



# Goal Based Standards and the “Safety-Level Approach” debate

Harilaos N. Psaraftis

Professor

National Technical University of Athens



# The drive for greener shipping

- Focus on safety
- Focus on environment
- Focus on prevention
- Be proactive

# The need for 'proactive' regulation

- **Early stage** identification of main factors that affect safety
- Development of regulatory action to **prevent** undesirable events
- Formulation of regulation **BEFORE** event
- Formulation of regulation **AFTER** careful analysis of **all** of its implications

# [Parenthesis:

- Much of the story thus far is quite the opposite
- Many regulations have been adopted **ad hoc** in the aftermath of catastrophic accidents
- *Exxon Valdez, Estonia, Erika, Prestige,*  
and so on. ]

# The long road from reactive to proactive regulation

- **Formal Safety Assessment** (some time now)
- **Goal Based Standards** (quite recently)

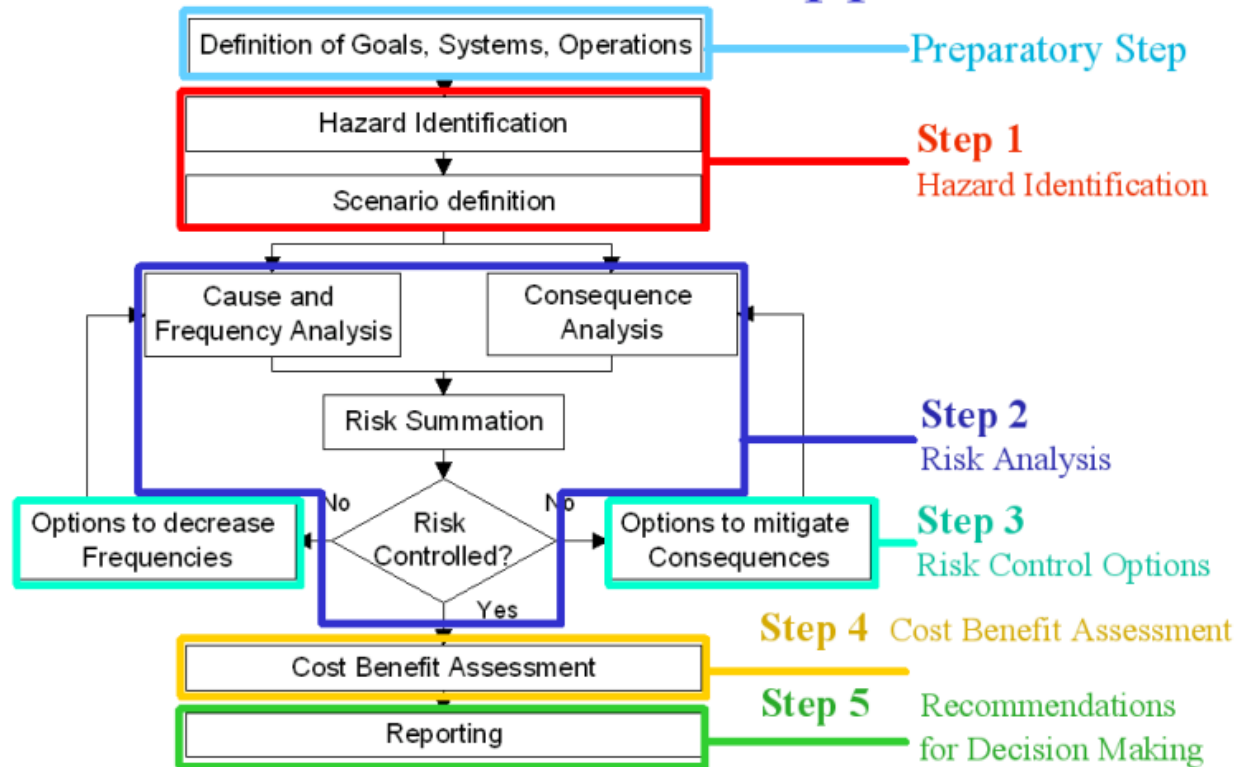
# Formal Safety Assessment (FSA)

FSA was introduced by the IMO as

- “a rational and systematic process for accessing the risk related to maritime safety and the protection of the marine environment and for evaluating the costs and benefits of IMO’s options for reducing these risks” (FSA Guidelines in MSC circ. 1023, MEPC circ. 392)

# FSA steps (IACS – MSC 75)

## FSA - a risk based approach



# Highest profile example (2004)

- Use of FSA within IMO, to decide not to mandate double hulls on bulk carriers
- FSA was critical in IMO's reversal of prior position on this issue



# Goal Based Standards (GBS)

- Proposed to IMO by Greece, Bahamas and IACS (2004)
- Main objective: Introduce a system of **standards**, as measures against which the safety of a ship could be assessed during its design and construction, as well as later on during its operation
- Basic premise: Standards should be broad, over-arching **goals** against which ship safety should be verified
- They are NOT intended to set prescriptive requirements or to give specific solutions.
- For the moment, work on GBS focuses on **SHIP CONSTRUCTION**

# Prescriptive vs GBS rule making

- Hull bottom plate for tankers
- Prescriptive:  
Plate thickness  $\geq X$  mm
- Goal based:  
Plate should not fail during tanker's life of  $Y$  years if operated in a specific environment (eg, North Atlantic)

# GBS: A five-tier approach

- Tier I: Goals
- Tier II: Functional requirements
- Tier III: Verification of compliance
- Tier IV: Technical procedures and guidelines, classification rules and industry standards
- Tier V: Codes of practice and safety and quality systems for shipbuilding, ship operation, maintenance, training, manning, etc.

# The GBS “safety level approach” debate

- Should the “safety-level approach” be used within GBS?
- Should GBS be “risk based”?
- Should GBS use FSA and other risk techniques?
- If yes, how?
- Etc, etc

# Why the debate?

- No question that risk-based principles are central for modern maritime safety regulation
- FSA and GBS have developed thus far in parallel
- But many linkages between FSA and GBS exist
- It is only natural that the “safety-level” arsenal be used in GBS
- The real question: **HOW, and WHEN?**

# Possible GBS-FSA linkages

GBS	FSA
Tier I (Goals)	Step 1 (HAZID) Step 2 (Risk Analysis)
Tier II (Functional requirements)	Step 2 (Risk Analysis) Step 3 (RCOs)
Tier III (Verification of compliance)	Step 4 (Cost benefit assessment) Step 5 (Recommendations)
Tier IV (Technical procedures and guidelines, classification rules and industry standards)	Step 3 (RCOs) Step 4 (Cost benefit assessment) Step 5 (Recommendations)
Tier V (Codes of practice and safety and quality systems for shipbuilding, ship operation, maintenance, training, manning, etc)	Step 3 (RCOs) Step 4 (Cost benefit assessment) Step 5 (Recommendations)

# “Safety-level approach” glitches

- Are there areas where SLA exhibits deficiencies (or glitches), which should be rectified **before** use in GBS?
  
- Answer: **Of course!**

# The “individual risk” glitch

## § Individual risk acceptance criteria

- BASIC QUESTION: what is the tolerable level of risk for an individual?
- Answer (incredible as it may seem):  
Neither the IMO, nor any other body has yet a definite position on this issue!
- Whatever exists today is only indicative



# From IMO's FSA guidelines

(adopted in 2002, amended in 2006):

Maximum annual tolerable risk of death  
**(INDICATIVE FIGURES ONLY):**

- For crew members: 1/1,000
- For passengers: 1/10,000
- For third parties or public ashore: 1/10,000

Negligible risk: 1/1,000,000

# Comparison to air transport

- Chance of being involved in a fatal air crash: 1 in 8 million per flight on 1<sup>st</sup> world airlines (Barnett, 2006)
- Take a flight every day: expected time until death is 22,000 years
- Take 8 flights a year: annual risk of death is 1/1,000,000
- Why is a ship passenger allowed an annual risk 100 times higher? (1/10,000)
- **Are maritime transport travellers second class citizens?**

# The “risk index” glitch

From FSA guidelines (MSC circ. 1023, MEPC circ. 392):

Frequency Index			
FI	FREQUENCY	DEFINITION	F (per ship year)
7	Frequent	Likely to occur once per month on one ship	10
5	Reasonably probable	Likely to occur once per year in a fleet of 10 ships, i.e. likely to occur a few times during the ship's life	0.1
3	Remote	Likely to occur once per year in a fleet of 1000 ships, i.e. likely to occur in the total life of several similar ships	$10^{-3}$
1	Extremely remote	Likely to occur once in the lifetime (20 years) of a world fleet of 5000 ships.	$10^{-5}$

Severity Index				
SI	SEVERITY	EFFECTS ON HUMAN SAFETY	EFFECTS ON SHIP	S (Equivalent fatalities)
1	Minor	Single or minor injuries	Local equipment damage	0.01
2	Significant	Multiple or severe injuries	Non-severe ship damage	0.1
3	Severe	Single fatality or multiple severe injuries	Severe damage	1
4	Catastrophic	Multiple fatalities	Total loss	10

# [Parenthesis:

- 10 severe injuries equivalent to 1 fatality
- No distinction for  $> 10$  fatalities
- This means that 50, 100, 1000, 3000, or more fatalities are equivalent to 10. ]

# Risk index $RI = FI + SI$

- Risk = Frequency X Severity

		Risk Index (RI)			
FI	FREQUENCY	SEVERITY (SI)			
		1	2	3	4
		Minor	Significant	Severe	Catastrophic
7	Frequent	8	9	10	11
6		7	8	9	10
5	Reasonably probable	6	7	8	9
4		5	6	7	8
3	Remote	4	5	6	7
2		3	4	5	6
1	Extremely remote	2	3	4	5

# Paradox

Once a month (FI=7), an accident leads to an injury (SI=1). This means that **RI=8**.

Within a year in a 1,000-ship fleet (FI=3), an accident leads to more than 10 deaths (SI=4). This means that **RI=7**.

- Why is 2<sup>nd</sup> scenario less serious than 1<sup>st</sup>?!

# Diagnosis

- Concept of risk is inherently 2-dimensional (probability, consequence)
- But Risk Index is 1-dimensional
- Collapsing to 1 dimension loses much of relevant information
- **Risk Index assigns more importance to high-frequency, low-consequence events, and less to low-frequency, truly catastrophic events**

# The “Political risk”..

- .. is that regulations that are promulgated may be more tailored to high-frequency, low-consequence scenarios than to low-frequency, truly catastrophic scenarios.
- One would need a way to cover both cases.



# The “Common Structural Rules” glitch

- Do new rules increase safety?
- IACS: Of course!
- UGS: No! (serious reservations)
  
- My opinion: **We don't really know**, as the level of safety of old rules is still not known (let alone safety level of the new rules)
- Also: Legislating **without environmental impact assessment?**

# The “environmental” glitch

- Very important issue
- So far no FSA study has tried to assess environmental risk
- Cost to Avert one Tonne of Spilled Oil (CATS)
- Project SAFEDOR estimates CATS at **\$60,000/tonne**
- Lots of assumptions used
- Issue just under discussion at IMO



# To arrive at \$60,000:

Per tonne cleanup costs assumed:

- constant with spill size
- independent of oil type, ie, a generic oil type is assumed
- constant within certain locations
- independent of all other factors!

None of these assumptions can really be justified

# What \$60,000/tonne means

- Prestige 4.9 billion dollars (1,633)\*
- Braer 6 billion dollars (2,000)\*
- Torrey Canyon 8.5 billion dollars (2,833)\*
- Haven 9.9 billion dollars (3,300)\*
- Amoco Cadiz 16 billion dollars (5,333)\*
- Castillo de Bellver 17.8 billion dollars (5,933)\*
- Atlantic Empress **19.7 billion dollars!** (6,567)\*

\*equivalent fatalities (assuming \$3M/fatality - IMO)

# Suggestion

- The \$60,000/tonne figure for CATS is unrealistic (or any other single figure for that matter)
- Additional work is required to develop environmental risk assessment criteria

# More issues to be looked at?

- YES!
- Full agenda at IMO
- Correspondence group on GBS for Tankers and Bulk Carriers
- Correspondence group on GBS-Safety Level Approach
- Submission by Greece on revision of FSA guidelines
- Next discussion: MSC82, Istanbul (11-12/06)

# Conclusions

- Basic question: Will “Safety-level approach” to GBS be developed correctly?
- If **yes**, road ahead is difficult (but worth taking)
- If **no**, road ahead may be easy (but outcome risky)

# References (some)

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# For more info:

- [www.martrans.org](http://www.martrans.org)
- Section 'library'
- Page 'maritime safety'



Thank you very much!