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Methods and Means for Analysis of Crew Communication in the Maritime Domain

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Abstract

The *Human Element,* among a group of maritime human factors terms, is used widely within the commercial maritime environment to incorporate many issues being addressed by maritime research institutions and industry bodies. In accident investigation losses are attributed frequently to *Human Error*, which itself has a variety of identifiable categories e.g. *Human Communicative Error*. This paper describes an analysis of a number of maritime accident reports in which a failure of effective crew communication played a central role in the causal chain. The analysis is based on an aviation industry accident investigation taxonomy, *ADREP 2000 Taxonomy* [8] and psychological theories of professional communication [13]. The paper discloses, accentuates and exemplifies the structure of problems related to maritime crew communication and problems related to different cultures and languages. It also explores the value, contribution and limitations of formalised taxonomies and analysis systems to maritime training authorities, when they are applied as tools in the analysis of accident reports. It also looks to highlight the need for further research into the sociolinguistic aspects of shipboard operation within the *shipboard society* not just during times of restricted manoeuvrability, but during everyday working and social communications in pursuit of recommendations to aid the reduction of occurrences of *Human Communicative Error*.

1. Introduction

1.1. Human Error, communication and multi-cultural crewing issues

With no formally accepted international definition the term *Human Element* is often used interchangeably with *Human Factors (*or *human factors),* the former being a research area with specific interest in cognitive science and ergonomics and the latter encompassing ”anything

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human‘ [12]. The International Maritime Organisation (IMO) has been addressing what it terms the *Human Element* since 1991 resulting in the adoption of specific strategy and policy at each jurisdictional level in countries ratifying its conventions. According to the UK Maritime and Coastguard Agency (MCA) ‘Human Element Strategy’, *Human Element* can be considered as:

> *“Ship personnel/human resources; Ship design and automation; Port operations e.g. cargo loading/unloading; Navigation and traffic management; and Organisational factors.”* [5]

The United States Coastguard defines the *Human Element* as:

> *Human and organisational influences on marine safety and maritime system performance* [16].

The five key areas listed by the MCA make up the term *Human Element* from their operational and legislative point of view, while simultaneously representing five human and technological system fields [5]. The US Coastguard’s definition of *Human Element* is, on the other hand, intended for use as non-regulatory terminology.

Another strong use of the term *Human Element* as a concept has been established by the Nautical Institute and Lloyds Register combined ‘Alert! Bulletin’ and their ‘International Maritime Human Element Forum’ projects. In this context the term *Human Element* is used to incorporate:

> *The Human Element is a critical feature of all aspects of ship or system design and operation… Poor ship design, bad ergonomics, equipment failure, fatigue, stress, boredom, commercial pressures, cultural differences, differing equipment designs, and a lack of proper training in the operation of equipments, all affect the way in which a ship is operated* [14]

Two other terms have also been introduced in this section, these are *Human Factors* and *Human Error*. As far as each of these terms is concerned example definitions should also be explored:

> ***Human Factors****: Aspects of human capabilities (physical, cognitive, psychological) and performance as applicable to the design of organisations, systems, and devices of all kinds* [16].

> ***Human and Organisational Error****: Unacceptable or undesirable performance on the part of an individual (Human Error) or group (Organizational Error) that can result in unanticipated or undesirable effects* [16].

Other industry bodies, than those included in the implementation of IMO policy, are showing increasing interest in managing *Human Factors* in the commercial maritime environment. The Royal Institute of Naval Architects (RINA) has been making:

> *Increasing efforts to gain awareness of human element issues and to improve their understanding of how and why their designs influence*

human behaviour [16].

The importance of reducing *Human* and *Organisational Error* through the management of *Human Element* and *Human Factors* was the key focus of their conference programme in February 2005 'Human Factors in Ship Design Safety and Operation'. Taking the view that *Human Error* is a symptom of deeper problems within an organisation or system, RINA is giving weight to the debate surrounding the labelling of accidents and near misses as simply being down to the failure of the individual or team of individuals to perform a task desirably. With a focus on ship design and man-machine interface, factors such as poor design, poor training and poor or inadequate management systems are being blamed. This has resulted in those concerned classing what has traditionally been called simply *Human Error* now as *Organisational* or even *Systematic Error*:

Sensible application of ergonomics and human factors can provide an opportunity to both reduce costs and improve safety [16].

The definitions of *Human Element* explored above are the result of an institution's perception of the *Human Element* based on their own research and that of others. The MCA regard *Human Element* as a regulatory factor, needing to be addressed in order to develop effective regulation with which to manage its influences. RINA, on the other hand, are looking to improve best practice and to educate naval architects of the influence of *Human Factors* on ship design in order to reduce *Human* and *Organisational Error* in the commercial maritime industry. Each of the example definitions given above are characteristic of many of the other uses of the term in that they do not describe, in the true sense of the word, an *element* – a basic constituent; incapable of being analysed into any simpler form, but more a cross disciplinary mixture or compound of elements. It is for this reason that *Human Element* and *Human Factors* are often used interchangeably, as when referring to a number of attributing issues inescapably working together it has become desirable to pluralize.

In the advent of a dialogue being fostered between maritime industry academics to decide upon the correct use of these terms - *Human Element, Human Factors* and *Human Error* - for the sake of this paper the definitions explored above have been used in this context. *Human Element* shall describe the holistic approach to the subject in using the word 'element' to actually refer to a group of factors relating to ship design or operation, *Human Factors* will be used to describe the list of components making up the *Human Element,* with a single component being referred to as a *Human Factor,* and *Human Error* and *Organisational Error* will be used in reference to unacceptable or undesirable performance on the part of individuals or groups respectively that result in the occurrence of an *Incident - an accident, major* or *serious injury,* or *hazardous incident* as defined by the UK Marine Accident Investigation Branch (MAIB).

Accidents and incidents in the maritime domain are often caused by a break down in the socio-technical system which constitutes and characterizes the work in the domain. The ingredients in this system are humans (e.g. crew members), groups (e.g. the crew), technology (ship, instruments, equipment, tools etc.), work practice (procedures, conventions, traditions), organization (management, company culture, pressures etc.) and work environment (light, noise, vibration etc.). A break down in the socio-technical system could be related to or caused by poor design of equipment (human – technology), inconsistency between work practice and written procedures (work practice – organization), crew stress caused by company pressures (human – organization), poor communication between crewmembers (human – group) or fatigue caused by

vibrations and noise (human – group – work environment). The network is illustrated in fig. 1 below [9], [10], [11].

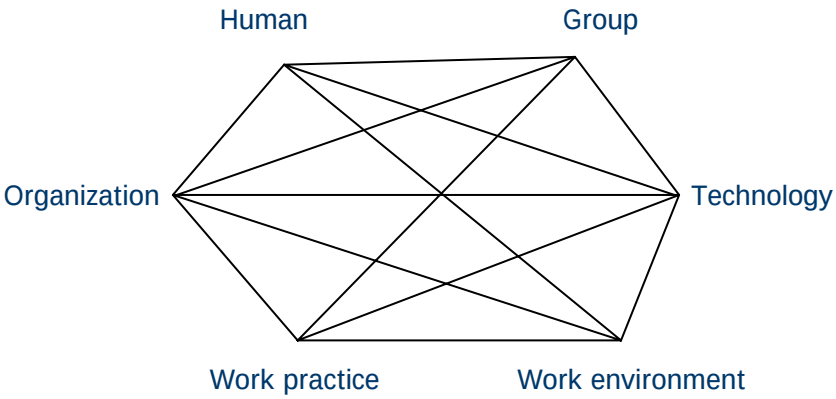

Fig. 1. The Socio-Technical Network

It is evident from studies of maritime accident reports where, in the chain of causation, 'human error' has been identified as a significant factor, that it is possible to break down this category further and to identify that crew communication failure (human – group) has played a key role in the incident [2]. Poor communication between crewmembers from the same culture who are speaking the same language can, through misunderstandings and mistakes, be a threat to the overall safety of a vessel and pose an additional threat if one considers the risk of subsequent pollution. If one adds the additional variables of crews using English as a second language and the cultural differences which may be experienced, then the odds of miscommunication may be increased. In turn, it is recognised that maritime safety can be enhanced by the improvement of crew communication, facilitated through training in the use of Standard Marine Communication Phrases (SMCP) [6].

Navigation is mostly performed by one person, an individual, working alone. When a ship enters or leaves port or when manoeuvrability is restricted the computational requirements of the task are assumed to exceed the capabilities of any one individual, so navigation is carried out by a team of individuals working together and the need for effective communication, in one common language, is paramount [7].

Navigators will work in a bridge team when required to do so in order to ensure the safe operation of a vessel. During such times e.g. when manoeuvrability is restricted, miscommunication can cost lives, loss of cargo, and pollution. Hutchins [7] writes about *Learning to Navigate* and describes navigation as an activity normally carried out by an individual, working alone, who is joined by other deck crew when the computational requirements of the task are assumed to exceed the capabilities of one Navigator. Examples of such a time include times of restricted manoeuvrability, when a ship enters or leaves port or when there is heavy congestion of maritime traffic. At these times it is common for a Pilot to be onboard and it is through the presence

of a Pilot that the most comprehensive crew communication research project to date, the *MARCOM Project*, collected some of its data. Data were collected from the Pilot's own experiences of mixed nationality crews' use of English and Maritime English and from observations made during periods of pilotage, when a researcher joined the vessel with the Pilot.

Research into the pros and cons of multicultural crews, is attracting increasing interest from across the widespread maritime research community and industry alike. In 2004 the journal *Maritime Policy and Management* detailed the existence of three major studies carried out in this field, the most relevant of which to this paper is the work completed by the Seafarers International Research Centre (SIRC), at Cardiff University in the UK entitled *Transnational Seafarer Communities.* The issues arising from these recent research publications were those of onboard culture and language as it is commonplace on ocean going vessels engaged in world trade that staff will frequently come across crews and other industry groups whose members come from a number of countries and related cultures [4].

1.2. Accident Investigation and Human Communicative Error

Much of the work carried out in the field of marine accident investigation reflects what is underway and has already been done in the aviation industry, which is generally viewed by the marine industry as being superior in terms of its advancement in research and policy making and its overall safety record. It is for this reason that a taxonomy used in the investigation of accidents in the aviation industry the ECCAIRS ADREP 2000 taxonomy of explanatory factors - has been applied in the analysis of maritime accidents in search of a further breakdown of *Human Communicative Error (HCE)* into relevant categories. HCE can be defined as *Human Error* which occurs as a result of a failure in communication, be it ship to ship, ship to shore or intra-ship.

In order to illustrate the failures in communication and the role of formal taxonomies, this paper describes a number of accident reports in which *HCE* has been cited as a factor in the chain of causation.

1.3. Objectives

The main issues surrounding *culture and the work context* are discussed by means of a literature review in Section 2 of this paper. Sections 3 contains any references to methodology and features *concepts suitable for use in analysis of marine accidents.* Section 4 incorporates a brief summary of each accident and the analysis of secondary data from accident reports with the ultimate aim of breaking down the *HCE* involved and classifying it using the ADREP 2000 Taxonomy.

Given that this paper has been written with its firm foundations set in the hypothesis that the interaction of multicultural crews onboard has an effect on the ability of the crew to communicate effectively, the concerns regarding *culture* and *HCE* are of utmost importance and relevance and are integrated into the investigation and analysis.

Conclusions have been drawn from the secondary data analysis contained within section 4, which incorporates a brief summary of the issues surrounding multi-cultural crew communication and why the ADREP 2000 Taxonomy is a suitable classification for maritime accidents.

2. Culture and the work context

2.1. Hofstede‘s cultural dimensions

There are plenty of studies detailing the culture differences in the context of employment. One of great significance is *Cultures and Organisations: Software of the Mind* [3], which is an account of a study of how values in the workplace are influenced by culture. From 1967 to 1973, while working at IBM as a psychologist, Hofstede collected and analysed data from over 100,000 individuals from forty countries using the complexity of such a multinational corporation as IBM as a clear canvas for such a study. An industry such as shipping is unmatched in its complexity, which may be so much the case that it limits the possibility for variables to reflect one another to a sufficiently scientific extent for such analysis. From the IBM results Hofstede developed a model that identifies four primary dimensions to differentiate cultures: *individuality, masculinity, uncertainty avoidance,* and *power distance.* He later added a fifth dimension, *Long-term Orientation.* In his 1984 text Hofstede investigated the *International Differences in Work Related Values,* a study which was updated in 2001. Hofstede‘s studies focused on the influence of national culture on the sub-cultures of the worldwide organisation, which he also executed by questioning and observing employees of IBM. His conclusions have shed valuable light on key cultural differences between nations in the way in which they conduct themselves in the workplace. Hofstede identified these four key dimensions in order to distinguish between the differing values and attitudes of those within the bell curve which represents the mainstream of a culture. In short, Hofstede‘s dimensions are generalisations about the members of a society or cultural group. A summary of each relevant dimension and its contextualisation into a team setting, such as that found on the bridge of a ship, follows:

Power distance – Low power distance helps the creation and maintenance of self-directed teams, since empowerment is easier to achieve in this culture. Countries with high power distance are ones where employees are seen as frequently afraid of disagreeing with their bosses.

Individualism – Low individualism or a collectivist society is more adaptable to the creating of self-directed teams since the team spirit must overcome the individual needs. Individualist cultures are expected to act according to their own interest, and work should be organised in such a way that this self-interest and the employer‘s interest coincide.

Uncertainty avoidance – For teams to reach self-direction or a high level of participation, the society must have low uncertainty avoidance otherwise the team members will be afraid to take necessary decisions [3].

These dimensions can be related to the operational requirements of the specific work context. The 4th dimension – *Masculinity* – is not considered as relevant for this paper nor is the 5th dimension of *Long-term Orientation;* these have therefore been omitted.

This paper investigates the requirement for effective communication in the maritime work domain as there are some inferences that each of these dimensions may also influence communication in the multi-cultural work setting. A fear of questioning the actions of a superior is a characteristic related by Hofstede to cultures with high power distance. The subsequent failure to communicate because of this perception of power distance and failure to indicate to a superior that there may be a problem with his or her actions, in principal allowing an accident to happen, is just one example explored through the cases of marine accidents contained in section 4 – *See Bunga Teretai Satu.*

2.2. Inter-cultural Communication

Intercultural communicative competence is vital because people's communication styles are inherently culturally bound [3]. The STCW convention and its amendment in 1995 theoretically dissolve such divides as value and culture in training and education, but in reality these factors still thrive. Discussing culture is a sensitive issue and to avoid slipping into stereotyping this paper in referring to a particular nationality, is referring to a bell curve of a culture. In this bell curve the people in the centre represent the mainstream, which should be interpreted with an awareness that cultures are made up of individuals whose behaviour can vary greatly, [7]. The 1995 major revision of the STCW Convention saw the first inclusion of specific requirements for English Language certification. Communication lapses identified as *Human Error* in the causal chain of accidents have led to the use of English as the common language under the revised STCW Convention 1995.

Setting aside the further issues of loneliness, stress and fatigue brought about by the reduction in numbers as a result of technological advances, the 80% of the world‘s merchant ships which have become multilingual and multi ethnic in terms of crew composition [2] are facing the reality of those very concerns relating to the *Human Element* as outlined by Horck [4], Hughes [6], Hofstede [3] and Hutchins [7].

> *“If there are also problems of communication contributing to a lack of mutual confidences, suspicions and misunderstandings, then the opportunities for human errors leading to dangers to the ship, the people on board and the environment, are greatly increased.”* [2]

The need for clear verbal communications between parties in the commercial marine environment is multi faceted as the ship is the working environment, learning environment and social environment for its personnel. Those on board must communicate between ship and shore when in coastal waters, between ships in areas of congestion or where avoiding action is required, or even during search and rescue activities. During periods of pilotage, English is frequently used as a common language and both Pilot and crew must be able to communicate effectively to ensure safety. Those working onboard passenger vessels must have a strong command of a common language in order to communicate with passengers. Communication on an intra-ship level takes place daily between personnel during operation of the vessel – when giving and carrying out orders under ”normal‘ or ”emergency‘ situations – and when the multinational crew must interact to

maintain ”social harmony‘ in an off duty context and in their everyday ”teamwork‘ to ensure effective day to day operation [2].

2.3. Potential Limitations

As with any study of activity in any *context* – the circumstances in which an event occurs e.g. an occurrence of an accident -the primary debate surrounding the observation of human behaviour, specifically that of cultural interaction among mixed nationality crews in relation to its affect on English language competence, for scientific analysis, centres around one fundamental question:

> *“How can one analyse and interpret data that record and describe human behaviour and discourse?”* [1]

The written accounts of marine accidents are recorded in official Accident Reports and any analysis of data in this paper must come from these written accounts. The ability of these reports to record the relevant information for discourse and communication analysis is limited, as they are usually based on log books, charts and whiteness accounts and are retrospective. One difference between shipping and aviation is the use of the black box flight recorder which records intra-cockpit speech and external verbal communications. Such devices are available in shipping, but their use is limited and is not enforced by statute, therefore data from this source is not readily available to marine accident investigators.

3. Methodology

3.1. Concepts suitable for analysis of HCE in marine accidents

There are two principal approaches to exploring the issues relating to culture and language issues that were identified in the literature review. The first is a post accident approach and involves the analyses of maritime accidents and indications of cultural issues and HCE in safety critical situations. These analyses are based on accident reports and the technical terminologies contained within them reflect the fact that investigators are often navigators or engineers. This approach suits analyses which incorporate the use of formal taxonomies and has the inclination to fall within the quantitative bracket of research as its results are often suitable for manipulation using statistical programmes in order to generate frequency descriptives and to establish statistical associations. The ADREP 2000 taxonomy suggests a terminology based on psychological concepts, rather than the technological ones used by the navigators or engineers who usually investigate marine accidents, which are suitable for description of the human element and human factors involved in an accident. The authors of this paper believe that the development of the marine accident investigation process to include Industrial Psychologists and Human Factors specialists could aid the inclusion of such psychological terminology into accident reports and would subsequently make this information source more suitable for analysis using the ADREP 2000 taxonomy.

The second of these approaches to exploring issues relating to culture and language in the marine

environment is a qualitative one, which studies culture and language in everyday life. By studying crew communication and behaviour and by interviewing the crew onboard multi-cultural vessels the researcher can observe the issues relating to culture and language in non-safety critical situations and inform how this behaviour and discourse may relate to or influence communication in safety critical situations. This paper utilises the former approach.

Another relevant example of a system of concepts suitable for use in the analysis of accidents where communication or language was important is the communication model by Metze and Nystrup. Metze and Nystrup defined four dimensions of verbal communication in a professional context. Any communication sequence (conversation, statement, order, question, answer etc.) can be analyzed according to these four dimensions:

1. *Cognitive* (knowledge and sense, exchange of exact information) – *affective* (feelings and intuition)
2. *Expanding* (long conversation or dialogue, questions which lead to comprehensive answers) – *limiting* (closing the conversation as quickly as possible, short answers, yes/no)
3. *Confronting* (focus on problems and conflicts) – *concealing* (hiding problems and conflicts)
4. *Listening* (paying attention to what is said and showing that by gestures or answers) – *not listening* (not paying attention, indifferent, no eye contact)

In most professional contexts the communication is preferred to be cognitive, confronting and listening. It whether the communication should be expanding or limiting varies depending upon the context and purpose of the communication. The command/confirm-communication, which is used on the bridge, is an example of limiting communication, which - of course -is appropriate in the given situation. The applicability of the ADREP 2000 taxonomy and the communication model by Metze and Nystrup will be illustrated with a few empirical examples in section 4 of this paper.

3.2. Accident classification from taxonomy

A quick browse through maritime accident reports from USA, Canada, UK, Australia and Denmark shows several examples of accidents in which the human element and culture or language related problems played an important role in the causality of the accident. The following examples can be mentioned:

- Problems related to multi-cultural crews (e.g. the Bunga Teretai Satu accident, the death of a crew member on board Sally Maersk, and the Scandinavian Star)
- Problems related to different cul-tures/languages among crew and pilot (e.g. the Bright Field accident)
- Problems related to different cul-tures/languages among crew and passengers on passenger vessels (e.g. the Skagerak accident and the Scandinavian Star accident)
- Problems related to different cul-tures/languages with respect to external communication, VHF communication with other vessels (e.g. the Royal Majesty accident)

It is possible to assume that the following mentioned examples also could be found if further re-

search is done:

- Problems related to different cul-tures/languages with respect to external communication, VHF communication with VTS stations.
- Problems related to different cul-tures/languages with respect to crew interaction with equipment or procedures.
- Problems relating to everyday communication too as this is where a lot of problems stem from.

4. Results and discussion

4.1. Problems related to multi-cultural crews

The grounding of the Malaysian flag container ship Bunga Teratai Satu on the Great barrier Reef occurred when a waypoint alteration was not made. The significant act identified by the accident investigators to have caused the waypoint alteration to be missed, was the telephone call made by the Pakistani Mate and his wife to their family. The mate had developed a practice of asking the AB from Myanmar to plot the ship‘s position from the GPS every hour when the ship was in open waters. As the Pilot had left the ship and they were out of the compulsory protection zone, but not onto their next waypoint, the AB assumed his role and proceeded to plot this position.

The position plotted was adjacent to waypoint 34 on the ship‘s passage plan, where the ship‘s course was due to be altered. According to the AB, he kept expecting the mate to come back into the wheelhouse to alter course. But the mate did not re-enter the wheelhouse until about 0715, whereupon he and his wife proceeded to make some coffee at the sink at the port side of the wheelhouse. At around 0717, after making coffee, the mate went to the chart table and checked the 0700 position. He looked over the chart table console and told the AB that he had made a mistake in plotting the position. Shortly afterwards and in desperation he told the AB to ”change to hand steering‘ and shortly after the vessel was aground.

The AB was obviously an intelligent young person with some six years seagoing experience. He had learnt to plot GPS positions but was not familiar with chart symbols or issues such as scale, or time/distance estimations. He did not realise the ship was standing into danger. He resumed his lookout duties assuming that the mate would make the appropriate alteration in due time. Such an attitude reflects a large ”power-distance‘ as described in section 2.1 according to Hofstede [3] and in their account the accident investigators noted that there existed a strict hierarchy between the Pakistani senior officers and the Malaysian, Indonesian and Myanmese junior officers and crew. It was important in the national culture of the crew that the AB although he knew that something was wrong -did not question the decisions of his superior. The ADREP 2000 taxonomy classifies this problem as follows:

202030000 Cultural issues.

Factors related to cultural issues, e.g. crew mix, authority gradient, cultural issues and

crew resource management.

It is less likely that this problem could occur with an all Scandinavian crew because there are few differences in culture, nor can this culture be characterised by a high ”power distance‘ [3].

Using the Metze and Nystrup model, the communication on the bridge before the grounding could be described as cognitive (about facts), limiting (com-mand-confirm style with no room for questions from the AB), concealing (the AB concealed his awareness about the mistake made by his superior due to the cultural factors described above) but - in general -listening. The cause of the accident could be found in the *limiting* and *concealing* qualities of the bridge communication. The appropriate ADREP 2000 category is:

> 501010100 The interface between humans in relation to communication between crew members.
> *Factors related to the interface between humans in relation to communication between crew members.*

In the incident which occurred on board the M/V Sally Mærsk in June 2000 on a voyage from Hong Kong to Long Beach, a repairman from Poland suffered from pain in his back and fever. Due to poor English language skills he asked his colleague – another repairman from Poland – to act as an interpreter for him during the medical consultation with the chief officer. The sick repairman had an injury in his back few days ago. His colleague was aware about this and assumed that the pain was caused by the injury. The sick repairman explained and asked his colleague to translate that he had pain and felt sick with fever, but the information about fever was lost in the translation and the chief officer got the impression that the problem was the pain assumable caused by the injury. The chief officer prescribed mild pain killers as the only treatment. The Polish repairman paid several visits to the sick repairman in the following two days. The sick repairman complained about his illness and the fever which had become worse. During the last visit the sick repairman seemed to be asleep and his colleague left him without talking to him. Later that day the sick repairman was found dead and the cause of death was pneumonia.

4.2. Problems related to different cultures/languages among crew and between the crew and the Pilot

The communication problems in the Bright Field case are quite similar to the problems in the Bunga Teretai Satu case in relation to Hofstede‘s cultural dimensions and the phenomena he describes as ”power distance‘. While the Bunga Teretai Satu case was a matter of communication between crewmembers from the same culture, the Bright Field case illustrates a situation with a crew and a pilot from different cultures: American and Chinese. The word "no" is a very impolite word to the Chinese. It is therefore the cultural practice of Chinese crews that they always answer "yes" - especially to an authority such as a pilot - even though they are well aware that the correct answer is "no". This is in fact a very extreme example of concealing communication according to the model by Metze and Nystrup.

The correct ADREP 2000 taxonomy classification of the problem is again:

202030000 Cultural issues.
Factors related to cultural issues, e.g. crew mix, authority gradient, cultural issues and crew resource management.

Further, the pilot suffered from a lack of information due to the fact that he was not able to understand the communication between the engine room and the bridge, which was in Chinese. He was prevented from recognition of the engine problems from the bridge/engine communication and he therefore suffered from information deprivation.

The correct ADREP 2000 taxonomy classification of this problem is:

501010500 The interface between humans in relation to language.
Factors related to the interface between humans in relation to the use of a particular language,e.g. English in a French speaking area.

Using the Metze and Nystrup model, the communication on the bridge before the collision could be described as cognitive (about facts), limiting (com-mand-confirm style), concealing (the engine problems was concealed with the expression "yes sir" used consequently even if the correct answer was no) but - in general - listening. The cause of the accident could be found in the *limiting* and *concealing* qualities of the bridge communication.

4.3. Problems related to different cultures/languages among crew and passengers on passenger vessels

The ferry Skagerak foundered in heavy weather in 1966 on route between Norway and Denmark. The passengers and the crew were all saved due to a remarkable effort from the crew as well as from the vessels and helicopters engaged in the search and rescue operation. The mustering of the passengers was not done using loudspeakers. A member of the crew knocked on the door to every cabin and asked the passengers in Norwegian or Danish to don their lifejackets and go to the mustering stations as quickly as possible. A couple of French speaking passengers did not understand the instructions given and assumed that the crewmember talked about the arrival. They therefore dressed carefully and prepared for the arrival and went to the passenger area where they found the other passengers dressed in pyjamas and lifejackets. Although the situation now can be considered amusing - the passengers were in fact saved -it is evident that the problems with the communication between the crew and the passengers could have had fatal consequences.

The ADREP 2000 categories of explanatory factors for this particular example from the foundering of Skagerak are:

501010500 The interface between humans in relation to language
501011100 The interface between humans in relation to aural/oral interpretation/misinterpretation
Factors related to the interface between humans in relation to interpretation/misinterpretation associated with communication.

The communication model by Metze and Nystrup cannot directly be applied in this example because the model is based on two-way communication. The communication in the example was only one-way: From crewmember to passengers. It is however likely that the communication was *limiting* in such an extreme way that the passengers did not dare to ask the crewmember about the instructions. It was probably also *cognitive* due to the context and it was most likely *not-listening* -otherwise the misunderstanding would not have occurred. We do not know if it was *confronting* or *concealing*, but given the circumstances and the need for an urgent message to be conveyed there was probably not time to formulate the statement in a concealing way. The limiting and not-listening properties of the message did clearly contribute to the misunderstanding of the message. If the passengers had shown (listening) that they did not understand the message or if the crewmember had used an expanding way of communicating, the misunderstanding would probably never have occurred in the first place.

The ferry Scandinavian Star burned out completely on a voyage from Norway to Denmark in 1990. A lot of the passengers and crewmembers died in the fire, and the accident was considered to be one of the worst passenger ferry disasters ever in European waters. Witness testimonies express problems related to crew-passenger communication and crew-crew communication due to different languages. The captain even complained about the poor English language skills of the crew in a telefax to the shipowner before the accident occurred. The appropriate ADREP 2000 category describing this problem is:

501010500 The interface between humans in relation to language.

4.4. Problems related to different cultures/languages with respect to external communication, VHF communication with other vessels

The grounding of Royal Majesty on Rose and Crown Shoal near Nantucket, Massachusetts on 10th June 1995 is a very complicated case with a number of human factors issues. The issue to be used in this analysis is the communication between M/V Royal Majesty and a group of Portuguese fishing boats and the ship to ship communication between the fishing boats on VHF channel 16 a short time before the grounding. The M/V Royal Majesty was off route due to a malfunction of navigation equipment on the bridge, but the crew were unaware of this malfunction due to false indications from the navigation equipment. At a certain point, the crews on board a group of Portuguese fishing boats realised that M/V Royal Majesty was heading towards danger and tried to call it on channel 16. Because they called a vessel on a certain position, and the crew on board M/V Royal Majesty was convinced that they were in another position, the crew on M/V Royal Majesty did not respond to the call - the call was made in English. The call in English did not indicate any danger, but the ship to ship communication within the group of Portuguese fishing vessels did indeed indicate danger, but this communication was in Portuguese and was not understood by the crew on board M/V Royal Majesty. There is a possibility, that the crew would have paid attention to it, had the communication been in English and there is a further possibility that the crew might had been alerted that their vessel was off course.

Sections of coastguard transcript of VHF-FM radio transmissions:

2042 fishing vessel (f/v) Sao Marcos [in English]: "Fishing vessel, fishing vessel call cruise boat."

2043 f/v Rachel E [in Portuguese]: "Are you there Toluis [nickname of Tony Sao Marcos]?"

f/v Sao Marcos [in Portuguese]: "Yeah, who is this?"

f/v Rachel E [in Portuguese]: "It's Antonio Pimental. Hey, that guy is bad where he is. Don't you think that guy is wrong in that area."

f/v Sao Marcos [in Portuguese]: "I just tried to call him. He didn't answer back. He is very wrong."

f/v Rachel E [in Portuguese]: "I've been watching him for the last half hour. He was a big contact on my radar. I picked him up 8 miles away.

[source unknown] [in English]: "Channel 16 is a distress channel and this is international, please change your channel, please change your channel."

2045 f/v Rachel E [in English]: "Calling the cruise boat in the position 41 02N, 69 24W. Over."

40 seconds later f/v Rachel E [in English]: "Calling the cruise boat 41N, 69 24W. Over."

Again the appropriate ADREP 2000 category describing this problem is:

501010500 The interface between humans in relation to language.

5. Conclusions

The issues surrounding intercultural crews and the potential for HCE were identified in the literature review and examples have been given from maritime accidents of problems related communication, language and culture. These examples have been analysed successfully using the ADREP2000 taxonomy and the psychological model of professional communication formulated by Metze and Nystrup.

The need for clear verbal communications between parties in the commercial marine environment is multi-faceted as the ship is the working environment, learning environment and social environment for its personnel. The multinational crew must interact and communicate in a common language to maintain "social harmony' in an off duty context an in their everyday "teamwork' to ensure effective day to day operation. The most commonly recognised failure occurs with the level of understanding of English between ship to ship and/or ship to shore under conditions of restricted manoeuvrability, or when under critically congested circumstances where little time or space can be afforded for mistakes to be made. It is apparent from the examples of accidents that seafarers cannot be expected to communicate in a variety of languages, using

some English of non standard origin and then be expected – under the stressful circumstances of restricted manoeuvrability or emergency operations – to revert to using a standard marine vocabulary and to remove any redundant language.

It is possible to minimise the amount of accidents directly related to poor communication by improving crew communication through training and education of the crew, improved procedures for communication, better selection of personnel and improved design of maritime equipment and technology including means for communication (e.g. telephones, VHF, radios etc.). Any effort of improvement of crew communication should be based on fundamental knowledge about the dynamics of crew interaction and communication as can be obtained from analyses of maritime accidents using psychological terms and concepts as exemplified in this paper.

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