Report on the investigation of

the collapse of cargo containers on

Annabella

Baltic Sea

26 February 2007

Marine Accident Investigation Branch
Carlton House
Carlton Place
Southampton
United Kingdom
SO15 2DZ

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Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2005 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 13(9) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

Cover photograph and figure 10 courtesy of Mr H. Lappalainen

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AB	-	Able seaman
BAPLIE	-	Bayplan/Stowage Plan Occupied and Empty locations message
CSC	-	Convention for Safe Containers, 1972
Edi	-	Electronic data interchange
Feeder vessel	-	This is a vessel which trades on short sea shipping routes and ‘feeds’ containers to other ports from the larger ‘hub’ ports used by deep-sea container ships
FMA	-	Finnish Maritime Administration
GL	-	Germanischer Lloyd
GM	-	Metacentric height
HSE	-	Health and Safety Executive
IMDG	-	International Maritime Dangerous Goods Code
ISM (Code)	-	International Safety Management (Code)
ISO	-	International Standards Organisation
kg	-	kilogram
Knot	-	Measurement of speed in nautical miles per hour
kW	-	kilowatt
MCA	-	Maritime and Coastguard Agency
SMS	-	Safety Management System
STCW	-	Standards of Training, Certification and Watchkeeping Convention for Seafarers 1995
Teu	-	Twenty foot equivalent unit (container size)
UTC	-	Universal Time Co-ordinated

Photograph reproduced courtesy of Döhle (IOM) Limited

Figure 1

Annabella

SYNOPSIS

During the evening of 25 February 2007, on passage in the Baltic Sea, *Annabella* encountered heavy seas which caused the vessel to roll and pitch heavily. The master reduced speed and adjusted course to reduce the motion and by the early hours of 26 February the vessel had resumed her normal passage. That morning it was discovered that a stack of seven 30 foot cargo containers in bay 12, number 3 hold, had collapsed against the forward part of the hold. This resulted in damage to the containers, the upper three of which contained hazardous cargo, viz: Butylene gas (IMDG Class 2.1).

The vessel was originally heading for Helsinki and was redirected to the port of Kotka where the emergency services attended and specialist contractors safely unloaded the damaged hazardous containers on 4 March.

The collapse of cargo containers occurred as a result of downward compression and racking forces acting on the lower containers of the stack, which were not strong enough to support the stack as their maximum allowable stack weight had been exceeded and no lashing bars had been applied to them.

As a result of its analysis of this accident and the ascertainment of its causes and circumstances the MAIB considers that there are shortcomings in the flow of information relating to container stowage between the shippers, planners, the loading terminal and the vessel. While the industry recognises that the master must approve the final loading plan, in practice the pace of modern container operations is such that it is very difficult for ship's staff to maintain control of the loading plan.

The MAIB also considers that the presence in the transport chain of containers that have an allowable stacking weight below the ISO standard should be highlighted by appropriate marking and coding.

The safety issues identified in this, and other, published investigation reports, together with issues that are becoming apparent in the MAIB's ongoing investigation into the structural failure and flooding of the container vessel MSC *Napoli* (January 2007), identify a compelling need for a Code of Practice for the container shipping industry.

The MAIB has therefore recommended the International Chamber of Shipping (ICS):

> To work with industry to develop, then promote adherence to, a best practice safety code to ensure that (inter alia):
>
> - Effective communications and procedures exist between all parties involved in the planning and delivery of containers to ensure ship's staff have the resources and the opportunity to safely oversee the loading and securing of cargo.
> - Cargo securing manuals are comprehensive and in a format which provides ready and easy access to all relevant cargo loading and securing information.
> - Loading computer programmes incorporate the full requirements of a vessel's cargo securing manual. Such computers should be properly approved to ensure that officers can place full reliance on the information provided.

- The availability or otherwise of a reliable, approved, loading computer programme is a factor to be included in determining an appropriate level of manning for vessels on intensive schedules.
- The resultant increase in acceleration forces and consequent reduction in allowable stack weights when a vessel's GM is increased above the value quoted in the cargo securing manual is clearly understood by vessels' officers. The consequential effect on container stack weight, height and lashing arrangement for changes in the vessel's GM should be readily available and clearly displayed to ships' staff.
- Those involved in container operations are aware that containers with allowable stack weights below the ISO standard are in regular use and must be clearly identified at both the planning and loading stages to avoid the possibility of such containers being crushed.
- With respect to cargo planning operations:
    - cargo planners have appropriate marine experience or undergo training to ensure ship safety considerations are fully recognised
    - cargo planning software provided is able to recognise and alert planners to the consequences of variable data e.g GM, non standard container specifications
    - lessons learned from problems identified during container planning operations are formally reviewed and appropriate corrective measures put in place
    - ships' staff are provided with sufficient time to verify/approve proposed cargo plans.

The MAIB has also recommended Döhle (IOM) Limited:

- To ensure that when officers are promoted into senior ranks they receive sufficient familiarisation so as to be fully conversant with the contents of the vessel's cargo securing manual before taking responsibility for loading and securing cargo.
- To ensure that given a vessel's schedule, the manpower allocated to the vessel is sufficient to ensure that the requirements of the company's safety management system can be fully met.

The MAIB has also recommended Unifeeder A/S:

- To revise its current operating procedures to ensure lessons learned from problems identified during container planning operations are formally reviewed and, when appropriate, corrective measures put in place.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *ANNABELLA* AND ACCIDENT

Vessel details (Figure 1)

Registered owner	:	Annabella Shipping Limited
Manager(s)	:	Döhle (IOM) Limited
Port of registry	:	London
Flag	:	UK
Type	:	Container (868 Teu)
Built	:	2006, J.J.Siestas KG Schiffswerft & Co, Hamburg
Classification society	:	Germanischer Lloyd
Construction	:	Steel, Ice Class E3
Length overall	:	134.44 metres
Gross tonnage	:	9981
Engine power and type	:	8,399kW – MAK 9m43
Service speed	:	18.5 knots
Other relevant info	:	720kW bow thruster, 450kW stern thruster, single variable pitch propeller

Accident details

Time and date	:	Discovered at 0830 (UTC+1), 26 February 2007
Location of incident	:	In Baltic Sea, presumed near to Gotland Island
Persons on board	:	15
Injuries/fatalities	:	None
Damage	:	Seven 30 foot containers suffered varying degrees of damage. Minor structural damage to vessel in number 3 cargo hold.

1.2 NARRATIVE

All times in this report are ship's time = UTC + 1 hour

1.2.1 Schedule

Annabella was chartered by Unifeeder A/S on 24 October 2006, to operate in North-West European waters. The vessel had been specifically designed for trade in this area, being constructed to Ice Class E3 and capable of carrying a wide range of container sizes at a service speed of 18.5 knots.

Unifeeder had previously chartered seven vessels of the same class as *Annabella,* three of which were operating on the same route. The attraction of this class of vessel was its ability to carry irregular sized containers: 30 foot, over length tank, pallet wide and super pallet wide containers which are utilised in the European trades that Unifeeder specialised in. The vessels could also carry the more common 45 foot, 40 foot and 20 foot containers.

Initially, the vessel was engaged in regular voyages between Hamburg and St Petersburg. On 1 January 2007 *Annabella* was transferred to operate between Rotterdam and Helsinki, via the Kiel Canal, with calls at other ports along the route to meet the commercial requirements of the charterer's customers. In practice, the vessel made regular calls to Hamburg, Bremerhaven, Antwerp and Kotka, in Finland, in addition to the principal ports of the route.

1.2.2 Vessel's call at Rotterdam, 21 to 23 February 2007

At 0154 on 21 February 2007, *Annabella* arrived at the ECT Delta terminal (Europhaven) in Rotterdam on completion of a voyage from Finland via the Kiel Canal and Hamburg. Containers were discharged and loaded at this berth before the vessel departed at 0812 to a terminal in the Amazonhaven, Rotterdam, arriving at 0924, where more cargo operations took place.

During the day, an MCA surveyor undertook the initial audit of the vessel's Safety Management System. On completion of the audit a non conformity notice was raised as it was found that, on a number of occasions, the master, chief officer, chief engineer, deck cadet and deck crew had not achieved their statutory minimum rest periods.

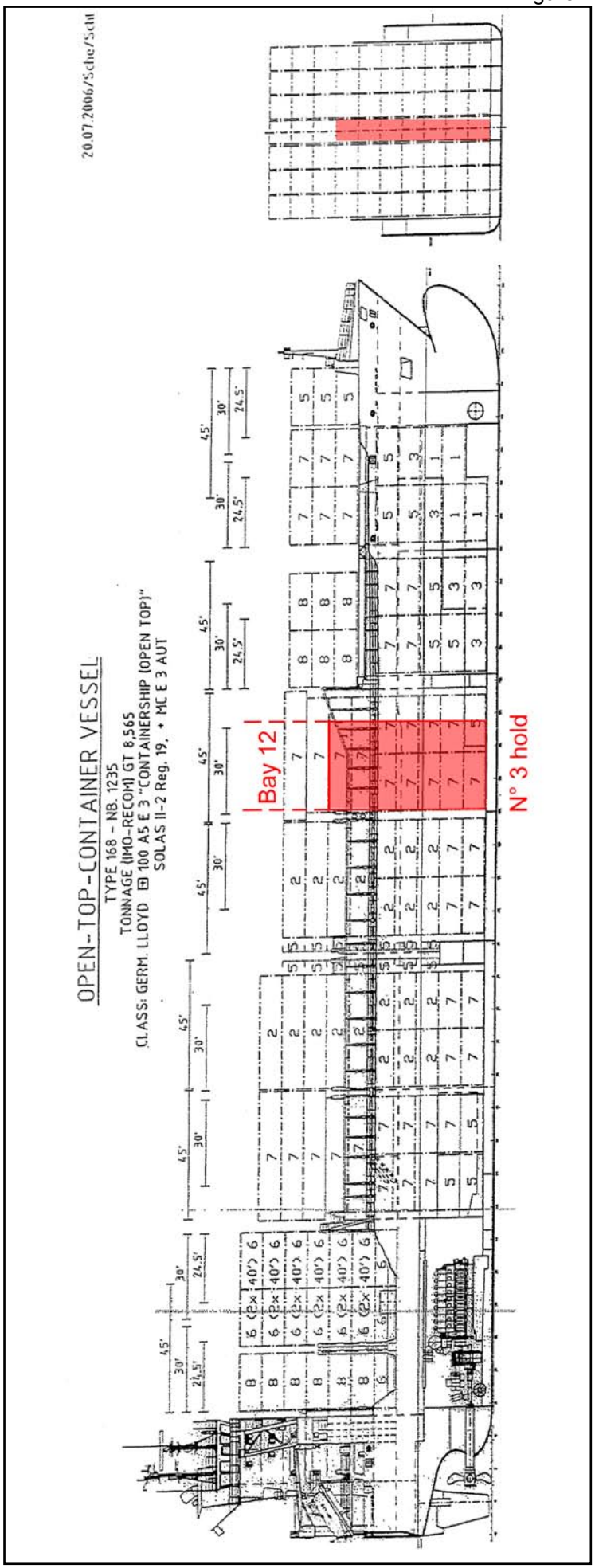
The vessel departed from Amazonhaven at 0238 on 22 February and proceeded to the Vaalhaven, arriving at 0512. She remained there until 1636 the same day awaiting berth readiness at the ECT (Home) terminal, where the vessel berthed at 1754 to undertake further cargo operations.

The stack of seven 30 foot containers that subsequently collapsed was loaded into the centre of bay 12, number 3 hold at this berth **(Figure 2)**. No lashing bars were applied to the containers in this stack.

The total weight of the seven containers was 225 tonnes. The cargo securing manual indicated that the maximum permissible stack weight for 30 foot containers loaded in this location was 150 tonnes. Furthermore, the lower four containers in the stack each had a maximum allowable stacking weight of approximately 100 tonnes.

The vessel departed from Rotterdam at 0136 on 23 February and proceeded to Antwerp, arriving there at 1348 on the same day. A new second officer had joined the vessel in Rotterdam and, as a result, the master elected to remain on the bridge for the duration of the passage between the ports.

Figure 2



Hold layout and location of collapsed containers

1.2.3 The passage, Antwerp to Helsinki

The vessel completed cargo operations in Antwerp and sailed from her berth in the Churchill Dock at 2006, 23 February 2007. The Antwerp pilot left the vessel at 0324 the following day, and she proceeded towards Helsinki, via the Kiel Canal.

The passage to the Kiel Canal was undertaken in generally good weather. Regular, routine checks of the cargo lashings were carried out and no problems were reported.

The vessel embarked the Elbe pilot at 1705, and entered the Kiel Canal at 2030 that day. She completed the transit of the canal at 0520 on 25 February, and entered the Baltic Sea en route to Helsinki.

The weather on the morning of 25 February was good, with a south-easterly force 4 wind, and the vessel proceeded at full speed, in slight to moderate seas, through the southern part of the Baltic Sea.

During the afternoon, the wind increased steadily from the south-east, reaching force 7 to 8 by 1950 when the vessel was rolling and pitching heavily at times in high seas and taking spray overall. In order to ease the vessel's motion, the master reduced speed to 12 knots and adjusted course to pass to the west of Gotland Island to gain shelter from the heavy seas.

By 0130 the next day, with the vessel to the north-west of Gotland Island, the sea conditions had moderated. Speed was increased to full ahead and the vessel resumed her passage to Helsinki.

At 0830 the chief officer was undertaking routine rounds of the cargo when he discovered that seven 30 foot containers had collapsed in the centre of bay 12, number 3 hold and were lying at an angle against the forward end of the hold **(Figure 3)**. He observed that bulk cargo had spilled from the lower containers, the bottom two of which had been crushed. The upper three containers in the collapsed stack were all tank containers full of Butylene Gas (IMDG Class 2.1, UN 1012) and appeared to have suffered some damage.

The chief officer reported the accident to the master who went to inspect the area himself. At 0900 the master mustered the whole crew in the ship's office to ensure everyone was accounted for, and briefed them on the situation.

The master then arranged for fire hoses to be rigged on either side of the accommodation and ensured that the sprinkler system for the hold was fully operational. Additionally the electrical power supply to the hold was isolated and the automatic bilge system was disengaged. A strict *No Smoking* policy was implemented and notices were posted on the inside of the external accommodation doors to remind the crew of the situation.

1.2.4 Notification of accident and emergency response

The master notified the vessel's management company of the accident by email at 1051, 26 February and also advised the charterer. The management company, on receipt of the report, instructed the master to ensure that the authorities at Helsinki were fully advised of the situation. The Finnish coastal authorities were subsequently advised of the situation on *Annabella* at 1400 by the Helsinki representative of the vessel's insurers.

Figure 3

Looking down on the aft end of the collapsed stack of containers

The Finnish authorities classified the accident as an “Uncertain situation” and made arrangements for the vessel to be boarded by representatives of the Finnish Maritime Administration (FMA) and the Helsinki Fire Brigade on arrival off Helsinki to assess the situation.

During the afternoon of 26 February, the Helsinki harbourmaster undertook a joint risk assessment with the local Rescue Department. This concluded that, due to the proximity of populated areas to the port, and to the frequent movement of passenger vessels in the port, it was unsafe for the vessel to berth in the port due to the damaged hazardous cargo containers.

The vessel was accordingly refused permission to enter Helsinki and, at 1640, was advised to proceed to the port of Kotka. At 2320 the vessel arrived off Kotka and officials from the Fire Department and the FMA boarded her to undertake an inspection of the damaged containers. The officials boarded by hovercraft as there was ice in the port and approaches.

Their inspection ascertained that there was no hazardous gas in No 3 cargo hold and that the tank containers were therefore intact. The vessel was then instructed that arrangements would be made for her to enter the port of Kotka.

At 1542 on 27 February, with the assistance of an icebreaker, the vessel berthed at the Mussalo container terminal, where a 400 metre restricted area was established around her **(Figure 4)**. The local authorities and vessel's representatives then began to develop a plan for the safe discharge of the damaged containers.

Figure 4

400 metre restricted area placed around vessel at Kotka - Finnish emergency plan

With the assistance of salvage experts from Rotterdam, a discharge plan was agreed by all parties and the damaged hazardous containers were discharged on 4 March, with all non essential personnel first being removed from the vessel.

Discharge of the remaining damaged, non hazardous, containers was completed on 6 March, when an inspection of the vessel's structure in number 3 hold confirmed that no significant damage had been caused as a result of the container stack collapse. The vessel then returned to service and sailed from Kotka at 1912 bound for Helsinki.

1.3 MANNING

1.3.1 Master

The Polish master had been at sea for 20 years and on *Annabella* for 3 months when the accident occurred. Aged 45 years, he had obtained his Master's certificate (STCW II/2) in Poland, in 1999. He held an endorsement issued by the MCA which was valid until July 2007. He had 7 years experience in command, mainly on container vessels of between 1600 and 2400 Teu capacity. This was his first command on a feeder container vessel.

The master did not keep a regular navigational watch, as the vessel carried three deck officers. His tours of duty were 4 months on board with 2 months leave.

1.3.2 Chief officer

The chief officer was a Ukrainian national, aged 39 years. He held a Ukrainian Chief Mate's certificate (STCW II/2) with a certificate of equivalent competency issued by the MCA.

He had spent several years in the Russian armed forces before joining the merchant service as an AB in 1997. He became a deck officer in 2003 and had 3 years experience on container vessels as an officer of the watch before obtaining his Chief Mate's certificate in June 2006. This was the first time he had sailed on a feeder container vessel.

Joining *Annabella* as second officer on 26 September 2006, he was promoted to chief officer on 24 December 2006. He had familiarised himself with the duties of the chief officer over a 10 day period prior to being promoted, while continuing to sail as second officer. During this 10 day period, he was instructed by the off-going chief officer in the use of the loading computer, but was not shown the special requirements for loading 30 foot containers.

The chief officer kept the 4 to 8 navigational watch at sea. He did not keep a watch in port, where he was responsible for overseeing the cargo operations and was available as and when required. The second and third deck officers kept cargo watches in port of 6 hours on, 6 hours off duty.

1.4 CARGO PLANNING

1.4.1 Unifeeder planners

The stowage plan for the cargo to be loaded onto *Annabella* was planned by the charterer, Unifeeder, at its offices in Aarhus, Denmark. The company had 41 vessels on charter at the time of the accident and employed 4 full-time and 1 part-time planners in its operations department who prepared the cargo stowage plans for all of these vessels.

Unifeeder did not require its planners to have had any previous marine experience, though 3 of the planners had worked at sea, 2 as chief officer and 1 as 3rd officer and the remaining 2 had 25 and 15 years experience as planners with the company. They had been assessed on an internal, informal and unrecorded basis prior to undertaking cargo stowage planning for the vessels.

The planners were aware of *Annabella*'s stowage capabilities and also held some details of her stability. However, they ultimately relied on the vessel's staff to alert them to any errors in the stowage plan, and expected the chief officer to critically check every aspect of the stowage plan before the vessel began loading.

The planners were aware of previous instances in which their plans to load stacks of 30 foot containers onto vessels of the same class had exceeded the maximum permitted stack weight limits. On those occasions, they had been alerted to the problem by the vessels' staff before the cargo was loaded, and an amended stowage plan had been mutually agreed.

However, no long term corrective action had been taken by the charterer as a result of the earlier planning errors.

1.4.2 Planners' loading computer

The planners used a bespoke computer planning software programme, developed for Unifeeder by a specialist company, Belco, Germany. This programme was created using stability and stowage information received from the shipbuilder for the class of vessels similar to *Annabella*.

After the accident, a simulation of the collapsed stack load was carried out and it was found that the planning software had not been programmed to recognise 30 foot containers. It transpired that when this size was entered into the programme, it was automatically changed to 40 foot without any alert being given to the operator.

No alarm was triggered by the programme when the stack of seven 30 foot containers, weighing a total of 225 tonnes, was planned for loading into bay 12, number 3 hold. However, it was later confirmed that the programme did alarm when, as a further test, the 40 foot maximum stack load limit of 240 tonnes was exceeded.

This planning software was not the same as the programme used on the vessel for planning the stowage of the cargo and the resultant effects on longitudinal and transverse stability. There was also no requirement for the planners' programme to be checked or approved by an external authority.

Once the cargo stowage plan had been prepared, it was sent as a Bayplan/Stowage Plan Occupied and Empty locations message (BAPLIE) file in electronic data interface (edi) format to both the vessel and the operations department at the loading terminal, ECT (Home), in Rotterdam.

1.4.3 Loading terminal planners

On receipt of the BAPLIE file, the loading terminal's planners loaded the information onto their own computer programme. They scrutinised the plan to ensure that the containers were available for loading to meet the vessel's commercial schedule.

The terminal planners' computer programme did not hold any stability information for *Annabella.* Once they had confirmed that the containers were available for loading, the terminal's planners checked that the chief officer was in agreement with the final stowage plan. This was then passed to their operational staff so that loading could commence without delay.

On this occasion, one of the seven 30 foot containers to be loaded in *Annabella*'s number 3 hold was unavailable, and the terminal planners changed the plan by replacing it with a container of similar dimensions, weight and cargo.

The container which the terminal removed from the planned stowage was IFFU 3899983, weighing 32.46 tonnes. This was replaced by IBCU 5502700, weighing 32.08 tonnes. Both containers were filled with the same cargo, viz: Bulk Xyclose crystals.

1.4.4 Receipt of the cargo stowage plan

The vessel received its electronic copy of the stowage plan for the cargo to be loaded at the ECT (Home) terminal, as an attachment to an email, at 1200 on 22 February 2007. The attachment included a stowage plan **(Figure 5)**, a list of Dangerous Goods **(Figure 6)** and a BAPLIE file in edi format.

The BAPLIE file was then loaded onto the vessel's loading computer by the chief officer, who checked the planned stowage to verify that the resultant bending moments and shear forces were acceptable. He also ensured that the planned locations were suitable for the various containers which held hazardous and refrigerated cargoes etc and were in accordance with the requirements of the vessel's cargo securing manual.

In the event that the chief officer had any queries regarding the stowage plan, he had been instructed to liaise directly with the charterer's planner using a mobile telephone supplied by them.

1.4.5 *Annabella'*s loading computer

The loading computer software on *Annabella* was the Cargo Assistant/II ship loading programme, which was produced by Clearwater Software & system Service GmbH, Hamburg.

The programme provided information on the stability conditions, including bending moments, shear forces and torsion moments for the vessel in both seagoing and harbour conditions. In addition, cargo securing arrangements for containers stowed on deck, dangerous goods and refrigerated container information and segregation requirements were also on the programme.

At the time of the accident, the loading computer system had not been checked and approved by the vessel's classification society, Germanischer Lloyd (GL).

The programme was fitted with an alarm function designed to operate if a number of parameters, including individual stack weight, was exceeded.

This software had not been correctly programmed and, as with the planners' software, did not recognise 30 foot containers, converting them automatically to 40 foot containers. Therefore it did not alarm when the stack of seven containers to be loaded into bay 12, number 3 hold was entered into the programme, even though the weight of the stack exceeded the limit quoted in the vessel's cargo securing manual.

C/V "ANNABELLA" MPJG8 UNIFEEDER

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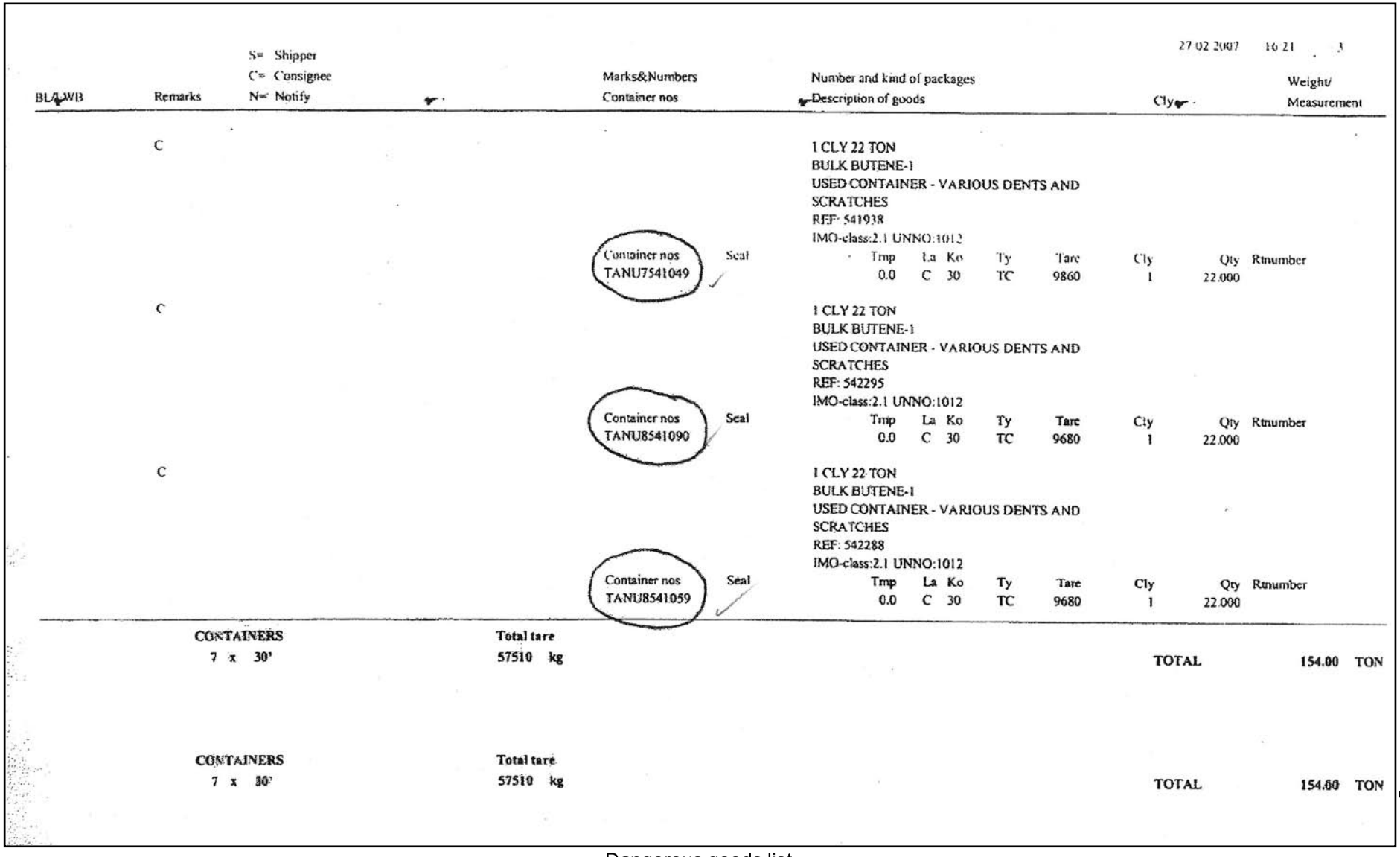
ASTERN — FORWARD

310884 DC RIMD HELW 5 EISU 3582836	290884	270884																			
310684 TK KTKM ANRH 4 PCVU 1510092	280684 >>>>4096>>>>	HC RIME KTKM 12 MSKU 8302511	240610 >>>>4096>>>>	HC RIME HELW 11 GESU 4341226	200610 >>>>4086>>>>	DC RIMD KTKM 17 UTIU 6067000	160610 >>>>4086>>>>	DC RIMD HELW 12 EISU 1581743	130610	110610	080610 >>>>4086>>>>	DC RIMD KTKM 18 UGMU 8096462									
310484 DC RIMD KTKM 12 UGMU 8635266	280484 >>>>4096>>>>	HC RIMD KTKM 15 GATU 8788351	240410 >>>>4086>>>>	DC RIME HELW 12 TINU 5638423	200410 >>>>4086>>>>	DC RIMD KTKM 17 FSCU 4273403	160410 >>>>4096>>>>	HC RIMD HELW 12 GATU 8709619	130410	110410	080410 >>>>4086>>>>	DC RIMD KTKM 17 TGHU 4700606	050410	030410							
310284 TK KTKM ANRH 4 VTGU 1251229	280284 >>>>4096>>>>	HC RIMD KTKM 15 FSCU 9546007	250210	230210	200210 >>>>4086>>>>	DC RIMD KTKM 17 HDMU 4225244	160210 >>>>4096>>>>	HC RIMD HELW 11 APHU 6040202	130210	110210	080210 >>>>4096>>>>	HC RIMD KTKM 17 EMCU 9220678	040210 >>>>4086>>>>	DC RIME KTKM 27 HLXU 5170486							
310184 TK KTKM ANRH 4 PCVU 1266134	280184 >>>>4096>>>>	HC RIMD KTKM 15 EISU 9011027	250010	230010	200010 >>>>4086>>>>	DC RIMD KTKM 17 FSCU 4269527	170010	150010	120010 >>>>3086>>>>	WBT RIME KTKM 30 TANU 7541049	080010 >>>>4086>>>>	DC RIMD KTKM 14 UESU 4156047	040010 >>>>4086>>>>	DC RIME KTKM 27 TGHU 4000705							
310384 DC RIMD KTKM 7 GLDU 2117804	280384 >>>>4096>>>>	HC RIMD KTKM 16 TGHU 7742415	250110	230110	200110 >>>>4096>>>>	HC RIMD KTKM 17 GESU 4582162	160110 >>>>4096>>>>	HC RIMD HELW 13 GVCU 5150084	130110	110110	080110 >>>>4086>>>>	DC RIMD KTKM 17 EMCU 2394364	040110 >>>>4086>>>>	DC RIME KTKM 23 HLXU 4172144							
310584 DC RIMD KTKM 8 HDMU 2374193	280584 >>>>4096>>>>	HC RIME KTKM 12 MSKU 9443366	240310 >>>>4086>>>>	DC RIME HELW 12 SUDU 4642733	200310 >>>>4096>>>>	HC RIMD KTKM 17 GATU 8764175	160310 >>>>4086>>>>	DC RIMD HELW 13 APZU 4175201	130310	110310	080310 >>>>4086>>>>	DC RIMD KTKM 17 EISU 1543677	050310	030310							
310784 DC RIMD HELW 5 CTXU 3289814	290784	270784	240510 >>>>4096>>>>	HC RIME HELW 11 SEAU 8660880	200510 >>>>4096>>>>	HC RIMD KTKM 16 HDMU 6090003	160510 >>>>4096>>>>	HC RIMD HELW 14 TRLU 5397460	130510	110510	080510 >>>>4086>>>>	DC RIMD KTKM 18 EMCU 1149589									

BAPLIE file attachment showing containers to be loaded onto the vessel and stowage locations



27 02 2007 16 21 3

S= Shipper
C= Consignee
N= Notify

BL/WB	Remarks	Marks&Numbers Container nos	Number and kind of packages Description of goods	Cty	Weight/ Measurement
	C	Container nos TANU7541049 Seal	1 CLY 22 TON BULK BUTENE-1 USED CONTAINER - VARIOUS DENTS AND SCRATCHES REF: 541938 IMO-class:2.1 UNNO:1012 Tmp La Ko Ty Tare Cty Qty Rtnumber 0.0 C 30 TC 9860 1 22.000		
	C	Container nos TANU8541090 Seal	1 CLY 22 TON BULK BUTENE-1 USED CONTAINER - VARIOUS DENTS AND SCRATCHES REF: 542295 IMO-class:2.1 UNNO:1012 Tmp La Ko Ty Tare Cty Qty Rtnumber 0.0 C 30 TC 9680 1 22.000		
	C	Container nos TANU8541059 Seal	1 CLY 22 TON BULK BUTENE-1 USED CONTAINER - VARIOUS DENTS AND SCRATCHES REF: 542288 IMO-class:2.1 UNNO:1012 Tmp La Ko Ty Tare Cty Qty Rtnumber 0.0 C 30 TC 9680 1 22.000		
	CONTAINERS 7 x 30'	Total tare 57510 kg		TOTAL	154.00 TON
	CONTAINERS 7 x 30'	Total tare 57510 kg		TOTAL	154.00 TON

Figure 6

Dangerous goods list

1.5 CARGO SECURING

1.5.1 Cargo securing manual

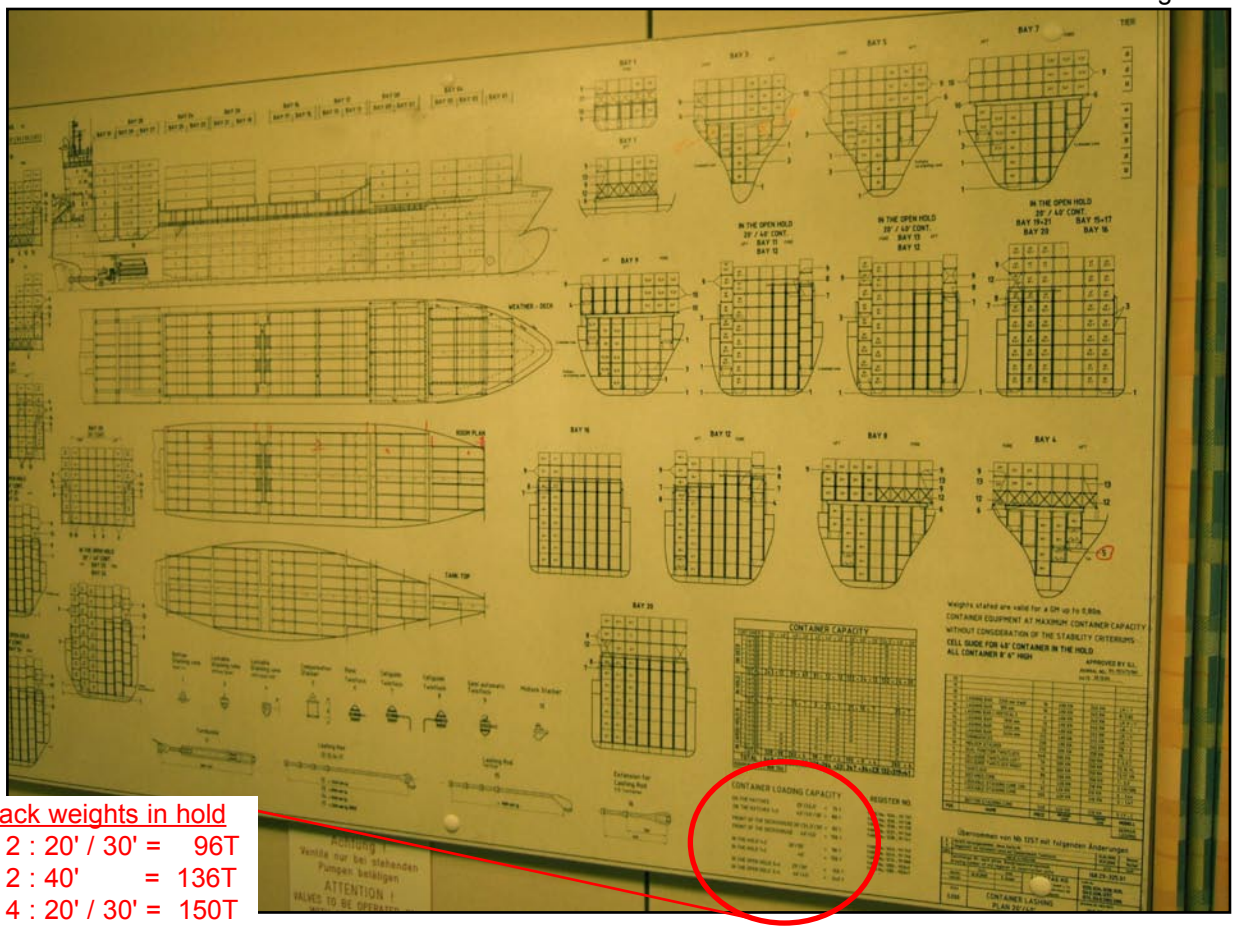
The cargo securing manual for the vessel was prepared by the shipbuilder, J. J. Siestas, Hamburg, and was approved by GL on 23 November 2006.

The manual, prepared by the shipbuilder for vessels of the same class as *Annabella*, provided details of the container securing arrangements and devices on the vessel as well as general information on safety related aspects of container stowage. Information relating to the specific lashing requirements for containers in the various stowage bays of the vessel was shown on plans annexed to the manual.

Details of the lashing requirements and guideline indicative weights for 30 foot containers, when stowed in number 3 hold, were shown on one of the annexes, the Container Distribution Plan, which had been approved by GL for vessels of *Annabella's* class on 23 February 2005. However, this plan was not included in the list of reference documents in the introduction to the cargo securing manual held on the vessel.

The Container Lashing Plan **(Figure 7)**, another annex to the cargo securing manual, had been approved by GL on 30 December 2004 and was permanently displayed on a bulkhead in *Annabella*'s cargo office. This plan indicated the lashings required on

Figure 7



Container lashing plan

containers in various stowage locations on the vessel together with indicative container stack weights. The plan indicated that the stack weights were valid for a GM of up to 0.8m.

No local lashing diagrams were displayed adjacent to the holds on the deck of the vessel.

1.5.2 Vessel's GM

The vessel's GM on departure from Antwerp was 1.68m.

Annabella was designed to operate in ice, and the schedule took her to Finland, where sea ice was present. This resulted in the vessel having to increase the amount of ballast water carried in the forward double bottom tanks to ensure the bow was at an optimum level for a passage in ice and also to provide cooling water to the main engine as normal sea water intakes would be blocked when in ice.

Records show that significant ice was present in the Gulf of Finland on 26 February **(Annex 1)**.

Table 1 shows the vessel's departure GM on voyages from loading ports for the period January to May 2007.

Date of voyage, loading port	Vessel's GM
08/01/2007 Hamburg	1.06m
11/01/2007 Bremerhaven	1.17m
20/01/2007 Rotterdam	1.33m
30/01/2007 Rotterdam	1.14m
11/02/2007 Antwerp	1.20m
23/02/2007 Antwerp	1.83m
11/03/2007 Rotterdam	1.88m
24/03/2007 Antwerp	1.50m
03/04/2007 Rotterdam	1.01m
15/04/2007 Rotterdam	0.95m
03/05/2007 Rotterdam	0.94m

Table 1 - Details of vessel's GM

1.5.3 Maximum permissible stack weights

The permissible weights for stacks of containers in varying locations on the vessel were listed on several of the plans annexed to the cargo securing manual, including: the Container Lashing Plan, Capacity Plan, and the Container Distribution Plan.

For the vessel's holds, these were shown in the following format:

Container point loads:

Stack weight in hold:

Hold 1+2: 20'/30'	=	96T
Hold 1+2: 40'	=	136T
Hold 3+4: 20'/30'	=	150T
Hold 3+4: 40'	=	240T

The details of the maximum loadings indicated the strength of the vessel's tank top in the various areas. In hold number 3, the maximum indicative stack weight for both 20 and 30 foot containers was 150 tonnes.

The maximum stack weights quoted were based on the vessel having a GM of 0.8m.

1.5.4 Lashing requirements

The vessel's Container Distribution Plan required that 30 foot containers stowed in hold number 3 were to be secured with lashing bars, to the top of the lower tier and the bottom of the second tier. Additionally, lashing bars were required to be connected to the top corners of the second tier of containers **(Figure 8)**.

The plan did not contain any details of the stacking cone[1] requirements for 30 foot containers but showed that for 20 foot or 40 foot containers in bay 13, number 3 hold, the following were required:

Bottom stacking cones on the tank top under the lower container,

Lockable stacking cones under the other containers in the stack.

1.5.5 Actual lashings fitted

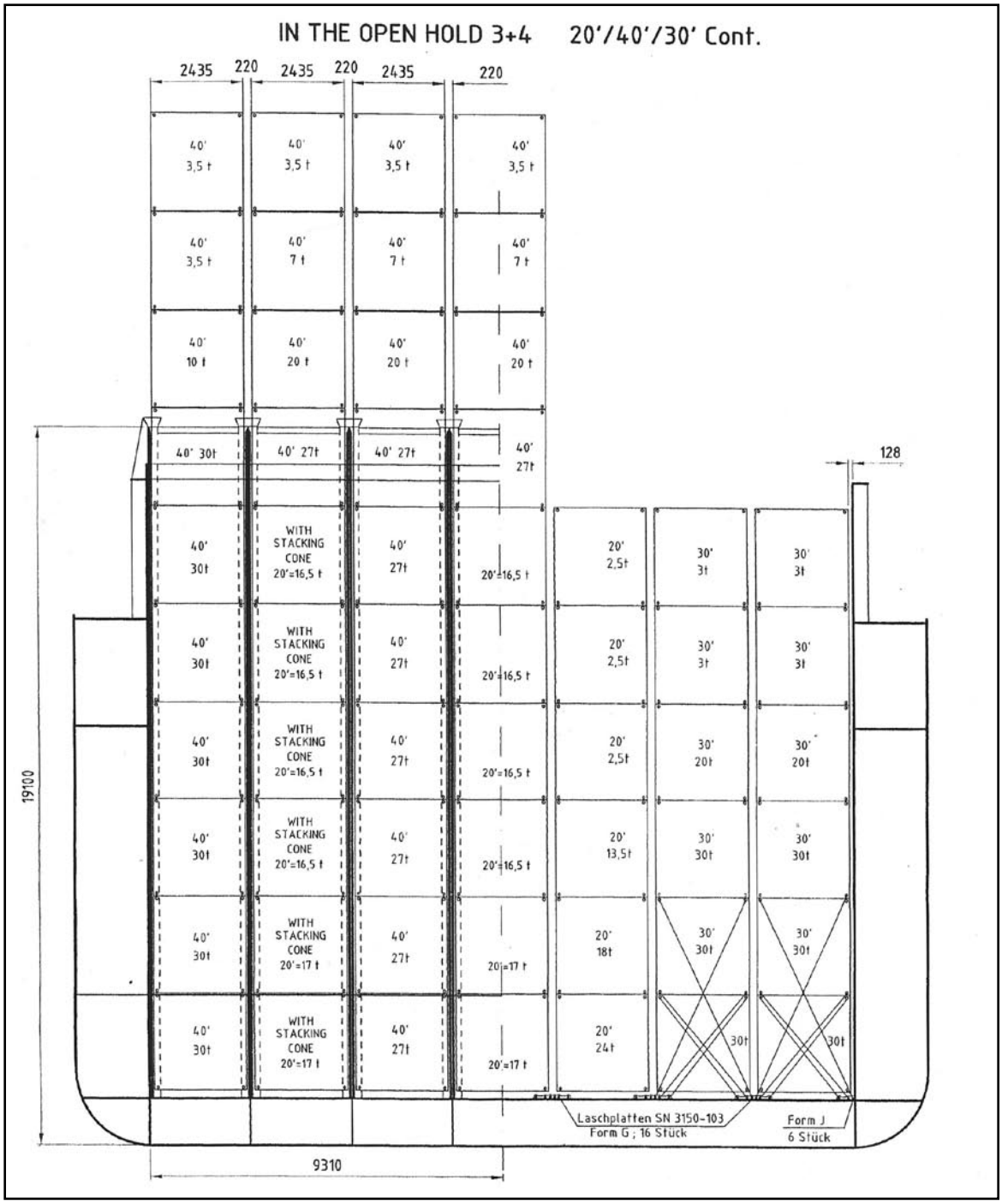
No lashing bars were secured to the container stack that collapsed in No 3 hold. Bottom stacking cones had been fitted to the tank top under the lowest container with midlock stackers placed at the forward end and lockable stacking cones under the cell guide (aft) end of the containers.

1.6 CONTAINER CONSTRUCTION

1.6.1 Allowable stacking weight

The allowable stacking weight information for individual containers is displayed on the container's CSC "safety approval plate". This plate has to be fitted in a conspicuous location on the container and must be a permanent, non-corrosive, fireproof rectangular plate measuring not less than 200mm x 100mm to meet the requirements of the Convention for Safe Containers, 1972.

[1] Stacking cone: a metal cone which is inserted into the corner fittings of a container to secure the container either to the tank top of the vessel (bottom stacking cone) or to another container in a vertical stack (midlock stacker).



Securing requirements for 30 foot containers in holds

The lowest four 30 foot containers in the collapsed stack were designed to carry non pressurised bulk materials. They were all fully laden and three had an allowable stacking weight of 100,500kg (100.5 tonnes) at 1.8g[2], with the remaining container being able to support 108,000kg (108 tonnes). This information was stamped onto the CSC safety approval plate, which was fixed at the end of each container **(Figure 9)**.

When the bulk containers from the collapsed stack were being discharged in Kotka on 5 March 2007, it was confirmed that the two containers at the bottom of the stack had been crushed during the voyage **(Figure 10)**.

[2] (where g is the acceleration due to gravity.) The value of 1.8g is used to allow for the dynamic forces acting on a stack of containers when a vessel is underway

Figure 9

CSC safety approval plate

Photograph courtesy of Mr H. Lappalainen

Figure 10

Lowest container discharged at Kotka, 5 March 2007

1.6.2 Inspection regime

The information shown on the bottom most container's CSC safety approval plate indicated that it had been manufactured in the UK in 1996 and had been subsequently inspected under a continuous examination programme, approved by the HSE, in accordance with the provisions of the International Convention for Safe Containers, 1972.

1.7 CARRIAGE OF 30 FOOT CONTAINERS

Annabella had previously carried 30 foot containers on voyages in the weeks preceding the accident.

Although the majority carried were empty, 5 laden 30 foot containers, with a total stack weight of 150 tonnes, had been loaded in early February. They were stowed in an open hold adjacent and similar to number 3 hold, and were delivered without mishap.

On 23 February, 2 stacks of 30 foot containers were loaded in Antwerp, and were stowed either side of the collapsed stack in number 3 hold. The stack weights were respectively 152 and 179 tonnes **(Figure 11)**. Apart from minor impact damage on the sides of some of these containers, from contact with the collapsed stack, these containers remained intact in their stacks.

No lashings had been applied to the stacks of 30 foot containers loaded in Antwerp or to any of the 30 foot containers carried on *Annabella* before the accident.

1.8 SAFETY MANAGEMENT SYSTEM (SMS)

The vessel's SMS procedures included a section entitled "Instructions for Container Vessels". This contained a specific reference to stack weights:

"Stack weights

The masters and all deck officers must be familiar with the maximum stack weights permitted both on deck and in the holds and must ensure they are never exceeded.

Stack weights on deck may be dictated by either the vessel's construction or by the maximum stresses for which the vessel's lashing system was designed.

In circumstances where values by both criteria are available on board, the lower must always be taken and not exceeded."

Cross section of container stowage plan

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

The collapse of containers on *Annabella* occurred as a result of downward compression and racking forces acting on the lower container in the stack as a consequence of the maximum allowable stacking weight having been exceeded and no locking bars having been applied to the lower containers. This analysis explores the reasons why this situation occurred.

2.2 CARGO PLANNING

2.2.1 Master's responsibility

Notwithstanding any cargo planning carried out ashore, the master has ultimate responsibility for the safety of his vessel. He must therefore be given the tools and the time to satisfy himself of the safety of the planned cargo disposition.

2.2.2 Charterer's planning staff

The cargo stowage was planned by the vessel's charterer. The planners were also involved in planning the cargo stowage for the other vessels on charter to Unifeeder.

At the time of the accident 5 staff were employed to plan the cargo stowage for the 41 vessels which were on charter to Unifeeder. The planners were familiar with the stowage of cargo on *Annabella* as there were seven vessels of the same class on charter to Unifeeder.

The planners had previously planned the stowage of 30 foot containers, in stacks which exceeded maximum stack weights, on other vessels of the same class. On those occasions, they had either been alerted to the fact that the proposed stow was not acceptable by ships' staff or the stack had been carried without mishap.

No system existed for appropriate lessons to have been learnt from the previous occasions when the planners had been alerted that the stack weight limits had been exceeded. Had this occurred, it is likely that the weaknesses in the cargo planning software would have been discovered before and would have prevented the collapse of containers on *Annabella*.

The planners were not required to have marine backgrounds before becoming planners, and were considered competent to plan a cargo stow on a vessel through a process of internal, unrecorded, assessment.

There is no recognised competence standard for cargo planners. While some planners have marine experience, this is not a prerequisite for the post and it appears to be quite normal for people without knowledge of vessel stability to be responsible for planning the cargo of container vessels.

Had there been a better awareness of the vessel's stability information and cargo securing manual by the planners, who had held the stability information for this class of vessels for several years, it is possible the accident might have been prevented.

2.2.3 Charterer's loading computer

The charterer had a bespoke computer programme for calculating the stowage and stability for the *Annabella* class of vessels. The raw data for this programme had been obtained directly from the shipbuilder, and a recognised computer software company had prepared the programme, which the planners used for the preparation of cargo stowage plans.

The programme, which was different from the vessel's computer programme, was designed to comply with the vessel's cargo securing manual. In the event that certain loading or stability limits were exceeded, the programme would provide an alarm to indicate which value had been exceeded.

There is no legal requirement for shore-based planners' computer programmes to be approved as is the case for shipboard loading programmes. As a result, very few companies have their bespoke computer systems approved by an external organisation.

In this case, if the computer system had been independently examined, it is possible that the programming error, in which the software did not recognise 30 foot containers, might have been detected before the accident.

2.2.4 Vessel's loading computer

The vessel's loading computer system, the Cargo Assistant/II was produced by Clearwater Software & System Service GmbH, and was approved by Germanischer Lloyd (GL), the vessel's classification society, in March 2007 **(Figure 12)**.

This approval confirmed that the shear forces, bending and torsional moment calculations corresponded with approved test conditions for static stability. The approval indicated that the computer system met the intact stability requirements of the International Loadline Convention 1966, viz:

Regulation 10

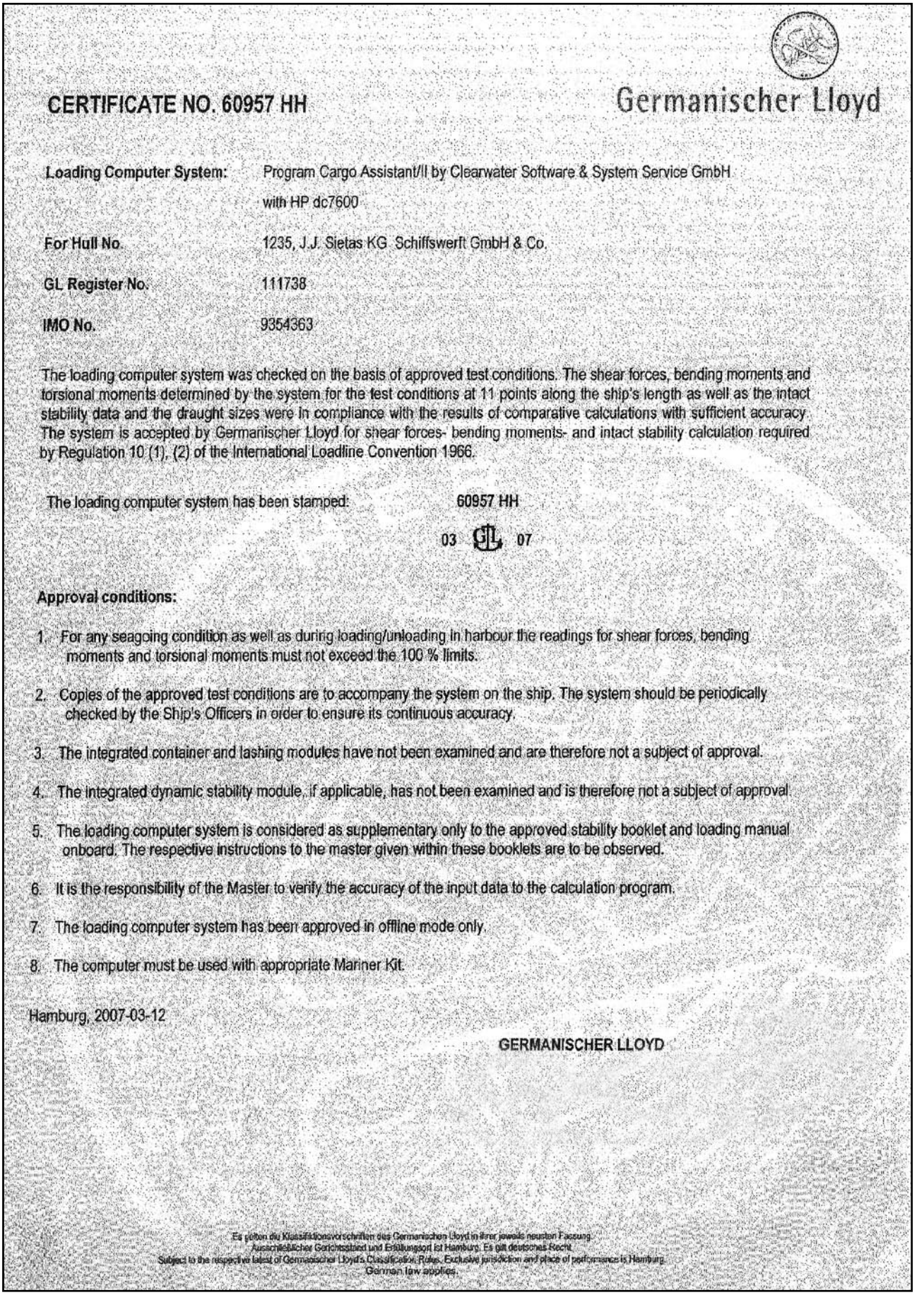
(1). The master of every new ship shall be supplied with information to arrange for the loading and ballasting of his ship in such a way as to avoid the creation of any unacceptable stresses in the ship's structure, provided that this requirement need not apply to any particular length, design or class of ship where the Administration considers it to be unnecessary.

(2). Information shall be provided to the master in a form that is approved by the Administration or a recognised organization. Stability information and loading information also related to ship strength when required under paragraph (1), shall be carried on board at all times together with evidence that the information has been approved by the Administration

The approval process did not include assessment of the integrated container and lashing modules or any dynamic stability module included in the programme.

The scope of the approval process for the loading computer of *Annabella* was the same as that applied on other container vessels across the industry.

Had the integrated container and lashing modules been included in the approval process, it is possible that the error in the vessel's stowage programme, which failed to recognise 30 foot containers and so did not alert the chief officer to the excessive stack weight, might have been detected and corrected before the accident occurred.



Germanischer Lloyd

CERTIFICATE NO. 60957 HH

Loading Computer System:	Program Cargo Assistant/II by Clearwater Software & System Service GmbH with HP dc7600
For Hull No.	1235, J.J. Sietas KG Schiffswerft GmbH & Co.
GL Register No.	111738
IMO No.	9354363

The loading computer system was checked on the basis of approved test conditions. The shear forces, bending moments and torsional moments determined by the system for the test conditions at 11 points along the ship's length as well as the intact stability data and the draught sizes were in compliance with the results of comparative calculations with sufficient accuracy. The system is accepted by Germanischer Lloyd for shear forces- bending moments- and intact stability calculation required by Regulation 10 (1), (2) of the International Loadline Convention 1966.

The loading computer system has been stamped: **60957 HH**

03 GL **07**

Approval conditions:

1. For any seagoing condition as well as during loading/unloading in harbour the readings for shear forces, bending moments and torsional moments must not exceed the 100 % limits.
2. Copies of the approved test conditions are to accompany the system on the ship. The system should be periodically checked by the Ship's Officers in order to ensure its continuous accuracy.
3. The integrated container and lashing modules have not been examined and are therefore not a subject of approval.
4. The integrated dynamic stability module, if applicable, has not been examined and is therefore not a subject of approval.
5. The loading computer system is considered as supplementary only to the approved stability booklet and loading manual onboard. The respective instructions to the master given within these booklets are to be observed.
6. It is the responsibility of the Master to verify the accuracy of the input data to the calculation program.
7. The loading computer system has been approved in offline mode only.
8. The computer must be used with appropriate Mariner Kit.

Hamburg, 2007-03-12

GERMANISCHER LLOYD

Es gelten die Klassifikationsvorschriften des Germanischen Lloyd in ihrer jeweils neuesten Fassung.
Ausschließlicher Gerichtsstand und Erfüllungsort ist Hamburg. Es gilt deutsches Recht.
Subject to the respective latest of Germanischer Lloyd's Classification Rules. Exclusive jurisdiction and place of performance is Hamburg. German law applies.

Approval certificate for *Annabella*'s loading computer system

Additionally, as the lashing module of the computer programme was not programmed to recognise 30 foot containers when stowed in the vessel's holds, the chief officer was not provided with any lashing guidance for the stack of containers which subsequently collapsed.

Although the computer programme met Flag State requirements, it provided the chief officer with no assistance or guidance for the stowage and securing of 30 foot containers.

2.2.5 Terminal's loading computer

The planners at the loading terminal also had a computer programme for *Annabella;* though this was limited to the stowage location plan for the cargo containers.

This programme enabled the planners to receive the BAPLIE file from the charterer's planners in advance of the load and to ensure that all the containers scheduled to be loaded were ready for the vessel.

No vessel stability information was included on this programme as this was not an area in which the terminal was involved.

2.3 CARGO HANDLING

During the investigation, it became apparent that the loading terminal operations staff regularly exchange containers, on an approximately like for like basis, if particular units are not available for loading when required.

An example of this practice was evident in that the container planned for stowage in Bay 120004. IFFU 3899983, was replaced by IBCU 5502700. Both of these containers held the same cargo but there was a difference of 400kg between the two units. There was no evidence to suggest that the chief officer was advised of this exchange until the final stowage plan was received at the conclusion of operations.

Further enquiries confirmed that the practice of exchanging like for like containers to avoid delays is commonplace throughout the industry.

The nature of the container trade is such that vessels are discharged and loaded very quickly. The benchmark for a container terminal is the number of containers its cranes can handle per hour.

A system should be established to ensure that any changes made are fully communicated to ship's staff.

2.4 CARGO SECURING MANUAL

*Annabella'*s cargo securing manual was approved by the vessel's classification society and met the requirements of SOLAS chapters VI and VII as well as the requirements prescribed in IMO MSC Circ. 745.

The manual provided guidance on securing devices and arrangements, stowage and securing of non standardised cargo as well as for the stowage and securing of containers. Details of the acceleration forces acting on containers and lashings in varying conditions with worked examples were also included.

Annexes to the manual contained plans which included: the Container Lashing Plan, Container Distribution Plan and the Capacity Plan. In the manual's introduction, reference documents are listed and the Container Lashing plan is included; this was the plan that was displayed on the bulkhead in the ship's cargo office.

However, no mention is made in the manual's introduction to the Container Distribution Plan; this is unfortunate as the only reference held on board the vessel to the specific requirements for lashing 30 foot containers in hold number 3, are shown on this plan. At the time of the accident, this plan was not on display in the ship's office.

Some container vessels post local lashing diagrams on deck adjacent to the loading bays to assist the crew in identifying the correct lashing requirements. There were no local lashing diagrams on *Annabella.*

It is possible that if such diagrams had been displayed in the ship's cargo office and adjacent to the holds, the requirement for lashing 30 foot containers in the hold might not have been overlooked.

2.5 VESSEL'S GM

Annabella's cargo securing manual included a section on the vessel's GM under the heading of "Important Remark" **(Annex 2)**. This highlighted that the stowing and securing system on *Annabella* was designed under the condition of a maximum GM and stated that if, for any reason, the vessel was to be operated at larger GM values, the expected acceleration forces acting on the containers would increase accordingly.

The section also stated that if a GM value greater than the designed GM value cannot be avoided, a reduction of stack weights or stack heights, or weight concentration to the lower tiers should be considered.

The use of computer programmes "to give the crew the possibility to calculate special loading cases" is recommended to the shipowner, as is "the use of lashing software by the ship's preplanners ashore".

At the time of the accident, the vessel's GM was 1.68m; the lashing recommendations made in the cargo securing manual were based on a GM of 0.8m.

Analysis of the vessel's GMs for voyages from January 2007 (Table 1) shows that the GM exceeded 0.8m throughout this period, and was noticeably larger when sea ice was present in the Baltic. This resulted from the vessel having to increase the amount of water ballast carried in her double bottom tanks.

The implications of the vessel sailing with a GM higher than the value used as the basis for the vessel's cargo securing manual do not appear to have been recognised by either the vessel's crew or the charterer's operational staff.

Calculations undertaken after the accident, by the shipbuilder, indicate that the effect of the increased GM for the voyage was to reduce the maximum stack weight allowed in number 3 hold to 90 tonnes, from the figure of 150 tonnes quoted in the cargo securing manual for a GM of 0.8m. Even this lower figure assumes that lashing bars would be in place on the lower containers of the stack.

The fact that the vessel's GM would, of necessity, increase as a result of the additional ballast required when navigating in ice does not appear to have been considered when planning the stowage and lashing requirements for the cargo. It would have been appropriate for the crew to have access to the requisite reductions in allowable stack weights, heights and securing requirements for cargo stowed in the hold when operating at an increased GM.

The vessel's officers do not appear to have appreciated the impact of an increased GM on the vessel's acceleration forces. Vessels' officers must be clear on the full implications when GM is increased above the maximum figure quoted in the cargo securing manual.

The vessel's loading computer was not programmed to recalculate the stresses and lashing parameters of cargo stowed in the hold when the GM varied from 0.8m. Had this been the case, the information relating to the reduction in allowable stack weight and the requirement to lash 30 foot containers would have been available to the vessel's officers.

2.6 CONTAINER STRENGTH AND MARKINGS

The two containers stowed at the bottom of the collapsed stack of seven containers were crushed by the weight of the containers loaded above them **(Figure 13)**. The containers were of similar construction, and both had an allowable stacking weight for 1.8g of 100.5 tonnes.

Figure 13

Crushed containers

As a result of the stowage, the weight of the stack of containers placed on the lowest container was 191.22 tonnes and the weight above the second lowest was 159.14 tonnes.

The third container in the stack had an allowable stacking weight of 108 tonnes which was also exceeded by 20 tonnes.

While an individual container's capacity, strength and maintenance details are clearly marked on the CSC safety approval plate, this was of no assistance to either the planners or the chief officer in alerting them, either at the planning or loading stage, to the fact that the allowable stacking weights of the containers would be exceeded when the seven containers were stowed in number 3 hold.

This accident might have been prevented if there was a universal method for identifying containers which are rated with less than the ISO standard rating for allowable stack weights of 213.36 tonnes. ISO 1496 – 1/Amdt.3:2005(E), section 6.2 **(Annex 3)**

2.7 VESSEL'S SMS

Döhle (IoM) Ltd, the vessel's managers, had implemented a well structured safety management system on *Annabella*, which provided detailed instruction and guidance on how the vessel was to be operated.

The procedures and instructions relating to the loading and stowage of the cargo were found to be comprehensive, and provided adequate and appropriate guidance for those involved in cargo stability calculations.

However, the feasibility of the officers being able to fully comply with all the instructions as per the manual against the background of a very intensive schedule does not appear to have been taken into account.

2.8 FATIGUE

Analysis of the vessel's movements between 21 and 26 February 2007 demonstrates that *Annabella* was on an intensive and demanding schedule with relatively short sea passages between ports of call, at which the vessel frequently undertook cargo operations at several different terminals.

An MCA surveyor had undertaken an initial audit of the vessel's safety management system shortly before the accident and had issued a non conformity notice. This was because he found that the master, chief officer, chief engineer and others in the crew were, on a significant number of occasions, not achieving their statutory minimum rest periods in contravention of The Merchant Shipping (Hours of Work) Regulations 2002.

2.9 CHIEF OFFICER

The chief officer was promoted on board, from second officer, 2 months before the accident and was therefore familiar with the vessel. However, as second officer he had kept a 4 hours on, 8 hours off navigation watch at sea and a 6 hours on, 6 hours off cargo watch in port. In practice, this is unlikely to have allowed him sufficient spare time to become fully conversant with the full range of the chief officer's duties or the full details of the vessel's cargo securing manual and its various annexes, before he took over as chief officer.

As chief officer, he kept a 4 hours on, 8 hours off, navigational watch during the vessel's relatively short sea passages and then played a key role in all aspects of the vessel's cargo operations whilst in port. With the vessel operating such an intensive schedule this resulted in him, on occasions, not being properly rested, as evidenced by the non conformity notice issued by the MCA surveyor, and his performance is therefore likely to have been impaired through fatigue.

Annabella had not carried 30 foot containers before he was promoted to chief officer, and he was not made aware of the special requirements for their carriage and securing. Further, these requirements were not readily apparent in the annexes to the cargo securing manual.

On this occasion, the vessel's loading computer had not been programmed for the stowage and securing of 30 foot containers loaded into the hold. For a vessel on an intensive schedule and with a heavy workload, the chief officer should have been able to rely on the computer system to assist him in all aspects of analysing the stowage plan, and provide him with advice on lashing requirements as well as on stability.

The consequences of the vessel having a GM greater than the value of 0.8m, which was the basis for the guidance contained in the cargo securing manual, were not appreciated by the chief officer. He did not take into consideration the requirement to reduce stack weights and increase lashings when GM is increased. However, he was not assisted by *Annabella*'s loading computer programme which was not programmed to provide stack weight or lashing variations for different GMs for cargo stowed in the hold.

The fact that the lower containers in the stack were limited to a maximum allowable stacking weight of approximately 100 tonnes could not have been identified by the chief officer from the information available to him when checking the stowage plan before loading commenced.

In this environment, where speed of operations is the imperative, the chief officer is unlikely to have the necessary influence to be able to stop or slow the operation while he makes a detailed check of all aspects of the stowage plan or of individual containers. Without such a check, it is inevitable that errors made during the planning/loading process will be undetected.

2.10 NOTIFICATION TO COASTAL STATE

The accident was discovered at 0830 on 26 February 2007. The master took prompt and effective action to ensure the safety of his crew by mustering and briefing them on the accident. He also introduced prudent control measures by posting notices detailing the IMDG class 2.1 cargo in the damaged containers, restricting access to the main deck, rigging fire hoses and imposing a no-smoking regime.

The master advised the ship managers and charterer of the accident, by email, at 1050 and 1102 respectively. However, he did not inform the nearest coastal state of the accident and the Finnish authorities were first advised of the accident by the vessel's local insurance representative at 1400, 5.5 hours after the collapsed stow had been discovered.

The master should have reported this accident to the coastal state authorities as soon as possible after discovery. This would have given the authorities sufficient time to plan an appropriate response and also, in the event that the situation on board had deteriorated, the vessel would then have been able to receive timely and effective support from the shore authorities.

2.11 SIMILAR ACCIDENTS

There have been several accidents within the last 18 months involving the collapse of stacks of containers, mainly as a result of heavy weather, in which cargo containers have been lost overboard. The MAIB investigated the loss of containers from the *P&O Nedlloyd Genoa*, which occurred in January 2006 and concluded, inter alia:

- Stow plan errors were not identified by the company planners, the loading terminal or the chief officer of the vessel.
- Planners had exceeded the maximum stack weight limits in stacks on the vessel.
- The cause of the collapse was probably due to a significant increase in downward compression and racking forces on the bottom container in the stack.
- Although the vessel's loading computer met Flag State requirements, it provided limited facilities to the chief officer, who was expected to conduct a full analysis of the proposed stow.
- The ship managers, as part of their ISM internal audit regime, should check not only that its instructions are understood, but also that they are achievable with the manpower available in the turn round times allotted.

2.12 INDUSTRY CODE OF BEST PRACTICE

Unlike in other sectors of the international shipping industry, there is currently no dedicated trade organisation which routinely provides guidance on best practice for the container industry. Working practices relating to the planning, loading, transportation and discharge of containers are largely unregulated and have been understandably focussed on the need to maximise efficiency and speed of operation. While key industry players will attest that safety is of paramount concern, evidence obtained during this and other MAIB investigations into container shipping accidents suggests that in reality, the safety of ships, crews and the environment is being compromised by the overriding desire to maintain established schedules or optimise port turn round times.

Many container ship and port operators have developed in-house working practices that effectively combine efficiency with safety. To avoid accidents in the future, there is a compelling need for the key industry players to work together and agree on what constitutes accepted safe working practices and incorporate these into an industry code. The code would serve as a benchmark for ship operators, charterers and port operators providing them with guidance on the minimum standards expected of companies who might wish to operate in this sector.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT WHICH HAVE RESULTED IN RECOMMENTATIONS

General

1. There is a clear need for an Industry Code of best practice. [2.12]

Factors relating to the vessel

2. The master has ultimate responsibility for the safety of his vessel [2.2.1]

3. Class approval of the vessel's loading computer system did not include the integrated container and lashing modules or any dynamic stability incorporated in the programme, thereby contributing to the programming error not being detected and providing the chief officer with no assistance or guidance for the stowage and securing of 30 foot containers. [2.2.4]

4. Ship's staff did not have access to the requisite reductions in allowable stack weights, heights and securing requirements for cargo stowed in the hold when operating at an increased GM due to the additional ballast required when navigating in ice, resulting in them not being taken into account in the planning process. [2.5]

5. The vessel's managers do not appear to have taken into account the feasibility of the vessel's officers being able to fully comply with all SMS instructions as per the manual against the background of a very intensive schedule, resulting in the requirements not being fully met. [2.7]

6. The chief officer's hours of work and rest before being promoted is unlikely to have allowed sufficient spare time for him to become fully conversant with the full range of the chief officer's duties or the full details of the vessel's cargo securing manual and its various annexes before he took over as chief officer. [2.9]

7. The vessel's intensive schedule resulted in the chief officer, on occasions, not being properly rested, and his performance is therefore likely to have been impaired by fatigue. [2.9]

8. The chief officer was not familiar with the carriage and securing of 30 foot containers before he was promoted to chief officer. [2.9]

9. The special requirements for the carriage and securing of 30 foot containers were not readily apparent in the annexes of the cargo securing manual. [2.9]

Factors relating generally to the loading operations

10. Changes to the loading plan made by the terminal must be fully communicated to the ship's staff. [2.3]

11. Where speed of operations is the imperative, the chief officer is unlikely to have the necessary influence to stop or slow the operation while he makes a detailed check of all aspects of the stowage plan or of individual containers. Without such a check, it is inevitable that errors made during the planning/loading process will be undetected. [2.9]

12. There is no universal method for identifying containers which are rated with less than the ISO standard rating for allowable stack weights of 213.36 tonnes, resulting in neither the planners nor the chief officer being alerted, either at the planning or loading stage, to the fact that the allowable stacking weights of the containers would be exceeded when the seven containers were stowed in number 3 hold. [2.6]

Factors relating to the planners

13. No system exists for appropriate lessons to have been learnt from the previous occasions at which the planners had been alerted that the stack weight limits had been exceeded, contributing to the charterer's loading computer programming error not being detected. [2.2.2]

14. The charterer's loading computer system had not been independently examined, contributing to the programming error not being detected. [2.2.3]

15. The cargo planners had no access to the detailed information contained in *Annabella*'s stability information and cargo securing manual and therefore the operational restrictions contained in these documents were not taken into account during the planning process. [2.2.2]

3.2 SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION WHICH HAVE RESULTED IN ACTIONS TAKEN

Factors relating to the vessel

1. Relevant lashing diagrams were not displayed in the ship's office or adjacent to the holds, contributing to the requirement for lashing 30 foot containers being overlooked. [2.4]

3.3 SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION WHICH HAVE NOT RESULTED IN RECOMMENDATIONS

1. The master did not report the accident to the coastal state authorities directly as soon as possible after discovery, potentially delaying timely and effective support from the shore authorities . [2.10]

SECTION 4 - ACTIONS TAKEN

4.1 DÖHLE (IOM) LTD

The shipmanagers have taken the following actions since the accident:

- Increased the manning by placing an additional deck cadet, capable of acting as lookout, on the vessel.
- Rectified the error in the vessel's loading computer programme to ensure that 30 foot containers will now be recognised.
- Posted the Container Distribution Plan in the ship's office.

4.2 UNIFEEDER A/S

The charterers have taken the following actions:

- Instructed all their chartered vessels that stack heights of 30 foot containers will be limited to a maximum of 3 high.
- Reprogrammed their computer software to ensure that it recognises 30 foot containers.

SECTION 5 - RECOMMENDATIONS

The International Chamber of Shipping (ICS) is recommended to:

2007/176 Work with industry to develop, then promote adherence to, a best practice safety code to ensure that (inter alia):

- Effective communications and procedures exist between all parties involved in the planning and delivery of containers to ensure ship's staff have the resources and the opportunity to safely oversee the loading and securing of cargo.
- Cargo securing manuals are comprehensive and in a format which provides ready and easy access to all relevant cargo loading and securing information.
- Loading computer programmes incorporate the full requirements of a vessel's cargo securing manual. Such computers should be properly approved to ensure that officers can place full reliance on the information provided.
- The availability or otherwise of a reliable, approved, loading computer programme is a factor to be included in determining an appropriate level of manning for vessels on intensive schedules.
- The resultant increase in acceleration forces and consequent reduction in allowable stack weights when a vessel's GM is increased above the value quoted in the cargo securing manual is clearly understood by vessels' officers. The consequential effect on container stack weight, height and lashing arrangement for changes in the vessel's GM should be readily available and clearly displayed to ships' staff.
- Those involved in container operations are aware that containers with allowable stack weights below the ISO standard are in regular use and must be clearly identified at both the planning and loading stages to avoid the possibility of such containers being crushed.
- With respect to cargo planning operations:
  - cargo planners have appropriate marine experience or undergo training to ensure ship safety considerations are fully recognised
  - cargo planning software provided is able to recognise and alert planners to the consequences of variable data e.g GM, non standard container specifications
  - lessons learned from problems identified during container planning operations are formally reviewed and appropriate corrective measures put in place
  - ships' staff are provided with sufficient time to verify/approve proposed cargo plans.

Döhle (IOM) Limited is recommended to:

2007/177 Ensure that, on promotion to senior rank, deck officers receive sufficient familiarisation so as to be fully conversant with the contents of the vessel's cargo securing manual before taking responsibility for loading and securing cargo.

2007/178 Carefully consider the demands imposed on its crews by the loading schedules of vessels within its fleet to ensure manning levels are appropriate, such that the requirements of the company's safety management system can be fully met.

Unifeeder A/S is recommended to:

2007/179 Revise its current operating procedures to ensure lessons learned from problems identified during container planning operations are formally reviewed and, when appropriate, corrective measures put in place.

Marine Accident Investigation Branch
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