Structural modelling with AVEVA™ E3D
Design for design collaboration and FEM

Juha Peippo, Rauma Marine Constructions
Jussi Puurula, Rapid Structural Design
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Introduction: Henri Särkkä

Principal Presales Consultant at AVEVA

- Located in Vantaa, Finland
- 6 years of experience in marine design software
- Experience from multiple major shipyards across North America, Europe, and Asia
Introduction: Jussi Puurula

Founder of Rapid Structural Design

• Located in Jyväskylä, Finland
• 15 years of ship structural design, modelling and analysis
• Various highly complex ship projects, from icebreakers to the world’s largest cruise vessels
• Hands-on, team lead, consultancy, and development
Introduction: Juha Peippo

Strength analysis coordinator and developer at Rauma Marine Constructions

• Educational background, D.Sc (Tech.)
• Located in Rauma, Finland
• 25 years of experience in strength analysis coordination
• Cross-industry development experience
  • Transformation from 2D drawings to 3D design
  • PLM-based FE analysis
Introduction: Rauma Marine Constructions

Experts in building challenging special ships

• Located in Rauma, Finland
• Design, construction and maintenance of
  • Car and passenger ferries
  • Icebreakers
  • Navy and other government authority vessels

| 1 billion EUR orderbook | 6 ships to be built | 200+ shipbuilding experts | 2014 founded in | 20+ partners in network | 100% Finnish ownership |
Challenges

"Faster delivery, Better product, Be competitive, Keep a schedule."

1. Enhance collaboration to shorten design lead time
2. Improve FEM response to structural changes
Lead time

Ship Design Spiral: Evans 1959
Graphic: Perez-Martinez, J.; Perez Fernandez, R. 2023

Design Lead Time

N design cycles
Earlier 3D collaboration

Worst case scenario

- Needs to place new equipment
- Changes general arrangement
- Is notified of change
- Accepts, or recommends changes

Machinery → Naval architecture → Structural → FEM

Design Cycle Time
Earlier 3D collaboration

Goal: Concurrent engineering

- **Machinery**: Needs to place new equipment
- **Structural**: Changes the unified design model, is notified of change, accepts, or recommends changes
- **FEM**: 

Design Lead Time — Time saved

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Faster FEM response

With current tooling
Faster FEM response

With enhanced tooling

- Request from outfitting to hull
- Response from hull to outfitting

Outfitting Cycle Time

FEM Cycle Time

Total Cycle Time

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THE SOLUTION

AVEVA™ E3D to OCX to FEM
AVEVA™ E3D Design: The Ship Design System for the next 20 years

PDMS + TRIBON

AVEVA™ MARINE HULL & OUTFITTING

Out of the box ship design system
Tailored for production purpose

AVEVA™ E3D DESIGN HULL & OUTFITTING

30 % faster design
Additional scope
Improved interoperability
Smooth migration

50 Years Shipbuilding Experience

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AVEVA™ E3D Design workflow

From modelling to production

Surface, Curves, Points → Functional Arrangements → Hull Model → Construction Drawings

Preliminary Calculations → OCX for Class Approval → Edge Modelling → Production Design

Part Generation → Manufacturing Plates → Part Manager

Nesting Sketch → Nesting

CNC File

Export Generic File

Input Model

Output Deliverable
Open Class 3D Exchange Standard (OCX)

Engage in a fully digital workflow

• Model-based design approval
• OCX Consortium
  • Classification societies
  • Software vendors
  • Shipyards, design offices
• Future use cases?
AVEVA™ E3D to OCX

E3D exports OCX file...

...which is state-of-the-art exchange format for transferring ship structures [COMPIT 2023]
TT-Line ROPAX remodelled in E3D
Panel Location

GRID PLANE

SURFACE

#212 + 0

/MAINHULL
Panel Limits
Panel Stiffeners

PRINCIPAL PLANE STIFFENING

PROFILE (DESIGNATION)
Panel Holes

POSITION (AIDPOINTS)

PROFILE (DESIGNATION)
Panel Cloning

TYPICAL TRANSVERSE WITH OPENINGS CLONED
Result 1: E3D structures for unified design model
OCX to FEMAP (RSD plugin)
Result 2: OCX to Femap – Case evaluations

Analysis-ready mesh in 20 min vs. 120 min (-80 %)
Refinement in 5 min vs. 30 min (-80 %)

OCX ID’s are preserved for automated updates
Update: 10 min vs. 60 min (-80 %)
Rapid change request FEA

FEA evaluation of change request is typically pending for days or even weeks. It could be done instantly.
RMC sees potential to reduce lead time with AVEVA™ E3D for structural design and FEM

Challenge
- Enhance collaboration to shorten design lead time.
- Improve FEM response to structural changes.
  → Keep schedule and shorten lead time.

Solution
- Earlier, more involved design collaboration with AVEVA™ E3D hull modelling.
- Streamlined E3D-to-Femap transfer for rapid FE modelling and updates.

Results
- Earlier availability of structural model.
- 80% time saved in FE model creation and update.
Questions?
Please wait for the microphone.
State your name and company.

Please remember to...
Navigate to this session in the mobile app to complete the survey.

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Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life's essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world’s most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. The company is headquartered in Cambridge, UK.

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