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Factoring the human into safety: Translating research into practice

Crew Resource Management Training for Offshore Operations

Volume 3 (of 3)

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Crew resource management training for offshore operations

Volume 3 (of 3)

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This is Volume 3 of the final report of HSE/JIP project 3661 'Factoring the Human into Safety', sponsored by: Agip UK Ltd.; AMEC Process and Energy Ltd; BP Amoco; Coflexip Stena Offshore Ltd. Conoco UK Ltd.; Elf Exploration UK; Halliburton Brown and Root; Health and Safety Executive (OSD) Kerr-McGee North Sea Ltd.; Salamis/SGB Ltd.; Transocean Sedco Forex; Shell Expro UK Ltd.; Texaco North Sea UK Ltd; Total Fina.

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This volume forms the third part of a series of reports for project 3661 : 'Factoring the Human into Safety: Translating Research into Practice'. Volume 1 of the report is (RR 059/2002) 'Benchmarking human and organisational factors in offshore safety' and Volume 2 of the report is (RR 060/2002) 'The Development and Evaluation of a Human Factors Accident and Near Miss Reporting Form for the Offshore Industry' The overall aim of the project was to develop practical programmes for the offshore oil and gas industry which can lead to;

a) A better understanding of human and organisational factors in safety,

b) Continued improvements in safety management and

c) An improved 'safety culture' throughout the industry as a whole.

In order to achieve this overall objective, three work packages were proposed which build on previous work (see Mearns, Flin, Fleming and Gordon, 1997)).

1. A bench-marking study to identify, analyse and share best practice on human factors safety-related issues.

2. Systematically analysing for trends in human factors causes of accidents so that the information can be used to develop training programmes for CRM and for training accident investigators. The information could also be used in the bench-marking study.

3. Developing crew resource management (CRM) packages especially for training supervisors and offshore teams in human factors issues.

Acknowledgement

We thank the sponsoring company, in particular the Safety Manager on our steering group, the Asset Managers who gave us access, those individuals who helped in the development of the training, and the OIMs and crews who attended the courses.

EXECUTIVE SUMMARY

This is Volume 3 of the final report of HSE/JIP project 3661 'Factoring the Human into Safety', sponsored by: Agip UK Ltd.; AMEC Process and Energy Ltd; BP Amoco; Coflexip Stena Offshore Ltd. Conoco UK Ltd.; Elf Exploration UK; Halliburton Brown and Root; Health and Safety Executive (OSD) Kerr-McGee North Sea Ltd.; Salamis/SGB Ltd.; Transocean Sedco Forex; Shell Expro UK Ltd.; Texaco North Sea UK Ltd; Total Fina.

Aim

The aim of this workpackage was to design and evaluate a form of human factors training called Crew Resource Management (CRM) which is intended to improve safety, productivity, and to reduce down time on offshore installations.

Development of a CRM course for offshore teams

The course was developed by liasing with CRM developers in other industries, analysing incidents, scrutinising previous human factors research in the offshore industry, interviewing people with offshore experience, and talking with onshore management.

Courses

Eight courses were delivered to a cross section of individuals working on five platforms from one operating company (n=104).

Evaluation

Each course was evaluated by receiving feedback from the participants regarding the content and delivery of the course. Participants' attitudes were evaluated before and after the course using an attitude questionnaire. Also, participants' evaluation of an accident scenario were analysed. The feedback from the courses was generally positive. However, a need to tailor the course further for the offshore environment with more videos and case studies of actual offshore incidents, and to provide more practical tools, and less theory was indicated by the course participants.

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1. BACKGROUND

1.1 Introduction

This report is concerned with the development, application to the offshore oil industry, and evaluation of a type of human factors training which was developed by the aviation industry called Crew Resource Management (CRM). This CRM study is Workpackage 3 of a larger two year HSE joint industry project 'Factoring the Human into Safety' (Project code D3661) sponsored by: Agip UK Ltd.; AMEC Process and Energy Ltd; BP Amoco; Coflexip Stena Offshore Ltd. Conoco UK Ltd.; Elf Exploration UK; Halliburton Brown and Root; Health and Safety Executive (OSD) Kerr-McGee North Sea Ltd.; Salamis/SGB Ltd.; Transocean Sedco Forex; Shell Expro UK Ltd.; Texaco North Sea UK Ltd; Total Fina. This report provides some background regarding CRM in aviation and the offshore industry. It describes a pilot offshore CRM course developed with the co-operation and support of one of the project sponsors. A description of the evaluation of the training, and suggestions for improving the training course will be discussed.

The project to develop Crew Resource Management training for the offshore oil industry extends from previous human factors research with the offshore oil industry carried out by Mearns, Flin, Fleming and Gordon (1997). They recommended that "*training programmes are developed for teaching human factors skills...Crew Resource Management (CRM) provides a framework for such training because it essentially teaches skills such as leadership, team-working, decision making, assertiveness and communication with the aim of reducing human error*" (p138-139).

1.2 CRM training in aviation.

The aviation industry recognised the significance of human error in accidents almost 30 years ago, and has been instrumental in the development of effective training programmes, designed to reduce error and increase the effectiveness of flight crews, known as Crew Resource Management (CRM; Wiener, Kanki & Helmreich, 1993). The motivation (particularly in the USA) to take measures to reduce human error can, in part, be attributed to a number of aviation accidents in the late 1970s and early 1980s in which a significant causal factor of the accident was deemed to be crew error. Analysis of Flight Data Recorders and Cockpit Voice Recorders identified a recurrent pattern emerging from accident investigation reports - crews were not fulfilling properly their assigned roles on the flight deck (David, 1996). Therefore, a type of human factors training addressing the specific causes of crew error was designed called Crew Resource Management (CRM). For further details of the evolution of CRM training in aviation see Helmreich, Merritt and Wilhelm (1999).

1.2.1 What is CRM?

The Human Factors Group of the Royal Aeronautical Society define the objectives of CRM to be:

"*To enhance crew and management awareness of human factors which could cause or exacerbate incidents which affect flight safety.*

To enhance knowledge of human factors and develop CRM skills and attitudes which when appropriately applied could extricate an aircraft operation from incipient accidents and incidents whether perpetrated by technical or human factors failings.

To use CRM knowledge, skills and attitudes to conduct and manage aircraft operations, and fully integrate these techniques throughout every facet of the organisation culture, so as to prevent the onset of incidents and potential accidents.

To use these skills to integrate commercially efficient aircraft operations with safety.

To improve the working environment for crews and all those associated with aircraft operations". (RAeS, 1996: 2)

CRM training is now used by virtually all the major international airlines. In the UK, human factors training and examination are mandatory for a Flight Crew Licence, and the Civil Aviation Authority (CAA) requires that CRM training be carried out annually by commercial pilots (CAA, 1993) and cabin crew or flight attendants (CAA, 1995). A typical CRM course initially takes 2-3 days. Teaching methods include lectures, classroom training, practical exercises, case studies, and films.

The topics covered by CRM courses are established through accident analysis, pilot interviews, and observations of flight crews in simulators. CRM is designed to add a team focus to training. "*They are designed to target knowledge, skills, and abilities as well as mental attitudes and motives related to cognitive processes and interpersonal relationships*" (Gregorich & Wilhelm, 1993: 173). CRM training can generally be separated into six core topics: team work, leadership, situation awareness, decision making, communication, and personal limitations such as stress and fatigue. In addition, refresher training is also advised. These are normally half or whole day courses focusing on a specific CRM topic.

1.2.2 Does CRM work?

For flight crews, the CRM skills are then practised and in flight simulator sessions known as LOFT (line oriented flight training). There is increasing emphasis on evaluation of CRM skills in the simulator (Line Operational Evaluation) or during routine operations using rating scales with behavioural markers to assess the CRM skills (Flin & Martin, in press; NOTECHS,1998). The overall objective is to improve safety, but as with other Human Factors interventions, this can be difficult to measure accurately, especially as the organisations using CRM tend to have very low accident rates. In military aviation, Diehl (1991) states that CRM training decreased the accident rate by 81% for US Navy A-6 Intruder crew members. Data from a number of airlines have shown that attitudes about flightdeck management also change in the desired direction as a result of training (Helmreich & Wilhelm, 1991). In addition, in experimental studies involving

military pilots, Salas and his colleagues have consistently found that CRM training can improve performance by 6%-20% (e.g., Smith-Jentsch et al., 1996; Stout, Salas & Fowlkes 1997).

The strongest testament to the perceived benefits of CRM is the widespread adoption by the international aviation industry and the increasing introduction of CRM courses in other high reliability industries.

1.2.3 CRM beyond aviation

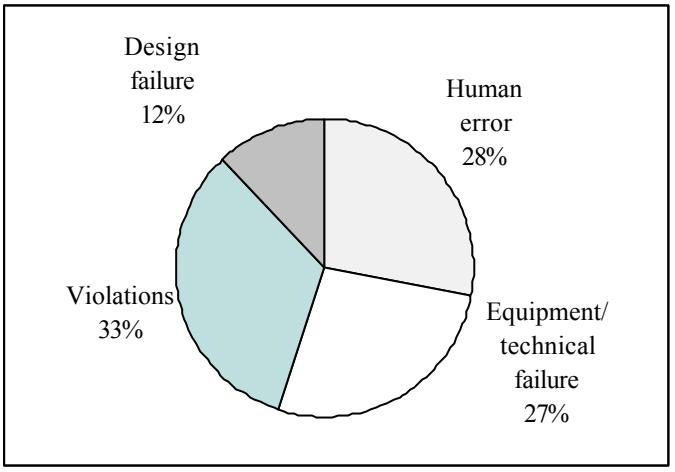
Further evidence of the success of CRM comes from the Danish company *Maersk*,. They introduced Crew Resource Management for their mariners in 1994, and have been running Rig Crew Resource Management since 1997 (Byrdorf, 1998). Incidents and accidents in *Maersk* shipping company have decreased by a third from one major accident per 30 ship years in 1992 (before the introduction of CRM training) to one major accident per 90 ship years in 1996 (after the introduction of CRM training). In addition, at the beginning of 1998 all insurance premiums were lowered by 15 percent. They attribute this reduction in accidents and incidents to combined use of CRM and simulator training. CRM training has been adopted by a number of other professions including anaesthetists (Howard et al., 1992), air traffic control, the nuclear power industry (Harrington & Kello, 1991), and aviation maintenance (Marx & Graeber, 1994). See Salas et al (in press) for a detailed review of the application and evaluation of CRM training in other industries.

1.3 The rationale for CRM training offshore.

Accident analysis from many industries reveals that human factors appear to dominate the risks inherent in complex installations (Reason, 1997). Often even equipment failure can be traced back to human failure. Studies offshore have revealed similar findings: Human errors are a frequent cause of accidents (Flin et al., 1996; Mearns et al 1997; Ringstad & Sunde, 1997).

Data collected by the Mineral Management Service in the USA also indicate that a high proportion of accidents and incidents are due to human error. Human error accounted for approximately a third of accidents and incidents in the US (Outer Continental Shelf) between 1995 and 1996 (MMS, 1997). This is similar to the proportion of human factors errors found in an examination of a representative selection of 1997 incident reports for a UK offshore operating company (Bryden & O'Connor, 1998: see Figure 1).

Figure 1. Percentage involvement of causal factors in offshore incidents.



Members of the workforce also recognise the consequence of human factors in accident causation. In a survey of a sample of the workforce on six UKCS platforms (n= 622) carried out by 70% of the workers agree that "most accidents are due to human failure" (Flin et al,1996). In addition, over a third of the respondents cited "lack of care and attention" as the most common cause of accidents (p75).

Data collected by Mearns et al (1997) allow a closer examination of human error offshore. They examined databases which showed human factors causes in accidents of seven offshore companies (Four operators and three contractors). The data were extracted over a two year period from 1994 to 1996 with the exception of one company which only had data for an 18 month period. A total of 1268 incidents were recorded (LTI, minor, or near-miss). These incidents were then coded into 55 human factors categories according to their underlying causes based on the ISRS system of coding. The incidents produced 1123 codes, with some incidents containing no human factors codes, and others having multiple codes. Although in a later study, the incidents were examined to establish how many of them would fit within the topics for a CRM course (team work, leadership, situation awareness, decision making, communication, and personal limitations). From Table 1, it can be seen that 46% of the 1123 human factors codes fell within one of the broad CRM topics.

Table 1. Incidence of 'CRM topic' errors.

CRM topic	Percentage of codes
Team work	6
Leadership	2
Situation awareness	9
Decision making	11
Communication	5
Personal limitations	13
Total	**46**

Mearns et al (1997) also found that the most effective supervisors, in terms of safety performance, utilise interpersonal skills more often than less effective supervisors. By way of illustration, the effective supervisors value their subordinates more, visit the work site more frequently, and encourage participation in decision making.

Thus, it has been demonstrated that human error occurs on offshore installations, and a large proportion of incidents are due to 'CRM topics'. Therefore, the type of skills that CRM training aims to teach should lead, in the longer term, to improved safety performance in the offshore environment.

1.4 CRM training offshore

The offshore oil industry does use some types of leadership and human factors training. In fact, a form of CRM training has been used as part of Control Room Operators' emergency response training (Flin, 1995), and for OIMs and their emergency response teams (Flin, 1996) in the same company as gave access for this project. A description of these courses is given below. Similar courses have also been adopted in Scandinavia: *Elf Petroleum Norge* has developed a CRM course for offshore crews called 'Emergency Resource Management' (Grinde, 1994) and *Maersk* have also adapted CRM training for drilling rig crews (Byrdorf, 1998).

Offshore Control Room Operators A prototype CRM course was used for human factors training during a programme of offshore control room operator competence assessments and emergency response training (Flin, 1995). The assessment was carried out in an onshore simulator. The training incorporated four modules: decision making, communication, stress, and assertiveness. These were originally based on the type of CRM modules used by commercial airlines, however, by drawing from industrial psychology research, and the expertise of the company's trainers, a customised CRM package was designed.

OIMs and their Emergency Response Teams CRM training has also been used with offshore installation managers (OIMs) and their teams undergoing emergency response team training, normally based in an emergency control centre simulator facility. The non-technical skills deemed critical for effective team performance in the emergency command centre of an offshore platform were identified by experienced staff within the oil company in conjunction with the psychologists, with reference to research material from a study of OIMs' crisis management (Flin & Slaven, 1994) and the industry's standards of competence for OIMs' emergency management (see Flin et al, 1996 for an example). In addition, material from command training in other organisations (Flin & Slaven, 1995) and other CRM research groups such as USNAWC and NASA Ames were also used (e.g. Orasanu & Salas, 1993). These included understanding of team roles, communication, group decision making/problem solving, assertiveness, team attitudes, stress management, and shared mental models.

Emergency Resource Management –Elf Norge CRM training has also been used with Norwegian offshore crews, for instance, Emergency Resource Management used by *Elf Petroleum Norge.* According to Grinde

(1994), this is an initial three day course with a two day refresher every two years. The objectives of the course are to give the platform emergency organisation a comprehensive understanding of the resources available during an emergency, and to provide training in: information transfer and logging, task allocation, decision making, communication, and situation assessment. Further, the management were also given an understanding of crisis psychiatry, human stress, terrorism and drugs. The course consists of lectures, and four scenarios run in an onshore simulator.

1.5 Aim

The aim of this workpackage was to design and evaluate a prototype CRM course for offshore platform crew

2. METHOD A: DESIGNING OFFSHORE CRM TRAINING

This section describes how the CRM course was designed. The topics covered by aviation CRM courses are established through accident analysis, simulator research, and confidential safety reporting systems. In addition, pilots were interviewed by researchers, and observed in simulators. From this careful analysis, CRM courses were designed in an attempt to address the main causes of teamwork failures in the cockpit.

2.1 Liasing with experts

Since the level of information regarding accidents and incidents offshore is not as detailed as in the aviation industry, the content of the offshore CRM course was established from the findings of our own research concerning human factors offshore (Flin & Slaven, 1996) and our own experience of designing CRM courses for emergency response teams. Furthermore, we also examined the topics and content of CRM courses in aviation (e.g. *British Airways*, *Dan Air*, and *Air Canada*), the topics covered in aviation maintenance (e.g. Taylor, 1998; Shell Aviation) CRM and the course designed by *British Energy* for nuclear Control Room Operators was also considered. In addition, advice as to the construction of the course was obtained from visits and contacts with aviation psychologists working in CRM. Members of our research team were permitted to take part in CRM courses being run by *Bond*, *British Helicopters*, *Bristows* and *British Energy*.

From our experience in developing the emergency response and control room CRM materials, it was found that it is essential to work with experienced offshore staff in order to select case studies and examples which will be relevant (Flin, 1996). Moreover, they can assist in the translation of psychological jargon into the language of their operations and procedures. Therefore, the workpackages were discussed in detail with a number of onshore based employees from the participating company who had many years experience working offshore in either operations or maintenance from the first two participating platforms.

2.2 Course content

The ultimate aims of the course were to improve safety, productivity, and to reduce down time for production and maintenance teams. The aim of the training was to provide participants with an increased awareness of the set of non-technical skills outlined in Table 2. This framework is based on our research outlined above, and a non-technical skills framework developed for aviation (NOTECHS, 1998). With reference to the skills identified in Table 2, specific objectives in terms of human factors training were written for each module with aid from personnel from the sponsoring company in the early stages of the course development.

Table 2. Offshore operations non-technical skills framework.

Categories	Skills
Situation Awareness	Plant status awareness
	Environmental awareness
	Anticipation
	Concentration/avoiding distraction
	Shared mental models
Decision Making	Problem definition/diagnosis
	Risk and time assessment
	Recognition Primed Decision Making /Procedures/Analytical
	Option generation/choice
	Outcome review
Communication	Assertiveness/speaking up
	Asking questions
	Listening
	Giving appropriate feedback
	Attending to non-verbal signals
Team Working	Maintaining team focus
	Considering others
	Supporting others
	Team decision making
	Conflict solving
Personal Resources	Identifying and managing stress
	Reducing/coping with fatigue
	Physical and mental fitness
Supervision/	Use of authority/assertiveness
Leadership	Maintaining standards
	Planning and co-ordination
	Workload management

2.3 Course Delivery

2.3.1 Participants

Eight courses were run during 1999 with participants attending from both shifts from five North Sea production platforms operated by a major offshore oil and gas company (n=104). 47% of participants were from production, 18% maintenance, 25% were 'other' (drilling, deck crew, etc.) and 10% gave no response. The OIMs attended with their crew on six of the courses. The course sizes ranged from 10 to 21 participants.

The course was delivered onshore over two days at the sponsoring company's training facility, and consisted of an introduction to CRM and six workpackages. The method of training included lectures, group exercises, group discussions, questionnaires, and videos. The content of the course is outlined in detail below.

DAY ONE

The course opened with a short introduction from an Asset Manager to illustrate that the course had the support of management and to outline the reason why this type of training was deemed relevant.

Introduction

The aim of this module is to provide the participants with an understanding of human error, the origins of CRM, and its relevance offshore.

- Definition of human error
- History of CRM, and its roots in the aviation industry
- Aims of CRM and standard topics
- CRM training beyond the cockpit
- The rationale for CRM training for offshore teams

Work Package 1: Situation Awareness

The aim of this work package is to give the participants an understanding of the concept of situation awareness, and the factors which can influence it.

- Definition of situation awareness
- Its application to offshore teams
- Situation awareness model
- The causes and symptoms of loss of situation awareness
- The concept of mental models and the importance of a shared mental model with other members of the team
- Combating situation awareness problems

Work Package 2: Decision making

This work package concentrates mainly on individual decision making. It aims to provide participants with a number of types of decision making, and to outline the situations to which each type is applicable and some of the factors which have a detrimental effect on decision making.

- Factors which hinder effective decision making
- The standard management decision making (analytic, option comparison)
- Rule based decisions (e.g. procedures)
- Intuitive/recognition primed decisions
- The limitations of human memory and the effect of working memory capacity on decision making
- Optimising decision making

Work package 3: Communication

The aim of this package is to stress the critical role of communication in any team working environment. Participants will gain an understanding of how to communicate more effectively.

- The advantages and disadvantages of one and two way communication
- The importance of feedback
- Internal and external barriers to communication
- Requirements of good communication
- Maintaining effective listening skills
- Assertiveness, and how it can be achieved in communication

DAY TWO

Work package 4: Team co-ordination

Participants should gain an understanding of some of the difficulties associated with making decisions in a team environment, as opposed to individual decision making.

- Team working
- Barriers to effective team co-ordination
- Optimising team co-ordination
- Team roles

Work package 5: Fatigue and shiftwork

Participants will gain an understanding of how fatigue can affect performance. They will gain an understanding of Circadian cycles and methods of reducing fatigue.

- Fatigue as a cause of accidents
- Acute and chronic fatigue
- The five phases of sleep

- Circadian rhythm
- The effects of fatigue on performance
- Methods of avoiding fatigue

Work package 6: Stress

Participants will gain an understanding of stress and how it affects performance. They will learn how to recognise it in themselves and others, and be presented with techniques to cope in stressful situations.

- Definition of stress and why it is relevant offshore
- Basic models of stress
- Causes of stress
- Stress and personality
- The human performance curve
- Symptoms of stress
- Stress management and coping techniques

3. METHOD B: TRAINING EVALUATION

The fundamental question of whether CRM training can fulfil its purposes of increasing safety and efficiency does not have a simple answer (Helmreich et al., 1999). The ultimate method of assessing the effect of CRM would be to measure whether there was a reduction in the number of accidents. The accident and near-miss data were obtained from four of the platforms who participated in the training to attempt to assess whether there were any changes which could be attributed to the training. However, there were distinct limitations with using the accident and near-miss data for assessing the effectiveness of the CRM training.

- The accident rate offshore is so low, as in aviation, that it does not provide a robust test for the effectiveness of CRM programmes.
- The time interval required to assess whether CRM training has an effect on the number of incidents is out with the scope of the current project.
- Only 10 to a maximum of 21 members of each crew participated in the training from each platform.

Thus, the accident and near-miss statistics were not found to be useful in assessing the effect of CRM training. The production trip data were also examined but although these were indicating an improvement over the test period, this appeared to be part of an overall longer-term pattern than a specific effect. If evidence that CRM training is an effective tool is to be obtained, there is a need for more immediate measures. The best approach used by CRM research teams in aviation is one which is multi-faceted and considers several separate methods of assessment.

3.1 Methods of CRM evaluation

3.1.1 Crew behaviour.

A flightdeck crew's CRM skills can be assessed through observation of their behaviours during simulated or routine flights. The crew is judged using a set of behavioural markers which have been identified as indicative of the critical CRM skills. New European aviation legislation will require the assessment of an individual pilot's CRM skills in multi-crew cockpits (see Flin & Martin, in press; Goeters, 1998). It was not possible to observe offshore crew behaviour to assess CRM skills in the current project. However, for certain groups (e.g. control room operators), this is something that is being done in other industries and could be examined in a control room simulator in the future.

3.1.2 Participants' feedback

A widely used method of assessing the success of the CRM course is to ask students the extent to which the training will affect their behaviour when they are actually flying, and to measure the degree to which they thought that the course was useful (Gregorich & Wilhelm, 1993). This is valuable for the trainers in providing feedback on the relevance of the course and gaining knowledge on where improvements can be made. Using

a questionnaire consisting of both open and closed questions, Salas et al (1999) found that military crews which had participated in a CRM course strongly endorsed the usefulness of the training, and considered it important for mission accomplishment and flight safety.

A course feedback questionnaire was designed for the offshore CRM course which contained statements about the delivery of the course (see Section 4.2). This questionnaire was administered after the course had been completed and consisted of closed statements in which the participants could respond on a five point Likert scale from 1 (very poor) to 5 (excellent), and with open-ended questions allowing the participants to write their comments (see Appendix 1).

3.1.3 Participants' attitudes.

Pilots' attitudes have been measured before and after CRM training This has usually been done with some form of the Cockpit Management Attitudes Questionnaire (CMAQ) (Gregorich, Helmreich, & Wilhelm, 1993). This is a well established training, evaluation and research tool developed to assess the effects of CRM training for flight crew. The CMAQ comprises 25 items chosen to measure a set of attitudes that are either conceptually or empirically related to CRM. The statement topics cover communication and co-ordination, command responsibility, and recognition of stressor effects. For each statement in the questionnaire, the degree to which the students agree is assessed using a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Where this has been applied before and after CRM training, it allows an assessment of the changes in the mental attitudes among individual students.

The CMAQ has been successfully adapted to assess the effects of CRM training in a number of industries. By way of illustration, the CMAQ has been used to assess aviation maintenance personnel (Taylor, 1991; Sherman, 1992), air traffic controllers (Choi, 1995), nuclear control room operators (Harrington & Kello, 1993) and operating room staff (Helmreich & Merritt, 1998). In order to measure any changes in CRM related attitudes in offshore workers, the CMAQ was adapted to form the Offshore Crew Resource Management Questionnaire (OCRMQ; see Section 4.3 for the item listing and Appendix 2). The advantage of basing the offshore questionnaire on the CMAQ, as opposed to designing a new questionnaire is that the CMAQ has been proven to have reasonable psychometric characteristics, and can be used as a good measure to evaluate communication and resource management training programmes (Taylor, in press).

3.1.4 Knowledge.

In CRM training, learning can be assessed by testing students on the curriculum. By comparing knowledge before and after training, this provides an indication of what parts of the course have been retained by the participants. Using a multi-choice knowledge test Salas et al (1999) found that although the training did not show an effect on the pilots' attitudes, it did appear to increase their knowledge of teamwork principles.

For the offshore CRM course it was decided that rather than have an explicit test of participants' knowledge of the curriculum, it was assessed by presenting them with two written accident scenarios. (This was only

undertaken in the last three courses). The scenarios were based on real incidents that had occurred while carrying out maintenance offshore, and indicated a range of human factors causes. The first was presented at the beginning of the course, and the second at the end of the course. The order of the scenarios was counterbalanced for each course The participants were asked to identify the human factors causes of the accident. To aid them in this, they were given a sheet with a list of possible headings: planning, communication, team working, supervis ion, personal limitations (e.g. stress or fatigue), and other contributory factors (see Appendix 3).

4. RESULTS

The results to follow are based on the responses from the 104 participants, described above**.**

4.1 Course feedback questionnaire

Responses were obtained to both closed and open-ended questions. Participants were given a series of questions after each workpackage to which they could answer on a scale ranging from 1 'very poor', 2 'poor', 3 'satisfactory', 4 'good', to 5 'excellent'. Table 3 shows the mean response to each question as well as the mode (the most frequently chosen response). Also, the mean of the six or seven questions in each category was calculated to give an overall performance score for each of the seven workpackages.

Table 3. Participants' views on the content and delivery of the course.

CRM background	***MEAN***	***MODE***	***RANGE***
How interesting did you find this section of the course?	3.6	4	2- 5
What did you think about the presentation of the teaching?	3.8	4	2- 5
What did you think about the structure of the teaching?	3.6	4	2- 5
Did you think that the videos were interesting and relevant?	3.5	4	1- 5
What did you think of the exercises?	3.4	3	2- 5
What did you think about the standard of the course materials (handouts etc.)?	3.6	4	2- 5
Mean and modal score over six questions in this section	**3.6**	**4**	**2.3- 4.8**
Situation Awareness	***MEAN***	***MODE***	*RANGE*
How interesting did you find this section of the course?	3.8	4	2- 5
What did you think about the presentation of the teaching?	3.8	4	2- 5
What did you think about the structure of the teaching?	3.7	4	2- 5
Did you think that the videos were interesting and relevant?	3.6	3	2- 5
What did you think of the exercises?	3.6	4	1- 5
What did you think about the standard of the course materials (handouts etc.)?	3.5	3	3- 5
What did you think of the relevance of this topic to your job?	3.8	4	2- 5
Mean and modal score over seven questions in this section	**3.7**	**4**	**2.7- 4.5**

Table 3 cont. Participants' views on the content and delivery of the course.

Decision Making	*MEAN*	*MODE*	*RANGE*
How interesting did you find this section of the course?	3.9	4	2- 5
What did you think about the presentation of the teaching?	3.9	4	2- 5
What did you think about the structure of the teaching?	3.7	4	2- 5
Did you think that the videos were interesting and relevant?	3.6	4	2- 5
What did you think of the exercises?	3.7	4	2- 5
What did you think about the standard of the course materials (handouts etc.)?	3.5	4	2- 5
What did you think of the relevance of this topic to your job?	3.9	4	2- 5
Mean and modal score over seven questions in this section	**3.8**	**4**	**2.5- 4.7**
Communication	*MEAN*	*MODE*	*RANGE*
How interesting did you find this section of the course?	3.8	4	2- 5
What did you think about the presentation of the teaching?	3.9	4	2- 5
What did you think about the structure of the teaching?	3.8	4	2- 5
Did you think that the videos were interesting and relevant?	3.8	4	3- 5
What did you think of the exercises?	3.7	4	2- 5
What did you think about the standard of the course materials (handouts etc.)?	3.5	4	2- 5
What did you think of the relevance of this topic to your job?	3.9	4	2- 5
Mean and modal score over seven questions in this section	**3.8**	**4**	**2.7- 4.9**
Team Co-ordination	*MEAN*	*MODE*	*RANGE*
How interesting did you find this section of the course?	4.1	4	3- 5
What did you think about the presentation of the teaching?	3.9	4	3- 5
What did you think about the structure of the teaching?	3.9	4	2- 5
Did you think that the videos were interesting and relevant?	3.8	4	2- 5
What did you think of the exercises?	4.1	4	2- 5

What did you think about the standard of the course materials (handouts etc.)?	3.7	4	2- 5
What did you think of the relevance of this topic to your job?	4.2	4	3- 5
Mean and modal score over seven questions in this section	**4.0**	**4**	**2.7- 5.0**

Table 3 cont. Participants' views on the content and delivery of the course.

Fatigue & shiftwork	***MEAN***	***MODE***	***RANGE***
How interesting did you find this section of the course?	3.9	4	3- 5
What did you think about the presentation of the teaching?	3.8	4	2- 5
What did you think about the structure of the teaching?	3.6	4	2- 5
What did you think of the exercises?	3.5	4	2- 5
What did you think about the standard of the course materials (handouts etc.)?	3.6	4	2- 5
What did you think of the relevance of this topic to your job?	3.9	4	2- 5
Mean and modal score over six questions in this section	**3.8**	**4**	**2.6- 5.0**
Stress	***MEAN***	***MODE***	***RANGE***
How interesting did you find this section of the course?	4.1	4	3- 5
What did you think about the presentation of the teaching?	4.0	4	3- 5
What did you think about the structure of the teaching?	3.8	4	2- 5
Did you think that the videos were interesting and relevant?	4.0	4	2- 5
What did you think of the exercises?	3.8	4	2- 5
What did you think about the standard of the course materials (handouts etc.)?	3.8	4	2- 5
What did you think of the relevance of this topic to your job?	4.2	4	2- 5
Mean and modal score over seven questions in this section	**4.0**	**4**	**2.7- 5.0**

Table 3 shows that the majority of participants rated the course as being good as the most frequent rating for almost all of the questions was 4 (good). The overall mean scores for the six or seven questions in each of the workpackages (see Table 4) were examined to assess whether there were any significant differences in

the feedback from participants in different job categories (i.e. production, maintenance, or 'other'). The results from a one way analysis of variance (ANOVA) did not reveal any significant differences. Therefore, all of the participants, regardless of the type of work they carried out offshore, responded equally positively.

Many of the course participants recognised that they could improve their behaviour at work, and indicated that they would attempt to make use of the skills and knowledge that had been presented at the course. For example:

'Recognition of my deficiencies that colour people's perceptions of me. Addressing stress and fatigue in my team',

'*Although I believe that I already practise many of these desirable behaviours, I'll be looking to consolidate and build on these*'

'*I can see the requirement to utilise all of the skills and knowledge during the course of my work*'

"*I will use a considerable amount of this course in my work. It has made me look at myself and my job from a totally different perspective*"

In general, the additional comments were favourable, with some individuals writing lengthy summaries of their thoughts. Particular comments included:

'I will get other supervisors to participate in the principles of CRM'

'There is a limit to how much can be squeezed into a two day course. I think this course achieved all its objectives in the time available. Presentation was interesting and varied.'

'It was a good introduction raising awareness. However, to be able to apply these concepts offshore, I think it would need a workshop about implementing the concepts and making changes'

"The course has, in many ways, been a refresher of similar courses in the past. It's good, however, to be reminded"

"Need more time to learn and practice the techniques"

"Formal 'handbook'. Reference book, CD-Rom or web site for use offshore would be useful"

"Good overview which would benefit from more offshore related info/examples as they become available"

"*the topics are relevant ... we perhaps need to look at specific safety incidents and use the techniques to tackle underlying causes*".

Participants were asked if they thought that any of the sections required more or less time. From Table 4 it can be seen that stress and teamwork were the most frequent topics that the participants would have liked to

have spent more time on, with some participants indicating that less time could have been spent on the background to CRM.

Table 4. Response frequency for time spent on workpackages .

	Background	Situation awareness	Decision making	Communication	Teamwork	Fatigue	Stress
Required more time	**1**	4	5	6	11	9	21
Required less time	8	2	1	1	-	2	2

Finally, only 3% of participants indicated that they would not use any of the skills they had learned on the course in their job.

Thus, the results from the course feedback questionnaire suggest that the majority of participants thought that the course was good, and were generally positive in the comments that they made about the course. The workpackage concerned with stress was recognised as being particularly relevant for the offshore environment. It was suggested that the course could be improved with more offshore case studies, more time devoted to learning the skills outlined in the training, and more support to help the platforms after they have finished the course.

4.2 Responses to the Attitude questionnaire

Table 5 depicts the mean responses to the Offshore Crew Resource Management Questionnaire (OCRMQ) before the course, and after the course (ranging from 1= '*strongly disagree*' to 5= '*strongly agree*'). Therefore, the higher the number, the more the participant agreed with the statement. In addition, where available, aviation responses were taken from the corresponding items in the Flight Management Attitudes Questionnaire (FMAQ). The mean score comes from Helmreich and Merritt's (1998) survey of pilots across 22 countries, 36 airlines, with 15, 454 respondents. Table 5 shows that the responses by pilots were broadly similar to the responses to the comparable statements from the participants in the offshore CRM course.

The 30 individual statements in the questionnaire were grouped into four categories, communication, decision making, situation awareness, and personal limitations (see the foot of table 5). A mean score was then calculated for each category (after the reversal of the negative statements). A two way independent ANOVA was run to assess whether there was any differences in the four categories before or after training, and whether there were differences between the different job groups. The difference between the mean scores on the categories before and after training was not found to be significant. Also, although there were no consistent differences between the different job categories, the 'other' category (drilling, deck crew, etc.) was significantly higher (4.05) than the maintenance group (3.90) on communication, and the production

participants (3.45) were significantly higher on decision making than either the maintenance group (3.24) or the 'other' group (3.24). However, although significant, the size of the differences is very small (less than a quarter of a rating point).

Table 5. Mean responses to the attitude questionnaire before and after the course, and comparison with aviation mean.

Statement	Before	After	Aviation
1. Team members should avoid disagreeing with others.	1.94	1.86	
2. It is important to avoid negative comments about the procedures and techniques of other team members.	2.50	2.60	
3. Before commencing a job, I consider potential problems which may occur and think about how I could solve them.	4.42	4.29	
4. I am more likely to make judgement errors when working under pressure	3.77	3.70	
5. Good communication and crew co-ordination are as important as technical proficiency.	4.62	**4.54**	4.85
6. I do not always assume that those that are more senior, or have more experience than me, are correct	4.21	4.21	
7. We should be aware of and sensitive to the personal and work-related problems of other team members.	4.27	4.23	4.09
8. If I am interrupted while carrying out a procedure, I will always back up a few steps or start again to ensure that I have not made a mistake.	3.78	3.76	
9. The OIM should take control and make all decisions in emergency and non-standard situations.	2.79	2.72	3.02
10. My performance is affected by working with others less experienced or capable than me	2.75	2.72	
11. Even if I am in a hurry, I try to listen and not interrupt or "talk over" others	3.7	3.60	
12. Team members should not question the decisions or actions of the OIM or senior supervisor except when they threaten the safety of the operation.	1.91	1.88	2.43
13. Even when fatigued, I perform effectively during critical phases of work.	2.62	2.53	2.66
14. I am embarrassed when I make a mistake in front of other workmates	3.22	3.26	
15. A debriefing should not only focus on negative outcomes, but should also include positives.	4.51	4.55	
16. I never take safety critical decisions of which I am not confident.	3.96	4.12	
17. Team members should recognise fatigue and take specific steps to help maintain team alertness	4.16	4.22	
18. Supervisors who encourage suggestions from team members are weak leaders	1.42	1.37	1.28
19. The individual in charge of a job should verbalise plans and should be sure that the information is understood and acknowledged by other team members.	**4.51**	4.49	

Statement	Before	After	Aviation
20. Technical proficiency leads to successful management	2.48	2.49	2.74
21. A truly professional individual, can leave personal problems behind when offshore.	2.31	2.10	3.09
22. I periodically review, check, and if necessary reassess the status during a job.	4.04	4.07	
23. My decision-making ability is as good in abnormal situations as in routine daily operations.	3.16	2.95	3.48
24. It is better to agree with other team members than to voice a different opinion	1.88	1.67	
25. When appropriate, I take the initiative and time to share my knowledge and experience with others, even if this means that a task takes more time.	4.09	4.20	
26. Team members share the responsibility for prioritising activities in high workload situations	3.70	3.90	
27. If I perceive a problem with a task, I will speak up regardless of who might be affected	4.24	4.26	4.37
28. If I am not entirely clear about a job, then I always check with a work colleague	4.27	4.24	
29. My concentration is as good in the middle of the afternoon as it is in the middle of the night.	2.48	2.14	
30. I let other team members know when my workload is becoming excessive.	3.48	3.53	

Factor scores	Before	After	
Communication	3.98	4.01	
(Statements 1,2,5,6,10,11,12,15,18,20,24,26,27)			
Decision making	3.30	3.40	
(Statements 9,14,16,23)			
Situation Awareness	4.19	4.17	
(Statements 3,8,19,22,25,28)			
Personal limitations	3.74	3.82	
(Statements 4,7,13,17,21,29,30)			

Based on the pre-training and post-training scores from the attitude questionnaire, the participants' attitudes remained relatively unchanged. A possible explanation for this finding is that the participants already had fairly positive attitudes towards the concepts at the onset of the training. Evidence for this comes from the fact that some of the course participants were knowledgeable about various aspects of CRM training as a result of attending other courses. In fact, the sponsoring company had already developed training for CROs and OIMs using CRM- type material (see Flin, 1995). Further, it can be seen that the attitudes of the participants of the offshore CRM course are broadly similar to those of pilots where CRM is widely used.

4.3 Accident scenario

The participants' explanations of the possible causes of the two scenarios were grouped on the basis of the non-technical skills framework depicted in Table 2. To validate the coding method, 30% of the explanations were coded by a second rater. The level of agreement between the raters was 81%. The reason for the lack of a higher level of agreement is that the non-technical skills framework was not designed for this purpose and sometimes it was difficult to decide which category a particular explanation should be placed. From Table 7 it can be seen that the majority of the causes were classified in one of the human factors categories, with very few of the participants explanations categorised as 'non human factors'. Table 6 also reveals that there was a tendency for participants to offer a larger number of possible explanations for the incident after the training, with an increase in the number of explanations classified as situation awareness, decision making, communication, and supervision. Thus, there is some tentative evidence of the effect of the training with a slight increase in the frequency of human factors explanations.

Table 6. Mean frequency of categorisation of responses to scenarios (frequency per participant)

Categories	**Before**	**After**
Situation Awareness	1.02	1.39
Decision making	1.55	1.76
Communication	2.50	2.98
Team working	1.43	1.17
Personal limitations	1.40	1.15
Supervision	0.83	0.88
Non human factors cause	0.36	0.12
Total	**9.10**	**9.44**

The use of accident scenarios to evaluate CRM training is a novel method, with no precedent in the literature. Therefore, if this is to be used as a technique to assess CRM training, more work will be required to improve the methodology.

5. DISCUSSION

5.1 Course Evaluation

To our knowledge this is the first CRM programme which has been specially designed for offshore production installation crews. The overall impression from running these prototype courses was that this is a training technique which could have benefit for the offshore oil and gas industry. The responses from the course feedback questionnaire showed a generally positive response towards the training course, although some delegates were familiar with aspects of the material covered. In the host company and their contractors, there are a number of human factors, safety, and teamwork training courses available to the workforce, and so the participants on these CRM courses arguably displayed more positive attitudes and were more knowledgeable about the human factors principles, than pilots prior to the introduction of CRM training in aviation. Although the responses to the attitude questionnaire did not display a significant shift in attitudes, and there was not a large difference in participants' ability to find the human factors causes of accidents in the written scenarios, these were very rigorous evaluation tests for a new training programme (Tests which are not used by most trainers in course evaluation).

5.2 Further Development

There are areas of this offshore CRM programme which would require further development. There is still a need to acquire additional offshore case studies (a potential source of which could be obtained using accident reporting forms, see Volume 2 of this report), but of particular benefit would be video re-enactments of incidents, which demonstrated the importance of non-technical skills. To illustrate, in some of the later courses, video clips were shown from the 'Safety- Who's Responsible?' video developed by the Safety Leadership Training Team of the North Sea Drilling Step Change Steering Group, which proved to be very useful in generating discussion. Ongoing research into safety climate on offshore installations (see Volume 1) and accident analysis (see Volume 2) should be incorporated into future CRM courses. This forms an ideal method of 'closing the loop' between safety investigations and workforce knowledge and awareness. There also needs to be further emphasis placed on practising the non-technical skills. Participants do not require an in-depth knowledge of the theoretical background, as long as they have an understanding of how these concepts affect their individual and team performance. In aviation the CRM skills are usually practised and evaluated in the simulator.

There were several issues relating to course delivery which were addressed.

OIMs It had initially been decided (by the psychologists) to run the courses without the OIMs present, on the basis that the presence of the site manager might inhibit the discussion of critical human factors problems. This proved to be a mistake and the feedback from the first two courses indicated strongly that

the crews wanted their OIM to be present to discuss key issues openly with him. The OIMs attended the next six courses with their shifts and this proved to be very beneficial.

Single or mixed platform crews The first two courses were run with a mix of crews from two platforms (one installation was significantly older than the other). The feedback from these groups was that they would prefer to take the course with their own platform shift, in order to discuss issues and events relevant to them. For the remaining courses single shifts were taught together which worked more effectively.

Single or mixed discipline The courses were run with a mix of personnel from operating and contractor companies, covering various functions - production, maintenance, drilling, services. This made it more difficult in some respects to select case examples and teaching materials that appealed equally to the different occupations. However the feedback from the crews was that this was preferable to single discipline courses as it was important for safe platform performance to develop a better understanding of common human factors problems.

Finally, it is not normal CRM practice for psychologists to deliver the courses. Their role is in human factors research and development. For a number of the courses an OIM assisted with delivery, he was on-hand to respond to technical and procedural questions and he presented a case study from his own offshore experience. This demonstrated clearly the value of experienced offshore personnel being involved in course delivery. In the aviation industry, CRM trainers are normally senior pilots who are taken off the line or given reduced duties to work as trainers for a period, as part of an ongoing professional development programme. An offshore CRM programme requires 'champions' from the workforce with experience of working out "in the field" who could deliver the course and deal with any technical aspects, thus giving it more operational credibility. A suitable champion would be an individual who has many years experience and commands the respect of his or her peers. In addition, they must also have an understanding and enthusiasm for a human factors approach (Drury, 1996).

6. CONCLUSION

If CRM were to be introduced across the industry, (as in aviation) then discussion would need to take place with the relevant industry bodies in order to establish appropriate methods of delivery and quality monitoring. Proper CRM training needs to be based on ongoing human factors research into safety for the industry, as it is one mechanism for 'closing the loop' between research/ accident analysis and current operational behaviour. There has already been interest in CRM training from other parts of the industry: two pilot CRM courses have also been run with Offshore Safety Division Inspectors (Flin, O'Connor & Mearns, 2000).

While the application of CRM offshore is still in its infancy, it is still possible to make some broad statements about the future direction this work could take. Given recent changes in manning levels, multiskilling, and workforce involvement, then the importance of high professional competence in non-technical skills can only increase. The introduction of semi-autonomous work groups in some companies (with the consequent removal of the supervisor's post) has highlighted the necessity for good communication and team skills, core components of CRM training.

Our experience suggests that aviation CRM can successfully be adapted for other high reliability industrial environments, such as offshore oil and gas platforms. One of the great strengths of the CRM field is the willingness of training providers and companies to share experiences of developing and delivering CRM. The common goal of improving safety transcends organisational competitiveness and industrial parochialism, because the core philosophy of CRM provides a basic drive for the step change in work culture required to reduce accidents towards the desired target zero.

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APPENDIX 1: COURSE EVALUATION FORM

Day 1

You will find below statements about the Crew Resource Management Course. For each statement please indicate whether or not you personally agree. (Circle one number on each line)

Introduction: CRM background	VERY POOR	POOR	SATISFACTORY	GOOD	EXCELLENT
How interesting did you find this section of the course?	**1**	**2**	**3**	**4**	**5**
What did you think about the presentation of the teaching?	**1**	**2**	**3**	**4**	**5**
What did you think about the structure of the teaching?	**1**	**2**	**3**	**4**	**5**
Did you think that the videos were interesting and relevant?	**1**	**2**	**3**	**4**	**5**
What did you think of the exercises?	**1**	**2**	**3**	**4**	**5**
What did you think about the standard of the course materials (handouts etc.)?	**1**	**2**	**3**	**4**	**5**
Other comments					

Workpackage 1: Situation Awareness	VERY POOR	POOR	SATISFACTORY	GOOD	EXCELLENT
How interesting did you find this section of the course?	**1**	**2**	**3**	**4**	**5**
What did you think about the presentation of the teaching?	**1**	**2**	**3**	**4**	**5**
What did you think about the structure of the teaching?	**1**	**2**	**3**	**4**	**5**
Did you think that the videos were interesting and relevant?	**1**	**2**	**3**	**4**	**5**
What did you think of the exercises?	**1**	**2**	**3**	**4**	**5**
What did you think about the standard of the course materials (handouts etc.)?	**1**	**2**	**3**	**4**	**5**
What did you think of the relevance of this topic to your job?	**1**	**2**	**3**	**4**	**5**
Other Comments					

Workpackage 2: Decision Making

	VERY POOR	POOR	SATISFACTORY	GOOD	EXCELLENT
How interesting did you find this section of the course?	1	2	3	4	5
What did you think about the presentation of the teaching?	1	2	3	4	5
What did you think about the structure of the teaching?	1	2	3	4	5
What did you think of the exercises?	1	2	3	4	5
What did you think about the standard of the course materials (handouts etc.)?	1	2	3	4	5
What did you think of the relevance of this topic to your job?	1	2	3	4	5

Other Comments

Workpackage 3: Communication

	VERY POOR	POOR	SATISFACTORY	GOOD	EXCELLENT
How interesting did you find this section of the course?	1	2	3	4	5
What did you think about the presentation of the teaching?	1	2	3	4	5
What did you think about the structure of the teaching?	1	2	3	4	5
Did you think that the videos were interesting and relevant?	1	2	3	4	5
What did you think of the exercises?	1	2	3	4	5
What did you think about the standard of the course materials (handouts etc.)?	1	2	3	4	5
What did you think of the relevance of this topic to your job?	1	2	3	4	5

Other Comments

Day 2

You will find below statements about the Crew Resource Management Course. For each statement please indicate whether or not you personally agree. (Circle one number on each line)

Workpackage 4: Team Co-ordination	VERY POOR	POOR	SATISFACTORY	GOOD	EXCELLENT
How interesting did you find this section of the course?	**1**	**2**	**3**	**4**	**5**
What did you think about the presentation of the teaching?	**1**	**2**	**3**	**4**	**5**
What did you think about the structure of the teaching?	**1**	**2**	**3**	**4**	**5**
What did you think of the exercises?	**1**	**2**	**3**	**4**	**5**
What did you think about the standard of the course materials (handouts etc.)?	**1**	**2**	**3**	**4**	**5**
What did you think of the relevance of this topic to your job?	**1**	**2**	**3**	**4**	**5**

Other Comments

Workpackage 5: Fatigue & Shift Work	VERY POOR	POOR	SATISFACTORY	GOOD	EXCELLENT
How interesting did you find this section of the course?	**1**	**2**	**3**	**4**	**5**
What did you think about the presentation of the teaching?	**1**	**2**	**3**	**4**	**5**
What did you think about the structure of the teaching?	**1**	**2**	**3**	**4**	**5**
What did you think of the exercises?	**1**	**2**	**3**	**4**	**5**
What did you think about the standard of the course materials (handouts etc.)?	**1**	**2**	**3**	**4**	**5**
What did you think of the relevance of this topic to your job?	**1**	**2**	**3**	**4**	**5**

Other Comments

Workpackage 6: Stress

	VERY POOR	POOR	SATISFACTORY	GOOD	EXCELLENT
How interesting did you find this section of the course?	1	2	3	4	5
What did you think about the presentation of the teaching?	1	2	3	4	5
What did you think about the structure of the teaching?	1	2	3	4	5
Did you think that the videos were interesting and relevant?	1	2	3	4	5
What did you think of the exercises?	1	2	3	4	5
What did you think about the standard of the course materials (handouts etc.)?	1	2	3	4	5
What did you think of the relevance of this topic to your job?	1	2	3	4	5

Other Comments

Did any section(s) deserve more time?

Did any section(s) require less time?

Will you use any of the skills or knowledge gained at the course in your job? If so, what in particular?

Other comments

Could you also please provide the following information to help us categorise the response patterns:

Department Maintenance..... Production..... Other.....

APPENDIX 2: THE OFFSHORE CREW RESOURCE MANAGEMENT QUESTIONNAIRE

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. Team members should avoid disagreeing with others.	1	2	3	4	5
2. It is important to avoid negative comments about the procedures and techniques of other team members.	1	2	3	4	5
3. Before commencing a job, I consider potential problems which may occur and think about how I could solve them.	1	2	3	4	5
4. I am more likely to make judgement errors when working under pressure	1	2	3	4	5
5. Good communication and crew co-ordination are as important as technical proficiency.	1	2	3	4	5
6. I do not always assume that those that are more senior, or have more experience than me, are correct	1	2	3	4	5
7. We should be aware of and sensitive to the personal and work-related problems of other team members.	1	2	3	4	5
8. If I am interrupted while carrying out a procedure, I will always back up a few steps or start again to ensure that I have not made a mistake.	1	2	3	4	5
9. The OIM should take control and make all decisions in emergency and non-standard situations.	1	2	3	4	5
10. My performance is affected by working with others less experienced or capable than me	1	2	3	4	5
11. Even if I am in a hurry, I try to listen and not interrupt or "talk over" others	1	2	3	4	5
12. Team members should not question the decisions or actions of the OIM or senior supervisor except when they threaten the safety of the operation.	1	2	3	4	5
13. Even when fatigued, I perform effectively during critical phases of work.	1	2	3	4	5
14. I am embarrassed when I make a mistake in front of other workmates	1	2	3	4	5
15. A debriefing should not only focus on negative outcomes, but should also include positives.	1	2	3	4	5
16. I never take safety critical decisions of which I am not confident.	1	2	3	4	5
17. Team members should recognise fatigue and take specific steps to help maintain team alertness	1	2	3	4	5
18. Supervisors who encourage suggestions from team members are weak leaders	1	2	3	4	5
19. The individual in charge of a job should verbalise plans and should be sure that the information is understood and acknowledged by other team members.	1	2	3	4	5

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
20. Technical proficiency leads to successful management	1	2	3	4	5
21. A truly professional individual, can leave personal problems behind when offshore.	1	2	3	4	5
22. I periodically review, check, and if necessary reassess the status during a job.	1	2	3	4	5
23. My decision-making ability is as good in abnormal situations as in routine daily operations.	1	2	3	4	5
24. It is better to agree with other team members than to voice a different opinion	1	2	3	4	5
25. When appropriate, I take the initiative and time to share my knowledge and experience with others, even if this means that a task takes more time.	1	2	3	4	5
26. Team members share the responsibility for prioritising activities in high workload situations	1	2	3	4	5
27. If I perceive a problem with a task, I will speak up regardless of who might be affected	1	2	3	4	5
28. If I am not entirely clear about a job, then I always check with a work colleague	1	2	3	4	5
29. My concentration is as good in the middle of the afternoon as it is in the middle of the night.	1	2	3	4	5
30. I let other team members know when my workload is becoming excessive.	1	2	3	4	5

Could you please provide the following information to help us categorise the response patterns:

Department: Maintenance _____ Production _____ Other _____

Other comments

APPENDIX 3: ACCIDENT SCENARIOS

Using the follow headings as a guide, what were the causes of this incident? Please write a few sentences under all of the headings you consider to be relevant
Planning
Communication
Team working
Supervision
Person factors (e.g. stress or fatigue)
Other contributory factors
From the causes you identified above, list the three main causes of this incident **1** **2** **3**

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