INTERNATIONAL COUNCIL FOR
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Fish Capture Committee

SAFETY ASPECTS IN REDESIGNING MEDIUMSIZED BEAM TRAWLERS

by

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Abstract

Unlike merchant marine vessels, safety regulations for fishing vessels have been mainly left to the discretion of each national administration.
Learnt from bitter experiences the global safety aspects (stablility, equipment) have been improved in the last decades for the Dutch beamtrawlers, however the personal safety aspects (working conditions) are still a matter of free and/or competitive interest for the shipyard/designer and skipper-owner.
Although a national working condition law, the so called Arbo-law, is approaching the Dutch fisheries.
Without going in details, but with emphasis on safety integrated vessel designing, in this paper three pressing groups of personal safety aspects will be discussed and the state of the art of the research activities given, viz. bridge-, decklayout and noise control. Because safety problems are always occurring on neighbouring fishing vessels, attention is paid to a new research methodology in this field, developed by the Safety Science Group of the Delft University of Technology and applied to beamtrawler design in close co-operation with RIVO as fishery expert consultants. Only then clear insights will be get in redesigning beamtrawlers on these aspects.

Contents

1. Introduction

Shipsafety means freedom from danger or risk for crew, ship and environment. Unlike merchant marine vessels, trading internationally for which safety regulations is compulsory (international certificates), safety regulations for fishing vessels have been left to the discretion of each national administration depending on the applied fishing methods, fishing grounds and fishprocessing.
The special operating conditions and design of the Dutch beamtrawlers (enclosure 1) create a situation involving various potentional dangers, particularly as regards intact stability which could cause accidents resulting in capsizing due to bottomnets fastening on one side (shipwrecks, stones etc.) After many capsize accidents in the sixties, the stability requirements for beamtrawlers increased considerably, described in the Dutch Regulations "Voorschriften voor Vissersvaartuigen 1970"
Besides these **global safety aspects** in beamtrawler design, also rules have been drafted concerning safe navigation, life-saving and fire-fighting equipment as well as preventing oil pollution.

However safety directly linked to working conditions, the **personal safety**, is still a matter of free interest of the shipyard/designer and the skipper-owner.
No mandatory rules have been drawn yet, although a new EEC- and national working condition law, the so-called Arbo-law, have entered the Netherlands, which may be expected to become also compulsory onboard fishing vessels in the nineties. In this Arbo law several fundamental safety principles of proper cooperation between employee and employer are given aiming healthier and safer working conditions.
Due to a lack of budget and manpower RIVO has only approached the personal safety aspects on ad-hoc basis and step by step.
Anticipating the Arbo-law and proceeding from the general safety design principles an safety integrated beamtrawler design method is then inevitable. On account of a number of personal safety and health requirements can be generated for beamtrawlers matching as far as practicable, with no radical changes in the beamerlayout and a systematically analysis of all factors touching the fishing operations at sea.

In the present days no one can longer accept human injuries and losses in onboard accidents as unavoidable fatalities. Of course it is clear that also beamtrawlers can't be built intrinsically unsinkable and full safety-proven within the economical constraints.

2. Safety aspects onboard Dutch beamtrawlers.

When in the sixties, the Dutch fisheries started to implement the beamtrawl fishing method on existing fishing vessels, a lot of casualties occurred. On the one hand side capsizings due to hampering of the nets to bottomobstructions on the other hand personal injuries due to gear handling onboard a moving working platform at sea.
For the first problem increased intact stability requirements have been worked out, and fishblock sliplines have been dictated. However the stability requirements are based on still water calculations integrating some safety margin for operating in seaways (beamtrawler metacentric height is 20% higher than for regular fishing methods, but at least 0.60 m). Because one of the major causes of capsizings was the lack of watertightness new rules have been drafted, also with regard to the necessary crew's certificates.
Besides to increase the manoeuvrability during fishing and to avoid rapidly bottomobstructions, the towing point of the fishing lines moved forward, giving the beamtrawler the nowadays characteristic layout.
Derived from the international Safety of Life at Sea Conventions (SOLAS), the Dutch safety regulations for beamtrawlers are only concerning the design, construction and equipment (fire-fighting, life-saving), the so-called **global safety aspects**. These

aspects have already been integrated in the beamtrawler design and building since 1970. (Encl. 2, state of the art of fishing vessel safety requirements).

Another group of safety aspects are concerning the **personal safety** of the crew, to which hardly any mandatory regulations have been drafted for beamtrawlers. Learnt by (bitter) experiences, skipper-owners and (shipyard) designers improved these safety aspects step by step, as far not intervening too much with the daily fishing and building practice.
Of course various safety and working conditions have been realized so far, but for safeguarding the crew's life and health much research work is still to be done.

Inherent to the traditional beamtrawler layout and fishprocedures, three groups of safety design aspects immediately draw the attention:

- **bridge layout**
- **deck layout**
- **noise control**

2.1. Bridge layout.

Profitable fishing and bridge layout are closely connected. The beamtrawler bridge is the nerve center for gear handling, fish finding and fishing but also for supporting functions as navigation, communication and engineroom control. Because the Dutch skipper-owner only wants a minimum crew, various bridge tasks have been automated and controlled in the one-man wheelhouse.
Although nearly every skipper considers his bridge layout as the optimum one, from an ergonomic and safety point of view the location of instruments and equipment still have to be improved.

2.1.1. Location of instruments and equipment.

In fig. 1 and enclosure 3 the wheelhouse layout of a modern representative beamtrawler have been given, based on historical functions and interaction between the skipperowner and shipyard for many years.
Different from the (merchant) marine, the Dutch beamtrawler skipper is also the owner and very eager to invest in new instruments, especially regarding fish finding and catch improving new technics.
Due to the fast developments in the chip-and informatic technology, various computerised navigating-, communication-, engineroom control- and fishfinding electronics entered the fisheries, to which for the beamtrawlers the topics are:

- navigation and communication equipment (to prevent hampering on bottomobstructions).
- propulsion and auxiliary machineries (designed for maximum towing of the two bottomnets and bridge controlled engine room).
- fishing gear handling (bridge control).
- fish processing equipment (mechanization, automation).

Especially with bridge electronics (such as color video plotter (= electronic chart), color echosounders and satellite navigator) and automated engineroom control, the beamers are far ahead on the merchant marine.

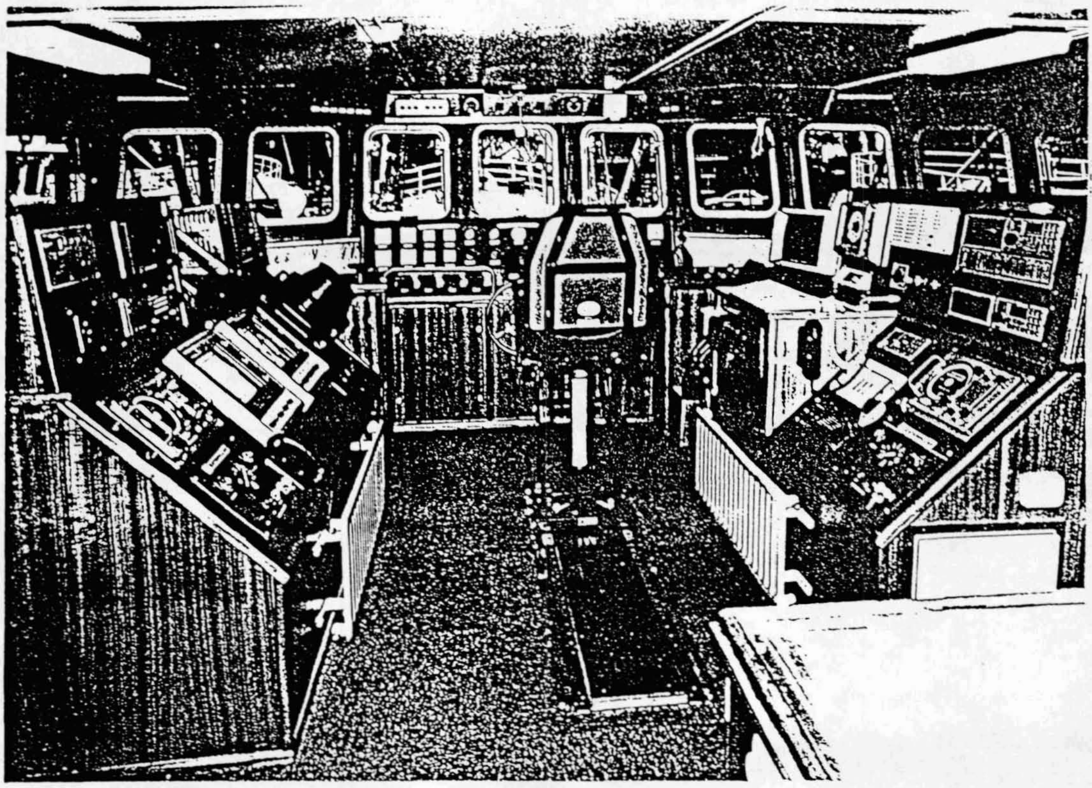

Fig. 1 Bridge layout modern beamtrawler.

The opposite side of all these modern bridge electronics is the redundancy in data, alarms and information, which the skipper should interprete at the same time. This is detrimental to the safety, efficiency and well being of the bridge personal.
Data supplied by the Dutch Shipping Council show an increase of the role of fishing vessels in collisions at the North Sea during the last decade (25%).
Analysis of these accidents learns misinterpretation of bridge electronics and much side activities which are not included in the actual bridge tasks.
Besides collisions with overtaking and crossing vessels are caused by a poor visibility from the bridge.

2.1.2. Vision Lines (360° field of view).

Because the beamtrawlers are towing two bottomnets with a speed of 4-7 knots, suddenly course changes are regularly taking place. So there should be a good field of view around the vessel, obtained by the skipper moving within the confines of the wheelhouse. Looking at the traditional beamer layout a number of design factors are limiting this. For example owing to the increased intact stability requirements, the designer is not free to place the wheelhouse high enough above the deck-levels.

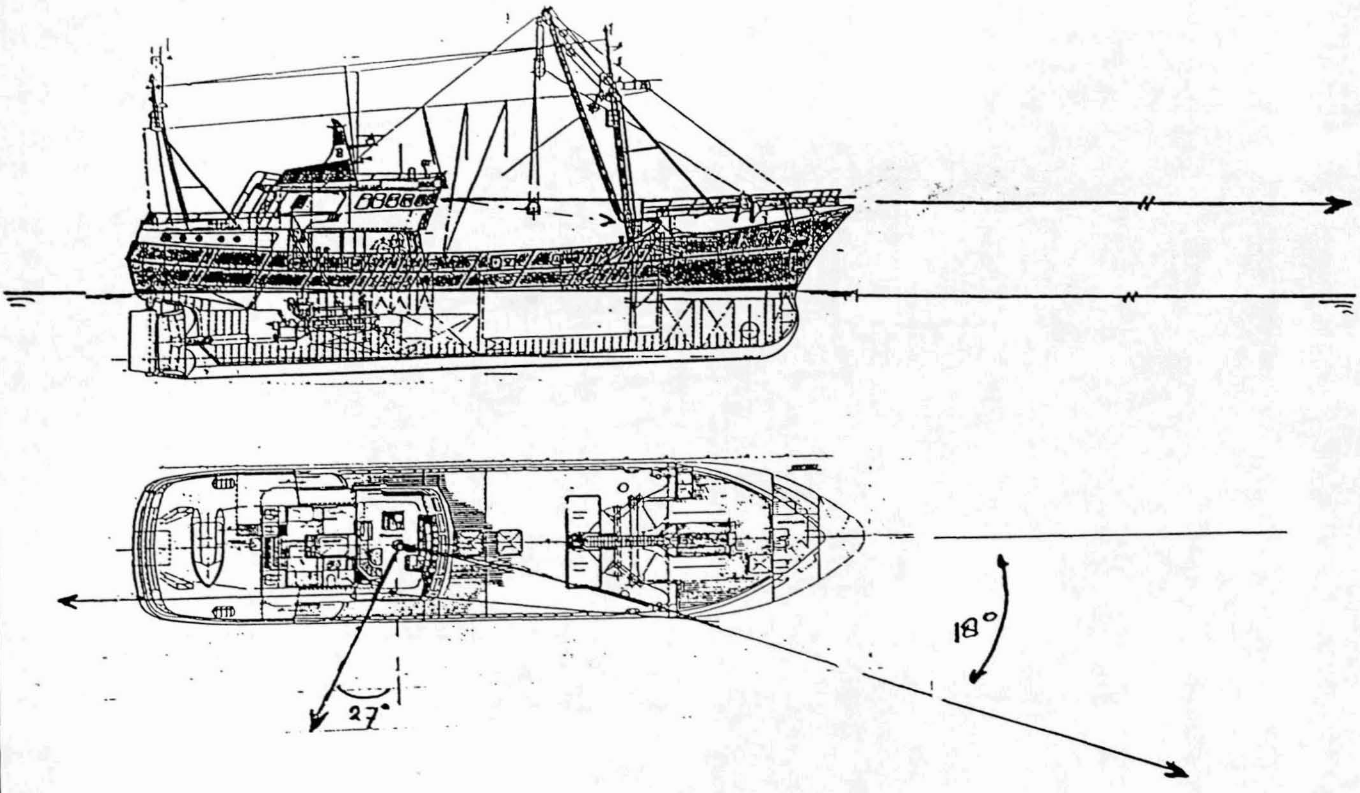

Fig. 2 Forward and aftward view.

The aftward view has also a large blind sector due to the layout of the skipperscabin on the same wheelhouse deck.
The total arc of blind sector is very large and should be reduced by carefully redesigning of the general layout, preferably within the constraints of the very effective beamtrawling practice. The main brigde taks are related to the profitability during the fishing week: gear handling (shooting, hauling) and bottomobstacle avoidance (navigation), while engineroom control and communication are considered as subtasks.

2.1.3 Research activities (follow-up).

Although the general wheelhouse layout and beamer fishing process is quite similar, every skipper prefers his own location of instruments and equipment based on his own experiences and the traditionally beamtrawler layout.
After finishing the state of the art studies regarding location of bridge electronics and controls (1989), a system approach of ergonomics should be conducted as well as the application of use scenarios and hazard patterns. With regard to the ergonomic point of view, much can be learned from and co-operation should be sought with the TNO Institute for Perception (Soesterberg, the Netherlands), where much experiences have been gained during contract-research studies for the merchant marine wheelhouse of the nineties (ref.). By means of accident analysing and simulator experiments (mock-up's) the feasability of single-handed bridge operation in a conventional and an automated bridge have been investigated (1986).

Concerning use scenarios and application of a cognitive model for human error theories, the already started cooperation with the Safety Science Group (Delft University of Technology, The Netherlands) should be continued. This safety science group has developed a method which structures the input of safety in the design process (ref.).

The basis of this methodology is the study of the undisturbed as well as the disturbed use processes, using simultaneously a retrospective approach (analysing accidents) and a prospective approach (use scenarios). In the undisturbed use process the actual use will be compared with the designed use to find out whether the use was foreseen in the design phase and whether the actual users were the target group as defined by the designer. By means of use scenarios and various disturbed use processes a range of potentional solutions (redesigning) can be investigated.

If the co-operation will be successfully in both research fields, financial support is inevitable.
Since a year a bridge research proposal (mock-up's) has been presented to the National Foundation for the Coordination of Maritime Research in the Netherlands, while a EC-proposal (France, Netherlands) will be prepared and sent to Brussels this year.

Research activities concerning vision lines will be integrated in the deck layout studies.

2.2 Deck layout.

The characteristic layout is a single deck hull with an extended forecastle and aftward the superstructure with the accomodation, wheelhouse and winchroom. The midship section of the maindeck is a teakwood covered working deck for fish gear handling, beamtrawl storage and a catch collecting pound (pit). The fresh fish processing mainly takes place in the forecastle. To which extent fish processing equipment is fitted depends on the skipper-owner and stability requirements. However this lastmentioned aspect is neglectable for newbuilding vessels.
After processing, the fish will be temporary stored in a chute in the fishhold (0°C), after which the crew will fill the 40 kg fishboxes with fish and crush ice and manually stock up the boxes up to 4-5 high.
From the wheel house the skipper has a good view on the working deck, where every 2-3 hours the codends will be emptied in the pits during the weekfisheries.

2.2.1 Deck equipment.

In fig. 3 a representative catch handling system on a modern trawler is given.

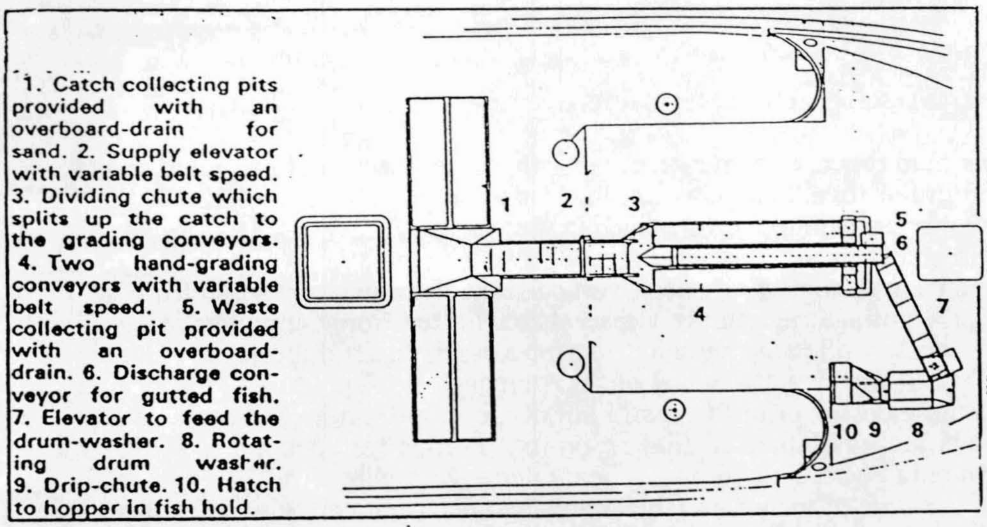

Fig. 3. Catch handling beamtrawler.

The advantage of these machines (to handle and process fish) is that the crew will no longer have to pick up fish from the deck and the movement of fishboxes will be minimised, however still necessary in the fishhold.
This and the emptying of the codends in the pits (every two hours hauling/emptying/shooting) means heavy labour for the 4 crewmembers on deck, to which the skipper controls the winches, from the bridge.
In co-operation with the Technical University Delft Safety Science Group and granted by the Directorate of Labour, in 1988 a two year study has been started to investigate the safety onboard the working deck of beamtrawlers. In the first place by means of analyzing the dominant causes of occupational accidents as reported by the Dutch Shipping Inspectorate as well as reported by the Radio Medical Services (Scheveningen Radio, fig. 4).
Besides in order to determine the safety problem areas, the beamer working conditions will be described extensivily and use scenarios will be applied, the safety problem solving methodology as developed by the already mentioned Safety Science Group (ref.).

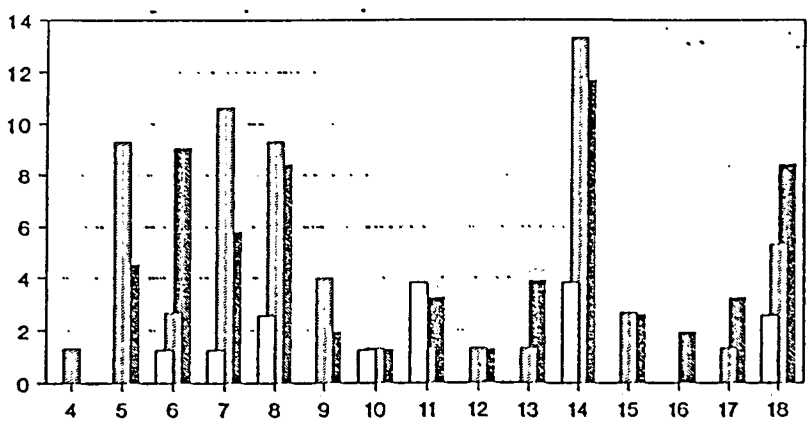

Fig. 4. Reported onboard accidents by Radio Medical Services.
5= jamming between fishing gear and shipconstructions
6= broken fishing gear components.
14= slipping on deck.

2.2.2. Vertical /lateral accelerations.

As mentioned in par. 2 to prevent beamtrawler capsizings the intact stability requirements had been increased in the seventies. This implies for the overpowered, relatively short vessels a adverse worse seakeeping performance in the North Seas.
Not with regard to maintaining the fishing speed in bad weather (4-7 knots), but especially regarding the human performance (vertical, lateral acceleration and roll).
For passenger vessels limiting criteria have already been drafted from the point of view of comfort and seasickness, while for merchant marine vessels criteria are recommended with regard to safety and working efficiency of ship personel.
For fishing vessels these design criteria are still out of the scope and no full-scale data or model tank best data are available. So that recommendations for acceptable levels of beamer motions can only be defined on basis of experiences elsewhere (ref.)
Having any idea of the state of the art, in table 1 and 2 some criteria are given. From own experiences the vertical accelerations below the forecastle deck (fish processing) are sometimes more than 1 x g (=9.81 m/s^2, acceleration of gravity).

Vert. acc. rms	Description
0.275 g	Simple light work. Most of the attention must be devoted to keeping balance. Tolerable only for short periods on high speed craft. Connolly (1974), Bakenhus (1980).
0.2 g	Light manual work to be carried out by people adapted to ship motions. Not tolerable for longer periods. Causes fatigue quickly. Mackay & Schmitke (1978), Applebee & Baitis (1984).
0.15 g	Heavy manual work, for instance on fishing vessels and supply ships.
0.1 g	Intellectual work by people not so well adapted to ship motions. For instance scientific personnel on ocean research vessels (Hutchison & Laible, 1987). Work of a more demanding nature. Long-term tolerable for the crew according to Payne (1976). The International Standard ISO 2631/3 (1986) for half an hour exposure period for people unused to ship motions (Figure 4).
0.05 g	Passengers on a ferry. The International Standard for two hours exposure period for people unused to ship motions. Causes symptoms of motion sickness (vomiting) in approximately 10% of unacclimatized adults. Goto (1983), Lawther & Griffin (1985).
0.02 g	Passengers on a cruise liner. Older people. Close to the lower treshold below which vomiting is unlikely to take place. Lawther & Griffin (1985).

Table 1 Limiting criteria with regard to vertical acceleration.

Root Mean Square Criterion			Description
Vert. acc.	Lat. acc.	Roll	
0.20 g	0.10 g	6.0°	Light manual work
0.15 g	0.07 g	4.0°	Heavy manual work
0.10 g	0.05 g	3.0°	Intellectual work
0.05 g	0.04 g	2.5°	Transit passengers
0.02 g	0.03 g	2.0°	Cruise liner

Table 2 Criteria with regard to accelerations and roll.

2.2.3 Research activities (follow-up).

After finishing the analysis phase of the contract research project "Safety and working conditions onboard beamtrawlers", a solution matrix will be generated to redesign the decklayout. Then use scenarios can be selected with respect to the safety problem to prevent introducing new risks and hazards in application of the potentional solutions.
At the same time fishery teaching methods will be developed in co-operation with the Dutch fishing schools, proceeding from the French experiences of the last years (EC-projects).
Above mentioned research project will be finished in 1991.

With regard to the seakeeping performances, together with Marin (modelbasins, Wageningen, The Netherlands) a proposal has been made for beamer model sea tank tests and already presented to the National Foundation for the Coordination of Maritieme Research, but without result up to now.

In the meantime it appears that application of bulbous bows to the recently built beamers, improves the ship motion during fish handling in the forecastle.

2.3 Noise control.

One of the main ergonomic elements of the man/ship system is the environmental aspect on board, such as climate, acceleration levels, noise and vibration. Optimising the system output of the beamtrawlers implies reduction of the high noise levels, directly improving the safety and well-being of the crew. Too high noise levels make verbal communication and hearing of audible alarms difficult (safety) and cause incurable hearing damage, fatique and stress (health, well-being). Although there are no Dutch or international noise level requirements for fishing vessels, an increasing number of beamer skipper-owners asks for an acceptable acoustical environment in the working and living spaces. With reference to the ship acoustical experiences on board the larger Dutch vessels, nowadays noise levels of 60-65 dB(A) are be considered as acceptable in the accommodation spaces and even required for the merchant marine vessels (IMO noise limit requirements)

2.3.1 Noise levels.

In the past five years RIVO has been taken noise measurements onboard ca. 50 beamers during sea trials as well as during fishing. Initially as decibel noise readings with a A-weighing filter and later also octave band analyses while the measurements have been carried out in accordance with the Recommendations of the Dutch Shipping Inspectorate for merchant vessels. In fig. 4 the noise reading of a representative 1500 kW beamtrawler has been given. In dB (A) readings for the steaming condition and in the following locations:

(1)	messroom/galley	(75-80 dB(A))
(2)	accomodation	(75-82 dB(A))
(3)	wheelhouse	(70-77 dB(A))
(4)	engineroom	(107-112 dB(A))

Between parenthesis the major and state of the art measurements are mentioned.

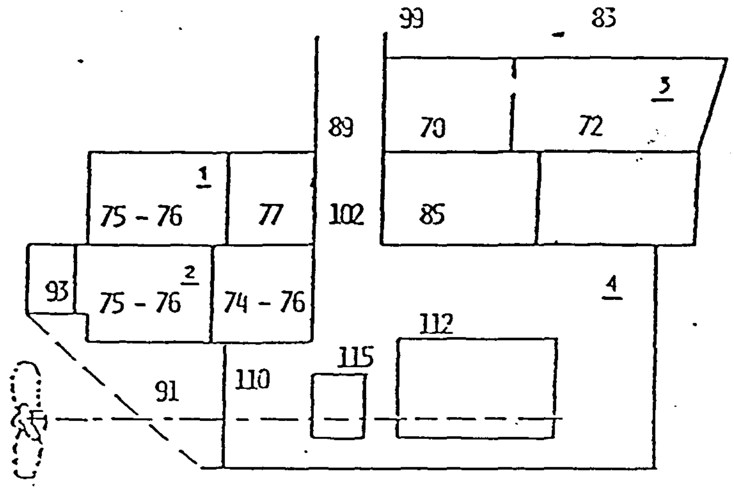

Fig. 4 Noise measurements onboard a 1500 kW beamtrawler in dB(A).

With reference to the IMO and Dutch SI noise limits of 60-65 dB(A), the beamer noise readings are 10-15 dB(A) higher for the working and living spaces.

2.3.2 Noise control packages.

In co-operation with the Ship Acoustic Department of the Institute of Applied Physics TNO-TH (Delft, the Netherlands) RIVO have been drafted economical noise control measures (ref.). The basis for this were extensive sound pressure and source velocity levels measurements, investigating the airborne and structure borne sound transmission paths (fig. 5) and the relative contributions of the dominant noise sources (propulsion machinery, propeller, diesel generator sets).

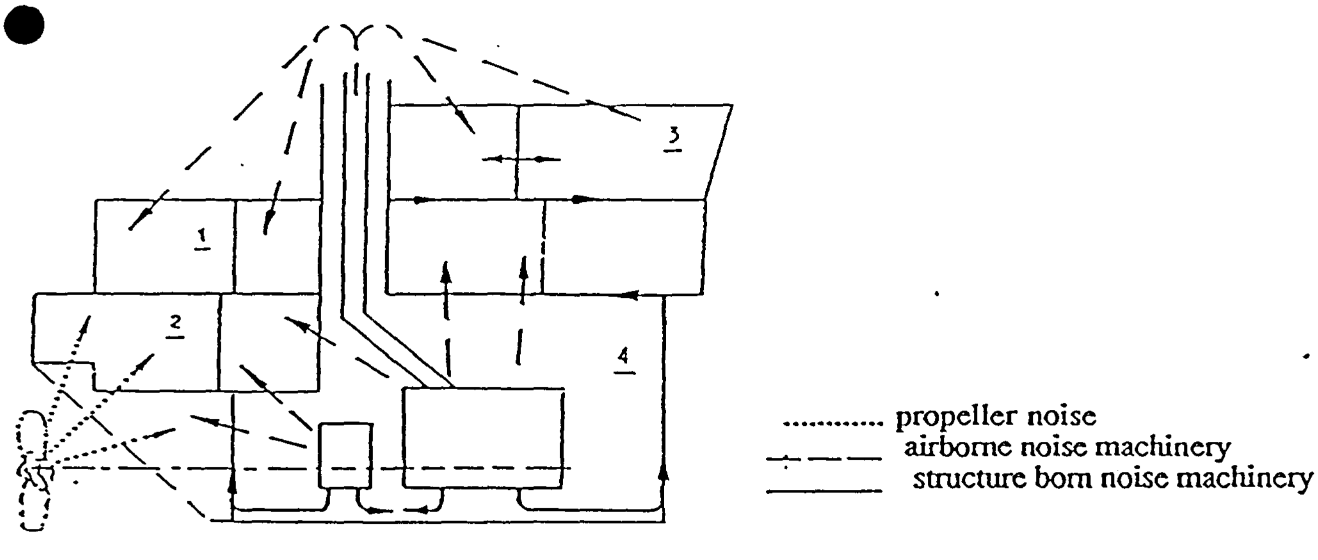

Fig. 5 Sound transmission paths onboard beamtrawlers.

Up to now it is common beamer design practice to apply the measures mainly in the accomodation areas (receiving spaces), to which the skipper-owner doesn't want any radical changes in the general layout and machinery setup. From the acoustical point of view a very illogical arrangement:

- the most noise sensitive compartments are located between the major noise sources
- the exhaust uptakes are directly separating the machinery spaces from the working and living spaces
- the exhaust and in take openings are very closely located near the wheelhouse and accommodation.

Because of the absence of statutory noise regulations for fishing vessels four noise control packages have been designed to attain noise level limits of:

1) 75 dB(A), max 80 dB(A); for a conceptual noise level limit of 75 dB(A) only measures should be taken in the receiving spaces (semi-floating floors and absorbent material behind linings).

2) 70 dB(A), max 75 dB(A); the measures in the receiving spaces should be extended (acoustical decoupling of floors, linings and ceilings) and completed with some measures in the sound transmission paths (flexible connections between sound sources and ship constructions).

3) 65 dB(A), max 70 dB(A); extension of the measures in the receiving spaces and transmission paths and noise control at the noise sources (resiliently mounting of the propulsion diesels and diesel generator sets).

4) 60 dB(A), max 65 dB(A); for this type of fishing vessel it is almost impossible to attain noise level limits of 60 dB(A). Either radical changes are here necessary and/or very costly measures like resiliently mounting of deckhouses are inevitable.

Based on the comparative studies of the last 5 years one may conclude that also for beamtrawlers acceptable noise levels of 65-70 dB(A) are attainable for reasonable costs in relation to the total investment (1-2%), to which no radical changes are necessary.

2.3.3. Research activities (follow-up).

For this year the National Foundation for the Coordination of Maritime Research in the Netherlands forwarded subsidies to implement the above mentioned noise control packages onboard new building beamers.
However the condition is participation of at least two skipper-owners with new building plans for this year within the Dutch problems of the beamtrawler overcapacity; up to now without any result.

Only after the implementation phase one can definetely give an opinion of the (economical) attainability of the reduced noise levels onboard medium sized beamtrawlers.

3. Safety integrated beamtrawler design method.

In stead of an ad-hoc design approach for the personal safety aspects, a new beamtrawler design method has to be introduced in the Dutch fisheries, the design-spiral (fig. 5).

Up to now North Sea proven comparison-ships with step by step improvements have been the common design/building practice, characterized by a large up-scaling in the past decade.
In the new design method all different design requirements, including the personal safety aspects can be properly matched with the required fishing vessel and catch effort by the potentional skipper-owner, preferably without radical changes of the traditional layout and equipment.

The spiral is turning inward to represent an increase in accuracy (drawings, calculations) and the sectors represent the decisive design requirements for the Dutch beamtrawlers:

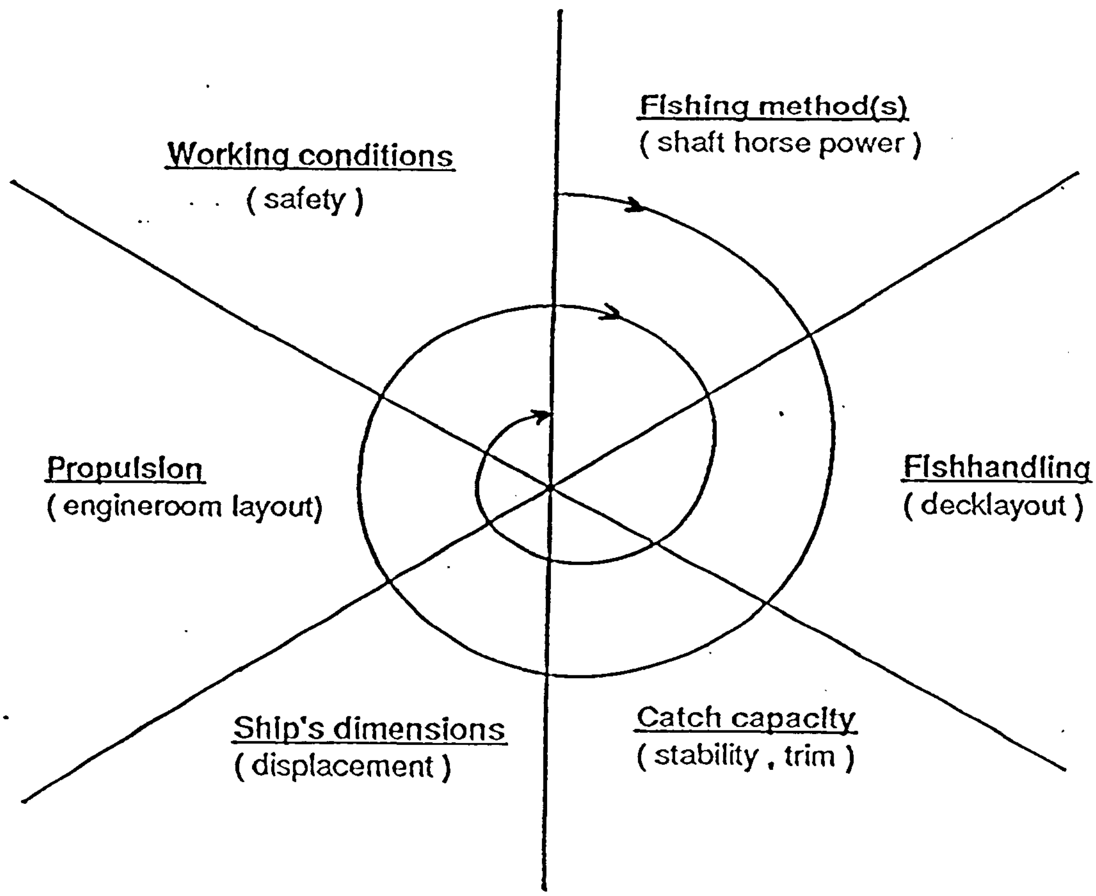

Fig. 5 Design method and requirements (Dutch seagoing beamtrawler).

- **fishing method** → **shaft horse power**
  - . fishing grounds
  - . fishing gears
  - . gear handling

- **fish processing** → **deck layout**
  - . fish quality
  - . fish storage
  - . mechanization/automation

- **catch capacity** → **stability, trim (global safety aspects)**
  - . fish hold
  - . cooling/freezing equipment
  - . weights/ballast/stores

- **ships dimensions** → **displacement**
  - . layouts
  - . manufactures/coefficients
  - . structures (strength calculations)

- **propulsion plant** → **engineroom layout**
  - . cruising/fishing speed
  - . manoeuvring
  - . auxiliaries

- **working conditions** → **safety (personal safety aspects)**
  - . sea performance
  - . shipacoustics
  - . vision lines

Because all the decisive design requirements can be properly integrated in the design, no excessive costs will be the case, also for the personal safety aspects. Important for acceptance by the skipper and crew without mandatory regulations.
This iterative design spiral is already a well known method in the merchant marine shipbuilding industries and applicable to new vessel types as well as to existing ones, also beamtrawlers.

4. Conclusions

Before safety aspects can be integrated in the beamtrawler design, good knowledge of the beamer practice is essential. Both for the global safety aspects and for the personal aspects, to which global aspects underlying many mandatory rules often learnt by bitter experiences.
However safety directed linked to the working conditions is still a matter of free and/or competitive interest of the shipyard/designer and skipper-owner, although a national working condition law has entered the Netherlands, which may be expected to become compulsory onboard fishing vessels in the nineties.
Inherent to the traditional beamer layout there are 3 groups of personal safety aspects directly to be focussed on: the bridge layout, decklayout and noise control.

Various skippers and crews are believing that safety problems in this field only occuring onboard colleagues. Carefully analysing of the state of the art, occupational accidents and longterm work-load are showing a worse situation, which only can be convincibly changed by application of the safety scenarios methodology in the redesigning process of medium sized beamtrawlers as developed by the Safety Science Group of the Technical University Delft (Netherlands). Of course this should be accompanied by cost/benefits calculations, so that the Dutch beamtrawling fisheries will get a clear picture.

Meanwhile for redesigning the bridge- and decklayout, studies and projects have already been started along these lines, while for noise control the studies have finished yet waiting for participation of skipperowners with newbuilding plans to implement the noise control packages.

Concerning vision lines and ship motion studies RIVO expects to start in the near future, depending on available research grants, nationally or EEC.

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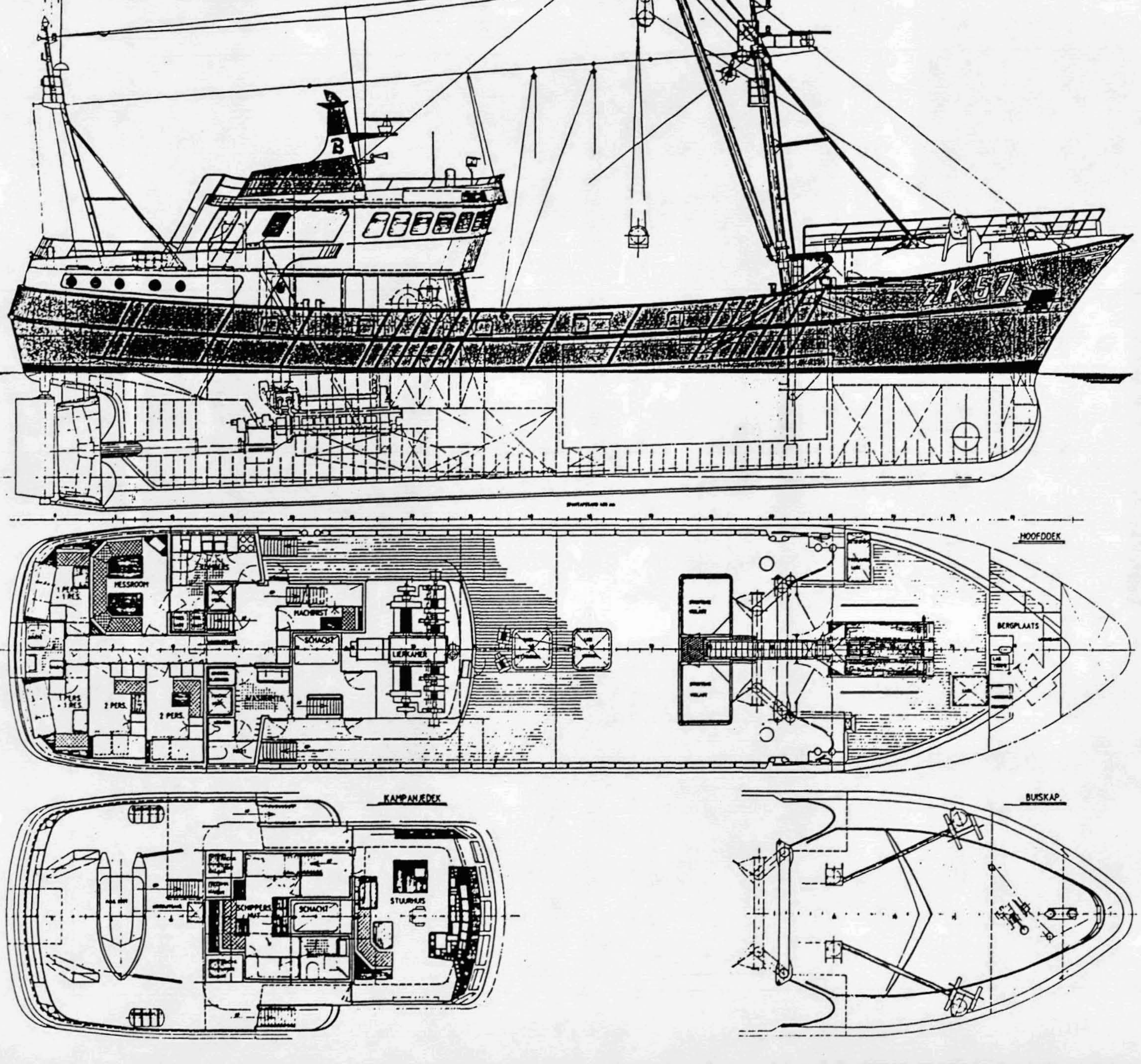


Main dimensions

Length o.a.	: 42.35 m
Length b.p.	: 37.15 m
Breadth mld.	: 9.00 m
Depth	: 5.10 m
Draft (½L)	: 4.50 m
Fishhold capacity	: ± 300 m³
Speed	: 14 kn.
Class	: Dutch Shipping Inspectorate

Tankcapacities

Fuel	: 150 m³
Fresh water	: 35 m³
Waterballast	: 22 m³

Machinery

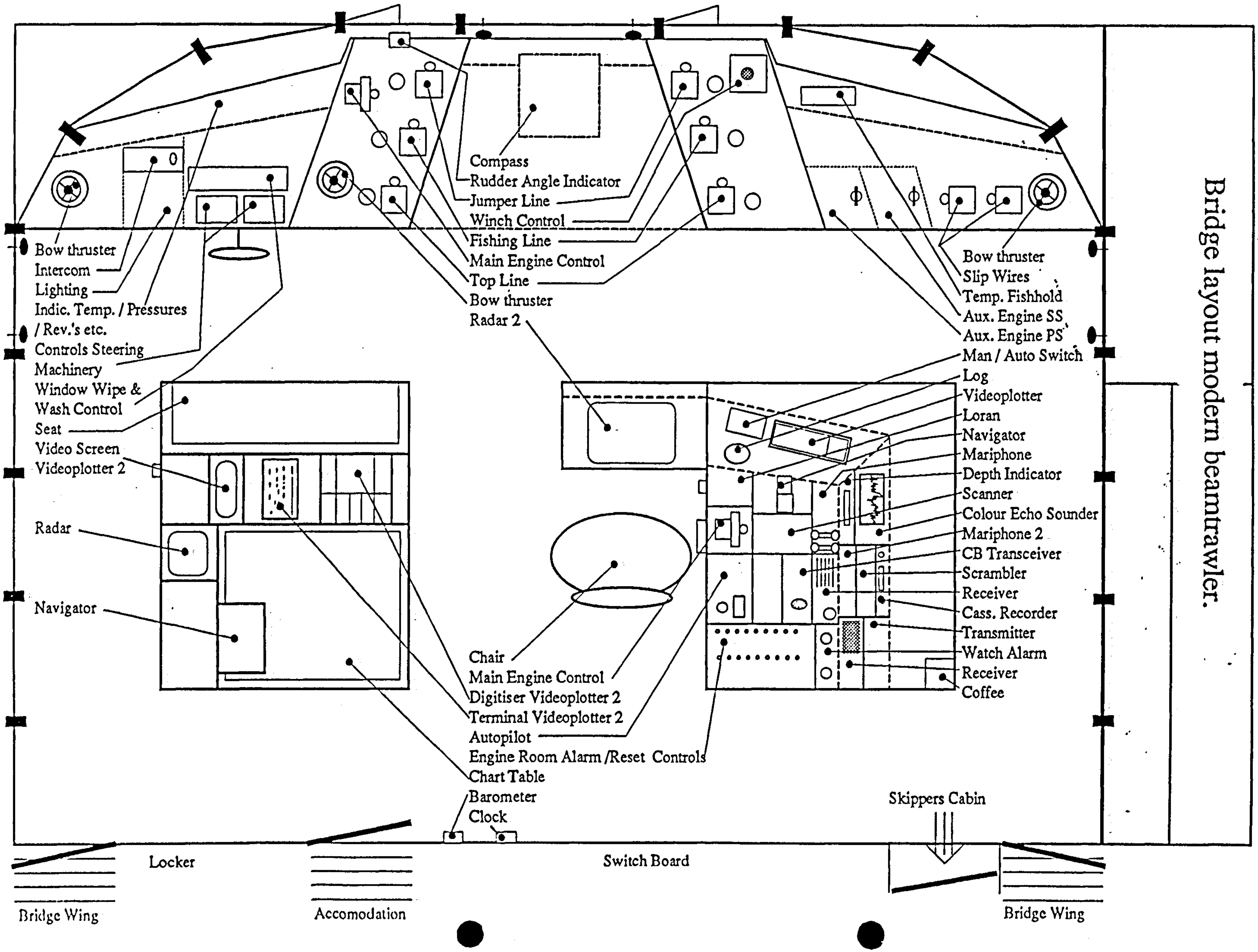
Main engine	: MAN B&W Alpha
Type	: 6L 28/32 a-d
Output	: 1470 KW/775 rpm
Flexible couping	: Holset
Type	: 855.5 Sh60
Reverse/Reductiongear	: Lohmann + Stolterfoht
Type	: Navilus GWE 45.66 S
Reduction	: 5.74 : 1
Propeller	: Lips (3200 mm)
Nozzle	: Lips
Steering gear	: Frydenbö
Type	: HS 30D
Auxiliary set (2x)	
Auxiliary engine	: Scania DSI-II
Generator	: Indar 355S, 275 KVA
Harbour set:	
Auxiliary engine	: Valmet 411 DSG
Generator	: Stamford MHC234D, 58 KVA
Bowthruster	: Lips
Type	: FT02, 950 mm
Bowthruster engine	: Indar
Type	: N250-L-b
Output:	: 100 KW
Flake-icemachine	: Buus Køleteknik
Type	: 4000 ABGHIJ
Capacity	: 4 tons/24 hours
Refrigerating plant	: Buus Køleteknik

Deck machinery

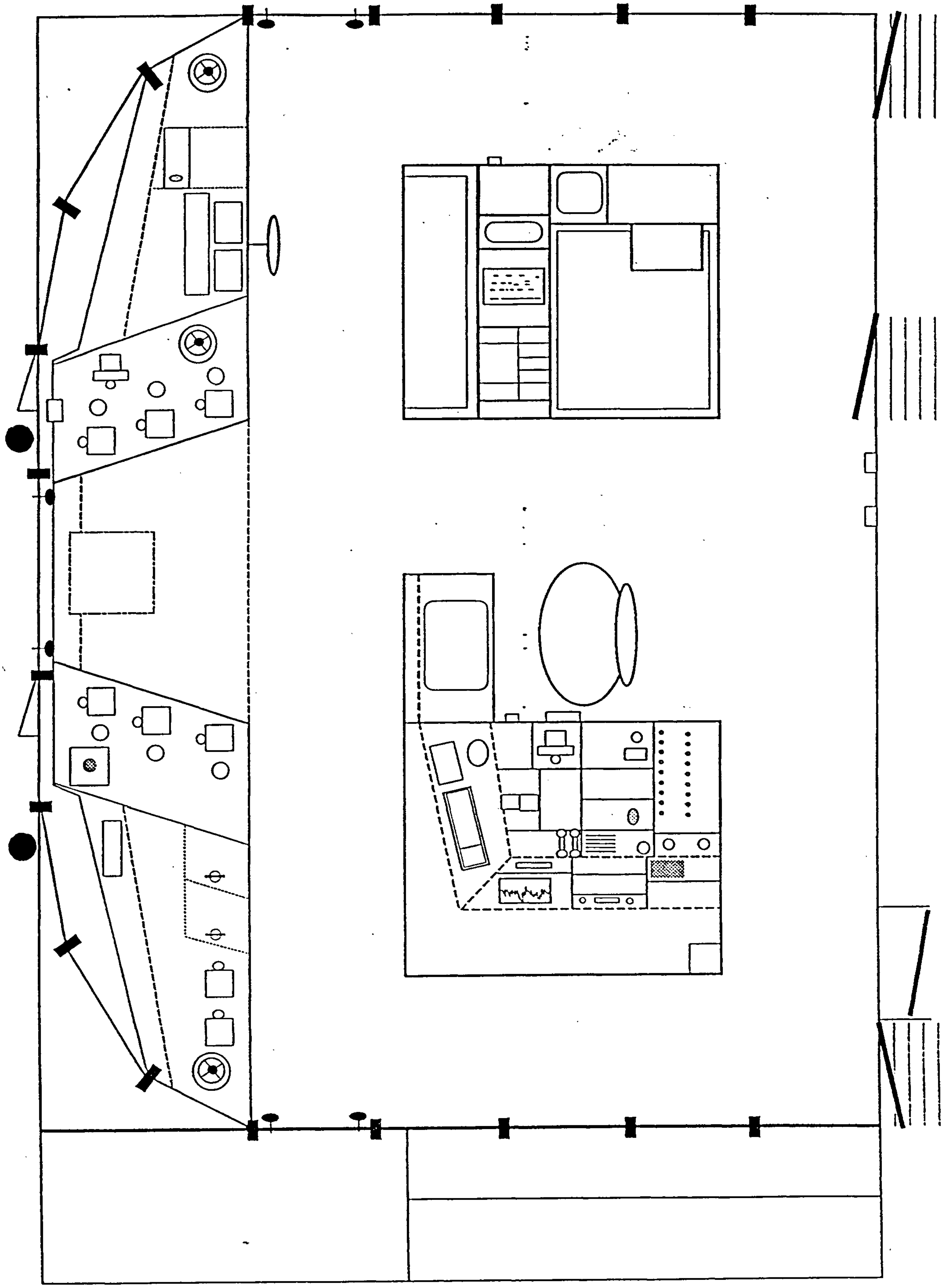
Fishing winch	: Luyt
Type	: 8 drums
Capacity	: 25 ton/fishdrum
Engine fishingwinch	: Indar
Type	: N-400-m-a
Output	: 240 hp
Cargowinches (2x)	: Kynde & Toft
Type	: OMV-500-KT
Capacity	: 1,6 tons
Winch in fishhold (el.)	: Kynde & Toft
Capacity	: 500 kgs.
Windlass	: Ridderinkhof
Type	: 24 mm
Fish processing/conveyor unit	: Van Rijn, Katwijk

Navigation equipment

Gyro compass	: Microtechnica Pol. MK2
Gyro compass repeater	: Microtechnica LR40
Magnetic compass	: Cassens + Plath Reflecta 4
Auto pilot	: Racal-Decca DP 450 G
Colour videoplotter	: Racal-Decca CVP 3500
Track plotter	: Racal-Decca 350-T
Speedlog	: Ben Athena
Telephone	: Siemens NMT
Watch receiver	: Skanti R6020
SSB Radio telephone	: Skanti TRP 8250 S
Radio receiver	: Kenwood R2000
VHF	: Sailor RT 144 C
VHF	: Sailor RT 2048
VHF directionfinder	: Furuno FD 525
Scanner	: Handic 50
Navigator	: Racal-Decca MK 53
Navigator	: AP navigator MK III
Sonar	: Furuno CH-16
Echosounder	: JRC JFV-90
Echosounder	: Furuno FCV-261
Radar	: Furuno FR-1505
Radar	: Furuno FR-701



Bridge layout modern beamtrawler.



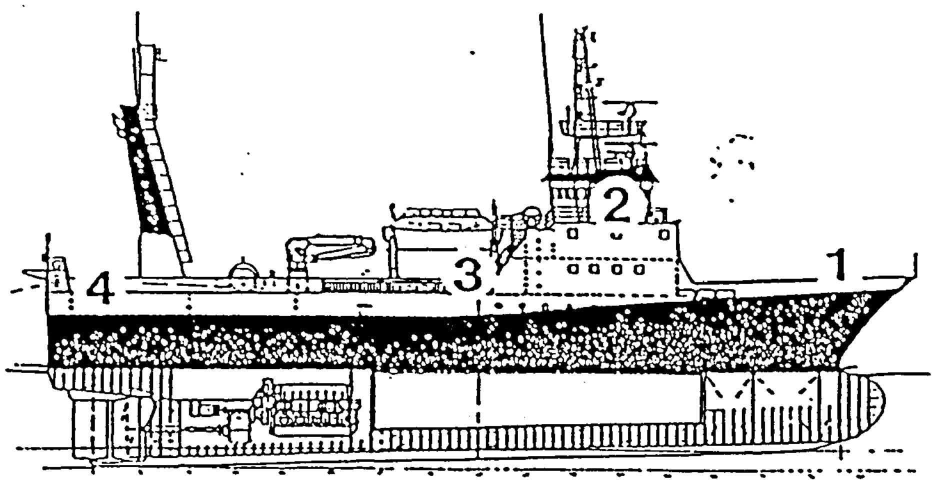
Safety regulations/recommendations fishing vessels.

Safety design requirements for fishing vessels	Regulations, codes recommendations for Dutch beam-trawlers	safety aspects	
		global	personal
<u>1968:</u> IMO Resolution A 168 (ES II), intact stability		-stability requirements	
<u>1970:</u> Voorschriften voor Vissers-vaartuigen (Dutch maritime administration)	Regulations	-structures -increased stability -life saving equipment -nautical equipment (compass, lanterns etc.) -mechanical and electrical equipment (explosion valves, combustible gasindicators etc.) -technical equipment (watertight doors, non combustible materials)	-fire fihting equipment -various equipment (safety lamps, gas suits etc.)
<u>1974:</u> "Code of Safety for fishermen and fishing vessels (jointly FAO, IMO, ILO)" •part A= safety and health practice for skippers and crew	guide/educational medium		safety manual for working onboard fishing vessels
•part B= safety and health requirements for the construction and equipment of fishing vessels	regulation as far as not already foreseen in national rules. (length > 24 m.)	information on design, construction and equipment	
<u>1977:</u> Safety of fishing vessels (Torremolinos International Convention)	> 24 m, not adopted yet.	specific constructional operational feactures of fishing vessels along the lines of SOLAS/ Load Line Conventions	

Safety design requirements for fishing vessels	Regulations, codes recommendations for Dutch beam-trawlers	safety aspects	
		global	personal
<u>1982:</u> IMO Noise levels on board ships	just as reference (methods of measuring)	-	standards to prevent the occurrence of potenti-ally hazardous noise levels
Classification Societies (Det. Norske Veritas; Bureau Veritas etc.)	rules > 24 m vessels	-construction (minimum structural strengh and machinery)	-fire figh-ting and life saving equipment
Marpol 73	regulations preventing marine pollution from ships, also fishing vessels	-	-

Criteria with regard to accelerations and roll.

Root Mean Square Criterion			Description
Vert. acc.	Lat. acc.	Roll	
0.20 g	0.10 g	6.0°	Light manual work
0.15 g	0.07 g	4.0°	Heavy manual work
0.10 g	0.05 g	3.0°	Intellectual work
0.05 g	0.04 g	2.5°	Transit passengers
0.02 g	0.03 g	2.0°	Cruise liner



1. Fore perpendicular (F.P.)
   Vert. accel. 0.15 g
   Lat. accel. 0.07 g
   Roll 4.0 deg

2. Bridge
   Vert. accel. 0.10 g
   Lat. accel. 0.05 g
   Roll 3.0 deg

3. At midship (Lp/2)
   Vert. accel. 0.15 g
   Lat. accel. 0.07 g
   Roll 4.0 deg

4. Aft perpendicular (A.P.)
   Vert. accel. 0.20 g
   Lat. accel. 0.10 g
   Roll 6.0 deg