

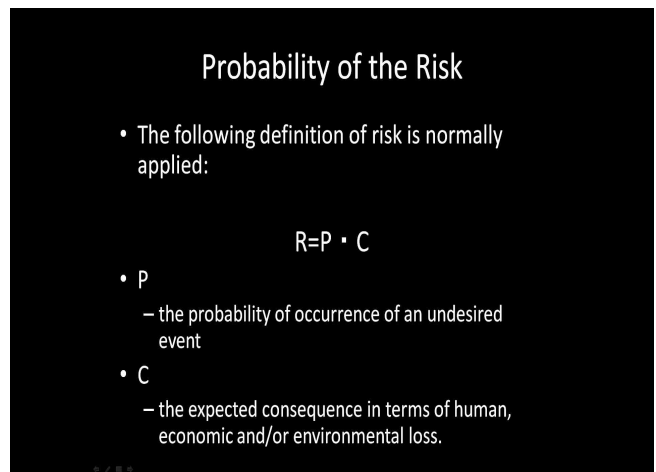
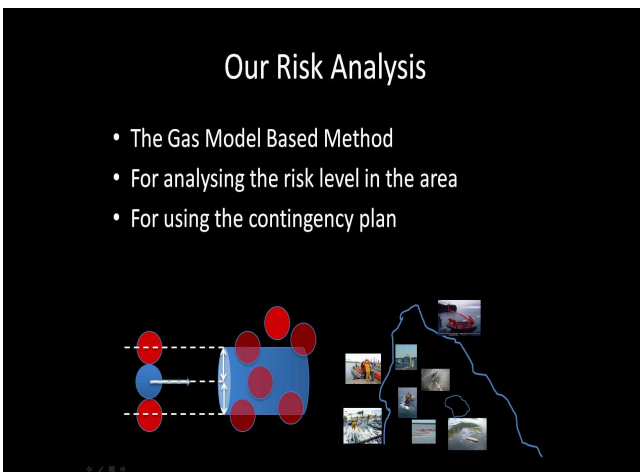
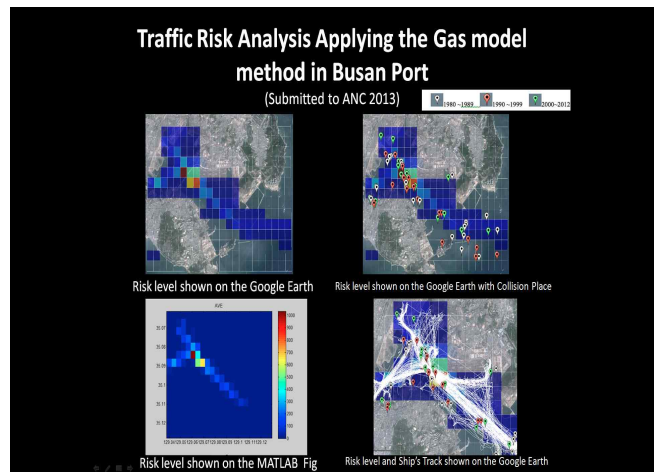
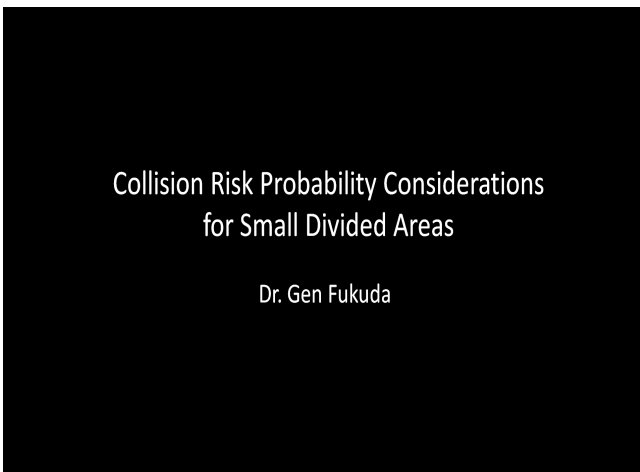
Collision Risk Probability Considerations for Small Divided Areas

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Abstract : In order to determine the collision risk, the probability estimation is very important part for accurate risk estimation. Recently, the collision risk at the Busan North Port is studied for making the risk map by authors. The result has been found some connections with previous collision places. For more precise estimation, the probability calculation is necessary. Recently the Bayesian matrix is mainly used for calculating the probabilities. Also considering the oil spill risk with tankers, ships' speed, relative angle and ships' size are key aspect whether breaking the double hull or not. This research presents the way of estimating the probabilities in other research and also the collision risk probability considerations for small divided areas.

Keyword : 항로표지, 시뮬레이터, 시각표지, 3D 모델링, 광달거리



The Way of Causation Probability Estimation

- Fault Tree Analysis or event tree analysis
- Bayesian Matrix

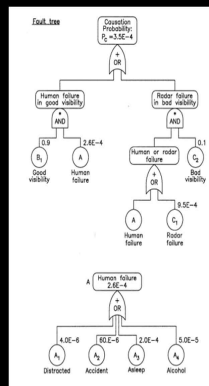
Bayesian Networks

- Bayesian Networks are used to get estimates of certainties or occurrence probabilities of events that cannot or are too costly to be observed directly.
- Bayesian Networks are directed acyclic graphs that consist of nodes representing variables and arcs representing the dependencies between variables.
- It can also be used as an aid in decision-making under uncertainty (Influence Diagrams).

Fault Tree and Event Tree Analysis

- Fault tree analysis
 - Seeks the causes of a given event
- Event tree analysis
 - Seeks the consequences of a given event

The human factor model does not capture the relevant tasks that must be considered.



Fault tree example

Haugen, S. "Probabilistic Evaluation of Frequency of Collision Between Ships and Offshore Platforms"

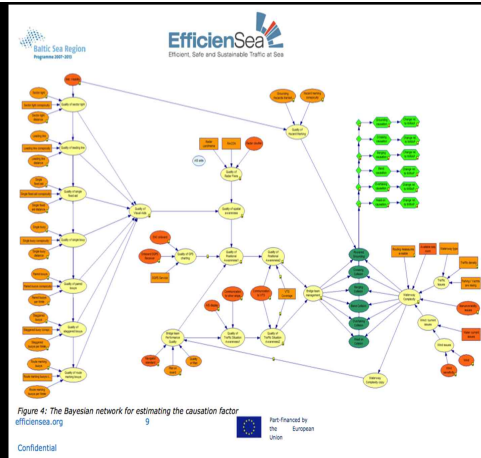


Figure 4: The Bayesian network for estimating the causation factor

efficiensea.org Part-financed by the European Union

Fault tree and Event tree analysis

- It is difficult to include conditional dependencies and mutually exclusive events in a fault tree analysis
- The size of an event tree increases exponentially in the number of variables.
- If including the primary failure mechanism, the global model becomes so big and not practically possible to use.

Bayesian Network

- Recently the Bayesian Network is used in many place.
 - IALA Risk Management Tool for Ports and Restricted Waterways
 - EfficienSea Risk Analysis
 - Formal Safety Assessment in the IMO (MSC/81/18-1)
 - Several risk analysis research

For our research??

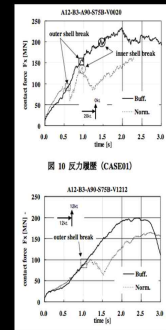
- For making own Bayesian Network, many opinion need to be collected from professionals such as navigators.
- There would be required the professionals in network modelling, ship traffic simulation and risk analysis.
- Republic of Korea has some unique characteristic such as archipelago.
- There might need develop the risk analysis tools suitable for Korean Sea Environment.

Considering Oil Spills



- Several research and also IMO estimated oil out flow by the collision.
- Few research are carried out for the area risk.
- Within the certain speed, the double hull's inner side is not broken

(Hisayoshi E, et al. "Research on the Buffer Bow Structure to Prevent Oil Outflow from a Struck Tanker")



Conclusion

- It is possible to use the causation probability by other researches however it might be good to have the causation probability suitable for the R. O. Korea sea by using Bayesian Network modelling.
- Considering the oil spill risks, ships' size, ships' speed and collision angle are hugely affected to break the double hull.
- 3 to 5 years might be required to complete the research in this area.