

# BowTie a Witchcraft that could have prevented Norman Atlantic?

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## The M/S Norman Atlantic Risk Challenge

The M/S Norman Atlantic probably became one of the most notorious Roll on/Roll off Passenger (Ro-Pax) ferries globally after she caught fire during one of her sails, back in December 2014. The Italian Company Visemar di Navigazione owned the ferry but at the time of the accident, the ferry was chartered to the Greek Company ANEK under a wet lease agreement starting a few days before the accident. On the day of the event, M/S Norman Atlantic was bound on a route from Patras (Western Greece) to Ancona (Italy). The ship stopped shortly at Igoumenitsa port (in the northern western part of Greece-opposite Corfu Island) according to its plans and fire on board had occurred a few miles northern of the Greek FIR. Time had come for a risk management challenge.

Ship Sailing has been included among the generally accepted and profitable hazards of Maritime Industry for centuries. Ship owners and senior management of ship operators do understand that their ships face a number of threats during their sails, which immediately may lead to loss of control, an accident and, on occasions, to excessive losses.

## The Bow Tie Concept

Efficient Risk management shall be the rational answer for high-risk entities like maritime to mitigating risks, therefore Bowtie a Scenario Based and a qualitative Analysis tool for mitigating risks worth its inclusion among the most prominent ideas to solving risk control difficulties.

BowTie idea brought in an effective way a graphical representation of all potential interactions between (e.g. people, equipment, time, weather and mostly

of organisational factors, etc.) which might lead into an accident, in a measurable and understandable way, aiming at safety promotion within High Reliability Organisations. Bowties do that efficiently because they can be constructed in a way of submitting a better overview for each hazard and the specific threats that cause the loss of its control (creation of a top event) and respectively the negative consequences, in other words the building of the Risk Environment. The barriers put in place after the construction of the risk environment aim to prevent or mediate the potential outcomes of a released danger; they additionally submit the crucial tool for risk communication, and training from top to bottom within the organisation. The methodology serves individual accountability within an integrated tool that can also be used for audit and/or investigation. It also calculates cultural and organisational factors into the risk analyses.

Risk in Bow Tie methodology is elaborated by the relationship among Hazards, Top Events, Threats and Consequences. Barriers or Controls are used to display the exact mechanism, an organisation arranged for risk mitigation. The parts in the diagram are laid out in a sequential order and time factor is accounted as well.

Overall, BowTie methodology and BowTie diagrams portray in colour all information that is needed to present the current risk management decision status of each operation, as it had been decided to function. The methodology is so powerful that it also depicts the effectiveness of each control; therefore, it gives us the opportunity to estimate the exact risk exposure.

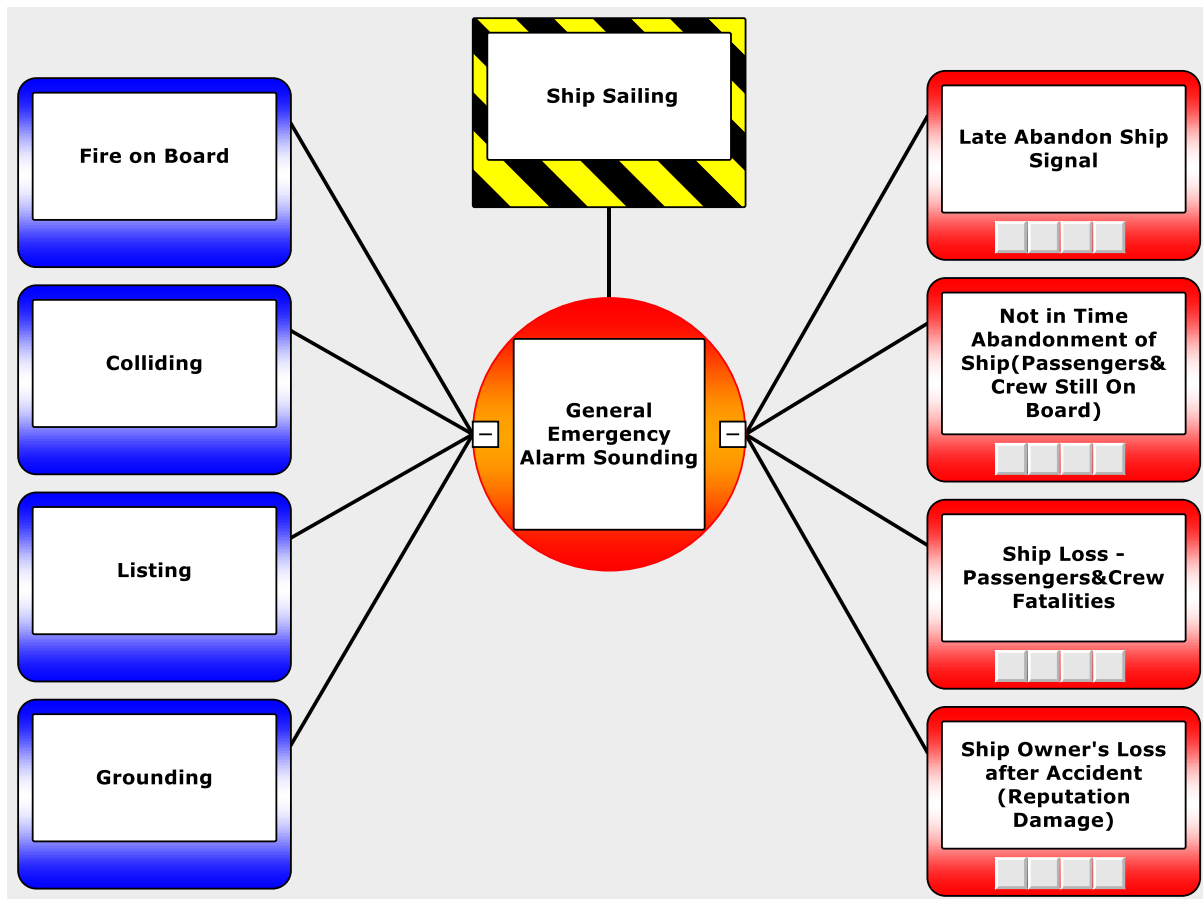
The endorsement of the methodology not only enhances the ability of organisations to form their opinion on the effectiveness of the established risk controls and measures but it also equips them with the means to train all their personnel respectively. BowTie use improves organisational

learning and clears communication channels related to safety goal setting; let us not forget either that it increases positive potential and also maximises the organisational learning ability.

Bowtie in another interpretation graphically presents the Safety Management System itself.

### **A generic Maritime Bowtie**

Senior management in maritime organisations has accepted the hazard of putting ships on sail around the globe altogether with all the threats that individually may lead into the release of a top event such as the general alarm sounding on board. In bowtie terms they know since day one of their doing business in maritime that any of the four causes(also some others) individually or in combination as depicted into the bowtie below can easily lead to a losing control situation and later on to many escalating unpleasant events(consequences).



### A Generic Bowtie for Maritime Industry

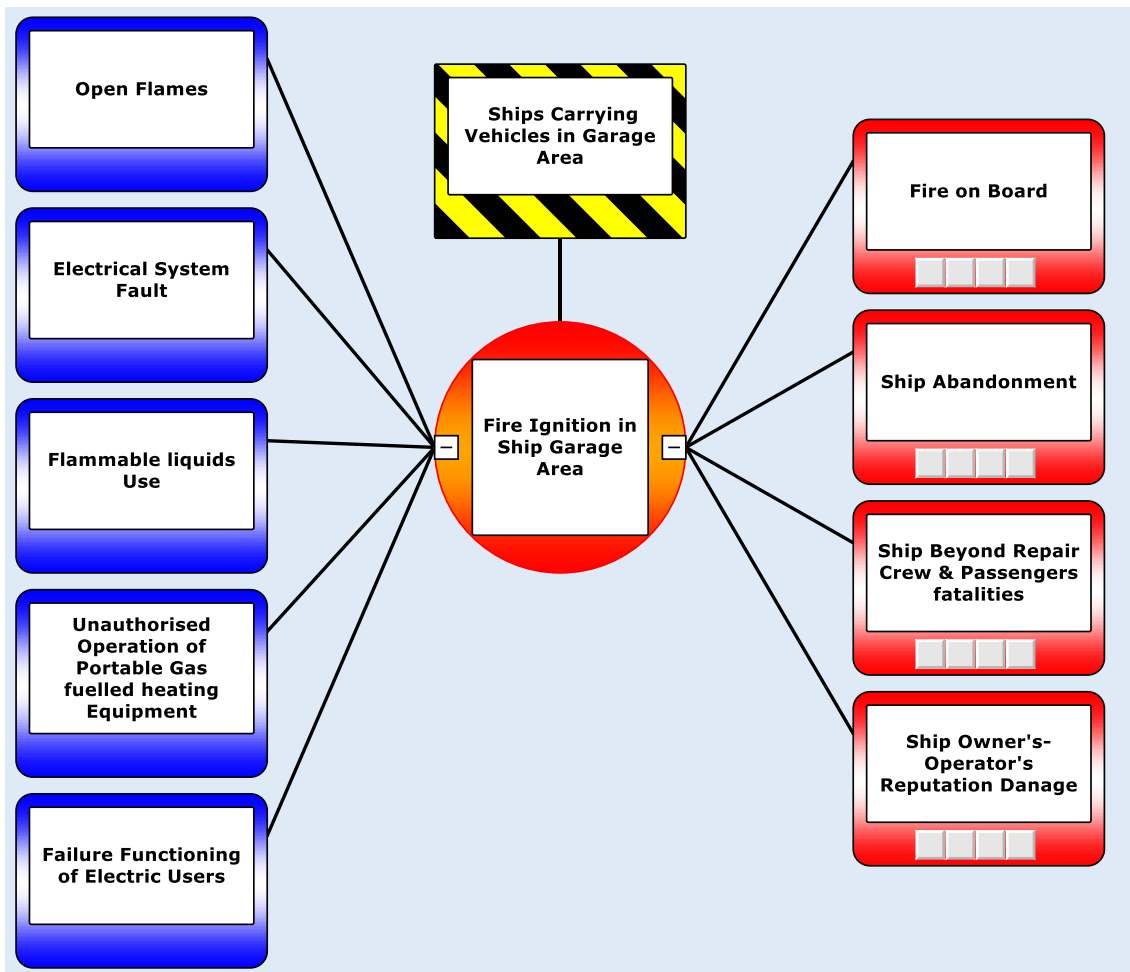
Bowtie diagrams exist to just sort out human thoughts and enhance efforts to communicate a devised complicated plan for mitigating risks. When combined with the use of a software like BowTieXP they can share the big image including all the data that show the tasks assignment for fulfilling all safety goals within any high reliability Organisation. Although much has been said about the need for simplicity in life, reality is that operations in high-risk industries, maritime included, are characterised by high interactions and tight coupling. Sailing in the 21<sup>st</sup> century became a rising complexity, as more ways exist for connection; more cultures are mingled within a crew, more ideas, opposing beliefs and different lifestyles are housed on board ships with an increasingly shorter time frame for handling risks. As Albert Einstein already said, “everything should be made as easy as possible, but not easier”.

Conclusively, BowTie was invented in order to bring in the simplification that is allowed to remedy the problem and not the one that first comes in mind.

## The Norman Atlantic Accident

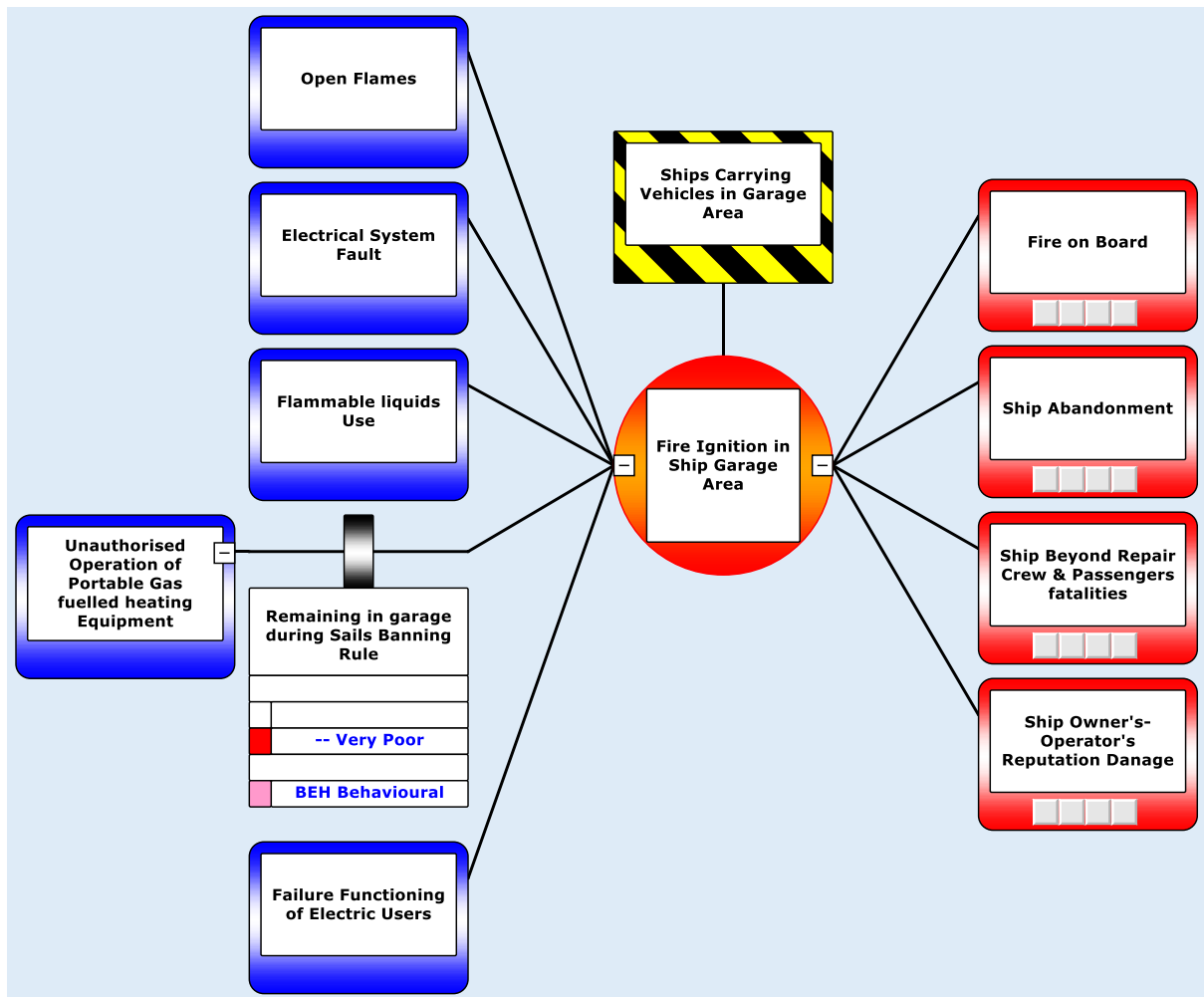
The necessity for ships carrying vehicles during sails had long ago been taken into account as certain ship types were especially designed after consideration of that demand. Probably cost constraints had led Ro-Ro, Ro-Pax ferries to using open-air garage areas in combination to closed garage areas for safekeeping vehicles during sails. Accidents on the other hand always play the role of a tester for the current risk management practices and past accidents of both M/S Norman Atlantic and that of its sister ship, M/S Sorrento had proven that risk management related to fire ignition threats within their garage areas had been problematic.

Both accidents occurred as sister ships had faced the same challenge related to fire ignition into garage areas but both did not have the effective barriers in place to stop the accident sequence. It seems odd but the bowtie that follows below, built from data submitted by the Marine Investigation (2015) was the problem that remained unsolved. Threats on the left hand side were the causes that individually or combined had led to the hazard release and to the fire ignition that later on resulted to the detrimental outcomes to both ships. The five threats answer to the question: “How can control be lost?” Likewise, the Consequences reply to the query “how may an event develop” and “what are the potential outcomes?”



### The Risk Environment in Norman Atlantic case

The Norman Atlantic as a Risk Environment definitely required barriers that could have prevented the hazard from being released, making it impossible for danger reaching the Top event point. Unfortunately, we all became witnesses to that moment being reached and to the further evolvement of the accident. What still lies unanswered is the ways-measures-barriers that Norman Atlantic Crew were employed to keep control of the situation and threats. We all know that there is a rule “banning passengers from staying in the garage areas during sail” but it is common knowledge that unauthorised persons remain in the ro-ro deck (to escape congestion? out of habit? Alternatively, to avoid control?) A BowTie diagram with the implementation of the specific barrier will look like it is below:

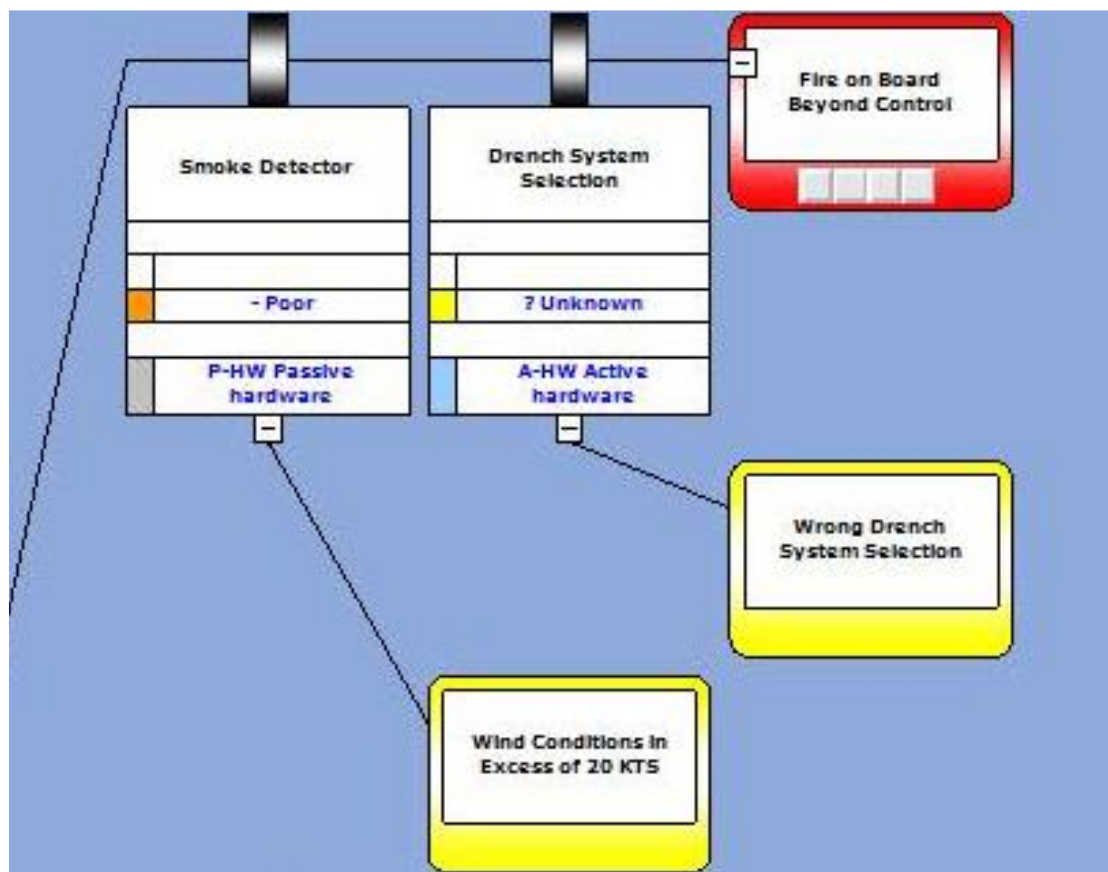


### Norman Atlantic Case with a Preventive Barrier

Much had been said about the ship electrician who did or did not manage the electric connections connecting ship electric power appliances and trucks in need of electric power. Definitely, his/her interference might be considered a barrier. The same could be said for any control that had been or had not been implemented to identify unauthorised persons in Garage areas during Norman Atlantic sail. Preventive barriers as they are called, the ones being on the left hand side of the BowTie diagram aim to “design away” the problem, if they can, or to find ways to avoid the threat. Needless to say that preventive barriers are much more effective as they are considered more proactive measures to



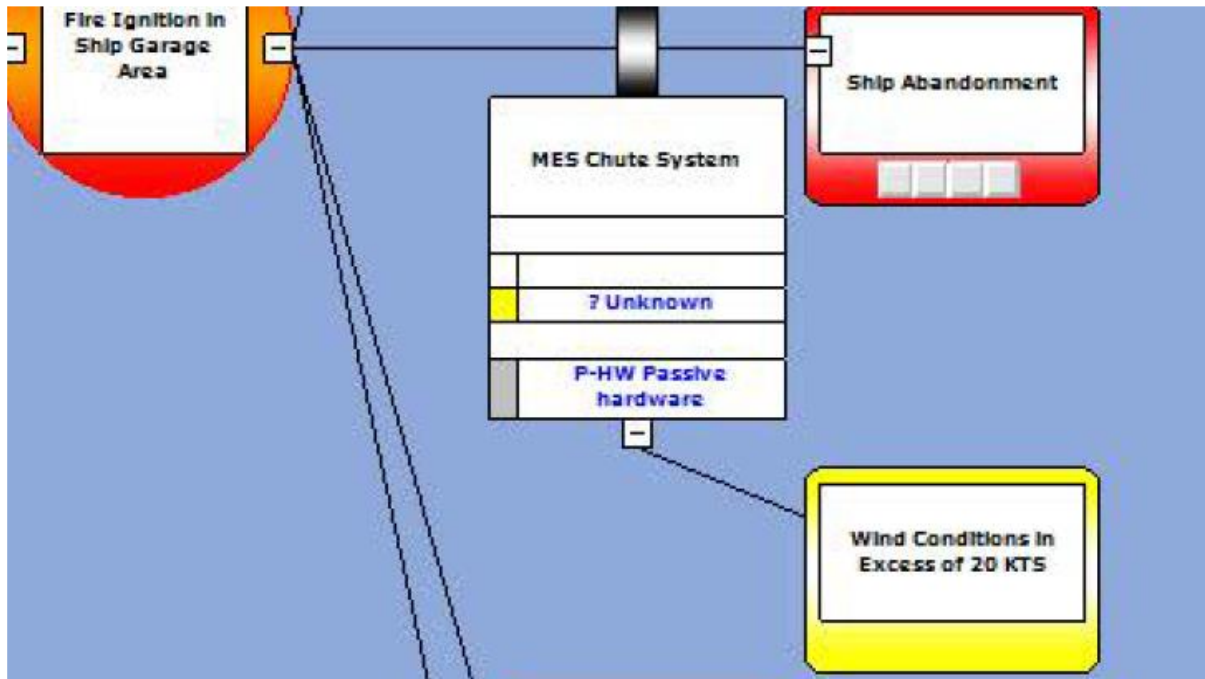
prevent accidents. On the occasion that preventive barriers can be thought well of in advance; there lies the possibility of them not being that expensive into their implementation. The crucial factor related to the cost for implementation is the barrier type. Apart from preventive barriers, the methodology entails the use of recovery barriers as well as minimising the chance of any consequence from occurring. Additionally recovery barriers are put in place to mitigate the potential losses. In the figure below there were added into the BowTie diagram two barriers, which had been employed on board Norman Atlantic during the accident.



Norman Atlantic case with preventive barriers and Escalation factors

Unfortunately, both barriers had been proven ineffective due to the existence of Escalation Factors, situations not part of the usual business that may cause human factors issues (human error), extreme or abnormal other conditions (like weather phenomena, etc.) and lastly loss of critical parts of any system. In the

occasion of Normal Atlantic accident escalations factors had been the excessive wind conditions and the wrong drench system selection by the first engineer.



Norman Atlantic case with preventive barriers and Escalation factors

The evacuation analysis unveiled that the MES chute system had been proven ineffective to be used during extreme wind conditions; in BowTie terms an escalation factor for the recovery barrier MES Chute System. The existence on the part of the BowTie diagram that is presented of three escalation factors, which were left without escalation factors controls, is a sign for a risk management process that had not taken account of all risks to their full magnitude.

## The Benefits from the Endorsement of BowTie from Maritime Industry

A working hypothesis claiming the endorsement of the methodology by maritime could not have prevented the specific accident or any other by itself.

The findings of any accident and the way we deal with them afterwards prove our maturity to take corrective actions that might later prevent future unpleasant events from happening. The escalation factors depicted on the parts of BowTie diagram related to the Norman Atlantic accident in the previous pages, in relation to the investigation, left us with no grounds to believe that any escalation factor control had been previously thought of. In other words, the threats on the recovery barriers that put holes into the cheese slices (Reason 2007) were left without organisational controls; in a different interpretation not much was left to minimize the chance of this consequence occurring or at least decrease the severity of potential outcomes. The role of the organisational controls could have been played by training programs, procedures and human factored design, etc.

The benefits from a potential BowTie endorsement from the Maritime Industry would have been:

- Better Design Understanding
- Adequate and Effective Procedures
- Compatible Goals setting
- Better Communication within the Company
- Better Understanding of Training Needs

Overall, it seems that the involved with the management organisations of Norman Atlantic were deprived of the chance to proceed into a critical revision of procedures on board before the accident. It is highly likely that in case they have had the opportunity to prior have carefully examined the specific BowTie diagram, before the devastating event, they would definitely have altered the way they mitigated risks and possibly the accident would not have happened.

Reality is related to perceptions that ideally cover a wide spectrum of truth and no one can accuse ignorance attributed to lack of knowledge. The culture of “no

compliance to rules” followed by passengers on occasions cannot change without controls that are needed in order to alter their local habits on board and their beliefs. As long as we refer to cultural concepts, maritime industry shall dedicate efforts to better understand them. Only maritime can control and create favourable conditions on board its ships and alter working conditions for its crews, in a way to block the most of their common human errors. In this domain, everybody is needed, especially the regulatory side and maritime senior management and BowTie is here, a medicine for blindness.

Norman Atlantic could have happened even after the endorsement of BowTie. On that occasion, gaps and the problematic performance of barriers should have been accounted since the beginning. At least every next time safety managers would be ready to be more proactive into devising new ideas for barriers and they could be more aggressive to propose them. On the other hand, maritime senior management, after BowTie endorsement, had better realise the benefits of their decision. BowTie in the beginning may be seen as witchcraft but still it applies the first rule: “Do not burn it, work with it”.

