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June 17–22, Rhodes (Rodos), Greece

The Twenty-second (2012) International  
**Offshore and Polar  
Engineering Conference**

*In addition ISOPE specialty symposia:*

1st Tsunami & Safety  
1st Asset Integrity  
**3rd Arctic Science & Technology**  
**2nd Arctic Materials**  
3rd Renewable Energy & Environment  
4th Sloshing Dynamics & Design  
4th Frontier & Clean Energy Tech  
10th High-Performance Materials  
5th Strain-Based Design

**ISOPE-2012**

Rodos Palace Hotel, Rhodes, Greece, June 17–22

## Technical Program

Refereed papers from **52** countries in **150** technical general  
Plenary and keynote presentations  
General Information, Reservations, Publications and Program  
Updates on [www.isopec.org](http://www.isopec.org) [www.isopec2012.org](http://www.isopec2012.org)  
Forms for Advance Registration and Venue Hotel:  
Inside this program and on [www.isopec.org](http://www.isopec.org) [www.isopec2012.org](http://www.isopec2012.org)

*Organized by:*

Technical Program Committee, ISOPE

*Sponsored by:*

International Society of Offshore and Polar Engineers (ISOPE)  
with cooperating organizations (listed inside)



ISOPE, P.O. Box 189  
Cupertino, CA 95015-0189, USA  
Fax: +1-650-254-2038

[meetings@isopec.org](mailto:meetings@isopec.org); [www.isopec.org](http://www.isopec.org)



ISOPE Awards, Scholarship, and Student Forum:  
Presentation at Banquet



Conference Opening Session



Annual Conference Banquet

More photos on [www.isopec.org](http://www.isopec.org) and [www.isopec2012.org](http://www.isopec2012.org)  
ISOPE-2011 Maui

21st Annual International Ocean and Polar Engineering  
Conference, Maui, June 19-24, 2011

## Welcome to ISOPE-2012 Conference

We greatly appreciate the excellent responses with **1250+** abstracts and help we have received from colleagues around the world in the successful organization of the 22nd International Offshore and Polar Engineering Conference (ISOPE-2012), Rhodes, Greece, June 17–22, 2012. The Conference features **150** sessions of *peer-reviewed* papers and **8** keynote presentations from more than **52 countries**, including the ISOPE specialty symposia as a part of the ISOPE-2012 Conference.

The conference program is issued in 2 versions: Printed and internet ([www.isopec.org](http://www.isopec.org) and [www.isopec2012.org](http://www.isopec2012.org)). To meet the page limit, only the first author data are listed in the printed version, and the internet version lists all authors.

The purposes of the ISOPE conference are to:

- \* Promote technological progress and activities, international technological transfer and cooperation, and opportunities for engineers to maintain and improve technical competence; and
- \* Provide a timely international forum for technical activities, cooperation, opportunity and fellowship among researchers and engineers by developing focused session topics with high quality papers (in both originality and significance) accepted through rigorous review, establishing high international standards for publication and worldwide distribution and promoting interdisciplinary interaction between academia and industry.

The International Society of Offshore and Polar Engineers (ISOPE) has already held **49 successful international meetings** with peer-reviewed papers:

- 1st (1990) European Offshore Mechanics Symposium (**EUROMS-90**) Trondheim; EUROMS-99 Moscow;
- 1st (1990) Pacific/Asia Offshore Mechanics Symposium (**PACOMS-90**) Seoul; PACOMS-94 Beijing; 1996 Pusan, 2002 Daejeon, 2004 Vladivostok, 2006 Dalian, 2008 Bangkok, 2010 Busan
- Annual **ISOPE** conferences, starting in Edinburgh, 1991 were held in San Francisco, Singapore, Osaka, The Hague, Los Angeles, Honolulu, Montréal, Brest, Seattle, Stavanger, Kitakyushu, Honolulu, Toulon, Seoul, San Francisco, Lisbon, Vancouver, Osaka, Beijing and Maui. Since 1992, the annual ISOPE conference program has been the world's largest of its kind with peer-reviewed papers;
- 1st (1995) ISOPE Ocean Mining Symposium (**OMS-95**), Tsukuba, 1995, Seoul, Goa, Szczecin, Tsukuba, Changsha, Lisbon; Chennai
- 1st (1996) International Deep-Ocean Technology (**IDOT-96**) Symposium and Workshop, 1996 Los Angeles; 2001 Stavanger and 2009 Beijing;
- ISOPE **HPM** Symposium: Honolulu 2003, Toulon 2004, Seoul 2005, San Francisco 2006, Lisbon 2007, Vancouver 2008; Osaka 2009 and Beijing 2010 ;
- ISOPE Series of specialty symposia : **ANGT**: Seoul 2005-; **Strain-Based Design SBD**: Lisbon 2007-; **Nanotechnology NANOS**: Lisbon 2007 Frontier Energy; **Sloshing Dynamics, Sloshing-2009-**, **Renewable Energy/Environment, REES-2010**; Arctic Science & Tech, **Arctic-2010-**; **Arctic Materials-2011-**; **Asset Integrity-2012-**

On behalf of the Technical Program Committee, it is our pleasure to welcome participants from all over the world to the ISOPE-2012 Conference in Rhodes, Greece.

Jin S Chung, USA	Demos Angelides Greece	Ronald H Knapp USA
Xizhao Jiang China	Shigeru Naito Japan	Michael Isaacson Canada

Co-chairmen of the ISOPE-2012 Conference

**SUNDAY JUNE 17**

09:00 ISOPE Board of Directors Meeting Executive D  
10:30 ISOPE-2010 Executive Committee Meeting Executive D  
EUROMS and PACOMS Executive Committees  
15:00-18:00  
**CONFERENCE REGISTRATION** Lobby  
17:00-18:00  
**WELCOME RECEPTION** Outdoor Pool Garden  
Tour Information Visit tour desk in ISOPE registration area:  
[www.isopec.org](http://www.isopec.org)  
Spouse Program Join Tour program: see [www.isopec.org](http://www.isopec.org)

**MONDAY June 18**

**On-Site Registration** starts at 07:30 Lobby  
**07:30 Session Chair/Co-chair Briefing** Lobby  
  
**08:30 Conference Opening** Jupiter  
08:30  
**1. OCEAN AND ENERGY INDUSTRY REVIEW—2011** Jupiter  
  
**10:30**  
**2. LNG SLOSHING I: GTT Progress** Room 1  
**3. VORTEX-INDUCED VIBRATIONS I** Room 2  
**4. RENEWABLE ENERGY I: Wind 1: Foundations 1** Room 3  
**5. TSUNAMI I: 2011 Tohoku Tsunami 1** Room 4  
**6. ASSET INTEGRITY I** Room 5  
**7. ENVIRONMENT I: Oil Spill and Emission** Room 6  
**8. SBD I: Materials** Room 7  
**9. FRONTIER ENERGY I: Clean Energy** Room 8  
**10. RISK & RELIABILITY I** Room 9  
**11. UNDERSEA I: Operation and Communication 1** Room 10  
  
**14:00**  
**12. LNG SLOSHING II: Physics & Coupling** Room 1  
**13. VORTEX-INDUCED VIBRATIONS II** Room 2  
**14. RENEWABLE ENERGY II: Wind 2: Foundations 2** Room 3  
**15. TSUNAMI II: 2011 Tohoku Tsunami 2** Room 4  
**16. ASSET INTEGRITY II** Room 5  
**17. ENVIRONMENT II: Physical & Chemical Processes** Room 6  
**18. SBD II: Numerical Modeling** Room 7  
**19. FRONTIER ENERGY II: Clean Coal** Room 8  
**20. RISK & RELIABILITY II** Room 9  
**21. UNDERSEA II: Operation and Communication 2** Room 10  
  
**16:20**  
**22. LNG SLOSHING III: LNG Tank Design 1** Room 1  
**23. HYDRODYNAMICS I: MetOcean 1** Room 2  
**24. RENEWABLE ENERGY III: Wind 3: Substructures** Room 3  
**25. TSUNAMI III: Generation & Warning 1** Room 4  
**26. ASSET INTEGRITY III** Room 5  
**27. ENVIRONMENT III: Water & Sediment Qualities** Room 6  
**28. SBD III: Strain Capacity Characterization** Room 7  
**29. FRONTIER ENERGY III: Hydrate Fundamental** Room 8  
**30. RISK & FATIGUE** Room 9  
**31. UNDERSEA III: Vehicle and Control 1** Room 10  
  
**18:30** Find from the bulletin board  
**ISOPE Technical Committee Meetings**

**Tuesday June 19**

<b>07:30</b> Session Chair/Co-chair Briefing	Lobby
<b>08:00</b>	
32. LNG SLOSHING IV: LNG Tank Design 2	Room 1
33. HYDRODYNAMICS II: MetOcean 2	Room 2
34. RENEWABLE ENERGY IV: Wind 4: Dynamics 1	Room 3
35. TSUNAMI IV: Generation & Warning 2	Room 4
36. ASSET INTEGRITY IV	Room 5
37. COASTAL I:Waves & Modeling 1	Room 6
38. SBD IV: Fracture Mechanics	Room 7
39. FRONTIER ENERGY IV: Hydrate Development	Room 8
40. OFFSHORE MECHANICS I: Floating Dynamics 1	Room 9
41. UNDERSEA IV: Vehicle and Control 2	Room 10
<b>10:30</b>	
42. LNG SLOSHING V: Sloshing Tests	Room 1
43. HYDRODYNAMICS III: MetOcean 3	Room 2
44. RENEWABLE ENERGY V: Wind 5: Floating 1	Room 3
45. TSUNAMI V: Generation & Warning 3	Room 4
46. ADVANCED SHIP TECH I: Ultimate Strength	Room 5
47. COASTAL II: Waves & Modeling 2	Room 6
48. SUBSEA, PIPELINES, RISERS I: NORD Stream	Room 7
49. FRONTIER ENERGY V: Hydrate Modeling	Room 8
50. OFFSHORE MECHANICS II: Floating Dynamics 2	Room 9
51. ARCTIC MATERIALS I	Room 10
<b>13:00</b>	
Chung Award Lecture	Room 2
<b>14:00</b>	
52. LNG SLOSHING VI: CFD	Room 1
53. HYDRODYNAMICS IV: Freak and Long Waves	Room 2
54. RENEWABLE ENERGY VI: Wind 6: Floating 2	Room 3
55. TSUNAMI VI: Propagation & Flooding	Room 4
56. ADVANCED SHIP TECH II: At-Sea Explosions	Room 5
57. COASTAL III: Waves & Modeling 3	Room 6
58. SUBSEA, PIPELINES, RISERS II: New Concept Develop.	Room 7
59. GEOTECH I: Suction Piles	Room 8
60. OFFSHORE MECHANICS III: Systems I	Room 9
61. ARCTIC MATERIALS II	Room 10
<b>16:20</b>	
62. LNG SLOSHING VII: Structural Responses	Room 1
63. HYDRODYNAMICS V: Wave Loading	Room 2
64. RENEWABLE ENERGY VII: Wind 7: Analysis Tools	Room 3
65. TSUNAMI VII: Structure & Sediment 1	Room 4
66. HPM I: Adv Materials & Structures 1	Room 5
67. COASTAL IV: Breakwaters & Waves 1	Room 6
68. SUBSEA, PIPELINES, RISERS III: Panel	Room 7
69. GEOTECH II: Offshore Foundations	Room 8
70. OFFSHORE MECHANICS IV: Systems II	Room 9
71. ARCTIC I: Navigation in Pack Ice	Room 10
15:30 Awards Committee Meeting	Executive D
16:30 Board of Editors Meeting	Executive D
<b>18:00</b> Student Forum (advance reservation to <a href="mailto:isope-2@isope-org">isope-2@isope-org</a> )	

**WEDNESDAY JUNE 20**

<b>07:30</b>	<b>Session Chair/Co-chair Briefing</b>	<b>Lobby</b>
<b>08:00</b>		
72.	RENEWABLE ENERGY XVI: Wave 4	Room 1
73.	HYDRODYNAMICS VI: Floating-Body Dynamics 1	Room 2
74.	RENEWABLE ENERGY VIII: Wind 8: Concepts	Room 3
75.	TSUNAMI VIII: Structure & Sediment 2	Room 4
76.	HPM II: Adv Materials & Structures 2	Room 5
77.	COASTAL V: Breakwaters & Waves 2	Room 6
78.	SUBSEA, PIPELINES, RISERS IV: Improved Perform.	Room 7
79.	GEOTECH III: Soil Improvement	Room 8
80.	FRONTIER ENERGY VI: Ocean Mining 1: Minerals	Room 9
81.	ARCTIC II: Ice Mechanics	Room 10
<b>10:30</b>		
82.	RENEWABLE ENERGY XVII: Wave 5	Room 1
83.	HYDRODYNAMICS VII: Floating-Body Dynamics 2	Room 2
84.	RENEWABLE ENERGY IX: Wind 9: Codes & Design	Room 3
85.	TSUNAMI IX: Risk Assessment 1	Room 4
86.	HPM III: Composites	Room 5
87.	COASTAL VI: Breakwaters & Waves 3	Room 6
88.	SUBSEA, PIPELINES, RISERS V: Component Develop	Room 7
89.	GEOTECH IV: Cyclic Loading	Room 8
90.	FRONTIER ENERGY VII: Ocean Mining 2: Systems	Room 9
91.	ARCTIC III: Coastal Arctic Properties	Room 10
<b>12:00</b>	<b>ISOPE Board of Directors Meeting</b>	<b>Executive D</b>
<b>13:15</b>	<b>Plenary Presentation: Pipeline</b>	<b>Room 1</b>
<b>14:00</b>		
92.	RENEWABLE ENERGY XVIII: Wave 6: Resources	Room 1
93.	HYDRODYNAMICS VIII: Floating-Body Dynamics 3	Room 2
94.	RENEWABLE ENERGY X: Wind 10: Resources	Room 3
95.	TSUNAMI X: Risk Assessment 2	Room 4
96.	HPM IV: Fatigue & Fracture 1	Room 5
97.	COASTAL VII: Wave-Structure Interaction	Room 6
98.	SUBSEA, PIPELINES, RISERS VI: Fatigue Assessment	Room 7
99.	GEOTECH V: Slope Stability	Room 8
100.	OFFSHORE MECHANICS V: Deepwater Installation	Room 9
101.	ARCTIC IV: Ice Environment & Forecasting	Room 10
<b>16:20</b>		
102.	RENEWABLE ENERGY XIX: Tidal & Current 1	Room 1
103.	HYDRODYNAMICS XIII: DP & Control	Room 2
104.	RENEWABLE ENERGY XI: Wind 11: Power 4	Room 3
105.	ADVANCED SHIP TECH III: Collision & Vibration	Room 4
106.	HPM V: Fatigue & Fracture 2	Room 5
107.	COASTAL VIII: Estuary Hydraulics	Room 6
108.	SUBSEA, PIPELINES, RISERS VII: Adv Analysis 1	Room 7
109.	GEOTECH VI: Piles & Foundations	Room 8
110.	OFFSHORE MECHANICS VI: Design & Installation	Room 9
111.	LNG SLOSHING VIII: Panel	Room 10

<b>19:00</b>	<b>Super Dome Pool</b>
<b>Annual Conference Banquet</b>	
22nd ISOPE Cultural Event, Best Paper, Best Student Paper, Outstanding Students and Awards	
<i>Don't forget the banquet ticket.</i>	

**THURSDAY JUNE 21**

**07:30 Session Chair/Co-chair Briefing** **Lobby**

**08:00**

112. RENEWABLE ENERGY XX: Tidal & Current 2	Room 1
113. HYDRODYNAMICS IX: CFD 1	Room 2
114. RENEWABLE ENERGY XII: Wind 12:	Room 3
115. ADVANCED SHIP TECH IV: Slamming & Load	Room 4
116. HPM VI: Fatigue & Fracture 3	Room 5
117. COASTAL IX: Coastal Sediment 1	Room 6
118. SUBSEA, PIPELINES, RISERS VIII: Install. & Fabric	Room 7
119. GEOTECH VII: Consolidation & Seepage	Room 8
120. OFFSHORE MECHANICS VII: Moored Structures	Room 9
121. ARCTIC V: Ice Structure Interaction	Room 10

**10:30**

122. RENEWABLE ENERGY XXI: Tidal & Current 3	Room 1
123. HYDRODYNAMICS X: CFD 2	Room 2
124. RENEWABLE ENERGY XIII: Wave 1	Room 3
125. ADVANCED SHIP TECH V: Propulsion	Room 4
126. HPM VII: Shipbuilding Steels	Room 5
127. COASTAL X: Coastal Sediment 2	Room 6
128. SUBSEA, PIPELINES, RISERS IX: Analysis 2	Room 7
129. GEOTECH VIII: Material Testing	Room 8
130. OFFSHORE MECHANICS VIII: FSRU 1	Room 9
131. ARCTIC VI: Operations in Ice)	Room 10

**12:00 Ocean Mining Executive Committee** **Executive D**

**14:00**

132. RENEWABLE ENERGY XXII: Thermal Energy	Room 1
133. HYDRODYNAMICS XI: CFD 3	Room 2
134. RENEWABLE ENERGY XIV: Wave 2	Room 3
135. ADVANCED SHIP TECH VI: System design	Room 4
136. HPM VIII: Advances in Welding Technology 1	Room 5
137. COASTAL XI: Coastal Sediment 3	Room 6
138. SUBSEA, PIPELINES, RISERS X: Flow Effects	Room 7
139. GEOTECH IX: Soil Properties	Room 8
140. OFFSHORE MECHANICS IX: FSRU 2	Room 9
141. ARCTIC VII: Ice Modeling & Operations	Room 10

**16:20**

142. RENEWABLE ENERGY XXIII: Marine Bioenergy	Room 1
143. HYDRODYNAMICS XII: CFD 4	Room 2
144. RENEWABLE ENERGY XV: Wave 3	Room 3
145. ADVANCED SHIP TECH VII: Seakeeping & Resist.	Room 4
146. HPM IX: Advances in Welding Technology 2	Room 5
147. COASTAL XII: Storm Surge & Inundation	Room 6
148. SUBSEA, PIPELINES, RISERS XI: System Integrity	Room 7
149. GEOTECH X: Construction & Materials	Room 8
150. OFFSHORE MECHANICS X: LNG Transport	Room 9

<b>Sunday – Thursday</b>	
<a href="#">Author Practice</a>	Individual session rooms
<a href="#">On-site Registration</a>	Lobby
<a href="#">ISOPE Headquarters</a>	VIP Lounge
<a href="#">Proceedings Pickup</a>	Registration Desk, Lobby
<a href="#">Committee Meetings</a>	Executive D, Mezzanine e

**FRIDAY June 22**

Find Updates in Program on [www.isopec.org](http://www.isopec.org) and [www.isopec2012.org](http://www.isopec2012.org)  
Tours: Click on [General Information](#)

**ISOPE-2012 Rhodes**  
**The Twenty-second (2012) International**  
**Offshore and Polar Engineering Conference**  
Rhodes, Greece, June 17–22, 2012

This 22nd annual conference features **150 technical and opening general sessions**, **1 plenary presentation and 4 keynote presentations** with top experts from industry, academia and government. After peer review of the manuscripts selected from 1,250+ abstracts, some **720** peer-reviewed papers will be presented and discussed by researchers, engineers and managers from more than **52** countries.

The conference proceedings of peer-reviewed papers in PDF files will be available in a set of 4 volumes on CD-ROM (4,200 pp. est.) — paginated within each volume — during the conference and later for worldwide post-conference mail order from ISOPE: **ISBN 978-1-880653-94-4; ISSN 1098-6189**.

The number at end of the session title indicates the tentative number of the proceedings volume. Only the changes on titles or authors the Technical Program Committee received in writing before January 19, 2012 are reflected in this program. Final corrections will be updated in the Conference Proceedings of peer-reviewed papers and the Final Program.

**All ISOPE publications are indexed by Engineering Index (EI).**

**SESSION LIST BY TOPICS**

**OCEAN AND ENERGY INDUSTRY REVIEW (V. 1)**

**1. OCEAN AND ENERGY INDUSTRY REVIEW—2011** Jupiter

**FRONTIER ENERGY, GAS HYDRATES & OCEAN MINING (V. 1)**

<b>9. FRONTIER ENERGY I: Clean Energy</b>	Room 8
<b>19. FRONTIER ENERGY II: Clean Coal</b>	Room 8
<b>29. FRONTIER ENERGY III: Hydrate Fundamental</b>	Room 8
<b>39. FRONTIER ENERGY IV: Hydrate Development</b>	Room 8
<b>49. FRONTIER ENERGY V: Hydrate Modeling</b>	Room 8
<b>80. FRONTIER ENERGY VI: Ocean Mining 1: Minerals</b>	Room 9
<b>90. FRONTIER ENERGY VII: Ocean Mining 2: Systems</b>	Room 9

**RENEWABLE ENERGY (OFFSHORE WIND AND OCEAN)  
AND ENVIRONMENT (V. 1)**

<b>4. RENEWABLE ENERGY I: Wind 1: Foundations 1</b>	Room 3
<b>14. RENEWABLE ENERGY II: Wind 2: Foundations 2</b>	Room 3
<b>24. RENEWABLE ENERGY III: Wind 3: Substructures</b>	Room 3
<b>34. RENEWABLE ENERGY IV: Wind 4: Dynamics 1</b>	Room 3
<b>44. RENEWABLE ENERGY V: Wind 5: Floating 1</b>	Room 3
<b>54. RENEWABLE ENERGY VI: Wind 6: Floating 2</b>	Room 3
<b>64. RENEWABLE ENERGY VII: Wind 7: Analysis Tools</b>	Room 3
<b>74. RENEWABLE ENERGY VIII: Wind 8: Concepts</b>	Room 3
<b>84. RENEWABLE ENERGY IX: Wind 9: Codes &amp; Design</b>	Room 3
<b>94. RENEWABLE ENERGY X: Wind 10: Resources</b>	Room 3
<b>104. RENEWABLE ENERGY XI: Wind 11: Power 4</b>	Room 3
<b>114. RENEWABLE ENERGY XII: Wind 12:</b>	Room 3
<b>124. RENEWABLE ENERGY XIII: Wave 1</b>	Room 3
<b>134. RENEWABLE ENERGY XIV: Wave 2</b>	Room 3
<b>144. RENEWABLE ENERGY XV: Wave 3</b>	Room 3
<b>72. RENEWABLE ENERGY XVI: Wave 4</b>	Room 1
<b>82. RENEWABLE ENERGY XVII: Wave 5</b>	Room 1
<b>92. RENEWABLE ENERGY XVIII: Wave 6: Resources</b>	Room 1
<b>102. RENEWABLE ENERGY XIX: Tidal &amp; Current 1</b>	Room 1
<b>112. RENEWABLE ENERGY XX: Tidal &amp; Current 2</b>	Room 1
<b>122. RENEWABLE ENERGY XXI: Tidal &amp; Current 3</b>	Room 1
<b>132. RENEWABLE ENERGY XXII: Thermal Energy</b>	Room 1
<b>142. RENEWABLE ENERGY XXIII: Marine Bioenergy</b>	Room 1

**7. ENVIRONMENT I: Oil Spill and Emission** Room 6



17. ENVIRONMENT II: Physical & Chemical Processes	Room 6
27. ENVIRONMENT III: Water & Sediment Qualities	Room 6

#### OFFSHORE MECHANICS AND HYDRODYNAMICS (V. 1)

40. OFFSHORE MECHANICS I: Floating Dynamics 1	Room 9
50. OFFSHORE MECHANICS II: Floating Dynamics 2	Room 9
60. OFFSHORE MECHANICS III: Systems I	Room 9
70. OFFSHORE MECHANICS IV: Systems II	Room 9
100. OFFSHORE MECHANICS V: Deepwater Installation	Room 9
110. OFFSHORE MECHANICS VI: Design & Installation	Room 9
120. OFFSHORE MECHANICS VII: Moored Structures	Room 9
130. OFFSHORE MECHANICS VIII: FSRU 1	Room 9
140. OFFSHORE MECHANICS IX: FSRU 2	Room 9
150. OFFSHORE MECHANICS X: LNG Transport	Room 9

#### GEOTECHNICAL ENGINEERING (V. 2)

59. GEOTECH I: Suction Piles	Room 8
69. GEOTECH II: Offshore Foundations	Room 8
79. GEOTECH III: Soil Improvement	Room 8
89. GEOTECH IV: Cyclic Loading	Room 8
99. GEOTECH V: Slope Stability	Room 8
109. GEOTECH VI: Piles & Foundations	Room 8
119. GEOTECH VII: Consolidation & Seepage	Room 8
129. GEOTECH VIII: Material Testing	Room 8
139. GEOTECH IX: Soil Properties	Room 8
149. GEOTECH X: Construction & Materials	Room 8

#### SUBSEA, PIPELINES AND RISERS (V. 2)

PLENARY: PNG PIPELINE	Room 7
48. SUBSEA, PIPELINES, RISERS I: NORD Stream	Room 7
58. SUBSEA, PIPELINES, RISERS II: New Concept Development	Room 7
68. SUBSEA, PIPELINES, RISERS III: Panel	Room 7
78. SUBSEA, PIPELINES, RISERS IV: Improved Perform.	Room 7
88. SUBSEA, PIPELINES, RISERS V: Component Develop	Room 7
98. SUBSEA, PIPELINES, RISERS VI: Fatigue Assessment	Room 7
108. SUBSEA, PIPELINES, RISERS VII: Adv Analysis 1	Room 7
118. SUBSEA, PIPELINES, RISERS VIII: Install. & Fabric	Room 7
128. SUBSEA, PIPELINES, RISERS IX: Analysis 2	Room 7
138. SUBSEA, PIPELINES, RISERS X: Flow Effects	Room 7
148. SUBSEA, PIPELINES, RISERS XI: System Integrity	Room 7

#### UNDERSEA VEHICLE, COMMUNICATION AND CONTROL (V. 2)

11. UNDERSEA I: Operation and Communication 1	Room 10
21. UNDERSEA II: Operation and Communication 2	Room 10
31. UNDERSEA III: Vehicle and Control 1	Room 10
41. UNDERSEA IV: Vehicle and Control 2	Room 10

#### ARCTIC SCIENCE & TECHNOLOGY (V. 1)

71. ARCTIC I: Navigation in Pack Ice	Room 10
81. ARCTIC II: Ice Mechanics	Room 10
91. ARCTIC III: Coastal Arctic Properties	Room 10
101. ARCTIC IV: Ice Environment & Forecasting	Room 10
121. ARCTIC V: Ice Structure Interaction	Room 10
131. ARCTIC VI: Operations in Ice)	Room 10
141. ARCTIC VII: Ice Modeling & Operations	Room 10

#### ARCTIC MATERIALS (V. 4)

51. ARCTIC MATERIALS I	Room 10
61. ARCTIC MATERIALS II	Room 10

#### HYDRODYNAMICS (V. 3)

23. HYDRODYNAMICS I: MetOcean 1	Room 2
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33. HYDRODYNAMICS II: MetOcean 2	Room 2
43. HYDRODYNAMICS III: MetOcean 3	Room 2
53. HYDRODYNAMICS IV: Freak and Long Waves	Room 2
63. HYDRODYNAMICS V: Wave Loading	Room 2
73. HYDRODYNAMICS VI: Floating-Body Dynamics 1	Room 2
83. HYDRODYNAMICS VII: Floating-Body Dynamics 2	Room 2
93. HYDRODYNAMICS VIII: Floating-Body Dynamics 3	Room 2
103. HYDRODYNAMICS XIII: DP & Control	Room 2
113. HYDRODYNAMICS IX: CFD 1	Room 2
123. HYDRODYNAMICS X: CFD 2	Room 2
133. HYDRODYNAMICS XI: CFD 3	Room 2
143. HYDRODYNAMICS XII: CFD 4	Room 2

#### TSUNAMI AND SAFETY SYMPOSIUM (V. 3)

5. TSUNAMI I: 2011 Tohoku Tsunami 1	Room 4
15. TSUNAMI II: 2011 Tohoku Tsunami 2	Room 4
25. TSUNAMI III: Generation & Warning 1	Room 4
35. TSUNAMI IV: Generation & Warning 2	Room 4
45. TSUNAMI V: Generation & Warning 3	Room 4
55. TSUNAMI VI: Propagation & Flooding	Room 4
65. TSUNAMI VII: Structure & Sediment 1	Room 4
75. TSUNAMI VIII: Structure & Sediment 2	Room 4
85. TSUNAMI IX: Risk Assessment 1	Room 4
95. TSUNAMI X: Risk Assessment 2	Room 4

#### SLOSHING DYNAMICS AND DESIGN (V. 3)

2. LNG SLOSHING I: GTT Progress	Room 1
12. LNG SLOSHING II: Physics & Coupling	Room 1
22. LNG SLOSHING III: LNG Tank Design 1	Room 1
32. LNG SLOSHING IV: LNG Tank Design 2	Room 1
42. LNG SLOSHING V: Sloshing Tests	Room 1
52. LNG SLOSHING VI: CFD	Room 1
62. LNG SLOSHING VII: Structural Responses	Room 1
111. LNG SLOSHING VIII: Panel	Room 10

#### FLOW-INDUCED VIBRATIONS (V. 3)

3. VORTEX-INDUCED VIBRATIONS I	Room 2
13. VORTEX-INDUCED VIBRATIONS II	Room 2

#### COASTAL HYDRODYNAMICS (V. 3)

37. COASTAL I: Waves & Modeling 1	Room 6
47. COASTAL II: Waves & Modeling 2	Room 6
57. COASTAL III: Waves & Modeling 3	Room 6
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87. COASTAL VI: Breakwaters & Waves 3	Room 6
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#### HIGH-PERFORMANCE MATERIALS (V. 4)

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#### ASSET INTEGRITY (V. 4)

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#### RISK & RELIABILITY (V. 4)

10. RISK & RELIABILITY I	Room 9
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#### ADVANCED SHIP TECHNOLOGY (V. 4)

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115. ADVANCED SHIP TECH IV: Slamming & Load	Room 4
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## TECHNICAL PROGRAM

### The Twenty-second (2012) International Offshore and Polar Engineering Conference Rhodes, Greece, June 17–22, 2012

The number at end of the session title indicates the tentative number of the proceedings volume. Only the changes on titles or authors the ISOPE-2012 Technical Program Committee (TPC) received in writing before January 19, 2012 are reflected in this program. Final corrections will be updated in the Conference Proceedings of peer-reviewed papers and the Final Program. Conference proceedings (ISBN 978-1-880653-94-4; ISSN 1098-6189) will be available as a set of 4 volumes (4,200 pp. est.) from ISOPE during and after the Conference. Proceedings papers are indexed by Engineering Index and Compendex and others.

#### SUNDAY, June 17 Conference Reception

17:00

Outdoor Pool Garden

#### 1. Opening General Session: OCEAN AND ENERGY INDUSTRY REVIEW (V. 1)

Monday                  June 18                  08:30                  Jupiter

Chair: Jin S. Chung, ISOPE, USA

Co-Chair: I Langen, Univ of Stavanger, Norway

#### Conference Opening Address

Raghavan Ayer, ISOPE President, ExxonMobil Research & Engineering, USA

#### From the Longest to the Deepest Sealines

Roberto Bruschi, Director, SAIPEM Energy Services, Fano, Italy

#### 2 MW Floating Offshore Wind WinFloat Prototype and Futue Plan [Oral presentation]

Antonio Vidigal, CEO, EDP Inovation, Portugal

## ARCTIC SCIENCE & TECHNOLOGY (V. 1)

**71. ARCTIC I: Navigation in Pack Ice (V. 1)**  
Tuesday June 19 16:20 Room 10

**Chair:** T Kokkinis, ExxonMobil Upstream Research, USA.

### Keynote

**Technical and Operational Development of Icebreaking Ships  
(Keynote)**

G Wilkman, Aker Arctic Technology, Finland

**Ships Breaking Through Sea Ice Ridges**

D Ehle, Hamburg Ship Model Basin, Germany

**Safety Assessment of Membrane Type Cargo Containment Systems in  
LNG Carrier under the Ice-Ship Repeated Impact**

JH Kim, DH Kim, Hyundai Heavy Industries; HC Song, Mokpo National Univ, Korea

**Development of the Arctic Fleet in the Russian Federation**

VI Pavlenko, Arctic Research Center; EK Glukhareva, Oil and Gas Research Inst; SY Kutsenko, Arctic Research Center, Russia

**Realistic Moving Ice Loads and Ship Structural Response**

BW Quinton, CG Daley, Memorial Univ of Newfoundland; RE Gagnon, Inst for Ocean Technology, NRC, Canada

**Simulation of Ice Loads on Ship Hull**

V Ttryaskin, V Yakimov, State Marine Tech Univ-St Petersburg, Russia; P Besse, Bureau Veritas, France

**Features of Ship Vibration in Ice Operation Conditions**

IM Belov, NN Spiridonov, Krylov Shipbldg Resesarch Inst, Russia

**81. ARCTIC II: Ice Mechanics (V. 1)**

Wednesday June 20 08:00 Room 10

**Chair:** V Squire, Univ of Otago, New Zealand

**Probabilistic Fracture Mechanics Applied to the Compressive Ice  
Failure**

RS Taylor, IJ Jordaan, C-CORE, Canada

**Development of New Methodology for Pack Ice Test in Ice Tank**

SR Cho, SY Jeong, Korea Ocean Research & Development Inst, Korea

**Ice Sample Production Techniques and Indentation Tests for  
Laboratory Experiments Simulating Ship Collisions with Ice**

SE Bruneau, AK Dillenburg, S Ritter, Memorial Univ of Newfoundland, Canada

**Theoretical and Experimental Studies of Specific Energy of Mechanical  
Failure of Sea Ice**

VG Tsuprik, Far-Eastern Federal Univ, Russia



**A Model of Ice Friction for an Inclined Incising Slider**

EP Lozowski, Univ of Alberta; K Szilder, Inst for Aerospace Research,  
NRC; S Maw, Mount Royal Univ, Canada

**Multi-Stepping Ice Prediction on Cylinders Using an Automated Procedure**

PG Verdin, Cranfield Univ, UK

**Challenges in Determination of Ice Action on Offshore Structures**

MM Karulina, EB Karkulin, Krylov Shipbldg Research Inst; LB Blagovidov, IL Blagovidova, CDB CORALL, Ukraine; IY Bardin, VolgogradNIPImorneft, Russia

**Concrete Abrasion Due to Ice-Indentation Pore Pressure**

S Jacobsen, NTNU, Norway; L Kim, E Pomnikov, Far-Eastern Federal Univ, Russia

**91. ARCTIC III: Coastal Arctic Properties (V. 1)**  
Wednesday      June 20      10:30      Room 10

**Chair:** CA Willemse, Delft Univ. of Tech, Netherlands

**Field Measurements of the Material Properties of Sea Ice at Chukchi Borderland**

SY Jeong, SR Cho, Korea Ocean Research & Development Inst, Korea

**Variation of the Near Bottom Current through the Bering Strait and its Relationship with Arctic Sea Ice Change**

L Du, JP Zhao, Ocean Univ of China; JC Zuo, Hohai Univ; SW Zhang, Ocean Univ of China, China

**Structural Reliability Approach to Design of Buried Pipeline Routes at Ice Actions for “Sakhalin–II” Project**

AT Bekker, OA Sabodash, Far-Eastern Federal Univ, Russia

**Evaluation of the Applicability of Active Air-Cooled Thermal Pile to a Site in Antarctica**

JM Kang, JG Lee, YS Kim, SS Hong, Korea Inst of Construction Tech, Korea

**External Structures for Protection of Subsea Equipment against Ice Contact**

EA Drover, S Kenny, Memorial Univ of Newfoundland, Canada

**Advanced Continuum Modeling of the Ice Gouge Process: Assessment of Keel Shape Effect, Geotechnical Data and Finite Element Formulation**

KP Pike, SP Kenny, Memorial Univ of Newfoundland, Canada

**Numerical Analysis of Rapid Gas Decompression from a Pipeline in Different Natural Gas Mixtures under Low Temperature Conditions and Water Presence in a Pipe**

E Burlutskiy, Inst of High Performance Computing, Singapore

**Reducing the Cost of Protecting Arctic Marine Pipelines against Ice Gouging**

AC Palmer, National Univ of Singapore, Singapore

**Assessment of Ice/Soil Interactions: Continuum Modelling in Clays**

CP Rossiter, S Kenny, Memorial Univ of Newfoundland, Canada

**101. ARCTIC IV: Ice Environment & Forecasting (V. 1)**  
Wednesday      June 20      14:00      Room 10

**Chair:** N Otsuka, North Japan Port Consultants Co, Japan

**Co-Chair:** V Pavlenko, Arctic Research Centre, RAS, Russia

**Asymmetry Variability between the Arctic and Antarctic Sea Ice**

F Huang, TT Fan, H Di, Ocean Univ of China; B Sun, Polar Research Inst of China, China

**Study on Wave Resistance of a Submarine Moving under an Ice Sheet**

VM Kozin, Inst of Machine Science & Metallurgy, FEB RAS; VL Zemlyak, Amur State Univ, Russia

**Interannual Changes in Sea Ice Coverage on the Northwest Passage Obtained by Satellite Microwave Data**

H Shibata, Kitami Inst of Tech; K Izumiyama, North Japan Port Consultants; K Tateyama, Kitami Inst of Tech; H Enomoto, National Inst of Polar Research, S Takahashi, Kitami Inst of Tech, Japan

**Better Operational Forecasting for the Contemporary Arctic via Ocean Wave Assimilation**

VA Squire, Univ of Otago, New Zealand; L Bertino, TD Williams, Nansen Environmental & Remote Sensing Center, Norway; LG Bennetts, Univ of Adelaide, Australia; D Dumont, Univ du Quebec a Rimouski, Canada

**Ice and Snow Property Variabilities of the Pack Ice off the Labrador Coast, Canada**

S Prinsenberg, I Peterson, Bedford Inst of Oceanography, Canada

**An Automated Sea Ice Analysis System**

T Carrieres, M Buehner, A Caya, L Pogson, P Pesticau, Environment Canada, Canada

**Deriving Snow Thickness Information on Sea Ice Using Polarimetric SAR Data**

JJ Yackel, J Gill, Univ of Calgary, Canada

**Advanced Radar and System Technology for Ice Monitoring and Ice Berg Detection and Response System Ice Management**

HF Wentzell, Rutter Inc, Germany

**121. ARCTIC V: Ice Structure Interaction (V. 1)**  
Thursday June 21 08:00 Room 10

**Chair:** AT Bekker, Far Eastern Federal Univ, Russia .

**An Application of Potential Theory to a Problem of Dynamically Loaded Ice Sheet in Shallow Water**

H Kitagawa, Ocean Policy Research Foundation, Japan

**The Vibration of Fixed Offshore Structures under Ice Action**

RS Gibson, BP, UK; K Shkhinek, A Zhylentkov, St Petersburg State Polytech Univ, Russia; G Thomas, Graham A N Thomas Consulting, UK

**Model Test Studies on Ice-Induced Dynamic Behavior of Moored Marine Structures**

EM Appolonov, KE Sazonov, NY Klementieva, AA Dobrodeev, Krylov Shipbldg Research Inst, Russia

**Feasibility Study of a Unmanned Floating Moored Platform Located in the Svalbard Archipelago for Monitoring of Ice Induced Responses and Ice Conditions Simultaneously**

PK Bruun, Aker Solutions; A Gürtner, Statoil, Norway

**Design of Platform for Shallow Water in the Arctic Region**

BR Livshyts, DY Nesin, VF Lenskiy, JS CDB Corall, Ukraine

**Failure Modes Analyses of Ice-Resist Jacket Platforms in Bohai Sea**

DY Zhang, Dalian Ocean Univ; QJ Yue, Dalian Univ of Tech, China

**Lightweight Structures in Extreme Environments: Cases from Antarctic and Sub-Antarctic Areas**

J Fernandoy, P Shepherd, PN Richens, Univ of Bath, UK

**131. ARCTIC VI: Operations in Ice (V. 1)**  
Thursday June 21 10:30 Room 10

**Chair:** SJ Prinsenber, Bedford Inst of Oceanography, Canada.

**On Full-Scale Onboard Ship Measurements in Various Ice Conditions, a Review of Existing Data Base at Aker Arctic Technology**

GW Wilkman, E Ranki, T Leiviskd, T Heinonen, Aker Arctic Technology, Finland

**An Integrated Ice Management Alert System**

AH Younan, JM Hamilton, VY Garas-Yanni, JD Blunt, CJ Holub, T Kokkinis, ExxonMobil Upstream Research, USA

**Ice Management: Analysis of Efficiency**

EM Appolonov, KE Sazonov, OY Timofeev, AA Dobrodeev, Krylov Shipbldg Research Inst, Russia

**Study of Operational Characteristics for an All Year Intervention Vessel for the Barents Sea**

TE Berg, BO Berge, MARINTEK; H Borgen, STXOSV, Norway; S Hamminen, VTT; RA Suojanen, Aker Arctic Tech, Finland

**Formation of Extreme Ice Seasons in the Pechora Sea and Elements of an Ice Management for Prirazlomnoe Oil Field**

GK Zubakin, IV Buzin, EA Skutina, VV Ivanov, Arctic & Antarctic Research Inst, Russia

**Structural Safety Assessment of LNGC CCS under Iceberg Collision Using FSI Analysis Technique**

SG Lee, JK Kim, JH Nam, Korea Maritime Univ, Korea

**Acoustic Communications and Navigation under Arctic Ice**

LE Freitag, P Koski, J Partan, S Singh, A Morozov, Woods Hole Oceanographic Institution, USA

**141. ARCTIC VII: Ice Modeling & Operations (V. 1)**

Thursday          June 21          14:00          Room 10

**Chair:** J Regina, ExxonMobil Development, USA

**Welcome to Arctic Symposium**

Simon Prinsenber, Jin Chung and Ted Kokkinis

**Probabilistic Modeling of Ice Environment from Lighthouses Zone in the Gulf of Bothnia**

AT Bekker, OA Sabodash, RG Kovalenko, DS Rusakov, Far-Eastern Federal Univ, Russia

**A Method to Determine Inward Boundary of Marginal Ice Zone Using AMSR-E Dual-polarized Brightness Temperature at 36.5GHz**

SG Zhang, T Li, Ocean Univ of China, China

**Effect of Bottom Slope on the Wave Resistance of an Air-Cushion Vehicle in Unsteady Motion over an Ice Sheet**

AV Pogorelova, Inst of Machining & Metallurgy, FEB RAS, Russia

**A Portable Raman and Surface Enhanced Raman (SERS) Sensor System Applied for Seawater and Sediment Investigations on an Arctic Sea-Trial**

A Kolomijeca, YH Kwon, HD Kronfeldt, TU-Berlin, Germany

**Technique for Determining the Architectural and Structural Type and Main Dimensions of Floating Drilling Unit for Drilling Exploration Wells in Russian Arctic Shallow Water Conditions**

DF Khalikova, Krylov Shipbldg Research Inst, Russia

**Procedure for Selection of General Project Parameters of Turret Production Platforms for Shelf Fields of the Arctic Regions**

OV Shinkarenko, Krylov Shipbldg Research Inst, Russia

**Environment Safety of Oil Resources Exploitation in Offshore Arctic Regions**

VI Pavlenko, Arctic Research Center; EK Glukhareva, Oil and Gas Research Inst; SY Kutsenko, Arctic Research Center, Russia

## ARCTIC MATERIALS (V. 4)

**Tuesday**                      **51. ARCTIC MATERIALS I (V. 4)**                      **Room 10**  
**June 19**                      **10:30**

**Chair:** OM Akselsen, SINTEF, Norway

### Keynote

#### **Arctic Materials and Platform Winterisation (Keynote)**

M Hauge, NTNU, Norway

#### **Low Temperature Fracture Toughness of X80 Girth Welds**

OM Akselsen, SINTEF/NTNU; E Østby, B Nyhus, SINTEF, Norway

#### **Robust Material Qualification for Arctic Applications**

AM Horn, Det Norske Veritas; E Østby, SINTEF; M Hauge, Statoil, Norway

#### **Mechanical Properties and HAZ Toughness of YS 345/420 MPa Steel Plates for Arctic Offshore Structures**

SH Jang, WG Kim, KM Ryu, SH Kim, IS Suh, POSCO, Korea

#### **In-situ Heating and EBSD Measurements of Arctic Steels inside the SEM**

KW Hansen, T SaeTRAN, J Hjelen, T Nilsen, W Dall, NTNU; M Karlsen, Statoil ASA; OM Akselsen, NTNU/SINTEF; E Østby, SINTEF, Norway

#### **Combined in-situ Deformation and EBSD Examinations of Arctic Steels at Ambient and Sub-Zero Temperatures inside the SEM**

LK Rølvåg, K Larsen, J Hjelen, W Dall, T Nilsen, NTNU; M Karlsen, Statoil ASA; OM Akselsen, NTNU/SINTEF; E Østby, SINTEF, Norway

#### **Determination of Crystallographic Facet Orientation of Fracture Surface in Arctic Steels at Low Temperature by Using EBSD**

P Mohseni, JK Solberg, M Karlsen, NTNU; OM Akselsen, E Østby, SINTEF; Norway

**Tuesday**                      **61. ARCTIC MATERIALS II (V. 4)**                      **Room 10**  
**June 19**                      **14:00**

**Chair:** KB Kang, POSCO, Korea,

**Co-Chair:** AM Horn, Det Norske Veritas, Norway

#### **Microstructures and Mechanical Properties of Heavy Gauge API-X80 Linepipe Steel for Arctic Application**

KB Kang, SH Chon, JY Yoo, POSCO, Korea

#### **Comparison of Fracture Toughness in Real Weld and Thermally Simulated CGHAZ of a 420 MPa Rolled Plate**

E Østby, SINTEF; G Kolstad, NTNU; OM Akselsen, SINTEF; NTNU; C Thaulow, NTNU; M Hauge, NTNU/Statoil, Norway

#### **Effects of Microstructure on Initiation of Brittle Fracture in Low Alloy Steel Welds**

K Brandt, T Salvesen, JK Solberg, NTNU; E Østby, SINTEF; OM Akselsen, NTNU/SINTEF, Norway

**Influence of Large Amount of H<sub>2</sub>S on Carbon Steel and Low Alloy Steel Toughness at Low Temperature**

P Fassina, T Cheldi, ENI, Italy

**The Influence of Plastic Strain on the Effective Hydrogen Diffusion Coefficient and Trapping in Base Metal and Weld Simulated Heat Affected Zone of an X70 Pipeline Steel**

V Olden, SINTEF; OM Akselsen, SINTEF/NTNU; AS Hauge, NTNU, Norway

**Low Temperature Brittle Fracture Susceptibility in Welding of F70 Grade Forging**

MT Welsch, D Bruch, Bruck Forgings, Germany; OM Akselsen, E Østby, SINTEF, Norway

**Material Mismatch Effects-Simplified Analysis**

C Thaulow, N Askgaard, NTNU; E Østby, SINTEF, Norway

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