CSSC 中国船舶及海洋工程设计研究院 MARINE DESIGN & RESEARCH INSTITUTE OF CHINA

MARIC

OCX APPLICATION IN INTEGRATED MODEL

NEW COOPERATION WAY FOR TOMORROW

O P E N C L A S S 3 D E X C H A N G E

1. INRTODUCTION OF MARIC
2. INTEGRATED MODEL REVIEW
3. EXTEND OCX SCHEMA
4. SUMMARY AND FUNTURE PROSPECT

IT DEPT.
VICE DIRECTOR
HAIYING ZHANG

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CSSC 中国船舶及海洋工程设计研究院
MARINE DESIGN & RESEARCH INSTITUTE OF CHINA

1

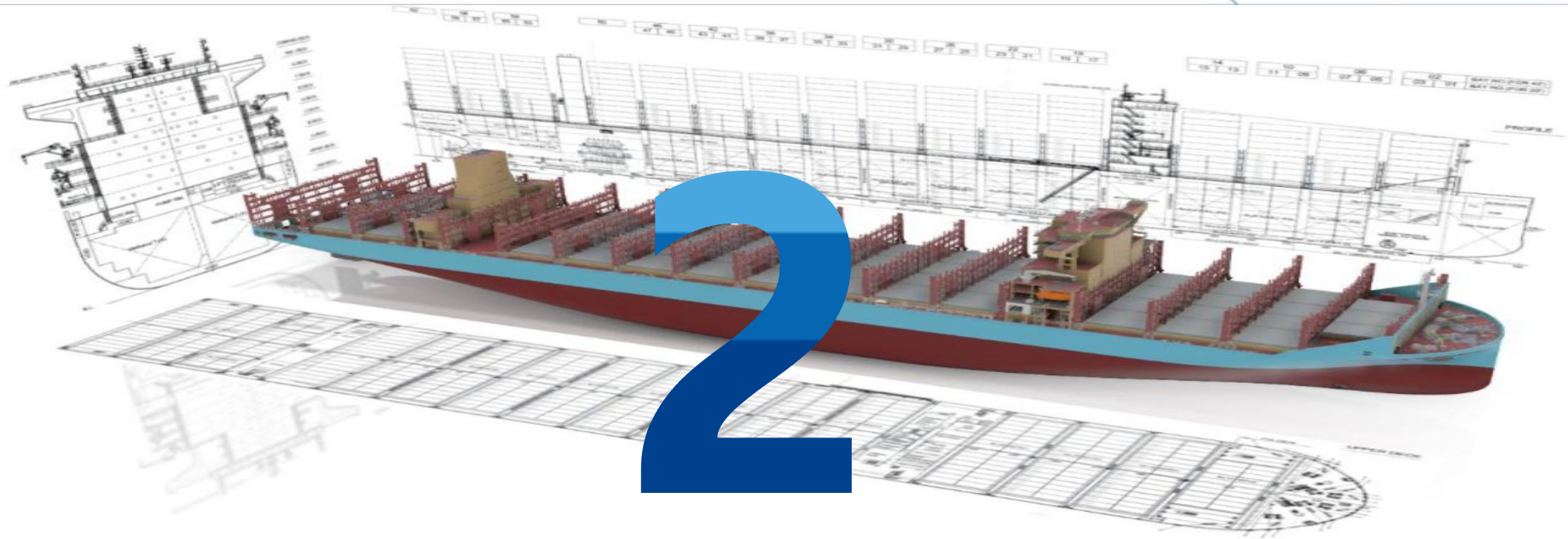
MARIC INTRODUCTION

BRIEF INTRODUCTION

1. MARIC INTRODUCTION

MERCHANT RESEARCH INSTITUTE OF CHINA(MARIC)

- The first design institute of merchant ships and offshore engineering in China.
- Subsidiary of China State Shipbuilding Corp (CSSC)
- Member of the International Ship Structure Committee (ISSC)
- Member of the International Towing Tank Committee (ITTC)
- Education and Research Program for Master and PHD in Marine Structure and Hydrodynamics



2

INTEGRATED MODEL REVIEW

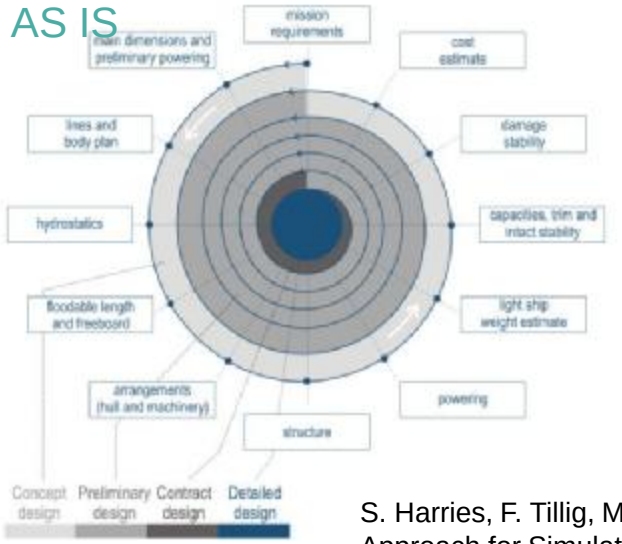
CHALLENGES FACED

2. INTEGRATED MODEL REVIEW

INTEGRATED SHIP DESIGN TO INCREASE CERTAINTY

U. La Monaca, S. Bertagna, A. Marinò, and V. Bucci, 'Integrated ship design: an innovative methodological approach enabled by new generation computer tools', Int J Interact Des Manuf, vol. 14, no. 1, pp. 59–76, Mar. 2020

AS IS



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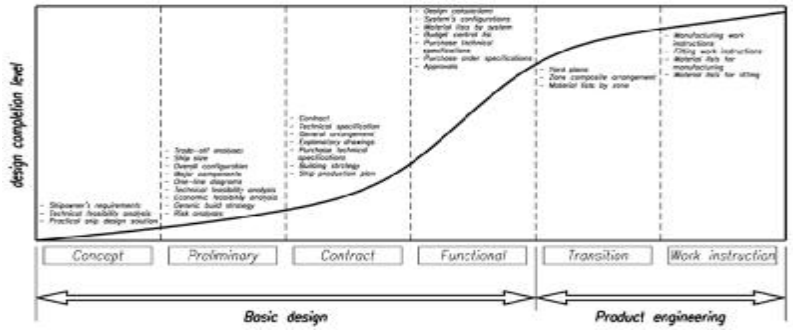
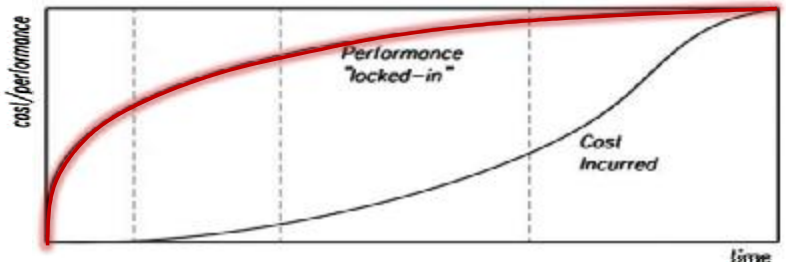




S. Harries, F. Tillig, M. Wilken, G. Lloyd, and G. Zaraphonitis, 'An Integrated Approach for Simulation in the Early Ship Design of a Tanker',

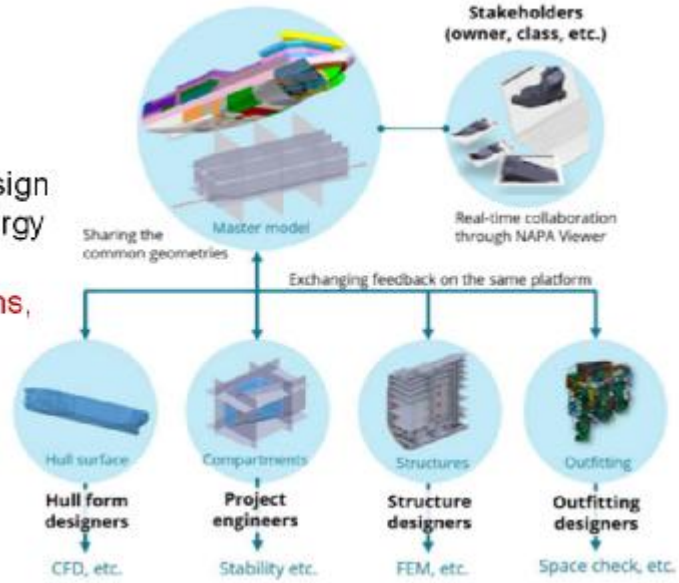
CHALLENGE TO DESIGN OFFICE

- RICHER NEEDS
- HIGHER COMPLEXITY
- SHORTER SCHEDULE
- STRICTER RULES

2. INTEGRATED MODEL REVIEW

SINGLE SOURCE TRUTH BASED ON THE 3D MODEL

" In the early design phase, which includes the development of new design concepts and the basic design process around contracts, it is necessary to study a variety of design options targetting improved energy efficiency, weight reduction, improved payload capacity etc. to achieve a competitive design within a limited design time frame. The process is very complicated because of frequent hull form modifications, compartment arrangement changes etc. Furthermore, when it comes to innovative designs such as vessels applying new fuels, many uncertainties make it more challenging to make decisions with confidence. "



Collaborative Single Model Design Platform for Ships of Tomorrow

Takayoshi Masui, NAPA Japan Ltd., Kobe/Japan, takayoshi.masui@napa.fi
Tapio Seppälä, NAPA Ltd., Helsinki/Finland, tapio.seppala@napa.fi
Myeong-Jo Son, NAPA Ltd., Helsinki/Finland, myeong-jo.son@napa.fi
Janne Huotari, NAPA Ltd., Helsinki/Finland, janne.huotari@napa.fi

3D x SHIP

Reducing Detail Design and Construction Work Content by Cost-Effective Decisions in Early-Stage Naval Ship Design

Robert G. Keane, Jr.,[1] Laurent Deschamps,[1] and Steve Maguire[1]
[1]Ship Design USA, Inc., 4913 Red Hill Rd, Kaodyville, MD 21756
[2]SPAR Associates, Inc., 927 West Street #101, Annapolis, MD 21401
[3]Fast Marine International, 39 St. James' St., London SW1A 1JD, United Kingdom

3D x SHIP

International Journal on Interactive Design and Manufacturing (IJIDeM)
https://doi.org/10.1007/s12008-019-00612-4
ORIGINAL PAPER

Standalone Intelligent General Arrangement Tool for Holistic Basic Design

Madalina Florean, CADMATIC, Groningen/The Netherlands, madalina.florean@cadmatic.com
Verónica Alonso de los Ríos, CADMATIC, Madrid/Spain, veronica.alonso@cadmatic.com
Juan Prieto, CADMATIC, Groningen/The Netherlands, juan.prieto@cadmatic.com
Ludmila Seppälä, CADMATIC, Turku/Finland, ludmila.seppala@cadmatic.com

3D x SHIP

Shipbuilding 3D CAD Tools as an Integrated Solution from Concept to Product

La herramienta CAD 3D para la construcción naval como solución integrada desde el concepto hasta la producción

DOI: https://doi.org/10.25043/19098642.220

Jaime Pérez-Martínez
Rodrigo Pé...

Integrated ship design: an innovative methodological approach enabled by new generation computer tools

Ubaldo la Monaca · Serena Bertagna · Alberto Marinò · Vittorio Bucci

Received: 31 May 2019 / Accepted: 19 September 2019

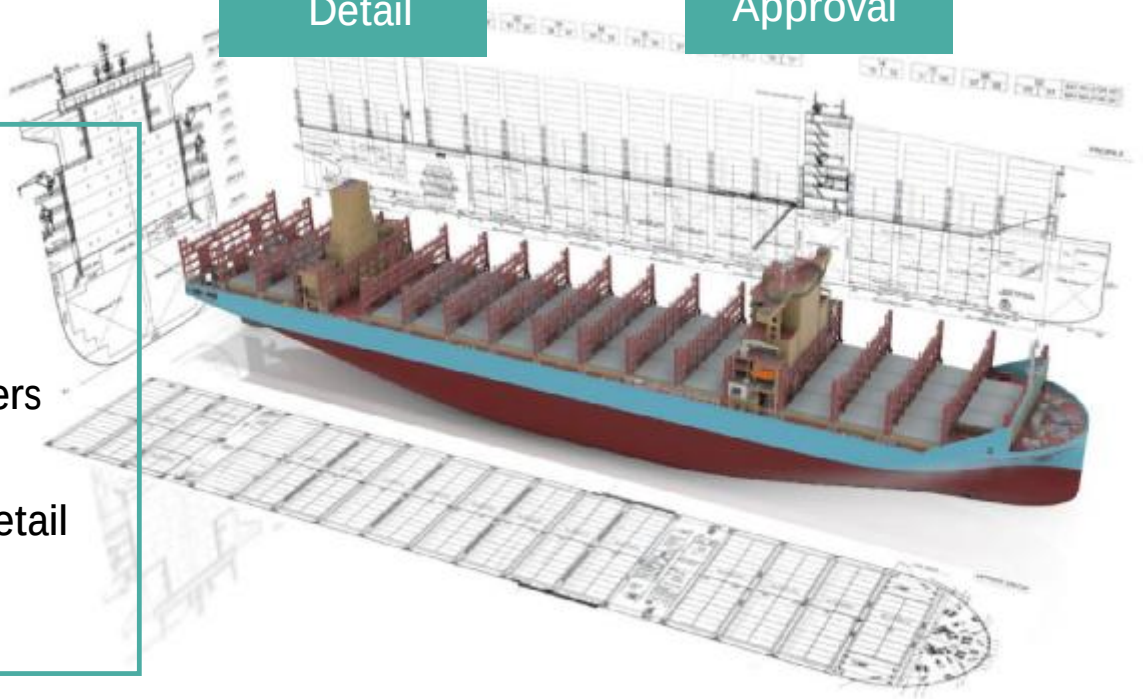
2. INTEGRATED MODEL REVIEW

SINGLE SOURCE TRUTH BASED ON THE 3D MODEL IN MARIC

DESIGN ACTIVITIES

Concept | Integrated | Detail | Approval

- Respond to needs of customers
- Express design intent
- Take the lead in the implementation of integration
- Reduce the cost of communication with stakeholders
- Early identification of design risks
- Reduce the workload of the structure during the detail design phase

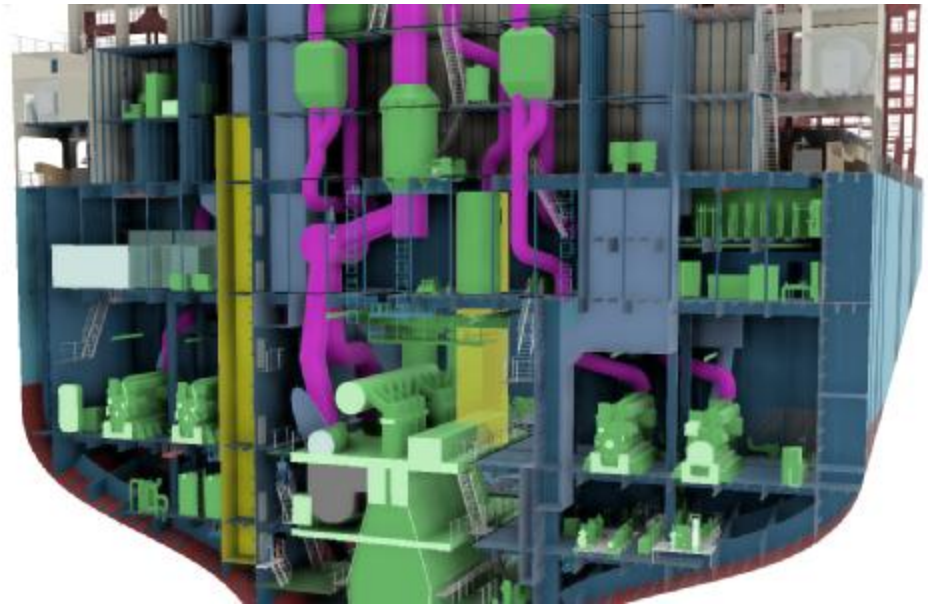


2. INTEGRATED MODEL REVIEW

SINGLE SOURCE TRUTH BASED ON THE 3D MODEL IN MARIC

DESIGN ACTIVITIES

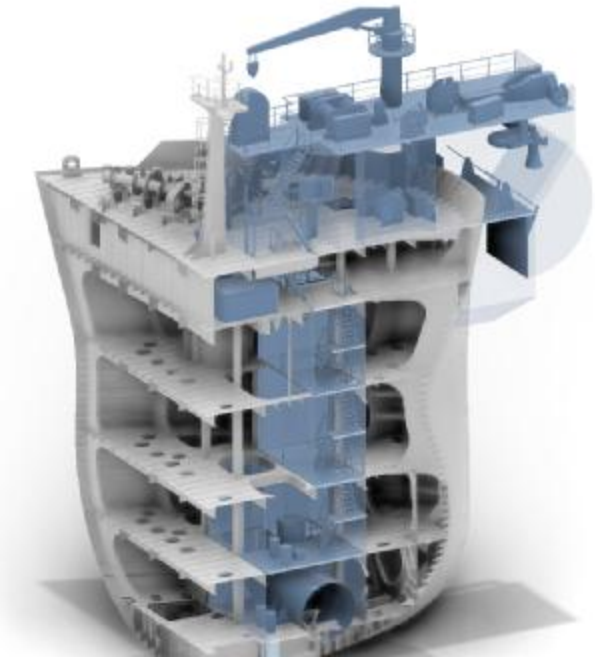
Concept → Integrated → Detail → Approval



- A more comprehensive model
- Less drawings
- Good design results based on rules driven design tools
- Reliability of CAE models on consistency with design
- Tight approval schedule based on reasonable decomposition
- Fast closed comments based on less misunderstanding

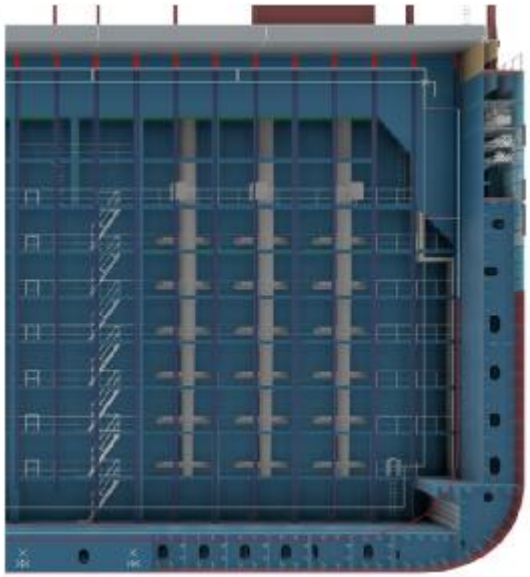
2. INTEGRATED MODEL REVIEW

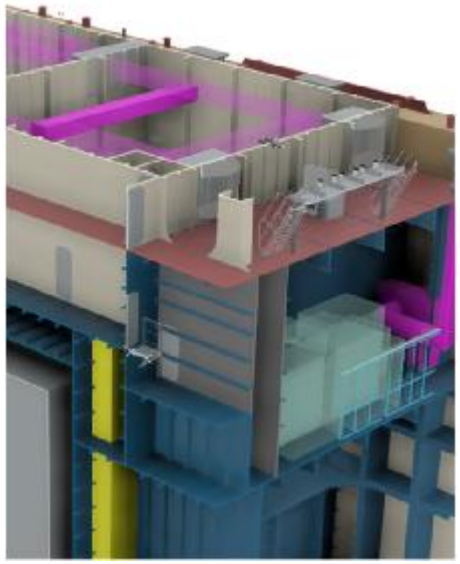
TYPICAL INTEGRATED DESIGN REVIEW SCENARIO



RETROFIT ASSESMENT

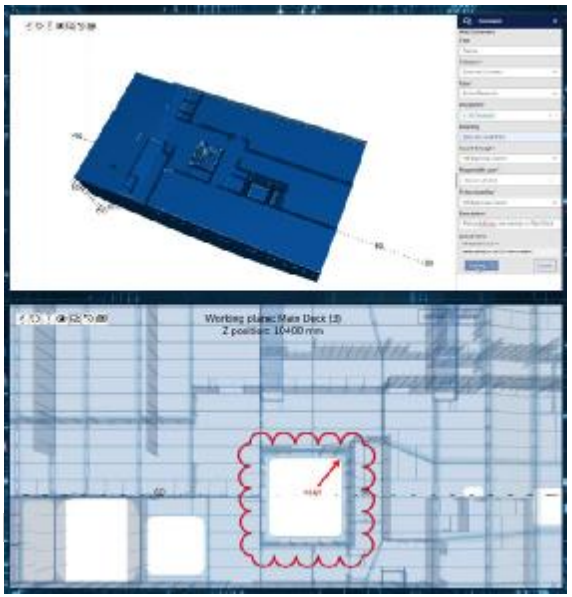
SAFT REGULATION VERIFICATION





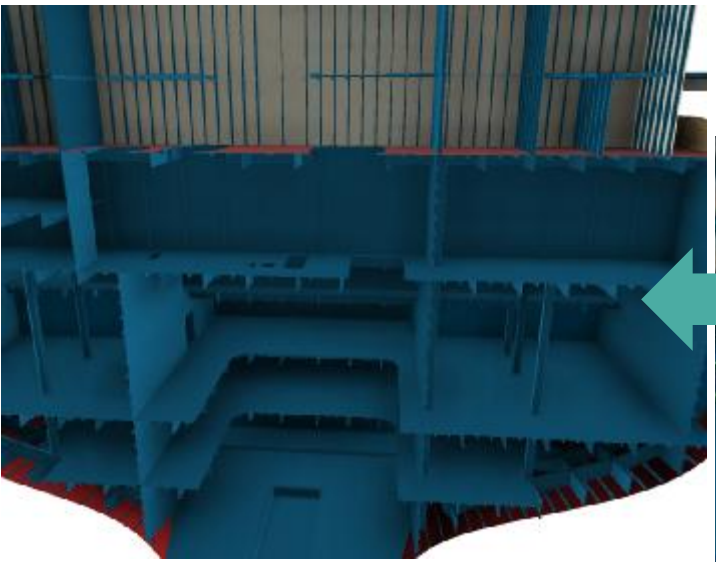
HAZARDOUS ANALYS

REFERENCE FOR 3D APPROVAL



2. INTEGRATED MODEL REVIEW

CONVERGENCE KEY ISSUES: DATA EXCHANGE FOR INTEGRATED MODEL

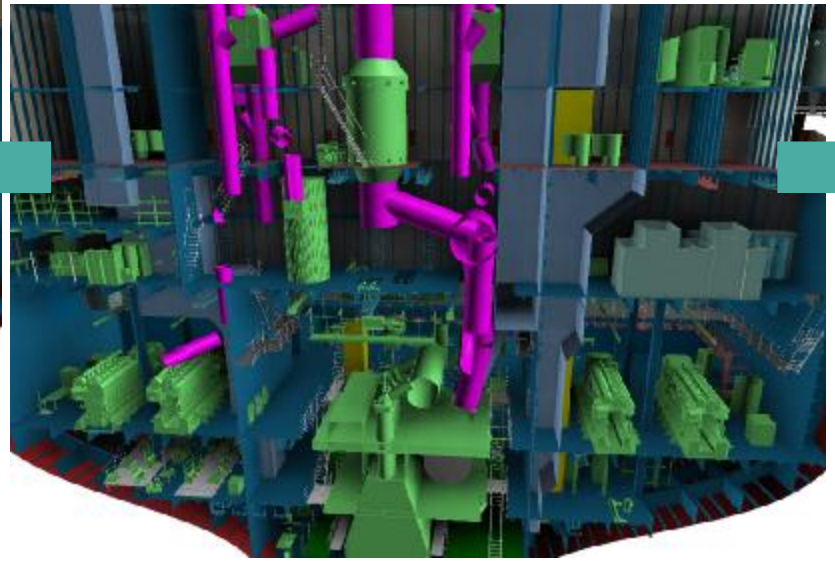


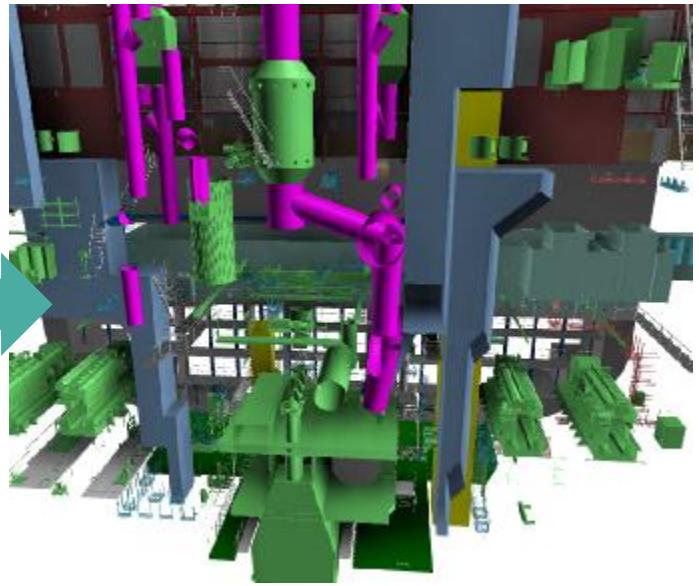
STRUCTURAL OBJECTS

↓

CURRENT OCX SCHEMA √

INTEGRATED MODEL





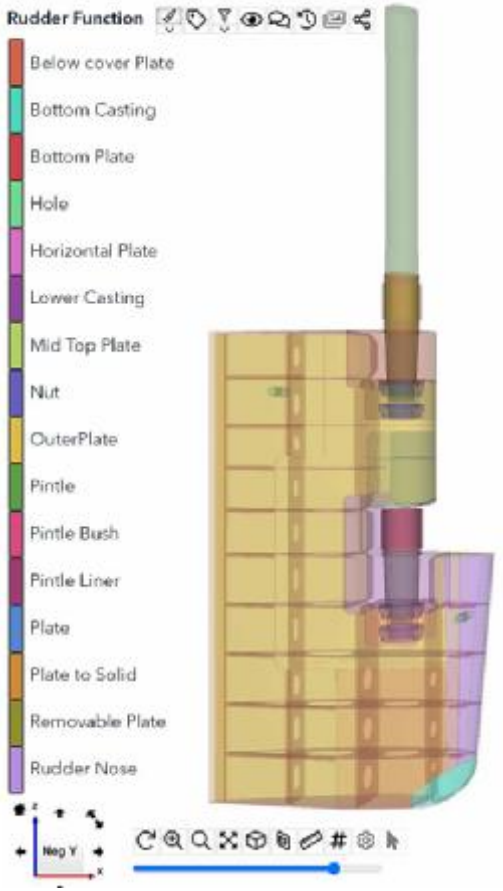
NON-STRUCTURAL OBJECTS

↓

EXTEND OCX SCHEMA

CSSC 中国船舶及海洋工程设计研究院 MARINE DESIGN & RESEARCH INSTITUTE OF CHINA MARIC

MARIC 3D rudder model displayed in Sesam Insight



3

MARIC DNV

EXTEND OCX SCHEMA

BASED ON CURRENT FRAMEWORK

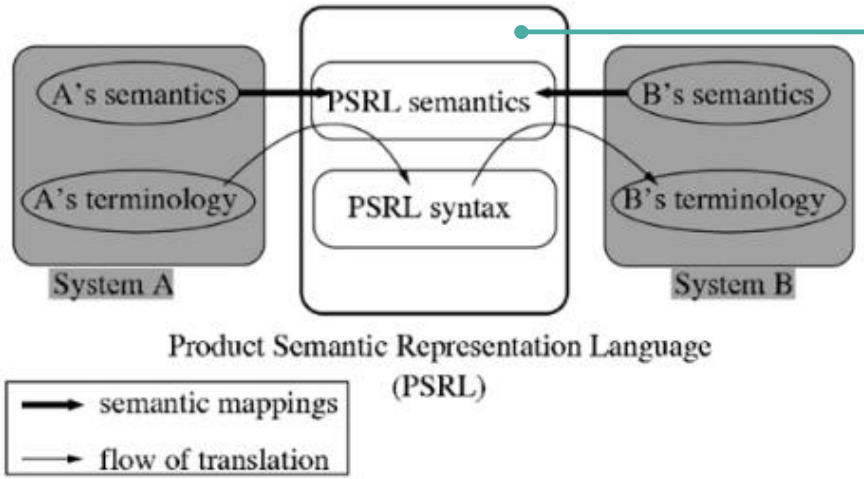
START WITH A SIMPLE DESIGN

3. EXTEND OCX SCHEMA

Understanding of heterogeneous software interoperability

To establish the mapping relationship between two different expressions describing the same design object.

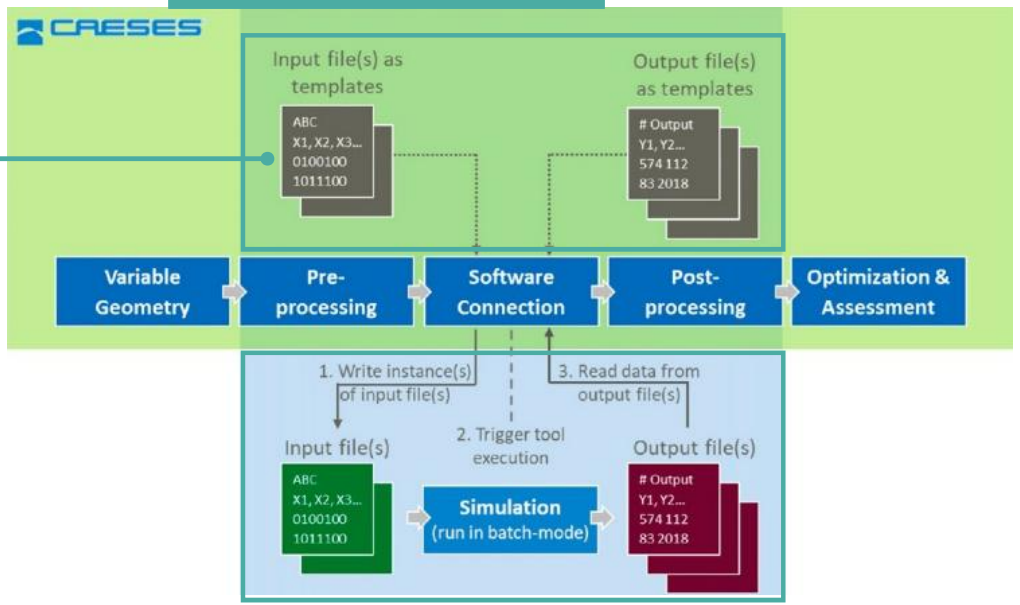
COMMON SEMANTICS → SCHEMA



L. Patil D. Dutta R. Sriram. Ontology-Based Exchange of Product Data Semantics. IEEE Transactions on Automation Science and Engineering, 2(3):213225, 2005.

OCX

COMMON SYNTAX → FORMAT

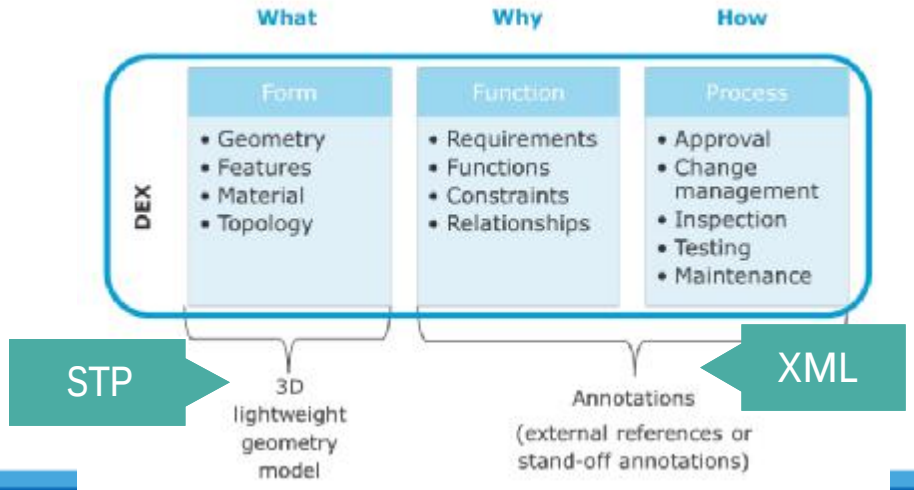


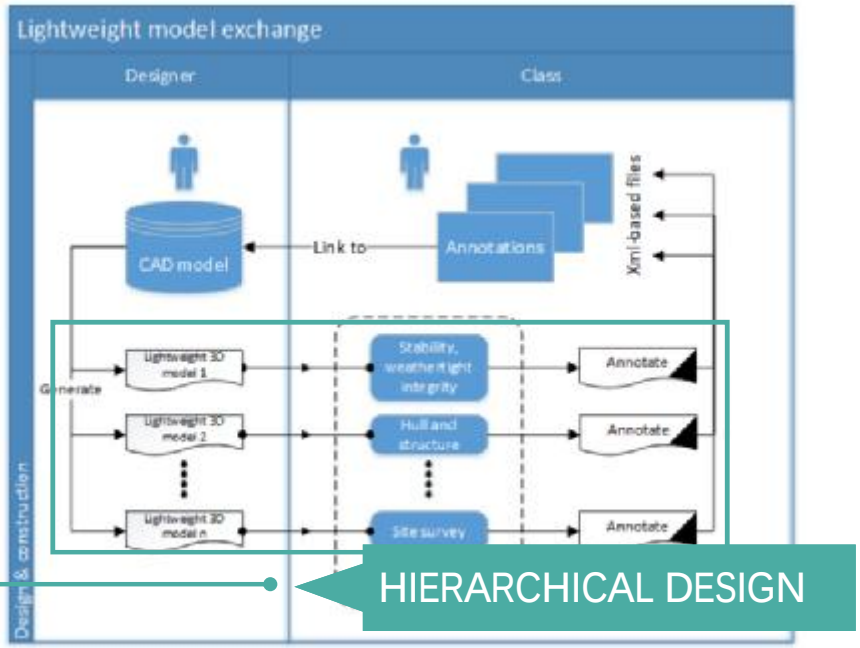
A holistic approach to ship design[M]. New York, NY: Springer Berlin Heidelberg, 2019.

3. EXTEND OCX SCHEMA

Implementation path applicable to MARIC startup

Modeling mechanism



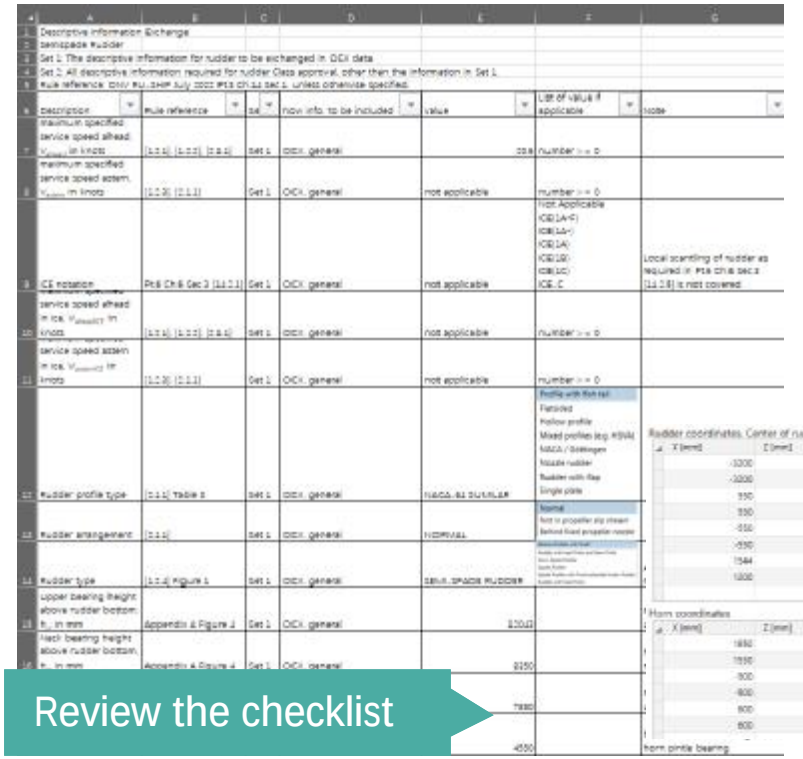


ASTRUP, O.C.(2017) A Model Based Definition for Shipbuilding. DNV 2017-0413, Oslo Norway

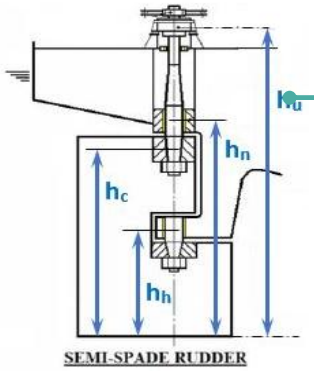
3. EXTEND OCX SCHEMA

Identify verification information beyond geometry

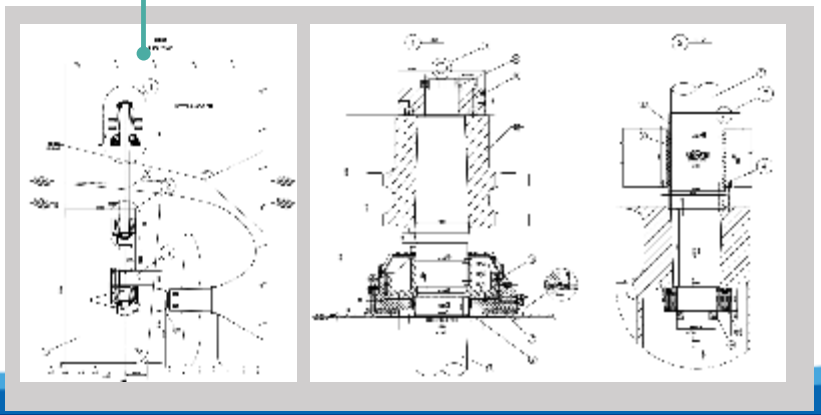
- Defined the inclusion of 3D model review information with attached PDF, not overly pursuing full 3D



Review the checklist



- 3D model contains as much comprehensive component design information as possible.
- For layout & technology, 2D PDF are used as support materials

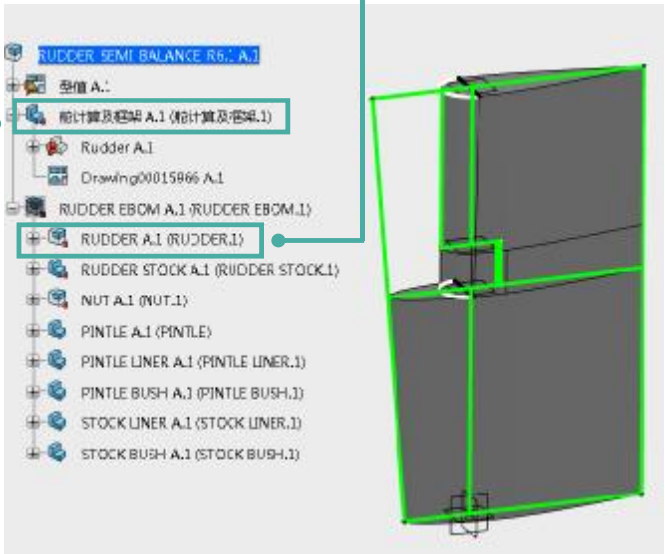


3. EXTEND OCX SCHEMA

Decomposing information in CATIA

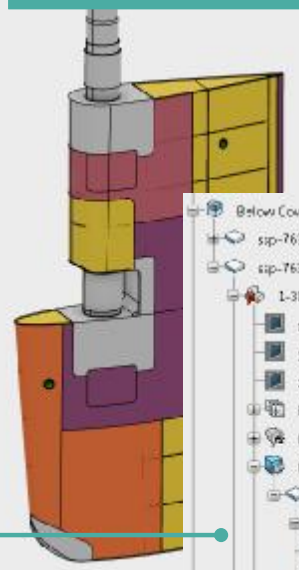
Access key information

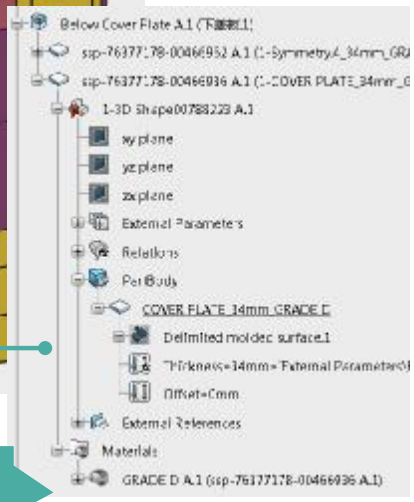
- MARIC adjusted the model architecture based on the consultation results



HIERARCHICAL DESIGN

=> STP





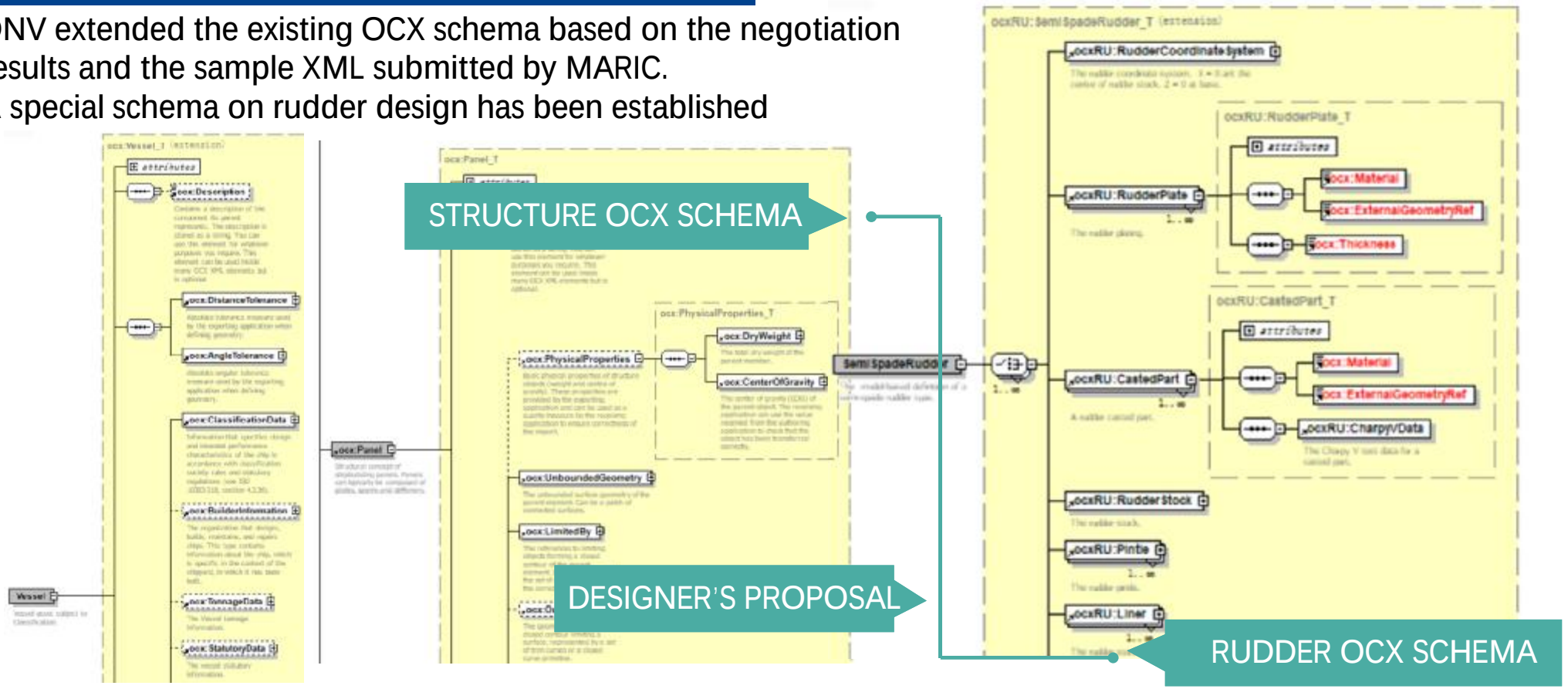
DESIGN FEATURE

=> XML

3. EXTEND OCX SCHEMA

Create new special schema

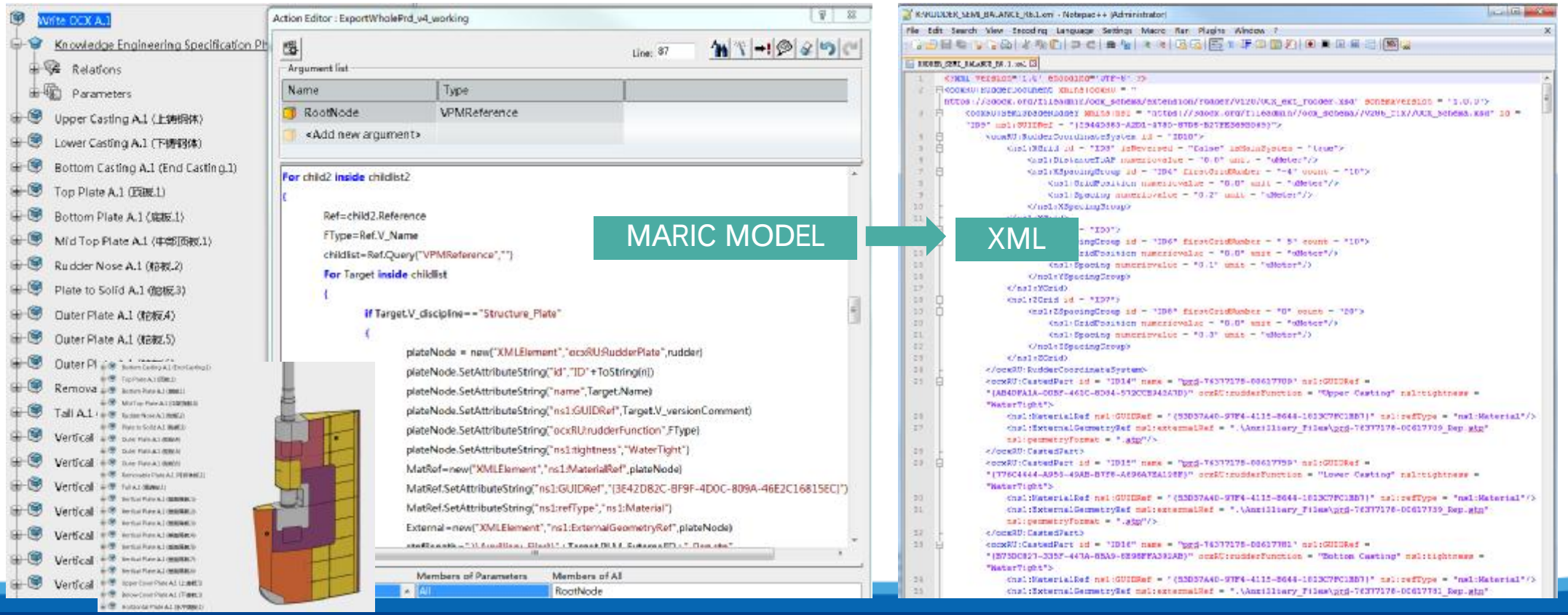
- DNV extended the existing OCX schema based on the negotiation results and the sample XML submitted by MARIC.
- A special schema on rudder design has been established



3. EXTEND OCX SCHEMA

In-house development

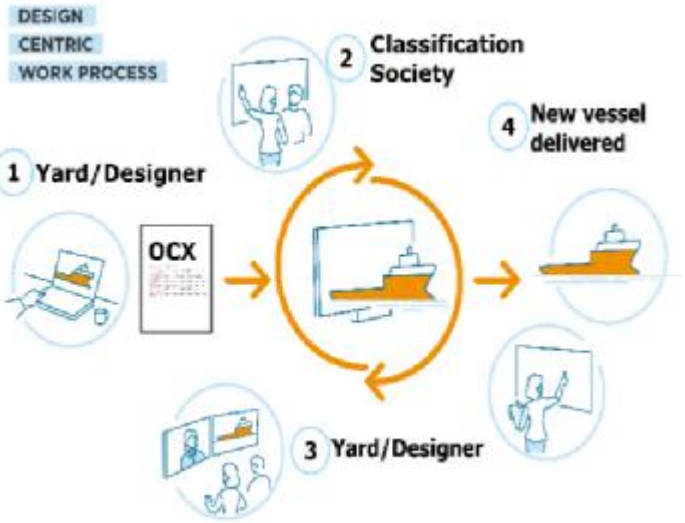
- Based on the built-in knowledge engineering language EKL of CATIA, the design information output xml file is obtained.
- Low cost and agile development.



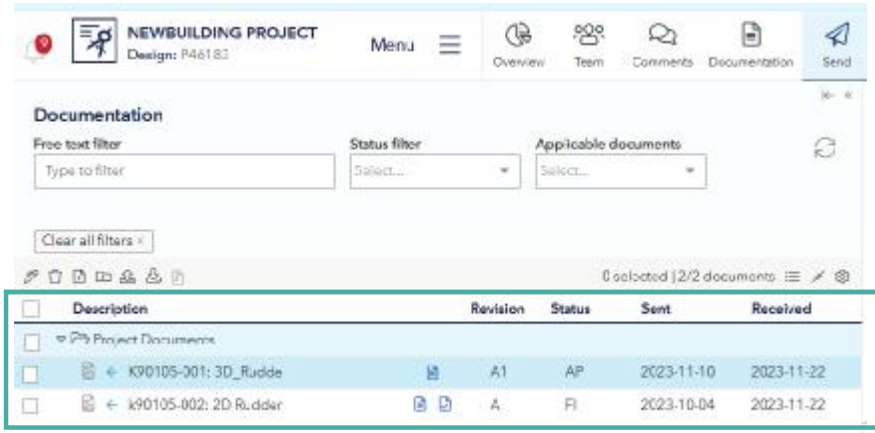
3. EXTEND OCX SCHEMA

Upload the OCX file

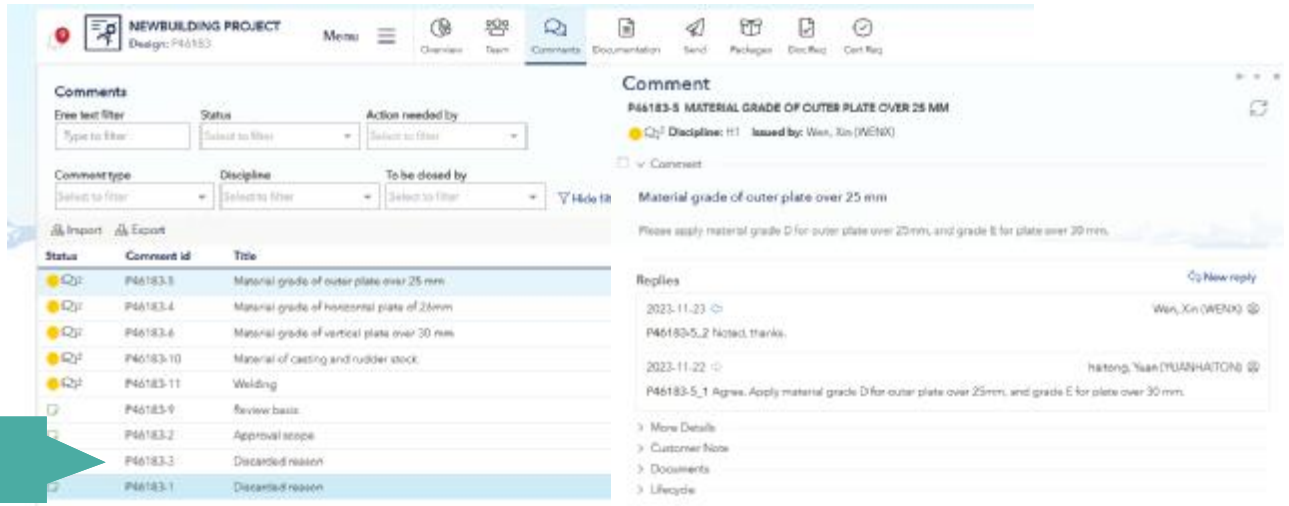
Process of 3DMBA



PAVING THE WAY FOR 3D MODEL-BASED CLASS APPROVAL. DNV 2023



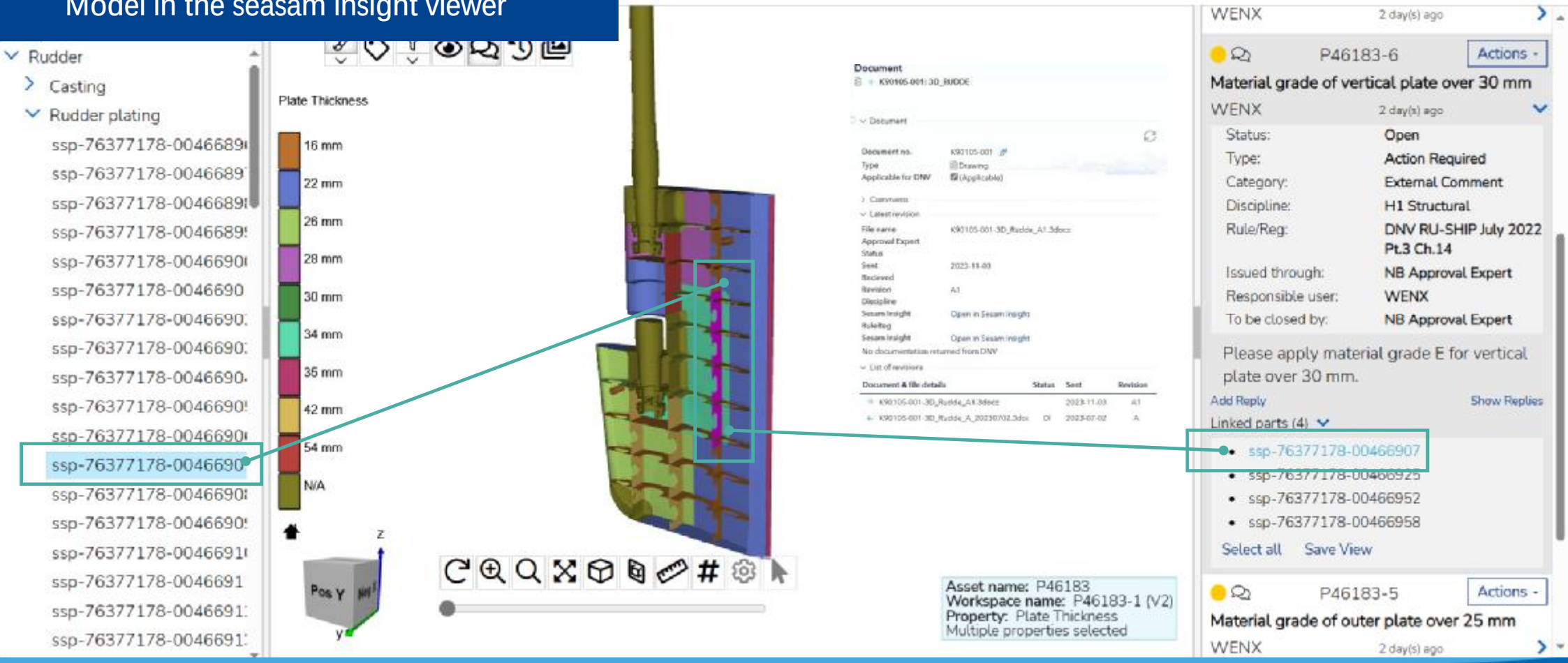
Upload OCX and pdf



Comments from surveyor

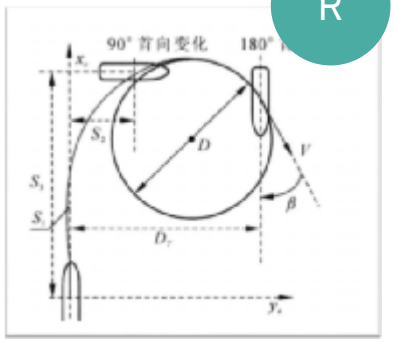
3. EXTEND OCX SCHEMA

Model in the seasam insight viewer



3. OCX IN DESIGN PROCESS

The position of 3D approval in the rudder design process



R

Ship Type

Performance

- Maneuverability
- Turnability
- Appendage Resistance

F

- Direction stability
- Strength

Rudder Layout

- Steering engine
- Hull
- Propeller

L

Physical Design

P

Drawings
Bill of material
Design Calculation

Validation

Sea trial

Rudder Design Process

Verification

CFD

FEM

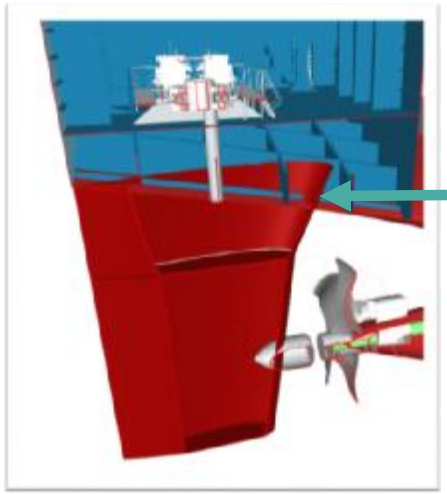
OCX

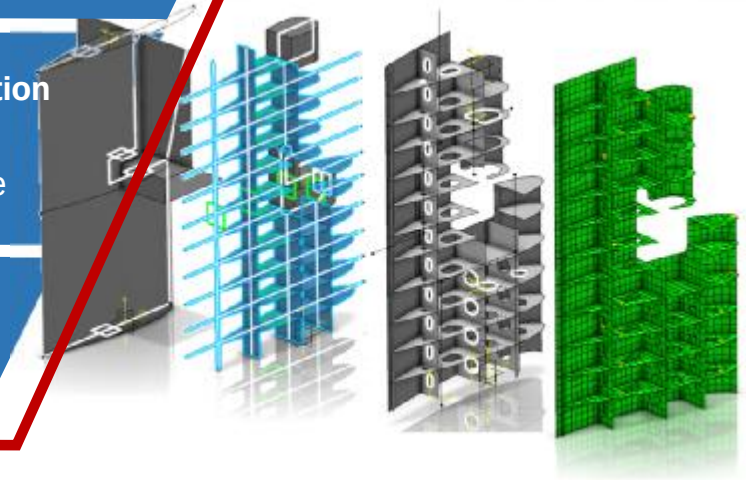
Regulation Calculation

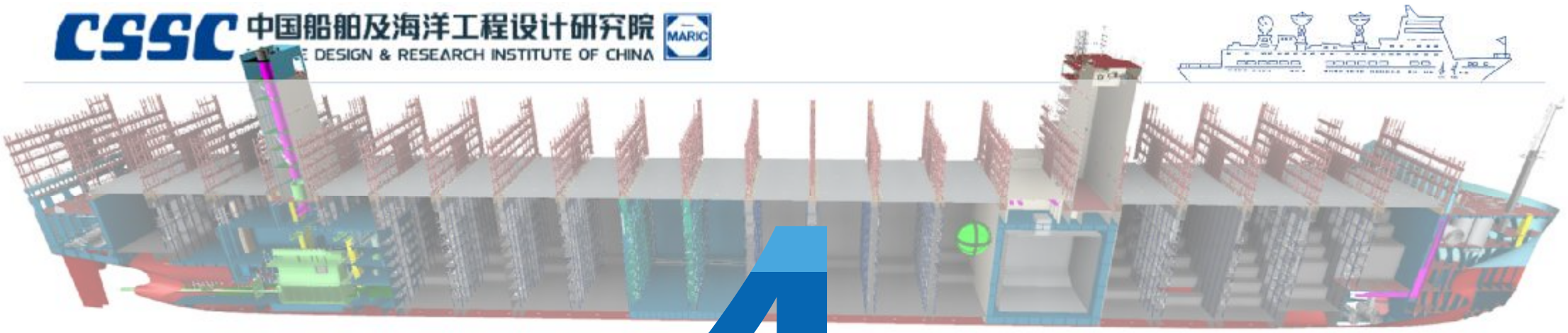
Verification

Integration

Virtual prototype







4

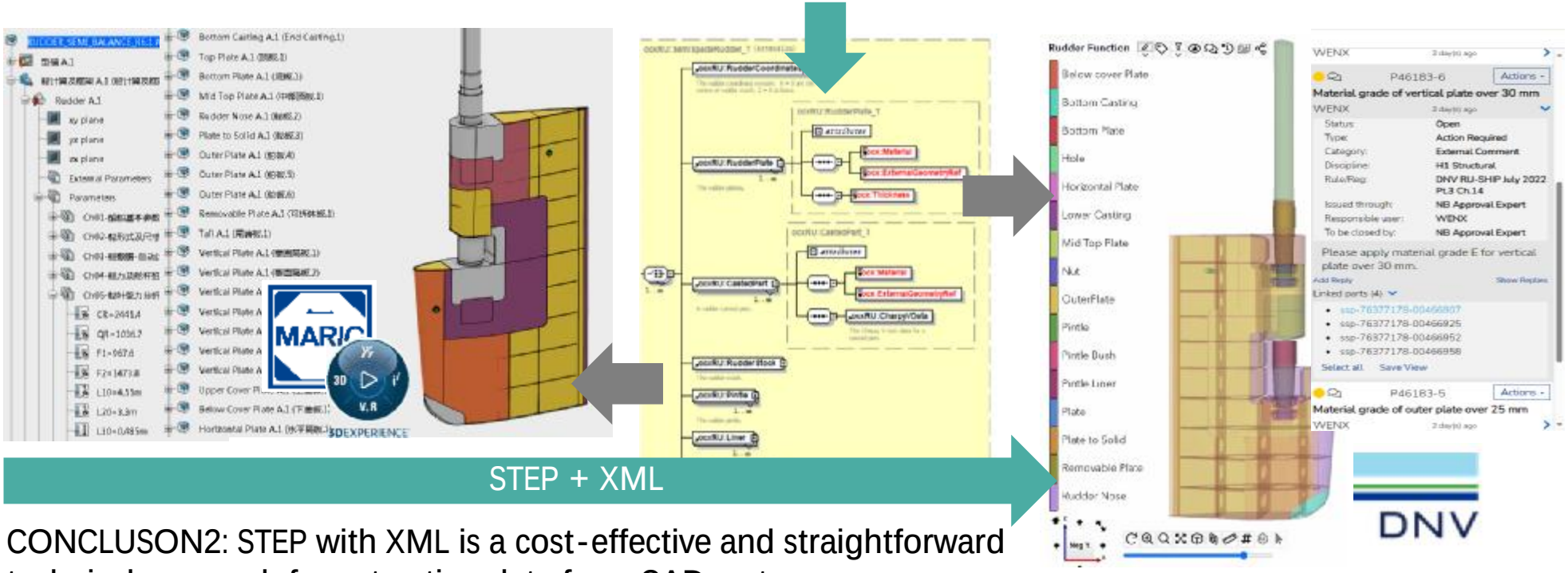
SUMMARY & FUTURE PROSPECT

READY FOR MORE SCENARIOS

4. SUMMARY

CONTRIBUTION OF RUDDER 3D APPROVAL

CONCLUSON1: Extend OCX schema based on consensus between designer and surveyor



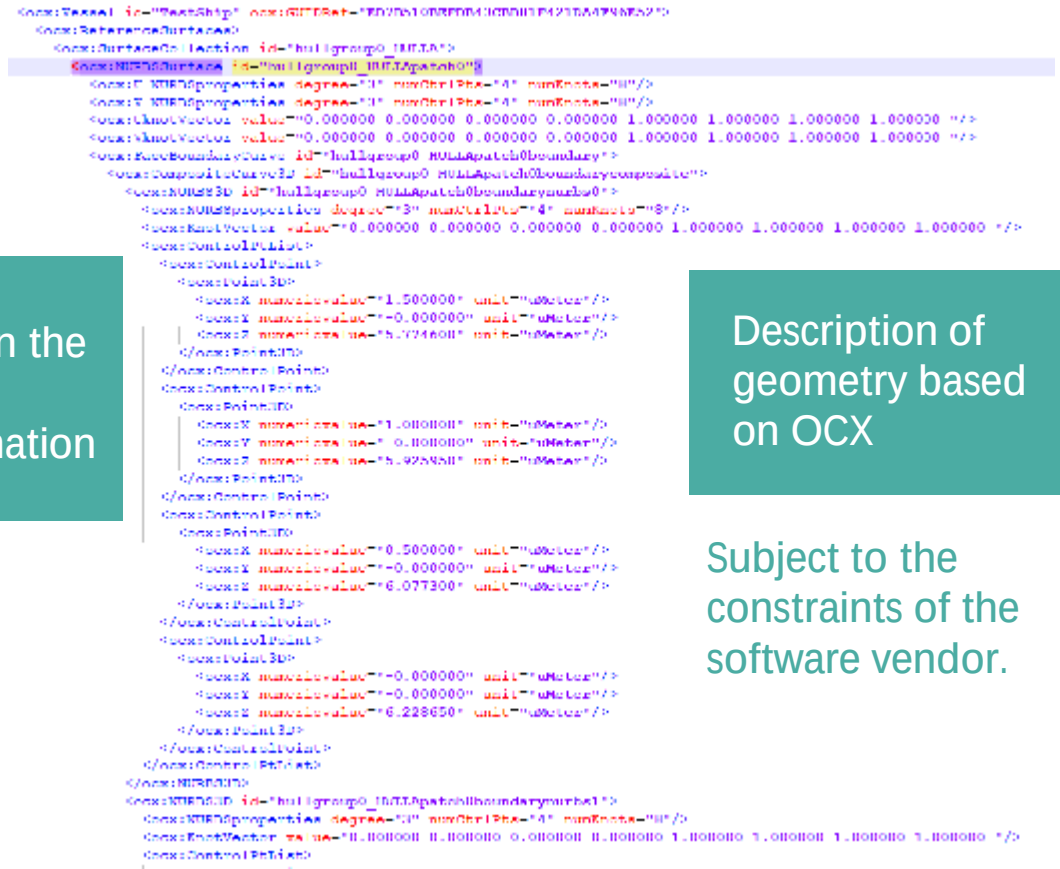
CONCLUSON2: STEP with XML is a cost-effective and straightforward technical approach for extracting data from CAD systems.

4. SUMMARY

CONTRIBUTION OF RUDDER 3D APPROVAL

The file content is greatly simplified by external reference STEP files.

More focus on the expression of design information



Description of geometry based on OCX

Subject to the constraints of the software vendor.

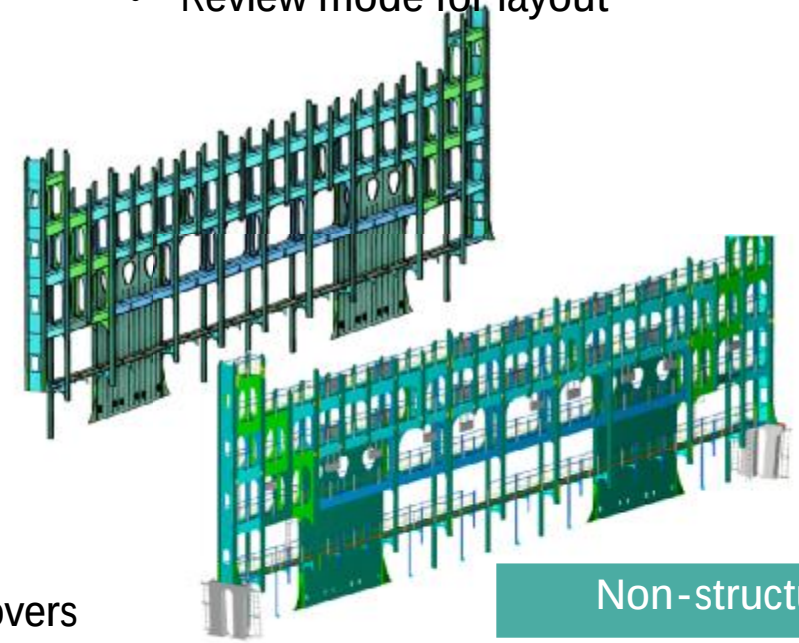
4. FUTURE RESPECTS

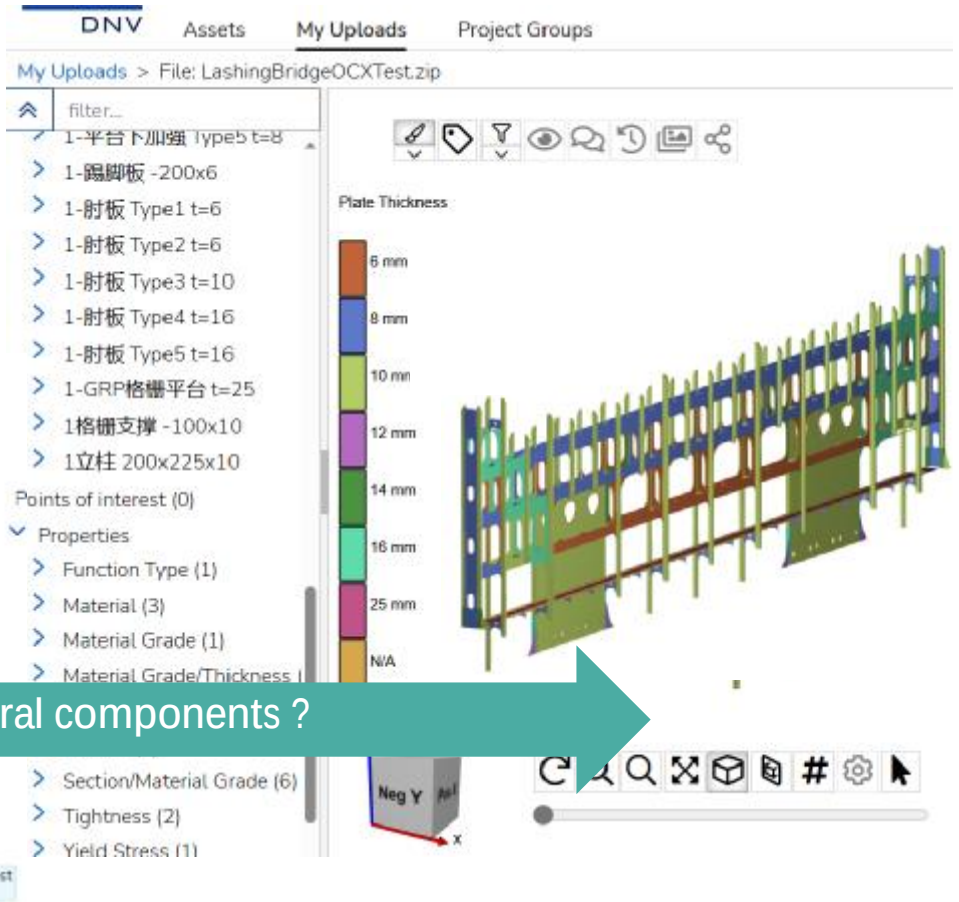
NEXT STEP

- Handrails
- Ladders and covers
- Eye plates
- Lashing Rod stack

Challenge

- Outfitting's representation
- Review mode for layout

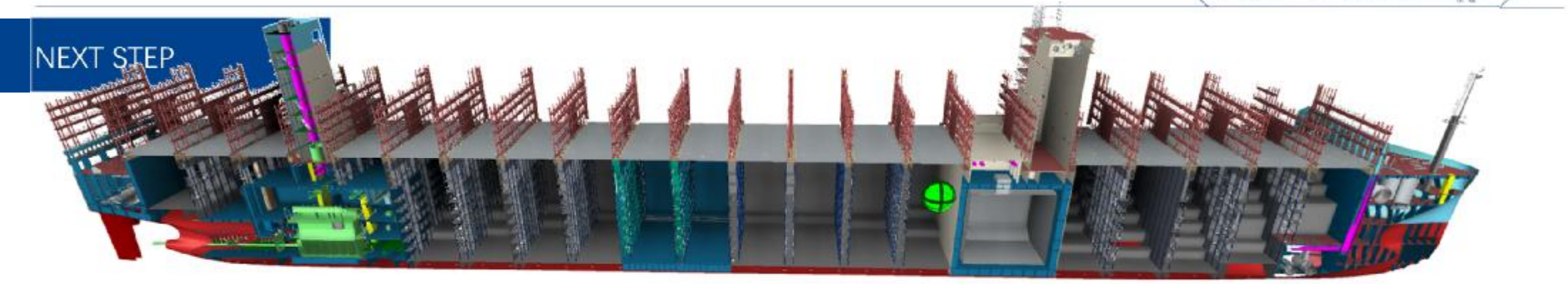




Non-structural components ?

4. FUTURE RESPECTS

NEXT STEP



- **n** Basic design
- **n** Detail design
- **n** Structural components
- **n** Non-Structural
  - Space allocation
  - Equipment
  - Outfitting
  - General information

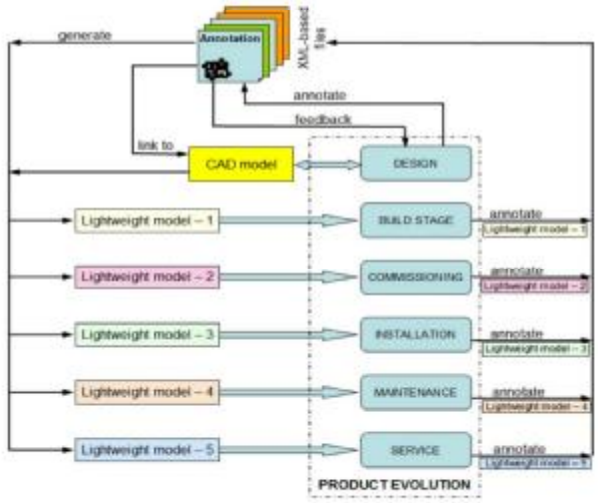


Figure 14: Light weight models with multi-layered annotations [23]

1. Enhance the usability of the OCX validator to assist customers in conducting independent verifications.
2. Strengthen support for the STEP/XML format to mitigate the impact of geometric complexity on OCX descriptions.
3. Accelerate the expansion of support for non-structured object types.

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MARINE DESIGN & RESEARCH INSTITUTE OF CHINA

THANKS

31, Oct, 2024