

NG-20000X THE WIND INSTALLATION SOLUTION FOR INCREASING HEIGHTS AND WEIGHTS

Since 2003 when GustoMSC designed the SEA-1250 jack-up Buzzard that installed monopiles at Horns Rev 1, the wind-farm installation market has developed rapidly. Dedicated and larger capacity equipment was quickly developed to install larger turbines. This led to the realization of the world's largest self-propelled jack-up: the NG-14000X Scylla, which installed the huge monopiles for the Veja Mate project in 2016. The wind turbines currently under design and testing will require a new generation of installation jack-ups to deal with the increasing weight and installation height of wind turbine components and the ever heavier foundations.

New strategic approach

The equipment that has entered the market since 2012 was designed to install 3 to 5 MW turbines on an industrial scale, ensuring safety and efficiency, and actively contributing to a reduction of the Levelized Cost of Energy (LCoE). Later, these jack-ups were modified to install up to 8 MW turbines. However, a different strategic approach is required for the future turbines with capacities beyond 10 MW. Key to the new approach is to stop the spiraling trend of growing crane weights due to the increasing requirements related to the heavy foundations and high installation heights, and to stay close to the proven design technology at the same time.

Advantages of a proven concept

From 2010 until 2016, around 2,600 turbines were installed in the North Sea of which over 75% were installed by GustoMSC designed jack-ups with GustoMSC jacking systems, for a large part using GustoMSC designed leg encircling cranes. The NG-20000X design is based on the same design principles as these successful jack-ups, making full use of the proven technology and feedback of these units.

By scaling up the jack-up design and jacking system and solving the challenging crane requirements in an innovative manner, the NG-20000X represents the next generation wind turbine installation jack-up in all its facets. Transit capability, deck loading capacity and flexibility and crane lifting capacity and height are reducing installation risks. The design enjoys the advantages of a proven jacking system and a large unobstructed deck area. The huge variable load capacity of 16,500 tons, enables the contractor to make a roundtrip carrying 6 complete sets of wind turbine components with a turbine weight of 1,000 tons, or carrying 7 pieces of 900 ton jacket foundations, optimizing the

cost per installed turbine or foundation. Additionally, by further balancing out the jack-up design with an optimized leg design, the overall performance of the unit is further improved. This results in the best operational installation jack-up with a well-balanced CAPEX to OPEX, providing for safety, efficiency and a low risk.

Integrated telescopic leg crane

A key feature is the innovative combination of high hoisting height for wind turbine installation and heavy load capability for foundation installation of the leg encircling crane. To combine these two extreme requirements, GustoMSC has developed the telescopic leg crane. By introducing a telescopic boom that features a very high hook height when extended and offers an increased hoisting capacity when retracted, it is possible to break the cycle of extremely long protruding booms and increasing crane weights, resulting in a more economic crane design and increased variable load available for operations. The telescopic leg crane has been designed on the basis of its successful predecessors: the leg encircling crane designs.

A lifting capacity of 1,250 metric tons at a record height of 161 meters is foreseen for installation of the high reach wind turbine and its components. Installation of jackets and monopiles of up to 2,500 metric tons is possible in retracted mode at a lifting height of 121 meters. Extending the crane boom by 40 meters from retracted to extended mode can be performed within 16 minutes. A splittable block facilitates the change in lifting capacity, the operation of splitting and joining the block can be completed within half an hour.

One major benefit of the telescopic leg crane is that the boom does not extend beyond the bow of the jack-up when the boom is stowed in the boom rest. A very long, protruding boom restricts the jack-up in its logistic movements as

it will impose operational restrictions in allowable wave height and access to the lifting blocks. Instead, the retracted boom can be laid down on the boom rest in an optimal supported position, resulting in more favorable boom loading, significantly less sea conditions limitations in transit mode, and the ability to access the lifting blocks, properly stored in block pockets on deck. This allows for straightforward and easy maintenance. Furthermore, the retracted boom position also eliminates obstruction to the helideck, increasing uptime on helicopter operations. In addition to the boom rest between the legs in turbine installation mode, a second boom-rest position outside the forward leg can be provided, freeing up valuable deck area to load multiple tall objects like jacket foundations.

Pronounced jacking system

The NG-20000X will be fitted with the industry proven Variable Speed Drive (VSD) controlled jacking system. This system enables safe, smooth and fully controlled jacking operations at all times. The low wear and tear characteristics of the system make it possible to control the jacking speed and loads on each individual leg very accurately during the entire jacking process including preloading. Due to the high maximum elevated weight and the nature of the very frequent jacking operations of this wind turbine installation jack-up, the layered system is specifically designed for a design life of 20 years, envisaging 150 operations a year.

MAIN CHARACTERISTICS

Hull length	152.0 m
Hull width	58.0 m
Hull depth	12.0 m
Accommodation	130 PoB
Water depth (survival)	up to 70 m
Variable load	± 16,500 t
Deck area	5,600 m ²
Deck load	10 t/m ²

Legs

Type	Triangular open truss, X-braced
Leg length max. (incl. spud-can)	120.0 m
Leg length max. under hull	± 90.0 m

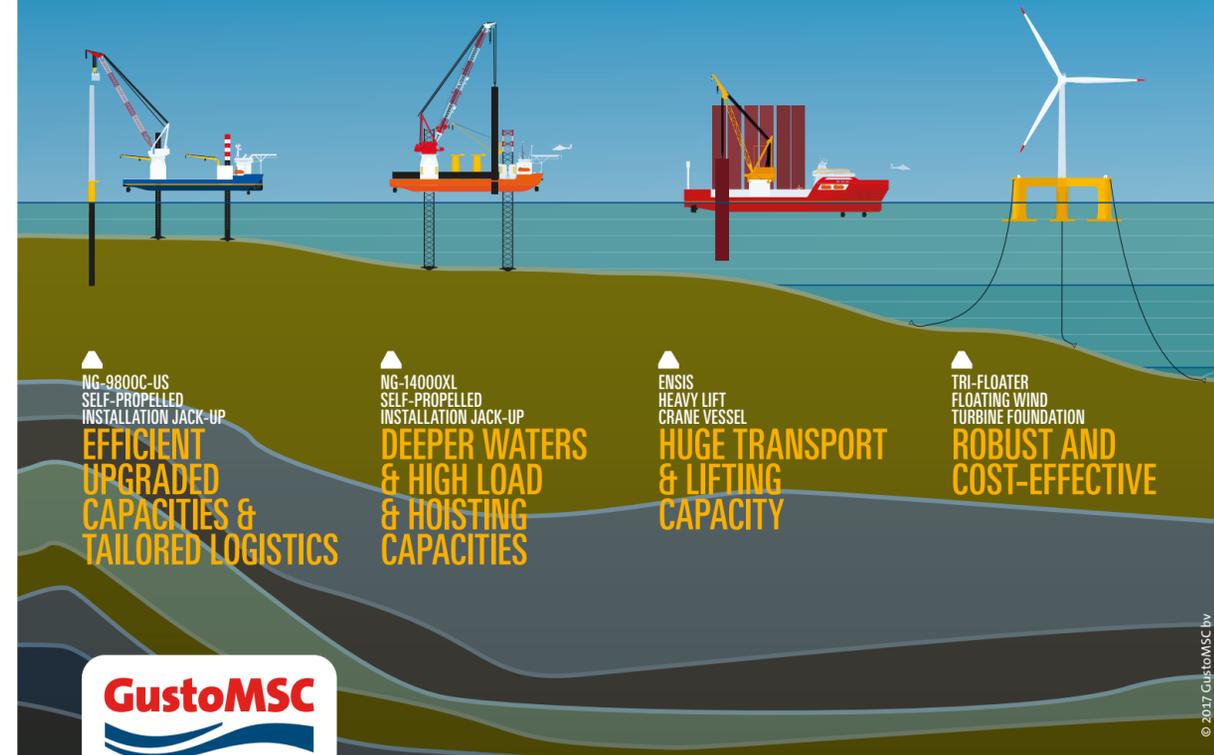
Jacking system

<i>Rack & Pinion with Variable Speed Drive</i>	
Pre-load	20,000 t / leg
Jacking moves	150 / year

Telescopic leg crane

Capacity retracted	2,500 t @ 30 m
Lifting height above deck	± 121 m
Capacity extended	1,250 t @ 47 m
Lifting height above deck	± 161 m

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GustoMSC

GustoMSC is an independent, world renowned and leading design and engineering company, thanks to the vast knowledge and expertise of our dedicated professionals and our cooperation with the most influential players in the offshore energy market. We serve the offshore industry by providing best-in-class solutions for mobile offshore units.

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NG-20000X

SELF-PROPELLED INSTALLATION JACK-UP
WITH TELESCOPIC LEG CRANE

INCREASED LOAD CAPACITIES AT DIFFERENT HEIGHTS



GustoMSC

The NG-20000X is the solution for the installation of the next generation wind turbine components and foundations. This self-propelled jack-up design is characterized by a high variable load and large water-depth capability. Equipped with the GustoMSC integrated telescopic leg crane, the NG-20000X is capable of installing heavy foundations and when the boom is fully extended it reaches adequate lifting height and capacity to install future generation wind turbine components.

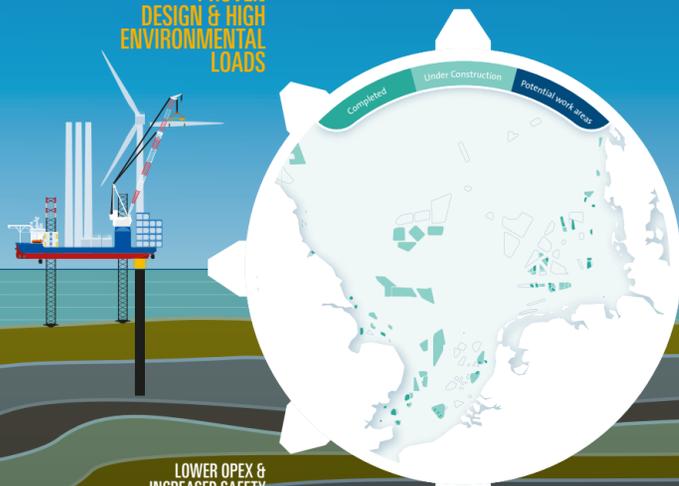
NG-20000X HIGHER & HEAVIER LOADS



TELESCOPIC LEG CRANE EXTREME LIFTING CAPABILITIES

SAFE & STABLE
PROVEN
DESIGN & HIGH
ENVIRONMENTAL
LOADS

HIGHER & HEAVIER
TELESCOPIC CRANE &
HIGH VARIABLE LOAD



AUTONOMOUS &
FAST RELOCATIONS
UP & SELF
PROPELLED

LOWER OPEX &
INCREASED SAFETY
VSD JACKING
SYSTEM



VARIABLE
LOAD
16,500 T

FREE DECK SPACE
FOR WTG COMPONENTS
5,600 M²

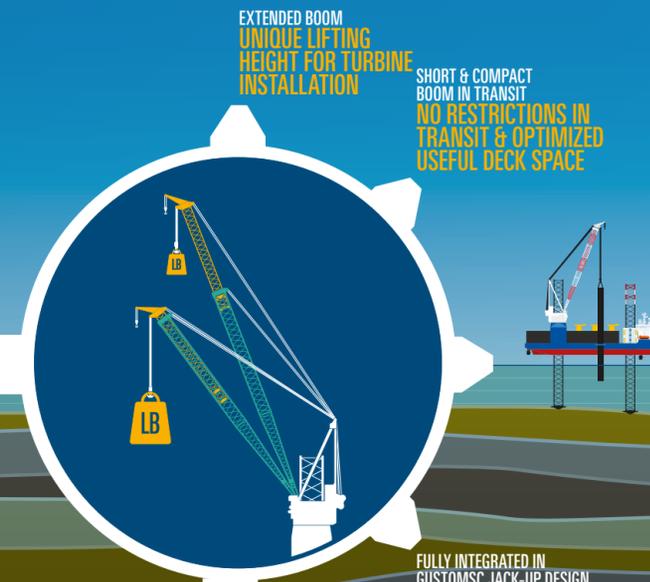
MAXIMUM
WATER DEPTH
120 M
LEG LENGTH

EXTENDED BOOM
1,250 T
@ 160 M

RETRACTED
BOOM
2,500 T
@ 120 M

VSD JACKING SYSTEM
ENVISAGING
150
OPERATIONS PER
YEAR

MAXIMIZED VALUABLE
DECK AREA
**2ND BOOM
REST**



EXTENDED BOOM
UNIQUE LIFTING
HEIGHT FOR TURBINE
INSTALLATION

SHORT & COMPACT
BOOM IN TRANSIT
NO RESTRICTIONS IN
TRANSIT & OPTIMIZED
USEFUL DECK SPACE

RETRACTED BOOM
INCREASED LIFTING
CAPACITY WITH IMPROVED
SIDE & OFF-LEAD FOR
FOUNDATIONS

FULLY INTEGRATED IN
GUSTOMSC JACK-UP DESIGN
OPTIMUM COMBINATION
OF CRANE CAPACITY &
VARIABLE LOAD