

ME290

**Global Engineering Professional
Seminar**

Problem Solving, Root Cause Analysis, Risk
Management

Lecture-2



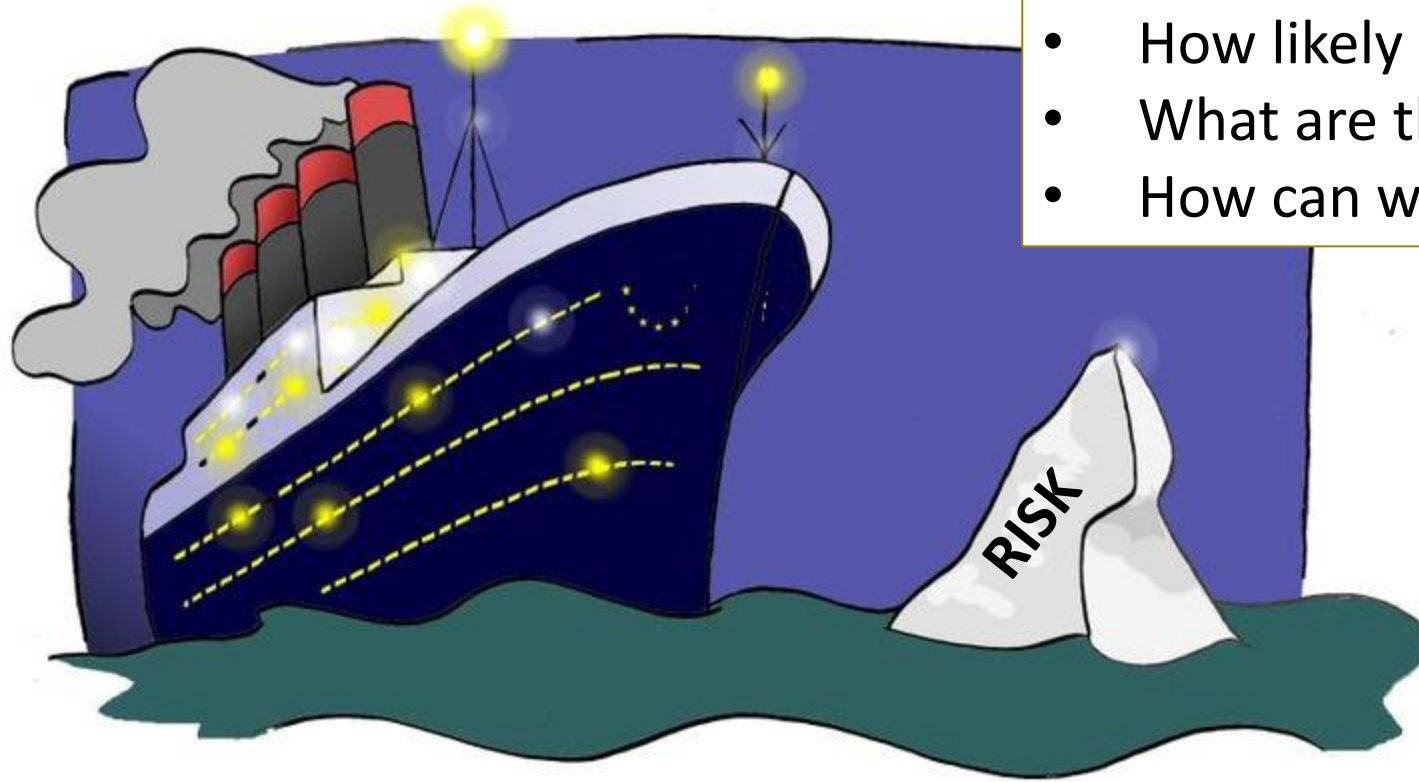
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Risk Management

Risk : the possibility of something bad happening*

- What can go wrong?
- How likely is it to happen?
- What are the consequences?
- How can we avoid/reduce it?

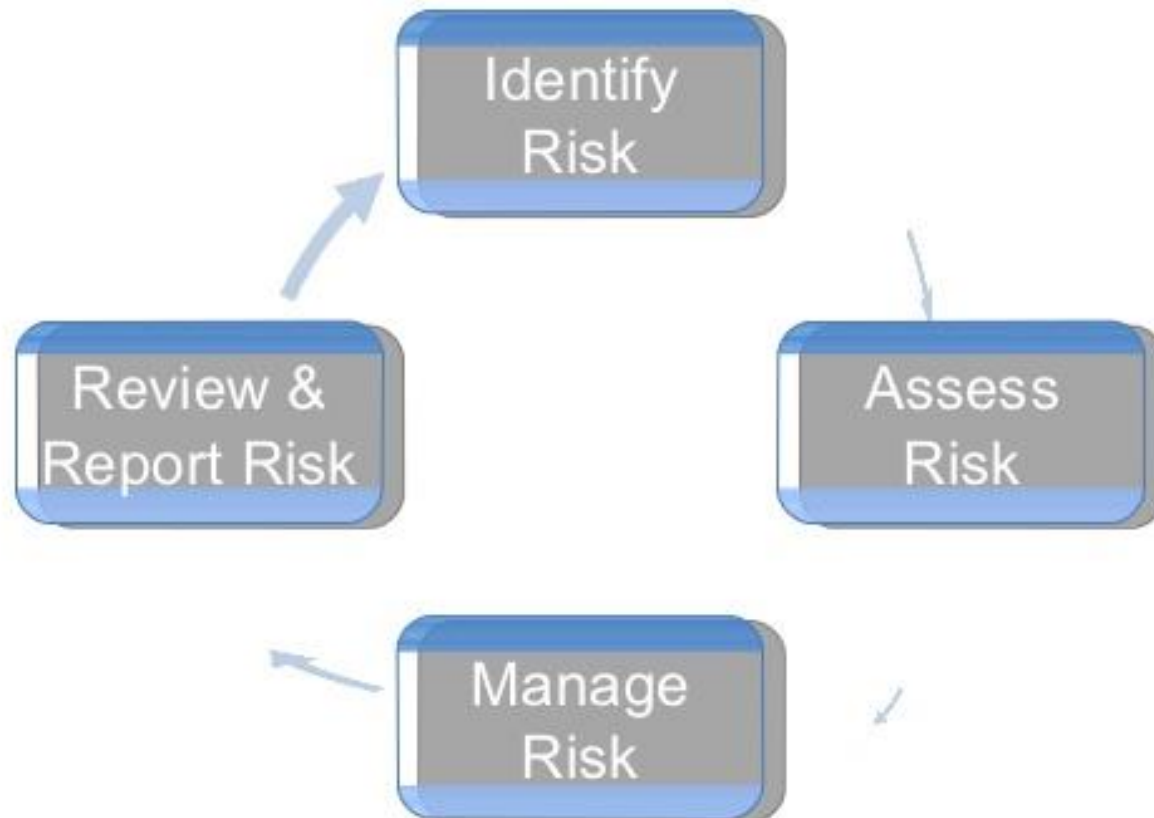




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Risk Management Steps



Risk Definitions

RISK ANALYSIS: Systematic use of available information to identify hazards and to estimate the risk

RISK ASSESSMENT: A risk analysis followed by a risk evaluation

RISK CONTROL: Controlling the residual risk by means of risk reduction measures

RISK EVALUATION: Procedure based on the risk analysis to determine whether the tolerable risk has been achieved

Step 1. Identify Risk

- What can go wrong?
- What can be a probable Hazard?
- What kind of unwanted scenarios we may have? Delay? Cost increase? Not meeting requirements?

Example (Titanic Case):

Risk Identified: Collision with Iceberg

Probability: Likely in the North Atlantic

Consequence: Deadly





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Step 2. Assess the Risk

Impact (Consequence)	Probability (Likelihood)	1 Extremely unlikely	2 Likely	3 Extremely likely
1 Not critical		1	2	3
2 Significant		2	4	6
3 Fundamental to continuing operations		3	6 (TITANIC)	9

Impact x Probability = **Risk score**

Risk Score = (3x2)= 6 for TITANIC case

Priority

Low
Medium
High



Step 3. Manage Risk

How to Eliminate/Reduce the Risk?
or accept if not critical.

Example (Titanic Case):

- Apply Safety rules in Design
- Use radar/sonar technology
- Get iceberg-monitoring info
- Improve visual observation
- Reduce speed if low visibility
- Better process of data
- Better team management
- Faster decision making

Actions to take against Risks



Step 4. Review and Report Risk

Description of Risk
Probability (Low/Med/High)
Impact (Low/Med/High)
Rating (score)
Risk Owner
Strategy to deal with Risk – (accept, treat, transfer, avoid, take the opportunity)
Cost \$
Cost Time
Frequency of Review
Re-assessor

- Document the Risk Studies on steps 1-4
- Make a plan for actions on risks
- Assign responsibilities for risks
- Assign dates for completion
- Review periodically the status of actions on risks
- In reviews: Close actions if risks are eliminated, open new actions if risks are not eliminated or reduced to acceptable level



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Risk Plan/Tracking template

#	Risk Event Description What is the event?	Category Sub-project, Project Phase, Location etc. (Optional)	Impacts						Risk Event Drivers What are the conditions, actions, or events that are likely to trigger the risk event to occur or is a leading indicator to the risk event occurring?	Response/ Mitigation Strategy What action(s) will be taken to limit the likelihood of these event occurring or limiting the impacts?	Contingency Plan What action(s) will be taken if this event occurs?	Owner	Risk Timeframe Critical date(s) or period of exposure	Organizational or Cross- Project Impacts	Comments
			Likelihood	Schedule	Cost	Quality	Safety	Scope							
1	Insufficient number of skilled internal technical resources available to support the development of the new system.	Development	H	H	H	M	L	L	75 + Drivers to monitor: - Development schedules slips - Excessive overtime is needed to keep pace with the schedule - High number of quality errors discovered during the testing cycle Drivers that have occurred: -	Planned Actions: - Train additional internal resources - Hire additional contractors - Add contingency to the budget to allow for overtime work Completed Actions: -	Planned Actions: - Outsource portions of the development to an outside vendor - Adjust project schedule and budget	Jane Smith	3/1/11 - 6/30/11	Yes	
2									0 Drivers to monitor: - Drivers that have occurred: -	Planned Actions: - Completed Actions: -					
3									0 Drivers to monitor: -	Planned Actions: -					

In a Risk Plan/Tracking template, typically below items are found:

- Risk event description
- Risk scoring
- Risk event drivers
- Risk mitigation action/strategy
- Contingency plan
- Owner of risk and actions
- Timeframe
- Comments

Could ISO 31000 Risk Management Guidelines have saved the Titanic?

ISO 31000 - Risk management

Risks affecting organizations can have consequences in terms of economic performance and professional reputation, as well as environmental, safety and societal outcomes. Therefore, managing risk effectively helps organizations to perform well in an environment full of uncertainty.

ISO 31000:2018

ISO 31000:2018, *Risk management – Guidelines*, provides principles, framework and a process for managing risk. It can be used by any organization regardless of its size, activity or sector.

Using ISO 31000 can help organizations increase the likelihood of achieving objectives, improve the identification of opportunities and threats and effectively allocate and use resources for risk treatment.

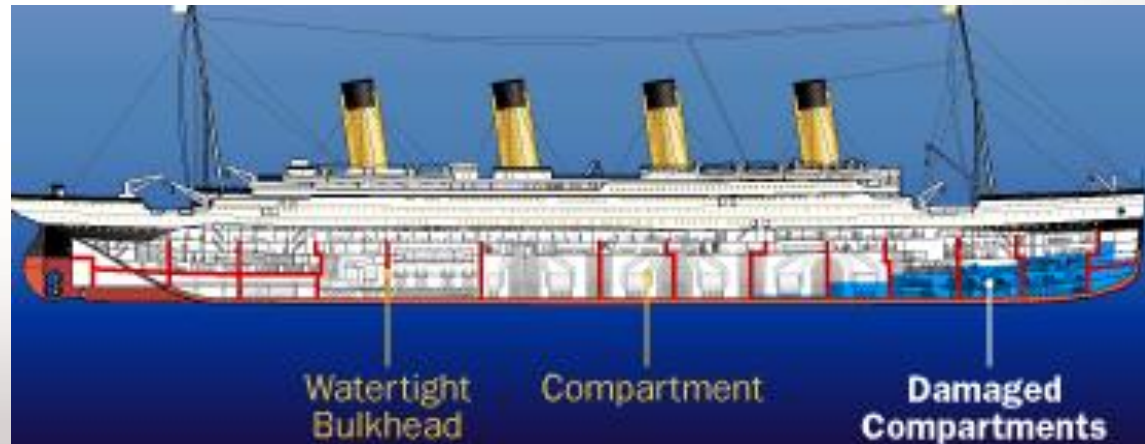
<https://www.iso.org/iso-31000-risk-management.html>

ISO 31000 Risk Management Guidelines Could have saved the Titanic

ISO 31000, Section 5.4.2, warns us that “**Risk identification** should include examination of the knock-on effects of particular consequences...”

CAUSE #1 THAT THREATENED THE TITANIC – **INADEQAUTE DESIGN**

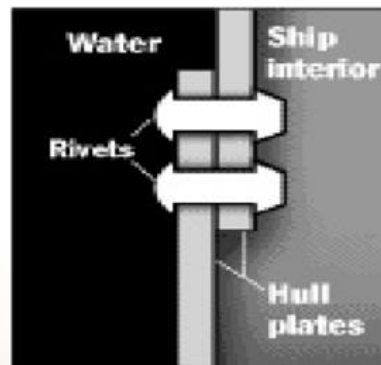
Titanic’s design was with many errors. It had many so-called “waterproof compartments” but they were open at the top, like an ice cube tray. It had far too few lifeboats, a result of cost cutting efforts during the design phase. It had a double bottom but it did not extend up to the waterline, which would have provided protection against a side-swiping iceberg.



ISO 31000 Risk Management Guidelines Could have saved the Titanic

CAUSE #2 THAT THREATENED THE TITANIC – **BAD QUALITY RIVETS**

Titanic required 3 million rivets to hold her together. Archives tell us at that time there was a shortage of riveters and the necessary materials to create high quality rivets. So they used lower quality rivets. Brittle rivets in the impact area popped off and allowed water to rush in the hull at a very high rate.



1. The rivets were used to seal the hull plates together, with the hammered end on the exterior.



2. Pressure from the iceberg collision may have caused the rivets to pop along some hull plates, causing the seams to open.



3. The total area open to the sea may have been no bigger than a closet door, through which 34,000 tons of water seeped.

ISO 31000 Risk Management Guidelines Could have saved the Titanic

CAUSE #3 THAT SANK THE TITANIC – **BOAT OPERATION AND EVACUATION ERRORS**

Titanic was cruising near top speed, which was very risky on a moonless night through an area with active iceberg warnings. Just hours before the disaster, a Lifeboat practice/exercise was cancelled by the Captain for no apparent reason. It was suspected that they were attempting to break a cross-Atlantic speed record. The Titanic sank in less than 3 hours. 1,502 people perished after a disorganized evacuation event filled the far too few lifeboats to just 61% of their total capacity.



Product Risk

Engineers need to consider RISKS on the safety issues of their Designs in human-product interaction



Design with safety regulations, put guards add warning label etc.



Products Liability: Risk Understanding



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Risk Preventative Actions

BAD

No sign, no protection



BETTER

Sign not enough



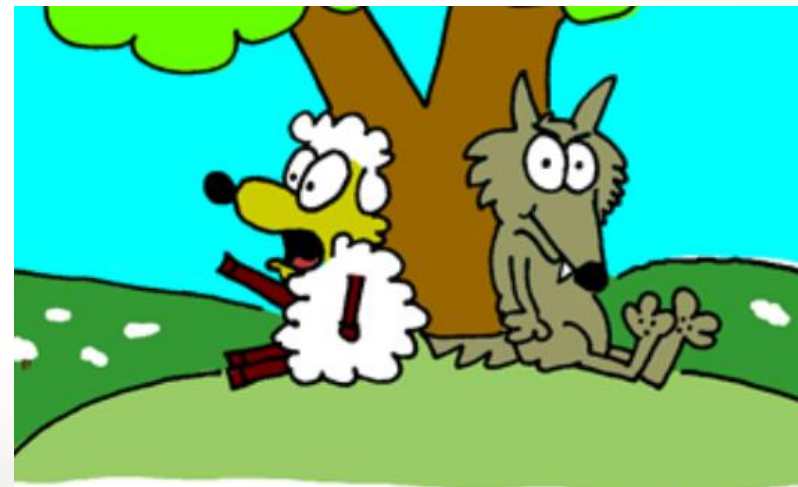
GOOD

Sign and Protection



Summary

- Problem Solving is a part of Engineer's life
- Using tools and techniques to solve the problems makes life easier
- Try to use/search/adopt problem solving tools and techniques in problems encountered
- Apply Risk Management system for products design, projects, operations, management etc.



"This year, I resolve to stay away from unnecessary risks."