The accident of m/v *Herald of Free Enterprise*

A failure of the ship or of the management?

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Abstract

Purpose – The purpose of this paper is to investigate whether the *Herald of Free Enterprise* disaster was due to the ship or the management, using the modern management theory of complexity.

Design/methodology/approach – The 75 pages investigation of the court has been studied and codified to the main aspects and mistakes producing the accident. After the mistakes were identified, a procedure adopted in analysis B to show how these could be avoided if a different management theory has been adopted.

Findings – The main finding was that management was responsible for the accident on shore mainly and on board and that a special communication mean which is called "dialogue" in complexity theory parlance had to be adopted.

Practical implications – Any shipping company and ship can identify itself through the common mistakes mentioned and adopt the proposed theory to improve safety and management's effectiveness.

Originality/value – The paper provides a concise analysis of the accident. A new theory is presented and linked to this case study. The study will be useful to management on shore and on board and for IMO of Flag administrations and departments of transport and others.

Keywords Disasters, Ships, Major accidents, Management failures

Paper type Case study

Introduction

Accident's details

In 6 March 1987 the seven years old ship built in Bremen classed +100A2 Lloyd's Register of Shipping, named *Herald of Free Enterprise* – owned by Townsend Car Ferries Ltd – RoRo type ferry boat, transporting 81 private cars, 47 cargo lorries and three other vehicles as well as 80 crew and 459 passengers, left internal berth 12 of the Zeebrugge port in Belgium at 18:05 hours destined for Dover in good weather assumed to arrive in four hours 30 minutes. The vessel capsized 23 minutes later after four minutes being in the open sea, leading to the deaths of 150 passengers and 38 crew, as well as many injured.

Purpose of this paper

The purpose of this paper is to answer the question whether the accident was due to the ship or to the management, using the modern management theory of complexity. We selected the specific accident amongst many others for the following reasons:

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- the court described this in 1987 as a very sad chapter in British maritime history;
- the accident considered as a reason[1] of introducing ISM Code by IMO in a mandatory form in 1998; and
- it appears to us to be a case in management failure and as such has high possibilities of being repeated.

Anderson (1998, p. 15) gives us a fuller account. Efforts in the UK to address the human error started in July 1986 due to the report related to mv *Grainville* and notice M 1188 (and followed by M 1424 in 1990), but the tragic loss of the *HFE* resulted indeed in the introduction of the Merchant Shipping (operations book) regulations 1988, laid before Parliament and passed end 1988 for all UK passenger ships on short sea trade and provide ... "safe and efficient operation" instructions and information and ... nominate a person to oversee, etc. (designated person). Then followed notice M 1353 in 1988. In 1989 the UK pressed IMO for a working paper which then ended as resolution A. 647(16). This is the forerunner of ISM Code.

Analysis A

An unbelievable marine accident of Titanic *type*

What is contradictory about this accident is that there was no reason for the accident to happen as all the prerequisites to the contrary were present: first class flag and class as well as company, young ship (seven years of age), British crew, SOLAS 1974 construction and Merchant Shipping/Passenger Ship construction Rules 1980, voyage under 600 miles, British management, sister company of P & O, good weather, more than required life saving means. Therefore, it was very strange to expect any accident under these circumstances. This may suggest that perhaps marine accidents cannot be avoided despite what the science and technology suggest (Goulielmos *et al.*, 2002; Goulielmos, 2004).

There are certain features of the accident that must be highlighted:

(1) *The number of passengers.* This was strangely a combination of ship's so-called condition, the number of crew and draught of the ship. So, for condition C1, i.e. freeboard 1,110 millimeters and draught 5.70 meters moulded, we had to have 550 passengers plus 80 for crew. These figures had to be known before sailing as the stability of the ship was affected and maneuverability as well. The ship was not fully fit for the port of Zeebrugge, as she was in Dover and Calais, because at Zeebrugge either the deck E or G[2] could be loaded with cars, not both at the same time. So, for loading deck E the ship had to trim by the head for the port ramp to reach (the higher than G) deck E. To do this the ship had to fill up the ballast tanks 13 and 14 or others at the head using the available very slow[3] pumps and the most important was to empty them fast again for the ship to go properly to open sea without a trim by the head. The time needed for usual pumps to carry out their duty was two hours and 15 minutes or about half the sailing time!

The first fault of the management not mentioned by the court was the allocation of the ship[4] at a no-users friendly port.

(2) *The culture of management.* This was for the ship to do the crossing at the least possible time reducing time at the port as a rule. Moreover, two written

instructions were issued in 1986 showing a pressure for the earlier sailing of the ship from Zeebrugge (as ships delayed in Dover as a rule), by 15 minutes, management asking for exerting pressure, especially on Chief Mate, for this end. The company had passed the culture of the urgency of sailing without this being supported by any marketing survey and as happened at the expense of safety. On the day of the accident the ship delayed five minutes instead of being faster by 15 minutes.

(3) *The ship clam and main bow doors.* Their closing was hydraulically by the manual handling of the assistant Bosun. There was no reason found by the court[5] for the bow doors not to be closed.

(4) *The management was not adaptive.* The management did not realize that the Dover-Calais crossing had basic differences from the Dover-Zeebrugge one. Though the number of deck officers were reduced by one in the latter crossing, the court found that the faulty fact was not the number of the officers, but the failure of re-organizing their duties effectively. The bow doors could be closed at the berth before going to open sea, as this was not possible in other berths. The culture mentioned above forced the Chief Mate to leave deck G of *HFE* (car deck) immediately after the loading (or even 15 minutes earlier?) to go to bridge at his so-called "harbour station" (position for sailing to the open sea).

(5) *False displacement.* A past but also a possible future problem indicated by the court was that the displacement of the ship written in the log was erroneous as there is a discrepancy between the stated weight and the actual weight of the lorries. This was found by research test as equal to 13 percent per average and per lorry. The ship was also 102 tons heavier due to modifications when built and some 150 tons for the occasion due to paints, stores and packing and similar. The court found that the ship was 376 tons heavier than indicated in the papers. The slope ahead was 0.83 meters and the bow draught was 6.26 and in stern the draught was 5.43 meters. Although the court found out that overloading of the ship was not the cause of the accident, the basic conclusion here is that it was impossible for the ship to know the exact weight of the cargo taken and the draught realized (as also they were no draught indicators). This problem remains in many parts of the world even today and certainly in Piraeus from our own experience.

(6) *The result of the accident.* The captain and the officers said that whenever the ship was trimmed by the head due to Zeebrugge restriction, they cared to inform captain to reduce speed so that the sea water be prevented from passing over the spade of the bow and enter into the G deck. This task had to be carried out by the second mate. This task was not accomplished, no mention is made by the court to the contrary or in the company's memos. The ship was designed following the culture of management mentioned above to accelerate fast from slow speed to full speed.

The captain, when the ship passed the outer mole of Zeebrugge put the ship to combinator 6 (meant at a speed that has created waves of two meters height and thus higher than the spade) for all three engines and the ship passed fast from 14 to 18 knots (final). In this way the ship "dived" into the sea, trimmed also by the head, and due also to the increase of the wave height, the sea water

entered into the G deck. In the meantime, the ballast tank was not fully emptied as mentioned above. The ship sloped by 30 degrees initially and capsized with final slope of 90 degrees. As argued by company's captains, we cannot blame the high speed, as an even reduced speed could also produce the same effect. What we identify as an important issue is the fact that the captain was not notified early enough to reduce speed, something that would prevent such quantity of water to enter into the ship. Furthermore, the water tightness or weather tightness of the G deck could then protect the ship from capsizing ... as the weather was good. A further number of mistakes/omissions took place here following the grave error[6] of the assistant bosun.

(7) *The cause of the accident.* The ship capsized due to the fact that the clam and the main bow doors were left open by the assistant bosun, who fell asleep and he did not even hear the ship's announcement (Tannoy Address System) for the order: "harbour station". The assistant bosun was awakened by the ship's capsizing throwing him out of his berth! The bosun on the other hand said that he was the last person who has left deck G and he worked near the bow doors and as far as he knew there was nobody else there to close the doors ... He put the chain across ship's entrance as the last car entered. Following that, the next action was closing the bow doors not by him but by the assistant bosun ... He left leaving the doors open and he explained: "This was never part of my duties and was not my duty to see that someone else will do it". No disciplinary measures are mentioned on the part of the company for assistant bosun or for the similar cases mentioned in this paper (fn 9) that happened before. As analyzed by Embrey (n.d.) "the blame and discipline"[7] is a traditional philosophy, but even this traditional philosophy apparently has not been followed in this case.

The management culture was for officers, etc. to staff promptly the "harbour stations" after loading (or even before), as mentioned. This means that the emphasis was not on safety but on crossing time where loading was seen as a frequently undesirable delaying factor.

(8) *The failure of management on board.* First, we shall examine the failure of management on board, and then on shore.

For the bosun and assistant bosun we mentioned above their grave sloppiness/and/or negligence.

A learning process[8], however, had no effect in this company. As mentioned the ship *Pride* in 1983 – four years earlier – left Dover with open both stern and bow doors open[9] because the assistant bosun fell asleep, as in *HFE*.

In the meantime, to give justice, general instructions have been issued in 1984 that the loading officer of deck G (cars) has the duty to ensure that the bow doors were secure upon departure. These were not very clear and accurate instructions and were ridiculed by the officers and interpreted to mean: "that the loading officer was obliged only to observe[10] that someone was ready at the door controls to close the doors". Even so these orders were not carried out by Leslie Sabel (Chief Officer) who has been accused by the court for irresponsible conduct and gross negligence. It was also tragic that Sabel relieved the second officer (Mr Morter) at that day of the accident while the court mentioned that there was also some tension between the two. Moreover, the time between loading and closing the doors was no more than 3 minutes maximum. Perhaps

the management's culture exercised more pressure on Chief Mate than on second officer for the ship to go earlier 15 minutes than usual as this can be inferred from the above. It seems that the "harbour station" order was given usually even before the loading had been finished and the doors were closed, so that the staff had time to go to their harbour stations.

The Captain of *HFE* told the court that especially in the Zeebrugge run it was necessary for the "harbour station" order to be delayed until the bow doors were closed due to the fact that the Chief Mate had thus to remain in deck G longer for a few minutes.

Another order was for the "Officer of the watch" or the captain to proceed to the bridge within 15 minutes before ship's departure, and if this officer was also loading officer, this was a conflicting order with the specific duties. Mr Hackett – Chief Captain – wrote in 21 August 1982 that it is not practical for the officer on the watch – chief mate or second officer – to be at the bridge 15 minutes before departure, as both are occupied with the loading of the ship. So it is evident that we have another management failure, i.e. to organize the duties of the officers properly.

The role of the captain. The captain is responsible for the safety of the ship and of every one on board. The captain brought the ship into the open sea with the bow doors open! He is, therefore, personally responsible for the loss of his ship. The company's standing order was that "the managers of ship's departments had to report to the Captain immediately are aware of any problem that may render the department is not fully sea ready". This is considered by the court as not satisfactory in many respects. Captains thought that the absence of such a report meant that everything was ok before departure – a dangerous hypothesis. The absence of such a report does not necessarily mean a positive report! Captain was accused by the court of gross negligence and his actions were considered as part of the causes of the accident.

As asked by Millar (1980) why so little attention has been given to the primary control or nerve center of a merchant ship namely the bridge when so many accidents at sea are caused by "human error[11]" ... and the answer is that the identified areas are those of training, bridge design, psychology and marine traffic discipline (Goulielmos, 1998)?

The role of Captain Kirby. He was a coordinator of the captains and officers for a uniform out practice of duties. There was a fast turn over of officers in the ships of the company and in *HFE*, an important issue in management studies. *HFE* complemented with more than 30-36 different deck officers in three months. The officers exhibited not a company culture but a ship culture and *HFE* considered by them not "their own" and were thus indifferent. Additionally, the ship's runs and crossings changed seven times in five months. Kirby also failed to issue clear orders (or to disagree with the existing). It was his responsibility to enforce compliance with orders for closing the ship's doors and for introducing a fail-safe system. He thus was also considered partly responsible for the accident.

As a conclusion about the board management's faulty actions and omissions mentioned above, we note that the responsible persons identified were: the captain, the Chief Mate, the second officer, the assistant bosun and Captain Kirby. But, if all the faults were only theirs, then the application in 1998 of International code[12] of safe management would have been unnecessary. As such the shore management had also important share of responsibility, as we will see in next session.

The shore management role

The court declared that the critical underlying mistakes were committed by individuals higher in the hierarchy of the company not merely by the management on board.

The board of directors, to start with, did not estimate properly their responsibility and their exact duties for ensuring the safe management of their ships. They lacked proper consideration about the organization of the *HFE* for the Dover-Zeebrugge crossing. Management failed from BD down to young managers all alike for committing errors and practicing sloppy management. Shore management had to issue proper and clear instructions intended for staff on board to prevent accidents.

Instructive is the order issued by the department of transport under the title "Good ship management" in July 1986: "The efficient and safe operation of ships demands practicing good management *both* [our italics] on board and on shore ... the total responsibility of the shipping company demands the close engagement on the part of shore management ... recommended that every shipping company operating ships to assign[13] a person on shore responsible for monitoring technical matters and matters of safe operation of the ships and for providing proper shore support ... emphasis is given to the need to provide to Captains and to Officers clear instructions ... there must be close cooperation and repeated effective communication in both directions from ship to shore". The Director Develin was aware of the above very wise order but thought that the company had complied with it and he did nothing. Management's control function was renounced here. The court said: "clear instructions are the foundation of a safe operation system", but there was no one responsible to issue orders (as argued by Clarke, on behalf of the company).

Responsibility for safety. Mr Ayers (director) said that no single director was responsible for safety. Mr Develin thought – before he joined BD – that safety of ships was a matter of the total responsibility of the BD. Mr Develin said that matters of sailing of the ships were handled through a consensus achieved by senior captains. Despite this emphasis on senior captains, the marine department did not listen to complaints, suggestions and wishes of ship captains as they received none satisfaction.

The complaints/requests advanced by ships' captains were:

- ships carried excess passengers[14];
- lights to be fit in bridge to see that bow and stern doors are closed or opened;
- draught marks could not be read; no devices were fitted for this; ships sailed with a trim by the head from Zeebrugge and nobody knew the effect of this on ships' stability; and
- high capacity ballast tanks pumps had to be fitted.

Captain Blowers wrote to management on 28 June 1985: "there is no indication in the Bridge about the most important fact which is whether the watertight doors are closed or not (bow or stern) ... given that the distance between berth and open sea is short and given that the person closing the doors delays or has a problem ..."

Four managers replied to the above commenting in an arrogant way. These were: Alcindor (Deputy Chief Superintendent), Reynolds (Assistant Marine Superintendent), Ellison (Marine Superintendent) and Hamilton (his capacity not found). The court found this as an action lacking proper responsibility.

Captain de Ste Croix in 1986 again wrote, to Chief Electrician, among others: "Ron, another incident reminded me of my older request for indicators in the bridge concerning the position of the doors ... He knew that someone checked visually doors position before ship went to sea ... but given the importance of this matter ... he asked for indicators in the bridge". Ron replied: "Tony, submit a request to Marine Department and if they bless it I will proceed to specifications ... it can be done ... some holes across the deck and bulkhead had to be done". The Captain did that on 13 October 1986. King (of the company) replied that this was unnecessary because a man was there for that and Alcindor agreed and added that the responsible person had to be disciplined if doors left open ... Captain de Ste Croix insisted on writing on 28 October 1986 to other captains for their opinions about the same matter. The conclusion is that company knew the possibility of ships' doors being left open, but the marine department had a negative attitude towards requests coming from masters of the ships.

Ship's draught knowledge. As mentioned ship's draught was unknown (something against UK law 1970 section 68(2) of Merchant Marine that draught has to be put down in ship's log) and also needed as mentioned for the proper number of passengers to be admitted on board. As put, however, by Captain Martin to Develin on 24 October 1983: "In full speed, or even in reduced speed, the bow wave comes above the bow belt and it climbs up to 75 percent of the bow door ... the ships do not listen so effectively with trim by the head and there are problems in maneuvering ... we do not know how much cargo we carry ... if we are overloaded by 400 tons and trimmed by the head by 1.40 meters, I do not know in what way this affects or harms the stability of the ship ..." The culture of management as has been revealed (Develin) was that every movement from the captains was an exaggeration of reality. Control function of management as mentioned has been renounced and management rested on a chair with three or rather two legs (even organization was missing as well). Control of the trim figures in the log could reveal that the ship was operated outside her limits and the passenger certificate. Captain Blowers wrote again in July 1982 about ship's draught ... but Ayers had a different expert opinion.

In 1982 the company's passenger ship *European Gateway* capsized after a collision off Harwich. Captain Martin wrote in 1983 to Develin a report read also by Ayers. The company and its captains can be considered negligent especially if the matters mentioned below can be interpreted as pursued under the so-called "commercial interests":

- ship's draught cannot be read before departure ... log figures are false ... Ayers noted by the margin that this is "a matter of policy";
- captain has no information about the number of passengers from the system ... Ayers wrote in the margin against this: "a working practice". "The system informs Captain but he does not (Captain) agree with the accuracy of that";
- tons of cargo was not stated to captain before departure (working practice ...); and
- full speed is maintained in dense fog (Policy ...).

Ayers found incompetent for his managerial duties. Managers had no special areas of responsibility as stated by him and the style of management was that of the musketeers (our comment): all for one and one for all. As Ayers mentioned about the

knowledge of responsibility of each Manager ... "was rather a case of overlapping out of ignorance not of deficiencies ... we were all one team grown up together".

In 1984 Chief Engineer Crone wrote to Develin, for ballast let say management. Ballast tanks 1 and 14 had to be filled with water at arrival and to be emptied upon completion of loading as mentioned. One pump needed then one hour and 55 minutes, while two pumps pumping together will require 90 minutes ... "the ship trimmed by the head for long periods had bad steering, high fuel consumption, constant ballast tank pressure, time consumption by the staff, the bow doors feel the stress affecting their locking mechanism ... a dangerous fully blind operation as characterized". Develin disagreed to certain aspects of the memorandum, he did not consider it as a matter of safety but a technical one, he did not know about ship's stability and he thought (as a Naval Architect perhaps) that *HFE* could have a trim by the head of 1 meter. He did not approve the "prohibitive" cost of the pumps of 25,000 pounds.

Analysis B by the tools of complexity theory

For the purposes of this paper we shall define complexity following McMaster (1996) as a science about making things simpler through patterns ... it provides ways of understanding things that do not require any great brain power ... it is dependent on patterns and simplification.

As shown in the above analysis dialogue has failed in the above organization because as argued by Battram (1996, p. 61): if dialogue partners view the process of dialogue *simply as the sending and receiving of messages* [our italics], then the dialogue will almost certainly fail (see messages in the above case study between Captain Blowers and other Captains to Develin, Ayers and the other directors). As this is also put by McMaster (1996): sending and receiving is a rather old-fashioned and mechanistic view of communication ... it is a view that in my experience gets organizations into all kinds of trouble ... a conversation occurs in (or emerges from) the *interaction* of two or more people ... *nothing* is communicated *directly* to another ... all communications go through interpretations: processes of context, meaning, significance, content, etc. (our italics). Dialogue is something different and more powerful than discussion. A lot of discussion in writing perhaps used to take place in the above company, but it did not generate more possibilities and more learning than dialogue. In dialogue if every one is being treated fairly, is then able to bring unknown parts of the bigger picture together at a conscious level. The dialogue rules are shown in Figure 1.

The particular rules shown in Figure 1 are used within a number of problem-solving sessions for managers (Battram, 1996, p. 62). Every setting, however, has its rules that must evolve. The first rule comes out of the assumption that one or perhaps more than one person is the problem holder. He is the one (and he has to be respected) of holding the context in the action learning set, keeping focus in the dialogue, exploring the point, not wandering off. Captains of ships obviously were the problem holders. The second rule is for management (or others) to suspend its tendency to judge and rather listen and try to understand. The practice has been to focus on what we want to say in response to what it has been said or written. The third rule and very important is to treat everyone's views as equally valid. This rule is imperative for the dialogue not to collapse.

In the case study, Mr Develin used to reject as a rule the opinions of his captains as exaggerations of reality. He was influenced by his profession as a naval architect providing him with a narrow confidence as he was sure that the ship could trim by the

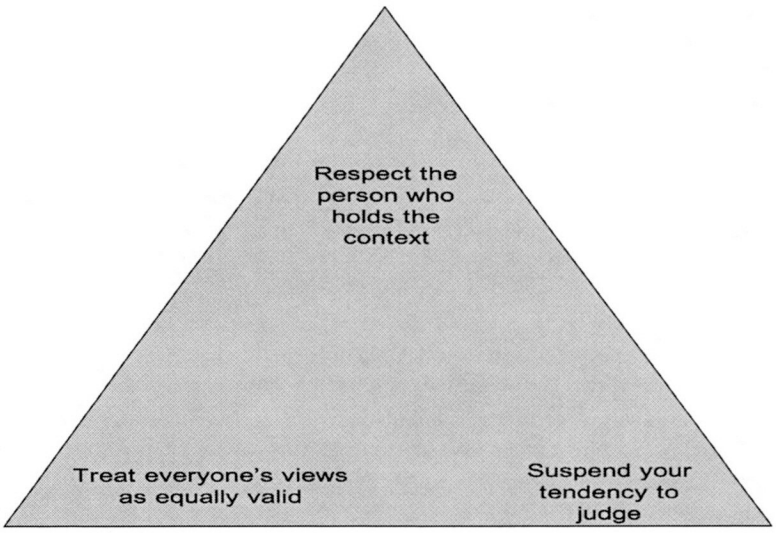

Figure 1.
The dialogue triangle

head by 1 meter, but he overlooked stability matters of an overloaded ship (by at least 376 tons) with 1.40 meters trimmed by the head and at a full speed (but also at reduced).

We have to be careful that when people talk about an event they often generate an innumerous amount of different interpretations, as this happened above, with the standing orders of a critical value. And more importantly, the views and ideas that come to dominate people's thinking is determined almost randomly within what we call possibility space of the "dialogue". Non-linear in character with tiny comments often having a disproportionately large effect on others, like the comments of Develin, Ayers and Young or even from the remaining captains as mentioned above.

The possibility space

I talked above about the possibility space of the dialogue. What is this? Is the place where all our ideas live before they are brought into being ... it is created in language (Battram, 1996, pp. 104 and after). More important, it is an extended metaphor for both the explorations of possibilities and the design of space for the creation of possibilities. The zone of possibility embraces complexity, while the zone of predictability embraces order. Language enables us to search in possibility space ... all complex adaptive systems engage in constant searching ... this is environmental scanning too.

As put by McMaster (1996), "... emergence is a valid term of cause and effect ... communication can be seen independently of individual senders and receivers ... as something that occurs in the [designed] space between people ... it does not matter who shows up ... those who show up will tend to get what they came for ... " The invitation, however, has to state:

- the purpose and the process in an appropriate space;
- displaying the rules of the meeting; and
- supplying a facilitator ... sentences have to have possibility of generation, creativity, exploration and information.

Analysis of the principles for the possibility space design, of objectives and of key elements of the relevant process is beyond the scope of this paper (Battram, 1996, p. 112). But we will comment of the future search process: it offers a model for achieving collaboration in organizations, as shown in Figure 2.

Participants are drawn from a "whole system" within an organization. In the case study is amazing that assistant bosuns never interviewed or contacted to find out while they were falling asleep in five at least cases? Was there a fatigue problem? The bosun, immediate up in hierarchy, why has not been assigned to him the duty to close the doors if assistant bosun failed?

In the future search process (Battram, 1996, pp. 113-4), shown in Figure 2, all work together to review the past, focus on the present and "mind-map" (Buzan, 1993) everyone's perspectives and views onto flipcharts (publicly) ... as well as experience, are all valued ... and people take responsibility for their contribution to the problems and the solutions as they see them ... the focus then shifts to the future and the barriers that need to be overcome to create the common ground on which everyone can play the part ... We cannot assume that we know the best way.

Interactions require a mechanism of fairly continual communication ... in the case study meeting with captains did not occur for 2-1/2 years ... Kauffman (1995) stressed that the units must communicate frequently ... this is not an advice like the one in old management standby of the independent self-sufficient business unit. Hard problems with many linked variables and loads of conflicting constraints can be solved by breaking the entire problem into non-overlapping domains (Battram, 1996, p. 220).

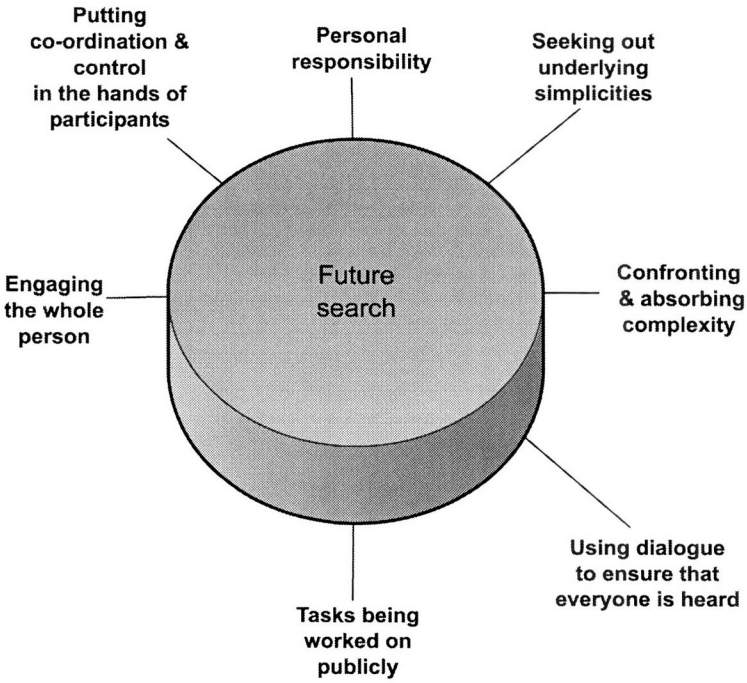

Figure 2.
The future search

In our work in organizations we act as if we believe that people behave "rationally". Is communication a straightforward matter of talking or sending out memos (as in our case study?) and training us mainly about input? The concept of autopoiesis (Greek word for self-making) says differently. The internal model of the world determines our response (Bosun Ayling said: closing the doors was not ever within my duties). We resist change. We are really only interested in what we are interested in, or what we need to be interested in and not much else. Human communication is innately difficult and human behavior is both self-determined and resistant to external changes.

Complexity though is the desirable state as it allows information to be exchanged and learning and adaptation to take place. In the autopoietic model persons actively scan (radar beams like) around them for anything that might interest them or affect them in some way, like threats, opportunities, food, and stimulation. Sabel (Chief Officer) did not talk to second officer about the critical matter of the closing of the doors but whether he (Mr Morter) will go aft. It seems the one did not like the other and this perhaps explains why Sabel relieved Morter. Autopoiesis is particularly relevant to topics in organizations that in fact are considered key ones, i.e. change and communication. If we wish to talk effectively with our staff we must begin listening effectively with them so as to discover their interests. Management in our case was interested in faster crossing and so was the captain of *HFE*, so was Mr Sabel. Communication is a process to establish resonance over a series of interactions. Its tune must suit the self-interests of the systems – not too dissonant (rejection) nor too "samey" (ignored) ... making a difference to the difference ... developing a consistent alternative model ... to describe their reality.

As put by Wheatley (1999) "life cannot create something new without information". If a system has the ability to process information, to observe and respond, then this system possesses the quality of intelligence! Intelligence is a quality that comes out when a certain organizational level is achieved that provides the capability to the system to process information. For a system to have a mind it must be capable of creating and disseminating information for feedback and self-organization (organizational intelligence). Repeating the same mistakes is a sign of an organizational stupidity. The company must be opened to new information and especially what is important is the degree of effectiveness in the interpretation of information from anyone in the company. We have to learn how all will support one the work of the other, to realize that intelligence is distributable and our role is to feed others with real and important information. How important for the HFE accident sounds the open communication system suggested also elsewhere (Goulielmos, 2002) and adopted by Zerox. It is now common that organizations must be networked – where people are connected one with the other aided by available and ever improving technology and the common purpose; this makes a company more effective. Imagine an open communication between assistant bosun, bosun, Chief Mate, second officer and captain for the doors ... where the assistant bosun would give no answer ... Kirby had to be one to propose such a system, as he was responsible for coordination, which means common and tantamount information and the capability to influence actions when are about to be done. Imagine supervisors over their PhD students in an open communication ... how would this be very fruitful.

Drucker (1994) talks about organization that rests on responsibility – an organization that is based not on command and control but on responsibility.

Conclusions

We have shown that the accident of the *HFE* was not a case of technical failure and that even the apparent human errors are deeply rooted in managerial and organizational inadequacies. Complexity theory shows how patterns of inadequacies emerge out of a problematic managing structure and procedures. For example, the assistant bosuns were noted sleeping many times before the accident happened yet there was no mechanism in place to readjust this deviation from expected performance. Long established mis-communication patterns and problematic misconceived dialogues between management and ship officers did not allow for an adaptation to changing parameters – a key characteristic of organizational decline (Cameron *et al.*, 1988) and of closed systems (Morgan, 1986). In understanding and preventing such accidents from happening we need not only to look for technical solutions in ship design and/or equipment and ship management systems but also in improving management structures in preventing patterns of underperformance from occurring. If we take on the view that failure is an emergent property of an under-performing management system and organization we can better design socio-technical systems that may absorb and understand complexity and achieve efficiency.

Notes

1. As argued by Hunt Sir Nicholas Adml. (1995), Director General, The Chamber of Shipping, UK, "UK, and then the Nordic Countries, put forward proposals which led to the development of the Guidelines on Management for the safe operation of ships and for pollution prevention ... adopted by IMO in 1991 and in 1993 – after further revision – these formed the basis of the ISM Code." As argued by Cowley (1995) the M 1188 (July 1986) notice of the UK Department of Transport was considered to give "very sound advice" by the April/June 1987 court of formal investigation into the *HFE* disaster and the UK took steps to introduce mandatory management requirements in respect of passenger ro-ro ferries. This notice considered the Governmental origins of ISM Code. See Anderson (1998).
2. G is the car deck. Decks are assigned to letters in reverse order. The ship had eight decks H-A.
3. The pumps produced 115-120 tons per hour while what was required was 1,000 tons per hour. The tragic fact is that the ship on the day of accident went to the open sea without emptying ballast tanks in full as there was no time for that given the capacity of the pumps and the time available between finishing loading and being in the open sea (4 minutes?).
4. The ship was constructed fit for the voyage Dover-Calais and especially to cross it at the high speed of 22 knots (in fact 18 knots achieved in practice) and carry that at the shortest possible time including turnaround time (port time).
5. Department of Transport (1987) September, The Merchant Shipping Act 1894, mv *Herald of Free Enterprise*, Report of Court No. 8074, formal Investigation, London HMSO.
6. As argued by Dr Embrey (n.d.) the modern human reliability consists of the following principles:
   - emphasize error prevention;
   - address underlying error causes;
   - base techniques on error theories;
   - see human as active problem solver;
   - adopt a systematic feedback of operational experience;
   - lessen emphasis on quantification;
   - consider management and organizational factors;
   - address cognitive as well as action errors; and

- consider positive (and negative) contributions of human. Compare this with traditional approach to human reliability mentioned below (fn 7).

7. The traditional approach to human reliability consists of the following principles:
   - focus on negative aspects of human performance;
   - no consideration of error prevention;
   - techniques as in hardware methods;
   - human is a component;
   - count numerical error frequencies;
   - ignoring organizational factors; and
   - major emphasis on quantity.

   See Embrey (n.d., p. 3).
8. According to Dr Embrey (n.d.) most techniques developed to assess and manage human error follow "the system induced error model", where all individuals tend to err – by a built in error tendency – which if combined with error inducing conditions (in our case fatigue or sleepiness) produce an error. But for the error to give rise to a significant consequence for safety, an unforgiving environment is needed. This prevents or reduces the likelihood of error recovery. This, if combined with vulnerable system state (VSS) (cases like 3 mile island or Chernobyl or *HFE*) causes the final undesirable consequence to occur. The error that produces a VSS without a significant consequence is a latent failure (common feature of management). If the consequence is significant, as in the case of HFE, the failure is called active. A recovery failure happens when an active failure while is possible is not recovered. Many error inducing conditions arise from organizational and management policies that are outside the control of the individual who makes the particular active failure initiating the safety lapse. In these situations the attribution of blame is far from clear. In the past the individual at the end of the chain of causality has usually been the recipient of blame and punishment. Organizational and management policies may create a situation where safety failures are at some stage inevitable.
9. At least five cases mentioned where ships of the company brought to the sea with the bow or stern doors open. Some of these cases were known to management. In 1983 the assistant bosun left all doors open of another company's ship sailing from Dover. In 1984 the Captain of *Pride* noticed two instances of open doors in the Zeebrugge run, as mentioned in the text.
10. What was required here was an enforcement of this critical and important order.
11. Defined by him as meaning "a mistake made which involved a human being, maybe even a chain of human beings".
12. The code introduced correctly the responsibility of the shore management (IMO, 2002).
13. ISM Code later in 1998 introduced the idea of the designated person ashore (DPA).
14. Captain Blowers reported to directors Young and Develin that he had from 40 to 250 more passengers in 1982. There were indeed conflicting estimates about the ship passengers between number of tickets collected by the Purser, the manifest office and counting passengers one by one. Captain Pearson reported the same in 1982 and especially that lorry drivers were excluded from counting. Captain Morgan said that children below 4 have no tickets. Captain de Ste Croix reported in 1986 that he counted 1,682 passengers and life save appliances were thus inadequate. The manifest indicated 1,228 and the Purser 1,288. Captain Stoker found in 1986 29 excess passengers. The same facts reported by Captain Martin who counted 1,550 in 1986, an illegal number. Captain Hartwell reported similar concern and also referred to the harm that can be caused if this matter was known to media. He had 1,442 passengers in 8 November 1986, with some in excess. Captain Ferrier in 1986 he too had 72 excess passengers as well as Martin who had 200. Young (director) did not pay proper or honest efforts to solve this illegal and dangerous practice. The court considered this problem to be inferior of company's intelligence and in fact – after the Accident-boarding cards for all

passengers up to the legal maximum were introduced ... Number of passengers was also connected with ship's draught for 550 passengers (and 80 crew) for 5.50 m moulded.

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