

Schallminimierungskonzepte bei Offshore-Rammungen

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Maritimes Clustermanagement S-H "Ozean der Zukunft"– 2. Kieler Marktplatz: "Lärm im Meer", 18. Mai 2010







Overview

- MENCK Who we are
- Past Hammer Techniques and MHU Hammer Design & MENCK`s "Noise mitigation" Engagement
- Aspects of Underwater Noise (UW) Mitigation: employment for Tripods/ Jackets – Research project and other concepts: Little Bubble Curtain, Inflatable Hose Concept, Hydro Dampers and Incorporated Foundation design concepts
- Noise Mitigation Concepts UW for Monopiles (MENCK Patents):
 Telescopic (sandwich) Tube & Piling Frame combined liftable Noise Curtain
- Other Examples: Large/Little Bubble Curtain & Hydro Dampers, Increased Impact Duration
- Conclusion

Facilities



Headquartered in Kaltenkirchen, Germany since March 2002

Piling hammers

Powerpacks (on-deck and underwater)

Winches, hoses, umbilicals

Followers

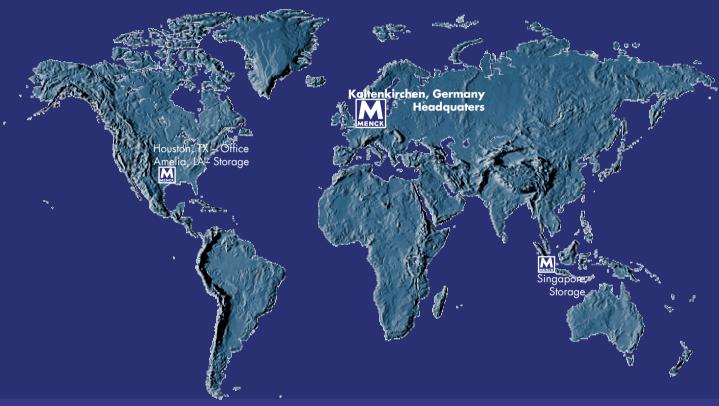
Accessories

Noise protection systems above & under water



MENCK Worldwide Markets Rental Fleet: 16 Hammer (systems)







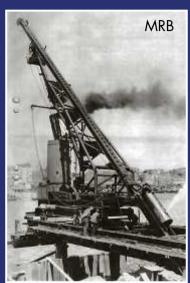




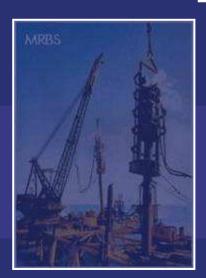


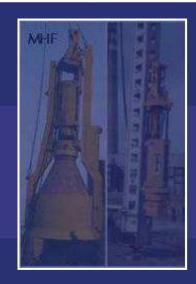
MENCK Hammer Competences





Туре	MRB	MRBS	MHF	MHU	MHU -T/S
Mode	Steam/Air	Steam/Air	Hydraulic	Hydraulic	Hydraulic
	Freefall	Freefall	Freefall	Double Act	Double Act
1 st Model	1936	196 <i>7</i>	1989	1980	1989
Ram weight	2,0 t	8,6 t	4,0 t	30,0 t	8,0 t
/ weight	20,0 t	125,0 t	20,0 t	230,0 t	168,0 t
Energy	25 kJ	129 kJ	30 kJ	220 kJ	150 kJ
	245 kJ	2.190 kJ	200 kJ	3000 kJ	3.000 kJ
Ratio min	7,58 kJ / t	8,3 kJ / t	5,97 kJ / t	8,7 kJ / t	7,11 以 / t
max	8,93 kJ / t	11,8 kJ / t	7,32 kJ / t	11,6 kJ / t	10,15 以 / t









YOUR SUCCESS - BASED ON MENCK

an ACTEON company

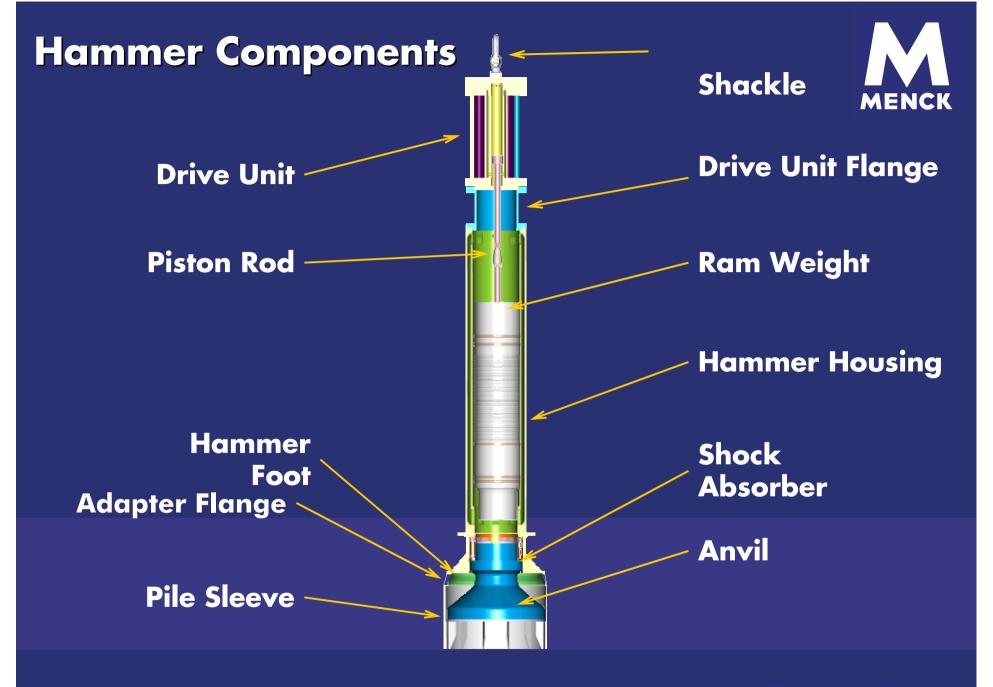


MHU Hammer Design

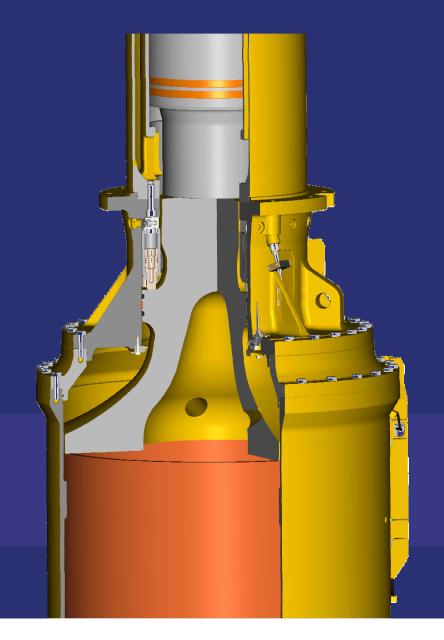


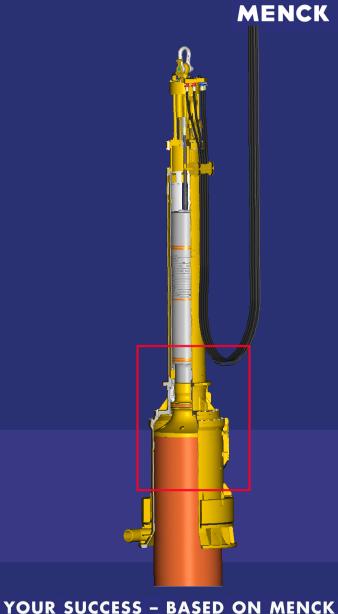


YOUR SUCCESS - BASED ON MENCK



Hammer foot, Sleeve, Anvil, and pile – to be connected stiff?





an ACTEON company

Reduction of above water noise





CT4 Terminal / Bremerhaven (2005) / GER

Driving of H-Beams

Manufacturing possible up to 6.0m OD

> 60dB in 1500m distance

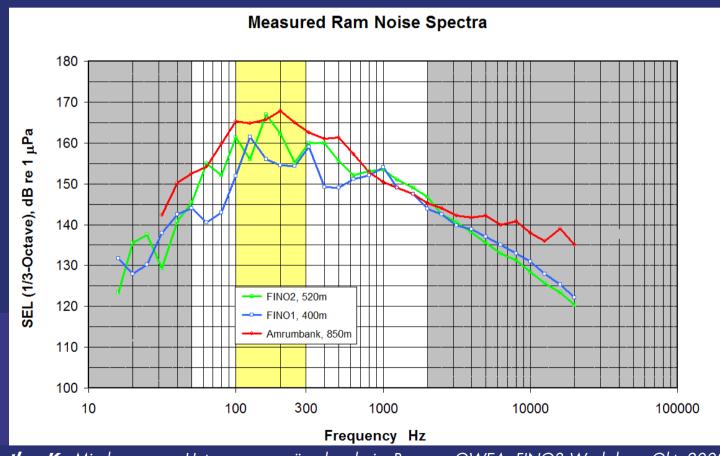




Spectral impact noise of hydraulic hammer underwater



Important frequency range: 50 Hz – 2000 Hz; Peaks: 100 Hz – 300 Hz



Betke, K.: Minderung von Unterwassergeräuschen beim Bau von OWEA, FINO3 Workshop, Okt. 2008.

Reduction of under water noise



To date no state-of-the-art (Stand der Technik) uw noise existing; only concepts

Basic test on MENCK Baltic Sea testpile 2006: Rubber curtain, steel caising & foam coated steel tube

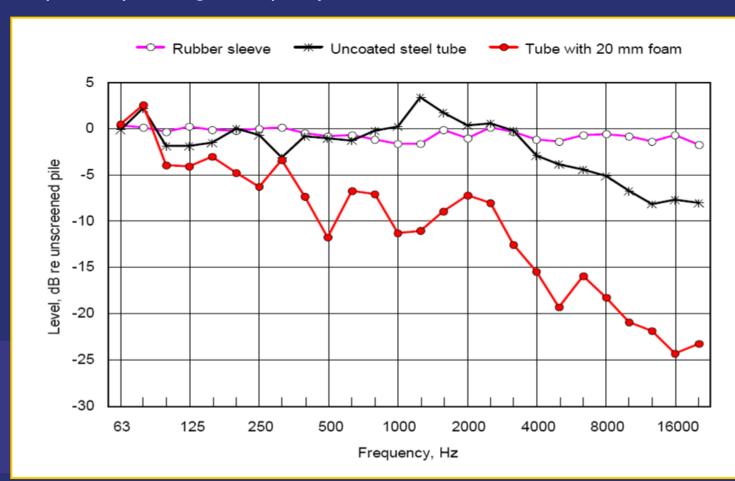




Test Results Baltic Sea: Reduction of under water noise



Air (Foam) Isolation/Barrier is most effective (especially in high frequency band)



UW Noise Bubble Curtains: Experiences









Illingsworth & Rodkin, Inc. (2001) / Reyff (2003)

Reyff (2003)





Vagle (2005)

Petrie (2005)

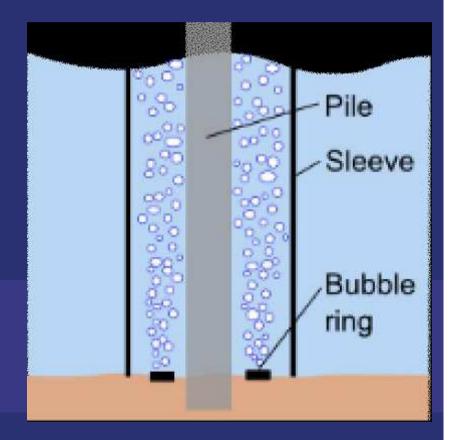


Bubble curtain: How Effective in marine environment?

Unprotected bubble curtain – bubble shift (Betke-ITAP)

1 m/s current ——

Protected bubble curtain



Research Project Little Bubble Curtain - Tripods Alpha Ventus funded by German BMU / PTJ



Located 30km north of Borkum (FINO 1)

6 Tripods for 6 Areva-Multibrid M5000 turbines

Pile OD 2.48m, 46 - 56 m length

Water depth 26 -28m





UW Noise Mitigation Research Project – Little Bubble Curtain funded by German BMU / PTJ



Involved parties:

Doti / Multibrid-Areva / Prokon Nord

MENCK / Hydro Technik

ISD / ITAP / DEWI

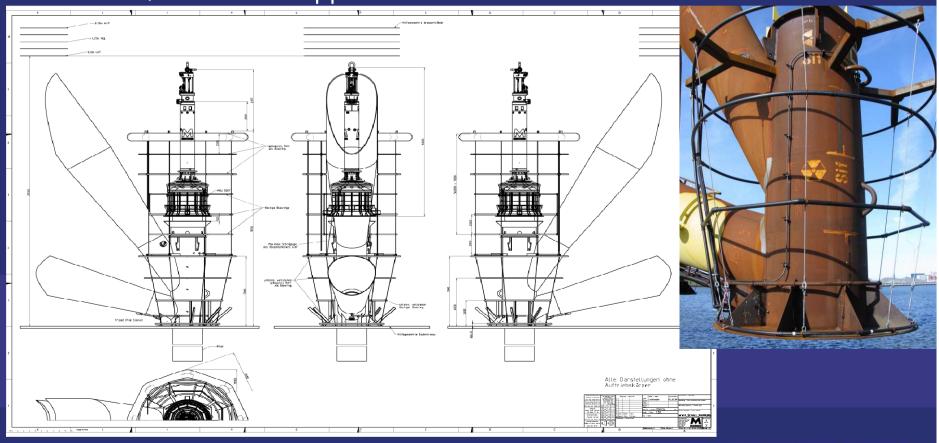




Research Project Little Bubble Curtain— Tripod Alpha Ventus; funded by German BMU / PTJ



Tripod AV– Little Bubble Curtain with hammer application designed by MENCK / Lower and upper Part



Noise Protection underwater – Tripod AV

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Tripod AV – Little Bubble Curtain: Upper Part with bouyancy tanks



Little Bubble Curtain

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MHU500T-3.2m short sleeve Alpha Ventus – start of Tripod pile driving without bubble curtain



Little Bubble Curtain

MHU500T-3.2m short sleeve Alpha Ventus – pile driving with lower bubble curtain (tested on two pile sleeves)

12 dB reduction possible!





Noise Protection underwater

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Large Bubble Curtain – FINO 3 / 10-12 dBa reduction, costs could be reduced in serial foundation installation

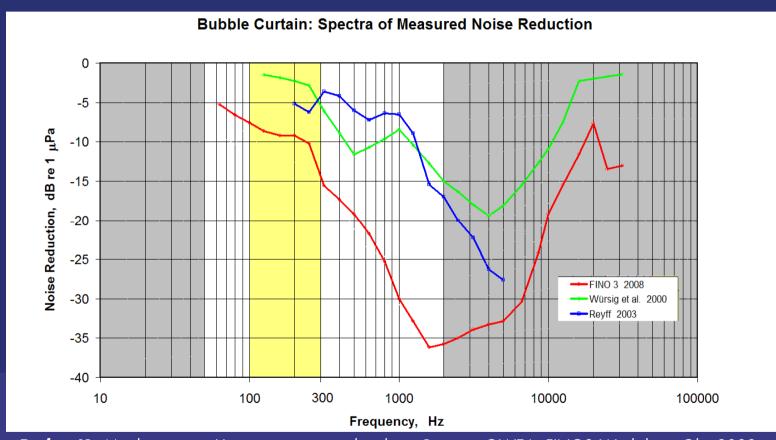




Noise Reduction Bubble Curtains



Bubble curtains very effective at high frequencies/ average -12 dB



Betke, K.: Minderung von Unterwassergeräuschen beim Bau von OWEA, FINO3 Workshop, Okt. 2008.

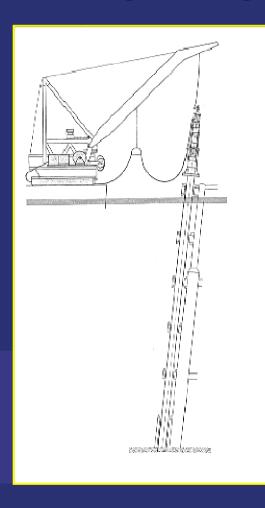
Reyff, JA:: Underwater sound pressures associated with the restrike of the PIDP pile; Illingw. & Rodk., 2003.

Würsig, B, Greene, GR, Jefferson, TA: Development of an air bubble curtain, Mar. Environ. Res., 49, 79-93, 2000.

Jacket Installation - MHU Free Ride



Driving through (noise insulated) legs



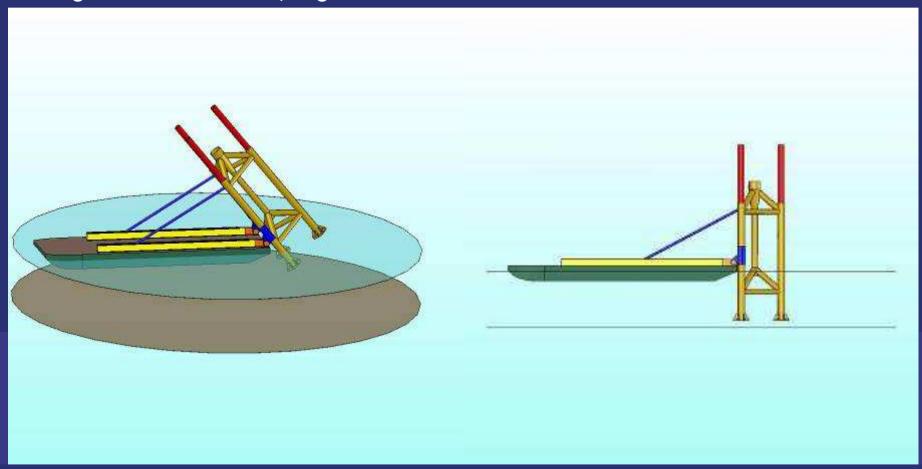




Noise Protection UW – Long Leg tripod



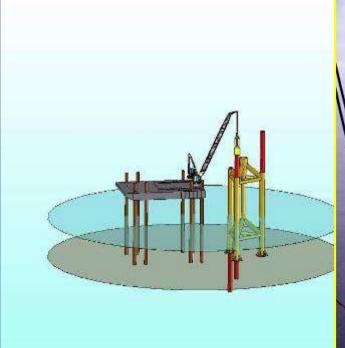
New Tripod Concept – Driving through noise insulated) legs



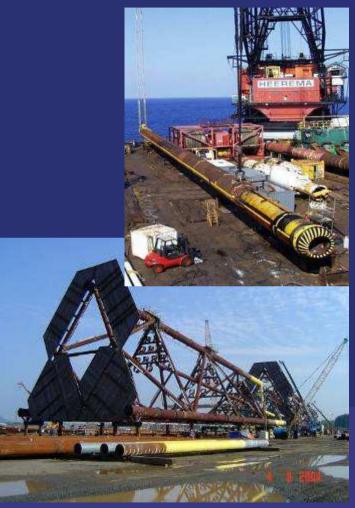
Noise Protection UW – LL Tripod



New Tripod Concept – Driving through noise dampened/insulated leg: foam and rubber/wood/kevlar liners





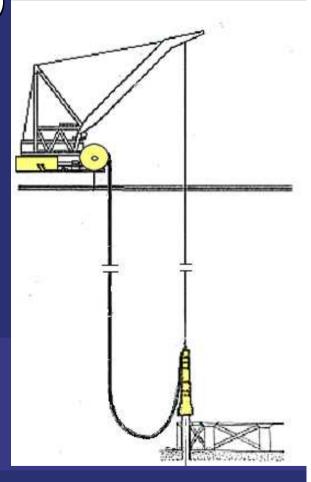


Jacket Installation – MHU Slender and Prepile installation by using a template



(with integrated UW Noise protection?)





Noise Protection UW – Monopiles & Similar











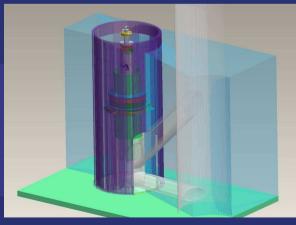
YOUR SUCCESS - BASED ON MENCK

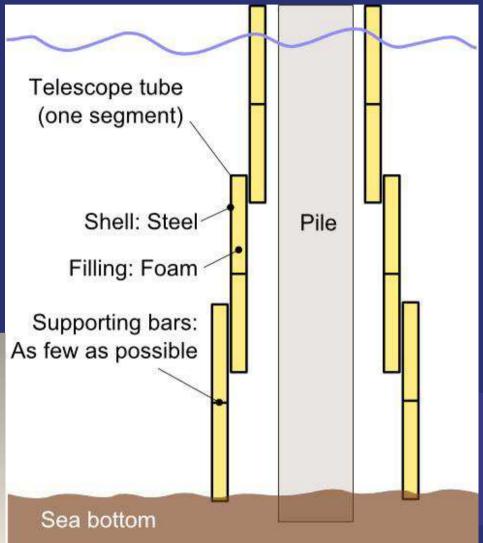
Reduction of UW Noise - Telescopic Tube



Telescopic noise mitigation tube (sandwich principle, schematically, not to scale)

- Supposed to be very effective in noise reduction (> 20 dB) but additional handling time and stability to be solved

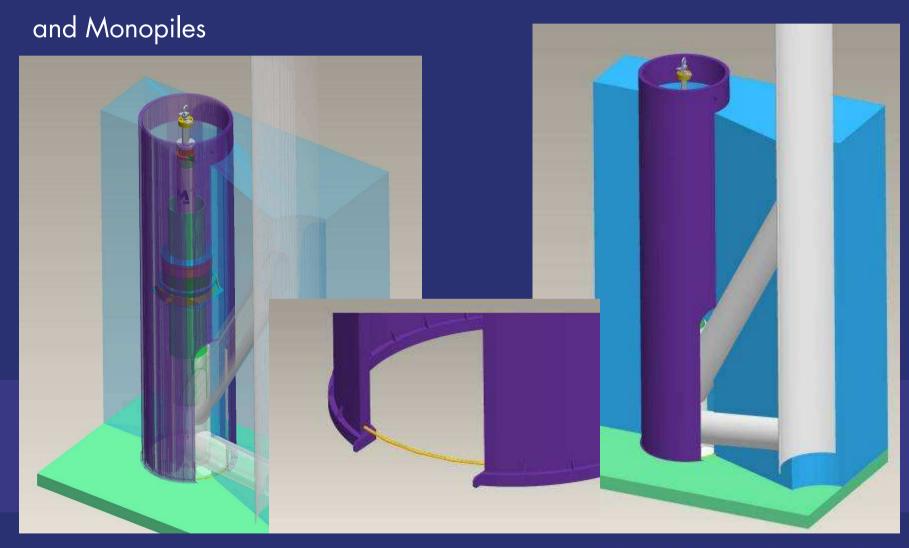




Noise Protection underwater



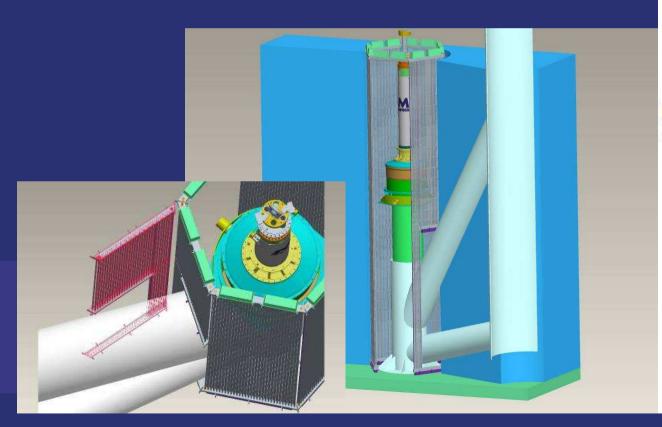
Double Wall (sandwich) Protection pipe for Tripods/Jackets

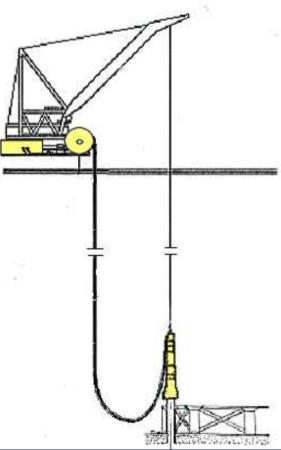


Noise Protection underwater



Inflatable Airhose Mitigation for Monopiles and Tripod/Jackets with bubble curtain for bracing slot – high resistance to current





Noise Protection UW - Monopiles



Various Piling Frames for Monopiles – necessary tool to be combined with noise mitigation system



Reduction of UW Noise – BubbleCurtain / Piling Frame Combination

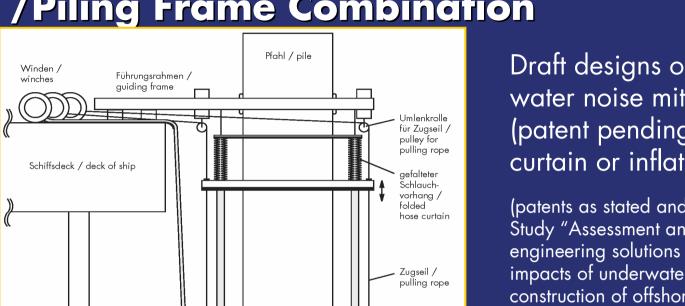
Schlauch-

vorhang,

Luftring /
air ring

Ballastring /
ballast ring

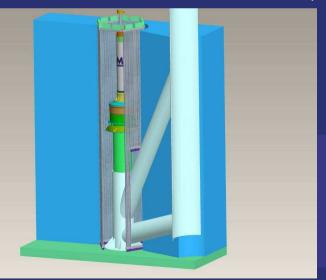
luftgefüllt / hose curtain, air-filled



Draft designs of large scale under water noise mitigation systems (patent pending) either bubble curtain or inflatable hoses

MENCK

(patents as stated and described in the COWRIE Study "Assessment and costs of potential engineering solutions for the mitigation of the impacts of underwater noise arising from the construction of offshore windfarms)



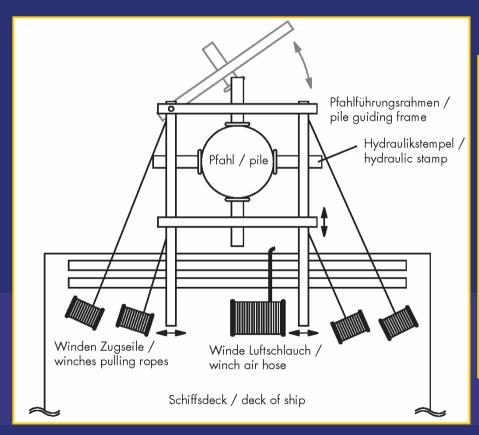
Luftschlauch /

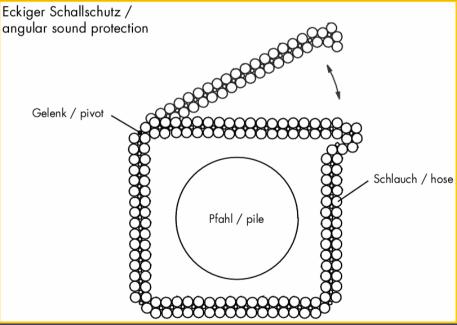
Seeboden / sea bottom

air hose

Anwendungmöglichkeiten Blasenschleier MENCK

Unter Piling Frame hängen und Ballast entsprechend gestalten

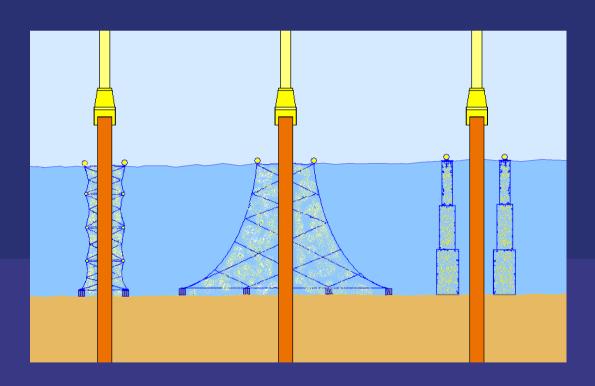




Noise Protection Hydro Sound Damper (HSD, Elmer 2010)



- using gas filled envelope bodies (balloons) instead of free bubbles
- scattering, absorption and additional material damping effects
- allow extreme resonant effects in decisive frequency range 100 300 Hz



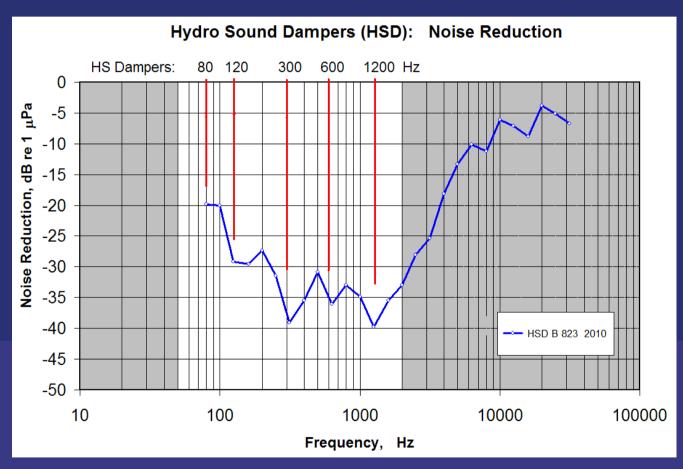
- fully controlled elast. Balloons
- fixed to fishing nets or frames
- number, size, damping rateand distribution are controlled/ designed
- reduced resistance to current
- no supply with compressed air needed
- easy adaptable to different applications

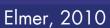


Noise Protection underwater (HSD)



Possible (predicted) noise reduction related to frequencies of Hydro Sound Dampers under water



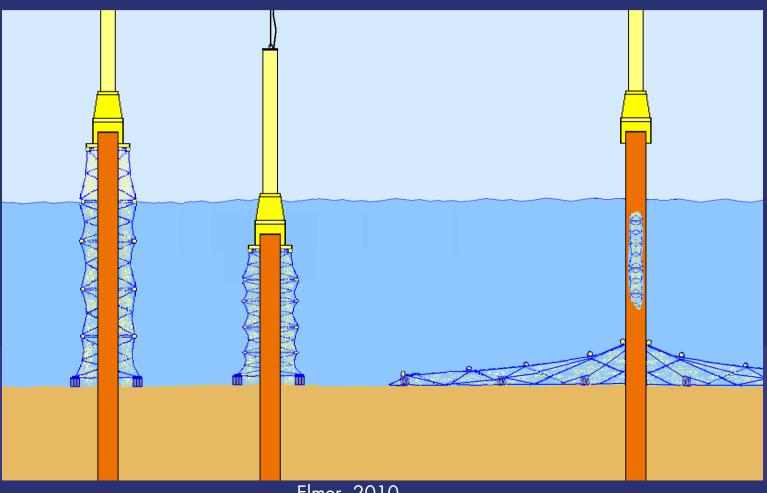




Noise Protection underwater (HSD)



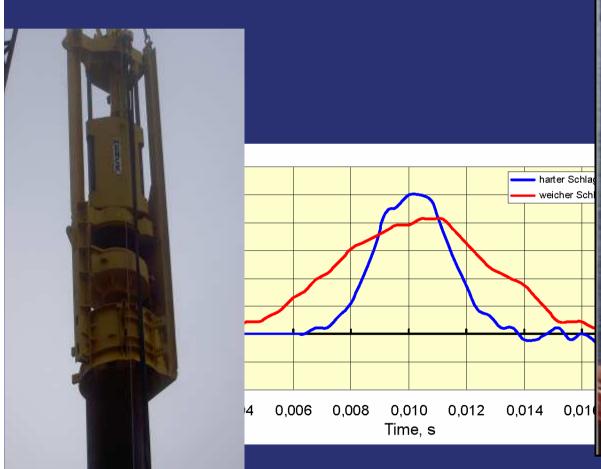
Hydro Sound Damper (HSD) Applications Offshore (Elmer, 2010)



Hard / Soft Hammer Stroke



using a cushion block between anvil and pile and/or heavy hammer due to impact energy loss per blow





Conclusion



- Underwater piling noise restricted to max. 160 dBa by law (hammered in stone unless political approach changes increase of noise level limit or skip and other methods of mitigation acceptable? E.g. Vibro & Soft piling)
- Bubble Curtain principle only in test phases for offshore application
- Test results for Bubble curtain offshore indicates reduction of 10-15 dB
- Alternative method (sandwich pile/air hose) limited in application offshore due to high loads (currents, waves) system has to be robust and user friendly
- Hydro Dampers in initial test phase, first laboratory results expected July 2010
- new or alternative mitigation proposals from everywhere appriciated
- •no state-of-the-art noise mitigation existing so far for serial pile installation Offshore (constraint for renewable target 2020/30)





Thank you!



Please ask questions!