

Diploma Thesis

Industrial Design
Braunschweig University of Art
2007

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HAVE YOU EVER SEEN ...

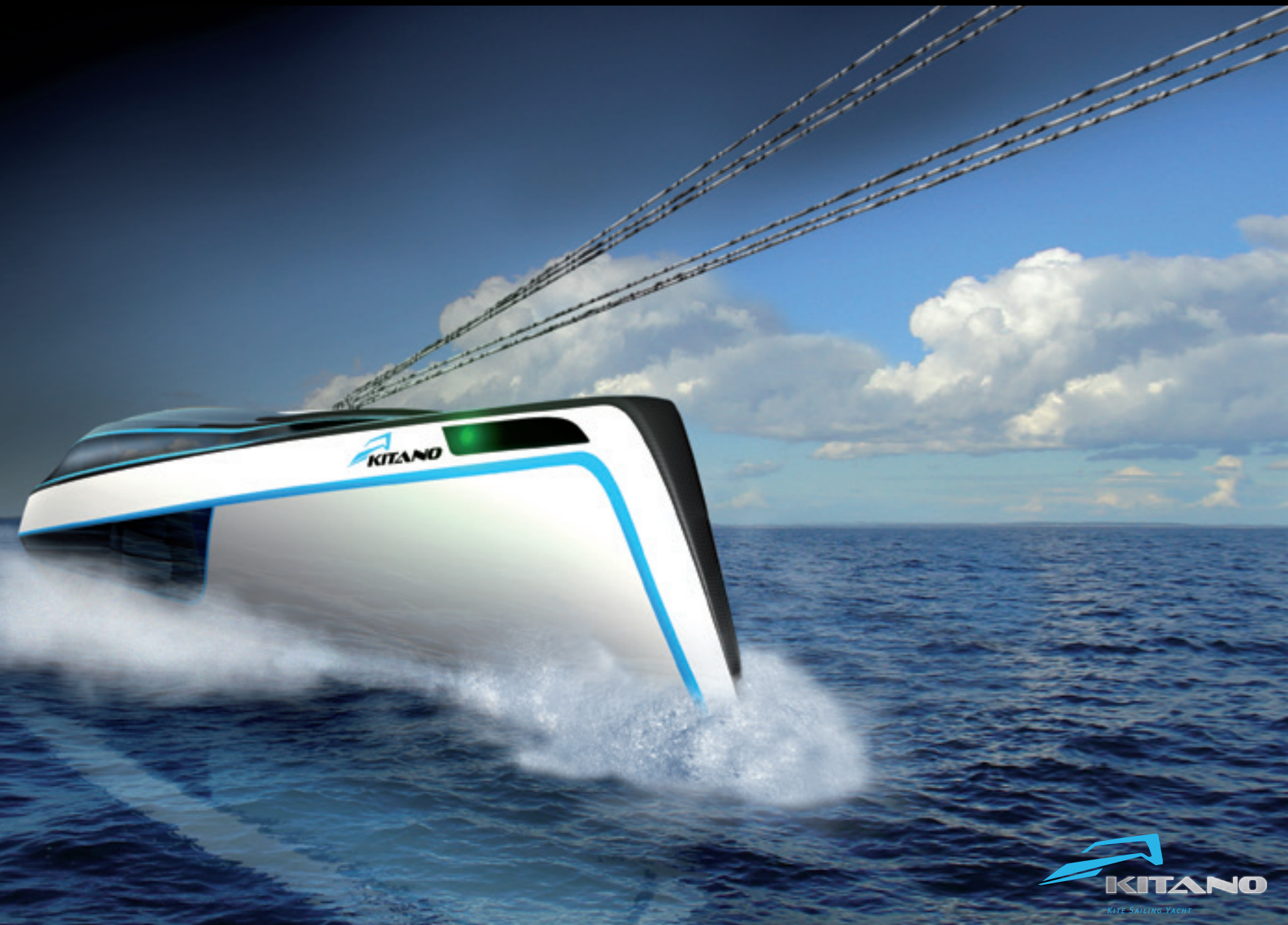


THE IDEA

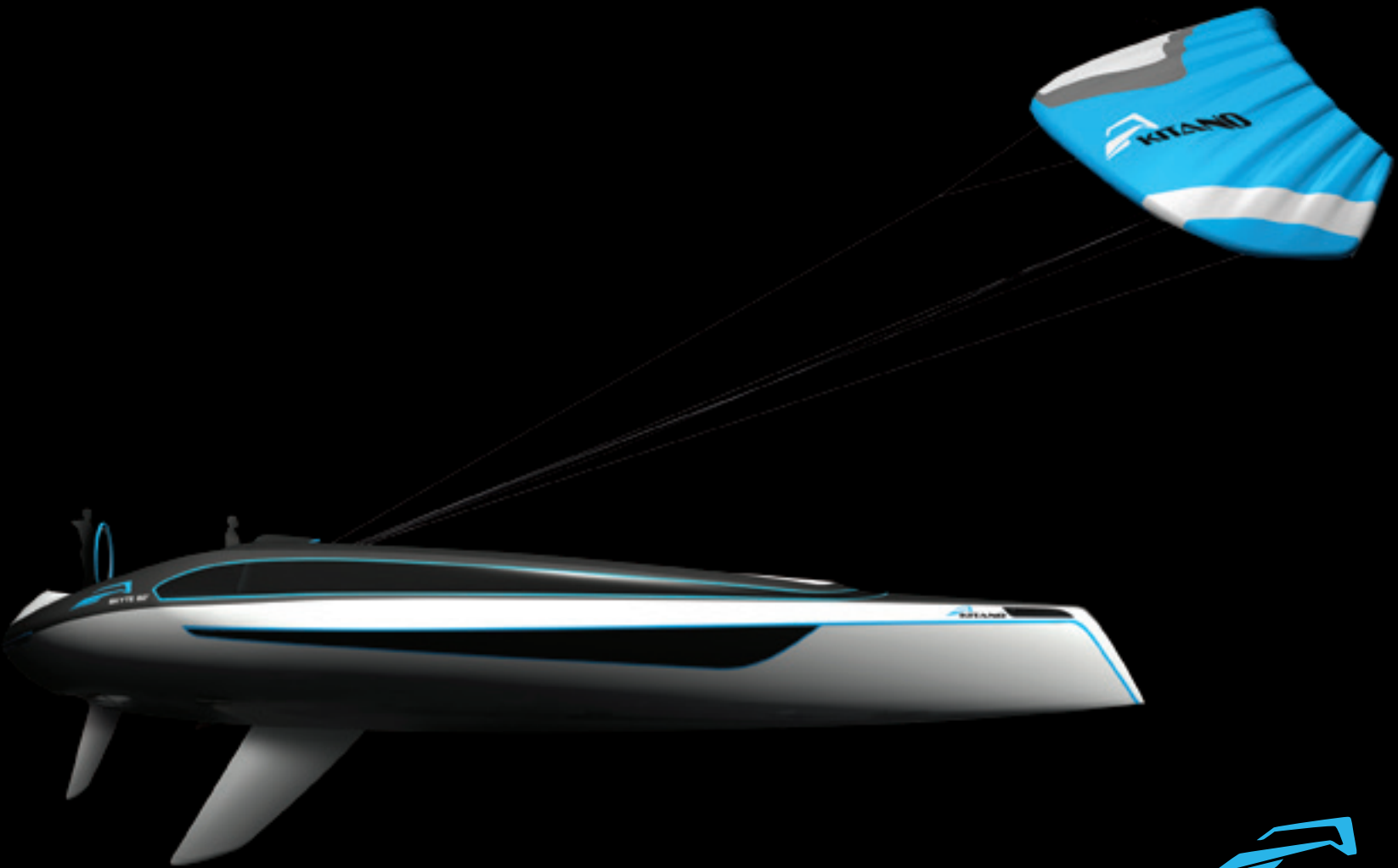
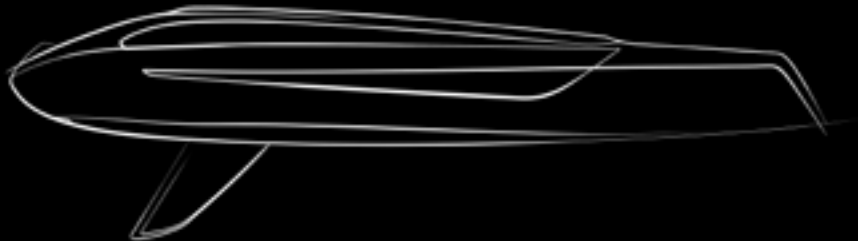
Have you ever seen kitesurfers having fun on the water in lower wind ranges while windsurfers were sitting bored at the beach and would not even consider rigging their equipment?
Have you ever heard about container vessels trying to save up some fuel by being drawn through the ocean by a huge kite?
Have you ever seen small catamarans or sport boats using an additional kite as piece of sports equipment?

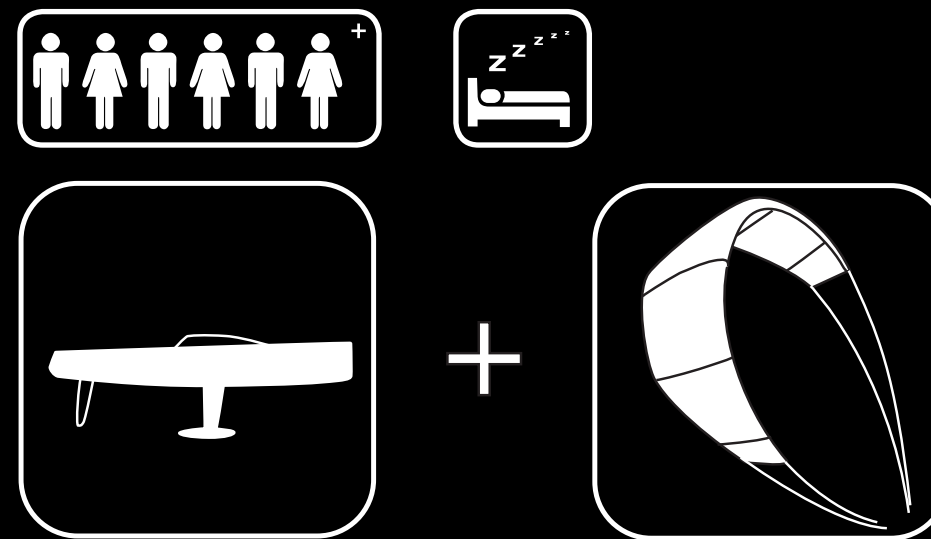
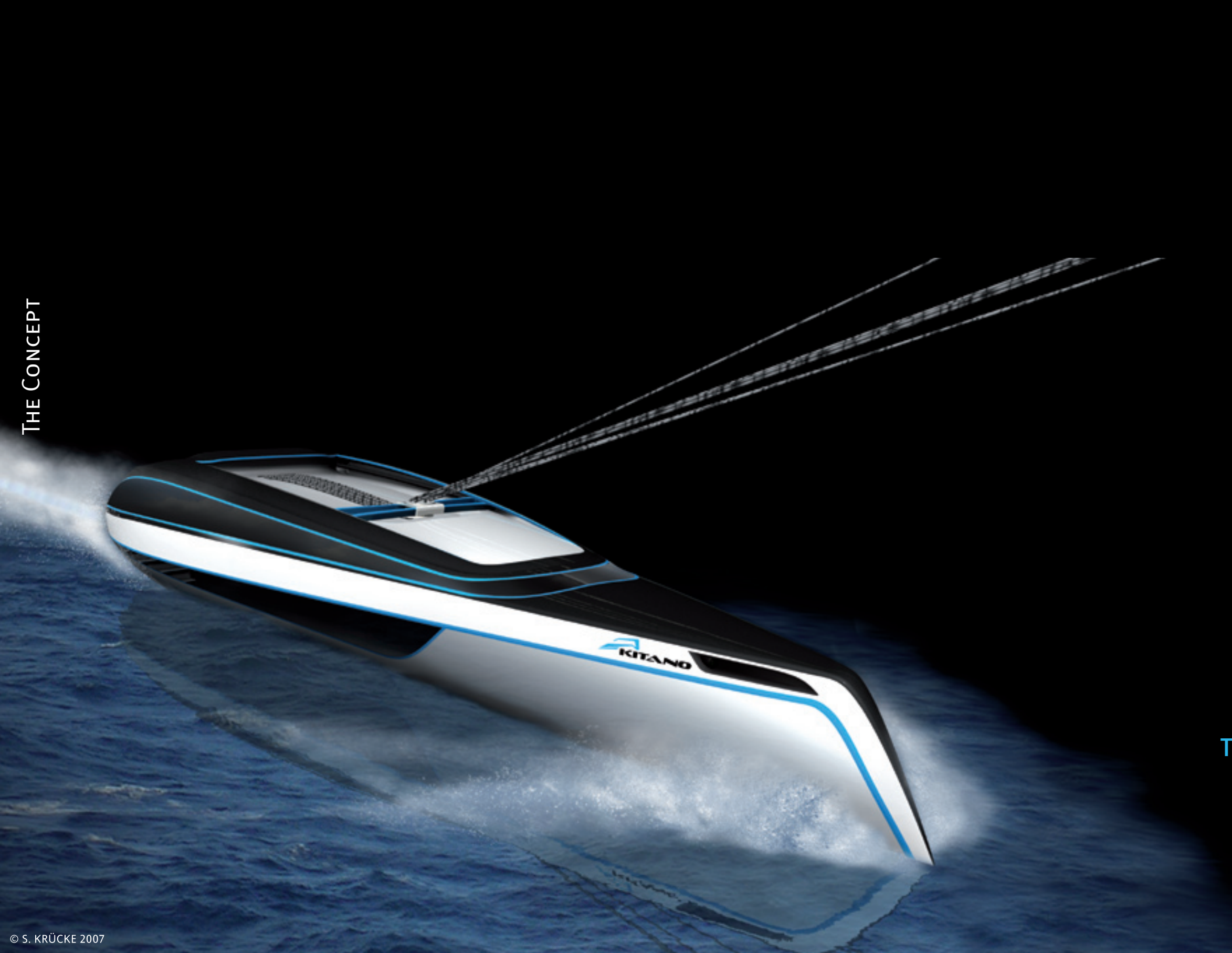
But have you ever seen a yacht exclusively designed for kite propulsion?

No, you haven't.
Until now...



A VISION IS GROWING





THE CONCEPT The KITANO Kite Sailing Yacht is a visionary concept yacht with innovative kite propulsion instead of a sail. It shows new possibilities and new design suggestion.

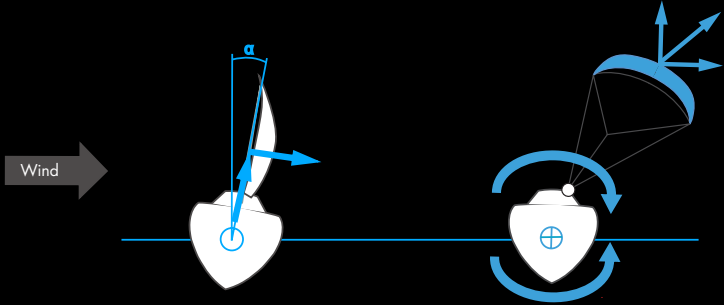
The concept yacht KITANO introduces the young kite sailing technology to the leisure sailing yacht class and benefits from the many advantages the kite technology has to offer.

One of them being the more constant and stronger wind speeds found in higher altitudes the kite sails in. Furthermore, compared to a normal sail the kite can have less sail surface and still generates more forward force so that even a gentle breeze can lift the hull to a planing speed.

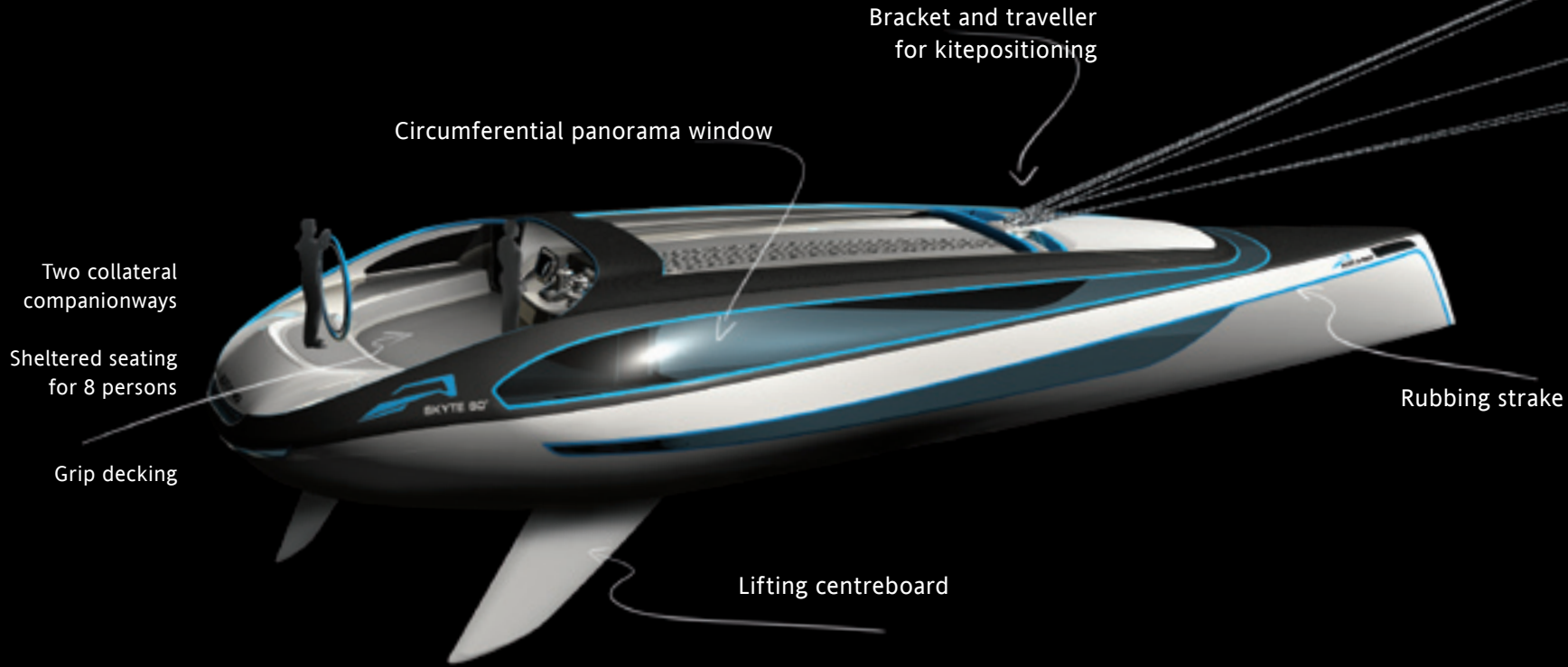
The comprehensive design of the KiteSailingYacht KITANO represents an innovative wind-driven watercraft for up to 8 passengers.

The intention is to enable a larger clientele to enjoy the fascination of planing on water powered by wind force.





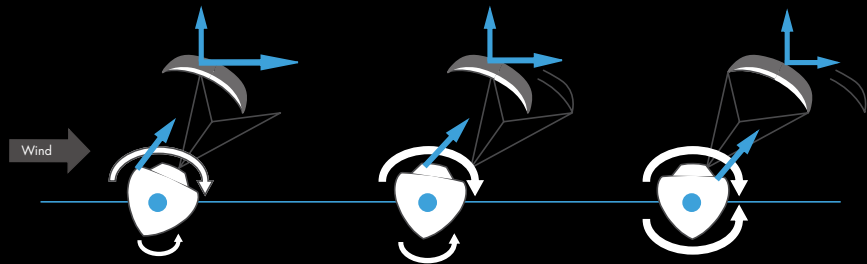
RIGHTHING + HEELING MOMENT
Kite propulsion causes less heeling force than using sail propulsion. The lift of the kite and its heeling force cancel each other out. The windward side of the hull will not be lifted and therefore the yacht is able to sail without tilting.



KITE PROPULSION The advantages of kite propulsion are obvious. Not only higher windspeeds and the better ratio of wind to power of a kite are appealing. Furthermore Kite propulsion causes less heeling force than using sail propulsion. Due to less distance between the centre of pressure and centre of pressure of the kite (the hauling point of the kite on deck) and also due to the fact that the lift of the kite and its heeling force cancel each other out. The windward side of the hull will not be lifted and therefore the yacht is able to sail almost upright. The eventuality of getting seasick can be much reduced and more important the hull does not need any solid ballast for stability, as sailing yachts do.

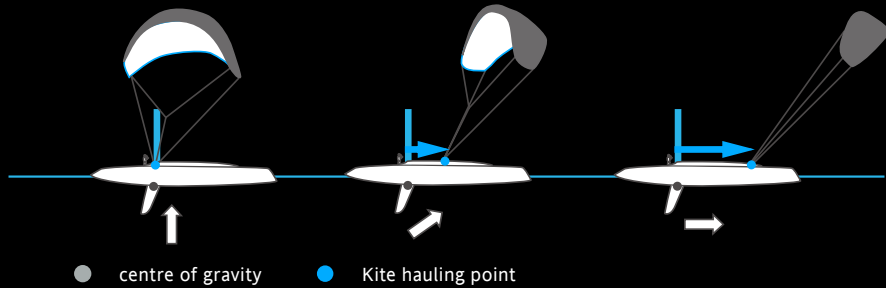
Therefore, only a hydraulically operated centreboard to countervail the leeway drift is needed. The overall weight will obviously be reduced and less weight needs less power to accelerate and reach a planning speed. Due to the hydraulically operated centreboard, even sailing in shallow water and littorals is possible without risk. Additionally the yacht is equipped with a dual water jet propulsion powered by a fuel cell, which will be much better to manoeuvre as a common propeller drive and is totally silent. The bow of the Kite Sailing Yacht tapers towards the Steven to support it cutting the waves. From the top view the bow should refer to the association of a surf- or wake-board.





POSITION KITE HAULING POINT IN CROSS DIRECTION

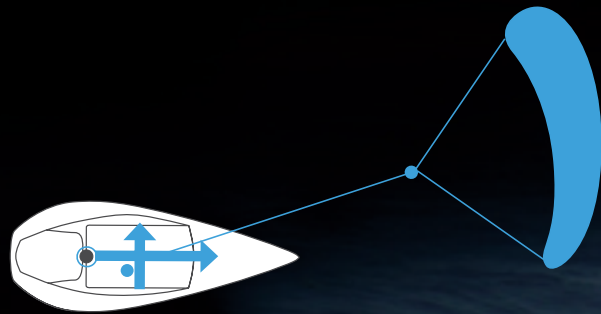
Moving the Kite Hauling Point leeward:
>> windward side will not be lifted
>> less heeling force
>> Hull sails upright
>>Lift and Heeling Force cancel each other out.



POSITION KITE HAULING POINT LONGITUDINAL

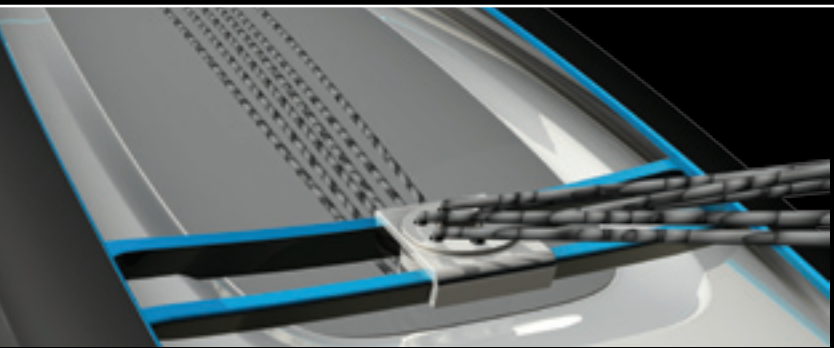
Close-hauled course:
>> Hauling point + centre of gravity perpendicular

Wind abeam, Beam Reach and Downwind course:
>> Hauling point moving forward



ADJUSTABLE KITE HAULING POINT

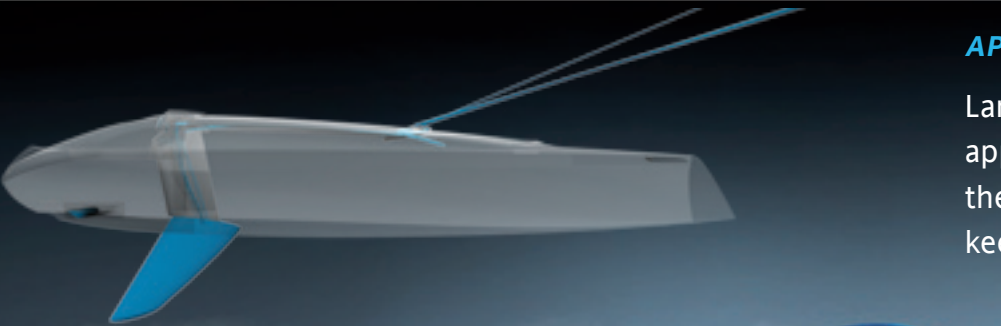
The Kite Hauling Point has to be adjustable in longitudinal- and transverse direction, depending on the course chosen.



VARIABLE KITE HAULING POINT

Therefore a movable bracket on a shiftable traveller is installed. Powerd by servo motors this allows the longitudinal- and transverse adjustment of the Kite Hauling Point depending on the course chosen.

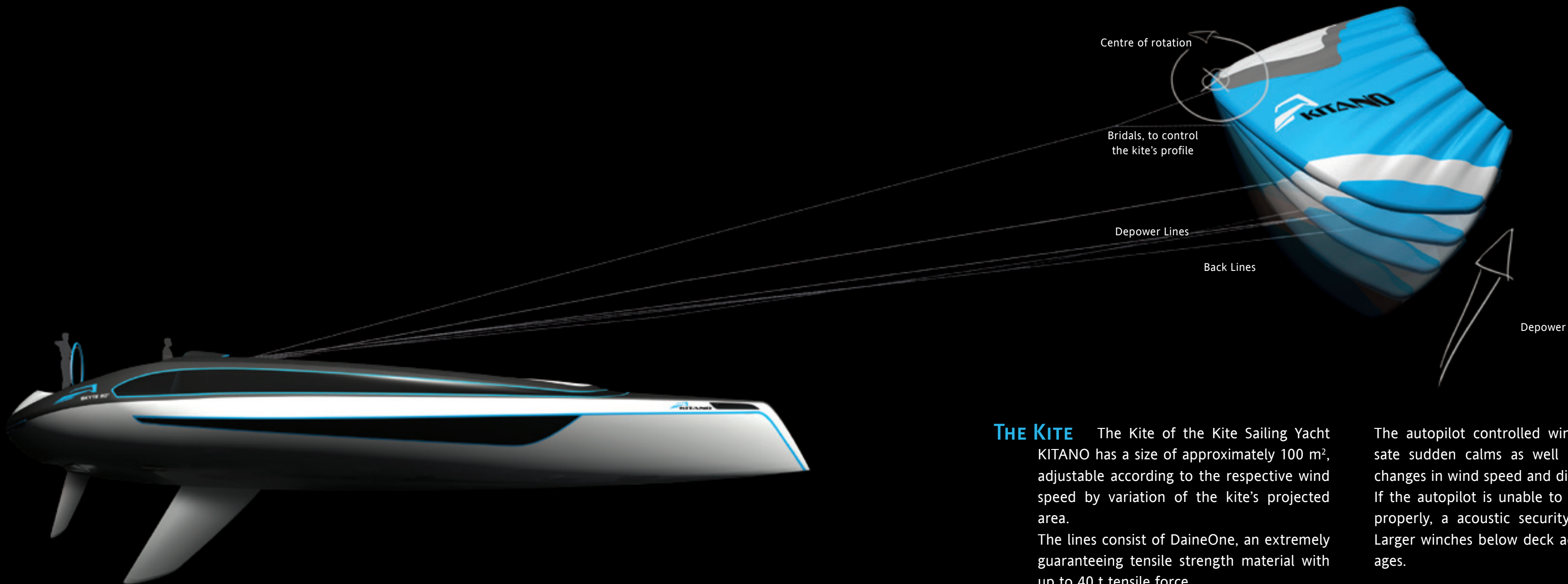
Kite abeam	>> Hauling point centred
Kite forward	>> Hauling point forward



APPLICATION OF FORCE

Larger winches below deck act as Line storages. The application force of the Kite is transmitted towards the lateral suspension and the lines to the hull's keel.

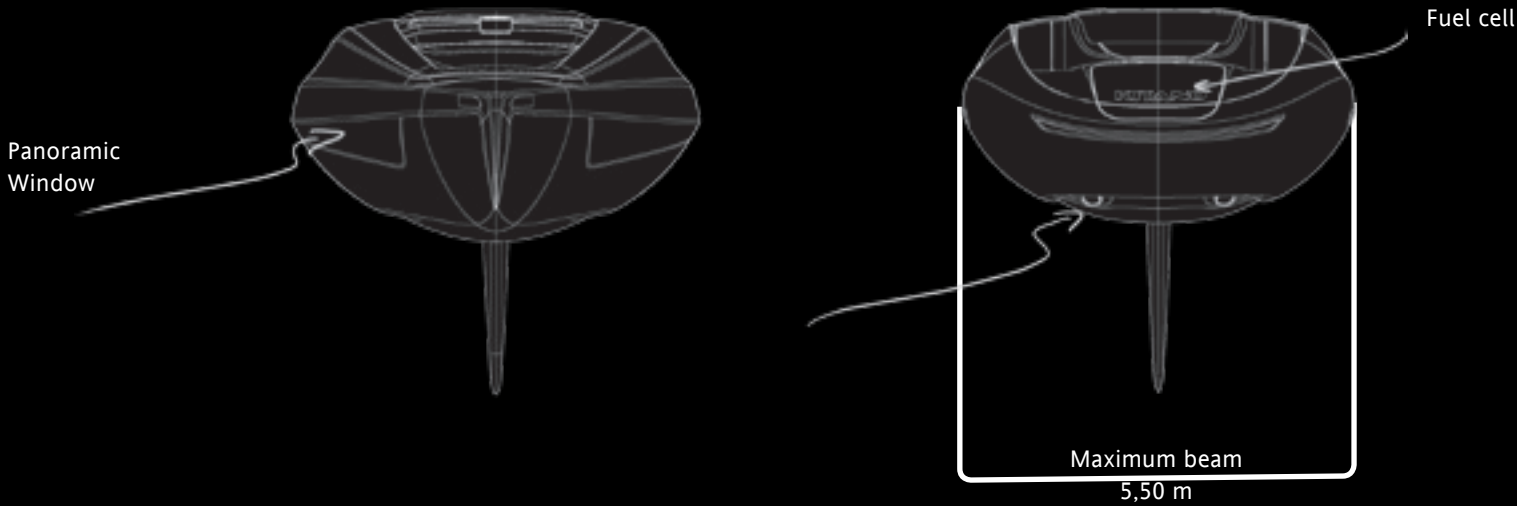
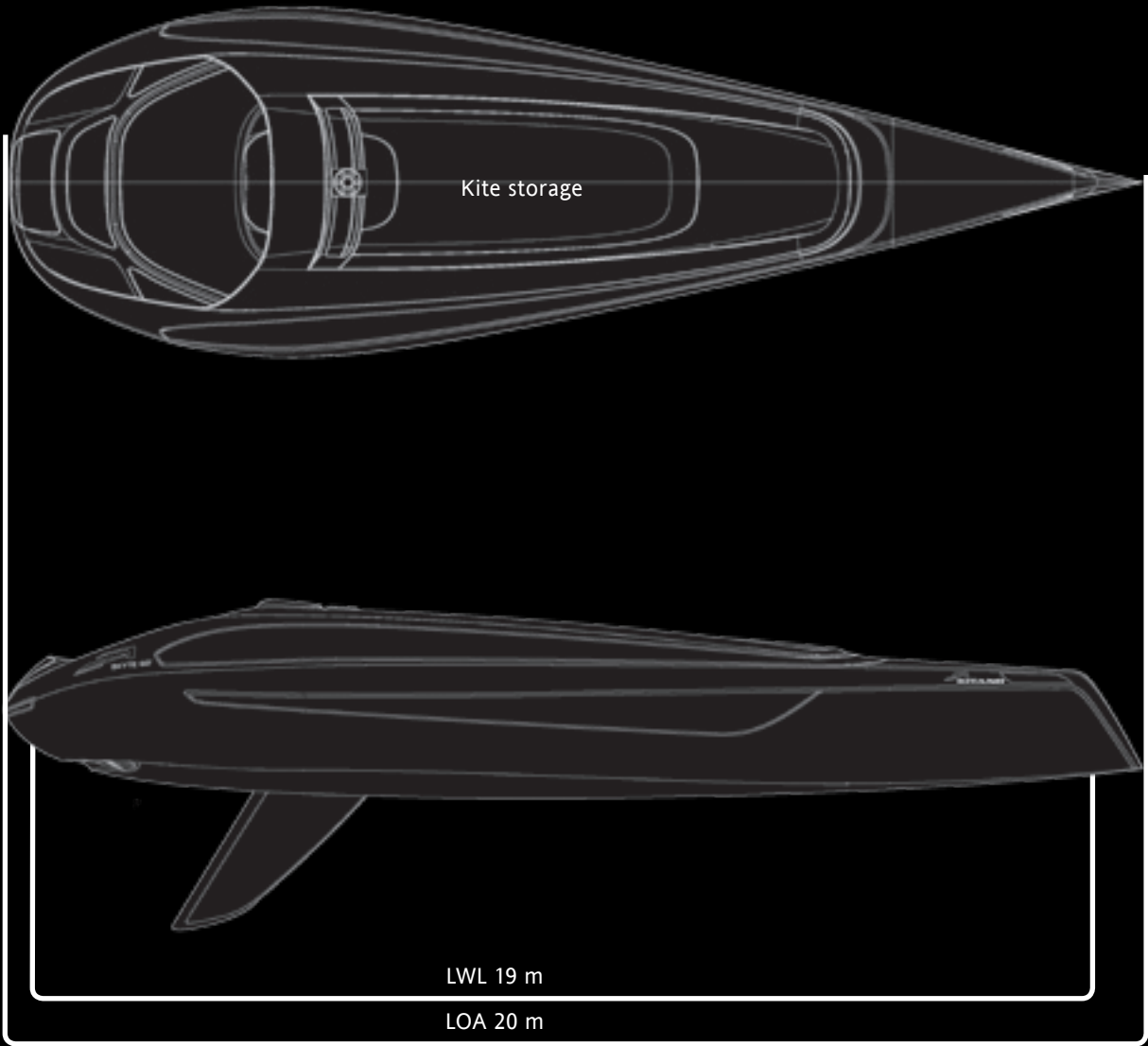




THE KITE The Kite of the Kite Sailing Yacht KITANO has a size of approximately 100 m², adjustable according to the respective wind speed by variation of the kite's projected area. The lines consist of DaineOne, an extremely guaranteeing tensile strength material with up to 40 t tensile force. The crew can steer the kite by modifying the length of Back Lines. For variation of the kite's projected area, modify the angle of wind attacked surface by hauling and slacking the Lines and/or changing the kite's position in the wind window. Electric winches on deck automatically control the hauling and slacking of the Lines as well as adjusting their tension.

The autopilot controlled winches compensate sudden calms as well as unexpected changes in wind speed and direction. If the autopilot is unable to adjust the kite properly, a acoustic security alert sounds. Larger winches below deck act as Line storages. The manual navigation of the kite works via a steering control unit; the navigation of the yacht works via steering wheel and rudder.





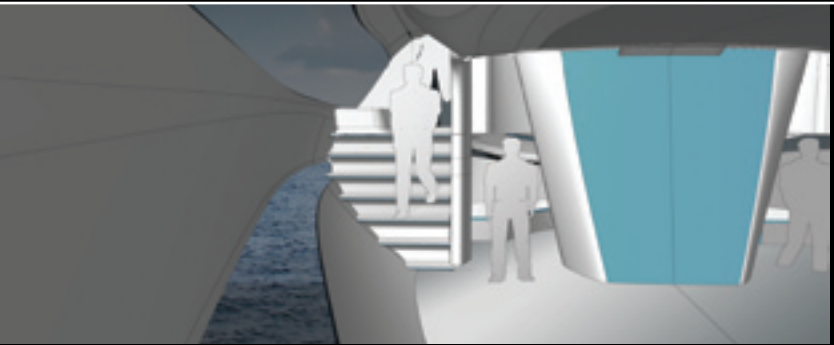
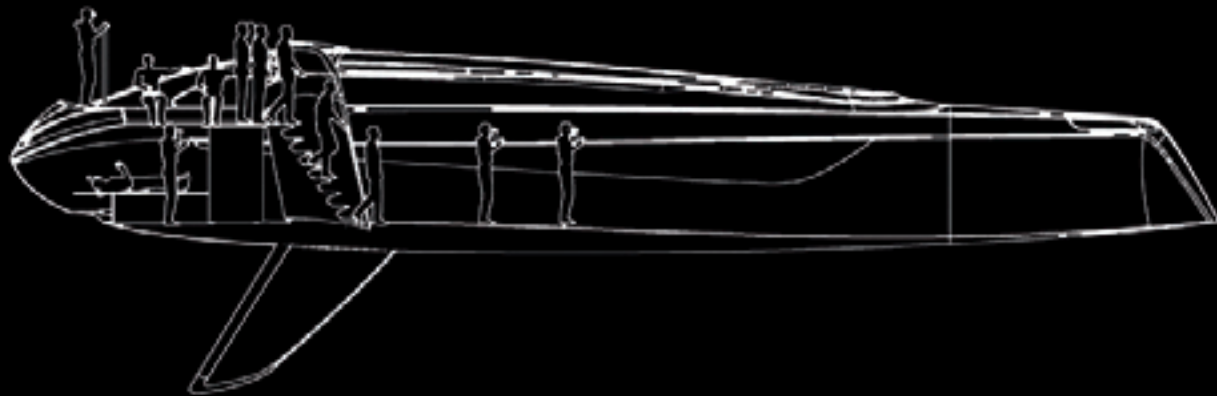
SPECIFICATIONS

TYPE	KiteSailingYacht
LENGHT OVERALL	20 m
LENGHT WATERLINE	18,5 m
BEAM	5,5 m
DRAFT	1,1 m - 0,5 m Lifting centreboard
DISPLACEMENT	~ 10 t
ENGINE	Dual waterjet propulsion [Twin HM521]
KITE	50 - 110 m²
STABILITY	Hydraulically operated centreboard

ACCOMODATIONS

SALOON	Tables and seating for 6-8 Wide panorama windows
CABINS	3 cabins Two separate toilet & shower
COCKPIT	optimized storage, enlarged working area, seating for 8 persons





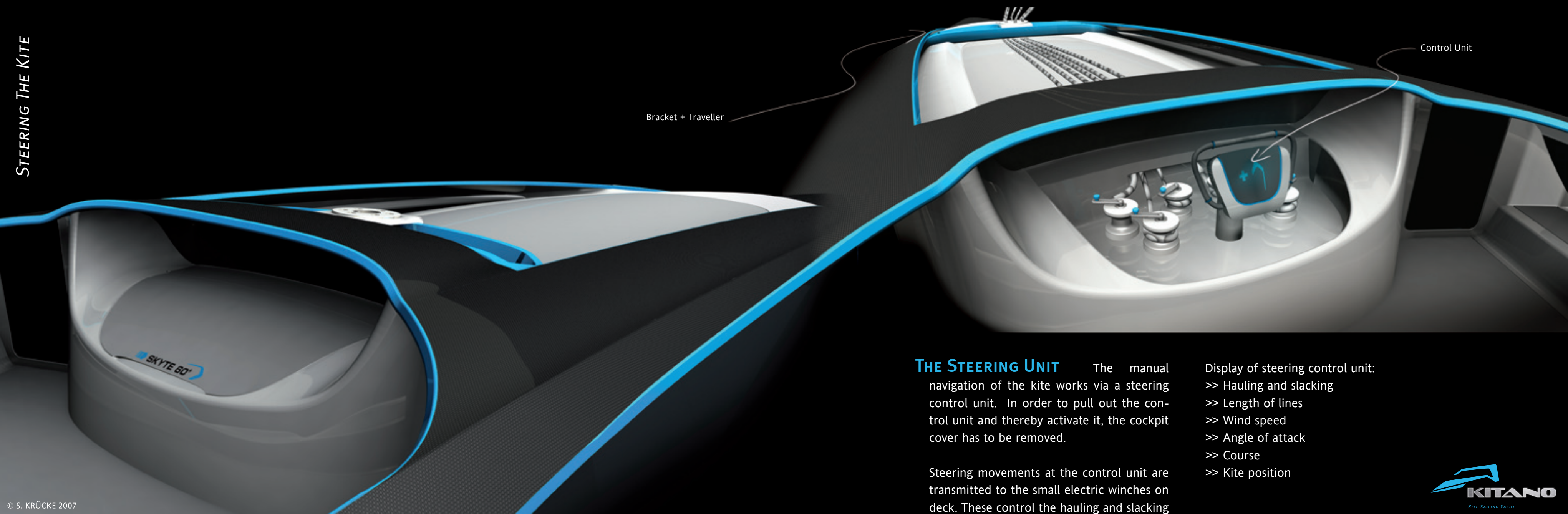
NEW INTERIOR + COMPANION WAY

Two collateral companionways offer enough space on the stairs below deck. The Line storage winches are situated above the centreboard and easily accessible if necessary.



PANORAMA WINDOWS

New panoramic windows applied with reflective coating enable the crew below deck to see the sky and ocean all the time. Furthermore, the whole interior will be illuminated by daylight.



Bracket + Traveller

Control Unit

THE STEERING UNIT

The manual navigation of the kite works via a steering control unit. In order to pull out the control unit and thereby activate it, the cockpit cover has to be removed.

Steering movements at the control unit are transmitted to the small electric winches on deck. These control the hauling and slacking of the Lines as well as adjusting their tension and thus navigate the kite. Adjustments at the control unit are transmitted to the servo motors in the bracket and traveller, to position the kite's hauling point.

Furthermore it is possible to let an additional Autopilot steer and control the kite's flight.

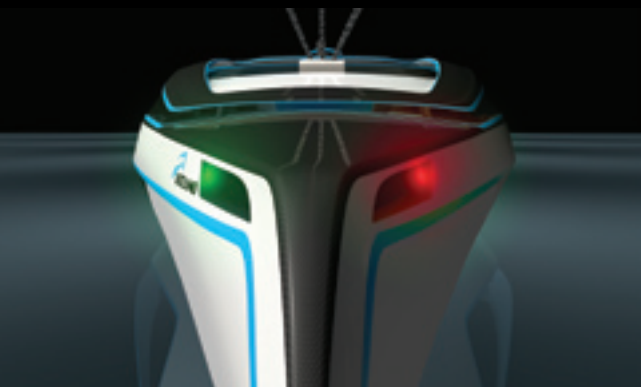
Display of steering control unit:

- >> Hauling and slacking
- >> Length of lines
- >> Wind speed
- >> Angle of attack
- >> Course
- >> Kite position



LAUNCH + JIBE Launching the kite will be supported by a downwind course; this means the kite will be launched directly in the power zone of the wind window. In stronger wind speeds a beam reach course will be more appropriate. A couple of additional inflatable bladders of the Kite will be filled with air or helium, to maintain the profile of the kite, to support it during the launch and to keep it in the air. The movable bracket on a shiftable traveller allows the longitudinal- and transverse adjustment of the Kite Hauling Point depending on the course chosen.

During the Jibe the Kite moves from the edge of the wind window to the powerzone and back. In this example the kite's position in relation to the yacht is changed from portside to starboard.



A VISIONARY CONCEPT

The KITANO Kite Sailing Yacht is a visionary concept yacht with innovative kite propulsion instead of a sail. It attracts not only attention by flying a kite. With no explicit division between hull and deck, it proposes a new architecture for watercrafts. The Yacht Concept reflects the innovative kite technology as well as sportive dynamics and the responsibility towards nature. The kite sailing yacht is an innovative wind-driven watercraft that approaches the traditional sailing yacht field with a new sportive concept and should show new possibilities and new design suggestion.

The KITANO Kite Sailing Yacht represents a crossover wate sport vehicle between luxury leisure boat and speed sailing yacht; innovative, environmentally sound and progressive at the same time.

Perhaps we may see it sailing some day.



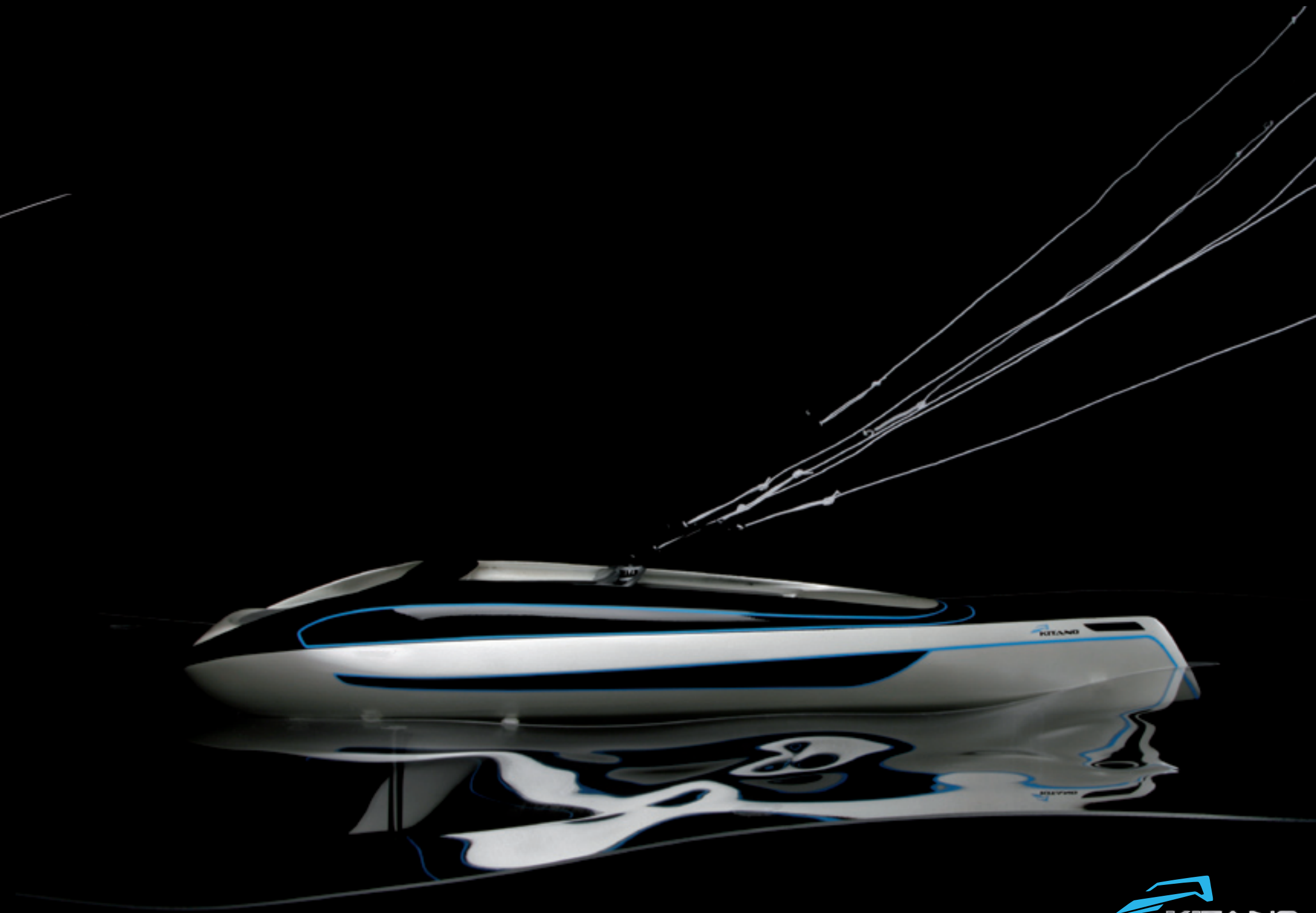
MODEL SCALE 1:30



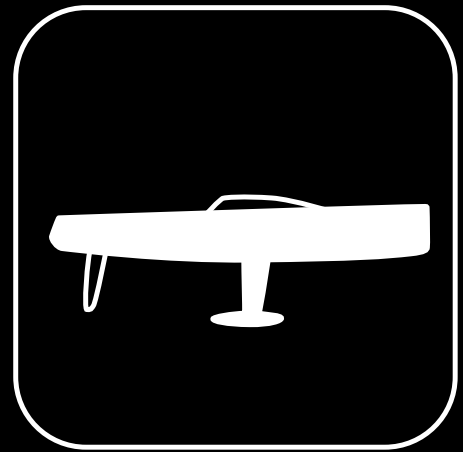
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THE MODEL Buoyant Computer Aided Model in scale 1:30.
The Prototype is made out of printed synthetic resin.



KITANO
KITE SAILING YACHT



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