

01 Factory for today: Boat Yard

SS 2008: Universität für Angewandte Kunst, Wien, o. Univ. Prof. Greg Lynn
assistants: Kristy Balliet, Oliver Bertram, Brennan Buck, Martin Murero, Johannes Mücke



This semester we will focus on the design of a contemporary factory. Structure, building systems, cranes and other large scale moving elements that integrate with building structure as well as a vocabulary of surfaces inspired by high performance sailing yachts will be the topics for design.

Due to the America Cup campaigns of billionaires, the research and development in design and materials have surpassed the aerospace industry in terms of innovation. The composites industry, now lagging in terms of innovation has been made exciting again thanks in part to the commercial aeronautics industry but primarily due to naval architecture. The racing sailboat and go fasts cruising boat industry is presently one of the most advanced, high-performance, design-led industries in the world. The merger between design, materials research, testing and unprecedented funding has put offshore race boats and their recreational cousins at the apex of synthesis of high performance, exotic materials and beauty today.

The industry places the highest priority on design as most major innovations are not in material developments but in design. There is no science to these innovations but instead leaps in typology, surfaces and structure that is then tested by intuition and prototyping. The focus on the design of surfaces and their specific quality makes this industry a great partner for architectural design.

Over the last several semesters, we have developed a facility for interior and organizational complexity; this task will be a return to contemporary technology, materials and geometry. The factory can be one vast room or many rooms but in each case it is filled with very large objects moving from day to day and even minute by minute.

The studio will design a state-of-the-art sailboat fabrication yard on the coast of Croatia. An organized cluster of buildings or a single modulated long span structure; the projects will rely on landscape, coastline and skyline, and look to boat design for surface refinement and structure and tectonics. There are requirements for outdoor yards, showrooms and boat slips on the water.

We will maintain disciplinary focus and the comprehensive scope of our work. Plans, sections, and physical models will remain instrumental. From the beginning of the semester, three-person groups will work like small offices, tackling a variety of issues simultaneously and pitching a complex project as a synthetic proposal. Finally, the boatyard should be a state of the art factory, and we will integrate building systems into the design early on. Thomas Auer from Transsolar Environmental Engineering in Stuttgart will join us 3-4 times over the semester. The expression, high performance, and integration of building systems will be a central focus of the term. The factories should be the most energy efficient (economical), state-of-the-art, robotic, precision and exciting building machines to date. The large scale CNC machines, hoists, cranes, gantries, ovens and autoclaves should be celebrated and expressed in the design.

Croatia has become an epicenter of high-tech boat fabrication as well as European sailing. The studio will travel to the coastal site on the island of Cres and to Murtic Yachts, a shipyard near Zagreb that builds racing boats for the America's Cup and high-end yachts for the Spanish designers Botin Cakeek. There, we will see the multiple production processes that our buildings will house: hull fabrication, deck construction and commissioning (assembly). We will have a presentation on tool making, autoclaving and sail making.

02 Factory for today: week 01

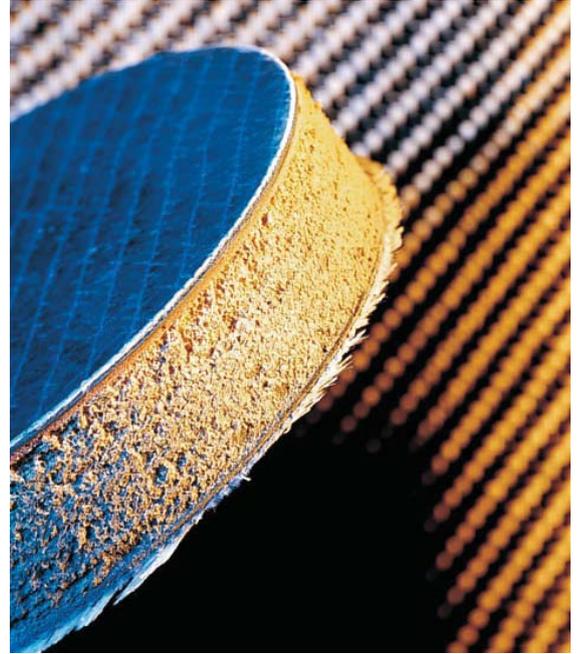
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WEEK 1: Each team must divide these tasks and coordinate to produce a coherent proposal for each:

HULL: Modeling technique to achieve surface qualities inspired by boat hull surfaces.

SPARS: Design concept and examples for framing, structure and tectonics. Special attention should be paid to how structure transitions into exterior and interior surfaces as well as how it meets the ground and how different structural lineaments are attached one to another. Each team should develop a tectonic strategy for integrating two or more materials.

SAILS: Design concept and examples of the skyline and coastline massing idea for a factory. There are no towers or vertical spaces but there are long span volumes that meet the water as well as slips, docks and cranes.



Greg will be here for the first time on Sunday March 9th so each team should prepare to present and discuss their initial scheme as a coherent (if rough) proposal. As with any group presentation, you should carefully design the visual materials and models so that there is a clear design intent to discuss in terms of development and design technique..

DESIGNERS:

<http://www.judel-vrolijk.com/>
<http://www.reichel-pugh.com/>
<http://www.farrdesign.com/>
<http://www.botincarkeek.com/>
<http://www.germanfrers.net/>
<http://www.knierim-yachtbau.de/>
<http://www.lucabrenta.com/>
<http://www.andrewsyacht.com/>
<http://www.trippdesign.net/>
<http://www.rodgermartindesign.com/>
<http://www.humphreysdesign.com/>

BOATS:

<http://www.wally.com/>
<http://www.murticyachts.com/>
<http://www.maxidolphin.it/>
<http://www.martenyachts.com/>

MORE BOATS:

<http://www.shipman.dk/>
<http://www.southernwindshipyard.com/>
<http://www.grandsoleil.co.uk/>
<http://www.x-yachts.com/>
<http://www.pogostructures.com/>
<http://www.akilaria.com/>

FABRICATORS:

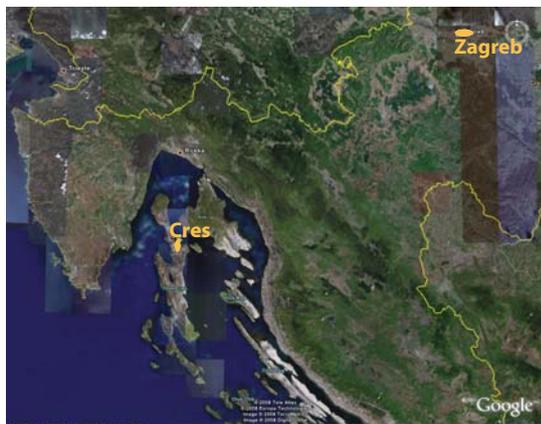
<http://www.northsails.com/>
<http://www.janicki.com/>
<http://goetzboats.com/>
<http://www.mcconaghyboats.com/>
<http://www.hakesmarine.co.nz/>
<http://www.westerly-marine.com/>
<http://www.high-modulus.com/>
<http://www.hallspars.com/>
<http://www.kingcomposite.com/>

03 Factory for today:Site

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Cres, Croatia
Site: 2 hectares (20,000 m²)



Cres:
Largest Island in Croatia
appr. 150 km Zagreb

04 Factory for today: program

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AREA	TOTAL m2	m2	notes	W	L	H
SAIL LOFT	3700					
Gantry & 2 flexible sail molds		1200	North Sails 3DL	18	50	
Finishing table		800	5 locations for rotating machines & one linear track machine	12	38	
Mylar patterning		500	large laser cutter and table for broadseam taping			
Cold storage locker		400	Aramide			
Prepreg area		300	rolling machines			
Sail racks & folding area		500				
HULL FABRICATION ASSEMBLY	5100					
3 bays		3000	45m x 15m each side by side	45	45	12
Woodshop		400	10m wide doors one end			
Metal shop		300				
Composites storage & freezer		400				
Outdoor commissioning yard		1000				
TOOLING	2000					
LG. Gantry CNC bay		400	5 - 7 axis gantry mill	10	30	12
Gantry CNC bay		200	5 - 7 axis gantry mill	6	25	8
Articulated arm CNC bay		200	standing CNC robotic arm	8	15	8
Panel shop		500	3 ovens: 15m x 8m each	24	15	6
Autoclave		300	for spars	8	30	8
Water jet		200	15m x 8m	8	15	
Flat table		200	15m x 8m	8	15	
FINISHING	800					
Paint		200				
Canvas shop		200				
Electronics		200				
Rigging		200				
LOADING	200					
SERVICING	1000					
OFFICES	700					
Sales offices		100	2 offices			
Management offices		200	6 offices			
Design & engineering offices		200	6 stations			
2 Conference and 1 presentation room		200				
SHOWROOM	4200					
Indoor		1800	for boats to be seen from below			
Outdoor		2400	and boarded from above			
DOCKS & LAUNCHING	1100					
6 slips		600	ranging from 15m to 40m slips	4	150	
Haul out slip		500		8	50	15
TOTAL	18800					
Enclosed subtotal		14300	all W/Cs, mechanical spaces, circulation and wall thickness is included in the total areas			
Outdoor subtotal		4500				

06 Factory for today: Terminology

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- Yacht :** any of various recreational watercraft: as
a: a sailboat used for racing or b: a large usually motor-driven craft used for pleasure cruising
- Mega yacht:** refers to a yacht (power or sail) over 34m
- Super yacht:** refers to a yacht over 70m
- Hull:** is the body of a ship or boat. It is a central concept in floating vessels as it provides the buoyancy that keeps the vessel from sinking.
- Spar:** a stout pole such as those used for masts, etc.; a mast, yard, boom, gaff, or the like.
- Mast:** a spar or structure rising above the hull and upper portions of a ship or boat to hold sails, spars, rigging, booms, signals, etc., at some point on the fore-and-aft line, as a foremast or mainmast.
- Sail:** an area of canvas or other fabric extended to the wind in such a way as to transmit the force of the wind to an assemblage of spars and rigging mounted firmly on a hull, raft, iceboat, etc., so as to drive it along.
- Fairing:** a structure on the exterior of an aircraft or boat, for reducing drag.
- Bow:** is the frontmost part of the hull
- Stern:** is the rear-most part of the hull
- Portside:** is the left side of the boat when facing the Bow
- Starboard:** is the right side of the boat when facing the Bow
- Waterline:** is an imaginary line circumscribing the hull that matches the surface of the water when the hull is not moving.
- Tack:** Another multifaceted word, most often used to describe shifting the sails from one side of the boat to the other when headed upwind.
- Jibe:** A similar motion to tacking, except that it occurs when sailing with the wind behind you. If uncontrolled, it can be violent and result in the loss of hats, sunglasses, the mast, and even consciousness.
- Boom:** A horizontal bar along the bottom of a sail to give it support. During an uncontrolled jibe, it is the source of the violence mentioned above.
- Sheet:** A line used to control the sails. When somebody yells "Sheet, Sheet," they are telling you to pull in the sheet as fast as you can.
- Autoclave:** a device for heating substances above their boiling point; used to manufacture chemicals or to sterilize surgical instruments
- Pre-preg:** a term for "pre-impregnated" composite fibres. These usually take the form of a weave or are uni-directional. They already contain an amount of the matrix material used to bond them together and to other components during manufacture. The pre-preg are mostly stored in cooled areas since activation is most commonly done by heat. Hence, composite structures build of pre-pregs will mostly require an oven or autoclave to cure out.
- Loft:** nautical: to form or describe (the lines of a hull) at full size, as in a mold loft
- Spline:** a function that has specified values at a finite number of points and consists of segments of polynomial functions joined smoothly at these points, enabling it to be used for approximation and interpolation of functions.
- Planing:** when the boat is going fast enough that the water forces it to the surface. Only happens with very small sailboats and power boats which is why only the wally power boats have these features
- Spray Rails:** near the bow of the boat, these are creases that are pulled out to spray the water out to the sides and downward. This creates more upward force from the water and allows the boat to plane earlier at a lower speed. It is also what gives the wally power boats their angled look
- Stepped Bottom** - some power boats also have lateral breaks in the bottom of the hull near the stern which reduces contact with the water once planing occurs.
- Carbon fiber:** also sometimes called graphite fiber. It has the highest compressive strength of all the reinforcing materials (composite materials), and it has a high strength to weight ratio and low coefficient of thermal expansion. The density of carbon fiber is also much lower than the density of steel. Carbon fiber is in the form of several thousand long, thin strands of material that is composed of mostly carbon atoms.
- Bulwarks:** a solid wall enclosing the perimeter of a weather or main deck for the protection of persons or objects on deck.
- Coamings:** A raised rim or border around an opening, as in a ship's deck, designed to keep out water.
- Keel:** a central fore-and-aft structural member in the bottom of a hull, extending from the stem to the sternpost and having the floors or frames attached to it, usually at right angles: sometimes projecting from the bottom of the hull to provide stability.
- Furling:** To roll up and secure (a flag or sail, for example) to something else.