The Offshore Wind Power Conference

“Essential Innovations”

12 February 2009, Den Helder

Promising Offshore Assembling, Transport and Installation Techniques

Wim de Boom
Senior Project Manager

GustoMSC
OFFSHORE WIND INSTALLATION

Content

- GustoMSC Company background
- Essential Innovations
  - Double acting jacking system
  - Small footprint/tall cranes
  - Special handling tools
- GustoMSC installation equipment
- Trends
  - Installation in one piece
  - Deeper water

Photo courtesy Deme / GeoSea: GustoMSC designed jack-up Buzzard
History GustoMSC

- **1862** Start of Gusto shipyard (The Netherlands)
- **1969** Start of SBM Inc. (Marly, CH)
- **1977** Start of Marine Structure Consultants (MSC) B.V. (Sliedrecht) as separate company
- **1978** Shut-down of Shipyard fabrication
- **1978** Start of Gusto Engineering (Schiedam)
- **2002** Return of MSC in same holding as SBM and Gusto (Schiedam)
- **2003** Start of GustoMSC alliance (Gusto, MSC and GustoMSC Inc.)
Total number of employees:
over 5100 representing 38 nationalities
GustoMSC Activities

Design of Offshore Vessels
• Drill ships/ Drilling semi-submersibles/ Drilling Jack-ups
• Pipelaying Vessels
• Construction (=crane) Vessels

Design of Floating Civil Construction Vessels
• Jack-ups/Backhoe dredgers
• Bridge installation vessels (Svanen)

Turn-key Supply of Special Equipment
• Offshore Cranes (500 t - 6500 t)
• Jacking systems
• Telescopic gangways

Engineering Services on FPSO’s within SBM Offshore Group
# DRILLING/PRODUCTION JACK-UPS

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# CONSTRUCTION JACK-UPS

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Creative Utilization Existing Jack-ups

Jack-up Buzzard (1982)
(with some modifications...)

Photo courtesy Deme / GeoSea: GustoMSC designed jack-up Buzzard
Re-utilization existing equipment

Photo’s courtesy A2Sea, Deme / GeoSea
Re-utilization existing equipment

Jack-up Vessel “WIND”
Re-utilization existing equipment

Photo courtesy Ballast Nedam: GustoMSC designed Svanen
New GustoMSC equipment

Jacking systems design & delivery for Wind Turbine Installation vessel MV Resolution

First double acting Jacking system
Recent references

“Resolution” (jacking system)  
“Seafox 7” (2008)  
“Buzzard” (1982)  
“Sea Worker” (2008)  
“Vagant” (2002)  
“Seajacks Kraken” (2009)
Essential Innovations

Double acting jacking system

Different from Oil and Gas (where platform jacking occurs only occasionally), quicker operation is required for Wind Turbine Installation Jack-up.
Double acting system

- jacking capacity: 2650t - 4500 t
(3 sets under construction)
Essential Innovations

Small footprint-tall boom cranes

Offshore Cranes on floating = moving vessels generally have robust large footprint construction.

Cranes on jack-up platforms (stable on seabed) can be slender. Wind turbine installation requires large lifting height, at relatively small outreach.
GustoMSC Derrick Cranes

Long track record in Heavy Duty Offshore cranes

Short reference list:
- “SHL5000” (5,000 t)
- “Hermod” (5,000 + 4,000 t)
- “Balder” (4,000 + 3,000 t), incl. fly-jib
- “DB 101” (3,500 t) (ex-Narwhal)
- “DB 52” (2,000/3,000 t) (ex-Thor)
- “Titan 1, 2*, 3 and 4” (600/800 t)
- “Stanislav Yudin” (2,500 t)
- “Ispolin” (1,200 t)
- “Kuroshio” (2,500 t)
- “Moricho-gumi” (1,500 t)
- “Svanen” (8,200 t)
- “Swing Thompson” (1,200 t)
- “Pacific Horizon” (1,000 t)
GustoMSC Cranes

Crane Models

- Derrick, Column & Leg Cranes
Column Cranes GCC series

GCC-550-ED
- Main 2 x 275t @ 29m
- Aux. 138t @ 64 m
- Trolley 30t, man riding 3t

 GCC-850-HD
- Main 850t @ 30m, max. hook height 115m
- Aux. 200t @ 65m
- Whip 10t, man riding 3t

Double block from oil & gas maintenance jack-up

Special Boom Tip for short radius lifts & high reaches Used in the WTI

Gusto B.V. - Proprietary and confidential information
GCC-1000-HD Offshore Crane

- 1000 t lifting capacity
- Hydraulically driven
- King post slewing bearing
GLC-800-ED Offshore Crane

- 800t @ 24m
- Electric driven
- Bogie wheel system
- On Top of the Jack-House & around the Jack-Up Leg

GLC series is located on top of the Jack-house and revolves unrestricted 360 degrees around the Jack-up leg
GLC-series is located on top of the Jack-house and revolves unrestricted 360 degrees around the Jack-Up leg

- Main 1200t @ 30m
- Aux 100t @ 94m
- Whip 10t (3t manriding)
- Bogie wheel system
- On Top of the Jack-House & around the Jack-Up Leg
Essential Innovations

Wind Turbine Installation
Special Handling Tools

Dedicated handling tools are essential to support a time efficient and safe installation operation.
GustoMSC Equipment: Handling Tools

Pile Up-ending tool
GustoMSC Equipment: Handling Tools

Pile upending tool: max 1400 t, $D_{\text{pile}} = 4 - 6$ m

In case pile weight > crane capacity
GustoMSC Equipment: Handling Tools

Equipment – Hub handling tool
GustoMSC Equipment: Handling Tools

Equipment – Hub handling tool
GustoMSC
Product Line

Wind Turbine Installation Vessels
GustoMSC has various designs for jack-up barges and vessels

- the SEA series, Non-propelled, ranging from the SEA-600 to the SEA-3250
- the NG series, Self-propelled, ranging from the NG-600 to the NG-10,000

Variations in:
- Accommodation
- Deck layout/size
- Variable load
- Jacking capacities
- Crane capacities
- Power requirement
- Speed, etc.
GustoMSC WTI Jack-ups

GustoMSC's Wind Turbine Installation Jack Up Vessel
Tools under Construction

Four legged Wind Turbine Installation Vessel “Windlift 1” for BARD, with

- High Performance Jacking System 2650 t per leg
- Heavy Lift Column Crane of 500 t @31 m
Two units of six legged Wind Turbine Installation vessels “Adventure” & “Discovery” for MPI Offshore, with

- High Performance Jacking System of 3750 t/leg
- Heavy Lift Column Crane of 1,000 t @ 25.5 m
Tools under Construction

Two units of four legged installation vessels of the NG-2500X series, for Seajacks “Kraken” & “Leviathan”, with

- GustoMSC Rack & Pinion system of 1,494 t/leg
- Mast type crane 300 t @ 16 m, with 45 m boom
GustoMSC has a number of proprietary designs for the Wind Turbine Installation market, together with patented High Performance Jacking Systems and special Heavy Lift Offshore Cranes dedicated for the Wind Turbine installations.

The present proprietary designs are:

- **NG-5300-HPE** (4x 2650 t/leg and 500 t @ 31m)
- **NG-7500-HPE** (4x 3750 t/leg and 850 t @ 25m)
- **NG-9000-HPE** (4x 4500 t/leg and 800 t @ 24m)
GustoMSC NG-9000-HPE

Main particulars

**Principal dimensions**
- Hull length: 128.79 m
- Hull width: 39.0 m
- Hull depth: 9.00 m
- Hull draft: 5.00 m
- Leg length max. (incl. spud-can): 74.10 m

**Jacking system**
- High Performance system GHJS-4500-HPE
- Hydraulic, positive engagement
- Max. Jacking capacity: 4,500 tf per leg
- Max. Holding capacity: 9,000 tf per leg

**High Performance Speeds**
- Platform lifting speed: 21 m/hr
- Platform lowering speed: 27 m/hr
- Leg handling speeds up to: 25 - 35 m/hr
- Optional leg handling speed: 86 m/hr
- Cylinder speed under load: 60 m/hr

**Propulsion and DP**
- 3x 4,000 kW Azimuth thrusters
- 3x 1,500 kW Tunnel thrusters

**Transit speed**
- 10-12 kn

**Accommodation**
- 90 persons

**Classification**
- 1A1 Self-elevating Crane Unit CLEAN DESIGN
- CRANE DYNPOS-AUTR E0 HELDK

**Design criteria**
- Jacking design condition
  - Significant wave height: Hs 1.8 m
  - Wave peak period: Tp 3.0 – 18.0 s
  - Wind velocity (1 min mean @ 10m): 14.0 m/sec
  - Current velocity: Vcur 2.0 kn

- Water depth max [m]: 45 m

**Payload**
- 4,500 t

**Main crane**
- GustoMSC, type GLC-800-ED
  - Main hoist: 800 t @ 24 m
  - Whip hoist: 25 t @ 94 m

**Metric system**
- Weights [t] and forces [tf] are in the metric system
Deliveries of Construction SEPs & Jack-ups

- **1998**
  - SIRI, Denmark

- **2000**
  - Petronas Saparmyrat Turkmenbashi, Turkmenistan
  - BIMA, Far East

- **2003**
  - Vagant, North Sea
  - Pauline, North Sea

- **2005**
  - Resolution, North Sea

- **2007**
  - Petronas Saparmyrat Turkmenbashi, Turkmenistan

- **2008**
  - Kraken, Lamprell

- **2009**
  - 2x NG2500X, GMS
  - 2x MPI, UK
  - Sea Worker & Seafox-7, Netherlands

- **2010**
  - A.R.B.-3, Jurong
  - MOPUstor, Yme

- **2011**
  - NG2500X, Lamprell

- **2012**
  - Conversion of Svanen, Netherlands
  - Wind Lift 1, Germany
  - 3x SEA2000, Europe

Gusto B.V. - Proprietary and confidential information
TRENDS

Further innovations
Essential Innovations

Installation in One Piece
Installation in One Piece

Installation in one piece?
Apply proven drilling technology:
XY cantilever system
Installation in One Piece

Test unit in China

Photo courtesy COOEC: GustoMSC designed crane vessel Lan Jiang
Essential Innovations

Deeper water
Deeper Water

Foundation types

Present: ± 40 - 45 m
Space frame or Truss type legs

- Basic design of unit
- Turnkey supply:
  - Rack & Pinion jacking systems
Self-propelled unit (NG series)

NG-2500X “Seajacks Kraken” with Truss type legs and GustoMSC track & pinion system
Future Development?

The SBM Group has in-house existing technology within the Group

A TLP (Tension Leg platform) for the Offshore Oil & Gas industry

Trifloater
CONCLUSION

Technology is there to install substantial amounts of wind turbines offshore – Provided timely investments are made in installation equipment
QUESTIONS?