ROUND TABLE DISCUSSION: "THE VIRTUOUS CIRCLE OF MARTIME SAFETY"

The International Maritime Organisation (Tom Allan)
The European Commission (Claudia Vivalda, Research Directorate General)
A Classification Society (Mario Dogliani, RINA)
A Shipping Company (Rolf Kjaer, Color Line)
A Towing Tank (Jan deKat, MARIN)
A Shipyard Design Office (Gianfranco Bertaglia, Fincantieri, Trieste)
A University (Apostolos Papanikolaou, NTUA)
The ITTC Stability Committee (Dracos Vassalos, NAME –SSRC, Chairman)

SUMMARY

This round table discussion attempts to address and discuss what is in essence a simple question: conceptualising the safety regime as a "wheel" with the number of stakeholders involved as the "teeth" of this wheel, what would be needed to render it virtuous, aiming at maximising maritime safety cost-effectively? Following a description of the said regime, the views of the key players in our industry are presented with the view to providing the stimuli for a constructive discussion in this fifth International Workshop on the "Stability and Operational Safety of Ships".

SAFETY REGIME [D. Vassalos]

The operation of merchant shipping is international, specialised and complex, currently governed by comprehensive rules and regulations developed by national and international authorities to provide a basis for common action. Legislation governing ship and environmental protection has progressed over time through a number of stages but in the main assurance of safety has always been sought through regulating widely existing best practices in ship design, construction and operation. In this evolutionary process, three co-existing and interacting ship safety regimes can be identified and are explained briefly next.

Punishment Regime: This relies on identifying and apportioning blame, frequently to the last person in the chain of events. The underlying principle is that the threat of punishment influences company and individual behaviour to the extent that safety gains a higher priority.
Compliance Regime: This constitutes the core of ship safety assurance today and involves mainly the regulation of ship safety by prescription with external rules.
Self-Regulation Regime: This concentrates on external management and organisation for safety and encourages individual companies to establish targets for safety performance. It is very much the result of a general acceptance by the shipping industry of the inadequacy of the previous two, to rely solely on regulations as a means of improving ship safety standards, and is in the heart of current and future developments. The adoption of the ISM Code, which became mandatory on 1 July 1998 by all IMO member states, constitutes an important step towards the establishment of a self-regulation regime.

The prevailing philosophy therefore is that of compliance, characterised by the following main steps and associated players:

Development of international instruments through the International Maritime Organisation (IMO)

IMO is an agency of the United Nations and has its headquarters in London. It was established in 1948 in response to the need for uniformity in shipping legislation with the task of developing a comprehensive body of international law dealing with maritime safety that would be applied by all shipping nations to ships under their flag. The IMO membership since then has grown to 155 countries, with more than 40 conventions, agreements and protocols developed in the process under the IMO aegis. The Maritime Safety Committee (MSC), which is responsible for all safety matters except marine pollution, has 12 sub-committees covering a wide spectrum of safety-related areas.

IMO have in the past been subject to criticism: too slow and by implication inefficient; a toothless tiger; responding to every crisis with a new piece of legislation; minimum standards fostered by a consensus approach; political rather than technical arguments often dominate. IMO, however, is undergoing major transformations involving changes in attitude, philosophy and approach to ship safety and environmental protection and this process is likely to continue at an accelerated pace. The legislation at IMO on ferries and the work of the Panel of Experts certainly demonstrated that IMO can move fast and the ISM Code and STCW Convention are clear indications of positive actions to improve safety.

Implementation of regulatory instruments by Ship Owners/Operators

With the exception of the master who has the ultimate responsibility for the safety of the ship, ship owners are top in the order of priority for the responsibility of implementing and maintaining safety standards. They

cannot, however, be relied upon universally and the existence of sub-standard ships is evidence to that. It is said that behind a sub-standard ship there is a sub-standard owner and it is common belief that enforcement and verification by the flag and port states and the classification societies are no substitute for the all-embracing responsibility of the owner. As with the safety regimes described above, it would be appropriate to classify the prevailing cultures of ship owners into the following three, Figure 1.

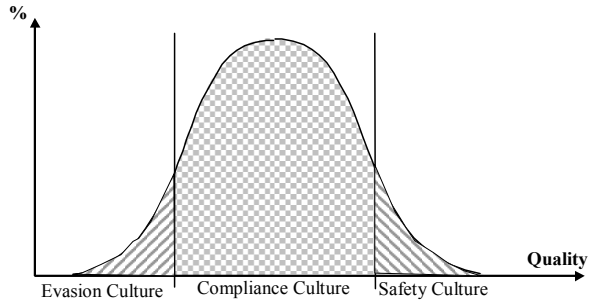


Figure 1: Ship Owners Prevailing Cultures Distribution

Evasion Culture: Evading rules and regulations, cutting corners. Taking the risk in the belief they can get away with it or yielding to economic pressures or as a result of failure in the enforcement and verification processes.
Compliance Culture: Simplistic compliance with prescriptive legislation is currently the industry norm aimed at satisfying minimum safety requirements and nothing more. The existence of this norm is demonstration of the passivity inculcated through prescription.
Safety Culture: Continuous safety improvements with safety becoming an almost subconscious priority and safe operation a matter of course.

Enforcement of regulatory instruments by Flag States and Classification Societies

Flag States
The next level of responsibility is that of the Flag State. Considering the tendency at IMO of adopting minimum standards, some countries enhance such standards through national rules and regulations. After all, the state has the ultimate responsibility, that of protection of human life. The duty and commitment of the state must not be confined to the satisfaction of IMO rules. Promotion of scientific research, improved vocational training, improved efficiency in port organisation, increased surveillance and assistance at sea are the duties of the state. The attitude of flag states to these duties and responsibility range quite widely. This is reflected in the casualty rates of individual flags, clear indication that regulations are implemented differently form country to country. The prevailing cultures of flag states could quite easily be classified in a way similar to the ship owners. In some cases, however, it is the lack of resources to enforce regulations that leads to evasion. "Flags of Convenience" are born out of the inability of a state to supervise the safety of its ships effectively. What is worrying in this respect is the fact that there is a significant number of flags of convenience with figures produced by the Institute of London Underwriters showing that, in general, registers with a higher percentage of total losses are expanding at the expense of those with a better safety record.

Classification Societies
Classification societies are independent, non-profit making organisations concerned primarily with the standards of construction and maintenance of ships. As such they contribute greatly to the advancement of the art and are a potential source of considerable technical experience gained worldwide. By means of the development of their rules for construction and periodical surveys they are in a position to influence the standards of ship construction and operation and their contribution to these matters and to ship safety generally has been considerable. Originally established to designate minimum standard, on which underwriters could rely before insuring a vessel as a form of risk management, they have in fact emerged as the unique arbiters of a standard, which is relied upon not only by underwriters but also by every section of the shipping community. In fact, from July 1998 an amendment to the SOLAS Convention comes into force making compliance with the classification society rules for ship structures and essential engineering systems a mandatory requirement. Notwithstanding this, today it is not possible for a ship to trade unless it is 'class maintained'. From this it follows that all vessels at sea (good or bad) are registered with one of the classification societies. Included among these are vessels, invariably brought to light by a casualty, the condition of which is such that they should not have been registered. In many cases it will transpire that the vessel is in possession of a special survey certificate of recent issue, notwithstanding the fact that numerous serious defects are long-standing. This is a serious problem facing all classification societies and it reflects the difficulty of maintaining consistent standards. The eleven major classification societies have a co-operative organisation, the international Association of Classification Societies (IACS), which enjoys consultative status with IMO, co-ordinates the policy of societies and issues unified recommendations for the standard to be applied in essential technical matters. In response, to the aforementioned criticism, IACS has developed a quality assurance concept, which all the members must comply with.

Verification of the proper implementation and enforcement of all applicable international requirements by Port States

Port state control is the first line of defence in the enforcement and verification of safety standards but can never be as effective as good flag state control, because

port states have to accept international certificates at face value unless there are clear grounds for disputing their validity. If not so, the ship owners are entitled according to SOLAS to be compensated if their ship is unreasonably delayed. Port state control alone has inherent limitations. Primarily it is a spot check but even when targeting those ships most likely to have shortcomings, it will be impossible to identify all substandard ships. Often it is impossible to inspect the holds if the ship is fully laden, and it may not be possible to assess fully the competence of those onboard.

General Remarks

This introspective look demonstrates that the prevailing safety regime is hard pushed to retain its integrity at the larger scale and allows for a worrying imbalance in the assurance for safety between property (ships and cargoes) and lives (seafarers and passengers). Those concerned with property have sophisticated insurance markets at their disposal, which compete for the insurance of ship and cargoes. The classification societies play a central role in this process in that they provide independent quality assurance to shipbuilders and expert advice to ship owners and insurers. The latter normally comprise a large percentage in the constitution of classification societies and are therefore in a position to either insist upon higher classification standards or quote higher premia for ships with greater risks. Thus, if ships and cargoes are lost, the sensible owners will be compensated by their insurers and, for their part, the insurers can make profit at any predictable level of risk. Therefore, ship loses are recorded, analysed and published, allowing the organisations concerned with classifying and insuring property to assess risk. By contrast, however, there is not a mechanism formal or informal in place to record systematically and assess the effectiveness of legislation aimed at improving the safety of life at sea. Fatalities have been reported since 1978 but not with the rigour necessary to draw conclusions from statistics. There are no incentives to do so.

This is a state of affairs that the marine industry simply could not afford as was amply demonstrated by the recent well-publicised ferry disasters. Furthermore, with passenger ships being built carrying 5,000 passengers such as the Eagle Class of the Royal Caribbean Cruise Lines, safety must become an integral part of ship design, construction and operation with the focus particularly on passenger safety. Added to this are the new challenges and new risks associated with the escalation of speed at sea. Historically, significant changes in the design, operation and management of ships have brought about new hazards and more casualties. Reliance on experience with conventional ships provided in most cases a cushion against impending disasters. But what is to be expected when this cushion is removed?

Could the answer to this question lie on what is (surprisingly) coming out from the IMO "furnace": ALTERANTIVE DESIGN AND SAFETY EQUIVALENCE? Could this approach provide the "fuel" that would make the wheel (Figure 2) of maritime safety turn?

Figure 2: The Virtuous Circle of Maritime Safety

SAFETY DRIVERS – PASSENGER SHIP SAFETY STAKEHOLDERS [A. Papanikolaou]

This input is wholly based on the MSC 70/INF paper on the Formal Safety Assessment (FSA) of Bulk Carriers, submitted by the United Kingdom to the Bulk Carriers Working Group. This has been properly amended to account for the fundamental differences between the Bulk Carrier's and the Passenger Ship's design and operation.

1 A key feature of the FSA methodology is that it should be able to recognize and account for the various interests and positions of those who will be affected by any changes to regulations resulting from the study.
2 *Interested entities or stakeholders, herein also understood as safety drivers,* are defined as any person, organization, company or state who is directly or indirectly affected by an accident or by the cost effectiveness of any proposed new regulatory requirements.
3 Stakeholders may be voluntary (e.g. ship owners) involuntary (e.g. cost state) or a combination of both (e.g. passengers, cargo owners). Similarly, the interests of stakeholders may be either beneficial or prejudicial in nature, or a combination of both. Stakeholders may be represented directly, indirectly or by representative groups where their interests are similar.
4 Each stakeholder creates and/or suffers a risk as a result of his involvement with the maritime venture and receives benefit and/or suffers cost of liability. The returns obtained by individual stakeholders will

not necessarily reflect their investment in the venture. Some stakeholders will obtain disproportionate returns in relation to the risk they create whilst others will obtain no return whatsoever. From this, the concept of Risk Balance is introduced, as shown in Figure 3.

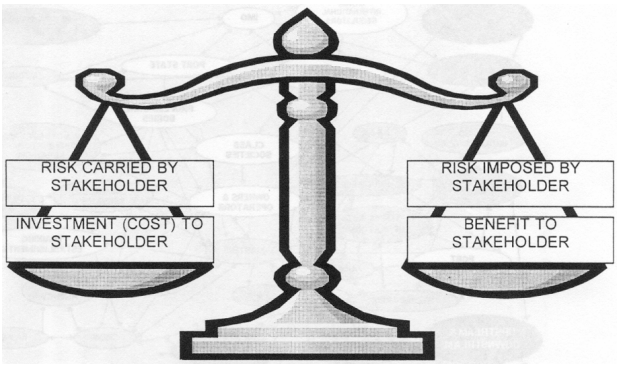


Figure 3: Concept of Risk Balance

5 Stakeholders with any degree of voluntary participation in the exercise will clearly expect that the benefit side of the balance will outweigh the cost side, however the proportion by which the benefit outweighs cost will generally be different for each stakeholder.

6 Ideally, the risks, costs and benefits derived from the maritime venture would be assessed for each stakeholder to determine whether the balance is equitable in relation to the other stakeholders. In practice, such an absolute solution would be very difficult to achieve due to historical factors. The final recommendations for the decision-making should, where practicable, seek to redress any imbalance between those stakeholders who impose risk and those who carry disproportionate risk in relation to the return they receive – i.e. the Risk-Imposer pays.

Stakeholder Map

7 The role of each stakeholder should be considered in the context of accident prevention and mitigation. The influences of, and interactions among, stakeholders should be assessed. In particular, a FSA study should recognize that the relative positions and prominence of stakeholders will vary at different stages of an accident (e.g. prior to, during and after).

8 The principal stakeholders of Passenger Ship operations have been identified and their interrelationships considered as shown in Figure 4 and listed with the effect of a casualty of their interests in Table 1 and 2.

9 It should be noted that only the principal influences are shown. Many secondary influences will be present in any given scenario.

10 Whilst legal services and consultants are considered stakeholders, it is considered that their influences may be represented on the influence map by those of their clients.

11 Only the principal insurance interests are shown. All stakeholders would probably have insurance cover (and many insurers would probably have re-insurance). As with legal and consulting services, insurance interests are considered to be represented on the influence map by their insurers.

12 Upstream and Downstream stakeholders are those stakeholders who are generally physically remote from the vessel but are affected by the consequences of an incident to it.

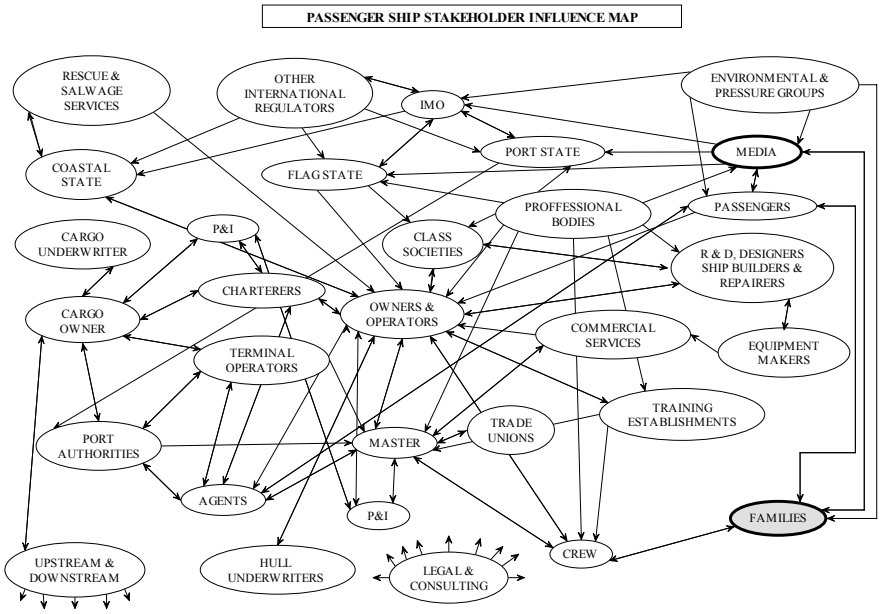


Figure 4: Stakeholder Influence Map - Passenger Ships

STAKEHOLDERS	EFFECT OF A CASUALTY
Owner, Operator or Manager	Loss of ship, direct and indirect loss of income (incl. possible losses in the stock market), loss of reputation, contract liabilities, employee liabilities and 3rd Party liabilities, possible indictment by jurisdiction.
Master	Loss of life, loss of reputation, loss of income, possible indictment by jurisdiction.
Crew	Loss of life and loss of income, possible indictment by jurisdiction.
Passengers	Loss of life and property.
Trade Unions	Representation expenses.
Families	Personal loss and loss of income.
Designers, Ship-builders & Repairers	Loss of reputation, liability and loss of income. Increase in income.
Equipment makers	Loss of reputation, liability loss of income. Increase in income.
I M O	Loss of reputation.
International Regulators	Loss of reputation.
Port State Control	Loss of reputation, possible indictment by jurisdiction.
Flag State	Loss of reputation, loss of income, possible indictment by jurisdiction.
Port Authority	Pollution, cost of removal of wreck and loss of income (trade).
Classification Societies	Loss of income and loss of reputation, possible indictment by jurisdiction.
Professional Bodies	Loss of reputation.
Training Establishments	Loss of reputation and loss of income.
Environmental and Pressure Groups	Increase of income, greater awareness.
Cargo Owner	Loss of goods, loss of income, loss of reputation, contract liability and downstream supply failure.
Charterer	Loss of income, contract liabilities and loss of reputation.
Terminal Operator	Damage to facility, disruption of facility and loss of income.
Hull Underwriters	Liability.
Cargo Underwriters	Liability.
P & I Club(s)	Liability.
Rescue Services	Possible loss of life and property damages (non-professional rescuers), 3rd party liability. Increase in income (professional rescuers)
Salvors	Increase in income.
Coastal State	Pollution and cost of removal the wreck.
Media	Increase in income and increase in ratings.
Legal Services	Increase in income.
Marine Consultants	Increase in income.

Table 1: Stakeholders

STAKEHOLDERS	EFFECT OF A CASUALTY
Regional & State Groups	Loss of trade. Additional trade.
Other Trading Nations	Additional trade.
Suppliers upstream	Loss of trade.
Alternative Suppliers	Additional trade.
Consumers downstream	Additional costs.

Table 2: Upstream & Downstream Stakeholders

Stakeholder Groupings

13 The stakeholders may be grouped into 'primary' groups to assist in identifying common interests and influences. This will serve to reduce duplication of effort in considering the effects of Risk Control Options (RCOs) on the various stakeholders. With each RCO, it will be necessary to verify that the grouping is valid. The FSA study should take account of the fact that Stakeholders within a group may not have exactly parallel interests and that the other Stakeholders and influences may emerge. The Stakeholder groups presently identified are:

.1 Owners & Operators;
.2 Staff and Support (Master, Crew, Crew Agency, Trade Unions, Families);
.3 Passengers (incl. families);
.4 Hardware (Ship designers, Ship builders, Ship Repairers, Equipment Makers, Port Commercial (supply) Services;
.5 Regulatory (IMO, International Regulators, Port State, Flag State, Port Authority);
.6 Non-Governmental Bodies and Pressure Groups (Classification Societies, Professional Bodies, Trade Associations, Training Establishments, Environmental Groups);
.7 Cargo Group (Cargo Owner, Charterer(s), Terminal Operators);
.8 Insurance Group (Hull & Machinery Underwriters, Cargo Underwriters, P&I);
.9 Response Services (Rescue & Emergency Services, Salvors, Coastal State)
.10 Media
.11 Service Group (Legal Services, Marine Consultancy and Surveying Services, General Insurance)

Upstream and Downstream Groups (Commercially or Geographically Dependant Region or States, Other Trading Nations, Suppliers, Consumers).

LEGISLATION/PROCEDURALISATION [T. Allan]

Dracos has set a few tasks for each of the members of the round table discussion to address "The Virtuous Circle of Maritime Safety". I have been allocated the task of considering "legislation / proceduralisation".

"Proceduralisation" not sure if there is such a word but it does seem to encapsulate the issue. Are Rules the answer? In an ideal world the answer has got to be NO! In such a world we could leave it to the ship owner to apply a full risk analysis to his particular vessel for specific operational requirements and then design according to his perceived risks. However in an international world-wide industry is this a practical proposition?

At present we have 158 member states of IMO. Is it practical in a business, where shipping can trade world wide, to have or operate ships which have been subject to 158 differing interpretations on something as fundamental as ship survivability? While it may be possible for a few like minded countries to accept the same version of perceived risk, there is no doubt that this approach could not achieve agreement on an international basis. Could a ship owner take the risk and build his ship to one set of requirements which a) may not be acceptable to all States to which he wishes to trade; or b) could limit his opportunities for the future sale of the vessel. I doubt it.

Obviously this is a very diverse and complex issue which could only be taken by the owner / State on a case by case basis. There may very well be a situation whereby a ship could be built to suit a specific operation and where the problems of the views or acceptance by others were not material. But I would suggest that this would be a minority of cases. The use of equivalence has been an accepted IMO procedure for a long time now but this is within very strict limits. That is equipment equivalents although lately we did address the model test procedure as an equivalence to a set standard. However here again it was within limits in that the prime standard (SOLAS '90) had to be achieved first and the equivalence addressed the additional element of survivability "water on the car deck". Equivalence will always be with us but I do not think it will be accepted as an overall concept, which could a request to the owner to prove that his vessel was "safe". Safety Codes are another possibility; here IMO has used Codes of Safety for specific types of ships. These Codes acknowledge the differing concepts of design and operation for example between conventional ships and high-speed craft. This is a concept worthy of further consideration where further elements of risk acceptance criteria could be applied.

A virtuous circle however requires all within the circle to accept an agreed set of aims and objectives. To develop a set of objectives were each owner / State could demonstrate that their ship can meet those aims e.g. "for the vessel to be safe and operable with two compartments damaged and flooded" requires some form of International collaboration. This is where the International Maritime Organisation achieves its goal.

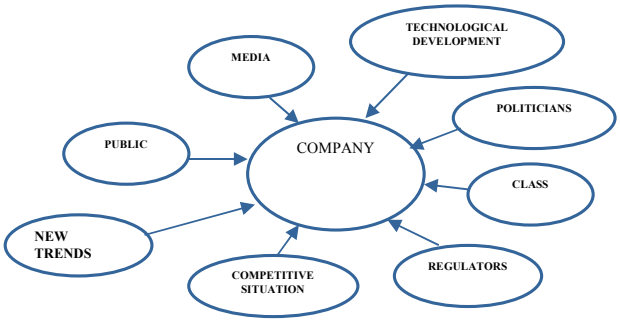
Member States at IMO, supported by their industry, are very much against unilateral action either by a single State or on a regional basis. One of the goals of IMO is to achieve a safety culture throughout all member Flag States, operators, charterers, brokers and financiers i.e. the full circle of stakeholders. Or to use the phrase given to us "the virtuous circle of maritime safety. One positive example, as I understand the situation, is the probabilistic approach. This accomplishes the aim in that once we agree a level of achievable safety then all that the owner / State has to do is demonstrate that level of achievement. How he achieves it is up to the owner and his designers. The main point is that the level can be demonstrated and accepted by all States to which the vessel trades.

Therefore as much as I would wish otherwise some form of Internationally agreed regulation is, I believe, essential to maintain a level playing field. With the help of the "virtuous" or "safety culture" that should assist in raising the playing field to an acceptable safety standard. Or am I wrong?

IMPLEMENTATION - GOALS OF SAFETY CONCERNED PASSENGER SHIP COMPANY [R. Kjaer]

- Leading operator within transport and short cruise segment
- High quality of:
  - *Safety*
  - *Service*
  - *Environmental policy*
  - *Competitiveness*
- Economy for growth
- Qualified operation of relevant tonnage
- Meet future requirements for high competence

INFLUENCE OF EXTERNAL FACTORS PEFORMANCE OF COMPANY



SAFETY AND ENVIRONMENTAL FACTORS

- Safe, economic operation
- Control/secure authorities requirements for operation
- Meet challenges according to new rules
- Future environmental requirements
- Provide cluster of experts for technical/maritime operation
- Competitiveness with high safety and environmental profile

MEDIA FOCUS

- Examples from large accidents
  - *"Scandinavian Star"*
  - *"Estonia"*
  - *"Prinsesse Ragnhild"*
- Proactive
- Open society, media
  easy access standard of operation
- Media create actions by politicians

CO-OPERATION RE SAFETY

- Important that operator is responsible for own operation
- Authorities/Class auditors re safety
- Importance co-operation all parties associated with safety:
  - *Regulators*
  - *Research*
  - *Operators*
  - *Class*
- Co-operation from day one
- Open co-operation also between operators ex NORDKOMPASS

OPERATORS VIEW

- View regulations should be channeled through IMO
- New regulations must be understood to be important
- Importance re co-operation regulators/-owners when discussing new rules
- New regulations should be based on safety assessment, not on accidents
- Important that regulators ensure influence operation friendly solutions
- Cost benefit factor, industry must survive

OPERATORS VIEW RE RESEARCH

- Closer contact operators/universities
- Importance useful research
- Operators must understand academic society - eliminate borders - vice versa
- Importance research projects participation different players
- Importance seminars establishing closer contact with parties

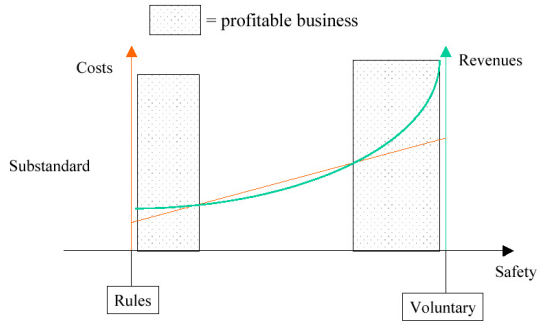
FUTURE WORK

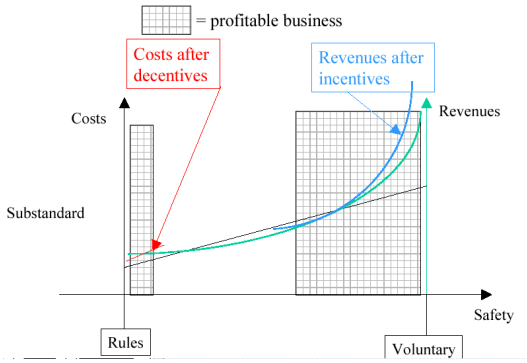
- Rules through IMO
- If no success IMO, regional solutions
- Proactive safety rôle, large passenger ships
- Establish fora for co-operation
- Importance EU research projects
- **Safety assessment**

ENFORCEMENT [M. Dogliani]

Safety = money

- Effective monitoring incentives
  decentives
- Standards (IMO's, Class, ..) = minimum acceptable safety level
- Minumum standard operator: cost driven = decentives
- Higher standard operator: revenue driven = incentives





How to achieve this? Partnership

LIFE-CYCLE DESIGN FOR SAFE OPERATION
Safety on the cruise ships – The FINCANTIERI Experience [G. Bertaglia]

Fincantieri developed the design of the Cruise Ship "Crown Princess" (70000 GT) in 1985 and in relationship to safety evaluation the following decisions was adopted:

- Embarkation deck and Lifeboats, was fitted at a height of less than 15 m from the sea level; this solution became recommendation in 1991 and rule in 1998.
- Having present the diesel-alternator room layout (the Diesel motors in one watertight compartment and the alternator in another), it has been verified the damage stability for three compartment flooded.
- Having the need to deploy a restaurant longer than 48 meters, the room has been divided with a water curtain (screen) of high flow rate, it has been oversized the sprinkler system and, in relationship with the stability problems of free surfaces effect of water on the floor of the restaurants, scuppers oversized in diameter has been provided to discharge overboard the water of the sprinkler system and non return valves was fitted for avoid problems to the air conditioning plant.

In 1992, during the design of the Cruise Ship "Destiny", at the time the biggest Ship in the world (101000 GT), Fincantieri proposed to the Owner, the passengers direct embarkation on the Lifeboats on the stowed position, defining a space not furnished completely protected for the muster stations. The Owner approved the proposal, considering it an investment for giving more safety to the passengers both real than psychological and for abbreviate the embarkation time.
Today, this Ship series, are the only with this layout.
In 1994 during the design of the Cruise Ship "Grand Princess" (109000 GT), Fincantieri developed:

- Safety availability studies with a flooding approach
- Smoke strategy

The above mentioned, to underline the importance of the safety for the Cruise Ships, that are grooving in number and in dimension. Today, many of these, have a maximum number of person on board of 4000-5000, others in designing reach 6000.

Flooding analysis

Flooding risk analysis has been carried out on Grand Princess design, as part of the overall safety and availability assessment. Hazard identification exercises were performed, examining historical casualty data (distribution, location and extent of damage along the hull) including hull, machinery systems and operational factors. The consequences of flooding were estimated on a compartment-by-compartment basis, and then to simultaneous flooding of two or more compartments. The predicted frequencies of the risks were estimated together with a detailed consequence and escalation assessment.

The results allowed some improvements in the design: It was found, for instance, that the probability of flooding two adjacent compartments was greater than flooding just one. As a consequence, the location of equipment was modified, either in compartments within B/5 boundaries or in non-adjacent compartments.

Therefore, in case or damage, the availability of the ship and her systems was improved As a general comment, the identification of modifications during basic design can prevent major changes being made during detailed design.

Smoke strategy (smoke control and ventilation)

Several F/C ships (all P&O cruise ships) have been designed having in mind a smoke strategy, based on a pre-planned strategy of the air conditioning and ventilation systems to contain the fire and the smoke in the place of origin. The statutory SOLAS requirements

simply consider the emergency shut-down of the complete Main Vertical Zone in case of fire. The smoke strategy allows the master and the senior officers of the ship to monitor and control the development of the fire with a direct control of the following aspects:

- air inlet (cutting off ventilation and fresh air)
- air exhaust (to keep extracting the smoke from the place of origin)
- controlled atmosphere and pressure along escape ways (corridors and stairs)

The correct implementation of the smoke strategy is a basic design requirement, since it involves the basic design of the air conditioning and ventilation systems from the beginning.

At the time being, the smoke control on passenger ships is voluntary and not mandatory, although discussions have been made at IMO Fire Protection (FP) sub-committee to draft Guidelines with a view toward keeping assembly stations and atriums smoke-free during a fire. The delegation of Italy at the IMO offered to prepare draft Guidelines on smoke control and ventilation based upon document FP 45/5 for consideration bv FP 46.

Post Panamax cruise ships safety

SOLAS rules, developed on the basis of past experience and incidents, have been defined with reference to all cruise ships, regardless of their size. The application of such rules to ships "up to panamax size" (as in past years) has proved fairly successful, as demonstrated by the very low rate of incident, which has qualified the cruise industry in these years of growth. Recently, however, the increasing trend of the cruise industry towards ships of much bigger size (Post Panamax) has evidenced some problem and concern about the "literal" application of SOLAS rules. Particularly there are two basic questions which need to be answered:

(1) Are these rules, as presently formulated, really effective for ensuring the safety standards of very big cruise ships (Post panamax)?
(2) Does the present obligation to strictly comply with to the individual rules and regulations as formulated cause problems in the development of the design of these big ships?

For answering to the first question in a factual way, it is necessary to actually measure and compare the "safety standards" of corresponding areas and arrangements on board of "consolidated" Panamax and Post Panamax ships. Such comparison has to be based on a detailed risk analysis, focused on the main "safety" factors (such as volume of each area, time needed for actually ensure the evacuation of an area, distance for the lifeboat embarkation deck a.s.o.), and developed with the same criteria and parameters on both Panamax and Post Panamax ships. Also the comparison with the results achieved in corresponding land based applications could offer useful terms of comparison.

Preliminary results of these risk analysis - focused on the measurement of the "evacuation time" - evidence that the ships up to Panamax size are safer than the corresponding land based applications, while the "Over-panamax size ships are, from the safety point of view, equivalent or even more effective than Panamax ones.

For what instead concerns the limits in the Post Panamax ship's design linked to the "literal" application of SOLAS rules, (such as, for example, the combined requirements of maximum length and maximum surface of a fire zone, which appear to be very demanding when applied to an "extra – wide" cruise ship), industry opinion seem to converge towards a "concept idea" of "equivalence", focusing on the "core" parameters and targets peculiar to the individual rules rather than on the application of individual prescriptions. A possible example of this approach, which aims to grant levels of safety equivalent or (due to the peculiar characteristics of Post Panamax cruise ships) even higher respective to the literal application of prescriptions, could possibly be found in the above mentioned limits to fire zone length and surface.
In this case the "core" targets of the SOLAS rules could possibly be anyhow reached by operating in terms of:

- equivalence of volume of the zone, in comparison with the maximum allowed by the standard criteria;
- reduced distance from muster stations deck
- specific provisions for reducing escape times
- introduction of specific further "risk reduction devices", in order to further ensure the correspondence between the safety standards achieved with the new arrangements and the ones ensured by the standard rules application:
  - further reduction of combustible materials;
  - area partition with "spray water" curtains
  - increase of active protection devices
  - positioning of the area respective to lifeboats embarkation decks
  - increase in the quantity and dimensions of escape doors
  - direct connection between the area and the open decks with one-only flight of steps
  - special emergency ventilation systems

Safety could be considered by more aspects:

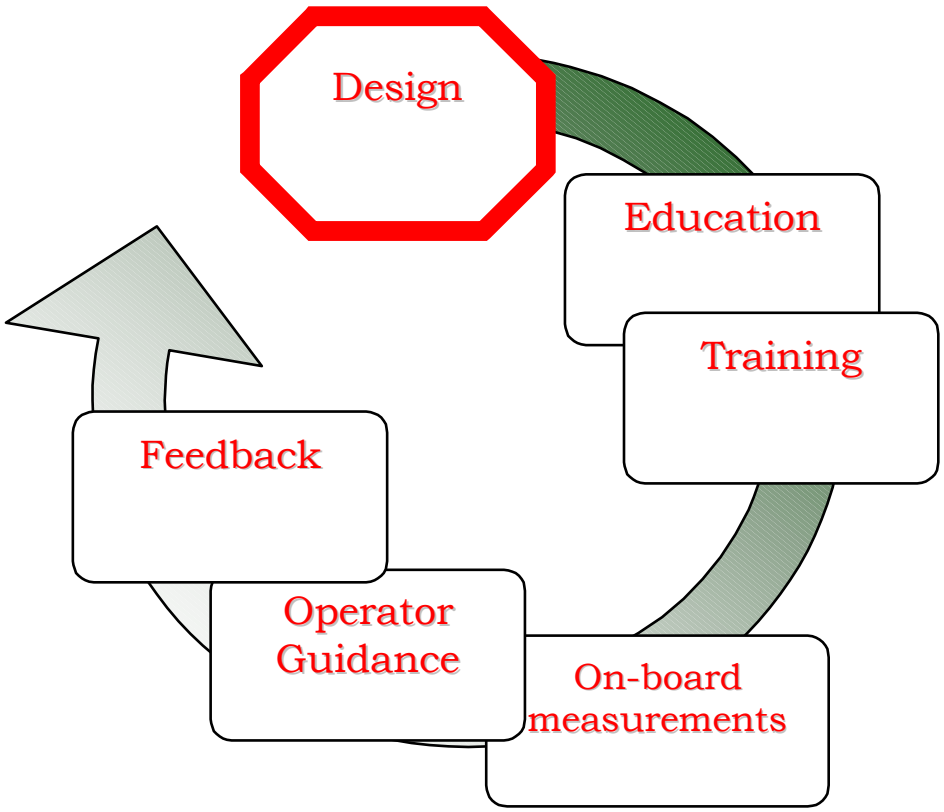
- Fire
- Lifeboats position / evacuation
- Grounding
- Collision
- Damage

Many are the approach of the Industry and the Owners for improve safety: for example technical solutions, behaviour's standards, crew and passengers training, etc. The above mentioned increase the safety, but isn't clear how much, and so it is not easy to correlate the investment made with the result.

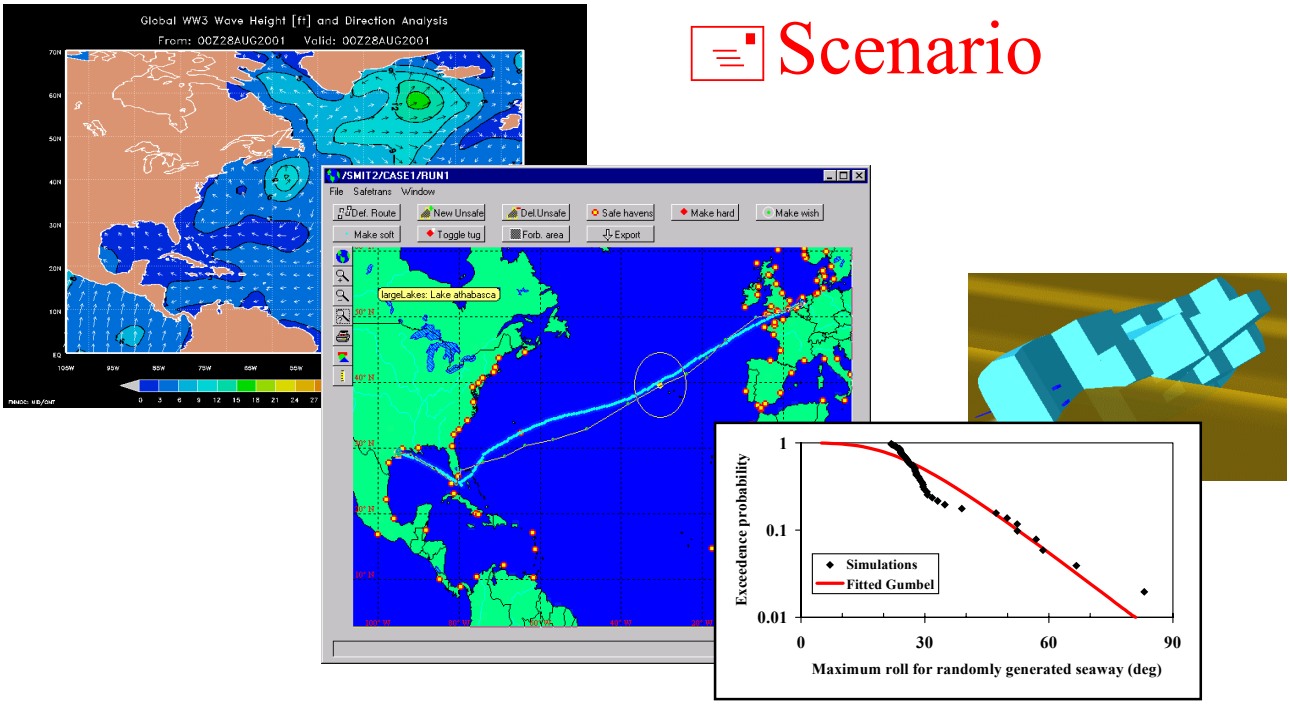
One possible solution is to determine the entity of the improvement: for example applying an opportune theory to a certain standard responding to the rules, quantifying some meaningful parameters. Then applying a modification and assess the results applying the same analysis. Comparing the results, it would be possible to quantify the variation of the safety aspect assessed, correlating, not the least, with the cost.

LIFE-CYCLE DESIGN FOR SAFE OPERATION [J. de Kat]

+*Design and operation should be coupled in an interactive fashion*- establish feedback from owners and seafarers to designers and yards
- reporting and analysis of extreme events and "near-misses"
- education and training with state-of-art tools: officers, seafarers
- operational guidance (dynamic stability, loads, etc.)
- on-board measurement systems (motions, stresses, sea state)
    - quantify operational profiles in design stage, incl. climate
        - stability/strength/… characteristics as function of time
            - account for human factors (MIS, MII, MIF), ergonomics
            - consider design and off-design conditions
            - incorporate surveys into design

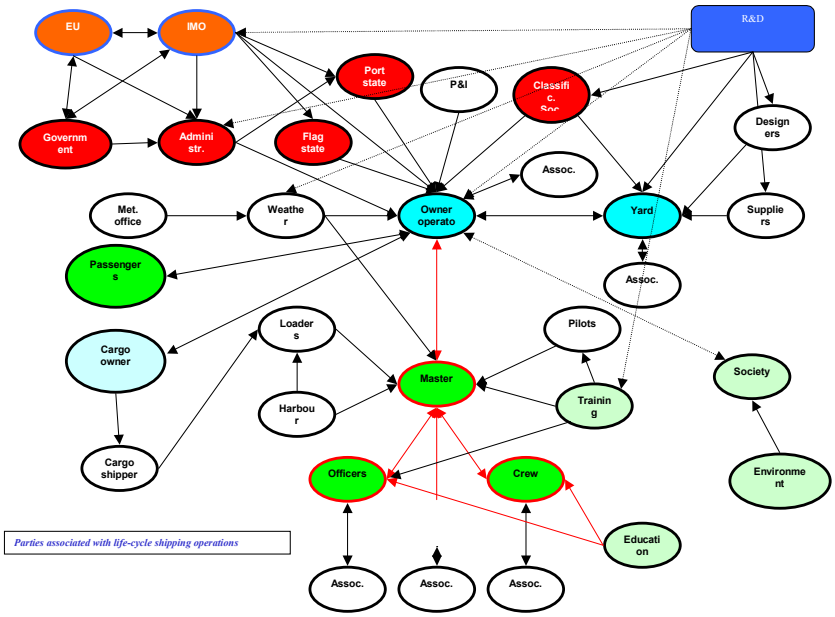


Stability and safe operation



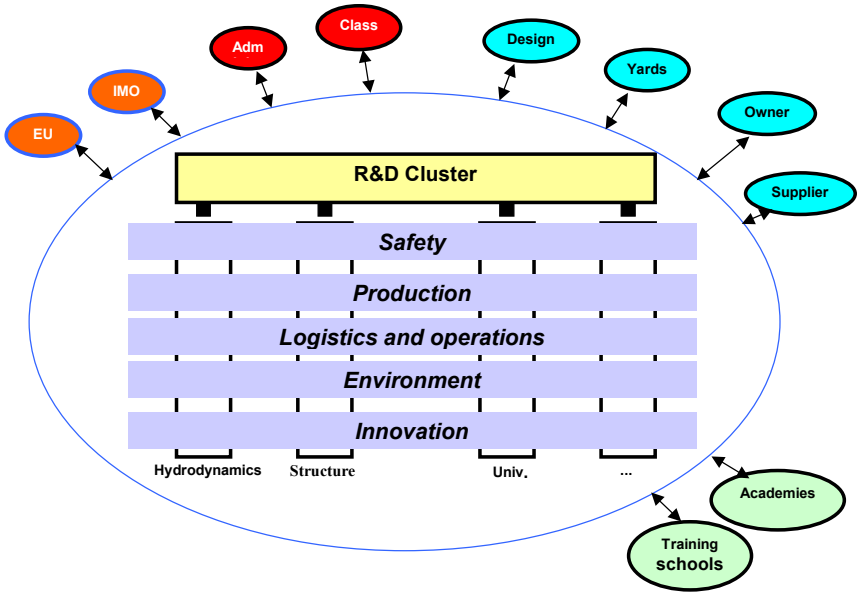
Maritime safety

- Safety: not a closed loop, but open and multi-faceted system
- Many associated parties/stakeholders: fragmented, few links; some have conflicting demands w.r.t. safety
- Fuzzy relationship between safety and economic performance of shipping operations (which tend to be marginal)
- Accidents will remain part of shipping operations -- ALARP?
- Why invest in R&D?



Role R&D

+ Cluster R&D with different disciplines and create process of interaction with stakeholders on different themes, including (but not solely) safety



Life-cycle design for safe operation

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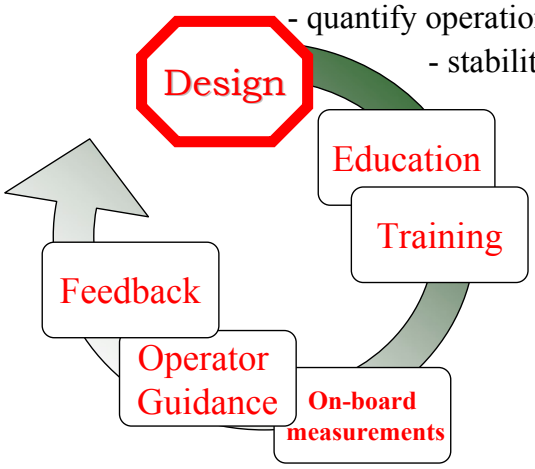

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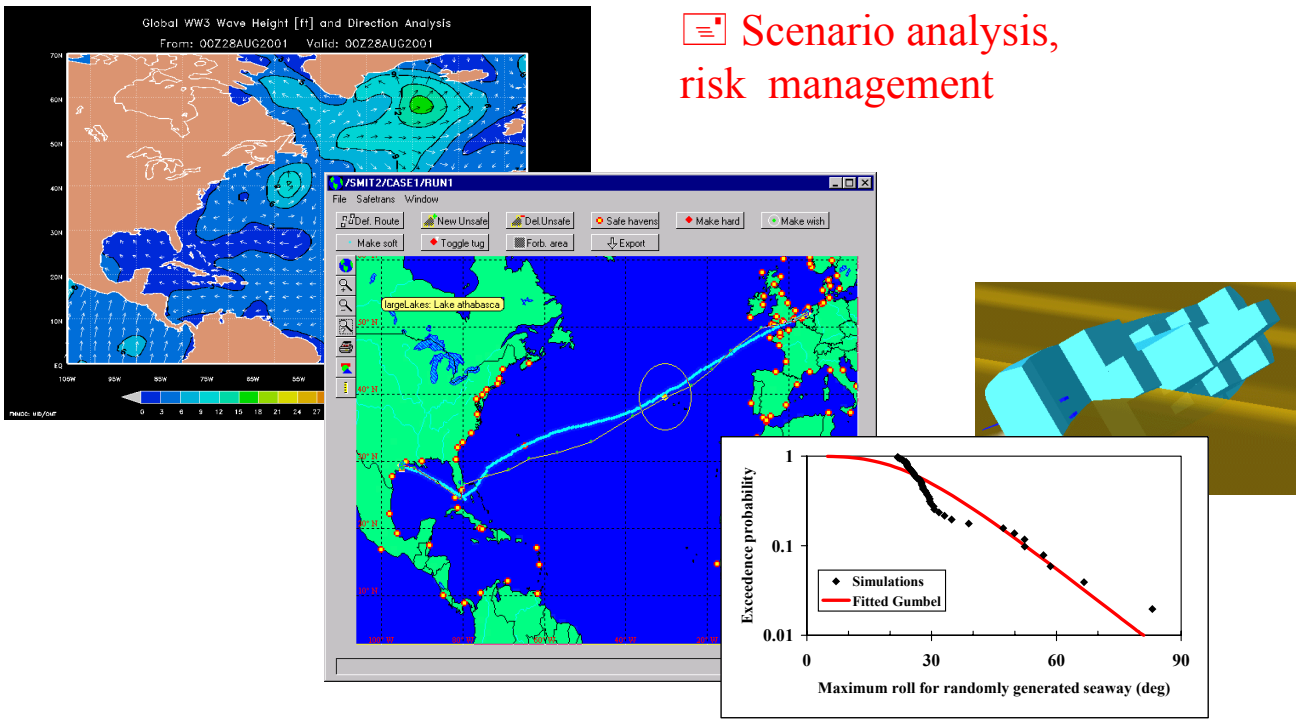
Stability and safe operation

Scenario analysis, risk management



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Maritime safety

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Multi-disciplinary problem ↓ integrated approach is a necessity

Combine performance and safety ↓ optimization depends on stakeholder groups

R&D can and should play a definitive role

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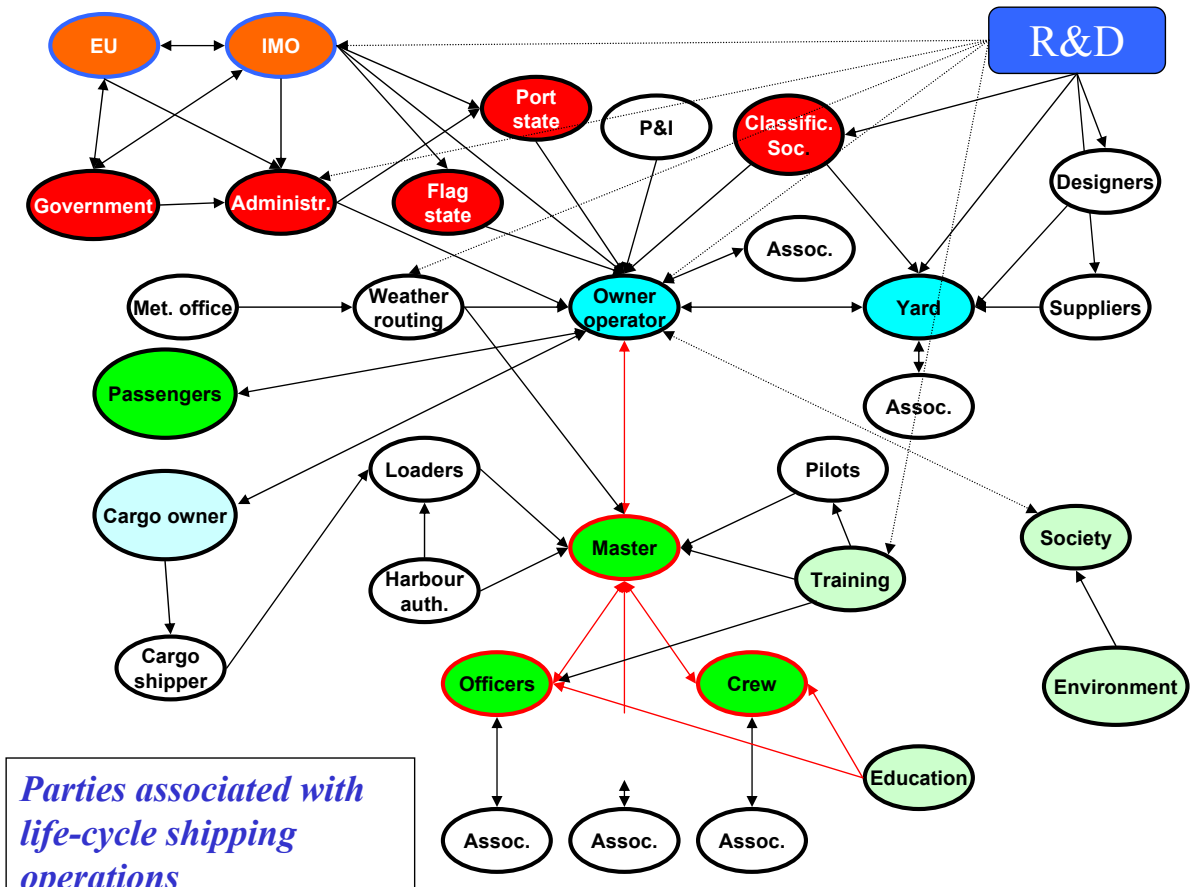

Parties associated with life-cycle shipping operations

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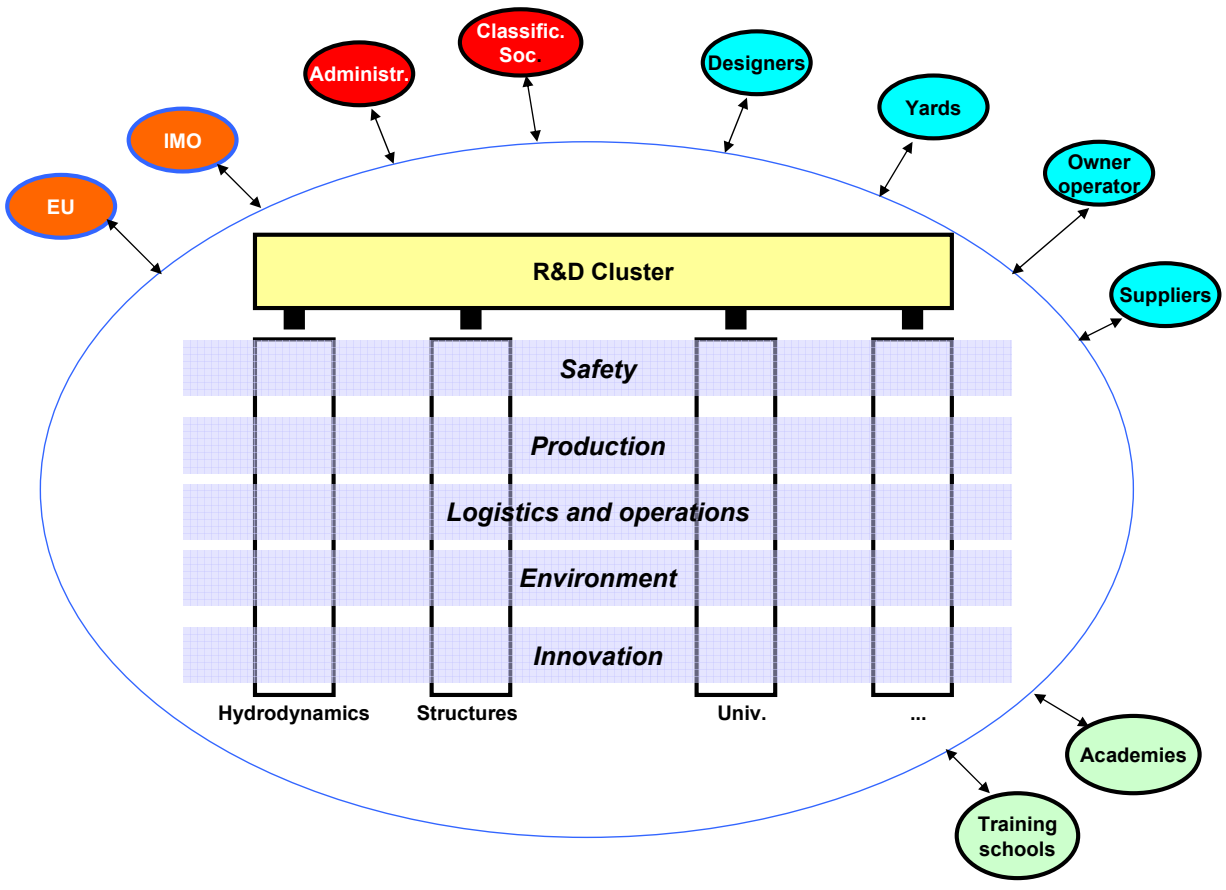

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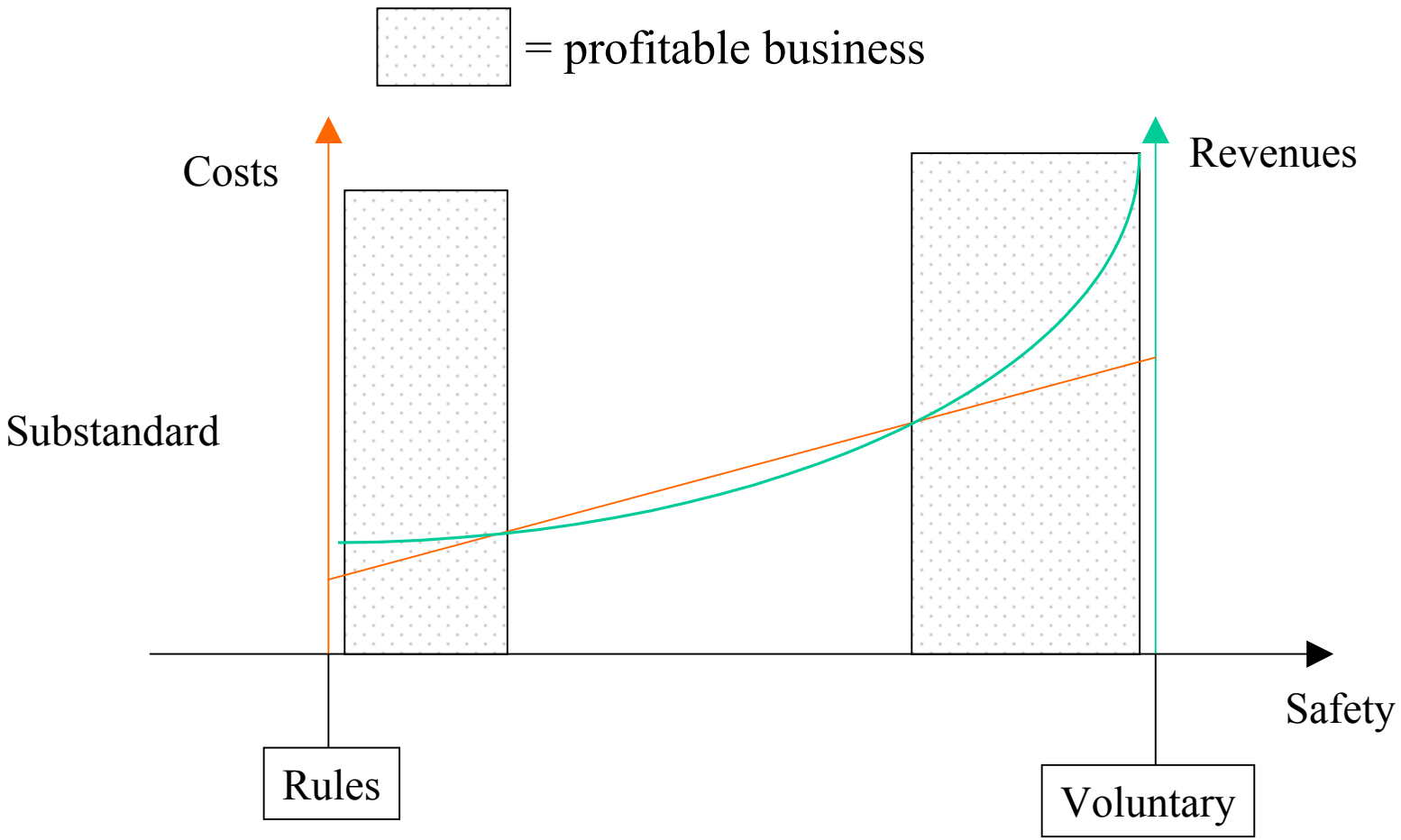
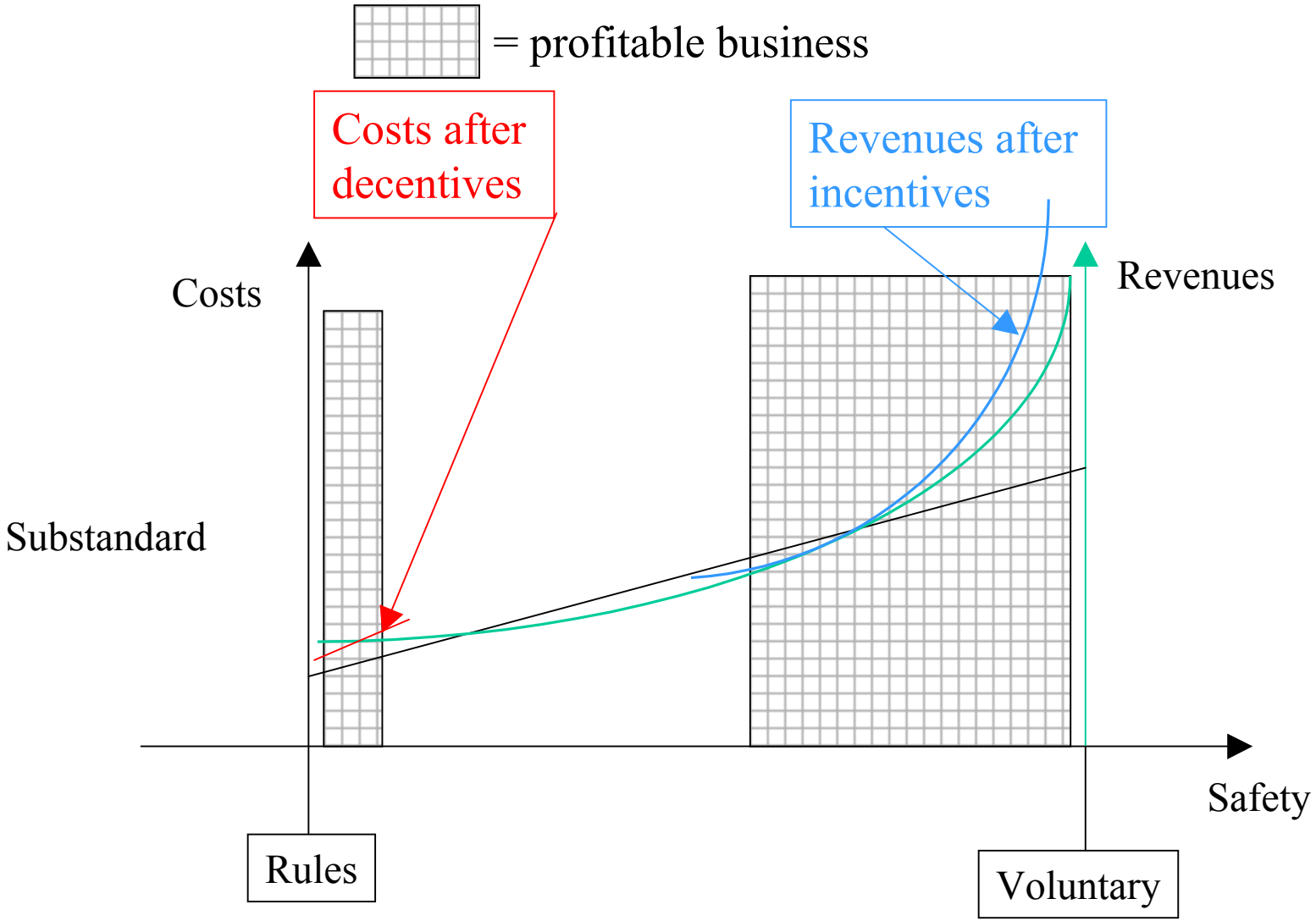
- Safety = money

- Effective monitoring incentives

decentives

- Standards (IMO's, Class, ..) = minimum acceptable safety level
- Minumum standard operator: cost driven = decentives
- Higher standard operator: revenue driven = incentives


= profitable business
Costs
Revenues
Substandard
Safety
Rules
Voluntary


= profitable business
Costs after decentives
Revenues after incentives
Costs
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Substandard
Safety
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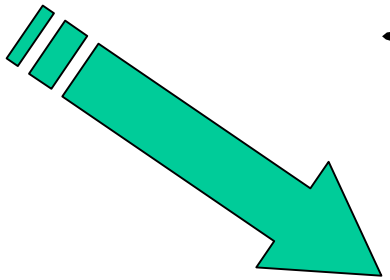
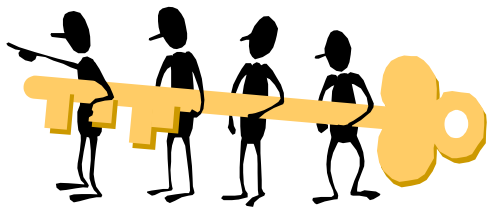
How to meet this?



Parternship



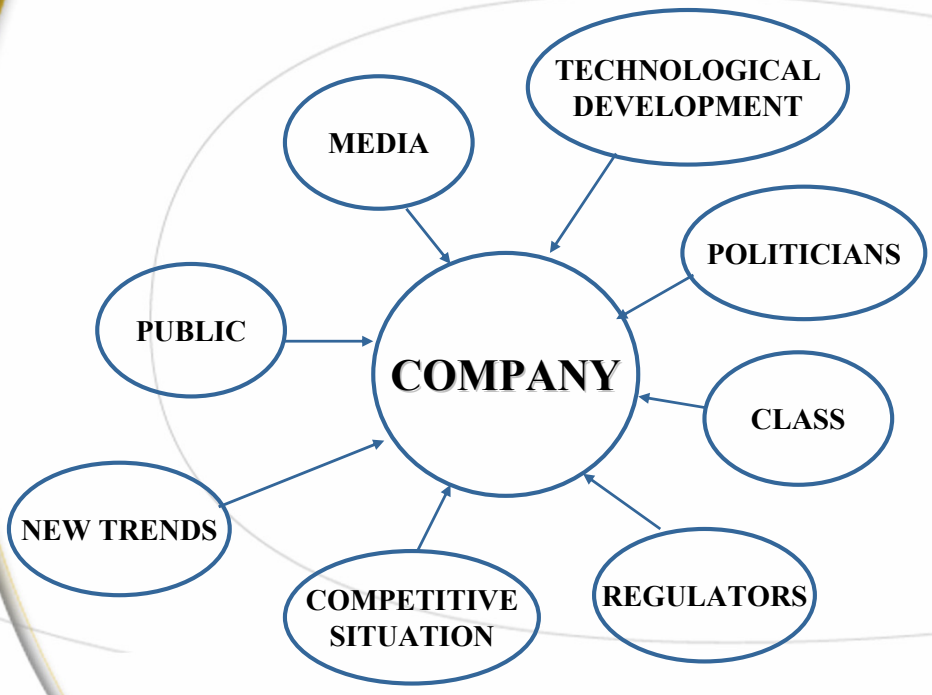
AGENDA

- Goals of safety concerned passenger ship company
- Influence externally on performance of company
- Safety and environmental factor
- Media focus
- Co-operation re safety
- Operators view regarding regulators/class
- Operators view regarding universities, consulting companies etc
- Future work

GOALS OF SAFETY CONCERNED PASSENGER SHIP COMPANY

- Leading operator within transport and short cruise segment
- High quality of:
  - Safety
  - Service
  - Environmental policy
  - Competitiveness
- Economy for growth
- Qualified operation of relevant tonnage
- Meet future requirements for high competence

INFLUENCE EXTERNAL FACTORS PEFORMANCE OF COMPANY



Color Line

SAFETY AND ENVIRONMENTAL FACTORS

- Safe, economic operation
- Control/secure authorities requirements for operation
- Meet challenges according to new rules
- Future environmental requirements
- Provide cluster of experts for technical/maritime operation
- Competitiveness with high safety and environmental profile

Color Line

MEDIA FOCUS

- Examples from large accidents
  - "Scandinavian Star"
  - "Estonia"
  - "Prinsesse Ragnhild"
- Proactive
- Open society, media
  easy access standard of operation
- Media create actions by politicians

CO-OPERATION RE SAFETY

- Important that operator is responsible for own operation
- Authorities/Class auditors re safety
- Importance co-operation all parties associated with safety:
  - Regulators
  - Research
  - Operators
  - Class
- Co-operation from day one
- Open co-operation also between operators ex NORDKOMPASS

OPERATORS VIEW

- View regulations should be channeled through IMO
- New regulations must be understood to be important
- Importance re co-operation regulators/-owners when discussing new rules
- New regulations should be based on safety assessment, not on accidents
- Important that regulators ensure influence operation friendly solutions
- Cost benefit factor, industry must survive

OPERATORS VIEW RE RESEARCH

- Closer contact operators/universities
- Importance useful research
- Operators must understand academic society - eliminate borders - vice versa
- Importance research projects participation different players
- Importance seminars establishing closer contact with parties

FUTURE WORK

- Rules through IMO
- If no success IMO, regional solutions
- Proactive safety rôle, large passenger ships
- Establish fora for co-operation
- Importance EU research projects
- Safety assessment

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