

# ALERT



**TCA5-CT-2006-031459**

**ALERT**

**ASSSMENT OF LIFE-CYCLE EFFECT OF REPAIRS ON  
TANKERS**

COORDINATION ACTION

THEMATIC PRIORITY: SUSTAINABLE DEVELOPMENT, GLOBAL CHANGE & ECOSYSTEMS

**PUBLISHABLE FINAL ACTIVITY REPORT  
DOCUMENT ID CODE: 0-0-PPR-2008-01-03-1**

Period Covered: from 01-11-2006 to 31-10-2007

Date of Preparation: 03-12-2008

Start date of project: 1-11-2006

Duration: 2 Years

NEWCASTLE UNIVERSITY [UNEW]

Revision [FINAL]

**AUTHORS:**

<i>Name</i>	<i>Company</i>
Jonathan Downes	UNEW

**REVIEWING/APPROVAL OF REPORT:**

<i>Name</i>	<i>Company</i>	<i>Approved</i>	<i>Date</i>
Robert Dow	UNEW	Approved	

**DOCUMENT HISTORY:**

<i>Revision</i>	<i>Date</i>	<i>Company</i>	<i>Initials</i>	<i>Revised pages</i>	<i>Short description of changes</i>
0	03-12-2008	UNEW	JD	All	Initial Draft incorporating all contributions from Partners

**DISCLAIMER**

Use of any knowledge, information or data contained in this document shall be at the user's sole risk. Neither the ALERT Consortium nor any of its members, their officers, employees or agents accept shall be liable or responsible, in negligence or otherwise, for any loss, damage or expense whatever sustained by any person as a result of the use, in any manner or form, of any knowledge, information or data contained in this document, or due to any inaccuracy, omission or error therein contained.

The European Community shall not in any way be liable or responsible for the use of any such knowledge, information or data, or of the consequences thereof.

# CONTENTS

<b>PROJECT EXECUTION .....</b>	<b>4</b>
1.1. ASSESSMENT OF LIFE-CYCLE EFFECT OF REPAIRS ON TANKERS: ALERT .....	4
1.2. ALERT PARTNERS.....	5
1.3. RELEVANCE TO STATE OF THE ART.....	5
1.4. MAIN OBJECTIVES AND ACHIEVEMENTS OF THE PROJECT .....	10
1.5. WORK PACKAGE 1: SHIP REPAIR PRACTICES .....	11
1.5.1. Work Package Objectives.....	11
1.5.2. List of Deliverables.....	11
1.6. WORK PACKAGE 2: CONDITION MONITORING OF SHIPS.....	12
1.6.1. Work Package Objectives.....	12
1.6.2. List of Deliverables.....	12
1.7. WORK PACKAGE 3: STRUCTURAL ASSESSMENT METHODS.....	13
1.7.1. Work Package Objectives.....	13
1.7.2. List of Deliverables.....	13
1.8. WORK PACKAGE 4: THROUGH LIFE MANAGEMENT .....	14
1.8.1. Work Package Objectives.....	14
1.8.2. List of Deliverables.....	14
1.9. WORK PACKAGE 5: INTEGRATION, DISSEMINATION AND EXPLOITATION .....	15
1.9.1. Work Package Objectives.....	15
1.9.2. List of Deliverables.....	15
1.10. PROJECT TIMETABLE AND STATUS.....	16
<b>2. PLAN FOR USING AND DISSEMINATING THE KNOWLEDGE .....</b>	<b>17</b>
2.1. EXPLOITABLE KNOWLEDGE AND ITS USE .....	17
2.2. DISSEMINATION OF KNOWLEDGE.....	17
2.3. PUBLISHABLE RESULTS.....	18

## PROJECT EXECUTION

### 1.1. Assessment of Life-cycle Effect of Repairs on Tankers: **ALERT**

In recent tanker accidents Erika and Prestige in European waters with catastrophic consequences, structural deficiencies may have largely contributed to the accident. Casualty investigation after the Prestige accident identified the need for better understanding in areas of the detecting of defects and weaknesses during and after survey and after repairs, the reduction of any adverse effects of repairs, current strength requirements for deck opening securing arrangements, etc. The Coordination Action project ALERT was developed in response to this need. The ALERT project (Assessment of Life-cycle Effect of Repairs on Tankers) undertook a thorough examination of current practices in the field of ship repair and to propose improvements to the underlying processes in consultation with industry. The project aimed to critically review the current and emerging technologies, identify and prioritise future R&D needs and developments in the areas of ship repair practices (WP1), Condition monitoring of ships (WP2), Structural assessment methodologies (WP3) and Through life management (WP4). Finally, the project disseminated and exploited the results through publications, seminars and workshops and prepared future R&D project proposals (WP5).

The objectives of the ALERT project were:

- To undertake a thorough examination of current practices in the field of ship repair and to propose improvements to the underlying processes in consultation with industry.
- Review existing and emerging technologies appropriate for ship repair practices and to propose areas for the development of technologies for future application
- Sense the development of loss of structural integrity by reviewing existing and emerging technologies and proposing solutions for the future.
- Improve the efficiency of tankers by considering inspection, maintenance and repair scheduling.
- Consider a framework that will be capable of determining the extent of repair work that an existing ship could safely undergo with minimum additional risk of structural failure for the rest of her service life, in a rational way
- Promote a safe transportation system for Europe,

---

ALERT is the acronym for Assessment of Life-cycle Effect of Repairs on Tankers, supported by the European Commission under the Sustainable development, Global change and Ecosystems thematic area, Sustainable Surface Transport Programme of the 6<sup>TH</sup> Framework Programme.

The support is given under the scheme of CA, Contract No. TCA5-CT-2006-031459.

- Reduce human losses, injuries and environmental damage risk associated with transportation of hazardous goods by tankers
- Encourage best practice in the tanker shipping and ship repair community.
- To effectively disseminate the results and facilitate the acceptance by European society and by industry.
- To coordinate these efforts and to demonstrate the positive effect of this coordination through the participation in integrated projects (IPs), Networks of Excellence (NoE), Strategic Targeted Research Projects (STREPs) and other Coordinated Actions (CAs) for effective distribution of best practice.

## 1.2. ALERT Partners

Participant Role	Participant no.	Participant name	Participant short name	Country
CO (Coordinator)	1	University of Newcastle	UNEW	UK
TCO (Technical Coordinator)	2	University of Strathclyde	NAME-SSRC	UK
ECO (Exploitation Coordinator)	3	Bahamas Maritime Authority	BMA	Bahamas
CR (Contractor)	4	Bureau Veritas	BV	France
CR	5	Materiaal Metingen Europe	MME	Netherlands
CR	7	International Association of Independent Tanker Owners	INTERTANKO	Norway
CR	8	Alpha Marine Services Ltd	AMS	Greece
CR	9	Technical University of Hamburg-Harburg	TUHH	Germany
CR	10	Lisnave Estalerios Navalis SA	LISNAVE	Portugal

Furthermore, the IMO Secretariat participated as an observer to the project. The project coordinator is Professor Robert Dow (+44 191 222 6749 or [r.s.dow@ncl.ac.uk](mailto:r.s.dow@ncl.ac.uk)) and more information about the project can be found at the project website <http://alert.ncl.ac.uk>

## 1.3. Relevance to State of the Art

Tankers carry close to 40 percent of the world's seaborne trade. In 2003, 57 percent of all the oil consumed in the world was transported by sea – approximately 2,200 million tonnes. Although, maritime transport, in general, causes minimal disruption of the environment when compared with other modes of transport, the nature of cargoes carried by tanker vessels, which include hazardous and polluting liquid substances, in the event of a major structure failure, has the potential to cause catastrophic damage.

The International Maritime Organisation's (IMO) major function is to make shipping safer and more environmentally friendly. The measures IMO takes are incorporated in numerous conventions and recommendations, and apply to tanker vessels as well as to other ship types. The International Convention for the Safety of Life at Sea (SOLAS) 1974 and International Convention for the Prevention of Pollution from Ships, (MARPOL73-78) include special requirements for tankers.

Despite efforts, tanker accidents continue to occur causing disastrous consequences and the efforts towards reinstating the environment after an oil spill can cost many hundreds of millions of US\$. The most expensive oil spill in history is the Exxon Valdez (Alaska, 1989). Total costs (including fines, penalties and claims' settlements) are estimated at US \$9.5 billion. The Amoco Cadiz (France, 1978) reportedly cost about US \$282 million. The Braer (UK, 1993) cost in the region of US \$83 million. The Sea Empress' (UK, 1996) total costs for the incident are likely to be in the region of US \$62 million once all settlements are made. Claims are still being processed for the Erika (France, 1999), but are likely to considerably exceed US \$180 million. Present estimates of the total cost of the Prestige are that it may reach up to 1 billion Euros (IOPC estimate August 2005). Last two casualties were particularly harmful as the cargo was heavy fuel oil.

As a result of the Exxon Valdez accident MARPOL was amended to make it mandatory for tankers of 5,000dwt and more, ordered after 6 July 1993 to be fitted with double hulls, or be constructed to an alternative design approved by IMO. The requirement for double hulls that applies to new tankers has also been applied to existing ships. All non-double hull tankers have to be converted (or, realistically speaking, taken out of service) when they reach a certain age.

The investigations into the Erika accident (off the coast of France in December 1999) carried out by the French Government and the Malta Maritime Authority concluded that age, corrosion, insufficient maintenance and inadequate surveys were all strong contributing factors to the structural failure of the ship. Following the Erika accident, IMO adopted a revised phase-out schedule for single hull tankers, which sets out a stricter timetable for the phasing-out of single-hull tankers and gives the year 2015 as the principal cut off date for all single-hull tankers. Also, since 1995 all tankers and bulk carriers aged five years and over have been subject to a specially enhanced inspection programme which is intended to ensure that any structural deficiencies such as corrosion, fatigue cracking are detected.

The tanker Prestige suffered a structural failure in November 2002 in heavy seas off northern Spain and developed a severe list. She was carrying 77,000 tonnes of heavy fuel oil, a fraction of which was lost at the time of the initial damage and more was lost subsequently. The casualty was taken in tow and moved away from the coast. She broke in two and both sections sank in water more than two miles deep. At the time of the sinking it was reported that a substantial further quantity of oil was released.

The Bahamas Maritime Authority (2004) undertook a thorough casualty investigation concerning the initial actions taken onboard; the rescue of the crew; the salvage operation; the refusal of a place of refuge; and the treatment of the master. The possible causes of the initial structural failure were additionally explored in some detail. A number of recommendations for future research were reported. These

recommendations related to; the detecting of defects and weaknesses during and after survey and after repairs; the reduction of any adverse effects of repairs; current strength requirements for deck opening securing arrangements; the need for clear lines of authority during an emergency; the authority of a master during an incident; and places of refuge.

One of the outcomes of the Prestige casualty was the expression of a new doubt by some regulators on whether major repairs conducted on older ships could be considered safe. The reason this new doubt was expressed was that the M/T Prestige had extensive repairs 18 months prior to its casualty. Furthermore, these repairs were conducted under the Enhanced Survey Program of a major classification society in a shipyard and in the presence of the mandated two exclusive surveyors. Records of these repairs appear to indicate that the procedures of the classification society were followed and that no shortcuts were taken. In the absence of a generally accepted explanation for the cause of the casualty, the above events have resulted in questioning the safety of conducting large repairs on older ships. There are a number of obvious and compelling reasons as to why this question needs to be addressed from a rational and technical standpoint. ALERT Project aims to address this issue by concentrating on those recommendations contained in the Prestige casualty investigation report which are relevant to ship repairs.

The area of ship repair was considered in several reports of the Tanker Structure Cooperative Forum (TSCF, 1986, 1992, 1995) and more recently in the ISSC 2003. Specialist Committee V.2 Inspection and Monitoring (Bruce et al 2003) considered the inspection and monitoring regimes imposed by class and regulatory authorities. Fatigue cracking and corrosion were highlighted as areas of concern. Specialist Committee V.6 Fabrication Technologies (Wilckens et al 2003) investigated the material properties of very high strength steels and the welding practices used within the marine industry, and considered in particular the weld deposit material properties, as even when the weld and parent materials have the same or similar properties, the weld material must be treated as an individual material in the analysis. Cutting, forming and fabrication processes were additionally considered, however this was in the context of new building in a ship yard.

Bruce et al (2003) reviewed the inspection and monitoring regimes currently in use within the marine industry. Guidelines are issued by a range of bodies, ranging from the IMO and class societies to industry associations. Most inspection and monitoring processes are limited by the means of access into the hull structure; means of access is discussed in detail by Caridis (2001). Given the problems associated with manual inspection of the hull structure, one area of research is that of robotic inspection equipment.

Inspections of ships are undertaken at regular intervals, typically those laid down by class regulations. These are generally considered to be the minimum and additional requirements can be followed by the owners. As discussed by Straumann (1997), one example of these being the Condition Assessment Program.

As discussed by Bruce et al (2003), fatigue cracking generally occurs in welds and in areas of high stress concentration. Inspection of these cracks is a time consuming process and typically done by the eye. In selected highly critical regions, x-ray and

ultra-sonic methods are additionally used. Technical Committee III.2 (Brennan et al 2003) and Special Task Committees V.1.1 (Watanabe et al 2003) & V.1.2 (Berge et al 2003) of ISSC all considered different aspects of fatigue and fracture within marine structures. Specific process and analysis procedures related to fatigue and fracture were discussed. The specific process and analysis procedures related to fatigue cracking have also been investigated by numerous researchers, including the Ship Structures Committee (various reports), Fricke et al (2002, 2000, 1997a, 1997b), Collette (2005), De Souza and Ayyub (2000) and many others.

Similarly to fatigue and fracture, corrosion and residual stresses have been investigated by several prominent researchers (Sun et al 2000, Guedes Soares and Teixeira 2000, Wirsching et al 1997, Fricke 2005).

In a previous European Commission FP6 funded project POP&C (Pollution Prevention and Control) (Aksu et al 2004), a comprehensive analysis of accident/incidents of AFRAMAX tankers have recently been carried out (Papanikolaou, et al 2005). Of the total approximately 1300 incidents for the period of 1978-2003, non-accidental structural failure incidents represent 9% of the total incidents and in terms of oil pollution, non-accidental structural failure incidents resulted nearly 100000 tonnes of spills accounting for 23.4% of the total spill amount from Aframax tankers. These figures clearly demonstrate the importance of efforts to be made in reducing tanker incidents/accidents due to structural failures/weaknesses.

## References

- Aksu, S., Vassalos, D., Tuzcu, C., Mikelis, N. and Swift, P. (2004), "A Risk Based Design Methodology For Pollution Prevention and Control" RINA International Conference on Design and Operation of Double Hull Tankers, London, UK, February 2004.
- Bahamas Maritime Authority (2004). "Report of the Investigation into the Loss of the Bahamian Registered Tanker "Prestige" of the Northwest Coast of Spain on 19 November 2002." Bahamas Maritime Authority, London, UK: 263.
- Berge, S., D. Kihl, I. Lotsberg, S. Maherault, T. P. Mikkola, L. P. Nielsen, H. Paetzold, C.-H. Shin, H.-H. Sun and Y. Tomita (2003). "Report of the Special Task Committee V1.2 Fatigue Strength Assessment." Proceedings of the 15th International Ship and Offshore Structures Congress, San Diego, USA, Elsevier.
- Brennan, F., W. Cui, L. Josefson, M. Koval, K.-S. Kim, M. Norwood, R. Pohl, R. Tedeschi, X. Wang and S. Wastberg (2003). "Report of Committee III.2 Fatigue and Fracture." Proceedings of the 15th International Ship and Offshore Structures Congress, San Diego, USA, Elsevier.
- Bruce, G., M. Duan, G. V. Egorov, R. Folso, Y. Fujimoto, Y. Garbatov, J.-C. Le Hire, B.-C. Shin and O. T. Vardal (2003). "Report of the Specialist Committee V.2 Inspection and Monitoring." Proceedings of the 15th International Ship and Offshore Structures Congress, San Diego, USA, Elsevier.
- Caridis, P. (2001). "Inspection, Repair and Maintenance of Ship Structures." Witherby & Co., London, UK.
- Collette M. (2005) "Strength and Reliability of Aluminium Stiffened Panels". School of Marine Science and Technology, University of Newcastle upon Tyne, UK. PhD Thesis. p.249.

- De Souza GFM and Ayyub B. (2000). "Probabilistic Fatigue Life Prediction for Ship Structures using Fracture Mechanics". *Naval Engineers Journal*, July 2000: 375-397.
- Fricke, W. (2005): "Effects of residual stresses on the fatigue behaviour of welded steel structures". *Proc. Symp. on Struct. Durability*, Darmstadt
- Fricke, W. (2002): "Recommended hot spot analysis procedure for structural details of ships and FPSOs based on round-robin FE analyses." *Int. J. of Offshore and Polar Engng.*, Vol. 12, No. 1, pp 40 - 47.
- Fricke W, Berge S, Brennan F, Cui W, L Josefson, H Kierkegaard, D Kihl, M Koval, T. P. Mikkola, G Parmentier, M Toyosada, and J. H. Yoon. (2000). "Report of ISSC Technical Committee III.2 - Fatigue and Fracture". In: Ohtsubo H, Sumi Y, SNAJ (Host), editors. *14th International Ship and Offshore Structures Congress*; 2-6th October 2000; Nagasaki, Japan: Elsevier Science Ltd; 2000. p. 323-392.
- Fricke W, Petershagen H, Paetzold H. (1997). "Fatigue Strength of Ship Structures: Part 1 - Basic Principles". In: *GL-Technology*. Hamburg: Germanischer Lloyd; p. 47.
- Fricke W, Petershagen H, Paetzold H. (1997). "Fatigue Strength of Ship Structures: Part 2 – Examples". In: *GL-Technology*. Hamburg: Germanischer Lloyd; p. 43.
- Guedes Soares, C. and A. P. Teixeira (2000). "Structural reliability of two bulk carrier designs." *Marine Structures* 13: 107-128.
- Papanikolaou, A., Eliopoulou, E., Alissafaki, A., Aksu, S., Tuzcu, C., Delautre, S. and Mikelis, N. (2005) "Critical Review of AFRAMAX Tankers incidents" *Proceedings of the International Marine Science and Technology for Environmental Sustainability Conference, ENSUS 2005*, Newcastle, 13-15 April 2005.
- Straumann, P. (1997). "Ageing vessels – experience from CAP as a condition as a condition assessment tool." *Proceeding of the Ships Ageing Process Conference (IMAS '97)*. London.
- Sun, H.-H., G.-H. Liao and Y. Bai (2000). "Reliability Analysis of Ship Hull Girders Considering the Degradations of Corrosion and Fatigue." *Key Engineering Materials* 183-187: 1023-1028.
- TSCF (1986). *Guidance Manual for the Inspection and Condition Assessment of Tanker Structures*. Tanker Structures Co-operative Forum (TSCF), Witherby & Co., London.
- TSCF (1992). *Condition Evaluation and Maintenance of Tanker Structures*. Tanker Structures Co-operative Forum (TSCF), Witherby & Co., London.
- TSCF (1995). *Guidelines for the Inspection and Maintenance of Double Hull Tanker Structures*. Tanker Structures Co-operative Forum (TSCF), Witherby & Co., London.
- Watanabe, I., K. Branner, A. Cariou, T. Fukasawa, X.-K. Gu, G. Kapsenberg and E. Rizzuto (2003). "Report of the Special Task Committee V1.1 Fatigue Loading." *Proceedings of the 15th International Ship and Offshore Structures Congress*, San Diego, USA, Elsevier.
- Wilckens, H., T. Borzecki, M. Heinemann, F. Lallart, N. Wu, D. Olson, J. Y. Park, R. A. Sheno and Y. Takeda (2003). "Report of the Specialist Committee V.6 Fabrication Technologies." *Proceedings of the 15th International Ship and Offshore Structures Congress*, San Diego, USA, Elsevier.
- Wirsching, P. H., J. Ferensic and A. Thayamballi (1997). "Reliability with Respect to Ultimate Strength of a Corroding Ship Hull." *Marine Structures* 10: 501-518.

## 1.4. Main Objectives and Achievements of the Project

The primary objective of each work package during the project has been to critically review the current knowledge and understanding (the *state-of-the-art*) in each area and then to identify the future needs and requirements for research in each of these areas. These areas being ship repair practices, condition monitoring of ships, repair orientated structural assessment methods and through life management of ships.

Dissemination activities have included:

- Presentation to the International Maritime Organisation (IMO) Maritime Safety Committee on the 8<sup>th</sup> October 2007
- Ship Repair Symposium 2008, held in Newcastle on the 1<sup>st</sup> and 2<sup>nd</sup> September 2008.

### Dissemination Overview

Planned/Actual Dates	Type	Type of Audience	Countries Addressed	Size of Audience	Partner responsible / involved
December 2006	Project Website		Worldwide		UNEW
9 <sup>th</sup> January 2007	Press release (press)	Industry (Marine)	Worldwide		BMA/UNEW
Feb 2007	Article in in "Shipping World and Shipbuilder"	Industry (Marine)	Worldwide		UNEW/BMA
Feb 2007	Industry Briefing - CESA	Industry (Marine)	Europe		UNEW
8 <sup>th</sup> March 2007	UNEW Corporate Brochure on FP6 research projects	General Public and higher Education			UNEW
8 <sup>th</sup> October 2007	Lunchtime Presentation to IMO MSC 87	Industry (Marine)	Worldwide	Approx 300	All Project members
16 <sup>th</sup> October 2007	Article in "Lloyd's List"	Industry (Marine)	Worldwide		BMA/UNEW /INTERTANKO /NAME-SSRC/ MME/BV
November 2007	Article in "BV Veristar" in-house publication	Bureau Veritas Staff and Customers	Worldwide	7000	BV
April 2008	Lloyd's Maritime Academy course on 'Marine Structural Failures'	Industry	Europe		BMA and MME
1 & 2 September 2008	Ship Repair Technology Symposium	Industry and Academia	Europe	42	UNEW and All Partners

## **1.5. Work Package 1: Ship Repair Practices**

### **1.5.1. WORK PACKAGE OBJECTIVES**

The objective of this work package was to critically review the current knowledge and understanding, and identify future research and development needs in the following areas

- Standard practices and class society requirements for the repair of ships
- Alternative repair practices
- Consequences on structural reliability of new to old steel replacement, and
- Development and implications of common repair, inspection and maintenance procedures, requirements and acceptance by the classification societies.
- Contribute to the preparation of another project proposal to perform substantial research about the performance of repaired ships:

### **1.5.2. LIST OF DELIVERABLES**

<b>Del. No</b>	<b>Deliverable Name</b>	<b>Lead Contractor</b>
D1.1	State of the Art Reports on Tasks 1.1, 1.2 and 1.3	BV
D1.2	Reports on the future R&D needs and requirements for Tasks 1.1, 1.2 and 1.3	BV

## 1.6. Work Package 2: Condition Monitoring of Ships

### 1.6.1. WORK PACKAGE OBJECTIVES

The objective of this work package was to critically review the current knowledge and understanding, and identify future research and development needs in the following areas

- Non-destructive testing of welds
- Means of detecting fatigue cracks and recording presence of fatigue cracks prior to repairs or renewals
- Monitoring the environment in void and ballast spaces, and
- Corrosion detection and protection in double hull ballast and cargo tank spaces of tankers.
- Contribute to the preparation of another project proposal to perform substantial research about the performance of repaired ships:

### 1.6.2. LIST OF DELIVERABLES

<b>Del. No</b>	<b>Deliverable Name</b>	<b>Lead Contractor</b>
D2.1	State of the Art Reports on Tasks 2.1, 2.2 and 2.3	MME
D2.2	Reports on the future R&D needs and requirements for Tasks 2.1, 2.2 and 2.3	MME

## 1.7. Work Package 3: Structural Assessment Methods

### 1.7.1. WORK PACKAGE OBJECTIVES

The objective of this work package was to critically review the current knowledge and understanding, and identify future research and development needs in the following areas

- Contact damage on the strength of a ship side structure
- Strength and securing arrangements for openings
- Strength of lighter ship panels
- Influence of residual stresses, and
- Investigate the possibility of using existing examples for application to tankers to consider both ultimate hull girder strength, and fatigue strength assessment methods.
- Contribute to the preparation of another project proposal to perform substantial research about the performance of repaired ships

### 1.7.2. LIST OF DELIVERABLES

<b>Del. No</b>	<b>Deliverable Name</b>	<b>Lead Contractor</b>
D3.1	State of the Art Reports on Tasks 3.1, 3.2 and 3.3	UNEW
D3.2	Reports on the future R&D needs and requirements for Tasks 3.1, 3.2 and 3.3	UNEW

## **1.8. Work Package 4: Through Life Management**

### **1.8.1. WORK PACKAGE OBJECTIVES**

The objective of this work package was to critically review the current knowledge and understanding, and identify future research and development needs in the following areas

- Operational profiles of tankers
- Legislative responsibilities during both normal operations and emergency situations, and
- Effect of repair and maintenance scheduling on structural integrity.
- Contribute to the preparation of another project proposal to perform substantial research about the performance of repaired ships:

### **1.8.2. LIST OF DELIVERABLES**

<b>Del. No</b>	<b>Deliverable Name</b>	<b>Lead Contractor</b>
D4.1	State of the Art Reports on Tasks 4.1, 4.2 and 4.3	NAME-SSRC
D4.2	Reports on the future R&D needs and requirements for Tasks 4.1, 4.2 and 4.3	NAME-SSRC

## **1.9. Work Package 5: Integration, Dissemination and Exploitation**

### **1.9.1. WORK PACKAGE OBJECTIVES**

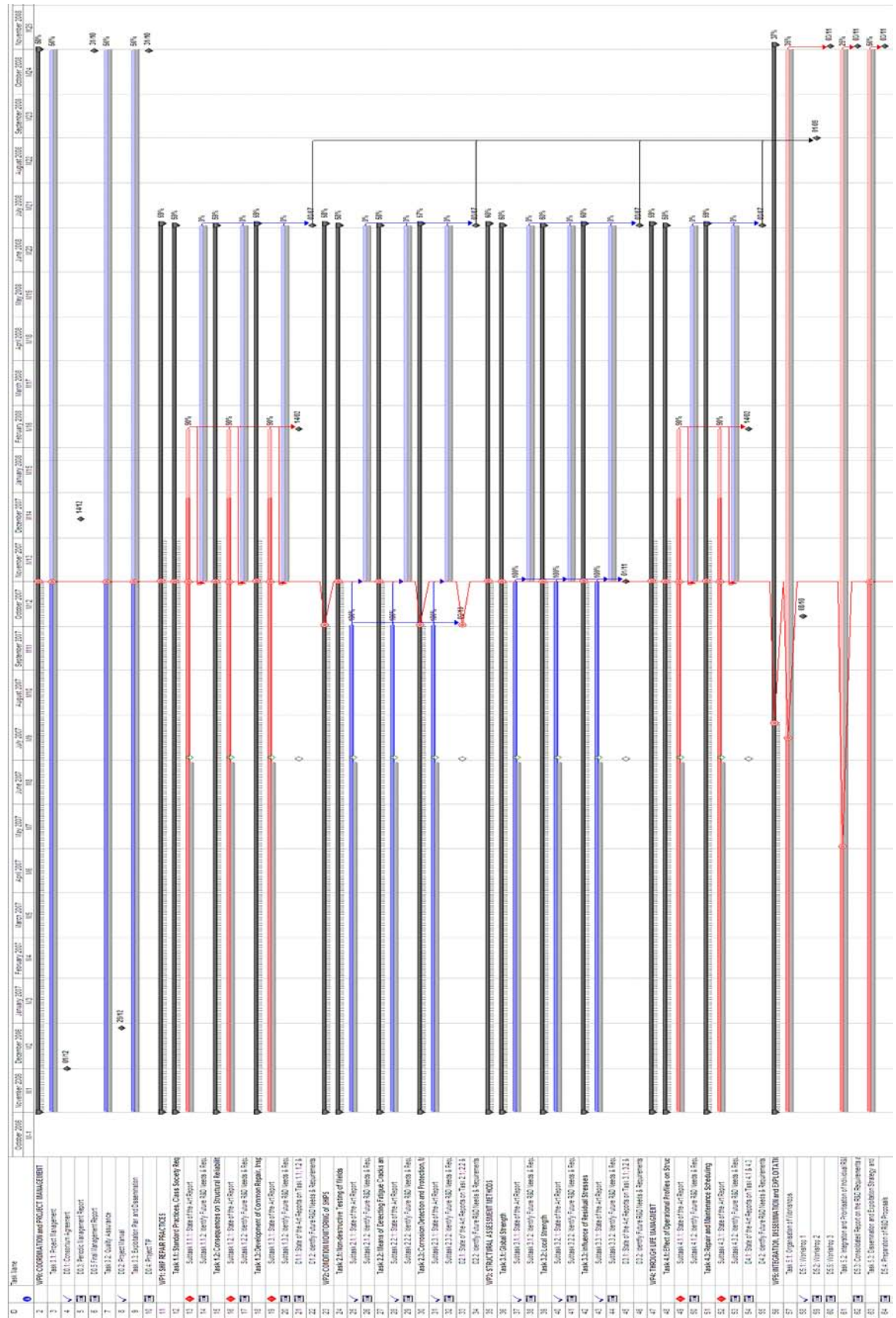
The objective of this work package was to:

- Integrate and prioritise the research and development needs identified in WPs 1-4
- Organise and coordinate project-wide workshops
- Disseminate and interface with external organisations, and
- Exploit the project results and prepare research proposals in prioritised R&D areas.

### **1.9.2. LIST OF DELIVERABLES**

<b>Del. No</b>	<b>Deliverable Name</b>	<b>Lead Contractor</b>
D5.1	Organisation of Workshop 1	BMA
D5.2	Organisation of Workshop 2	UNEW/BMA
D5.3	Consolidated report on the R&D requirements and Priorities	BMA / UNEW
D5.4	Preparation of R&D project proposals	BMA / NAME-SSRC
D5.5	Organisation of Workshop 3	NAME-SSRC/BMA

# 1.10. Project Timetable and Status



## 2. PLAN FOR USING AND DISSEMINATING THE KNOWLEDGE

### 2.1. Exploitable knowledge and its Use

Not applicable

### 2.2. Dissemination of Knowledge

**Overview Table**

Planned/Actual Dates	Type	Type of Audience	Countries Addressed	Size of Audience	Partner responsible / involved
December 2006	Project Website		Worldwide		UNEW
9 <sup>th</sup> January 2007	Press release (press)	Industry (Marine)	Worldwide		BMA/UNEW
Feb 2007	Article in in "Shipping World and Shipbuilder"	Industry (Marine)	Worldwide		UNEW/BMA
Feb 2007	Industry Briefing - CESA	Industry (Marine)	Europe		UNEW
8 <sup>th</sup> March 2007	UNEW Corporate Brochure on FP6 research projects	General Public and higher Education			UNEW
8 <sup>th</sup> October 2007	Lunchtime Presentation to IMO MSC 87	Industry (Marine)	Worldwide	Approx 300	All Project members
16 <sup>th</sup> October 2007	Article in "Lloyd's List"	Industry (Marine)	Worldwide		BMA/UNEW /INTERTANKO /NAME-SSRC/ MME/BV
November 2007	Article in "BV Veristar" in-house publication	Bureau Veritas Staff and Customers	Worldwide	7000	BV
April 2008	Lloyd's Maritime Academy course on 'Marine Structural Failures'	Industry	Europe		BMA and MME
1 & 2 September 2008	Ship Repair Technology Symposium	Industry and Academia	Europe	42	UNEW and All Partners

The project website is available at: <http://alert.ncl.ac.uk>

This contains both public sections and partner only sections in order to both inform the public about the project but also to facilitate communication between project partners.

### **2.3. Publishable Results**

Downes, J., Race, J., Bruce, G., Dow, R., Asku, S., Barltrop, N., Xu, L., Hifi, N., Incecik, A., Bell, D., Waite, J., McGregor, J., Thygesen, B., Rauta, D., Rodrigues, C., Braga, L., Moerland, P., Fricke, W., Vasouras, C., and Batistatos, N. "ALERT: Assessment Of Life-Cycle Effect Of Repairs On Tankers", Proc. of Int. Symp. on Ship Repair Technology (Ed. R.S. Dow and J. Downes), Newcastle University, 1st & 2nd September 2008, Newcastle upon Tyne. ISBN: 978-0-7017-0220-5

Downes, J., Dow, R., Fricke, W., Barltrop, N., and Xu, L. "An Assessment of the Effect of Repairs on the Strength of Tankers", Proc. of Int. Symp. on Ship Repair Technology (Ed. R.S. Dow and J. Downes), Newcastle University, 1st & 2nd September 2008, Newcastle upon Tyne. ISBN: 978-0-7017-0220-5

Barltrop, N., Hifi, N., Aksu, S., Xu, L., Incecik, A., Batistatos, N., and Vasouras, C. "Effect of the Environment and Ship Repair on Structural Reliability for Oil Tanker Vessel" Proc. of Int. Symp. on Ship Repair Technology (Ed. R.S. Dow and J. Downes), Newcastle University, 1st & 2nd September 2008, Newcastle upon Tyne. ISBN: 978-0-7017-0220-5

Moerland, P., Barltrop, N. and Aksu, S. "Testing Practices in Present Ship Repair Situations" Proc. of Int. Symp. on Ship Repair Technology (Ed. R.S. Dow and J. Downes), Newcastle University, 1st & 2nd September 2008, Newcastle upon Tyne. ISBN: 978-0-7017-0220-5

Thygesen, B., and Rauta, D. "Corrosion Detection and Protection: Monitoring the Environment in Void and Ballast Spaces – An Owners View" Proc. of Int. Symp. on Ship Repair Technology (Ed. R.S. Dow and J. Downes), Newcastle University, 1st & 2nd September 2008, Newcastle upon Tyne. ISBN: 978-0-7017-0220-5

Fricke, W. and Zacke, S., "Influence of Welding Sequence and Structural Stiffness on Residual Stresses of a Replaced Plate During Ship Repair", Proc. of Int. Symp. on Ship Repair Technology (Ed. R.S. Dow and J. Downes), Newcastle University, 1st & 2nd September 2008, Newcastle upon Tyne. ISBN:978-0-7017-0220-5

Research proposal "AS-BUILT - Assessment of Ship Repairs – Based on Ultimate Structural Integrity and Life-cycle Maintenance Technologies".