Ingenieurtechnik und Maschinenbau GmbH

Industriestrasse 08
18069 Rostock
Germany
Phone: + 49 381 793 435
Fax: + 49 381 793 461
r.gaede@img-tech.de

Rainer Gaede
Vice President

IMG Your competent Partner

- Content of workshop presentation

1.The company IMG

2.Shipyard and offshore yard planning

3. Animation and simulation of shipyard processes

4.Logistic concept

5. Equipment for high productivity

6.Projects in Brazil

The Company


IMG
IMG


Norway
NORTH
SEA
Sweden
Denmark
BALTIC
SEA
Rostock
Poland
Netherlands
IMG
Belgium
Germany
Czech Republic
France
Austria

The Company

Head Office :

IMG -Ingenieurtechnik und Maschinenbau GmbH
Industriestraße 8
18069 Rostock, Germany
Phone: +49(0) 381 793 0
Fax. +49(0) 381 712 189
E-mail info@img-tech.de
Internet www.img-tech.de

CEO Mr. Steffan Saüberlich

Year of foundation: 1990 (under the name IMG GmbH)

Employees: 115 (50 research and design engineers)

Turnover: approx. 20-25 Million EUR

History

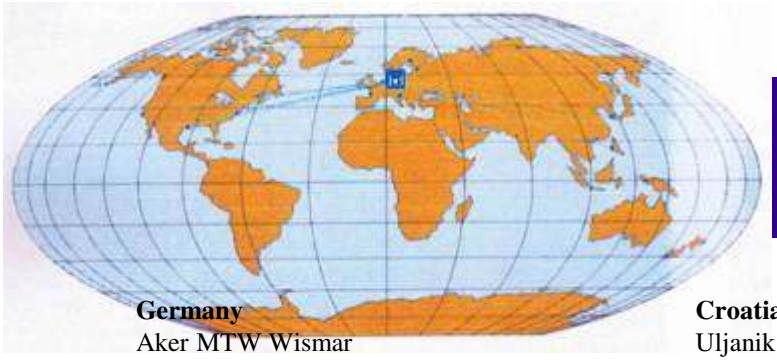
08.06.1990	Incorporation of IMG – Ingenieurtechnik und Maschinenbau GmbH as an autonomous company with more than 30 years experience
1991 – 1996	Engagement in the big German shipyard modernisation projects at Baltic Sea coast: ◆ Peenewerft, Wolgast; Volkswerft, Stralsund; MTW, Wismar ◆ Neptun Industries, Rostock Export order from Korea / first supplies to Asia
1995	Further export orders from France, USA, Canada, Taiwan, Finland, Croatia and China
Since 1996	Equipment to build the Philadelphia Shipyard, USA (TURN KEY- basis) Including Large Panel Line, Double Bottom Line, Web Line, Bulkhead Line,
1998	Curved Panel Line, Handling and Service Gantry) Modernisation of the Uljanik Shipyard in Pula, Croatia Modernisation of NASSCO Shipyard - San Diego, USA
1999	Modernisation of Baltisky Shipyard - St. Petersburg, Russia
2000	Profile bending machine - Severnaja Shipyard St. Petersburg, Russia
2002	Profile cutting line and automatic crane of Baltisky Shipyard , St. Petersburg, Russia
2004	Stiffener Mounting Gantry - Daewoo Korea, Heavy Load transportation system – Roland Shipyard Berne; Profil cutting line – Hudong Shipyard / China; Panel line 12 m – Tulcea Romania
2005	Modernisation Bollinger Shipyard / USA; Feasibility study – Changxing / China Panel Line – Krasnoje Sormovo/ Russia; Laser Hybrid developments

Profile of activities: **Production technology for shipbuilding engineering and steel construction - industry**

Deliveries

- Development of new shipyards
  Complex modernising of old shipyards
- Development and delivery of production sections for shipyards
- Development and delivery of single installations (special machines)
- Development and delivery of production logistics based on modern production technology
- Development and delivery of production technology for precision steel and machine construction
- Handling and logistic systems
- Ship and heavy structure transport and lifting systems
- Rust removal and conserving equipment

The Company – Assembly Shop



IMG - References since 1991

Germany
Aker MTW Wismar
VW Stralsund
PW Wolgast
Neptun Industrie Rostock
Dieselmotorenwerk Rostock
Kvaerner Warnow Werft
Flender Werft Lübeck
Meyer Werft Papenburg
Thyssen Nordseewerke Emden
Lürssen Werft Bremen
Flensburger Schiffbau Gesellschaft
Howaldswerke Deutsche Werft AG / Kiel
Berne werft Bremen

Netherland
Niestern Sander B.V.

France
Chantiers de l ´Atlantique

Finland
Kvaerner Masa-Yards Helsinki
Finnyards Turku

England
BVT Potsmoos
BAE Systems

Russia
Zavod Imeni Frunze Penza
Nordwerft Sankt Petersburg
JSC Baltiysky Zavod
Krasnoje Sormovo
Admirality Shipyard

Croatia
Uljanik Brodogradiliste Shipyard
Shipyard Trogir
Brodosplit Brodogradiliste
Brodogradiliste Kraljevica

Korea
Daewoo Heavy Ind. Ltd.
Hyundai Heavy Ind. Co., Ltd.

Taiwan
CSBC Keelung

Canada
Davie Industries
KOS –Kiwit Offshore Services

USA
Atlantic Marine
Nassco
Alabama Shipyard
Amfels
Kvaerner Philadelphia Shipyard Inc.
Avondale Industries, Inc.
Bollinger Marine
Bay Shipbuilding

Brasil
Rio Naval
Estaleiro Rio Grande- Engevix
Odebrecht Itaguai

Qatar
Qatar Peroleum

Australia
BAE Systems

Romania
Aker Tulcea
Aker Braila
Damen Galati

Turkey
Sedef Shipbuilding
H.G.S Shipyard
Inebolu Shipyard
Palmali Shipyard

P.R. China
Hudong Shipyard
Ohua Shipyard
Changxing Shipbuilding
Base
Longshu Shipyard

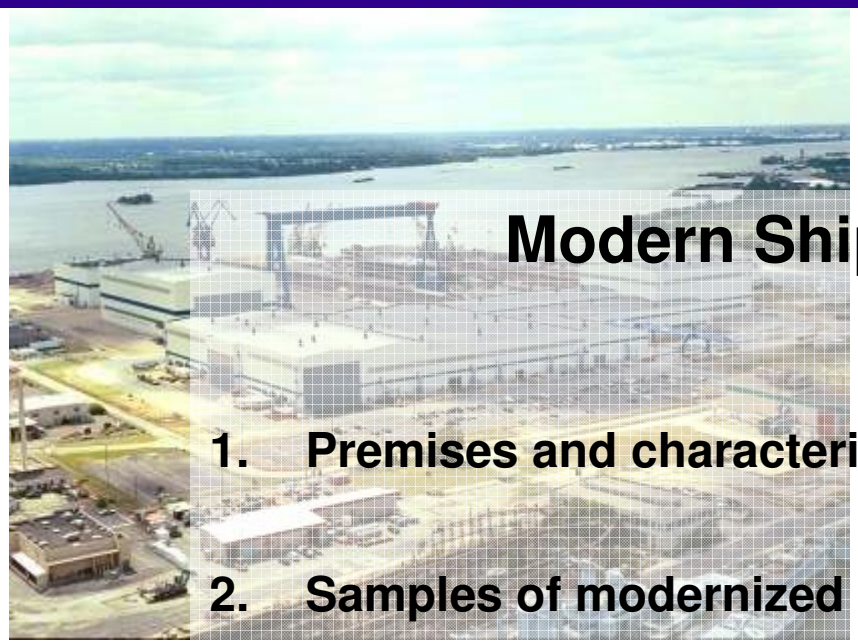
Ukraine
Damen Okean Shipyard

Lithuania
Baltija
Western Shipyard Klaipeda

Italien
Fincantierie Monfalcone

India
L&T

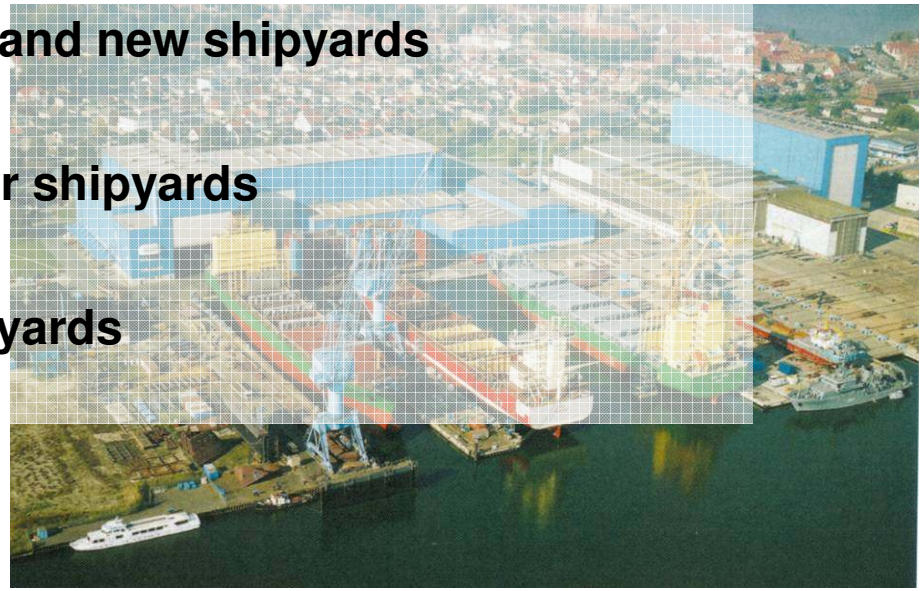
Vietnam
Bason Shipyard



Modern Shipyard Projects

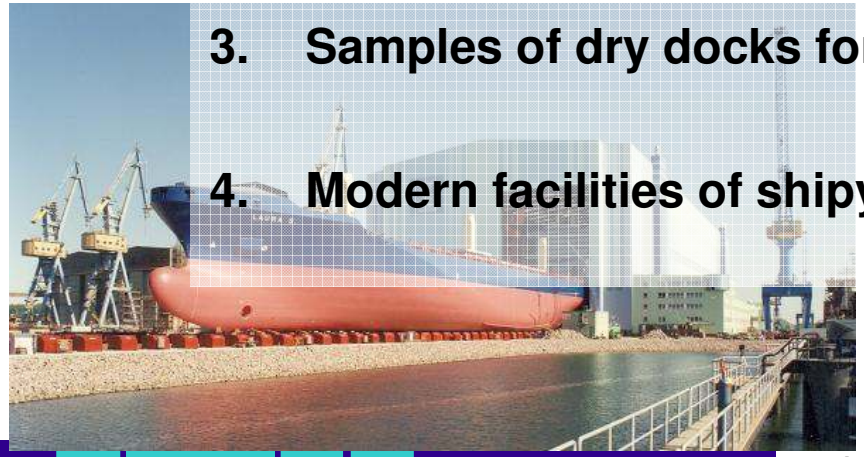
1. Premises and characteristics of modern shipyards

2. Samples of modernized and new shipyards



3. Samples of dry docks for shipyards

4. Modern facilities of shipyards



1. Premises and characteristics of modern shipyard projects

Selection of principle basics

→ **Climate and environmental conditions of shipyard location**
- Weather conditions (temperature, humidity, wind conditions, rainfall) and climatic based work interruptions and time of nonuse
- Necessity of partly or / and complete roofing of storage areas, transport areas and production areas (under consideration of the further production program)

→ **Available area and ground conditions**

→ **Economical infrastructure**
- Definition of a optimal production depth (core competence of the shipyard) under the aspects of subcontracting of works and products (make or buy)
- Dimensioning of stockyards in dependence of supply cycles of material
- Material supply conditions: pre treated steel material available → yes / no

→ **Legal requirements**
- Immission controls (harmful substances, sewage water, air pollution, noise protection)
- Selection of the shipyard location

→ **Social requirements and laws**
- Work organization
- Working time and shift regime
- Qualification of staff
- Employment requirements

1. Premises and characteristics of modern shipyard projects

Selection

→ **Climate**

- Weat
  rainfall) and climatic based wo ... and time of nonuse
- Necessity of partly or / and cor ... storage areas, transport areas
  and production areas (under consideration of the further production program)

Strategy of the shipyard regarding the further shipbuilding program

<u>Modern shipyard projects are custom – made!</u>

- Philosophy of IMG:
  - **Working out of the project in tight co-operation with the customer**
  - **Customer inserts into the project his own experiences and specific knowledge**
  - **IMG implements the complete Know How based on experiences of plurality of shipyard projects**
  - **Using of modern planning methods including simulation and animation tools for shipyard projects including detailed layout planning of modern fabrication lines, material flow, planning and logistics systems, necessary information for operating of equipment, requirements on buildings, utility supply systems and requirements on infrastructure**

➔ Efficient shipbuilding production under consideration of the available basics ➔

1. Premises and characteristics of modern shipyard projects

- process-oriented coordination of production and flow of material having optimized transport routes and storage areas in conjunction with compact arrangement of all areas required for production
- automated production equipment in the area of prefabrication providing a flexibility tuned with the intended production program
- automated production lines which are conveniently integrated into production auxiliary processes
- economical depth of inhouse manufacturing and
- high parallelism between manufacture of shipbuilding components, assembly, coating and outfitting processes

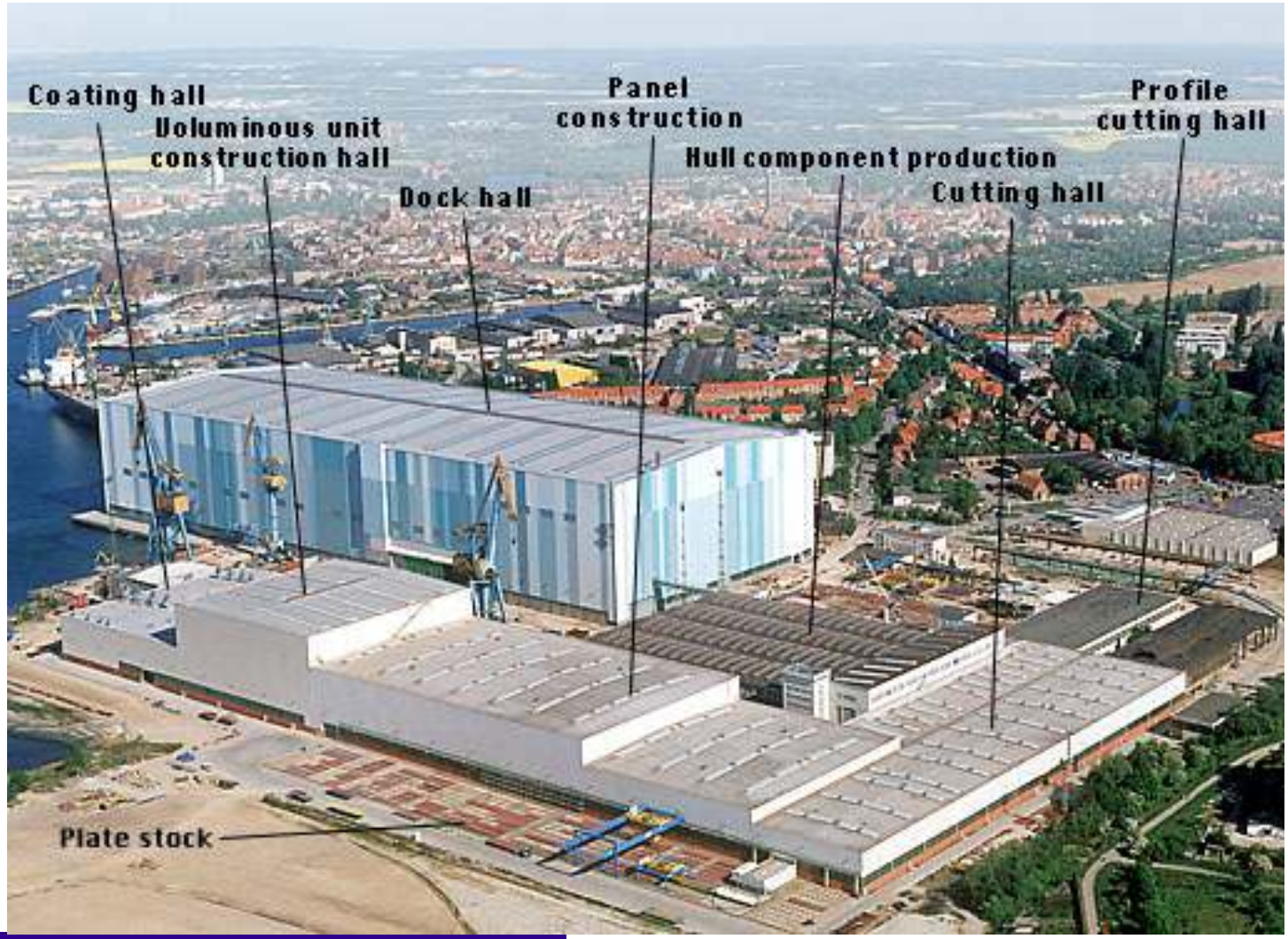
High Level of Production Engineering, Production Planning and Control as well as Logistics at all Process Stages from Bidding for Order up to Ship Delivery

Products: Consulting & Engineering

- Feasibility Studies
- Material Flow & Logistic Concepts
- Analysis, Planning & Project Engineering
- Software for Produktion Planning & Control
- Software for Workshops

Aker MTW GmbH before modernization, Germany

Aker MTW after modernisation



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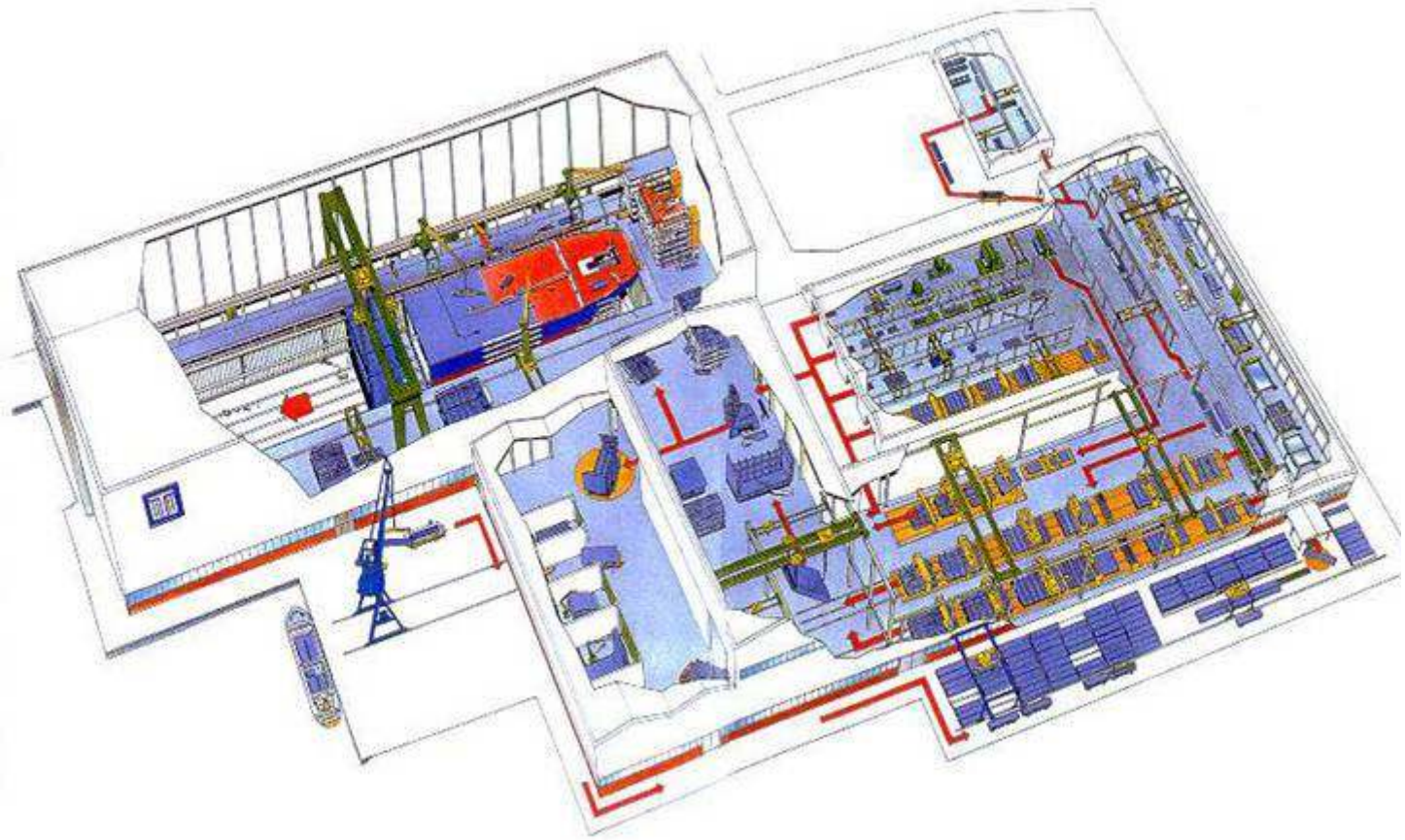
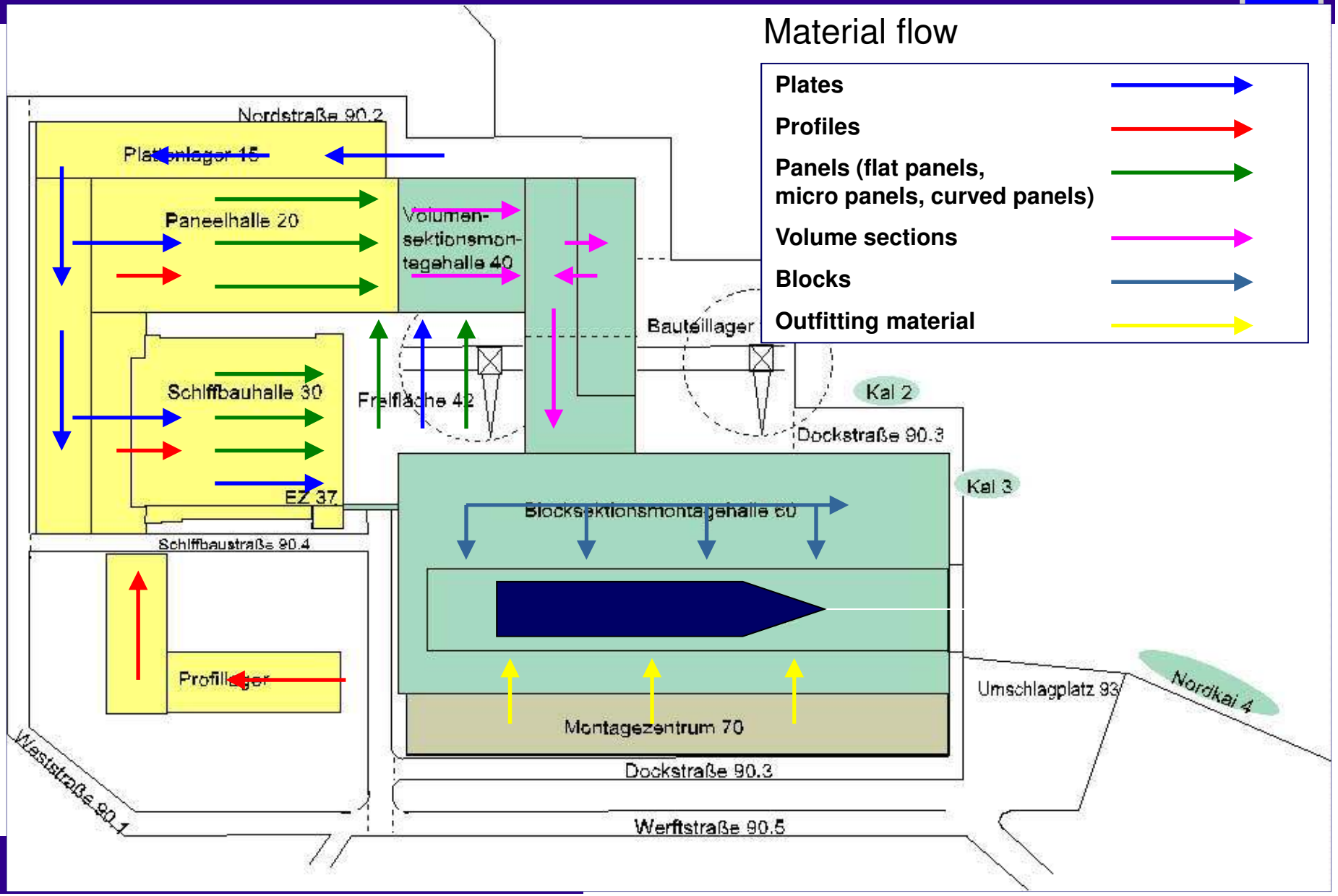


Material Flow Concept Aker MTW GmbH

4. **Modern facilities of shipyards**



Products: Consulting & Engineering

- Feasibility Studies
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- Software for Workshops

Volkswerft Stralsund GmbH / The A. P. Moller Group, Germany, before Modernization

Products: Consulting & Engineering

- Feasibility Studies
- Material Flow & Logistic Concepts
- Analysis, Planning & Project Engineering
- Software for Production Planning & Control
- Software for Workshops

Volkswerft Stralsund GmbH / The A. P. Moller Group, Germany, after Modernization

Peene-Werft Wolgast

2. Samples of modernized and new shipyards

AKER Philadelphia Shipyard – USA

Products: Consulting & Engineering

- Feasibility Studies
- Material Flow & Logistic Concepts
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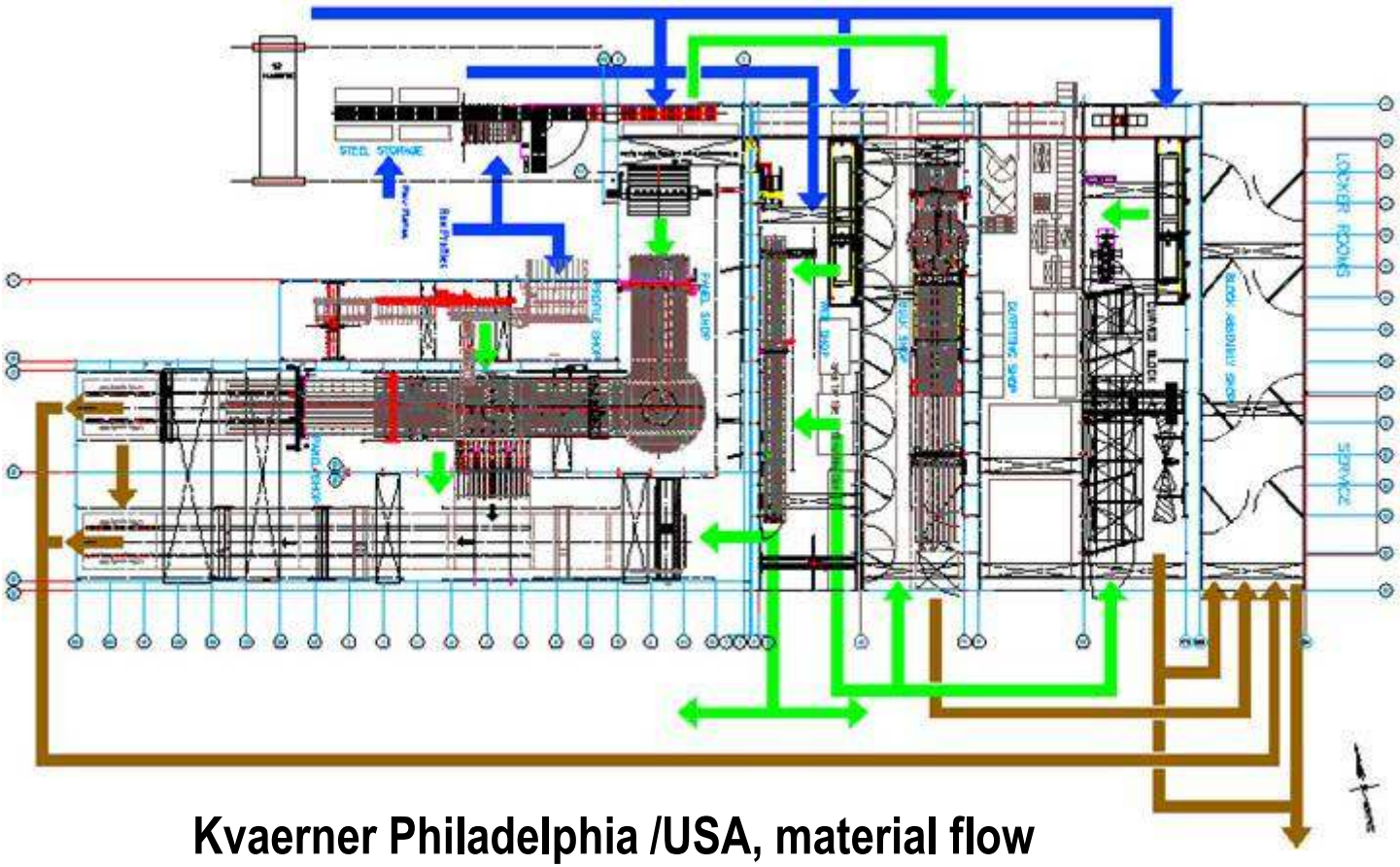
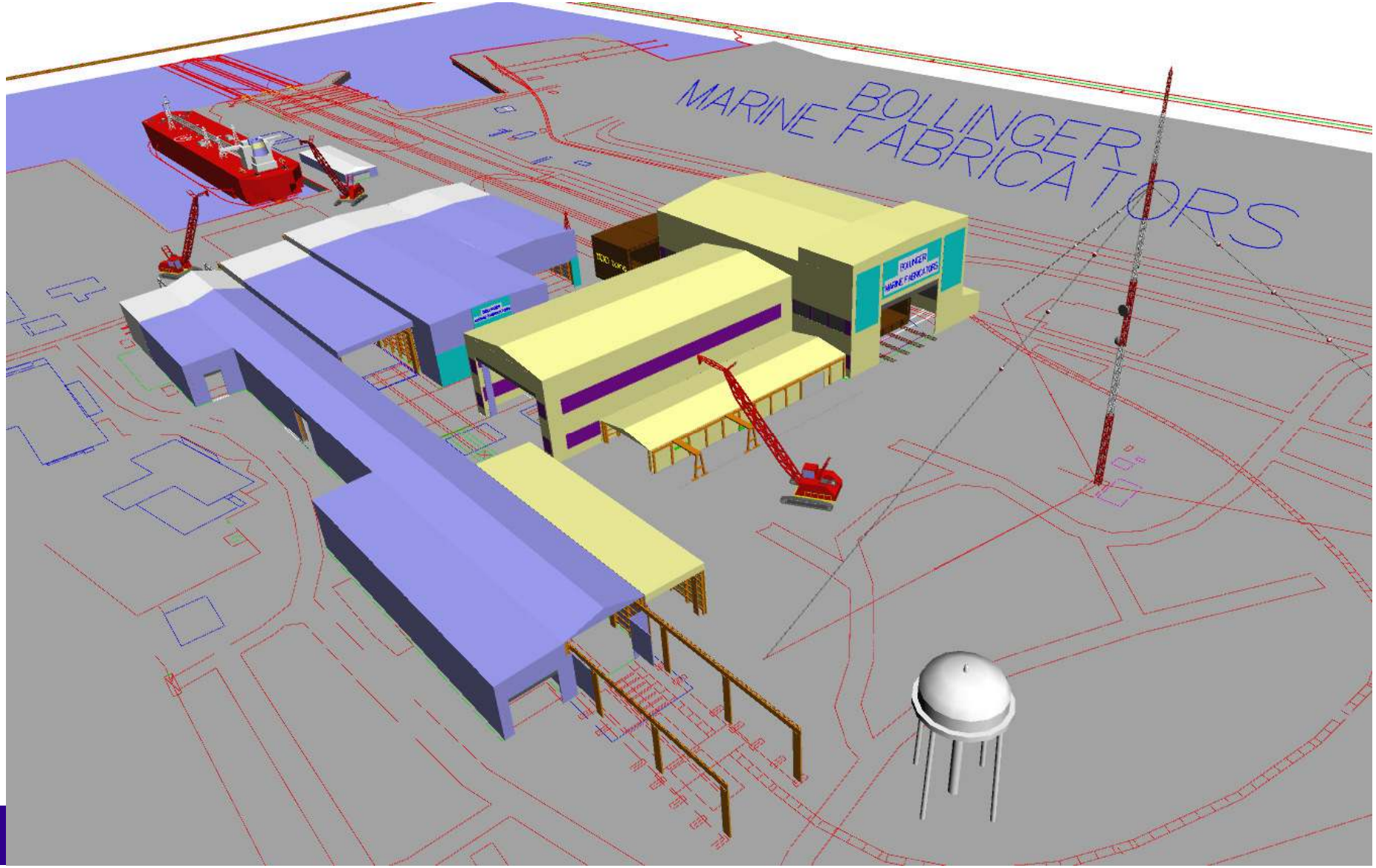
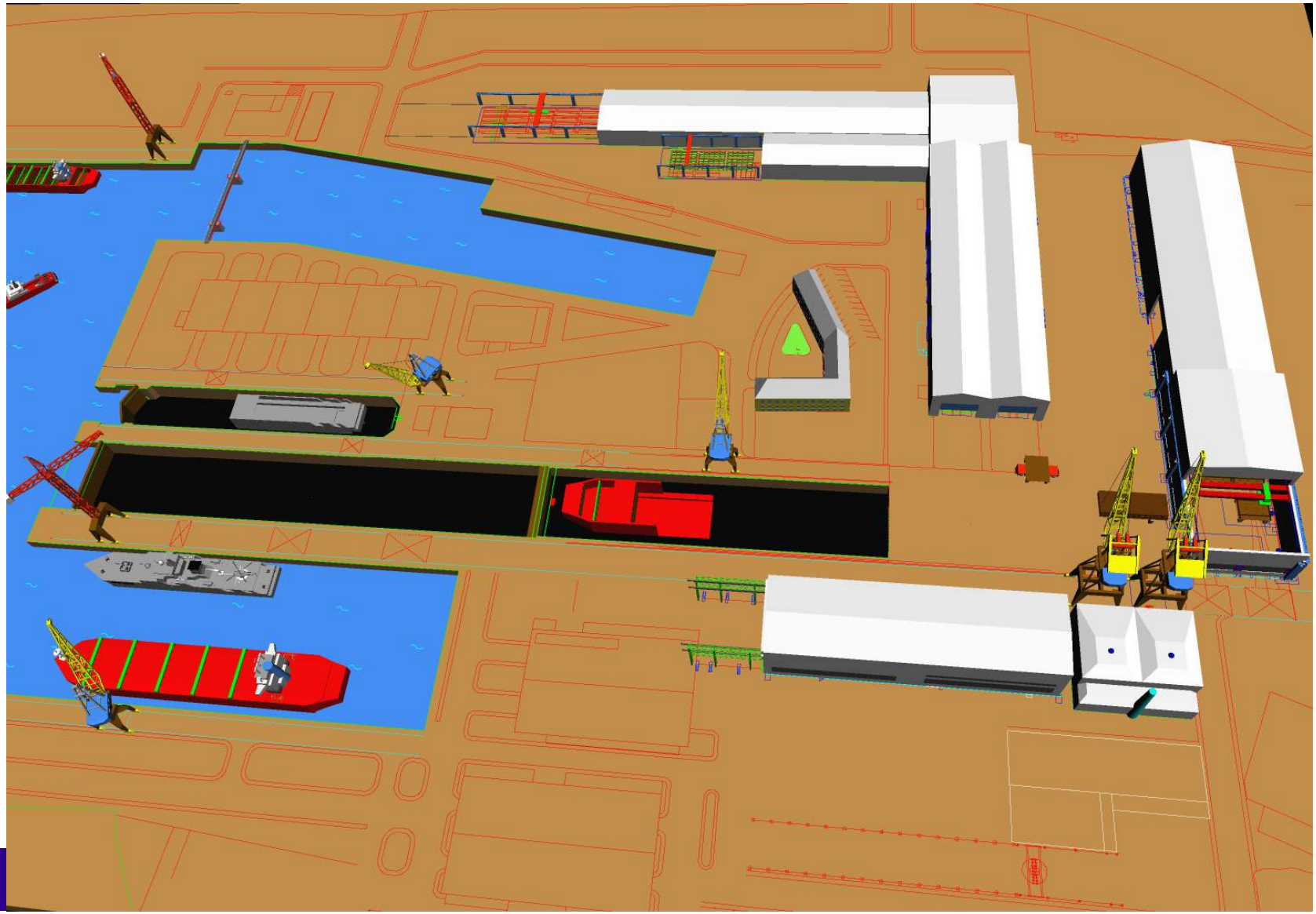


Kvaerner Philadelphia /USA, material flow

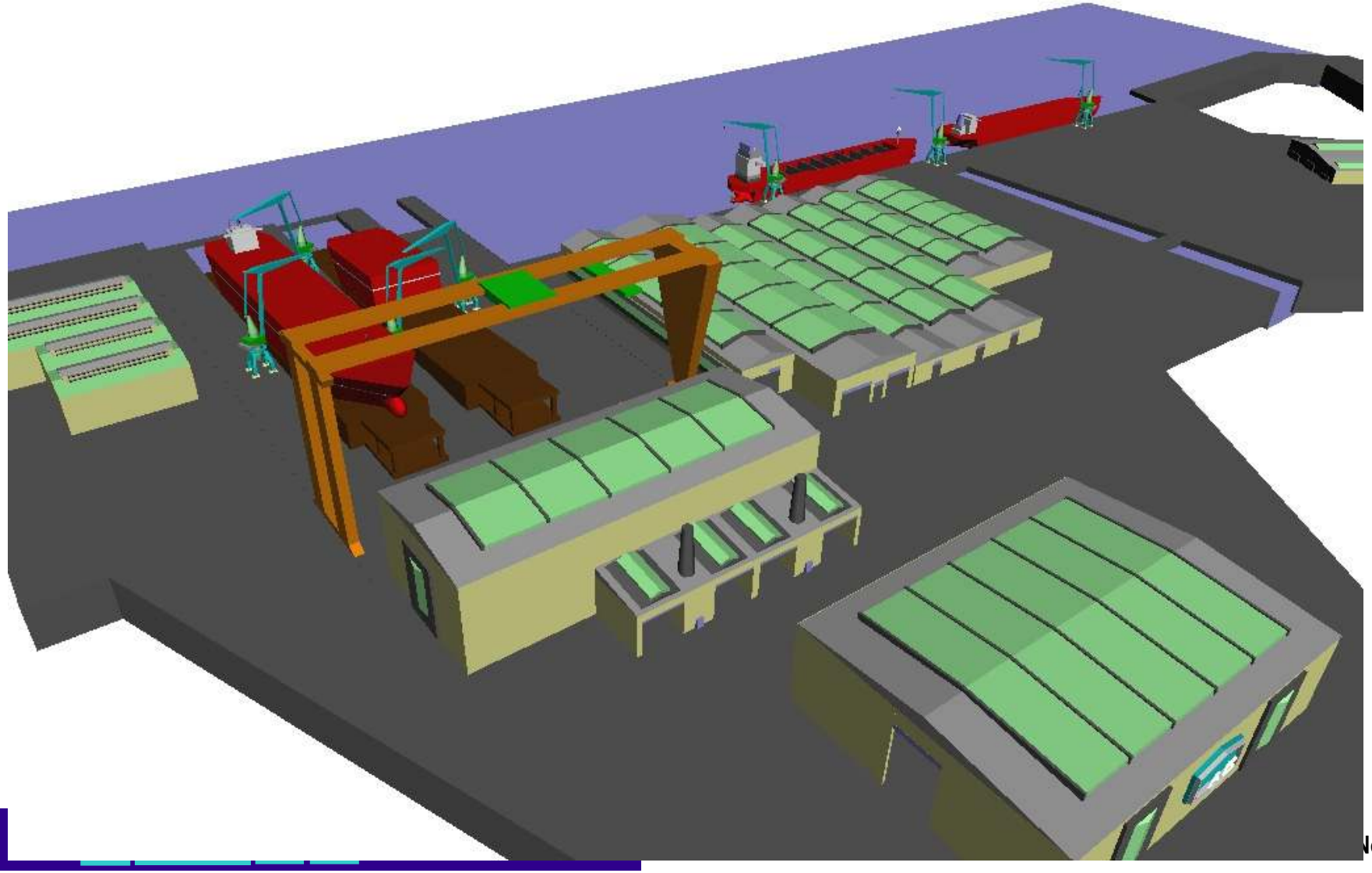
Bollinger Marine Fabricators



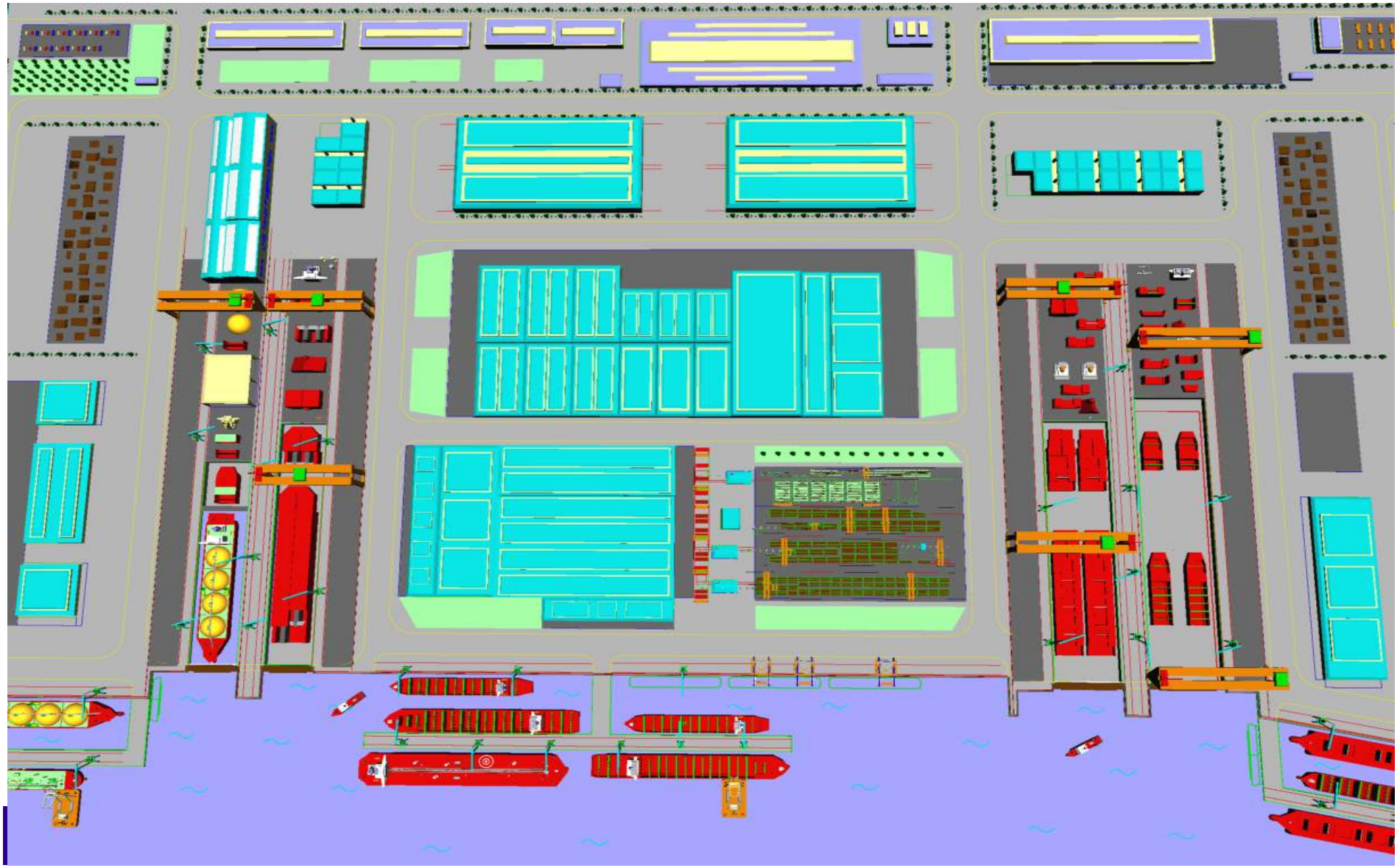
ENVC Shipyard



Admiralty Shipyard

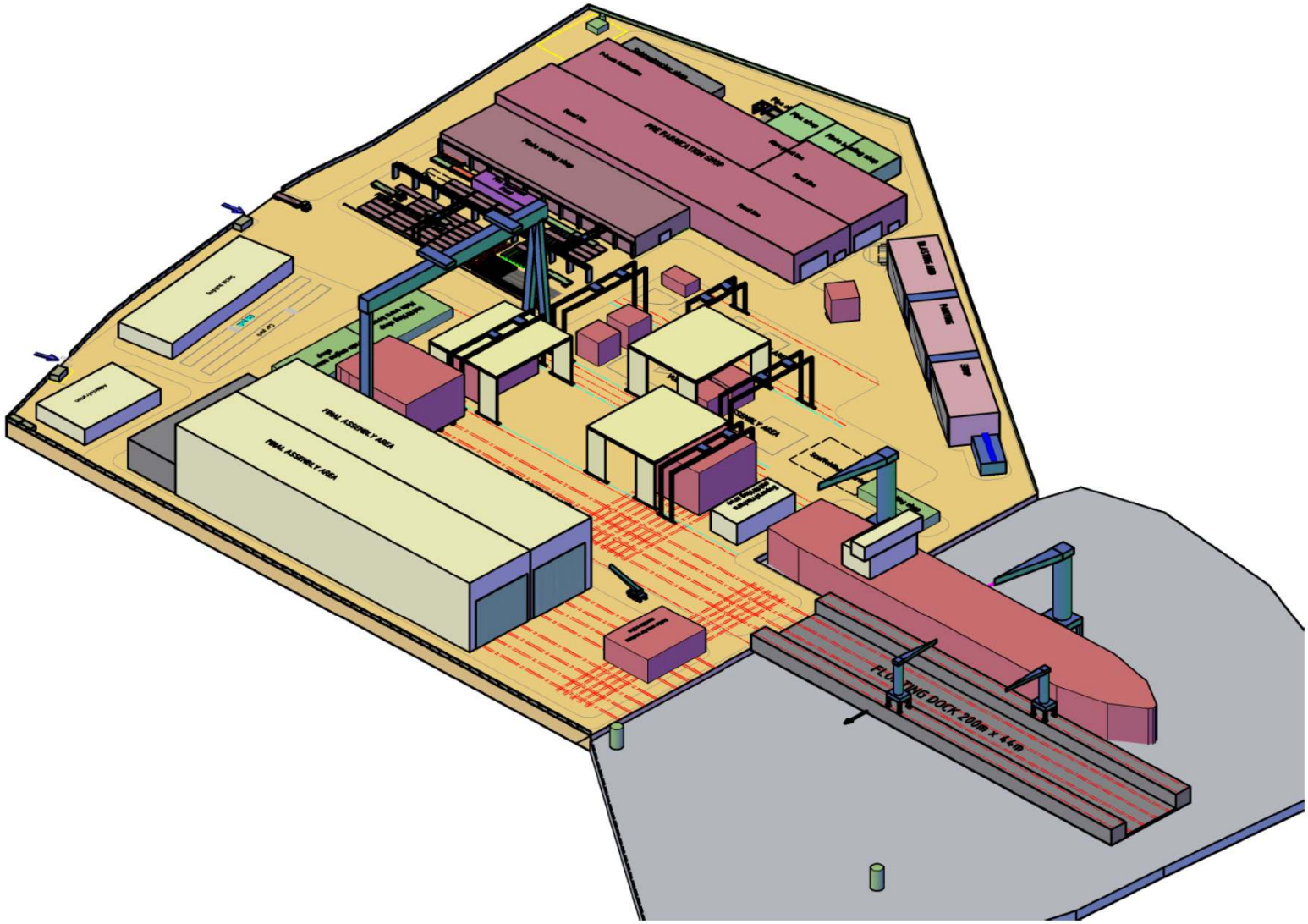


CHANGXING SHIPBUILDING BASE

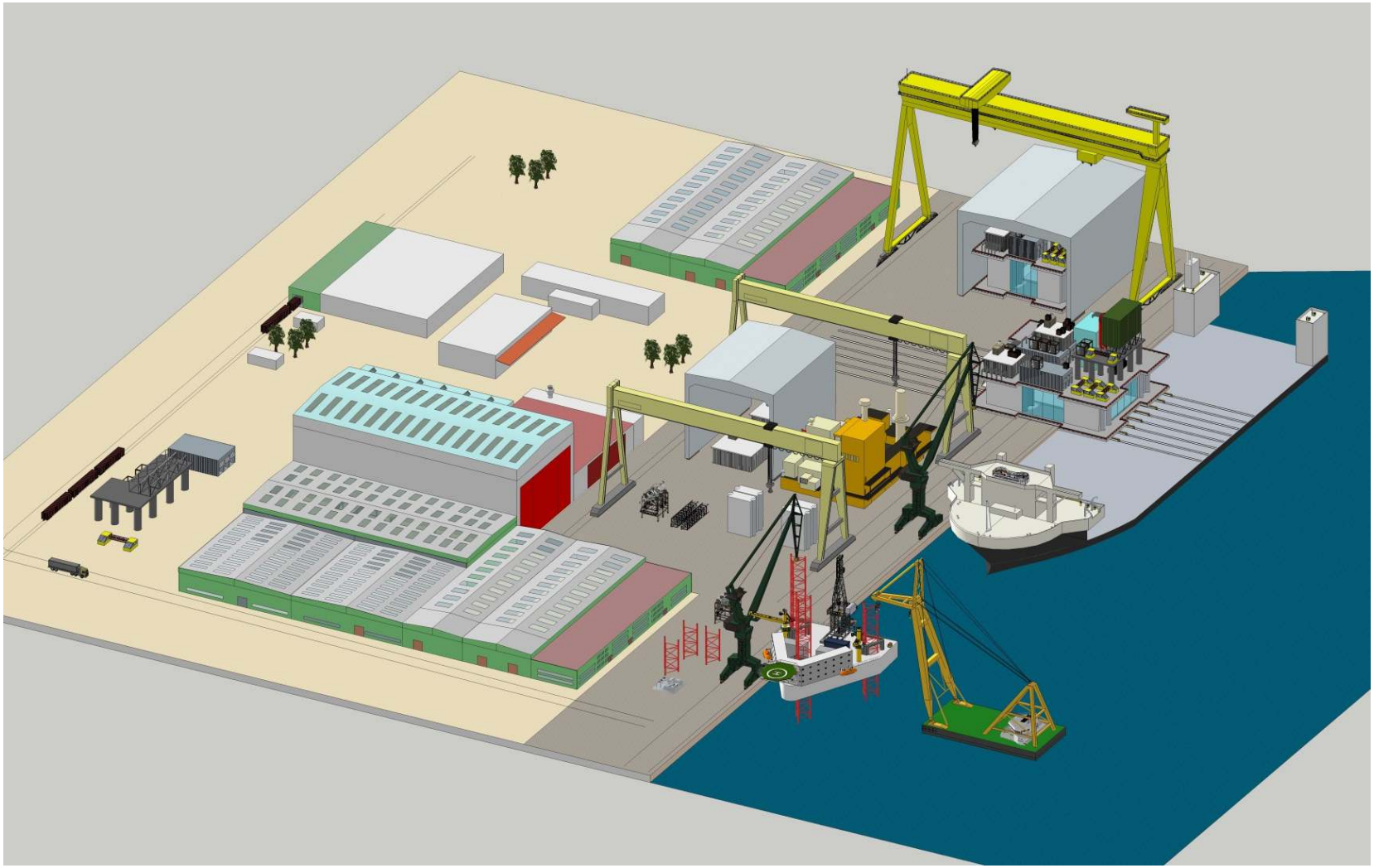


Compact shipyard Turkey

Shipyard project with floting dock

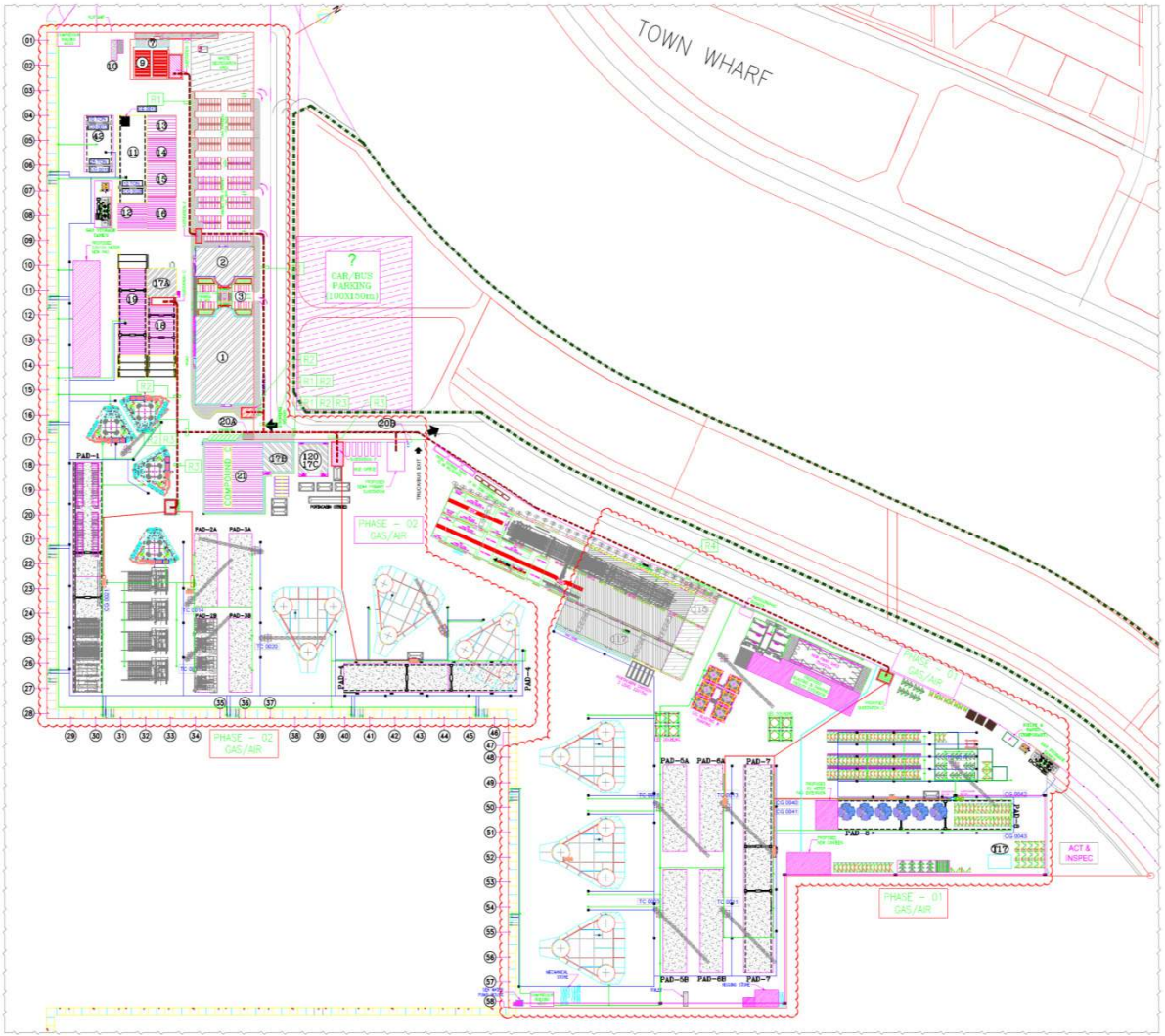


Offshore yard Vostock Raffels



Jack up production at Lamprell

Jack up production yard



RIG LOCATION PLAN @ HAMRIYAH YARD

	Paved area (concrete floor partly with embedded beams)
	Intermediate paved area (steel plates)
	Remaining outdoor areas (unpaved)
1	Accommodations
2	Cantilever beams
3	Drill packages (steel structure)
4	Block assembly
5	Final assembly (Rig 4 – 6)
6	Final assembly (Rig 1 – 3)
7	Panel & beam manufacturing
8	Leg structures
9	New prefabrication
10	Blasting and painting (sections, legs, panels)

4. Modern facilities of shipyards

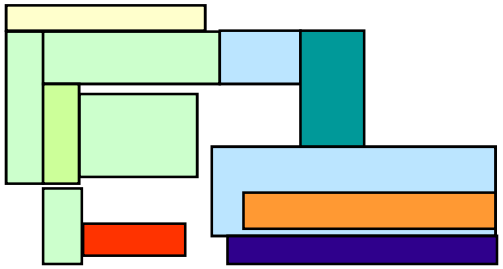
Shipyard modernization: Steps of realization

Februar 1997

März 1998

Profile store

- area approx. 9.500 m²
- max. storage capacity 3.500 t
- semi gantry crane 17 t x 30 m
  92 m travel range ,radio remote controlled
- storage system (each 5 storage racks
  for Profile of 16 m standard length
- transfer system (chain cross conveyor-
  and roller conveyor)
- profile drying unit



Profile shop

- DNC- machining centre with edge milling machine, side cleaning units and 2 robot-plasma cutting tatic as well as devices for transfer of the profiles to the automatic transport sytem
- Manipulator crane for profile cassettes (25 t, radio remote controlled)
- CNC-controlled hydraulic Frame Bending Machine with contour measuring devices

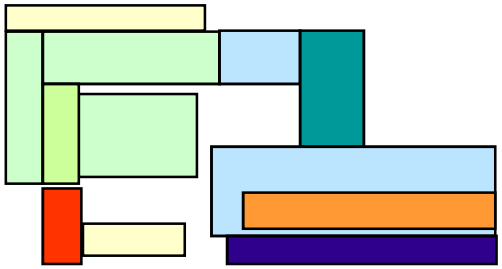
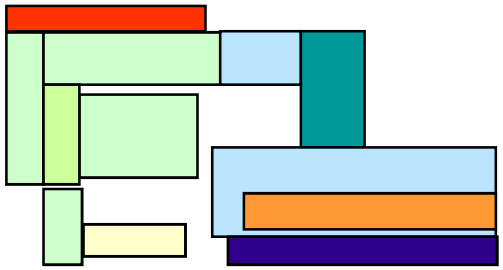


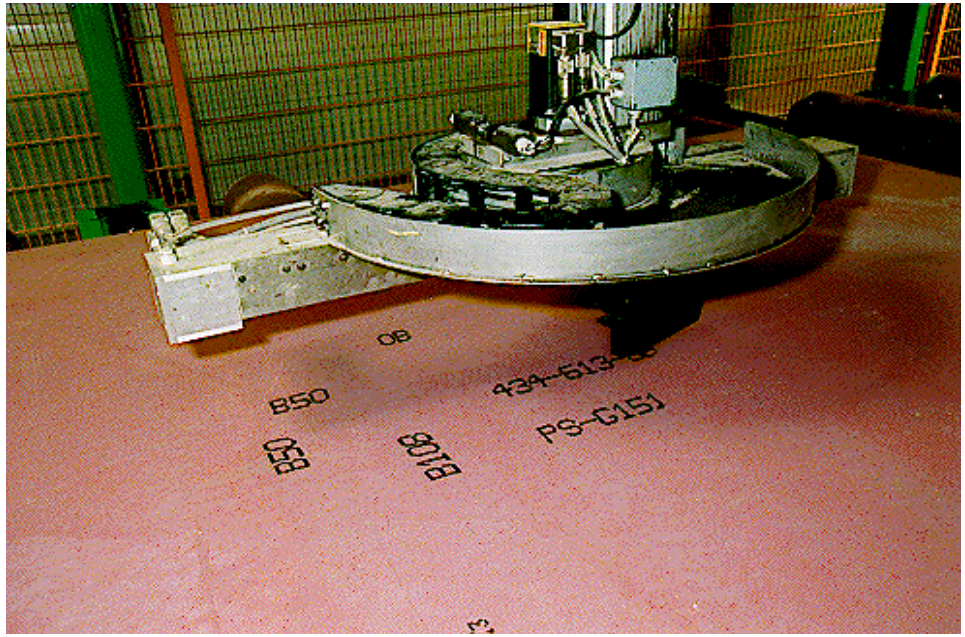
Plate storage

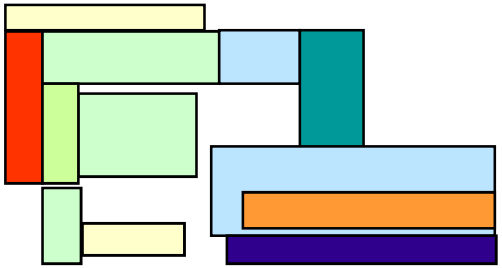
- max. storage capacity approx. 6.500 t
- chaotic storage principle
- plate input by automatic semi gantry crane (25 t x 35 m, radio remote controlled) and online-connection to storrage computer
- devices for plate transfer to cutting shop (loading crane, roller conveyor, svival roller conveyor sectin with drying unit)
- standard plate 16 x 3,2 m (max. 25 t)

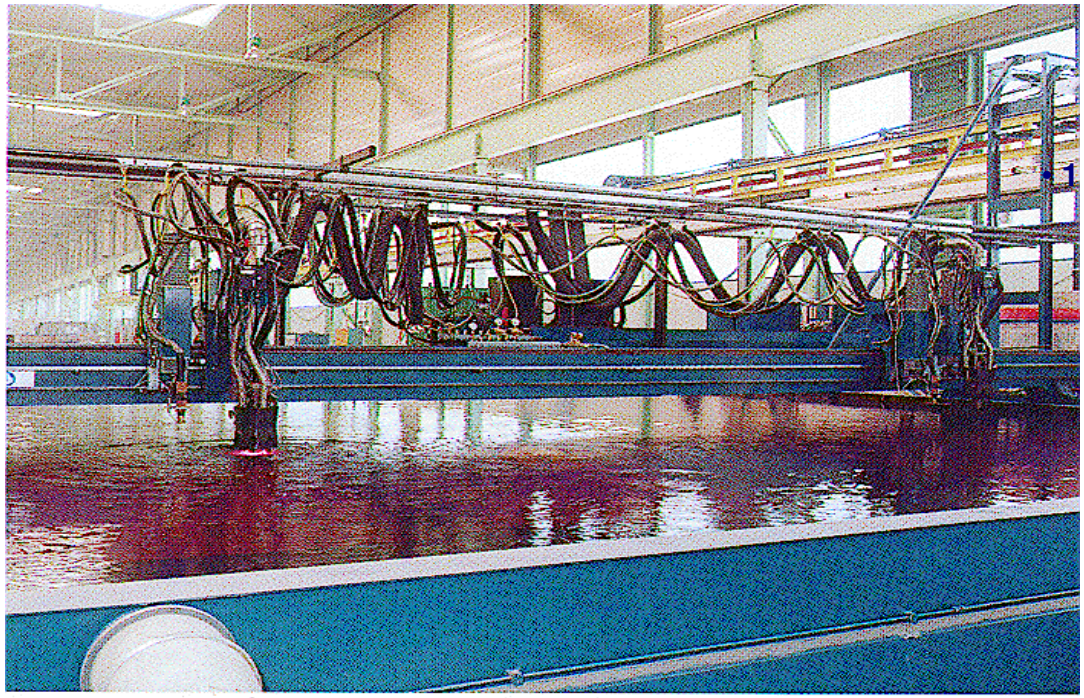


Cutting shop

- Plate supply by roller and chain conveyors
- loading and unloading of machines by 2 automatic cra
(16 t x 24 m, 25 t x 16,4 m)
- 2 DNC-controlled signing gantries

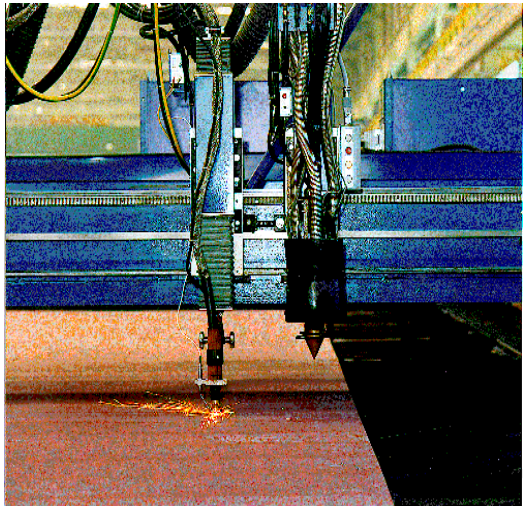


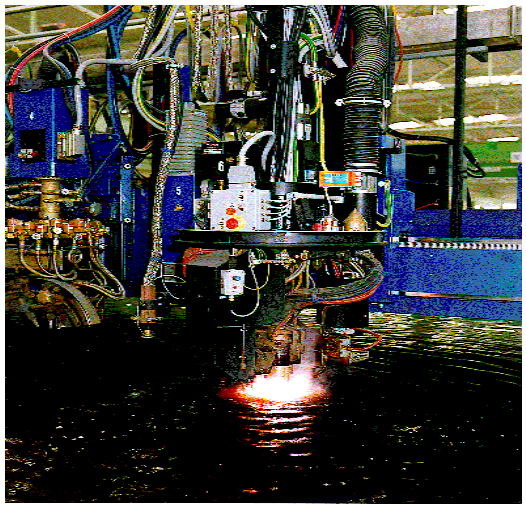


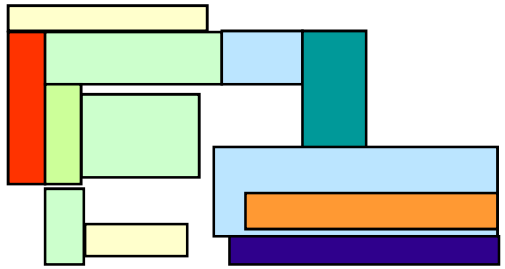


Cutting shop

- 3 under water plasma 7 oxy fuel cutting machines for bevel cuts as well as for marking
- siultaneous cutting of 2 plates (equal or mirro shaped parts)
- thickness range 5 ... 60 mm

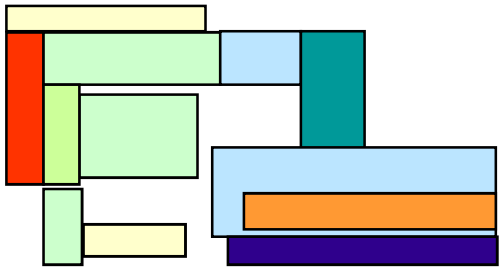






Cutting shop

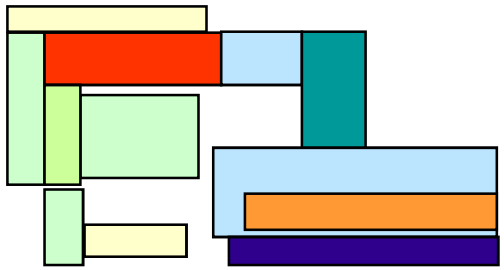
- FTS- transport system (3 lorries)
- drive-way-guidance by induktionlines
- electro drives (battery powered)
- max. load capacity 25 t
- automatic loading and unloading at 23 different load stations
- online-connection to CPC of central transport system

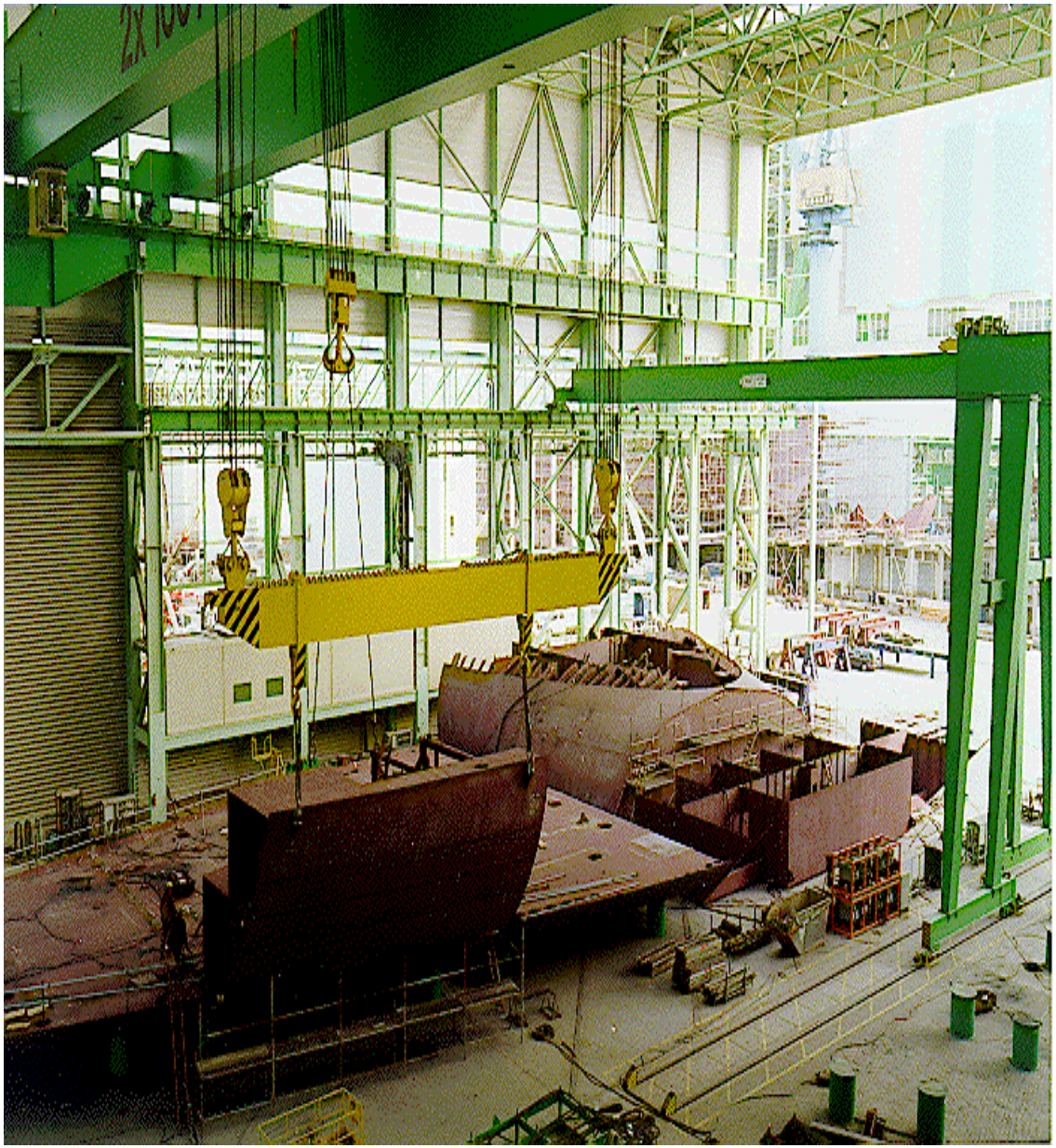


Panel shop

- Panel line 16 x 22 m for flat panels
  - SMA- single side wlding station
  - DNC-controlled cutting-, blasting-, marking-, and signing-gantry
  - profile fit-up and tack welding gantry
  - fillet welding gantry
  - web mounting and welding service gantry
  - integrated transport system with provision for direct transfer into volume section assembly shop
- production of flat panels, single hull or double hull up to 4 m height

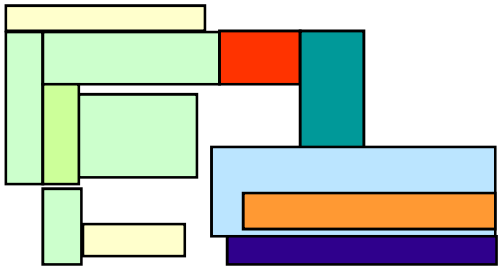
- panel line for curved panels
  - min. 4 x 4 m
  - max. 16 x 16 m
  - max. weight 110 t

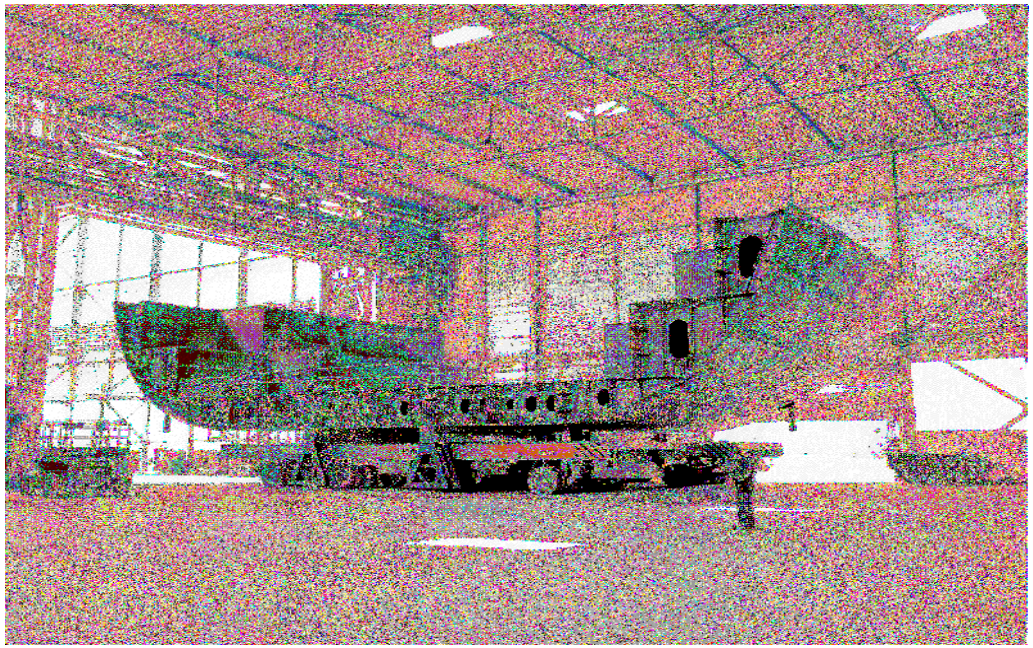




Volume-section shop

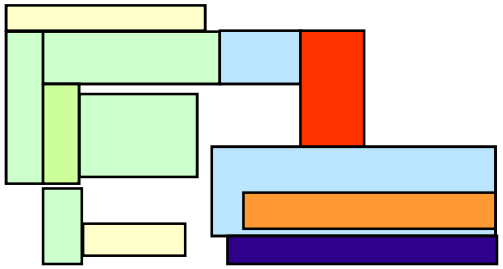
- 2 assembly cranes 2 x 20 t x 20 m
- turn over crane 160/240/160 t x 80 m





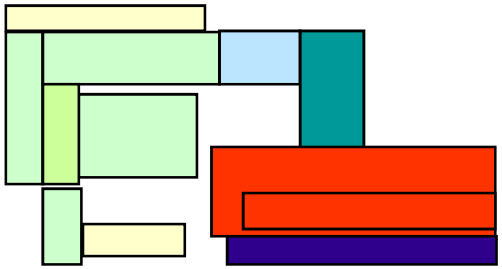
Blasting/painting shop

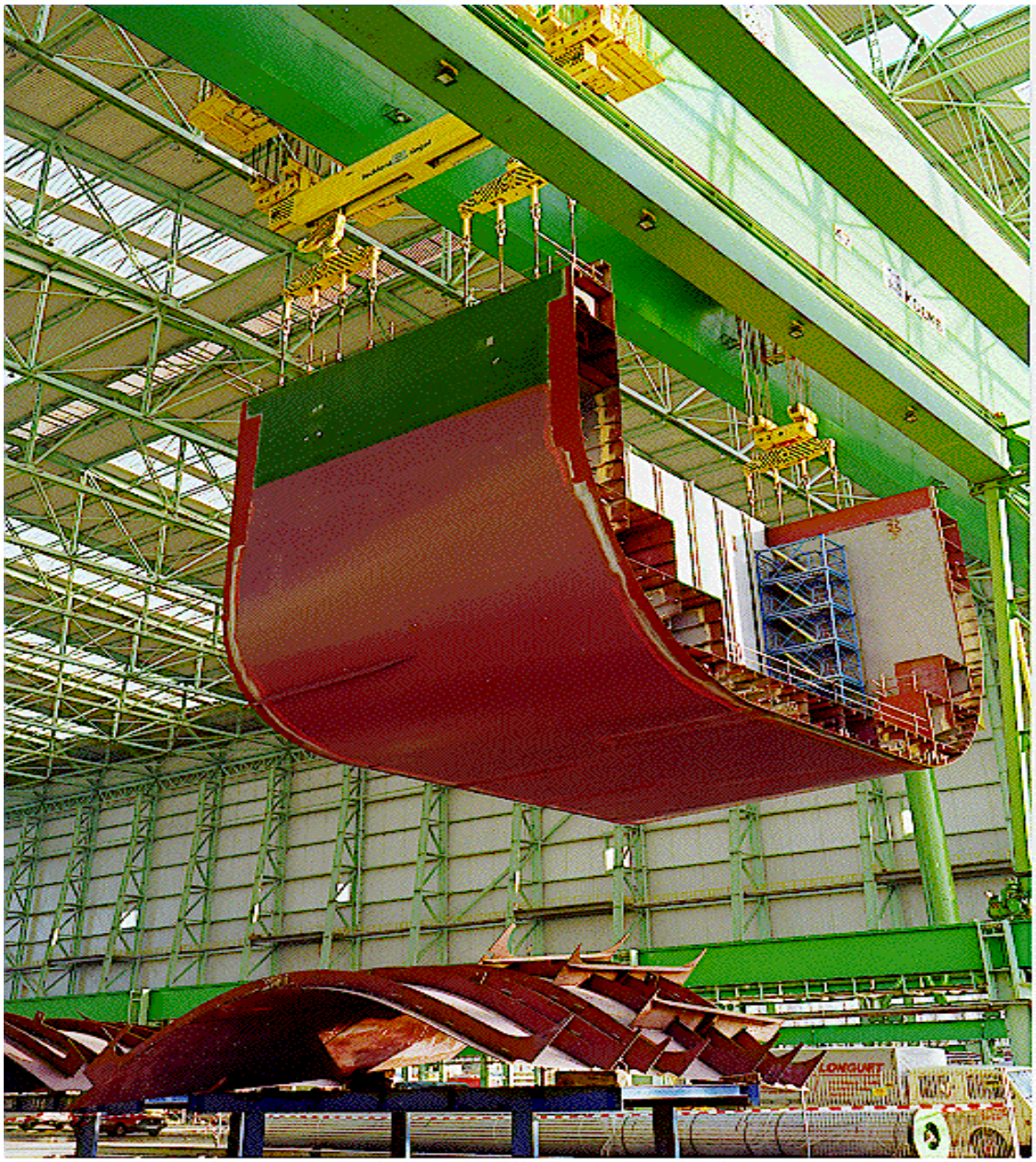
- 1 blasting box (metallic blasting grid at closed circuit)
- 1 combined blasting/painting box
- 2 painting boxes
- 4 technical rooms with all equipment (airless-paint spraying devices for single and double component paints)
- ventilation- and heating system with heat recovery
- heavy load transporters



Dock-shop / Dock

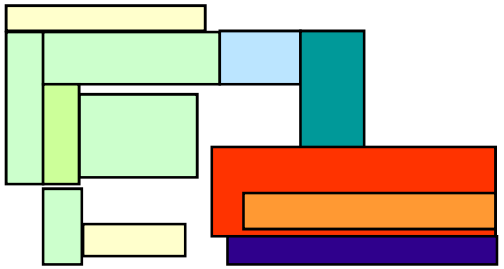
- Dock-shop 395 x 155 x 72 m
- 9 cranes (10 t up to 800 (1.000) t)
- dry-dock 340 x 67 x 11 m (HN)
  with main gate and intermediate gate
  (6 different gate positionsA)

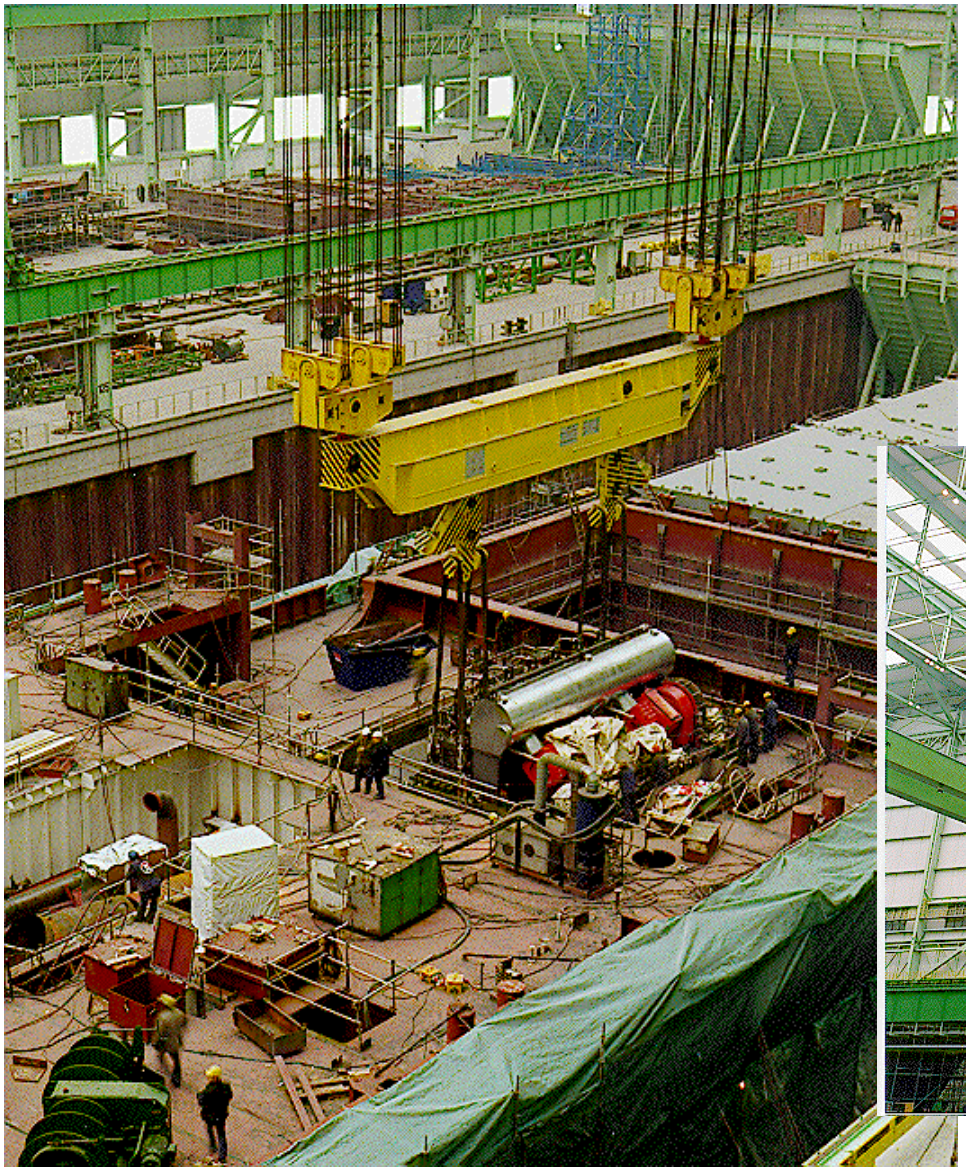




Dock-shop

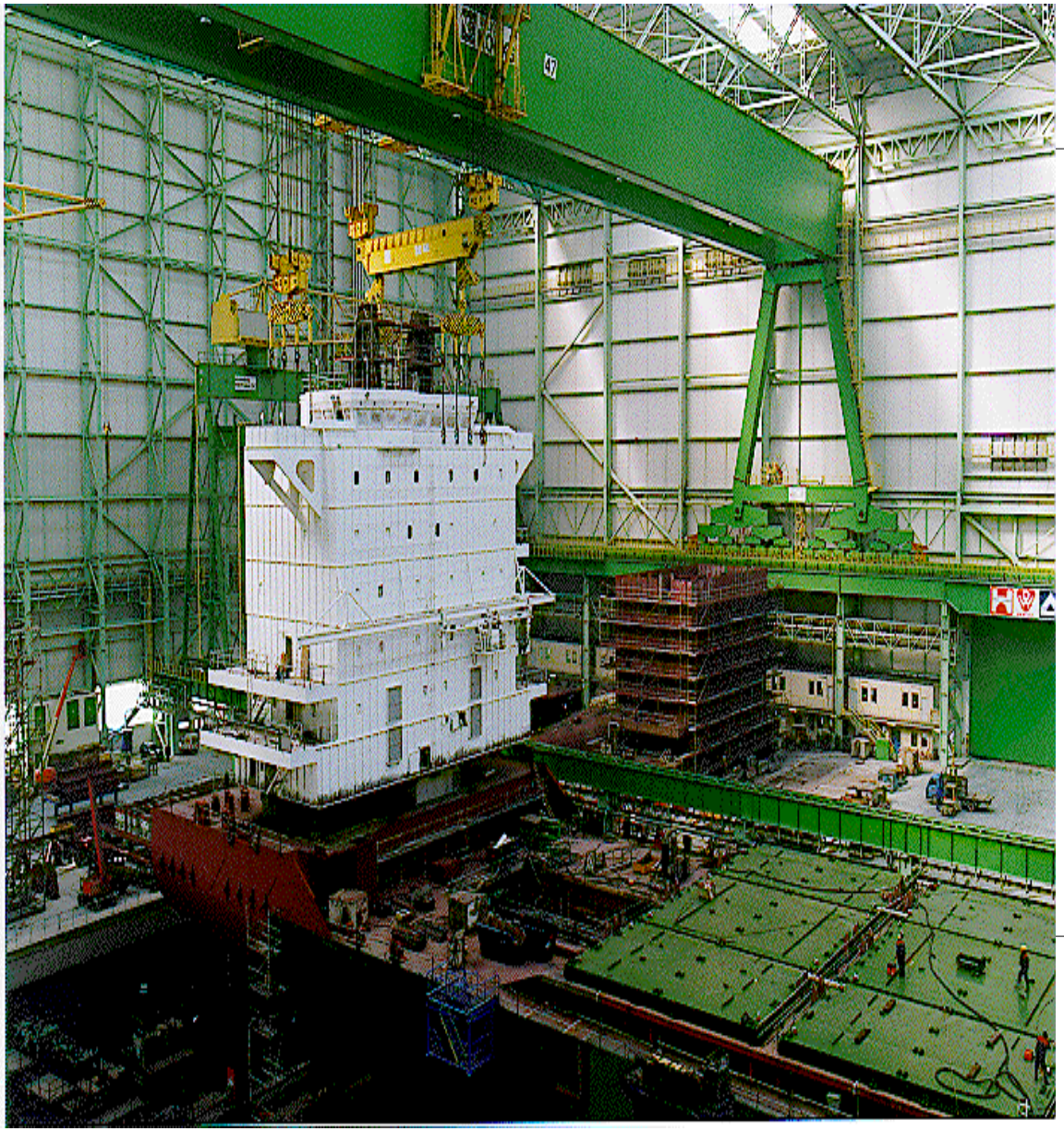
- ring section assembled at the block construction area beside the dock





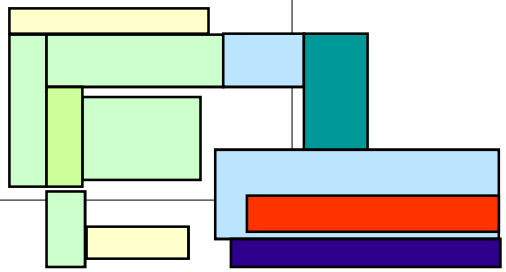
Dock-shop / Dock

- installation of main engine into ship
  (1 block, max. 1000 t)

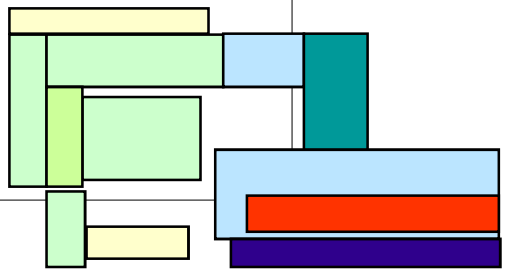


Dock-shop / Dock

- highly completed superstructure assembled in one piece to the ship, after installation of the main engine



Dock-shop / Dock



4. Modern facilities of shipyards

Dock hall / final assembly

- Launching of ship and relocation of ship hull part by floating and tug boat support

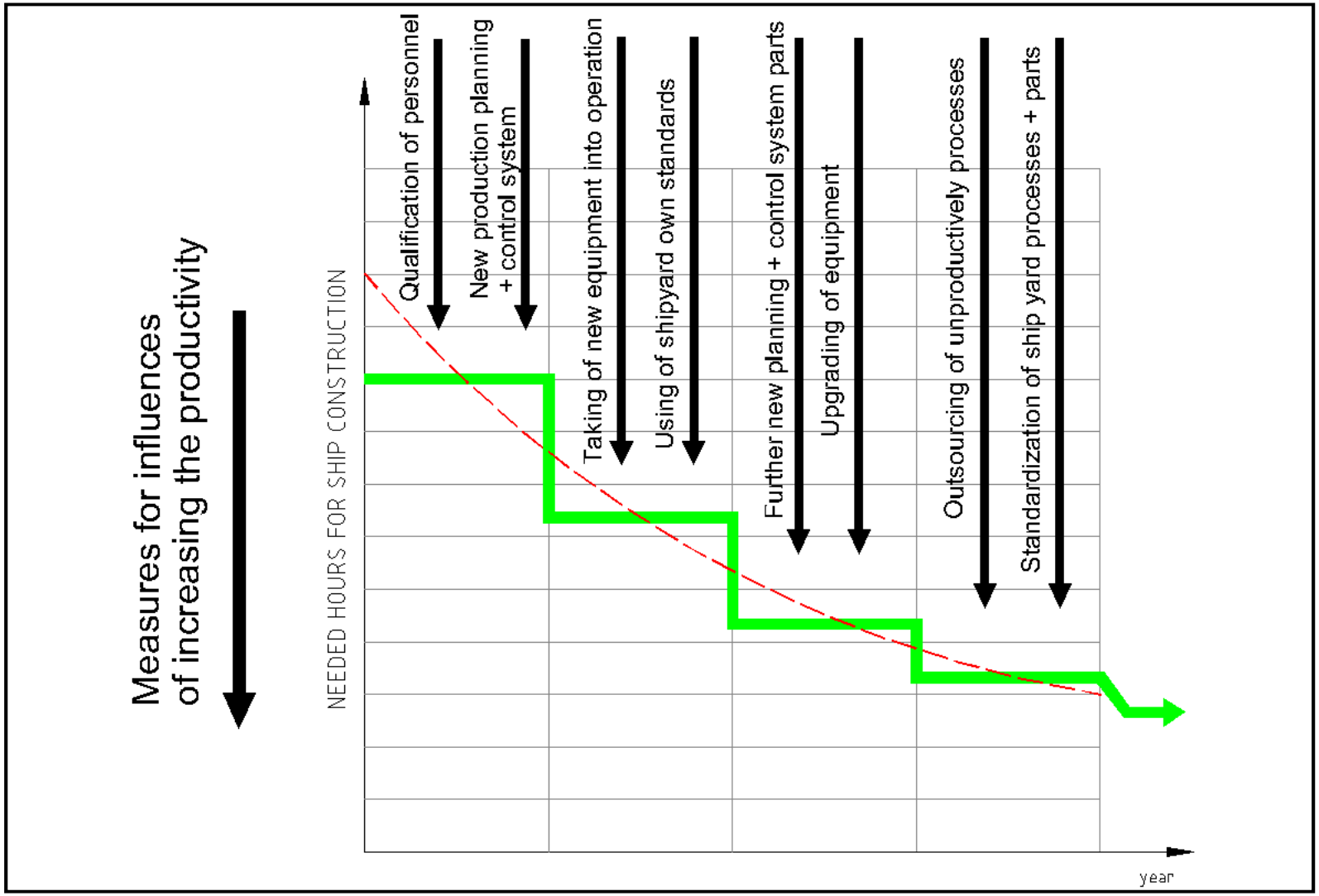
Productivity of modern yard - Performance goals

	Fertigungsabschnitt **Production shop**	Anteil am Gesamtstahl durchsatz **Share of the entire steel through put**	Produktivität **Productivity**
1.	Paneellinie eben **flat panel line**	**50 - 60 %**	**2,5 - 4,0 h/t**
2.	Paneellinie gekrümmt **curved panel line**	**25 - 35 %**	**2,5 - 3,5 h/t**
3.	Mikropaneellinie **micro (web) line**	**10 - 15 %**	**2,0 - 3,0 h/t**
4.	Plattenzuschnitt **plate cutting**	**80 - 90 %**	**ca. 0,5 h/t**
5.	Profilfertigung **profile production**	**10 - 20 %**	**0,5 - 1,0 h/t**

Productivity of modern shipyards - Types of ships

	Schiffstyp **typ of ship**	Schiffskörperbau **hall structure**	Gesamtschiff **ship**
1.	VLCC Tanker **VLCC tanker**	**9,0 h/t**	**18,0 h/t**
2.	Container 6000 TEU **container ship**	**16,0 h/t**	**22,0 h/t**
3.	Container 3000 TEU **container ship**	**18,0 h/t**	**31,0 h/t**
4.	Passagierschiff 2000 Passagiere **passenger ship 2000 passenger**	**28,0 h/t**	**68,0 h/t**

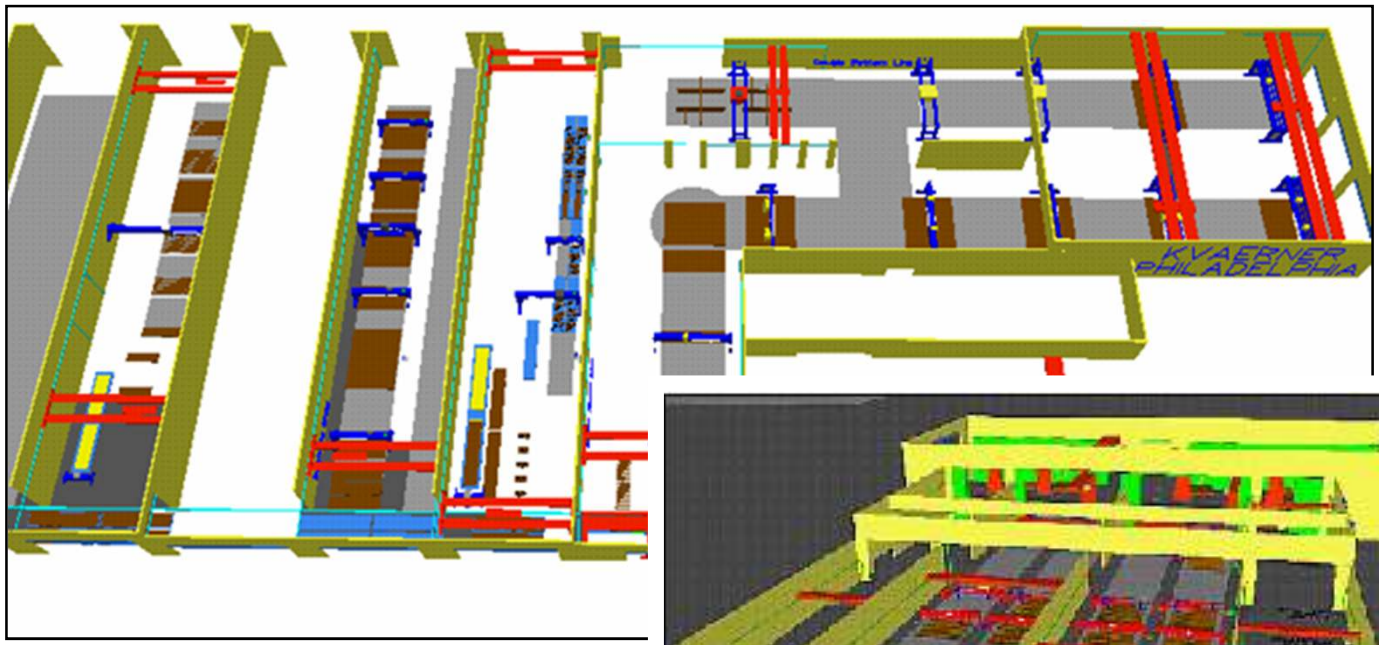
Productivity target of new shipyard



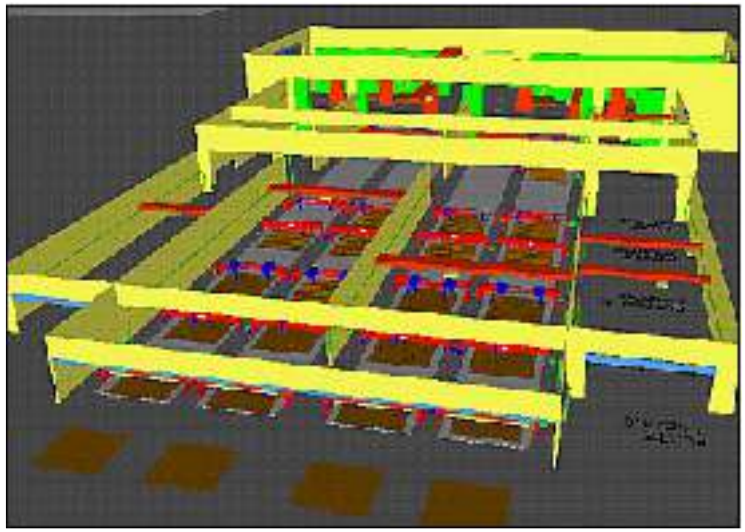
Products: Consulting & Engineering

3D Simulation- complex systems

- Feasibility Studies
- Material Flow & Logistic Concepts
- Analysis, Planning & Project Engineering
- Software for Production Planning & Control
- Software for Workshops



Simulation of material flow



Simulation of panel production shop

Products: Consulting & Engineering

The application of the simulation results in:

Conformation /optimization of projects Proof of functionality of planned systems Minimalization of the business risk (Simulation of investments)	➔ increase of safety
Optimization of stock quantities and buffer sizes Optimization of work processes and work capacities	➔ Cost effective solutions
Avoiding / elimination of bottlenecks Dynamic analysis and display of production-processes via animation	➔ improved system understandment
Optimization of production periodes, utilization etc. Increase of productivity	➔ improved production processes

Products: Consulting & Engineering

- Feasibility Studies
- Material Flow & Logistic Concepts
- Analysis, Planning & Project Engineering
- Software for Production Planning & Control
- Software for Workshops

IMG Logistics

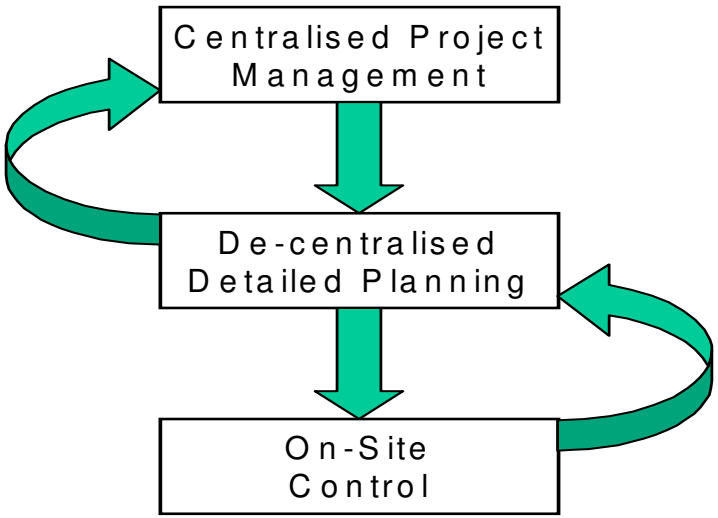
➔ Concurrently with the development and delivery of production sections of shipyards and the manufacture of individual parts, IMG is also able to supply the associated production logistics for the machinery.

➔ Graphically interactive, computer-based software aids the user in capacity and detailed planning tasks.

➔ IMG assists you in analysing your strengths and in finding a concept that allows you to realise and maintain customised solutions.

General approach of planning and control in a modern shipyard

- General Approach is to have **hierarchical top-down planning with closed control loops**
- Planning and control in **centralized and decentralized organization structures**
- The objects of an **overall business plan** go through an **event-oriented planning process in several planning – levels**
- The several **planning levels** correspond with the **phases of order processing**



- **Scope of planning and control**
  - In general the scope of planning and control shall cover the **entire shipbuilding process** from project acquisition to delivery including the integration of subcontractors in multi project environment
  - **Scheduling** for all processes direct and indirect related to production as there are:

    - Design
    - Work preparation
    - Production
    - Planning
    - Purchasing and procurement
    - Delivery

  - **Resource planning** for all resources needed for the processes in terms of:

    - Material
    - Machines
    - Floor space
    - Money
    - Human resources
    - Facilities
    - Drawing, programs, documents

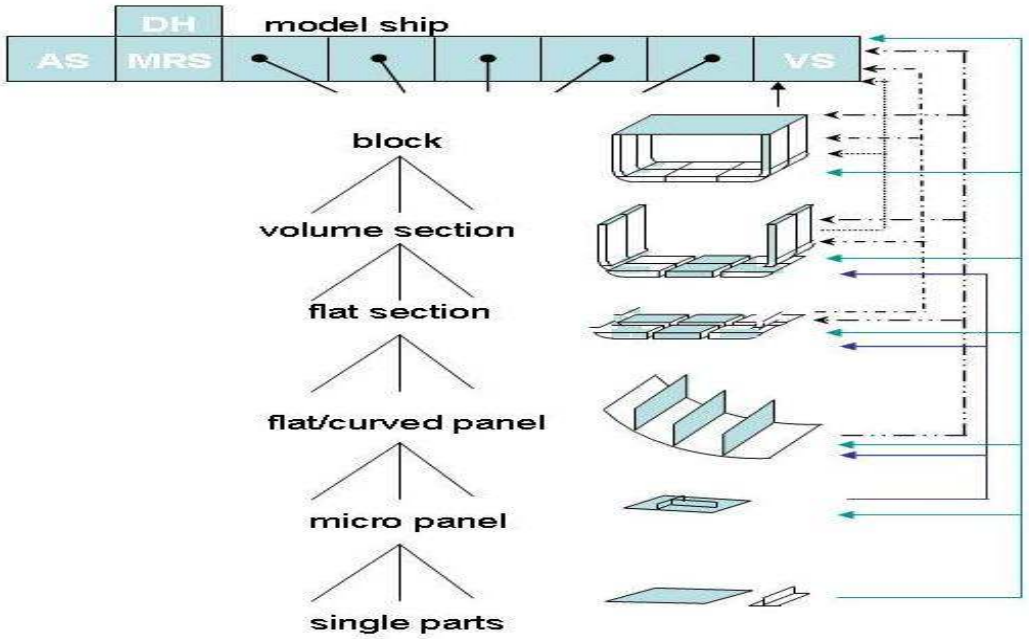
Basic concept of logistics, planning and process control

- Primary aims:
  - Adherence to the contract concerning performances, quality and dates
  - Adherence to the calculated expenditures as well as costs
  - Always high delivery reliability and high quality
- Secondary aims:
  - High productivity of resources
  - High and balanced resource utilization
  - Short construction times / total lead times and exact date observance
  - Support of necessary decisions, if processes on the basis of disturbances are not realized as planned
  - transparency
  - recognizing of the connections between the processes
  - Assuring of as low as possible stocks
  - Minimised material costs
  - High availability and reuse of information
- Conflicts:
  - Conflicts occur between the above mentioned aims (that is a normal situation)
  - The conflict situation will be intensified by straight ahead acting object manager responsible for parallel produced objects
  - **An efficient system of planning and control is necessary!**

Process planning

Process planning

Progress in time:
„The right part in the right time on the right place“



Products: Production Lines

Plate Cutting Shop

Profil Cutting Shop

Micro Panel Line

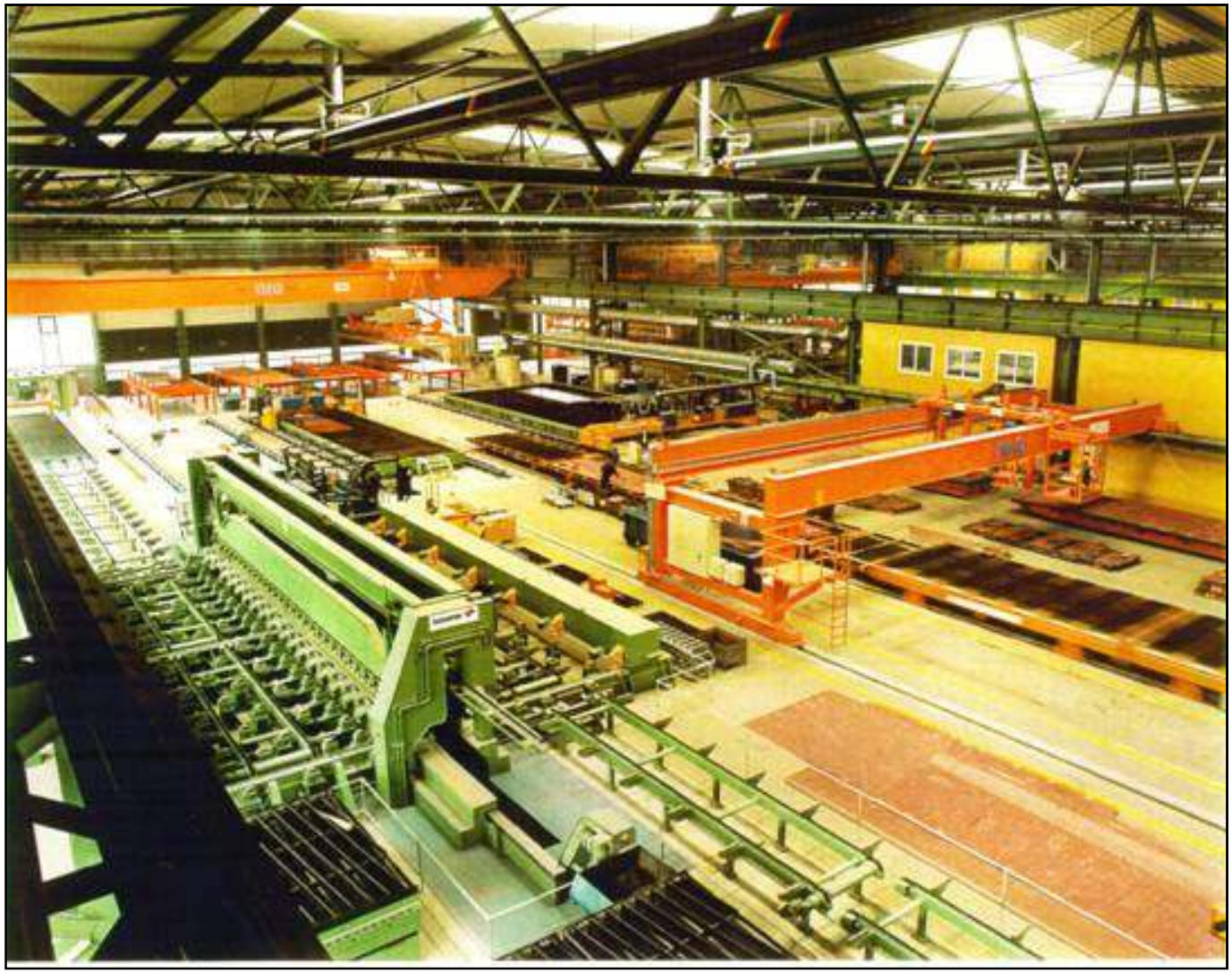
Panel Line

Curved Panel Line

Pipe Shop

Products: Production Lines, Plate Cutting Shop

Automated Plate Processing in Shipbuilding



Products: Production Lines, Plate Cutting Shop

Plate Cutting Shop VWS, Automatic Crane

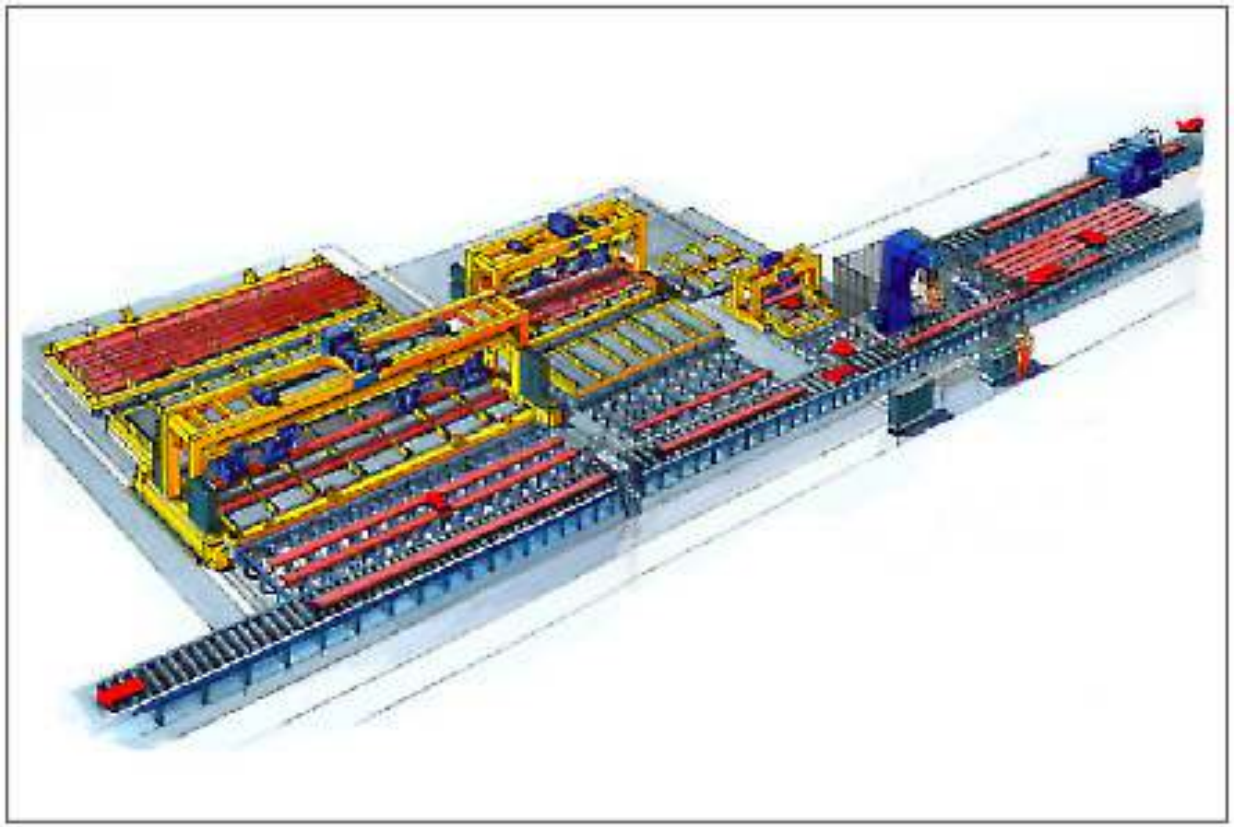
Products: Production Lines, Plate Cutting Shop

Sorting Gantry MNR

Products: Production Lines, Profile Cutting Shop

The advanced cutting system for profiles and rolled sections

- automatic profile storage
- profile transfer systems
- edge cleaning systems
- cutting station
- sorting gantries
- profile cassettes
- profile bending machine



rought draft

Profile cutting line

Products: Production Lines, Profile Cutting Shop

sample cut profiles

Products: Production Lines, Micro Panel Line

Micro Panel Line, Aker MTW GmbH

Stiffener Grasper

Products: Production Lines, Micro Panel Line

Products: Production Lines, Micro Panel Line

Micro Panel Line, Aker MTW GmbH

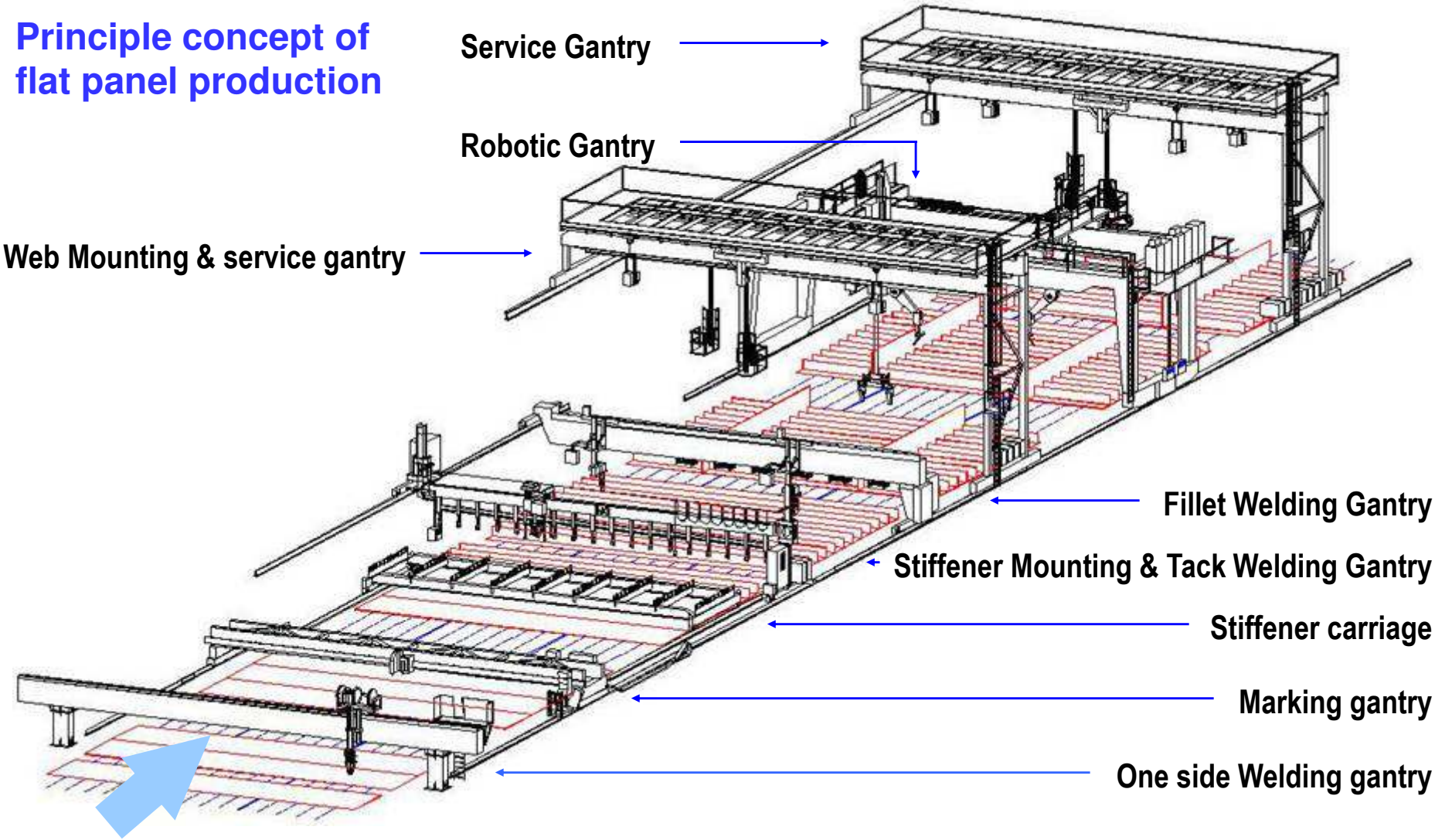
Welding Robot

Kvaerner Philadelphia Shipyard / USA

Micro Panel Line

Products: Production Lines, Panel Line

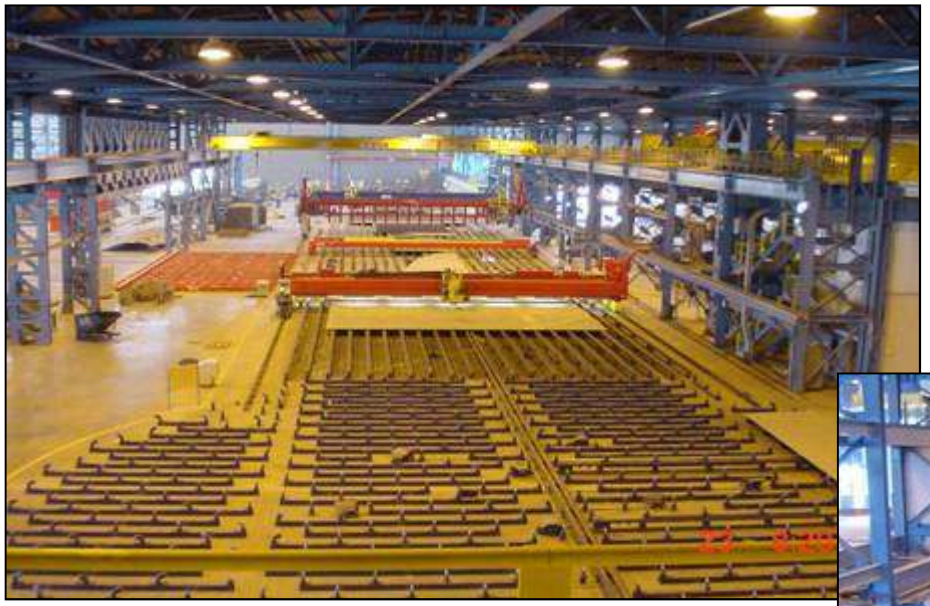
Principle concept of flat panel production



Products: Production Lines, Panel Line

Panel Line Aker MTW GmbH, Germany

Kvaerner Philadelphia Shipyard / USA



Panel Line 16 m

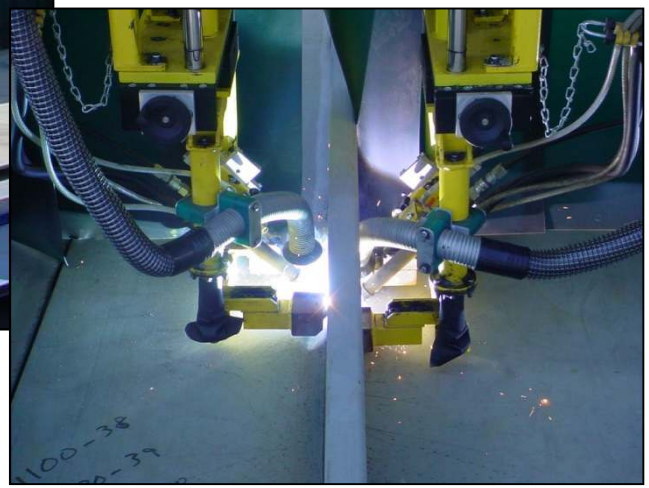
Panel Line 12 m

Products: Production Lines, Panel Line

Panel Line DAEWOO, Korea

Butt welding from both sides
Flensburger Schiffbaugesellschaft – 12 m Panelline

Fillet welding gantry for five (5) profiles in one run - Nassco USA



Products: Production Lines, Panel Line

Aker MTW GmbH Wismar/Germany:
Service gantry

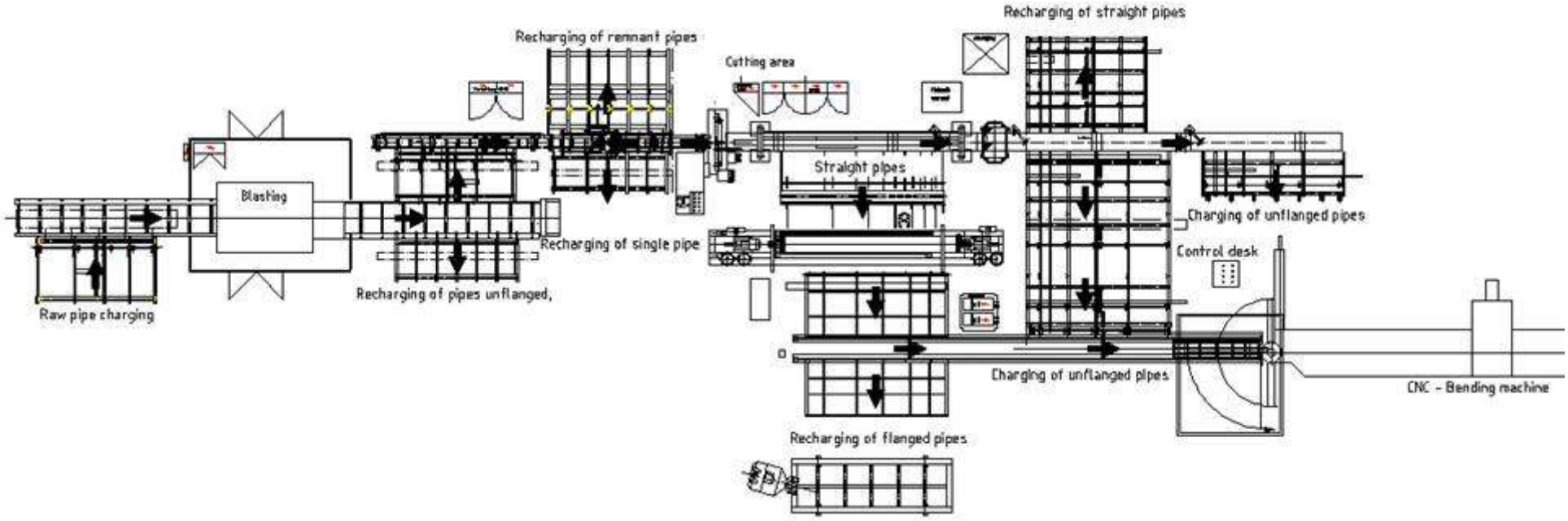
Robot welding MPL

Robot welding gantry

Kvaerner Philadelphia Shipyard / USA

Curved Panel Line

Products: Production Lines, Pipe Shop

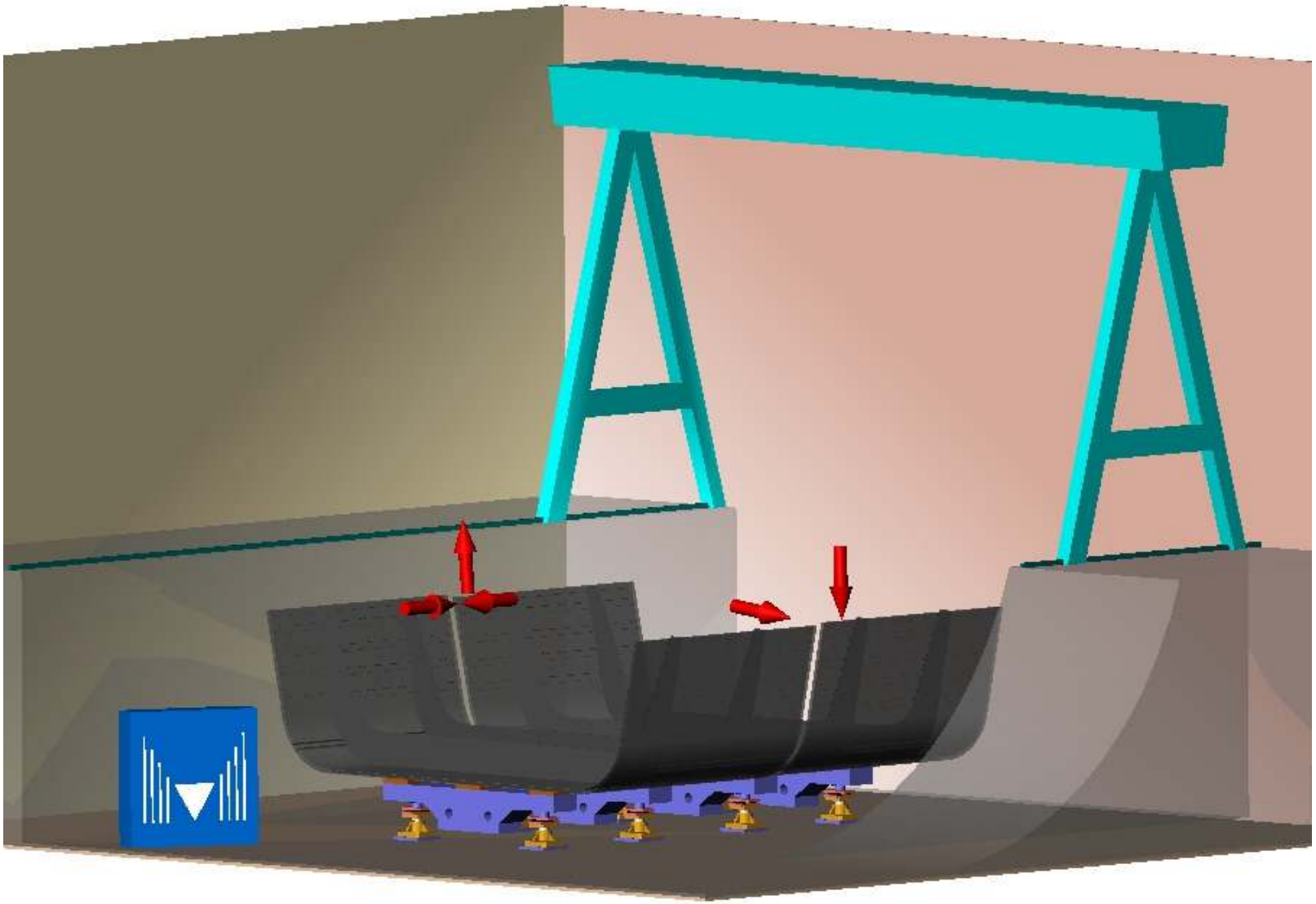


Pipe Shop Aker MTW GmbH, Germany: Layout

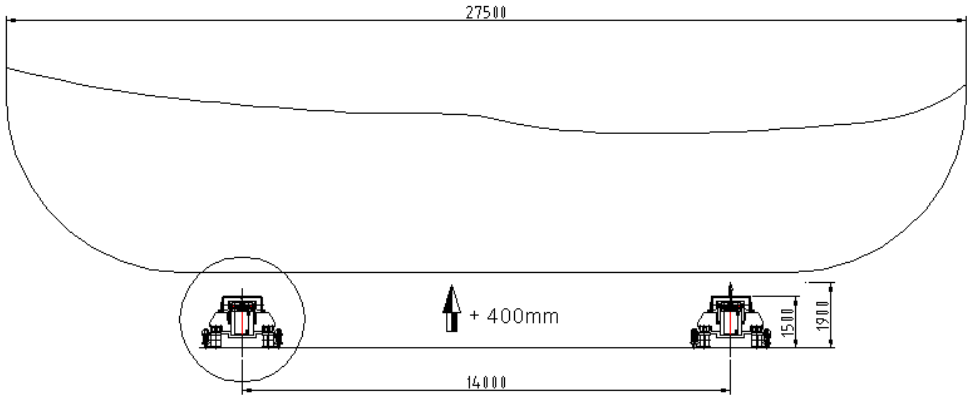
Products: Production Lines, Pipe Shop

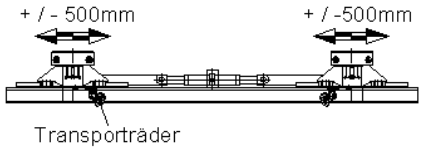
Pipe Shop Aker MTW GmbH, Germany:
Pipe Flange Welding Machine

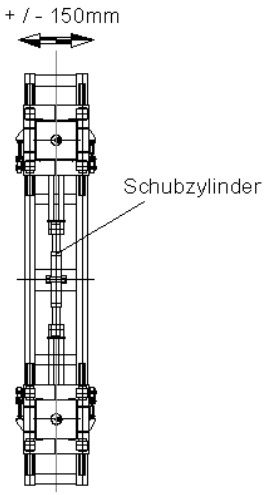
Havy load transportation system

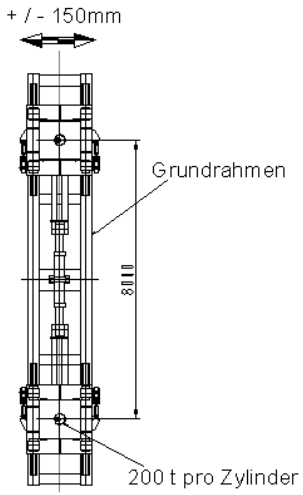


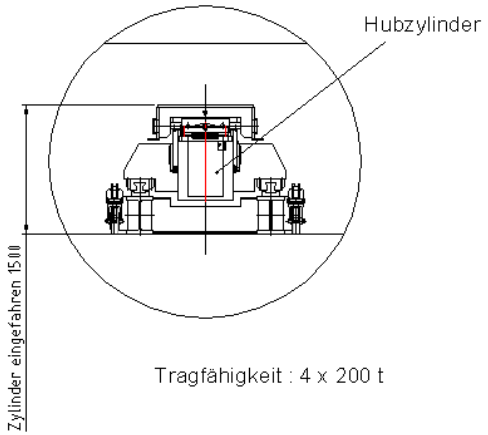
HLTS-Principe











Products: Production Equipment

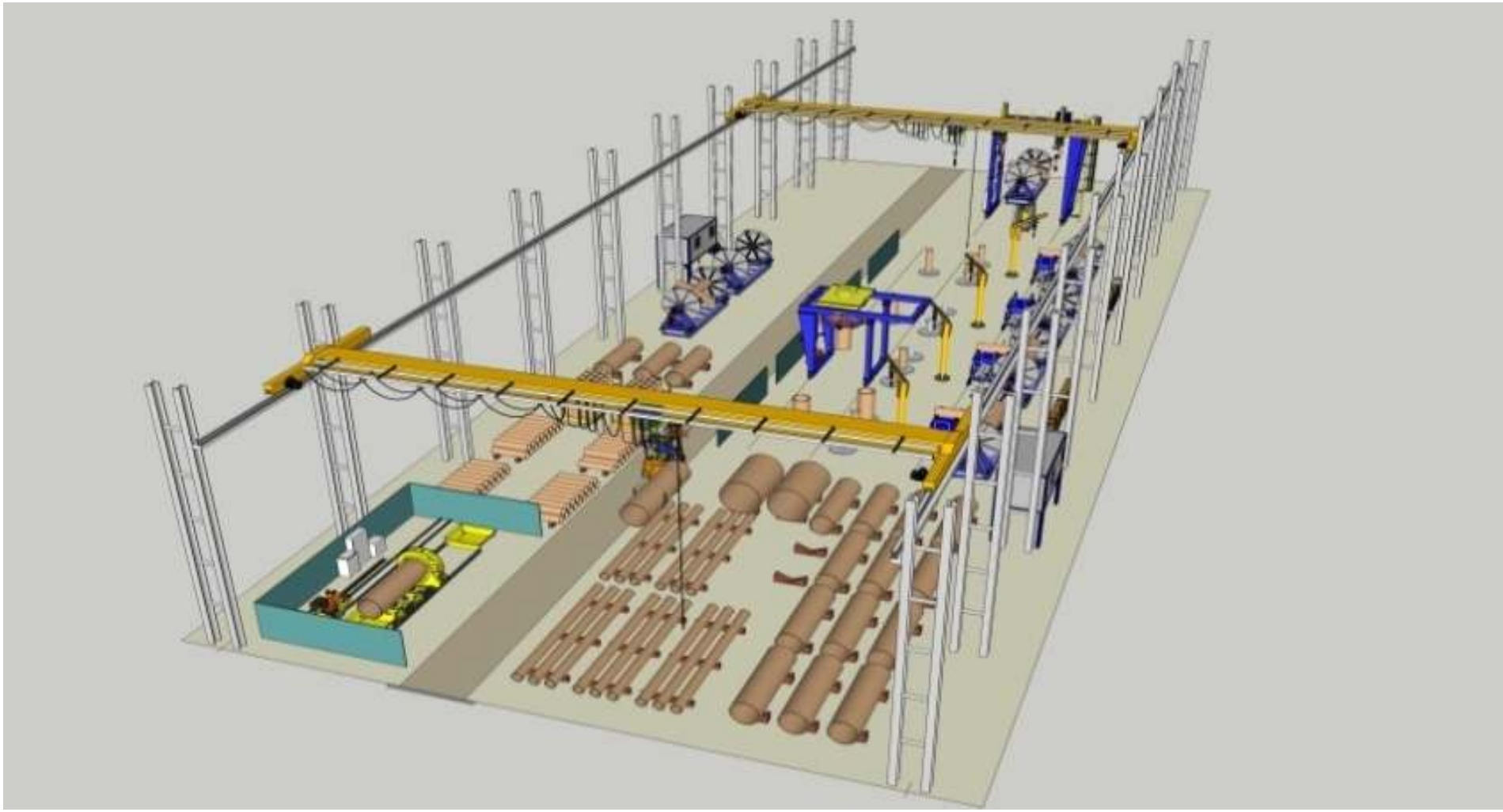
Transport and Positioning System for ship sections up to 1200 tons

Accuracy of adjustment : ± 1 mm
Period of positioning: ca. 20 min.
(including position controlling)

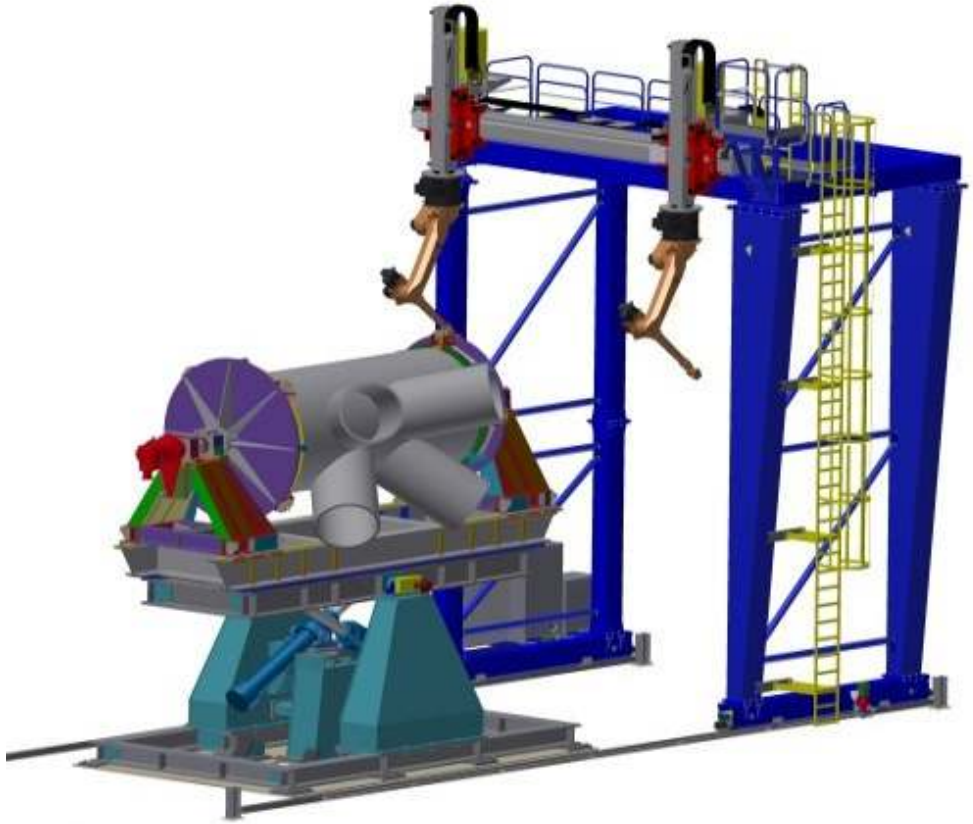
Flensburger Schiffbau-Gesellschaft/Germany

Ship transportation system

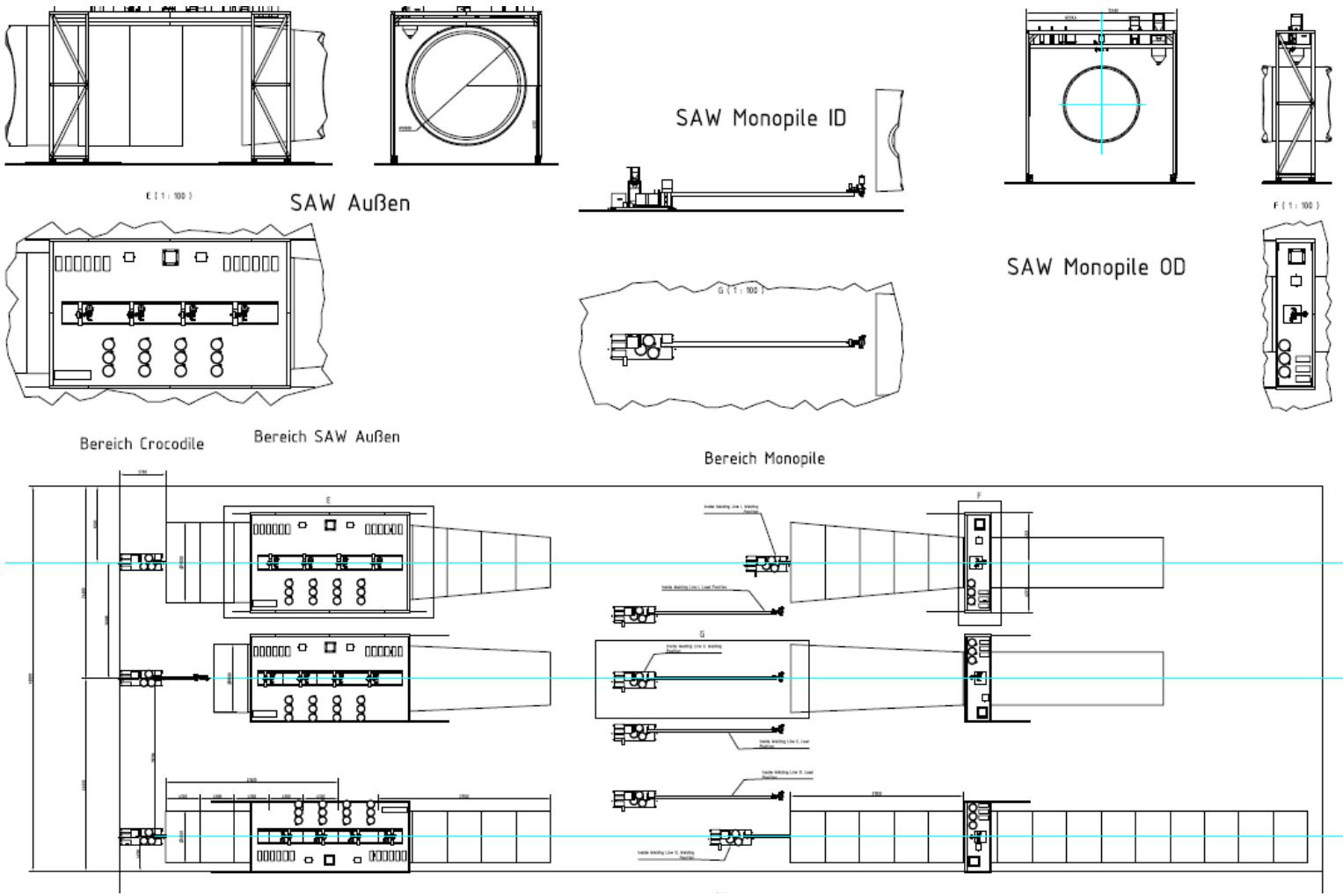
Production idea for knotes



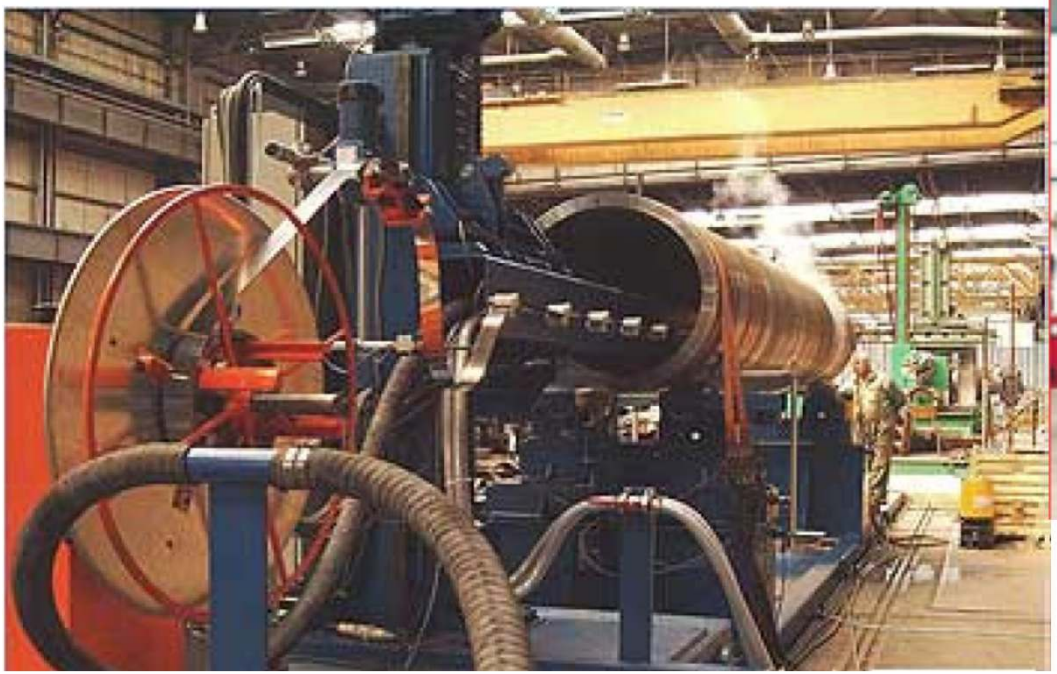
Robot welding and cutting robots for offshore structures



General idea monopile production



Monopile welding station



Final product

Concept layout Rio Naval

RG Estaleiro Rio Grande

RG Estaleiro Rio Grande

PROSUB Project Odebrecht

IMG your company for modernization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