# A SUDDEN DISASTER – IN EXTREME WAVES.

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**Abstract for Rogue waves 2000 workshop, Brest, 29 - 30 November**

## 1. Introduction.

Loss of a large norwegian ship with the entire crew in the middle of the North Atlantic is not a common event. However at a special occasion two large norwegian bulk ships M/S ”NORSE VARIANT” and M/S ”ANITA” disappeared at the same time at the same location. Both ships passed Cape Henry with only one hour interval in time on voyages from the U.S.A. to Europe. Both ships came right into the center of a very extreme weather event with a strong low pressure giving 15 m significant wave heights and mean wave periods close to 10 seconds and strong northerly winds with wind velocities near 60 knots. ” NORSE VARIANT” had deck cargo that was damaged and moved by water on deck with the result that a hatch cover was broken and left open. The ship took in large amounts of water and sank before an organised evacuation was finished. Only one member of the crew was rescued on a float.

”ANITA” disappeared completely at sea with the whole crew and no emergency call was ever given. The Court of Inquiry then concluded that the loss can be explained by an event in which a very large wave suddenly broke several hatch covers on deck, and the ship was filled with water and sank before any emergency call was given.

## 2. Summary of research on freak waves linked to ship and offshore accidents.

The wave that caused the loss of ”ANITA” was probably a freak or rogue wave. In our research we have defined a freak wave as a wave with a zero-downcrossing wave height that exceed 2 times the significant wave height. A crusial question is then:

***Will the freak or rogue wave that hits the ship be a breaking wave ?***

It is not possible to characterize the severeness of a particular sea state containing large random waves some of them even breaking using only traditional parameters height and period of the individual waves. Experiences show that accidents occur if there is a quite unique exceedance of critical threshold values for several parameters simultaneously. Wave steepness seems to be a parameter at least as important as wave height, under some special circumstances even more important. Traditionally wave steepness of a random wave has been introduced as a ratio between total wave height and total wave length. However, in random sea many waves can occur with the same total steepness but different asymmetry, and thus some of them will be breaking others not. The random waves in a directional wind generaqted sea are clearly asymmetric both in the wind direction and in the vertical direction. In order to obtain a better description of freak waves and rogue waves, and in particular to distinguish if they are breaking or not a DATUM and 4 new wave parameters were introduced. Then the mean water level is taken as reference DATUM and crest front steepness, crest rear steepness and horizontal and vertical wave asymmetries are introduced see Kjeldsen & Myrhaug (1979) and I.A.H.R./P.I.A.N.C. (1986).

Accidents including a large number of severe heavy weather damages on ships and offshore structures were then collected in a WORLD DATA BANK from 3 sources:

1. **– Cargo ships, trawlers and passenger liners.**
2. **– NATO ships operating in the North Atlantic and North Pacific oceans.**
3. **- Experiences from the offshore industry.**

Ship capsizings caused by freak waves were mapped, however the actual waves that caused the accidents were normally not recorded. However freak or rogue waves with a capsizing potential were also measured and analysed from many places in the world.
The data bank contains now also a unique event recorded on radar in which 2 FREAK WAVES follows each other. A capzising can easily occur if a small ship is exposed to such a scenario.
Analysis of the data bank showed that freak waves often occur in a pattern with opposing ocean currents. For this reason a series of extensive model experiments were performed with deep water waves focusing into large giant waves on opposing currents.
A kinematic model was also established in order to predict both wave kinematics and wave impact forces and global wave forces caused by the wave crests of such giant waves. These kinematic and wave force models were then confirmed by extensive model testing and full scale sea trials.

## 4. Learning from ship accidents.

The research work related to establishment and analysis of the WORLD DATA BANK, has shown certain patterns and risk elements that should be taken into account by:

1. **– Ship officers.**
2. **– Naval Architects and designers.**

Thus it became obvious that there is a great need for further research in this area.

## 5. References.

Kjeldsen S.P. 1997:" Examples of Heavy Weather Damages Caused by Giant Waves." Bulletin of the Society of Naval Architects of Japan. Vol 820-1997/10. pp 24-28.
Kjeldsen S.P., Myrhaug D. 1979:» Breaking Waves in DeepWaters and Resulting Wave Forces.» Paper No. 3646.Proc. 11th Offshore Technology Conference. Houston, Texas. U.S.A.
I.A.H.R./P.I.A.N.C. 1986: "List of Sea State Parameters. Supplement to Bulletin No 52.".

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Compared with full scale sea trials, with all hydroelastic effects taken into account.

EXPERIENCE DESIGNER ( Faulkner)

CONCLUSIONS
Freak weather events.
Performace of norwegian ship officers – need for education ship handling in very severe weather.

REF:
JAPAN

CONTACT !