



**6th INTERNATIONAL
SHIP STABILITY WORKSHOP
PROCEEDINGS**

OCTOBER 13-16, 2002

**Editor
Dr. Stefan Grochowalski**

***Dedicated to the memory of our esteemed colleague,
Dr. Willard J. Pierson, Jr.,
a pioneer in developing the technology on which
this workshop is based.
1922 - 2003***

INTRODUCTION

The International Workshops on Ship Stability are organized every year between the Stability Conferences STAB. They are guided by the **International Standing Committee**.

This was the sixth Workshop in the series, after the Workshops in Glasgow, UK (1995), Osaka, Japan (1996), Hersonissos, Greece (1997), St. John's, Canada (1998) and Trieste, Italy (2001).

The Workshop is, essentially, an invitation based scientific event. It gathers those researchers and practitioners who are actively involved in stability subjects. It is the forum for in-depth discussion of all problems in the field of stability safety. This includes theoretical models, design intact stability, safety standards, operational elements of safety, damage stability, and regulatory aspects for all types of ships.

The 6th International Ship Stability Workshop was hosted by Webb Institute in Glen Cove, New York. The program was coordinated by the **Workshop Organizing Committee** and the **Session Organizers**, while the organizational and administrative matters were in the hands of the **Webb Local Committee**.

The program of the sessions is listed in the **Technical Program** and the overall time table of the Workshop is presented in the **Schedule**.

The papers presented here are grouped into sessions, as they were presented in the Workshop. The summary of the discussion during each session is presented as well.

ACKNOWLEDGMENTS

I wish to thank all the members of the **Workshop Organizing Committee** for their assistance and advice regarding the topics of the technical program, and their help in establishing the invitation list of the authors and participants.

Remarkable work was performed by the **Session Organizers**. Their knowledge of the topics, the right selection of authors for the sessions, and their skillful chairing of the presentations and discussions were the foundation of the fruitful sessions. I wish to express my deep gratitude to them.

The success of the Workshop is due to the support and encouragement provided by the **President of Webb Institute, Mr. Ronald Kiss** and the **Dean, Dr. Roger Compton**. Webb Institute's sponsorship is greatly appreciated.

The Workshop could not have happened without the exerted efforts of the **Webb Local Committee**. In particular, **Ms. Patrice Burke's** administrative and organizational skills and professionalism, and **Mr. Christopher Mader's** dedication and professionalism in development of the Workshop website were fundamental to the overall success of the event. Also, the efforts and the help provided by **Mrs. Jill Compton, Ms. Erica Hansen, Mr. John Heslin, Mr. Joseph Mazurek, Mr. Peter Morris and his staff, Ms. Gailmarie Sujecki, and Mr. Geoff Whitely and his staff** were essential to successful preparation and running of the Workshop.

A sincerely felt thank you to each!

Stefan Grochowalski, Chairman
6th International Ship Stability Workshop

6TH INTERNATIONAL SHIP STABILITY WORKSHOP

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OPENING REMARKS

by

**Prof. Stefan Grochowalski,
Chairman of the Workshop**

Dear Colleagues and Friends:

Welcome to Metropolitan New York! Welcome to one of the oldest colleges of Naval Architecture on this continent –Webb Institute.

This is the sixth Workshop in the series, which started in Glasgow in 1995. The fact that this is already the sixth meeting and that it is so well attended, proves that this is the right format for discussion of ship stability problems, that it is desired and it satisfies the expectations of open and in-depth discussion. It also means that many of the problems in stability safety are still unsolved:

- Despite very significant progress in theoretical approaches to damage stability, there is still a problem with conversion of the knowledge into appropriate standards and regulations.
- Parametric resonance, which seemed to be an interesting but rather academic case, became recently a suspect of major problems for large containerships in waves.
- Stability safety of ships in following and quartering waves still waits for adequate mathematical models. The work is in progress, but conversion into safety standards is a long way down the road.
- The same situation is with modeling the deck-water interaction and its influence on stability safety.
- We do not have a mathematical model of extreme waves.
- Not much is changed in the stability safety of fishing vessels.

These are just some of the problems which will be subjects of the discussion at the Workshop.

The topics for the discussion sessions have been selected in accordance with your suggestions. I think they reflect very well the present situation in the area of stability safety. The fact that for each selected topic

there are at least two papers, indicates that this group of researchers not only knows where the problems are, but also works to solve them.

Over the years, camaraderie developed among participants of the Workshop. This friendship and the frequent contacts facilitate the open exchange of information, discussion, cooperation, and often even joint projects. This also stimulates new ideas and directions of research, which would not be so fruitful if working in isolation. I think this is another valuable effect of our Workshop.

I hope that as a result of our discussions, new light will be shed on those problems which constitute a great challenge, and that we will be one step closer to development of rational stability safety criteria.

Today, October 14, Columbus Day is being celebrated in the United States. What a coincidence – a celebration of the discovery of a new and unknown land. Let this be a good omen for our Workshop.

WELCOME ADDRESS

by

Ronald K. Kiss, B.S., M.S., P.E.
President of Webb Institute

Good Morning. On behalf of Webb Institute, I want to extend our official welcome to everyone who has come to the North Shore of Long Island to collectively work on the many aspects of ship stability.

As a young naval architect, over 35 years ago, I spent much of my time analyzing the stability characteristics of many types of ships for the Maritime Administration. We were concerned with early containerships, tankers and even fishing boats. Our tools were basic and our understanding was grounded in static concerns. The power of improved computational capability is enabling us - you - to unlock some of the secrets of dynamic considerations that will hopefully lead to better understanding – and more importantly safer ship designs and safer operating practices.

Many of you visited Webb Institute last night for a welcoming reception. The informality of the evening precluded telling you something about our college. I'd like to take a moment this morning to tell you about Webb. In 1889 a successful New York shipbuilder and ship owner, William Henry Webb, established a school leaving a legacy that has lasted over 100 years. The first freshman arrived at the new building in the Bronx in the spring of 1894. Originally accepting only men and providing them with a “free and gratuitous education,” Webb became accredited and began granting degrees in the thirties and moved to its present location here in Glen Cove in 1947. Today we continue to provide full tuition scholarships to all students who meet our tough admission standards. We are located in what used to be one of the Pratt family estates. Our magnificent main building was constructed in 1912, and houses the core of the Webb program – dorms for most students, all the classrooms, the chemistry and physics labs, the Pub, dining room, the student lounge, and most of the faculty offices and administrative offices. The Robinson model tank and the alumni

gym were constructed when Webb moved here in 1947 and the Luckenbach graduate building was added shortly thereafter to educate naval officers in the art and science of naval architecture and marine engineering. The library and lecture hall were added in the seventies. The walls and display cases throughout the building are replete with half models and old drawings and prints of William Webb's ships. His college has a long established reputation of excellence and rigor in its academic program.

I have brought copies of our catalog for your information and will leave them for you.

Before I close I must apologize for not attending your entire conference, but as with so many things I'm over committed this week. Tomorrow I have meetings with Committees of Webb's Board of Trustees and Thursday we have our annual meeting of the Board. As much as I wish I were completely prepared there are still many things to attend to. I wish you well in your deliberations and before I turn the podium back to Professor Grochowalski, I wish you would all join me in applauding the excellent work he has done in coordinating this most important workshop.

May you have a most productive and satisfying Workshop.



**6TH INTERNATIONAL
SHIP STABILITY WORKSHOP
SCHEDULE**

Sunday, October 13, 2002

1600-1900 **Roslyn Claremont Hotel** - Registration
1900-2100 **Webb Institute** – Welcoming Reception

Monday, October 14, 2002 **Claremont Hotel**

730-830 Roslyn Claremont Hotel - Registration

0830-0900 Opening of Workshop - Webb Institute
President Ronald K. Kiss

9:00-11:00 **Session 1:** Theoretical Advances in Damage
Stability

Coffee Break

11:15-13:00 **Session 2:** Approaches and Standards for
Assessing Damage Survivability

13:00-14:30 Lunch

14:30-15:00 **Guest Speaker Dr. Willard J. Pierson, Jr.**
Lecture

15:00-16:15 **Session 3:** Intact Stability in
Following/Quartering Seas

Coffee Break

16:30-18:15 **Session 4:** Theoretical Approaches in Modeling
Intact Stability

19:00 Dinner

Tuesday, October 15, 2002 **Claremont Hotel**

8:00-9:30 **Session 5:** Ship Dynamics with Water on Deck

9:30-11:15 **Session 6:** Experimental Investigation of Intact
Stability

Coffee Break

11:30-13:00 **Session 7:** Stability Standards: The Way Ahead

13:00-14:30 Lunch

14:30-16:15 **Session 8:** Fishing Vessels Stability Safety

Coffee Break

16:30-18:00 **Session 9:** Operational Aspects of Stability
Safety

19:30 **Workshop Dinner – Guest of Honor**
Dr. Willard J. Pierson, Jr.

Wednesday, October 16, 2002 **Webb Institute**

9:00-10:30 **Plenary Session 1:** Prevention of Excessive Roll

Coffee break

10:45-12:15 **Plenary Session 2:** Evolving CFD Applications
in the Study of Ship Capsizing

12:15-12:45 **Workshop Closing**

12:45-13:30 Lunch

**6th INTERNATIONAL
SHIP STABILITY WORKSHOP**

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Session 5: SHIP DYNAMICS WITH WATER ON DECK

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Session 9: OPERATIONAL ASPECTS OF STABILITY SAFETY

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Plenary Session 1: PREVENTION OF EXCESSIVE ROLL

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Plenary Session 2: EVOLVING CFD APPLICATIONS IN THE STUDY OF SHIP CAPSIZING

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SHIPS AND WAVES

Lecture

by

**Dr. Willard J. Pierson Jr.,
Guest of Honor
The City College of the City University of New York**

In my travels to various meetings there has been the opportunity to talk about ships and waves with many different people. Also it has been my pleasure to serve as a consultant on various cases where some kind of accident or loss has occurred as a result of wave conditions at sea. This lecture will describe a few of these instances as a part of the Sixth International Ships Stability Workshop.

Hydrographic Office Publication Number 603

Gerhard Neumann, Richard James and I prepared a wave forecasting manual for the Navy Hydrographic Office that was based on the idea of the spectrum of ocean waves. In it, there was an aerial photograph of waves that we described as showing many different properties of a random sea surface. It was pointed out that there were regions where the waves were quite high and other regions where, over an extensive area, they were low. A European naval architect, Professor Aertsen, read this manual and noted this property of the waves.

He was taking a trip on a small cargo ship to observe its motions. The ship got into head seas that were quite high. The pitching motion of the ship caused it to take water over the bow. The waves stove in the forward hatch so that the ship was taking on water every time the waves broke over the bow. This was a dangerous situation because without making some correction the ship would founder. Prof. Aertsen told the captain that he would get up on the roof of the bridge so that he could look out over the ocean. He said that when I shout “turn” you should

make a 180 degree turn so that you will be running before the waves. This maneuver was accomplished, and the ship was saved.

The Mormakite

A ship carrying iron ore was heading into Hampton Roads when it took a large roll. The ore shifted so that the ship remained in a permanent 45 degree list. The lifeboats could not be used and the ship gradually sank. The crew with lifejackets walked off the stern and drifted in the water for several days. Aircraft carriers on maneuver passed by but did not hear their shouts. Some were eventually rescued; others were killed by sharks.

My part was to calculate the wave conditions at the time the ship sank. My opposite number on the other side of trial also calculated the waves. Unfortunately he discovered a mistake in his calculations and spent the day correcting his previous testimony line by line. Cases in Admiralty court are decided by a judge, and the judge took six months, or so, to render a decision. He dismissed the testimony of the two wave experts by saying that the wave conditions were not unusual and were not the main cause of the disaster. He said that two people in a Naval Architect's office had failed to recalculate the load lines of the ship when it had been modified by removing gun turrets at the end of World War Two and that the ship had been in danger ever since.

The question then arose as to what happened to the crew while in the water. I described what happened by a combination of drifting with the current and behaving like a parcel of water in the orbital motions of the passing random waves. These were questions by the other side but once they were informed that I had prepared this description it was accepted.

Admiral Howard Johnson

Admiral Howard Johnson was in command of a British dreadnought during World War Two, and he was operating in the Mediterranean. A mistral, which is a strong wind from the north that blows from France out over the Mediterranean, occurred and the ship was running before the waves heading south. Conditions were severe and the ship was pitching and rolling heavily. He was afraid to turn into

the waves because of the danger of capsizing, but he was coming up on the north coast of Africa and was afraid of running aground. Fortunately the high winds and waves abated and he was able to save his ship.

The Gulf of Tehuantepec

An area of the Pacific Ocean lies in a Gulf called the Gulf of Tehuantepec. The waves in that area are typically very low and uneventful. However, during the winter every once in a while, a strong polar outbreak over the Gulf of Mexico spills down with very high winds and this air passes through a low pass in the mountains near the Gulf. The air spills out aloft at about several thousand feet above the Pacific and then mixes down to the surface. When this happens, rather high waves are generated.

A containership was passing through this area headed toward the Panama Canal. The captain who was in his quarters felt that something was wrong and started to go to the bridge. Looking out a porthole, he saw a large wave and shouted to the crew to hang on. The ship rolled heavily so that several cargo containers broke loose, fell overboard and sank. The owners of the cargo wanted to be paid and the ship operator wanted to escape by claiming an uncontrollable event. My task was to evaluate the weather and wave conditions at the time of the loss. I was provided with geostationary cloud images that showed a circular band of clouds several hundred kilometers from the coast, a barograph trace of the pressure before, during and after the event and a copy of the deck log. The barograph record showed a jump in the pressure several hours before the loss. The geostationary cloud images showed that the winds aloft had progressed well past the location of the ship. The deck log showed that the seas and winds had begun to increase several hours before the loss. The standing orders of the captain were that anything unusual should be reported to him immediately.

My analysis consisted of saying that the captain had been negligent by not enforcing his standing orders and that the crew had also been negligent by not following them. There had been ample warning of the coming wave conditions. My employers at that time said "Thank you Professor, send us your bill," and that was the end of that.

During this investigation, the opposition was provided with the deck log. They commented their expert had said that these events could not possibly have happened and that the entire thing was fiction. Fortunately, a search of the records found a ship headed in the opposite direction through the same area that reported similar events so that the properties of the report by the containership under investigation could be validated by an independent source.

**6th INTERNATIONAL
SHIP STABILITY WORKSHOP
October 13 – 16, 2002**

**TECHNICAL PROGRAM
PAPERS PRESENTED**

SESSION 1: THEORETICAL ADVANCES IN DAMAGE STABILITY

Organizers: **D. Vassalos & Y. Ikeda**

1. *Some Remarks on Theoretical Modelling of Damage Stability.* **N. Umeda, T. Kamo, Y. Ikeda**
2. *On the Modelling of Floodwater Dynamics and Its Effects On Ship Motions.* **A. Papanikolaou, D. Spanos**
3. *Model Experiments and Simulations of a Damaged Ship With Air-Flow Taken into Account.* **J. de Kat, L. Palazzi**
4. *Damaged Ship Hydrodynamics.* **D. Vassalos, A. Jasionowski**
5. *A Methodology for Design Evaluation of Damage Stability.* **H. Cramer, J. Tellkamp**

**SESSION 2: APPROACHES & STANDARDS FOR ASSESSING
DAMAGE SURVIVABILITY**

Organizers: **A. Papanikolaou & A. Jasionowski**

1. *A Performance-based Assessment of the Survival of Damaged Ships – Final Outcome of the EU Research Project HARDER.* **R. Tagg, C. Tuzcu**
2. *On the Probability of Capsizing in Transient Flooding Conditions.* **A. Papanikolaou, D. Spanos**
3. *Time-based Survival Criteria For Passenger Ro-Ro Vessels.* **A. Jasionowski, D. Vassalos, L. Guarin**
4. *Large Passenger Ship Safety: Time to Sink* **R. van'tVeer, J. de Kat, P. Cojeen**

**SESSION 3: INTACT STABILITY IN FOLLOWING/QUARTERING
SEAS**

Organizers: **N. Umeda & A. Peters**

1. *Recent Research Progress on Intact Stability in Following/Quartering Seas.* **N. Umeda, A. Peters**
2. *Towards a Unified 6 DOF Maneuvering Model in Random Seas.* **Z. Ayaz, D. Vassalos, K.J. Spyrou, A. Matsuda**
3. *Enhanced Approach For Broaching Prediction with Higher Order Terms Taken into Account.* **H. Hashimoto, N. Umeda, A. Matsuda**

SESSION 4: THEORETICAL APPROACHES IN MODELING INTACT STABILITY

Organizers: **J. de Kat & K. Spyrou**

1. *On the Excitation of Combination Modes Associated with Parametric Resonance in Waves.* **M. Neves**
2. *Nonlinear and Stochastic Aspects of Parametric Rolling Modelling.* **A. Francescutto, G. Bulian**
3. *Extreme Roll Motion in Wide Frequency Range Due to Rapid Drift Motion.* **T. Kuroda, Y. Ikeda**

SESSION 5: SHIP DYNAMICS WITH WATER ON DECK

Organizers: **V. Belenky & J. Falzarano**

1. *Nonlinear Ship Roll Simulation with Water-on-Deck.* **V. Belenky, D. Liut, Y. Shin, K. Weems**
2. *Analysis of the Dynamical Behavior of an Offshore Supply Vessel with Water on Deck.* **J.M. Falzarano, M. Laranjinha, C. Guedes Soares**

SESSION 6: EXPERIMENTAL INVESTIGATION OF INTACT STABILITY

Organizers: **L. Thomas & M. Neves**

1. *Experimental Analysis on Parametric Resonance for Two Fishing Vessels in Head Seas.* **M. Neves, N. Perez, O. Lorca**
2. *Experimental Tests on Ships with Large Values of B/T, OG/T and Roll Period.* **A. Francescutto, A. Serra**
3. *Experimental Techniques to Assess Instability of High-Speed Planing Craft – Non-zero Heel, Bow-Diving, Porpoising and Transverse Porpoising.* **T. Katayama**
4. *Experimental Wind Tunnel Tests on Large Passenger Ships.* **A. Serra**

SESSION 7: STABILITY STANDARDS: THE WAY AHEAD

Organizers: **A. Francescutto & R. Tagg**

1. *Summary of the IMO Working Group on the Revision of Intact Stability Code.* **A. Francescutto**
2. *An Investigation into Head Sea Parametric Rolling of a Post-Panamax Containership.* **W.N. France, C. Moore, T.W. Treacle**
3. *Building an Alternative to the Weather Criterion.* **K.J. Spyrou**
4. *Towards the Direct Assessment of a Ship's Intact Stability.* **H. Cramer, J. Tellkamp**

SESSION 8: FISHING VESSELS STABILITY SAFETY

Organizers: **B. Johnson & W.A. Cleary, Jr.**

1. *Research Opportunities Identified During the Casualty Analysis of the Vessel ARCTIC ROSE.* **G.A. Borlase**
2. *Development of a Risk Based Fishing Vessel Stability Criteria - A Methodology Based on Scalable Model Tests.* **B. Johnson, S. Grochowalski**
3. *Small Fishing Vessel Intact Stability Analysis. Small Fishing Vessel Intact Stability Guidance to the Crews. Where Are We Now? Where Are We Going?*
J. Womack

SESSION 9: OPERATIONAL ASPECTS OF STABILITY SAFETY

Organizer: **P. Alman**

1. *Capsize Probability Polar Plots for Ship Operator Guidance.* **K. McTaggart, P. Carnie, R. Maze, D. Witzke**
2. *Integrated Systems for Ship Handling and Hull Monitoring Of Hull Loads.* **W. Kauczynski, S. Steen**

PLENARY SESSION 1: PREVENTION OF EXCESSIVE ROLL

Organizers: **R. Compton & K. McTaggart**

1. *Numerical Prediction of Z-Drive Roll Reduction Capability.* **E. Thornhill, D. Bass, J. Millan**
2. *Prediction Methods of Roll Damping and Their Application to Determine Optimum Stabilization Devices.* **Y. Ikeda**

PLENARY SESSION 2: EVOLVING CFD APPLICATIONS IN THE STUDY OF SHIP CAPSIZING

Organizers: **A. Troesch & J. Matusiak**

1. *Transient Motion of Ship During Hard Grounding*
J. Matusiak, P. Varsta
2. *A Perspective on the Progress and Role of RANS Codes for Predicting Large Amplitude Ship Motions.*
J. Gorski
3. *A Numerical Study on Complicated Motions of Two-dimensional Floating Bodies.* **S. Naito, M. Sueyoshi**
4. *Simulation of Damage Stability in Waves – Demonstration of the Time-Domain Simulation Program Developed at KTH.*
M. Schreuder

**COMMENTS ON THE 6TH INTERNATIONAL SHIP STABILITY
WORKSHOP**, by Dr. Willard J. Pierson, Jr.

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