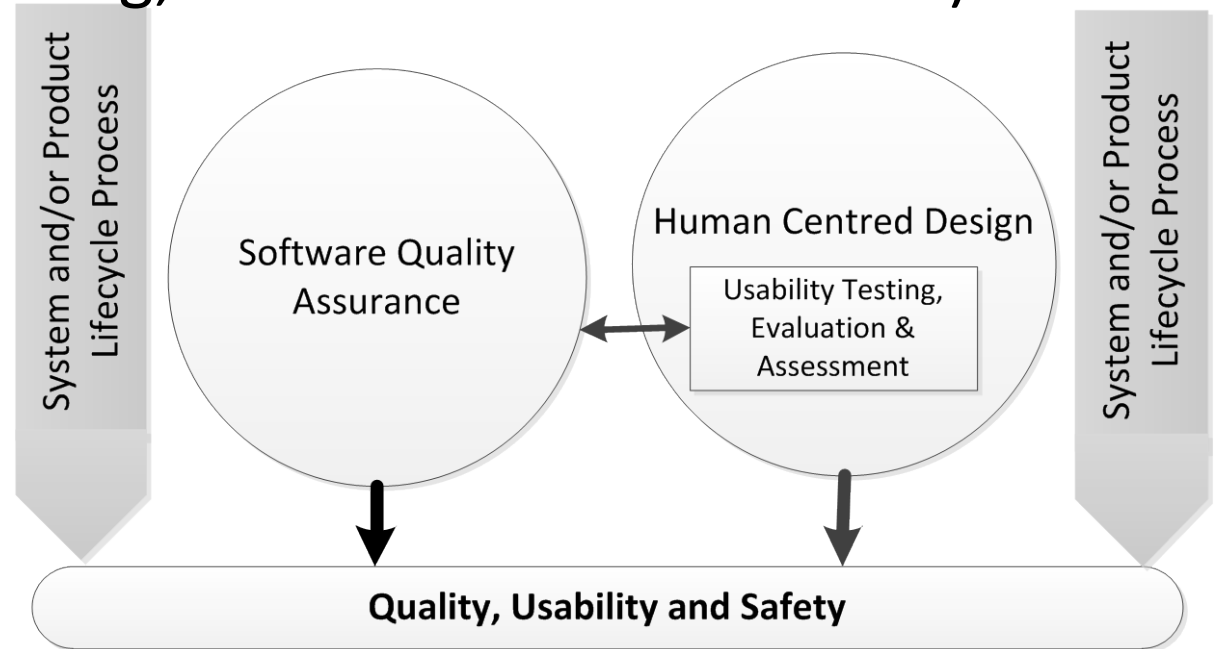
- ▶ By practices
- ▶ By stakeholders' requirements

# Considerations to be improved

## ▶ Relevant concepts

- ▶ HCD (Human Centred Design) and U-TEA (Usability Testing, Evaluation & Assessment)

**Links between the SQA, HCD and U-TEA guidelines**

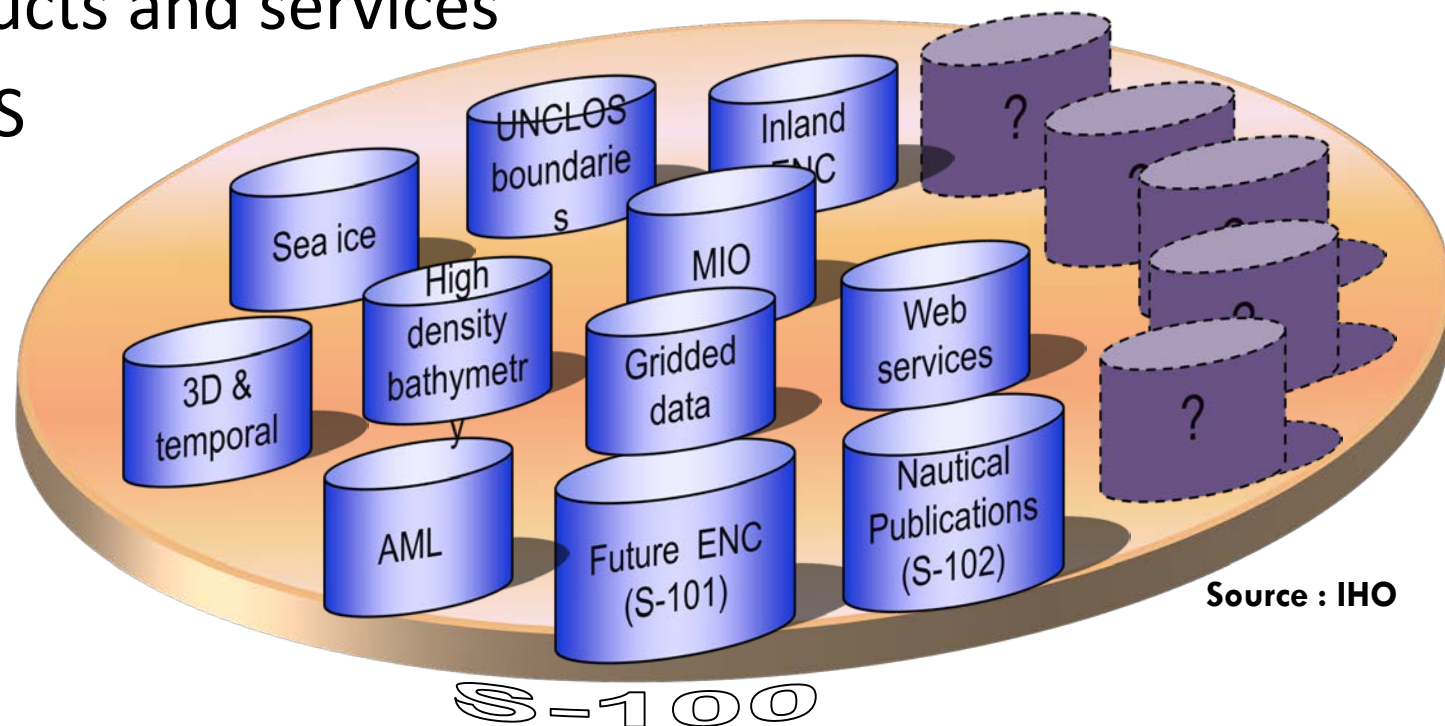


Source : Draft HCD guidelines on e-navigation systems

# Considerations to be improved

## ► Relevant concepts

- S-100 will support a great variety of data sources, products and services
- CMDS



Source : IHO

# Expectations

- ▶ To provide the benefits for all stakeholders, regarding on software/system/software service and data used in software through the life cycle
  - ▶ Customers can be served qualified software/data.
  - ▶ Providers can verify their qualified software/data.
- ▶ e-navigation SQA will support the two types of view points by how to dealing with.

# Conclusions

- ▶ SQA process will be designed in detail.
- ▶ Key activities will be developed for the SQA process.
- ▶ Practices will be developed for support the SQA process.





***Thank you very much.***