IMPROVE

PRODUCTION SIMULATION

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IMPROVE Workshop

4 October 2006

ERP and simulation activities of CMT – Overview
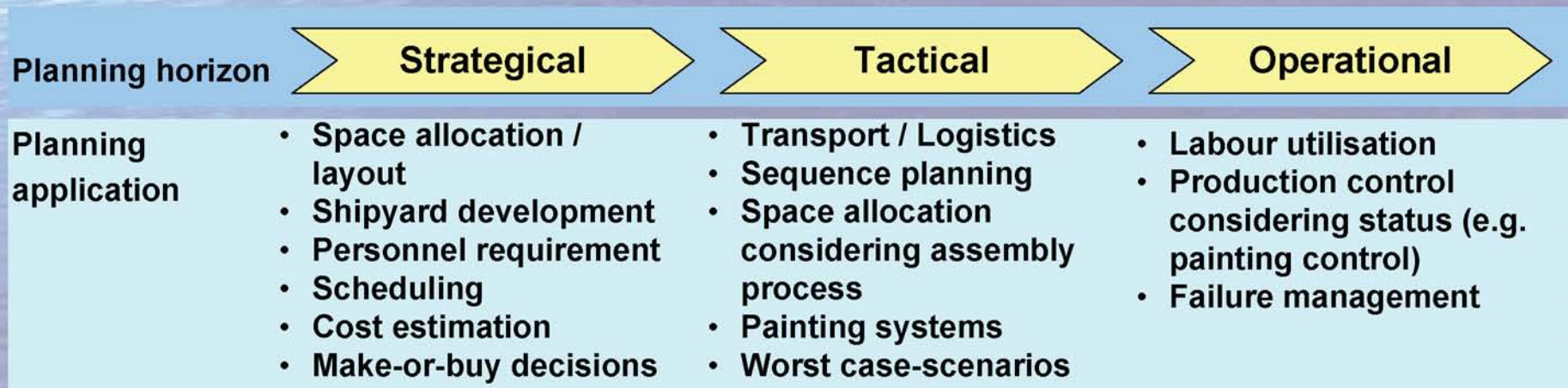
Consulting and technical support for projects concerning shipbuilding related production planning and control, assisted by simulation methodology

- **Project management** for simulation projects
- Preparation and check of investment decisions using simulation
- Integration of simulation solutions to the shipyard planning process (short, mid and long term planning)
- Complete development of simulation models (concept, development, start-up)
- Simulation studies covering activities ranging from strategic planning to operative control
- Simulation assisted failure management

Planning horizon	Strategical	Tactical	Operational
Planning application	• Space allocation / layout • Shipyard development • Personnel requirement • Scheduling • Cost estimation • Make-or-buy decisions	• Transport / Logistics • Sequence planning • Space allocation considering assembly process • Painting systems • Worst case-scenarios	• Labour utilisation • Production control considering status (e.g. painting control) • Failure management

Shipyards' problems with production scheduling and simulation

- Cost pressure and product properties → **scheduling complexity**
- one-of-a-kind or small lot size production → **scheduling frequency**
- Danger of incorrect planning is extremely high → **scheduling risk**
  - → Conventional planning and scheduling methods alone do not ensure sufficient results for shipyards

- **Discrete event simulation** provides opportunity to virtually test and evaluate planning scenarios, but...
- Building up required in-house know-how is **time and cost consuming**
  - → many shipyards only used simulation – if at all – from time to time for case studies performed by consultants

- Some shipyards tried out simulation tools in the 1990's, but...
- **lack of flexibility** (shipyard specific rules, pre-customised modules)
- **lack of maintainability** (adaptation of models according to shipyard process changes took longer than the processes' change itself)
  - → Simulation did not have the chance to become accepted at shipyards

Approach – benefits of simulation toolsets

- simulation toolsets are available for mass product industries
- toolset = tailored collection of modules representing typical resources, and logical units of a branch

→ toolsets help saving costs for model development and maintenance

- Shipbuilding simulation toolsets are not offered on the market, but...

→ object technology of simulators allow users for building up own toolset libraries...

...and so did some German shipyards
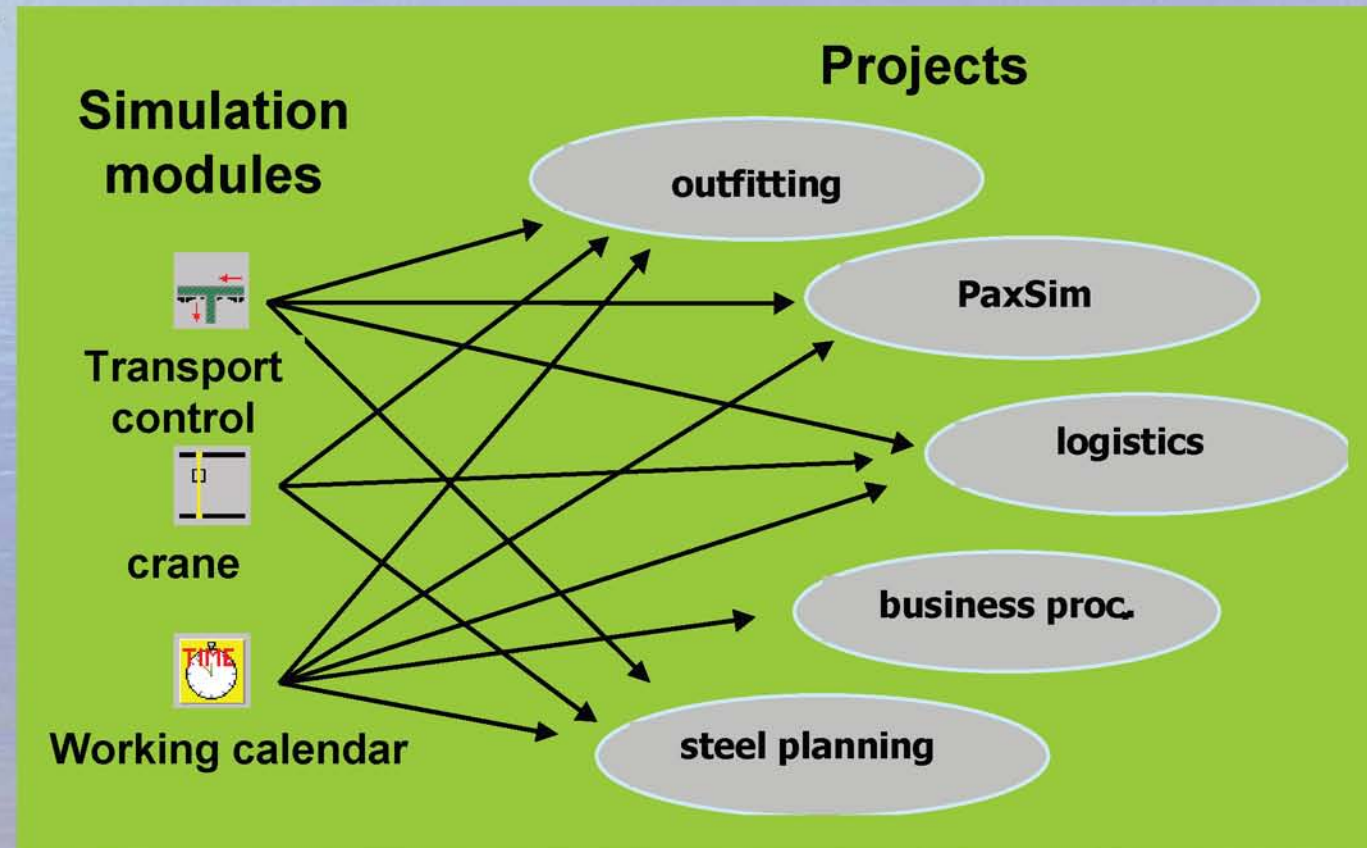
- **Administrative Modules**
  - **Staff Management, Shifts, ...**
  - **Toolset Administration**
- **Outfitting**
  - **Assembly**
- **Logistic**
  - **Storage management, space allocation, supplier, ...**
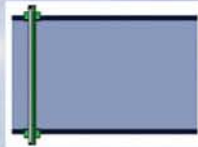- **Material**
  - **Product breakdown**
- **Steel**
  - **Machines and Portal for welding, cutting etc.,**
  - **Assembly, Coating, etc.**
- **Transport**
  - **Transport control, -vehicles, -aids, ...**

Example of Modules – Cutting machine

STS Cutting machine

CuttingPortal 4.118

Name: ESAB_L1

NC Interface | Statistics
NC Generator | Personnel
| Maintenance

Times | Portal | Waggons | WaggonSettings | Miscellaneous | Speeds | Shifts

Anlagenzeiten

Leerfahrt [m/s]	17.5
Rüstzeit Anlage	1.0000
Ausschaltzeit Werkz.	1.0000
Werkzeugwechselzeit	1.0000
Beschleunigung [m/s2]	1

Einschaltzeiten

Brennen	1.0000
Markieren	1.0000
Schleifen	1.0000
Beschriften	1.0000

Bearbeitungszeiten

Unterbrechungszeit	0.0000
Markieren [m/s]	0.9
Schleifen [m/s]	0.08
Beschriften [m/s]	9

☐ Schrottbrennzeit aus Methode

Schrottbrennzeit 1.0000   Schrottbrennzeit

Parameter | Hilfe | Öffnen
OK | Abbrechen | Übernehmen

Standard machine
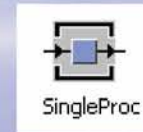
SingleProc

.Models.Frame.SingleProc

Navigieren Ansicht Extras ?

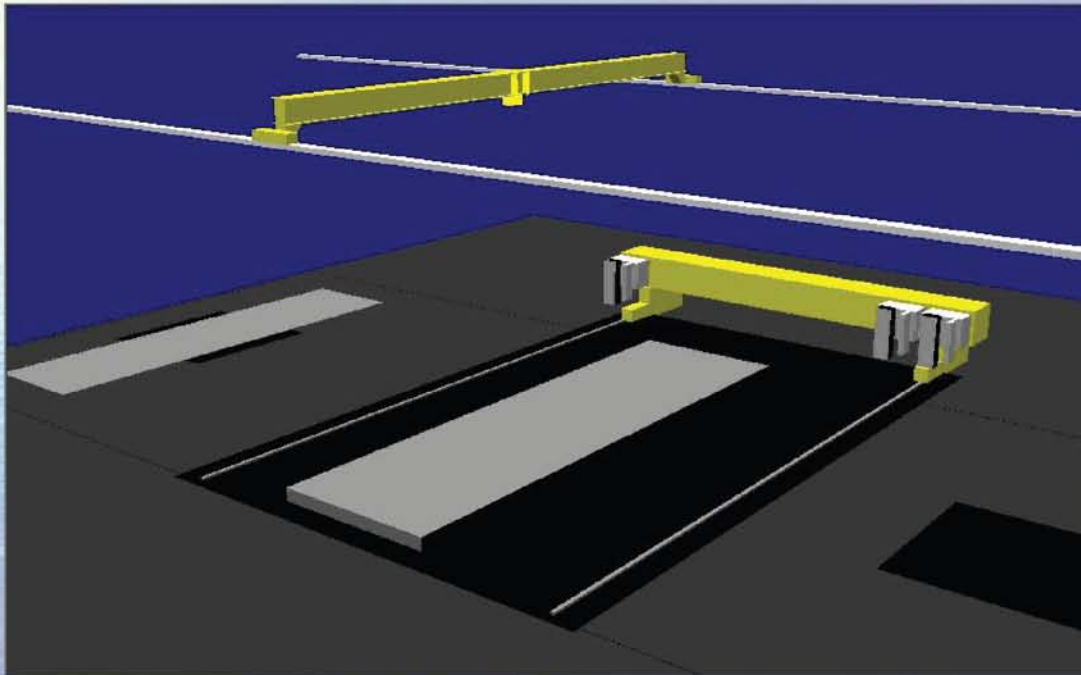Name: SingleProc ☐   ☐ Gestört   ☐ Eingang gesperrt ☐
Etikett: ☐   Planned ▼ ☐ Ausgang gesperrt ☐

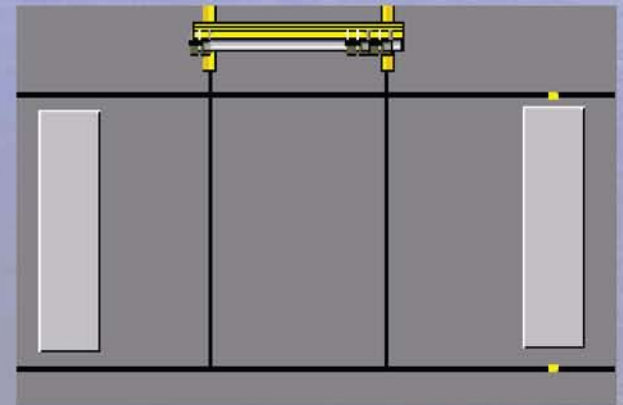Zeiten | Rüsten | Störungen | Steuerungen | Ausgangsverhalten | Statistik | Importer ◄ ►

Bearbeitungszeit:	Const ▼	1:00.0000	☐
Rüstzeit:	Const ▼	0.0000	☐
Erholzeit:	Const ▼	0.0000	☐
Zykluszeit:	Const ▼	0.0000	☐

OK | Abbrechen | Übernehmen

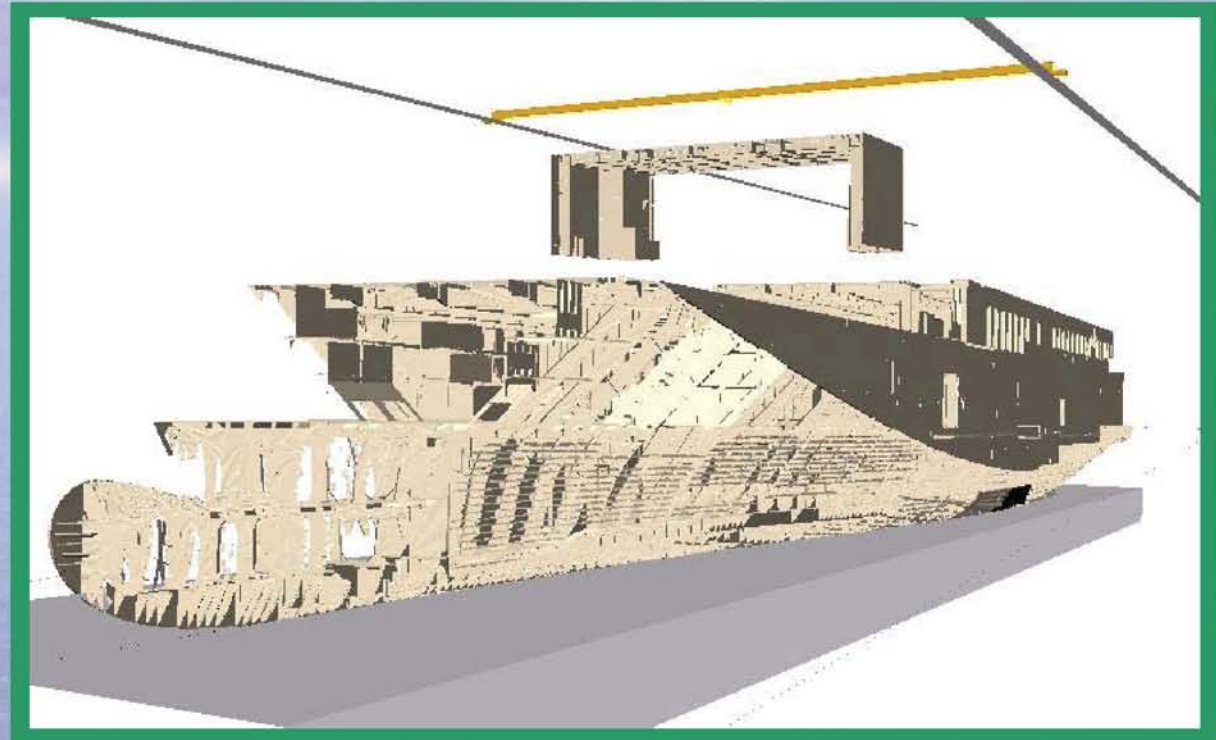# Example of Modules – Cutting machine animation

3D - Animation

2D - Animation

- **Simulation model of the whole production is being developed**
- **Actual project is modelling of final assembly phase**

3D visualisation included as an optional function in each model

- **New product mix → increased thin sheet production, many extra hours and external processing**
- **New thin sheet processing concept developed in 2005**
  - **Separation of cutting process from grinding, marking etc.**
  - **Evaluation of several concepts for processing material from two sides (turntable, lifting devices)**
  - **Combination of lifting device and two cutting machines proved to provide best throughput**
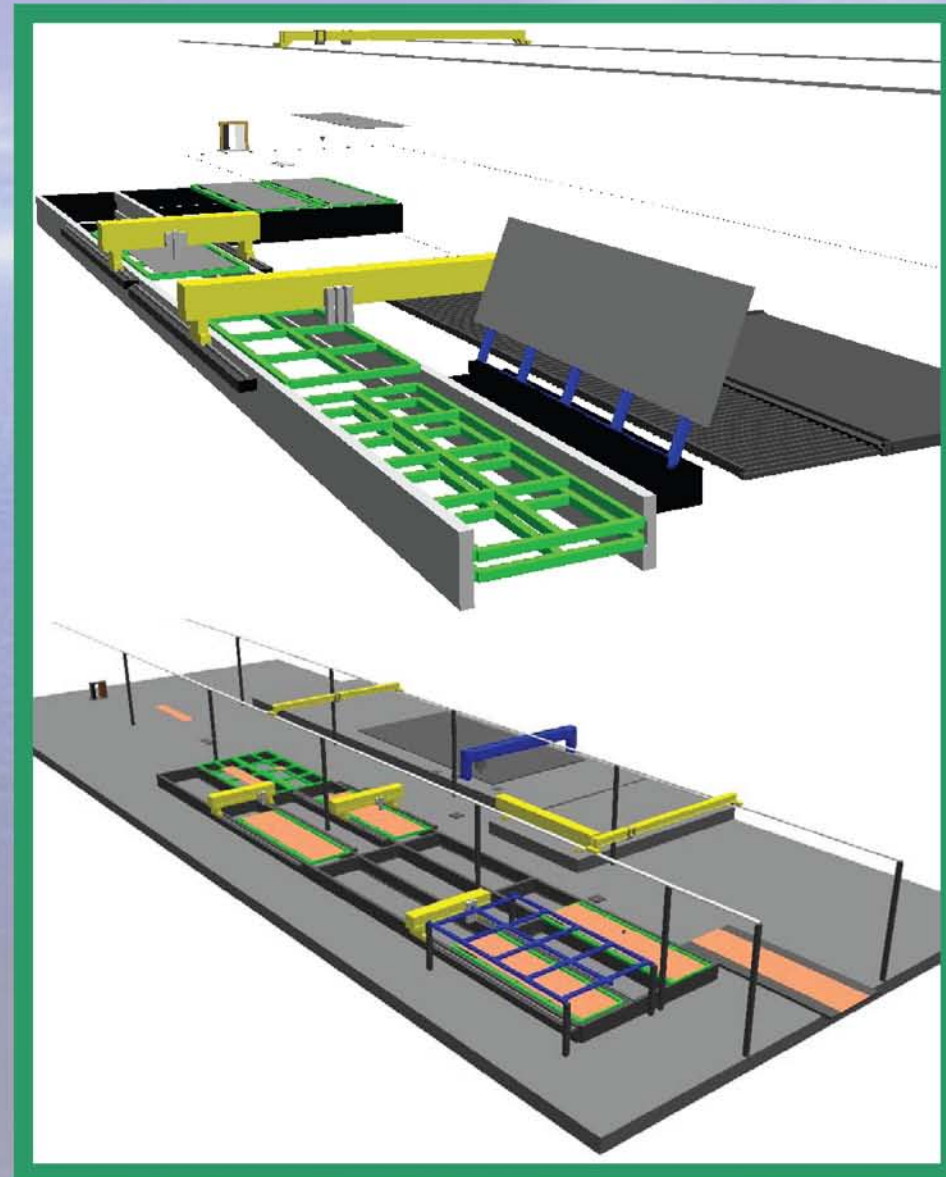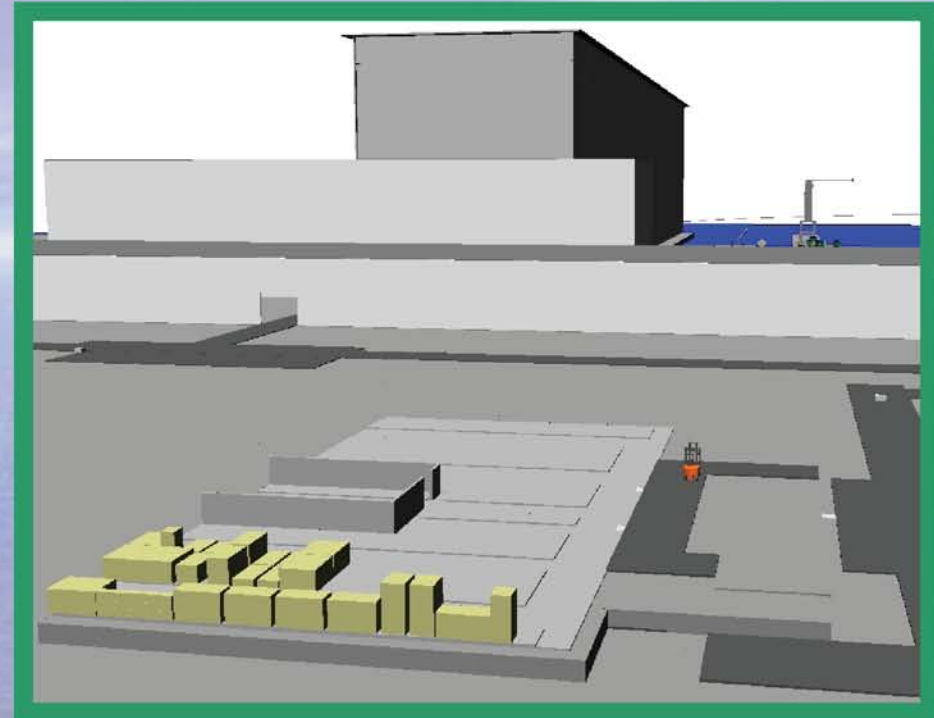
- **Large amount of furnishing etc. for newly built passenger ships and car ferries → new materials management concept required**
  - Preliminary analyses (material quantities, dimensions, delivery dates, transport devices' properties) and storage of results in Access database
  - Simulation study showed that existing stockroom on site is not sufficient
  - Consequently, external storage area close to FSG premises was arranged
  - Transport between material store and shipyard was ensured by simulation

cutting of plates

turning, welding 2nd side

profile erection

welding of plates 1st side

outfitting
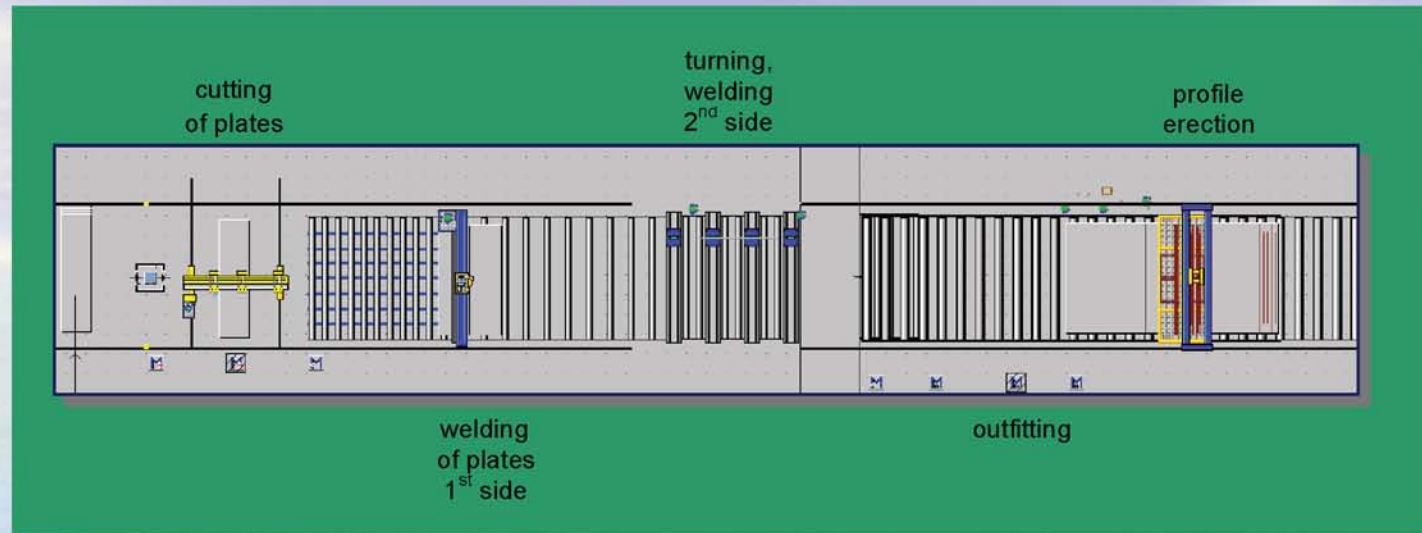
- **Simulation model originally developed for concept studies in 2001 (new panel line)**

- **Model still in use for planning of future production programs at FSG**

- **Goal of simulation in production planning: provide optimum plan at the time of production.**

- **Features:**

  - **Regular feasibility tests of production plans, performed by planner or foreman**

  - **Definition of required manning level for panel line and section assembly**

  - **Detection of bottlenecks (utilisation diagrams)**

Production simulation –
Design for production and cost

- **Aim: support the efficient use of resources within a mechanized panel fabrication line**

- **Development of a concept for a simulation tool for scheduling and resource planning**
  - **Data specification and concept**
  - **Design simulation model**
  - **User interface for planner**
  - **Integration to existing software landscape**

- **Basis: Simulation toolkit for shipbuilders**

- **Partner: University Liege**

Case study Aker Yards SA – Simulation procedure
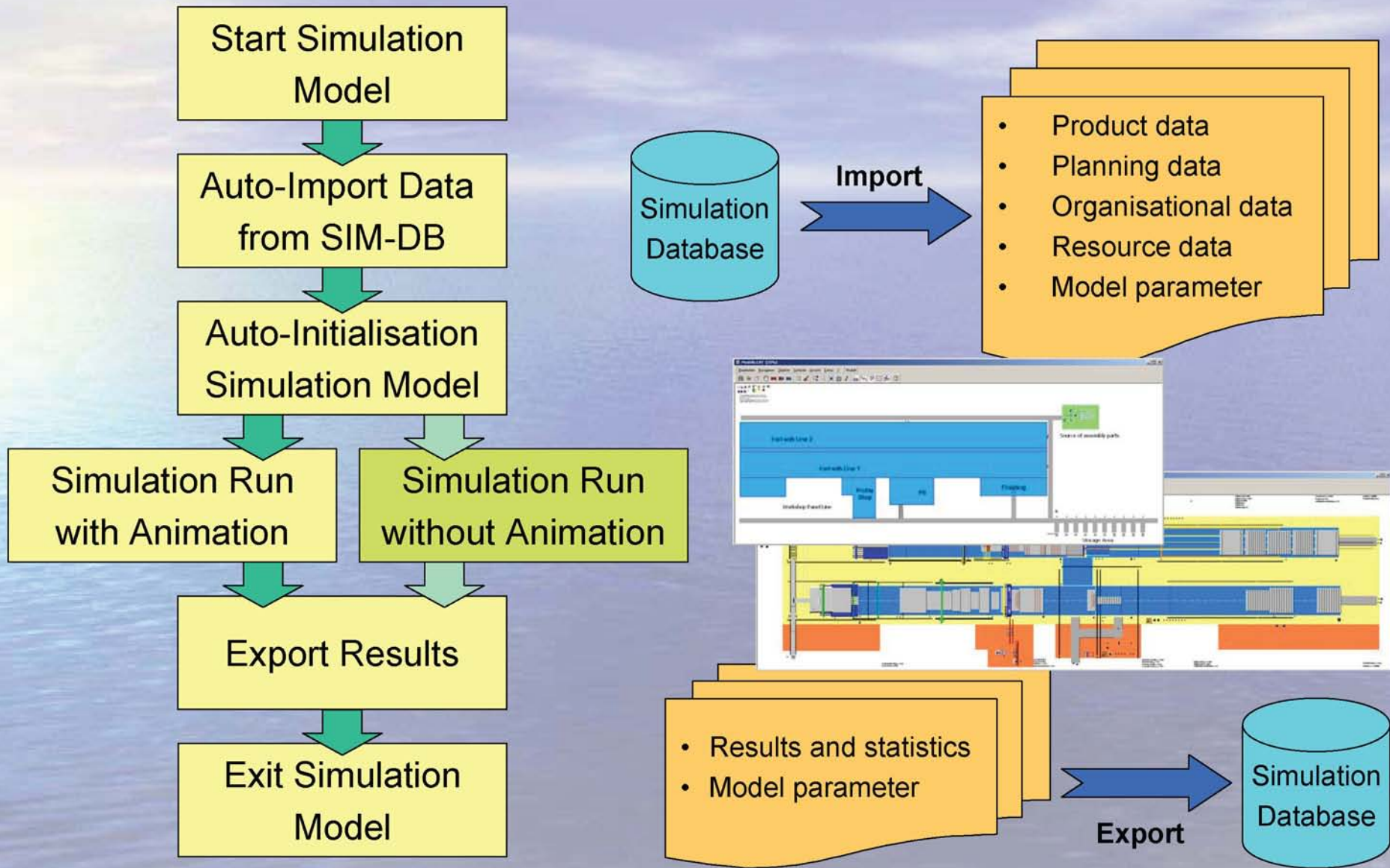
SimCoMar – Simulation Co-operation in the Maritime Industry
Innovative network for strengthening and enhancement of simulation in the maritime sector

FLENSBURGER SCHIFFBAU-GESELLSCHAFT

Nordseewerke

TUHH Technische Universität Hamburg-Harburg

TUDelft Technische Universiteit Delft

CMT

ULg UNIVERSITÉ de Liège

Simulation application (network of competence)

Dissemination (external)

Assistance in selection and introduction of simulation method and software

Consolidation, enhancement (internal)

Know how transfer

Project support

Simulation knowledge base

Research

Application oriented

Ship outfitting

Strategic development

Product use scenarios

Fundamental

Simulation and optimisation

Distributed simulation

Simulation and Virtual Reality

Tool development

Internally

Maintenance of toolkit

Development of new tools

Simulation data management

Externally

Impact on development of basis software (representation of shipbuilders' interests)

Shipyard practice

Contacts and questions welcome at

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Thank you for your attention!