ANNEX 20

Extract from Cambridge Test House Ltd Report T50068, dated 22 February 2005

(Please note For the purposes of the MAIB report artwork has been re-numbered and appendix pages are not included)

THE TEST HOUSE JOB AND REPORT REFERENCE: T50068

LABORATORY REPORT

EXAMINATION OF STEEL HULL SAMPLES FROM THE SALVAGED FISHING TRAWLER *JANN DENISE II*

For: **Marine Accident Investigation Branch**
First Floor
Carlton House
Carlton Place
Southampton
SO15 2DZ

This report comprises

Title Page 1
Text Pages 1 to 8
Figure Sheets 1 to 28
Appendix Pages 1 to 4

This project includes tests and examinations, some of which were completed against UKAS accredited procedures. The scope of laboratory accreditation does not, however, include the analysis of test data or the offering of professional opinions.

EXAMINATION OF STEEL HULL SAMPLES FROM THE SALVAGED FISHING TRAWLER *JAN DENISE II*

For: Marine Accident Investigation Branch, First Floor, Carlton House, Carlton Place, Southampton, SO15 2DZ.

The Test House (Cambridge) Ltd Reference: T50068
Sample Receipt Date: 22 December 2005
Instruction Receipt Date: 18 January 2005
Report Date: 22 February 2005

1. INTRODUCTION AND BACKGROUND

JANN DENISE II was a small inshore fishing trawler of welded steel hull and deck construction. The vessel was registered SH275 in its home port of North Shields.

We understand from the Marine Accident Investigation Branch (MAIB) that the vessel sank suddenly in heavy seas off the Tyne estuary on 17 November 2004 and that an average sea temperature of 10°C prevailed on the day of the casualty. The vessel was subsequently salvaged from a position of resting on its starboard side during 12 December 2004, and landed on the quayside of Tyne Dock for MAIB inspection.

During the salvage operations MAIB had noticed a crack in way of the underside of the port side hull. With a view to removing sample material to investigate the nature of the cracking, The Test House (TTH) was requested to attend the salvaged vessel at Tyne Dock on 14 December 2004. During the visit TTH documented both the known crack site and a second site of cracking discovered during the day and gave advice on the removal of sample material from the vessel.

The sample material removed from the vessel and its subsequent laboratory examination and testing by TTH was as follows.

2. VESSEL ATTENDANCE AND REMOVAL OF SAMPLE MATERIAL FOR LABORATORY INVESTIGATION

Protective sacrificial anodes fitted to the port and starboard sides of the keel had been largely consumed and the paint system below the hull waterline was in a state of local breakdown (Figure 39). Though the two anodes attached to the rudder retained a slightly larger remnant of sacrificial metal, these were also close to being spent.

The crack discovered during the salvage operation was vee-shaped and located in the port underside hull plating just aft of the stabiliser fin (Figure 40). The second crack site discovered by a MAIB surveyor during the day was also in the port underside plating and comprised two close proximity transverse parallel cracks. The two cracks were located aft of the vee-shaped crack and just aft of the stern most keel mounted anode (Figure 41).

MAIB were subsequently advised to remove rectangular shaped samples from the two port side crack sites and a third "control" sample from the starboard underside hull plating in a comparable location to the port side vee-shaped crack.

The three samples, along with a perforated section removed from below the waterline of the port side forward corner of the steering flat compartment, were subsequently forwarded to TTH for detailed laboratory examination and testing.

The four samples received by TTH on 22 December 2004 were subsequently examined and tested as follows.

LABORATORY EXAMINATION AND TESTING

3. PERFORATION IN PORT SIDE FORWARD STEERING FLAT COMPARTMENT CORNER

The sample provided comprised a 150mm x 163mm rectangular piece containing a through thickness local perforation of overall 32mm x 28mm maximum dimensions (Figure 42). The plates outer sea facing side exhibited widespread local breakdown of the protective red paint (Figure 42). The inboard plate side was coated in corrosion products and sludge type deposits and exhibited no evidence of a protective paint coating.

A maximum remnant plate thickness of 5.8mm was recorded. Large areas of the inboard plate side had suffered general corrosion wastage, in which the thickness had been reduced to 1.5mm. The cross sectional area of the through plate perforation was confirmed to be 416mm^2, and this had similarly resulted from general corrosion wastage from the plate's unprotected inboard side.

3.1 Metallographic Examination

A single metallographic specimen was removed from perforation site. The section served to confirm that perforation had occurred by plastic instability and collapse of a region which had been severely wasted by predominantly inboard side corrosion. The presence of heavy corrosion products at both sides of the perforation edge suggested that the area had exhibited some through thickness seepage for a period preceding the collapse, which had formed the gaping perforation.

4. AFT PORT SIDE SAMPLE EXHIBITING TWO PARALLEL TRANSVERSE (PORT TO STARBOARD) CRACKS

The sample provided contained two cracks, and comprised a section of hull plating measuring 305mm x 304mm, with welded internal longitudinal and transverse plate stiffeners of 6.1mm and 6.9mm thickness in the longitudinal direction and 6.4mm thickness in the transverse direction. The hull plating measured 5.4mm thickness in regions free from local corrosion damage, but was wasted down to 2.0mm in local areas of inboard side corrosion damage. Internal surfaces of the plating exhibited no evidence of paint protection and the external paint system was also showing evidence of local breakdown.

4.1 Fractographic Examination

The aft crack exhibited a length of 150mm and was located along the weld toe of a fillet weld attaching a transverse member to the hull plating. The forward crack exhibited a length of 117mm and was located in corrosion wasted hull plate material just beyond the end of the fillet weld joining the longitudinal member to the hull plating (Figure 43). The crack edges in both cases were close mating and neither crack exhibited any measurable gape.

Fracture face samples removed from the two cracks exhibited very heavy post cracking corrosion damage. The cracks had both originated at the inner hull side, propagated without branching and terminated in a fracture step at the outer hull side. The depth of corrosion damage apparent at the crack faces, and evidence of incursions along the plate segregation and non-metallic inclusions, suggested that cracking was of some age and pre-dated the casualty.

4.2 Metallographic Examination

Metallographic specimens were removed from the two crack sites. The section removed from the aft crack of the pair was confirmed to exhibit a fatigue crack which had originated in corrosion grooving at the fillet weld toe. Evidence of a corrosion groove incursion was also apparent at the hull side weld toe of the fillet weld at the joint's opposite side. The fracture edge exhibited evidence of post cracking pitting corrosion, and deep post cracking corrosion incursions along the plate's microstructural texture were also apparent. The crack had terminated in a fracture step at the outer sea side hull surface and a parallel secondary fatigue crack was seen to have initiated from a corrosion pit close to the principal fracture edge.

The forward crack in the pair was also confirmed to be a fatigue crack, which had originated in corrosion pitting at the inner hull side. This crack, like the aft one, exhibited evidence of widespread post cracking corrosion incursions along the hull plate's microstructural texture. The outer hull surface exhibited widespread pitting damage in regions still protected by the paint system, and such areas also exhibited shallow associated strain damage. Isolated instances of copper like particles were also seen to be present at the pit sites. Collectively the evidence would suggest that the outer hull surface pitting was old damage, which had been arrested by blast cleaning and re-painting. The evidence of copper particles in the vicinity of pit sites exhibiting blast cleaning strain damage would suggest that a copper slag-blasting medium had been used for the pre-paint preparation.

4.3 Characterisation of Hull Plate Parent Material

An ambient temperature tensile test oriented normal to the direction of crack growth and a set of sub-size Charpy impact tests were completed at the average casualty day sea temperature. The test data from the mechanical tests is presented in Appendix 1.

The tensile test appeared anomaly free and identified a property set generally in line with a Lloyds grade A type material. The ¼ standard size Charpy test set confirmed a high level of notch toughness at the casualty sea temperature and suggested that the plate was probably of a type better than Lloyds grade A.

Twenty three element optical emission spectrographic (OES) analysis (Appendix 4, lines 1 and 4) confirmed the steel to be of an aluminium killed weldable carbon manganese type and free from anomalies.

5. FORWARD PORT SIDE SAMPLE EXHIBITING A VEE SHAPED CRACK

The sample provided contained two cracks (Figures 44 and 45) and comprised a section of hull plating measuring 344mm x 292mm with an internally welded stiffener and engine bearer. The hull plating measured 5.6mm thickness in regions free from local corrosion damage, but was wasted down to 3.1mm at local corrosion pit sites. Internal surfaces of the plating exhibited no evidence of paint protection, and the external paint system was also showing evidence of local breakdown (Figure 44).

One leg of the vee shaped crack had a length of 41.7mm and a gape at the outer sea side which ranged from 0.5mm to 1.5mm. The cracks shorter leg exhibited a length of 30.3mm and a gape which ranged from nothing to 1.05mm. The estimated total gape area of the cracks combined legs was 52.5mm^2. The estimated gape area of the longitudinal crack portion included in the sample was estimated at 13mm^2.

5.1 Fractographic Examination

The vee shaped crack was located at the end of a welded longitudinal attachment (Figure 46), and was associated with a region of deep inboard side pitting corrosion. The longitudinal crack was located at the end of a transverse welded attachment, and was again associated with a region of inboard side pitting corrosion and wastage.

Fracture face samples were removed from the two cracks and exhibited very heavy post cracking corrosion damage. The cracks had both originated at the inner hull side, propagated without branching, and terminated in a fracture step at the outer hull side. The depth of corrosion damage apparent at the crack faces suggested the cracking was of some considerable age and pre-dated the casualty. The depth of post cracking pitting corrosion of the vee shaped crack fracture surface suggested that this crack in particular was of a very substantial age.

5.2 Metallographic Examination

Metallographic specimens were removed from both the vee shaped crack and the longitudinal crack. A further section was also removed from the attachment fillet weld associated with the longitudinal crack.

The section removed from the vee shaped crack confirmed a presence of widespread pre and post-cracking corrosion damage. The section from the longitudinal crack exhibited a particularly wide gape and appeared more typical of a corrosion fatigue type crack. The section removed from the fillet weld associated with the longitudinal crack exhibited widespread evidence of inboard side corrosion damage, and an incipient fatigue crack was apparent at one weld toe.

The outer hull surface exhibited features similar to those apparent in the aft port side sample, which again suggested that earlier outer sea side corrosion pitting had been arrested by blast cleaning prior to application of the current protective paint system.

5.3 Characterisation of Hull Plate Parent Material

Tensile, Charpy impact tests and chemical analysis were completed as detail earlier in section 4. The test data from the mechanical tests is presented in Appendix 2 and the analytical results in lines 2 and 5 of Appendix 4. The steel was again confirmed to be of a high Charpy notch toughness and exhibited a tensile test property set generally in line with a Lloyds grade A type material.

The chemical analysis in this case confirmed the steel to be of a silicon-aluminium killed weldable carbon manganese type, which had again been produced by fine grained metal practice.

6. STARBOARD SIDE CONTROL SAMPLE REMOVED FROM A COMPARABLE LOCATION TO THE PORT SIDE VEE SHAPED CRACK

Through the piece had originally been removed as a control sample, it was found on receipt by the laboratory to contain cracks in similar locations to the comparable port side sample. The sample provided comprised a section of hull plating measuring 315mm x 315mm with an internal stiffener and engine bearer. The hull plating measured a thickness of 5.8mm in regions free from corrosion damage, but was reduced down to 4.2mm at sites of local corrosion pitting. Internal surfaces of the plating exhibited no evidence of paint protection and the external paint system was also showing evidence of local breakdown.

The transverse generally vee shaped crack was located at the end of a welded longitudinal attachment to the hull plating. The total length of visually apparent cracking measured 72.0mm and 47.9mm at the inboard and outer sea sides respectively. The longitudinal crack was located at the end of a welded transverse attachment to the hull plating. In this latter case the total length of visually apparent cracking measured 58.8mm and 44.7mm at the inboard and outer sea sides respectively. The cracks in both cases were of unmeasurably small gape at the hull outer sea side.

6.1 Metallographic Examination

Metallographic specimens were removed from both the transverse and longitudinal cracks. The section removed from the transverse crack exhibited widespread evidence of both pre and post cracking pitting corrosion. Though the crack edges were very badly corrosion damaged, it was still possible to conclude that the through hull plate perforation had resulted from fatigue cracking. Evidence of deep pitting of the crack edges and corrosion of the outer sea side hull plating adjacent to the crack both suggested that the crack had breached the hull plating at some time preceding the casualty.

The section removed from the longitudinal crack was again seen to have initiated from pitting corrosion at the inboard hull side. The cracks appearance was again typical of fatigue cracking, which had again terminated in a fracture step at the hull plates outer sea side. Though the extent of crack edge pitting corrosion damage was less severe than was the case in the transverse crack, it was still judged to be consistent with the perforation pre-dating the casualty.

6.2 Characterisation of Hull Plate Parent Material

Tensile, Charpy impact tests and chemical analysis were completed as detailed earlier in section 4. The test data from the mechanical tests is presented in Appendix 3 and the analytical results in lines 3 and 6 of Appendix 4. The steel was again confirmed to be of a high Charpy notch toughness and exhibited a tensile property set generally in line with a Lloyds grade A type material.

The chemical analysis in this case confirmed the steel to be of a silicon-aluminium killed weldable carbon manganese type, which had been produced by fine grained metal practice. The similarity of the analysis for this item with that of the forward port sample suggests that both plates had originated from the same parent steel cast.

7. SUMMARY

7.1 The port side steering flat compartment sample exhibited severe inboard side corrosion wasting at a surface which exhibited no evidence of a protective paint coating. The perforation (416mm^2 area) had subsequently occurred by instability and collapse at a local site of very severe corrosion wastage. Corrosion products apparent in way of the perforation suggested that a phase of through thickness seepage had occurred prior to bulk perforation.

7.2 The aft port side sample contained two parallel transverse cracks in a section of hull plating exhibiting inboard side corrosion wasting down to 2.0mm. The two cracks were located adjacent to fillet welds attaching internal longitudinal and transverse stiffeners, and both had initiated from sites of inboard side corrosion damage. The cracks appeared typical of fatigue cracking, and both exhibited evidence consistent with an age pre-dating the casualty.

7.3 The forward port side sample contained two cracks, one of which was longitudinal and the other transverse. The two cracks were located in inboard side corrosion wastage adjacent to welds attaching internal members. The two cracks in this sample appeared more typical of corrosion fatigue type cracking, and evidence suggested that both cracks pre-dated the casualty incident. The vee shaped crack exhibited a significant outer sea side crack mouth gape resulting in an opening at the plates outer sea side surface of $5.5mm^2$.

7.4 The starboard side "control" sample was found on receipt by the laboratory to contain two crack perforations through the hull plating. The cracks appeared very similar to those seen in the equivalent port side sample, and both had originated in corrosion grooving adjacent to inboard side fillet welded attachments. The cracks appeared consistent with either fatigue or corrosion fatigue cracking, and evidence suggested that at least one had fully penetrated the hull plating prior to the casualty.

7.5 The inboard side hull plating surfaces of all three samples exhibiting cracking appeared to be void of any protective paint system, and the outer sea side protective paint system appeared to be starting to break down also. The outer sea side hull plating appeared to have suffered a period of earlier pitting corrosion, which had apparently been arrested with blast cleaning and application of the current paint system.

7.6 Hull plating was found to exhibit a tensile property set in line with a Lloyds grade A type material, which was accompanied by a level of Charpy impact toughness significantly better than one could typically expect from a grade A type material. The steel had consistently been produced by fine grained metal practice, and the starboard and aft port sides samples were thought to have originated from a common parent steel cast. The steel microstructures appeared typical of hot rolled products and we saw no evidence of material or microstructural anomalies that could have pre-disposed the hull plating to the levels of inboard side corrosion observed.

8. CONCLUSIONS AND DISCUSSION

We conclude that the port side steering flat compartment sample had suffered a perforation of $416mm^2$, as a consequence of advanced and severe corrosion wastage from the vessels inboard side. The samples inboard side exhibited no evidence of a protective paint coating system and evidence suggested that a period of through hull seepage had preceded the terminal perforation by plastic instability and collapse.

Cracks apparent in the two port side hull samples, and the starboard side sample, were all located either adjacent to, or at the ends of fillet welds joining internal attachments to the hull plating. The cracks had consistently initiated in areas of prior pitting or grooving corrosion damage, and were of either fatigue or corrosion fatigue cracking types. Evidence of advanced pitting corrosion at the crack surfaces was judged to be largely consistent with the hull having experienced multiple through thickness perforations some time prior to the casualty, and for a considerable period of time in some cases.

Under the normal service conditions of pitching and rolling, the hull stresses would, in a vessel of Jann Denise II type, be reacted against internal stiffening members. Consequently, the points of stiffener connections to the hull represent locations likely, by design, to experience high cyclic stressing; a fact which in some designs necessitates the use of doubler plates to reduce stress levels at stiffener connections. In the case of Jann Denise II, the presence of severe wastage by corrosion pitting and/or grooving at the high stress stiffener connection sites would have both heightened the bulk dynamic stress magnitude, and also introduced sites of pronounced stress concentration from which the fatigue and corrosion fatigue cracks would preferentially initiate.

We conclude that both the local perforation and the cracking had resulted directly from a failure to manage inboard side hull plating corrosion. Our attendance of the vessel immediately after its salvage, and subsequent laboratory examination of sample material lead us to the opinion that the vessel had been inadequately maintained, and that the hulls leak tightness had been compromised in multiple areas prior to the casualty.

Report prepared and authorised by

D Ellin
Director and Head of Laboratory.

Figure 39: Port side hull and keel, showing largely consumed protective keel mounted anodes and widespread local breakdown of the paint system

Figure 40: Detail showing extent of port side vee shaped crack mouth gape.

Figure 41: General view of the aft port side crack site (cracks arrowed)

Figure 42: Detail showing perforation site and widespread local breakdown of the protective paint system.

Figure 43: Detail showing crack (arrowed) originating from the fillet weld end

Figure 44: Forward port side sample viewed from the outer sea side and showing the two crack sites arrowed.

Figure 45: Detail of figure 44 showing second longitudinal crack.

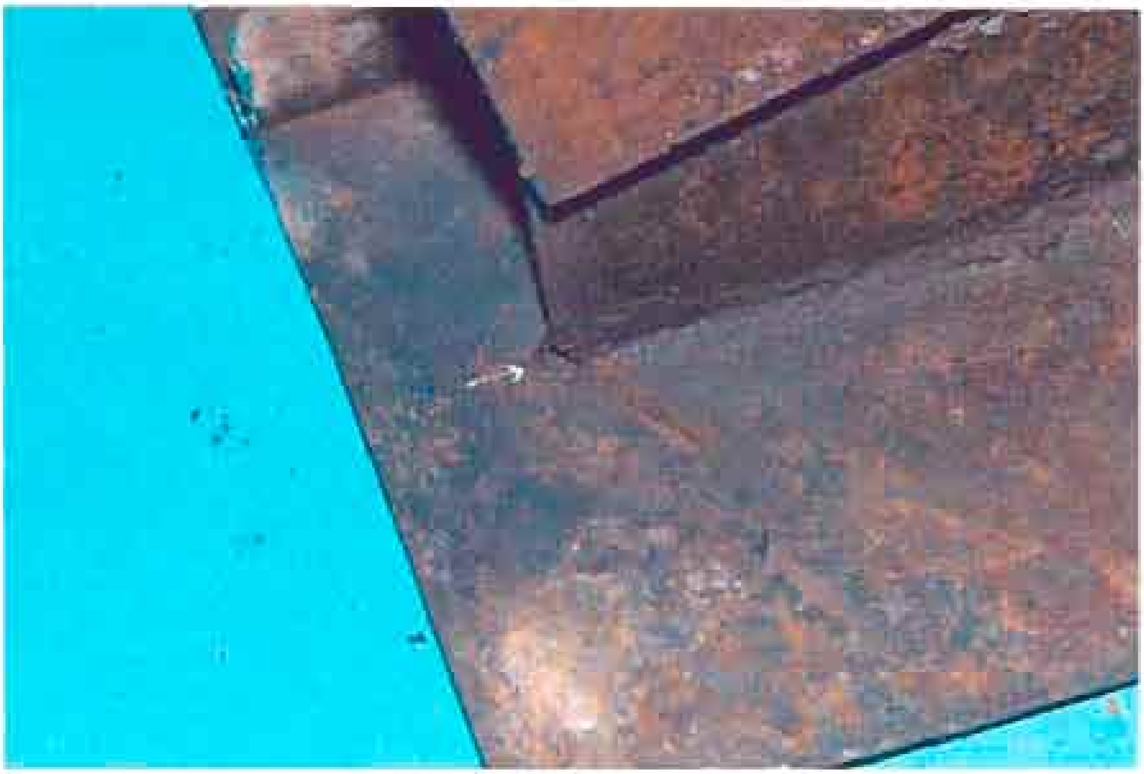


Figure 46: Vee shaped crack (arrowed), which was located at the end of a welded longitudinal attachment.

ANNEX 21

AWL Inspection and NDT Services Report on Hull Plate Thickness of *Jann Denise II*, dated 14 December 2004

ULTRASONIC EXAMINATION REPORT

AWL INSPECTION & NDT SERVICES
Unit 34, Royal Industrial Estate, Jarrow, Tyne & Wear NE32 3HR
Tel: (0191) 430 0837

Client: Tyne an Wear Marine			Report No:
			AWL No. 9974
Test Date: 14-12-04	Location: Tyne Dock.		Page 1 Of 2
			Project:
Drawing No:		Surface Condition: Ground to bare metal	

Acceptance Standard:	Material:	Plate/Pipe	HEAT TREATMENT			
Ansi B31.3	C/S	PLT.	PRE	n/a	POST	n/a

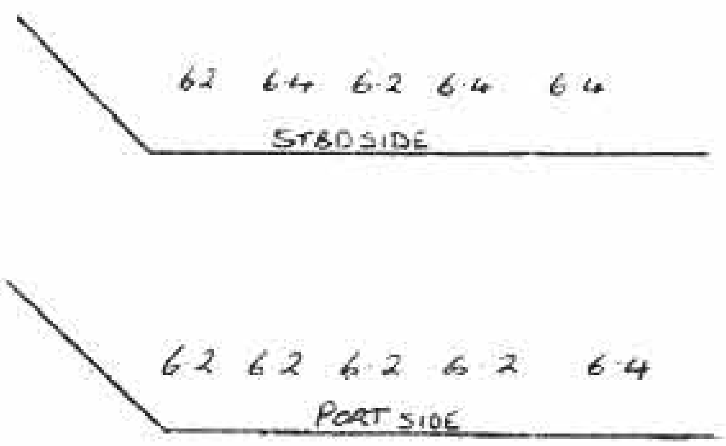
EQUIPMENT

UNIT TYPE:	PROBES	S	T	Angle	Size	Freq.	Ref. Sen.	Ser. Nos	Calibrated in Acc. with procedure: Yes / ~~No~~
Krautkramer USM-2			✓	0°	10mm	5mhz	2nd BWE	9790	Calibration Block V2/steel
SERIAL No:				45°					Signed: [signature]
U002				60°					
				70°					

PROCEDURE NO: AWL 200 **PLUS TRANS. CORR** ......+6...... **db**

ITEM / JOINT No.	THK.	DIA.	WELDER	PREP TYPE	AWL TECH NO.	ACC.	REJ.	DEFECT SKETCH Y/N (Page No.)	COMMENTS

0° THICKNESS SURVEY ON KEEL OF BOAT



Certified that the above results are a true record of the examinations carried out in accordance with the above procedures.

For AWL. S. Nixon	**Client.**	**Certifying Authority**
Signed: [signature]		
Name/Symbol PCN 113973		
Date: 14-12-04	**Date:**	**Date:**

ULTRASONIC EXAMINATION REPORT

AWL INSPECTION & NDT SERVICES Unit 34, Royal Industrial Estate, Jarrow, Tyne & Wear NE32 3HR Tel: (0191) 430 0837	Client: TYNE AND WEAR MARINE		Report No: AWL No: 9974
	Test Date: 14-12-04	Location TYNE DOCK	Page 2 Of 2 Project:

Drawing No:	Surface Condition: GROUND TO BARE METAL

Acceptance Standard:	Material:	Plate/Pipe	HEAT TREATMENT			
			PRE		POST	
ANSI B31.3	C/S	PLT		N/A		N/A

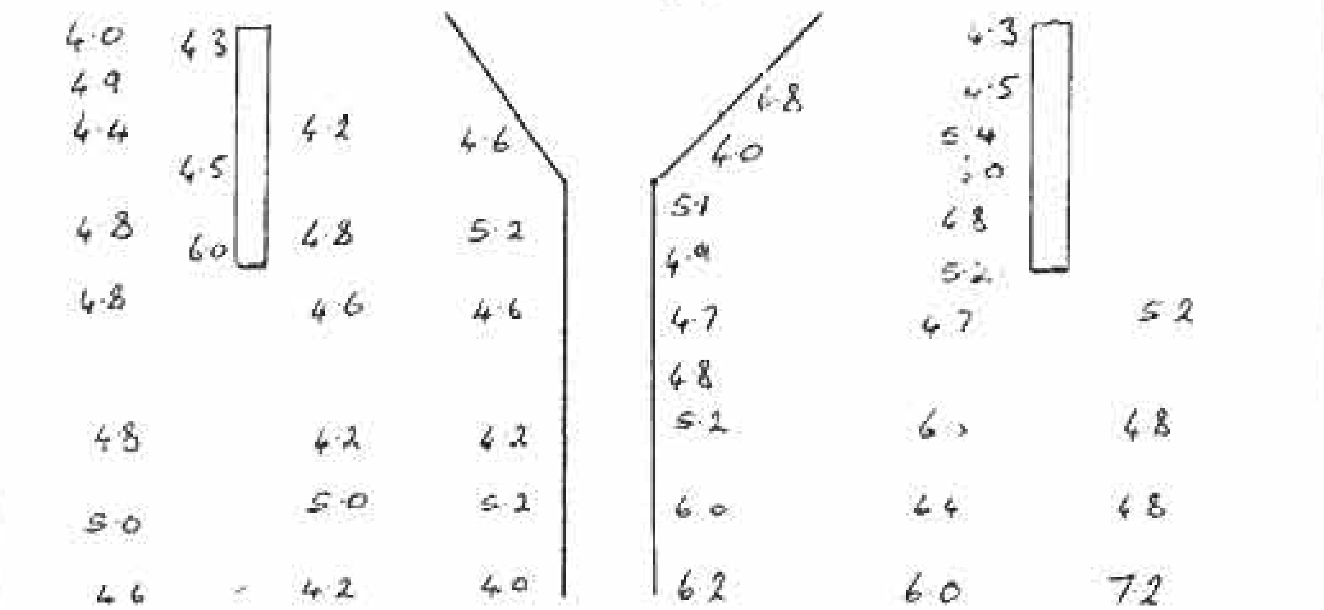
EQUIPMENT

UNIT TYPE:	PROBES	S	T	Angle	Size	Freq.	Ref. Sen	Ser. No.s	Calibrated in Acc. with procedure:
[illegible] 2			✓	0°	10mm	5mhz	2nd BWE	9790	Vos /[illegible]
SERIAL No:				45°					Calibration Block V2[illegible]
V007				60°					Signed:
				70°					

PROCEDURE NO: AWL 200 **PLUS TRANS. CORR** ....4.... **db**

ITEM / JOINT No.	THK.	DIA.	WELDER	PREP TYPE	AWL TECH NO.	ACC.	REJ.	DEFECT SKETCH Y/N (Page No.)	COMMENTS

0° THICKNESS SURVEY ON KEEL OF BOAT. ALL DIMENSIONS IN MM. VIEWED FROM ABOVE.



Certified that the above results are a true record of the examinations carried out in accordance with the above procedures.

For AWL. D LYONS Signed: Name/Symbol ASNT 1/3973 Date: 16-12-04	Client. Date:	Certifying Authority Date:

ANNEX 22

Extract of Marine Data International, Naval Architects and Marine Consultants Stability Report *Jann Denise II*, dated on 7 February 2005

Report on Stability Investigation - FV 'Jann Denise II'

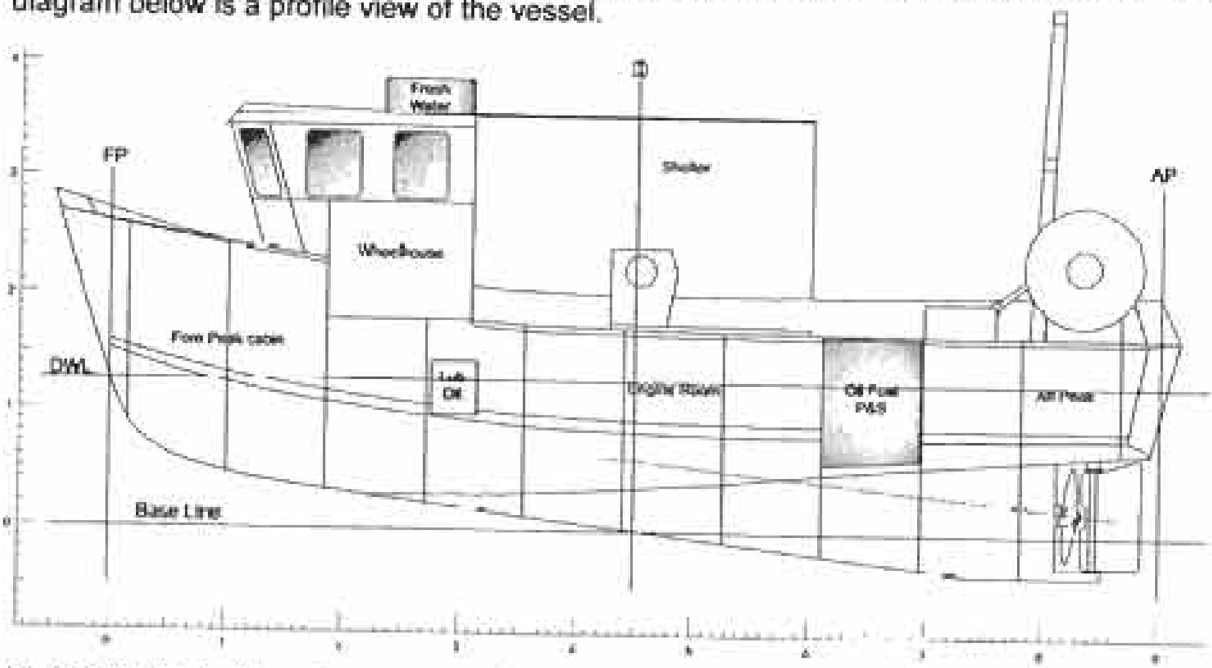
1. Introduction

The objective of this report is to assess the stability of the fishing vessel 'Jann Denise II' in the accident condition (with and without the net drum and the deck shelter) and in the set of conditions which would have been required for the compilation of a stability booklet if the vessel had a registered length greater than 12 metres.

Section 2 of the report describes the measurement of the boat's hull form and its internal compartments and the generation of the computer model from the dimensions obtained. Section 3 describes the manner in which this information and the results of the inclining trial are drawn together to compute the vessel's lightship displacement and the location of the centre of gravity in this condition. Sections 4 and 5 specify, respectively, the vessel's principal dimensions and the background data required for the stability analysis. Section 6 details the stability and freeboard requirements included in the 1975 Fishing Vessel (Safety Provisions) Rules; all fishing vessels over 12 metres in registered length must comply with these regulations. Section 7 describes the seven loading conditions which would have been included in a stability booklet had the vessel been over 12 metres length and summarises the data computed for these conditions. Section 8 describes the accident loading condition given the available information and assesses the resultant trim, stability and freeboard information in light of the additional factors which may have contributed to the loss of the vessel. Section 9 comprises the report's conclusions. The appendices at the end of the report consist of the data forming the basis for the analysis.

2. Hull and compartment definition

A Trimble TS315 infra-red distance and angle measuring theodolite was used to measure the vessel's hull on the Tyne Dock quayside. Half breadth and height dimensions for ten transverse sections were taken by this means and entered into the computer to create a coordinate model of the hull shape. An additional 27 sections were interpolated automatically from the input sections to improve the definition of the computer hull model. Appendix 4 is comprised of section, plan, profile and isometric views of this model. The diagram below is a profile view of the vessel.



All longitudinal dimensions were taken about a Forward Perpendicular (FP) at the intersection of the datum waterline (DWL) with the stem. The Aft Perpendicular (AP) was taken to be 9 metres aft of the FP. Vertical dimensions were taken about a Base Line parallel to the datum waterline and passing through the the lowest point of the keel at the mid-point of the length between perpendiculars, i.e. 4.5 metres aft of the FP.

Dimensions of the boat's internal compartments are listed below:

a. Accommodation ....: 3.13 metres in overall length
b. Wheelhouse ....: 2.10 metres in overall length
c. Engine space..................: 3.97 metres in overall length
d. Aft Peak ....: 2.50 metres overall length
e. Fuel oil tanks (P&S) ....: 0.80m length x 1.26m max. breadth x 1.17m max. depth
f. Hydraulic oil tank ....: 0.40m length x 0.51m breadth x 0.49m depth
g. Fresh water tank............: 0.77m length x 0.63m breadth x 0.31m depth

The geometry of the first five of these compartments was derived by the computer system from the hull model. The hydraulic oil and fresh water tanks were defined from measurements taken directly off the tanks. The geometry of all the compartments were entered into the computer system to complete the vessel model.

3. *Inclining trial*

The vessel was lifted back into the Tyne Dock to conduct the inclining trial. Appendix 1 is comprised of a report of this trial. Displacement, KMt, VCB and LCB values were computed for the hull at the trim and flotation waterline recorded at the trial. These values were used in conjunction with the pendulum offsets to establish the dimension between the vessel's centre of gravity and its transverse metacentre (GM transverse), and from this the height of the centre of gravity in the inclining trial condition was derived. The range of GMt values computed from the twelve pendulum offsets was from 0.417 metres to 0.480 metres, and the mean of these was 0.455 metres.

Tables of items to come off and to go on to obtain the lightship condition are also included in the appendix along with a light ship summary.

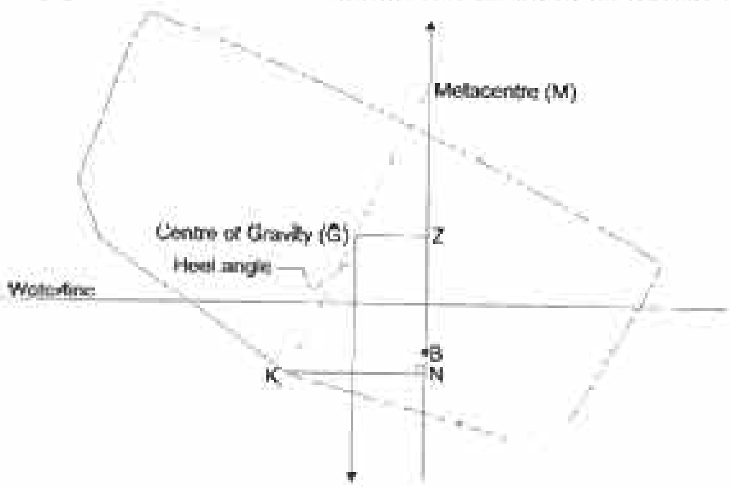
4. *Principal dimensions*

The vessel's principal dimensions are as follows:

Length Overall (LOA) ....:	9.61 metres
Length Between Perpendiculars (LBP) ....:	9.00 metres
Maximum moulded beam (at deck level) ....:	3.42 metres
Depth (base line to deck edge at midships) .....:	1.68 metres
Lightship displacement..:	13.477 tonnes
Draft midships at lightship displacement ....:	1.198 metres about Base Line
Keel rake ....:	1.10 metres in LBP

5. *Hydrostatic, KN and tank data*

Appendices 5 and 6 are comprised of hydrostatic and free-trim KN data computed from the hull model. The diagram below illustrates the relationship between KN values and righting levers (GZ):



It should be noted that the KN data used for the calculation of the stability data in section 7 of this report includes the volume of the hull below the fore deck and the main deck but excludes the volume of the wheelhouse. This is normal practice in compiling a stability booklet for submission to the MCA as the wheelhouse can not be considered as watertight. The data is presented for five trims in tabulated and plotted form.

However, it should also be noted that the KN data for the accident conditions in Appendix 3 does include the wheelhouse volume. Inevitably, the wheelhouse flooded as the accident developed, but nonetheless, it was intact and the windows were closed when the vessel was recovered. It would, therefore, have made a contribution to the stability before the accident moved into a critical phase.

Appendix 7 is comprised of tables of the calibration, centres of gravity and free surface effects data for the vessel's fuel oil, hydraulic oil and fresh water tanks.

6. *Criteria used for assessment of stability and freeboards*

The Fishing Vessel (Safety Provisions) Rules 1975 require that any fishing vessel of 12 metres in length or greater must comply with the following stability requirements:

I) The area under the righting lever curve (GZ curve) shall not be less than:

   (a) 0.055 metre.radians up to an angle of 30 degrees;
   (b) 0.09 metre.radians up to an angle of 40 degrees or such lesser angle of heel at which the lower edges of any opening in the hull, superstructure, deckhouses, or companionways being openings which cannot be closed weather-tight are immersed;
   (c) 0.030 metre.radians between the angles of heel of 30 degrees and 40 degrees or such lesser angle as defined in (b) above;

II) The righting lever (GZ) shall be at least 0.20 metres at an angle of heel equal to or greater than 30 degrees;

III) The maximum righting lever (GZ) shall occur at an angle of heel not less than 25 degrees;

IV) In the upright position the transverse metacentric height (GM) shall not be less than 350 millimetres;

The 'Jann Denise II' has a registered length of less than 12 metres and thus did not have to comply with these requirements. Nonetheless, it is instructive to compare the vessel's stability in the required conditions with the provisions of these rules.

The rules also specify that all fishing vessels of over 12 metres registered length shall be designed and operated so as to maintain adequate freeboards in all foreseeable loading conditions. Merchant Shipping Notice No. M975 expands on the definition of adequate freeboard and provides tabulated values and formulae for the calculation of minimum freeboards. With a registered length of less than 12 metres, the 'Jann Denise II' did not have to comply but again, it is instructive to compare the vessel's freeboards in the required conditions with the provisions of these rules.

Extrapolating the rule values downwards to a vessel of the length of 'Jann Denise II' yields the following minimum freeboard values:

Forward freeboard ($H_{Bulwark}$)	$= 1 + L/16$	= 1.550 metres
Forward freeboard (H_{Deck})	$= 0.8 + 7L/240$	= 1.057 metres
Aft freeboard ($H_{DeckAft}$)	$= 0.3 + L/30$	= 0.593 metres

Where L = 96% of overall length on a waterline at 85% of least depth = 8.803 metres

Note that where a watertight forecastle extends more than 0.07 x L aft of the FP, as in this instance, both forward freeboards may be taken about the top of the foredeck at the side. The greater of the two values is then used for the analysis.

7. Assessment of loading conditions for stability booklet

A fishing vessel is judged to comply with the requirements if it exceeds the stability and freeboard criteria stated in Paragraph 6 in 'all foreseeable operating conditions'. It is usual practice, therefore, for any stability submission to the MCA relating to a fishing vessel to include an assessment of the stability and freeboard in a set of loading conditions representative of a voyage profile.

The following conditions form such a voyage profile for the 'Jann Denise II', These were created on the computer for the purposes of this report:

1. Lightship
2. Depart Port - 100% Consumables
3. Arrival Fishing Grounds
4. Depart Fishing Grounds – Maximum Catch (1.25t) on deck
5. Arrive Port - 10% Consumables, Max catch (1.25t) on deck
6. Depart Grounds, 20% Max. Catch (0.25t) on deck
7. Arrive Port, 10% Consumables, 20% Max Catch (0.25t) on deck

The trim and stability data computed for these loading conditions is to be found in Appendix 2. As noted in section 5, the KN data used for these loading conditions does not include the volume of the wheelhouse. Transverse centres of gravity have not been included in the deadweight tables for these conditions as it would be normal practice not to include these in a stability booklet for submission to the MCA. Note also that maximum values have been used for the tank content's VCG and free surface moment data regardless of the fluid level. Again, this is normal practice in a stability booklet as it simplifies manual calculation and produces results which will err on the safe side.

Table 1 below summarises the results of this analysis and compares them with the requirements detailed in Section 6 above.

Table 1 – Stability and freeboard requirements and computed values

		Condition No.						
Requirement	***Min.***	***1***	***2***	***3***	***4***	***5***	***6***	***7***
Area to 30° heel (m.r.)	**0.055**	0.067	<u>0.053</u>	<u>0.053</u>	<u>0.034</u>	<u>0.047</u>	<u>0.050</u>	<u>0.056</u>
Area to 40° heel (m.r.)	**0.090**	0.091	<u>0.054</u>	<u>0.054</u>	<u>0.034</u>	<u>0.048</u>	<u>0.050</u>	<u>0.067</u>
Area 30°-40° heel (m.r.)	**0.030**	<u>0.024</u>	<u>0.000</u>	<u>0.000</u>	<u>0.000</u>	<u>0.000</u>	<u>0.000</u>	<u>0.010</u>
Max. GZ 30°-90° heel (m.)	**0.200**	<u>0.174</u>	<u>0.125</u>	<u>0.125</u>	<u>0.000</u>	<u>0.103</u>	<u>0.000</u>	<u>0.137</u>
Angle of GZ max. (degrees)	**25**	<u>23.58</u>	<u>21.57</u>	<u>21.58</u>	<u>19.42</u>	<u>20.83</u>	<u>21.27</u>	<u>21.88</u>
Min. GM fluid (m.)	**0.350**	0.574	0.464	0.465	0.402	0.425	0.452	0.486
Freeboard forward (m.)	**1.550**	<u>1.331</u>	<u>1.313</u>	<u>1.313</u>	<u>1.345</u>	<u>1.352</u>	<u>1.320</u>	<u>1.327</u>
Freeboard aft (m.)	**0.593**	<u>0.543</u>	<u>0.392</u>	<u>0.393</u>	<u>0.283</u>	<u>0.379</u>	<u>0.374</u>	<u>0.470</u>

<u>Red underlined values fail the requirements</u>

The data in the table above indicates that, with the exception of the GM values in all conditions and the areas under the righting lever curve up to 30 and 40 degrees of heel in the lightship condition, the vessel fails to comply with the stability or freeboard requirements and has a low residual stability in any condition.

The stability of a vessel will be dramatically reduced when it heels to the point where significant quantities of seawater can flood through apertures such as open hatches into the spaces that are assumed to be initially watertight. If a vessel is held over at such an angle or a greater angle for a period of time, there is the risk that such flooding will reduce the vessel's buoyancy and/or stability to the point where it will sink with or without capsizing first. Reflecting this, the regulations require that the righting lever, and thus the stability, is assumed to reduce to zero at the heel angle when the first flooding point is immersed.

Table 2 below lists the angles at which apertures in the vessel's watertight structure would become immersed in the loading conditions listed above. The angle at which the deck edge coincident with the net drum centreline would immerse is also noted.

Table 2 – Heel angles of flooding point and deck edge immersion

	Condition Nos.						
	1	2	3	4	5	6	7
Flooding points	Heel angles at immersion						
Access hatch to engine space	42.0	37.6	37.7	35.7	38.3	37.3	40.0
Access hatch to aft peak	39.2	30.3	30.4	25.9	30.2	29.6	34.7
Wheelhouse door	83.7	72.6	72.8	67.9	75.2	72.0	79.2
Deck edge in line with net drum centreline	*20.6*	*14.6*	*14.7*	*10.9*	*14.3*	*14.0*	*17.5*

8. The accident condition

The vessel's loading condition immediately prior to the accident was established as far as possible from the refloated vessel and from information provided by suppliers such as the fuel company. The detailed deadweight makeup and the resultant trim and stability data for the vessel prior to the accident form the first condition in Appendix 3. Transverse centres of gravity have been included in the deadweight tables for all accident conditions so as to model more accurately the possible causes of the loss. Actual vertical centres of gravity and free surface moments have been computed for the tank contents (as opposed to maximum values used for the conditions noted in section 7), again, so as to model the possible causes more accurately. Note also that the wheelhouse has been included in the KN data for the accident conditions – see section 5.

There is no doubt that sea water had been gaining access to the aft peak, probably for much of the voyage before the accident occurred. The access hatch, which was not fitted with a lock, may or may not have been closed, but the rudder stock was a very loose fit in the stock tube with approximately 6mm of movement at its attachment to the rudder and there was no effective sealing arrangement at the top of the tube within the aft peak. The data indicates that in calm water in the accident condition, the top of the tube would be below the water level at less than 1 degree of heel. In the rough conditions prevailing at the time, and particularly if the vessel was pitching heavily into heavy head seas, the top of the tube would have been immersed and therefore leaking significant quantities of water for most of the time. This water would have accumulated in the aft peak as it is understood the bilge pump was not functioning correctly, and would then have spilled through into the engine room, albeit in small quantities, through the several small holes at the base of the aft peak bulkhead. As seawater collected in the aft peak, its weight would depress the boat's stern, thereby increasing the rate of ingress of water through the rudder tube and increasing the amounts of water taken aboard over the bulwarks and through the freeing ports.

Whilst the calculations show clearly that water was leaking into the vessel through the stock tube there is, of course, no way of knowing how much water had collected in the aft peak before the accident occurred.

Appendix 3 includes stability data for 1.5 and 3.0 tonnes of seawater in the aft peak superimposed on the projected accident condition. It will be seen from this data that the increasing weight and free surface effect of the water, free to move throughout the length and width of the compartment, progressively reduced both the stability of the vessel and its freeboard, aft in particular.

It is known that the vessel was returning to port against waves built up by a North-Westerly wind which was increasing in strength. Had the waves been coming from astern rather than ahead, it is possible that a crew so thoroughly familiar with the movement of their vessel would have sensed, even in heavy weather, that something was wrong. In such circumstances, the unusual movement of the boat might have been investigated before the situation became critical, and a radio report issued accordingly.

It is evident that the vessel's reducing stability and freeboads would have rendered it increasingly vulnerable to water being taken aboard through the freeing ports and over the bulwarks. A strong case can be made, therefore, that the vessel was probably swamped by a combination of sea water already present in significant quantities in the aft peak and taken aboard through and over the bulwarks. However, this conclusion is anomalous in that the stability of the vessel was so low that capsize would apparently have occurred before it had taken on sufficient water to sink.

There is usually evidence to be found aboard a vessel raised after an accident which will indicate if it has sunk in a more or less upright attitude or if it has capsized, i.e. turned at least partially upside down, as a prelude to sinking. For example, a capsize will tend to encourage loose objects and objects that may come free when inverted to collect on one side of a compartment, and this will be the same side throughout the vessel. In investigating the cause of a vessel loss, there is a significant difference between a vessel that has sunk without capsizing and a vessel that has capsized before sinking.

By definition, low levels of inherent stability relative to the provisions of the Safety Provisions rules make a vessel particularly vulnerable to capsize. Section 7 of this report indicates that the inherent stability of the 'Jann Denise II' was very low and well below the rule provisions, regardless of the loading condition the boat was in. The risk of capsize was therefore high.

However, no evidence of capsize was found aboard the 'Jann Denise II'. The random disposition of loose items around the vessel suggested that it had not capsized, or rather perhaps, that it had sunk before reaching a large angle of heel.

The first paragraph in this section of the report discusses the inclusion of the wheelhouse in the KN data for the boat, despite the fact that it is non-watertight. Other structures, such as a deck shelter and bulwarks can also contribute to a significant but temporary increase in righting moments which disappears once the water has found its equilibrium on both sides of the structure. It is considered that immediately prior to the accident a quantity of seawater came aboard the vessel over the bulwarks and/or through the freeing ports but that she did not capsize because of this temporary contribution which the deck shelter and bulwarks made to the stability. As it came aboard, a sufficient quantity of this water then found its way below into the engine space and/or the aft peak to take the vessel from a state where it was just afloat to a state where sinking was inevitable.

Sufficient water to sink the vessel in this state could only have found its way below decks through a large aperture such as an open hatch. The hatch to the aft peak has low coamings 0.285m high and was found to be open when the 'Jann Denise II' was inspected by the divers. Given that the vessel appears not to have capsized before sinking and that it was found upright on the bottom, it is likely that this hatch was open before the vessel sank.

The access hatch to the engine space was found to be closed by the divers. This hatch had coamings 0.55 metres high, almost double the height of those under the aft peak access hatch. Whether it was closed or open when the accident occurred, it was much better protected from 'green' water by the aft wheelhouse bulkhead 0.4 metres ahead of it and by the deck shelter on both sides.

It would therefore appear that sea water had been gaining access to the hull for some time before the accident occurred through the rudder stock tube and at the time of the accident through the access hatch to the aft peak. The combination of the two was sufficient to swamp the vessel, leading to its sinking.

The net drum and the shelter were fitted to the vessel some time before the accident occurred. These items weigh approximately 0.8 tonnes and 0.29 tonnes respectively, and their installation added to the vessel's weight and increased the height of its centre of gravity thereby reducing its stability. A condition for the vessel with these items removed has been included in Appendix 3. The data for this condition indicates a considerably improved level of stability, though still not complying with the provisions of the 1975 rules, and an increase in the vessel's aft freeboard of about 120mm. It must remain a matter of conjecture as to whether this would have been sufficient to prevent the accident from occurring.

9. *Conclusion*

All the conditions processed for this report indicate that the 'Jann Denise II' has a very low level of inherent stability and insufficient freeboard relative to the provisions of the 1975 Fishing Vessel (Safety Provisions) Rules.

This lack of adequate stability and freeboard probably contributed to the accident, but only insofar as the vessel would tend to roll to greater heel angles and take more sea water aboard than a more stable vessel with greater freeboard.

It is considered that the principal cause of the accident was probably the water leaking into the fishing vessel's aft peak through the rudder stock tube. This would have accumulated at an increasing rate and could not be cleared because the bilge pump was defective. It is likely that the accident became inevitable when further quantities of sea water found their way below, probably through the open aft peak access hatch.

Inclining Trial Report

Vessel name/number ....: MFV 'Jann Denise II'
Trial location ....: Tyne Dock, Jarrow, Durham
Trial time and date ....: 13:30hrs. Thursday 6th January 2005
Weather conditions ....: Strong (5-6) West-North-Westerly wind
Water conditions ....: 3-4cm wavelets – vessel sheltered from weather
Mooring ....: Slack bow line to barge, vessel away from quay
Specific gravity of water ....: 1.0155
Vessel condition ....: See table of items to come off
Freeboard at Forward Perpendicular ....: 0.280 metres about upper chine
Draught at Forward Perpendicular ....: 1.320 metres about Base Line
Draught at Aft Perpendicular ....: 0.485 metres about transom base on centreline, 1.195 metres about Base Line
Mean draught at midships LBP ....: 1.258 metres about Base Line
Trim on LBP ....: 0.125 metres by bow
Pendulum ....: 2.418 metres in length, at forward E/R access hatch
Inclining weights ....: 0.450 tonnes total, transverse centres 2.720m apart
Personnel ....: Mr. N. MacWhirter - Surveyor for MAIB
Assistant - Tyne and Wear Marine Ltd.

Pendulum deflection table

No.	*Shifts Direction*	*Weight tonnes*	*Distance Metres*	*Pendulum deflections - mm*	*GM metres*
1	Port>Stbd	0.075	2.720	72.5	0.457
2	Port>Stbd	0.075	2.720	71.0	0.467
3	Port>Stbd	0.075	2.720	73.0	0.454
4	Stbd>Port	0.075	2.720	73.0	0.454
5	Stbd>Port	0.075	2.720	69.0	0.480
6	Stbd>Port	0.075	2.720	73.5	0.451
7	Stbd>Port	0.075	2.720	72.0	0.460
8	Stbd>Port	0.075	2.720	79.5	0.417
9	Stbd>Port	0.075	2.720	73.0	0.454
10	Port>Stbd	0.075	2.720	78.5	0.422
11	Port>Stbd	0.075	2.720	70.5	0.470
12	Port>Stbd	0 075	2.720	70.5	0.470
				Mean GM:	*0.455*

Inclined condition

Displacement ....: 14.886 tonnes
KMt ....: 2.147 metres
GMt mean ....: 0.455 metres
KG fluid ....: 1.692 metres above Base Line
LCG (corrected for trim) .....: 4.845 metres aft of FP

Items to come off for lightship condition

Item	*Weight Tonnes*	*LCG - m about FP*	*Long'l moment t.m*	*KG - m about Base Line*	*Vertical moment t.m*	*FSM t.m*
Person at inclining pendulum	0.088	3.750	0.330	1.050	0.092	-
Person on deck	0.085	6.400	0.544	2.750	0.234	-
Inclining test weights	0.450	5.560	2.502	1.770	0.797	-
Heel counterbalance weights	0.100	4.850	0.485	1.770	0.177	-
Fresh water in tank	0.148	2.709	0.401	3.733	0.552	0.000
Hydraulic oil in tank	0.076	2.918	0.222	1.208	0.092	0.004
Bilge water in engine room	0.042	5.450	0.229	0.475	0.020	0.017
Net on net drum	0.120	8.350	1.002	2.300	0.276	-
Trawl doors - Port and Stbd	0.140	8.200	1.148	2.200	0.308	-
Trawl wires - Port and Stbd	0.045	6.100	0.275	2.200	0.099	-
Misc. fishing gear under shelter	0.060	3.900	0.234	2.050	0.123	-
Misc. fishing gear on aft deck	0.055	8.400	0.462	1.900	0.105	-
Total items to come off	*1.409*	*5.559*	*7.833*	*2.040*	*2.874*	*0.021*

Lightship summary

Item	*Weight tonnes*	*LCG - m about FP*	*Long'l moment t.m*	*KG - m about Base Line*	*Vertical moment t.m*	*FSM t.m*
Vessel as inclined	14.886	4.845	72.123	1.692	25.187	0.021
Total items to come off	-1.409	5.559	-7.833	2.040	-2.874	-0.021
Lightship	*13.477*	*4.770*	*64.290*	*1.656*	*22.313*	*0.000*
			FSM correction	*0.001*		
			KG corrected	*1.654*		

ANNEX 23

Cosalt Ltd (Southampton) Report on Liferaft – Serial Number 40346 from *Jann Denise II*, dated 10 January 2005

To: MIB
Cc: LW
Subject: Lifeguard s/n 40346 Liferaft Investigation

Attn: MIB

07/01/05 Venue Cosalt Southampton
Attendees MIB
MIB
Premium
Premium
Cosalt Service Dept
Cosalt Chief Service Inspector

Please find our investigation report as follows.

Lifeguard 4 person Liferaft Serial number 40346 in container next service due date 06/05 c/w Hydrostatic release HAMMER H20.

Hydrostatic release unit expiry dated May 2002 and although out of date the unit had worked and cut the Hydro cord to release the liferaft, we cannot be sure this item operated as expected.

The liferaft was wet when opened due to the length of time the raft was under water.

The liferaft painter line had been pulled to extend 4 mtrs with approx 6 inches left inside the container to be pulled in order for the raft to inflate, there was no evidence of the liferaft or the painter being packed incorrectly or the painter caught or jammed inside the container.

General condition of the raft good and the operating head of the cylinder checked and found to be operational when fired, the liferaft fully inflated.

We are unable to confirm the reason as to why the liferaft painter did not fully extend to fire or inflate the liferaft but the liferaft cradle stowage pictures may suggest the liferaft could have been held in place by the cradle and this may have caused the painter to be pulled by the Hammer Release unit but prevent it from pulling out the full length as the liferaft is held underwater long enough to fill with water.

Premium representatives have removed the liferaft from our premises.

Kind Regards

C M Hammer AB (Sweden) Technical Report on Hydrostatic release
Unit – Hammer H20 No G54822 from *Jann Denise II*, dated 17 December 2004

Technical Examination

Date

2004-12-17

Examination performed by

Magnus Glans, Quality Manager

References to other documents

MAIB letter dated 17th January 2005

Equipment under test

Hammar H20 no G54822, manufactured in Mars 2000. The HRU was shipped to Avmar Ltd the 11th of April 2000.

Summary of technical examination

Nothing indicates that the HRU did not operate correctly. The white rope was cut and the HRU as well as its ingoing components where all in good condition.

As regards the release depth it is impossible to tell exactly at what depth this particular HRU did activate. However our experience from in-house testing of expired HRUs, i.e. older than 2 years (returned by the local service station), shows that the average release depth for units between 44 and 54 months old is 4,01 m.

Technical Examination

A visual inspection was performed; the absence of the white rope shows that the HRU has activated. Apart from the missing white rope no other remarks where observed.

The HRU was x-rayed in order to establish the positions of the knife spring, membrane spring, knife and stud. No remarks.

The HRU was disassembled. The below remarks where observed.

1. The pressure chamber was filled with water, high water pressure under long time has pressed water in through the ceramic valve.

2. A small amount of surface rust on the knife blade, yet the knife is considered to be in a very god condition. When the rope is cut the rust protective layer is destroyed, i.e. the stainless steel will be exposed to the surrounding environment, seawater in this case.

3. Sand around the knife, knife spring and the outer side of the water sensitive membrane. There was however no sand inside the pressure chamber.

Note. Remarks 1 to 3 are a result due to the fact that the HRU has been activated and that it has been under water for some time.

Pictures

Picture 1: X-ray of HRU no G54822

Picture 2

Picture 3

Picture 4

Picture 5:

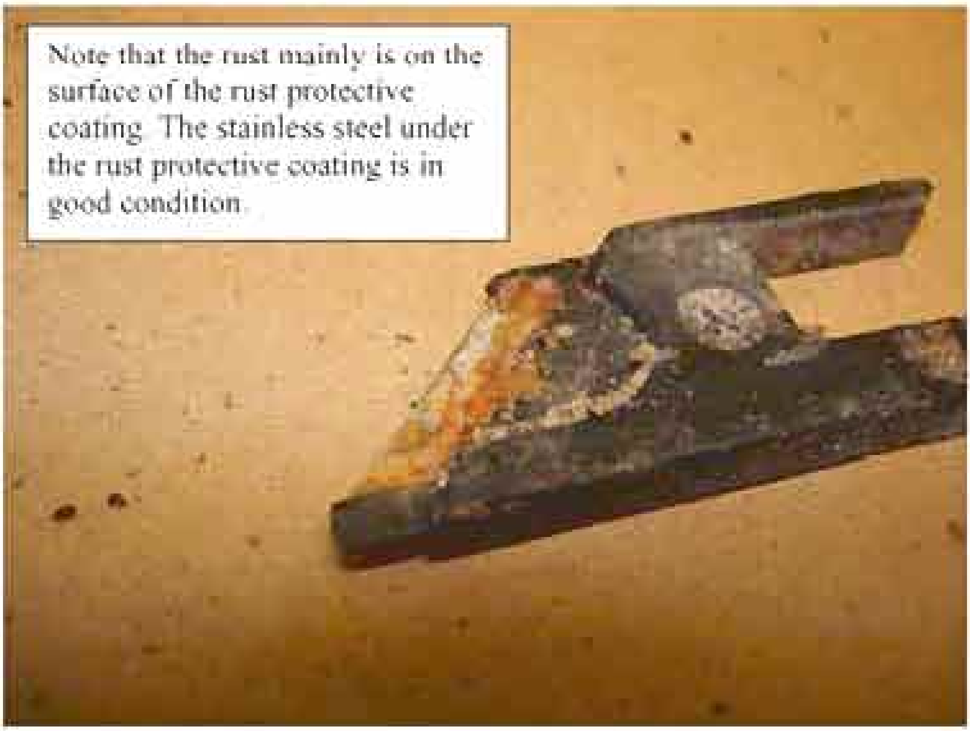
Picture 6:

Picture 7.

Picture 8:

Picture 9:

Picture 10:



MGN 20 (M+F) – The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997

MARINE SAFETY AGENCY

MARINE GUIDANCE NOTE

MGN 20 (M+F)

Implementation of EC Directive 89/391

MERCHANT SHIPPING AND FISHING VESSELS (HEALTH AND SAFETY AT WORK) REGULATIONS 1997

Notice to Shipowners, Ship Operators and Managers, Masters, Officers and Ratings of Merchant Vessels, and Skippers and Crew on Fishing Vessels.

This Notice supersedes Notice 1398

Summary

This Marine Guidance Note announces new regulations governing occupational health and safety on board merchant and fishing vessels, and gives guidance on the application of the Regulations

Key points:

The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations come into force on 31 March 1998.

They supersede the Merchant Shipping (Health and Safety: General Duties) Regulations 1984 and the Merchant Shipping (Safety Officials and Reporting of Accidents and Dangerous Occurrences) Regulations 1982.

The main new requirements for employers under the regulations are risk assessment and health surveillance - the annexes to this Marine Guidance Note contain advice on those two duties.

1. The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997 (S.I. 1997/2962) will come into force on 31 March 1998. They implement Council Directive 89/391/EC on the introduction of measures to encourage improvements in safety and health of workers at work (the "Framework Directive"). The Regulations apply to United Kingdom ships and to other ships when they are in United Kingdom waters, except where the Management of Health and Safety at Work Regulations 1992 apply. The Code of Safe Working Practices for Merchant Seamen is currently being revised to reflect the new regulations and the new edition will be published by the Stationery Office later this year.

2. Copies of the Regulations are available from The Stationery Office Publications Centre, PO Box 276, London, SW8 5DT. Tel (orders) 0171 873 9090; (enquiries) 0171 873 0011. Fax (orders) 0171 873 8200. Copies may also be ordered through the Stationery Office's bookshops, its accredited agents (see Yellow Pages) or from any good bookseller

MSOS(A)
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Spring Place, 105 Commercial Road
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MS 122/6/54

DETR
Environment
Transport
Regions

An executive agency of the Department of the Environment, Transport and the Regions

Introduction

1. The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997 replace the Merchant Shipping (Health and Safety: General Duties) Regulations. They have a wider scope than the regulations that they replace, in that they place duties on all "employers" and "workers" on board ships, and there are no exemptions for types of ship. "Employers" and "workers" are defined as follows:

   "employer" means a person by whom a worker is employed under a contract of employment;

   "worker" means any person employed by an employer under a contract of employment, including trainees or apprentices;

   "contract of employment" means a contract of employment, whether express or implied, and if express, whether oral or in writing.

   Those attending training courses on sail training vessels are excluded from the scope of the Regulations.

2. Under the Regulations, it is the duty of employers to protect the health and safety of workers and others affected by their activities so far as is reasonably practicable. The principles for ensuring health and safety are:

   (a) *the avoidance of risks, which among other things includes the combating of risks at source and the replacement of dangerous practices, substances or equipment by non-dangerous or less dangerous practices, substances or equipment;*

   (b) *the evaluation of unavoidable risks and the taking of action to reduce them;*

   (c) *adoption of work patterns and procedures which take account of the capacity of the individual, especially in respect of the design of the workplace and the choice of work equipment, with a view in particular to alleviating monotonous work and to reducing any consequent adverse effect on workers' health and safety;*

   (d) *adaptation of procedures to take account of new technology and other changes in working practices, equipment, the working environment and any other factors which may affect health and safety;*

   (e) *adoption of a coherent approach to management of the vessel or undertaking, taking account of health and safety at every level of the organisation;*

   (f) *giving collective protective measures priority over individual protective measures; and*

   (g) *the provision of appropriate and relevant information and instruction for workers.*

Duty holders under the Health and Safety at Work Regulations

3. It is important that those on whom duties are placed are in a position to carry them out. Employment relationships on board ship can be complex - for example the master may not be employed by the owner or operator of the ship, or by the same employer as the crew. There may also be people working on board such as contractors and sub-contractors, stevedoring companies and those under franchising arrangements (eg in retail or service outlets) whose employer has no direct responsibility for the safety of the ship. There is therefore no single "person" on whom it is appropriate to place the entire "employment" responsibility for health and safety on board.

4. The regulations therefore recognise two levels of "employment" responsibility. The regulations use the terms "Company" and "employer". The "Company" may have duties as an "employer".

   "Company" means the owner of a ship or any other organisation or person such as the manager, or bareboat charterer, who has assumed the responsibility for operation of the ship from the owner;

5. Many aspects of the safety of the ship as a workplace (eg the structural soundness of the vessel, the provision of adequate lighting and ventilation, provision of life-saving appliances, and fire-fighting equipment) are under the control of the Company, either directly, or through contractual arrangements with the owner.

6. Each employer, which may include franchise companies operating catering facilities or retail outlets, has control over the occupational health and safety training of the staff employed, and over everyday working practices.

7. The duties for each are explained below.

Duties of employers

8. All employers have a duty to ensure so far as is reasonably practicable the health and safety of workers and others affected by their activities in accordance with the principles set out in paragraph 2 above. The basis of all safety measures should be an assessment by the employer of any risks to workers' health and safety from their work activities.

9. The measures taken must not involve cost to workers and are required to include the provision of:

- safe working places and environment;
- safe plant, machinery and equipment;
- health and safety training, instruction, supervision and information;
- any necessary protective clothing and equipment where risks cannot be removed by other means;
- a health and safety policy;
- information for workers about the findings of their risk assessment;
- health surveillance of workers as appropriate;
- information on the special occupational qualifications required to any employment business supplying them with temporary workers;
- information about their activities and staff to the Company;
- consultation with their workers or elected representatives on health and safety matters.

Competent person; "protective and preventive services"

10. The employer must appoint a competent person to take responsibility for health and safety, who will advise the employer on compliance with the regulations. If there is no-one competent among existing workers, a competent person may be employed from outside the company, or the employer may "appoint" himself.

New and expectant mothers

11. A new duty introduced by these regulations is that of assessing whether their duties or hours of work could place in jeopardy the health of new or expectant mothers or that of their unborn child (or if they are breastfeeding, their baby) . If so, their hours or conditions of work should be changed or alternative work found, or, if that is not possible, they should be suspended, subject to their statutory rights.

Duties of the Company

12. In so far as the Company is an employer on board ship, it has a duty to assess the risks to workers and others affected by its activities. The Company's activity is the operation of the ship, and so it is responsible for co-ordinating the control measures identified in the risk assessments of all other relevant employers on board, as appropriate.

13. "The Company", in addition to its duties as an employer, is required to:

- consult other employers on board about the health and safety of workers;
- co-ordinate health and safety measures between all the employers on board;
- provide information to workers about the ship safety systems;
- appoint a safety officer (see paragraphs 14 and 15 below);
- organise the election of safety representatives and safety committee (see paragraphs 14 and 15 below).

Safety Officials/Consultation with workers:

14. These Regulations also supersede the Safety Officials and Reporting of Dangerous Occurrences Regulations 1982. Regulations 15 to 17 deal with the appointment of safety officers, the election of safety representatives and safety committees.

15. These regulations apply, as before, to merchant vessels on which more than 5 workers are employed. The regulations are supported by guidance in the Code of Safe Working Practices for Merchant Seamen.

16. In addition, there is provision for consultation with workers where the election of safety representatives does not apply (ie fishing vessels, and merchant vessels on which less than 5 workers are employed). No rules are laid down for consultation in these circumstances, as this will best be decided in the light of the operating patterns and crewing arrangements on the vessel. In many cases, informal discussion will be the most practicable solution.

Duties of Workers

17. **Workers** are required to:

- take reasonable care for their own health and safety and that of others on board who may be affected by their acts or omissions;
- co-operate with anyone else carrying out health and safety duties - including compliance with control measures identified during the employer's or Company's evaluation of risk;
- report any identified serious hazards or deficiencies immediately to the appropriate officer or other authorised person;
- make proper use of plant and machinery, and treat any hazard to health or safety (such as a dangerous substance) with due caution.

18. Under the Regulations, it is also an offence for any person intentionally or recklessly to interfere with or misuse any thing provided in the interests of health and safety.

RISK ASSESSMENT

1 Introduction

1.1 Under the Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997, employers are required to ensure the health and safety of workers and other persons so far as is reasonably practicable, by the application of certain principles. These principles include the avoidance of risks, and the evaluation of unavoidable risks and the taking of action to reduce them.

1.2 Specifically, employers are required to make a suitable and sufficient assessment of the risks to health and safety of workers arising in the normal course of their activities or duties, for the purpose of identifying:

(a) groups of workers at particular risk in the performance of their duties; and
(b) the measures to be taken to comply with the employer's duties under the Regulations;

The assessment should extend to others on board ship who may be affected by the acts or omissions of the employer.

1.3 Every employer and every self-employed person on board ship is required to inform the Company of any relevant risks to health and safety arising from the conduct of their business.

1.4 Employers must ensure that measures are taken to ensure an improvement in the safety and health of workers and other persons in respect of those risks identified by the assessment.

1.5 Employers must review the assessment when there is reason to believe that it is no longer valid, and make any necessary changes.

1.6 Workers must be informed of any significant findings of the assessment and measures for their protection, and of any subsequent revisions made.

1.7 The Company is also required to ensure that anyone working on the ship, whether or not they are directly employed by the Company, is aware of the findings of the Company's risk assessment and of the measures taken for their protection.

1.8 This guidance note explains the principles of risk assessment in relation to occupational health and safety and provides some advice on how the assessment and control of risks may be approached.

1.9 Regulation of occupational health and safety on board ship is of course not new. Existing safety measures may already provide a high level of safety for workers. For example, well-established procedures, inspections by safety officers and the use of "permits to work" which control safety conditions, will contribute to the identification of hazards and measures for safe working.

1.10 However, what is new is the explicit requirement in regulation for employers to adopt the risk assessment approach to occupational health and safety. This means that all work activities should be considered from a risk assessment standpoint.

1.11 Employers may adapt existing safety management systems to meet the risk assessment principles set out in section 3 and the main elements described in section 10, taking into account the nature of their operations and the type and extent of the hazards and risks to workers.

2 Key terms

2.1 Key terms, used frequently in this chapter, are defined below.

a) A hazard is a source of potential harm or damage or a situation with potential for harm or damage;

b) risk has two elements:

- the likelihood that a hazard may occur;
- the consequences of the hazardous event

3 Principles of risk assessment

3.1 A "risk assessment" is intended to be a careful examination of what, in the nature of operations, could cause harm, so that decisions can be made as to whether enough precautions have been taken or whether more should be done to prevent harm. The aim is to minimise accidents and ill health on board ship.

3.2 The assessment should first identify the hazards that are present and then establish whether a hazard is significant and whether it is already covered by satisfactory precautions to control the risk, such as permits to work, restricted access, use of warning signs or personal protective equipment, including consideration of the likelihood of the failure of those precautions which are in place.

3.3 Any risk assessment must address risks to the health and safety of workers.

4 Risk assessment in practice

4.1 There are no fixed rules about how risk assessment should be undertaken, although section 10 gives the main elements. The assessment will depend on the type of ship, the nature of operations and the type and extent of the hazards and risks. The intention is that the process should be simple, but meaningful. The following sections give advice on good practice.

5 What should be assessed?

5.1 The assessment should cover all risks arising from the work activities of workers on the ship. The assessment is not expected to cover risks which are not reasonably foreseeable.

5.2 Employers are advised to record the significant findings of their risk assessment. Risks which are found to be trivial, and where no further precautions are required, need not be recorded.

6 Who has to carry out the assessment?

6.1 In all cases, individual employers have responsibility for assessing the risks to their workers and other persons who may be affected by their activities. The Company will be responsible for co-ordinating the risk assessments covering everyone on the ship including workers directly employed by itself, taking account of the other employers' assessments.

6.2 The process of risk assessment should be carried out by suitably experienced personnel, using specialist advice if appropriate.

7 How thorough should the assessment be?

7.1 Regulation 7(1) requires that a suitable and sufficient assessment be made of the risks to the health and safety of workers arising in the normal course of their duties. This requirement to assess risk relates only to risks which arise directly from the work activity being undertaken and which have the potential to harm the person(s) actually undertaking that work, or who may be directly affected by that work. The requirement to assess risk does not extend to any consequential peril to the ship resulting from the particular work activity, nor to any external hazards which may imperil the ship, either of which may cause harm to those on board or to others. These aspects are covered by other regulations.

7.2 The assessment of risks must be 'suitable and sufficient'. The process need not be overcomplicated. This means that the amount of effort that is put into an assessment should depend on the degree of harm that may occur and whether risks are already controlled by satisfactory precautions or procedures to ensure that they are as low as reasonably practicable.

8 When to assess?

8.1 Risk assessment should be seen as a continuous process. In practice, the risks in the workplace should be assessed before work begins on any task for which no valid risk assessment exists. An assessment must be reviewed and updated as necessary, to ensure that is reflects any significant changes of equipment or procedure.

9 Risk assessment pro-forma

9.1 Employers may wish to use a simple pro-forma to record the findings of an assessment, covering, for example:

a) work activity;
b) hazard(s);
c) controls in place;
d) personnel at risk;
e) likelihood of harm;
f) severity of harm;
g) risk levels (sometimes called "risk factor");
h) action to be taken following the assessment;
i) administrative details, e.g. name of assessor, date, etc.

10 Elements of risk assessment

10.1 The main elements of the risk assessment process are

a) classify work activities
b) identify hazards and personnel at risk
c) determine risk
d) decide if risk is tolerable
e) prepare action plan (if necessary)
f) review adequacy of action plan

10.2 Further guidance on how each element may be accomplished is in the Appendix, which is based on British Standard 8800.

GUIDANCE ON MAIN ELEMENTS OF RISK ASSESSMENT

1. Classify work activities

1.1 A useful preliminary to risk assessment is to identify separate work activities, to group them in a rational and manageable way, and to gather necessary information (or collate existing information) about them. Infrequent maintenance tasks, as well as day-to-day operations, should be included. Possible ways of classifying work activities include:

a) department/location on board ship/on the dockside;
b) stages of an operation or work routine,
c) planned and unscheduled maintenance;
d) defined tasks (e.g. loading/unloading cargo).

1.2 Information required for each work activity might include:

a) tasks being carried out: their duration and frequency;
b) location(s) where the work is carried out;
c) who normally/occasionally carries out the tasks;
d) others who may be affected by the work (e.g. contractors, passengers);
e) training that personnel have received for the task.

2. Identify hazards

2.1 Asking these three questions should help to identify where there is a hazard

- Is there a source of harm?
- Who (or what) could be harmed?
- How could harm occur?

Hazards that clearly possess negligible potential for harm should not be documented or given further consideration, provided that appropriate control measures remain in place.

2.2 To help with the process of identifying hazards it may be useful to categorise hazards in different ways, for example by topic, e.g.:

a) mechanical
b) electrical
c) physical
d) radiation
e) substances
f) fire and explosion

2.3 A complementary approach may be to develop a prompt list such as:

During work activities could the following hazards exist?

a) slips/falls on the level;
b) falls of persons from a height;
c) falls of tools, materials, etc, from a height;
d) inadequate headroom;
e) inadequate ventilation;
f) hazards from plant and machinery associated with assembly, commissioning, operation, maintenance, modification, repair and dismantling;
g) hazards from manual handling.

The above list is not exhaustive, and employers could develop their own 'prompt list' taking into account the particular circumstances.

3. **Determine risk**

3.1 The risk from the hazard may be determined by estimating:

- the potential severity of harm, and
- the likelihood that harm will occur.

These two components should be judged independently.

3.2 When seeking to establish potential **severity of harm**, the following should be considered:

a) part(s) of the body likely to be affected;
b) nature of the harm, ranging from slightly to extremely harmful:

i) slightly harmful, e.g.:

- superficial injuries; minor cuts and bruises, eye irritation from dust;
- nuisance and irritation (e.g. headaches); ill-health leading to temporary discomfort,

ii) harmful, e.g.:

- lacerations; burns; concussion; serious sprains, minor fractures; musculo-skeletal disorders;
- deafness; dermatitis; asthma; work related upper limb disorders, ill-health leading to permanent minor disability;

iii) extremely harmful, e.g.:

- amputations; major fractures; poisonings; multiple injuries; fatal injuries;
- occupational cancer; other severely life shortening diseases; acute fatal diseases.

3.3 In order to establish the **likelihood of harm** the adequacy of control measures already in place should be considered. Legal requirements and guidance in this Code and other safety publications are good guides to adequate control of specific hazards. The following issues should then typically be assessed:

a) number of personnel exposed;
b) frequency and duration of exposure to the hazard;
c) effects of failure of power or water supply;
d) effects of failure of plant and machinery components and safety devices;
e) exposure to the elements;
f) protection afforded by personal protective equipment and its limitations;
g) possibility of unsafe acts by persons for example, who:

i) may not know what the hazards are;
ii) may not have the knowledge, physical capacity, or skills to do the work;
iii) underestimate risks to which they are exposed;
iv) underestimate the practicality and utility of safe working methods.

The likelihood of harm can be assessed as highly unlikely, unlikely or likely.

3.4 Any given hazard is more serious if it affects a greater number of people. But some of the more serious hazards may be associated with an occasional task carried out by just one person, for example maintenance of inaccessible parts of lifting equipment.

4 Decide if risk is tolerable

4.1 Table 1 below shows one simple method for estimating risk levels and deciding whether risks are tolerable. Risks are classified according to their estimated likelihood and potential severity of harm. However, employers may wish to develop other approaches according to the nature of their operations.

Table 1

	Slightly harmful	Harmful	Extremely harmful
Highly unlikely	TRIVIAL RISK	TOLERABLE RISK	MODERATE RISK
Unlikely	TOLERABLE RISK	MODERATE RISK	SUBSTANTIAL RISK
Likely	MODERATE RISK	SUBSTANTIAL RISK	INTOLERABLE RISK

Note: Tolerable here means that the risk has been reduced to the lowest level that is reasonably practicable.

5. **Prepare risk control action plan**

5.1 Having determined the significant risks, the next step is to decide what action should be taken to improve safety, taking account of precautions and controls already in place.

5.2 Risk categories form the basis for deciding whether improved controls are required and the timescale for action. Table 2 suggests a possible simple approach. This shows that the effort made to control risk should reflect the seriousness of that risk.

Table 2

	ACTION AND TIMESCALE
TRIVIAL	No action is required and no documentary records need be kept.
TOLERABLE	No additional controls are required. Consideration may be given to a more cost effective solution or improvement that imposes no additional cost burden. Monitoring is required to ensure that the controls are maintained.
MODERATE	Efforts should be made to reduce the risk, but the costs of prevention should be carefully measured and limited. Risk reduction measures should be implemented within a defined time period. Where the moderate risk is associated with extremely harmful consequences, further assessment may be necessary to establish more precisely the likelihood of harm as a basis for determining the need for improved control measures.
SUBSTANTIAL	Work should not be started until the risk has been reduced. Considerable resources may have to be allocated to reduce the risk. Where the risk involves work in progress, urgent action should be taken.
INTOLERABLE	Work should not be *started* or *continued* until the risk has been reduced. If it is not possible to reduce the risk even with unlimited resources, work has to remain prohibited.

Note: Tolerable here means that the risk has been reduced to the lowest level that is reasonably practicable.

5.3 The outcome of a risk assessment should be an inventory of actions, in priority order, to devise, maintain or improve controls.

5.4 Controls should be chosen taking into account the following, which are in order of effectiveness:

a) if possible, eliminate hazards altogether, or combat risks at source e.g. use a safe substance instead of a dangerous one;
b) if elimination is not possible, try to reduce the risk e.g. where risk is of electrocution, by using a low voltage electrical appliance;
c) where possible adapt work to the individual, e.g. to take account of individual mental and physical capabilities;
d) take advantage of technical progress to improve controls;
e) give precedence to measures that protect everyone;
f) if necessary, use a combination of technical and procedural controls;
g) introduce or ensure the continuation of planned maintenance, for example, of machinery safeguards;
h) ensure emergency arrangements are in place;
i) adopt personal protective equipment only as a last resort, after all other control options have been considered.

5.5 In addition to emergency and evacuation plans, it may be necessary to provide emergency equipment relevant to the specific hazards.

6. **Review adequacy of action plan**

6.1 Any action plan should be reviewed before implementation, typically by asking:

a) will the revised controls lead to tolerable risk levels?
b) are new hazards created?
c) what do people affected think about the need for, and practicality of, the revised preventive measures?
d) will the revised controls be used in practice, and not ignored in the face of, for example, pressures to get the job done?

HEALTH SURVEILLANCE

1. Duty of employers

1.1 Employers must provide workers with such health surveillance as is appropriate taking into account the risks to their health and safety which are identified by the assessment undertaken in accordance with the regulations.

2. Purpose of health surveillance

2.1 Health surveillance is a means of identifying early signs of ill health caused by occupational hazards so that action can be taken to protect individuals at an early stage from further harm. For example:

- where a worker's exposure to a hazardous substance is approaching the agreed limit, the worker should be removed from exposure before any harm is done;

- if symptoms of minor ailments (e.g. skin rash) are detected, action should be taken to prevent them becoming major health problems.

2.2 In addition, the results of health surveillance can provide a means of:

(a) checking the effectiveness of health control measures;
(b) providing feedback on the accuracy of health risk assessment;
(c) identifying and protecting individuals at increased risk.

2.3 Health surveillance is not a substitute for measures to control risks to health and safety. Control measures should always be the first consideration to reduce risk. Nor is it the same as medical examinations which are intended to assess fitness for work (for example pre-employment, sickness resumption or periodic examinations). However, where relevant, health surveillance should be conducted, for example at pre-employment assessment, where a base-line reference can usefully be established.

3 Application

3.1 Health surveillance should be introduced where risk assessment (see Chapter 1) identifies that :

(a) a particular work activity may cause ill health;
(b) an identifiable disease or adverse health condition is related to the work;
(c) recognised testing methods are available for early detection of an occupational disease or condition - e.g. audiometry, skin inspection where dermatitis is a hazard;
(d) there is a reasonable likelihood that a disease or condition may occur in relation to particular working conditions;
(e) surveillance is likely to further the protection of workers' health.

3.2 All workers should be subject to whatever health surveillance is appropriate for the work activities they are involved in. Examples of circumstances in which it may be useful include :

- exposure to hazardous substances;
- working with vibrating tools;
- exposure to high levels of noise;
- use of substances known to cause dermatitis (e.g. solvents); and
- exposure to certain dusts (e.g. asbestos);

4 **What to do**

4.1 Once it is decided that health surveillance is appropriate, it should be maintained whilst the worker remains exposed to the hazard(s) in question. A worker's health surveillance records should where possible be retained, even when the worker changes employment.

4.2 Health surveillance may involve one or more of the following, as applicable:

(a) inspection of readily detectable conditions (e.g. skin damage) by a person acting within the limits of their training and experience;
(b) enquiries about symptoms;
(c) hearing checks (audiometry);
(d) medical examinations or company health checks;
(e) testing blood or urine samples.

4.3 The frequency of such checks should be determined either on the basis of suitable general guidance (e.g. skin inspection for skin damage) or on the advice of a qualified occupational health practitioner. The workers concerned could be given an explanation of the purpose of health surveillance and an opportunity to comment on the proposed frequency of such health surveillance procedures, either directly or through their safety representatives.

4.4 Where medical surveillance is required, and it is necessary to take samples or record other personal information, it is essential that confidentiality is maintained in respect of individual health records containing clinical information.

ANNEX 26

Recommendations resulting from investigation reports into the losses of fvs "*Charisma*", *Kirsteen Anne*" and "*Amber*".

Charisma

SECTION 5 – RECOMMENDATIONS

The Maritime and Coastguard Agency is recommended to:

In consultation with the fishing industry develop and promulgate guidance for the loading of fishing vessels under 15m LOA.

Marine Accident Investigation Branch
November 2002

Kirsteen Anne

SECTION 5 - RECOMMENDATIONS

The Department for Transport and the Maritime and Coastguard Agency are recommended to:

1. Develop a simple method of assessing stability, including freeboard, of small fishing vessels, and issue guidance accordingly.

The Maritime and Coastguard Agency is also recommended to:

2. Conduct a formal safety assessment of the introduction of a mandatory stability requirement for existing fishing vessels under 15m.

3. On a vessel's change of ownership, provide new owners with information regarding the relevant Code of Practice and other key regulations to be followed.

4. Ensure the Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations apply to all vessels regardless of the contractual arrangements of the crew, and that hazards which imperil a vessel are included in risk assessments.

5. Note, on the safety equipment checklists contained in the Code of Practice for Safety of Small Fishing Vessels, that the equipment required is a minimum, and that risk assessment should be used to identify additional items. In particular, a liferaft should be carried whenever possible.

6. Investigate how stability awareness can be raised among the owners and crew of fishing vessels under 15m.

Marine Accident Investigation Branch
July 2003

SECTION 4 - RECOMMENDATIONS

Many of the recommendations made in this report correspond to those already made following the *Kirsteen Anne* accident investigation report[1].

These include, to the **Department for Transport** and the **Maritime and Coastguard Agency,** to:

1. Develop a simple method of assessing the stability, including freeboard, of small fishing vessels, and issue guidance accordingly.

and to the **Maritime and Coastguard Agency:**

2. To conduct a formal safety assessment for existing under-15m fishing vessels, to ascertain whether or not a mandatory stability requirement would be appropriate.

3. On a vessel's change of ownership, provide new owners with information regarding the relevant Code of Practice and other key regulations to be followed.

4. To ensure The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997 apply to all vessels regardless of the contractual arrangements of the crew.

5. To ensure that hazards which imperil a vessel are included in risk assessments that are required by The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997.

6. To investigate how stability awareness can be raised among the owners and crew of fishing vessels under 15m.

7. Develop a risk-based approach to target uninspected fishing vessels of less than 15m overall length, so as to achieve 100% inspection as soon as is practicable.

Marine Accident Investigation Branch
October 2003

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[1] Marine Accident Investigation Branch Report No.19/2003

ANNEX 27

MGN 267(F) – The Location and Stowage of Liferafts and Emergency Positioning Beacons (EPIRBS) on UK Registered Fishing Vessels

MARINE GUIDANCE NOTE

MGN 267 (F)

The Location and Stowage of Liferafts and Emergency Positioning Radio Beacons (EPIRBs) on UK Registered Fishing Vessels

Notice to Designers, Builders, Owners, Skippers and Crews, of Fishing Vessels.

This notice should be read in conjunction with MGN 104 Stowage and Float Free Arrangements for Inflatable Liferafts, and supersedes MGN 130 (F).

Summary

- This note gives guidance on suitable stowage positions and other measures that will significantly reduce the possibility of a liferaft or an EPIRB becoming trapped or snagged when being deployed automatically from a sinking fishing vessel.

1. LIFERAFTS

1.1 To enhance the chances of successful deployment in an abandon ship emergency, the Maritime and Coastguard Agency strongly recommends that for liferaft containers:

(a) The owner/skipper should review the liferaft stowage arrangement on the vessel and consider:

(i) Are the liferaft containers stowed in an area that is free from overhead obstructions, and as far away from bulkheads, railings and other vertical structures as is possible?

(ii) Does the vessel have rigging, equipment or structure which could interfere with the deployment of a liferaft?

(b) A liferaft container may be released when the vessel is on its side or at some other extreme angle of heel and trim. A deep cradle should allow for this but be designed to avoid inadvertent release.

(c) Manual launching may also be necessary, and any arrangement should allow this to be easily achieved.

(d) The arrangement should allow easy access for crew from their normal working positions.

1.2 Of the 104 fatalities from vessel losses between 1992 and 2000, 69 were never found, and it is possible that a significant proportion of these losses were because of the incorrect operation of life saving equipment. As a result of one of these incidents the Maritime and Coastguard Agency commissioned a research project to find out:

(a) why some liferafts failed to reach the surface; and

(b) the optimum positions for the stowage of inflatable liferaft containers.

1.3 Phase 1 was undertaken by the Wolfson Unit for Marine Technology and Industrial Aerodynamics, and involved conducting a series of tank tests using two models of common fishing vessel types. This investigated the behaviour of a sinking vessel.

1.4 This work concluded that a liferaft positioned away from fishing gear and structures would have a much greater chance of reaching the surface from a sinking vessel than a more traditional aft mounted liferaft.

1.5 The research from *Phase 1* showed that:

(a) Because of masts, rigging and fishing gear on beam trawlers, when compared with other fishing vessels, there is an increased likelihood of liferaft containers and/or painters becoming fouled and snagged on superstructure and/or fishing gear; and therefore being prevented from reaching the surface.

(b) Due to variations in fishing vessel design and operation, the attitude (angles to port, starboard, forward and aft) that the vessel takes up as it sinks is difficult to predict.

(c) In some cases the container may become so fouled or jammed that it cannot deploy automatically.

(d) More commonly, when the liferaft container is released by the Hydrostatic Release Unit, the painter becomes fouled as the liferaft ascends to the surface. As a result, the painter weak link does not break and the liferaft will not reach the surface.

1.6 Phase 2 was undertaken by the Inflatable Safety and Survival Equipment Trade Association (ISSETA), working with SEAFISH and the Maritime and Coastguard Agency.

1.7 A six person liferaft in a rectangular container was placed on the bow of a beam trawler for a trial period of two years, in addition to the existing liferafts, to prove that a liferaft could cope with the conditions encountered. (The report is attached).

1.8 The research from Phase 2 showed that:

(a) The trial of the liferaft on the bow showed that over the two years of service the case and liferaft itself remained in good condition with no degradation. The Hydrostatic Release Unit was also found to operate as required when tested. (The Hydrostatic Release Unit was of a type which would operate at 6-10 metres depth to avoid accidental operation caused by seas shipped over the bow).

(b) A liferaft stowed forward, properly fitted with a suitable Hydrostatic Release Unit and protection from waves will provide an effective alternative to stowing both liferafts aft.

1.9 For vessels with little rigging or obstruction, alternative actions could include:

(a) The possibility of local structures hindering the container's deployment can be minimised by incorporating angled stanchions to guide the container upwards and past the obstruction.

(b) To reduce the possibility of automatic deployment failure occurring as a result of the painter snagging on wires used for rigging etc., consideration should be given to the fitting of smooth sheathing over wires in areas close to where liferafts will float free.

2. EMERGENCY POSITIONING INDICATING RADIO BEACONS (EPIRBs).

2.1 Tank tests also provided information on the conditions for automatic deployment of EPIRBs. From this the following advice is given on the siting of this equipment:

2.2 To provide the best conditions for automatic deployment, the EPIRB should be sited so that it can float free and clear regardless of the attitude of the vessel during or following capsize. The wheelhouse top is the favoured position, although rigging, masts, equipment etc. could indicate that an alternative position should be found. Access should be easy so that the EPIRB can be manually activated and placed in the liferaft if abandoning ship.

2.3 If the EPIRB is placed on one side of the vessel, or immediately behind the wheelhouse then the likelihood of correct deployment is much reduced.

Further Information

Further information on the contents of this Notice can be obtained from:

Fishing Safety Branch
Maritime and Coastguard Agency
Spring Place
105 Commercial Road
SO15 1EG

Telephone: 023 8032 9130
Fax: 023 8032 9173

Maritime and Coastguard Agency
Website Address: http://www.mcga.gov.uk

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Safer Lives, Safer Ships, Cleaner Seas

Department for Transport

The MCA is an executive agency of the Department for Transport

ANNEX 28

SCOTNI Regional Operations Manager (Survey & Inspection) Instructions – "<15m Fishing Vessel – General Conditions", dated 13 December 2004

Maritime and Coastguard Agency

From: Alistair Struthers

Date: 13 December 2004

Ref:

<15m FISHING VESSELS – GENERAL CONDITION

1 We recently had a report alleging that the hull of a <15m fishing vessel was in poor condition, implying that the boat was unsafe. An inspection by a surveyor confirmed this and remedial action was taken. A short time previously the boat had been inspected by MCA with minor deficiencies in the equipment recorded.

2 I recognise that the inspection regime is limited to the items listed in the code but I think that we have as responsibility to look beyond these items of equipment. We have lost two boats this year with loss of life. MAIB and a Sheriff have commented upon the lack of stability standards on <15m F/Vs. I would like inspectors to be aware of the general condition of the boat and to use their interpersonal skills to discuss concerns with skippers, whose safety may be at risk. If the inspector has any concern about the condition of a boat this must be brought to the attention of a surveyor.

3 I would like inspectors to:

be aware of the general condition of <15m F/V:

is the hull damaged?

does it have a low freeboard?

does it look top heavy?

Is it taking water?

Can deck openings be closed?

If you have any concerns:

avoid antagonising the skipper;

take photographs;

let a surveyor know;

Alistair Struthers
ROM (S&I)
SCOTNI
DDI: 01224 59 7903
FAX: 01224 57 3725
C:\...docs\2004-2005\RMB Action FV condition Nov 17