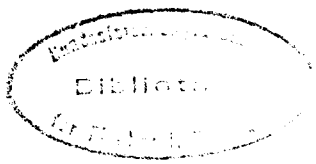
INTERNATIONAL COUNCIL FOR
THE EXPLORATION OF THE SEA

C.M. 1991/B:20
Fish Capture Committee



BRIDGE LAYOUT BEAMER 2000

by

A.M. Buys & A.M. van der Sluijs
Netherlands Institute for Fisheries Research
P.O. Box 68, 1970 AB IJmuiden
The Netherlands

INTERNATIONAL COUNCIL FOR
THE EXPLORATION OF THE SEA

C.M. 1991/B:20
Fish Capture Committee

BRIDGE LAYOUT BEAMER 2000

by

A.M. Buijs and A.M. van der Sluijs
Netherlands Institute for Fisheries Research
P.O. Box 68, 1970 AB IJmuiden
The Netherlands

Abstract

Building Dutch beamers is still a traditional matter. In the 'Beamer 2000 project' a study was launched for an improved bridge layout. Also a study was made for an integrated screen presentation of navigation data, engineroom alarms and fishfinding. Innovative bridge layout, depending on the budget, is proposed as a step-by-step improvement plan. RIVO believes that a good bridge layout will benefit the safety and workconditions on board of the Dutch beamer.

Contents

Abstract....1
Contents....2
1. Introduction....2
2. Research strategy for a 2000 hp beamer bridge....2
3. The beamer bridge in the eighties....2
4. The overview display....4
5. The beamer bridge in the nineties....5
6. The beamer bridge in the year 2000....7
7. Conclusions....9
References....10

1. Introduction

The Dutch fishing fleet includes a group of 573 beamers, with a power range between 300 and 4700 hp. These beamers normally catch flatfish. In Holland the building of these beamers is a traditional matter. Building is in the hands of just a few shipyards. Decision-making in the area of new construction and renovation of these ships therefore are in the hands of a few men. New ideas in this field are not based on scientific research, but are the results of day-to-day practise. The wheelhouse of the beamer needs special attention as to the design. The wheelhouse has become the operational centre of the ship and controls the ship and all the fishing operations; most of the decision are made here. In recent years electronic equipment has increasingly determined the interior of the bridge. Growing numbers of units have appeared on the bridge to help the skipper. All these units must have an appropriate location on the bridge. Research and experience have shown that any additional equipment would interfere with safety on board. RIVO has already argued in favour of a reduction of the number of units and actions needed to operate them.

2. Research strategy for a 2000 hp beamer bridge

RIVO in cooperation with the Technical University at Delft has done research centring on the 2000 hp beamer, the so-called Beamer-2000 project: safety integrated redesign of workingdeck, wheelhouse and engineroom layout. The specific wheelhouse research was split into three parts. First a survey was made of the existing beamers in this category (S. Tan RIVO 1989). Secondly an investigation was made as to the possibility of integrating all the navigation data in a single unit, according to ergonomic and safety principles. In other words: the design of a user-friendly integrated navigation unit (B. de Vries, RIVO / Delft-TU 1990). Finally, the entire bridge layout was redesigned. This was done along two lines. A bridge using today's equipment, and a bridge using the integrated equipment of the future (A.M. van der Sluijs, RIVO / Delft-TU 1991), both based on ergonomic and safety principles.
Also a step-by-step system of introducing bridge improvements was worked out. According to the shipowner's budget, a decision can be made about the level of improvements.

3. The beamer bridge in the eighties.

The watch on the bridge is done by the skipper, sometimes relieved by another crewmember. Because of the skipper's continuous presence, the bridge acquires the function of a kind of living-room. Naturally, the skipper wants to have a voice in the arrangement of the new bridge. In consultation with the shipyard and the supplier of the equipment, the bridge layout is traditionally decided by the skipper and crew.
On the bridge, general navigation tasks are performed. In the case of the beam trawler, extra tasks are generated by gear handling. Nowadays there are two workstations: one for

the fishing or steaming modes and one for the gear handling mode. The separate workstation for gear handling is necessitated by the need of a good view of the working deck. The problem is, that during gear handling good eye and voice contact is needed between the crew on deck and the winch-operator on the bridge. The gear handling must be a concerted effort of gear operator and crew. Any faulty action may cause casualties. Most navigation tasks are left unattended during gear handling. On the bridge, the Dutch beamer has a front-console split in two parts and two mid-consoles (see Figure 1, a typical bridge of the eighties). A chair is positioned between the midconsoles. The skipper's cabin is to the rear of the bridge, assuring swift access in case of trouble, but taking away a backwards view.

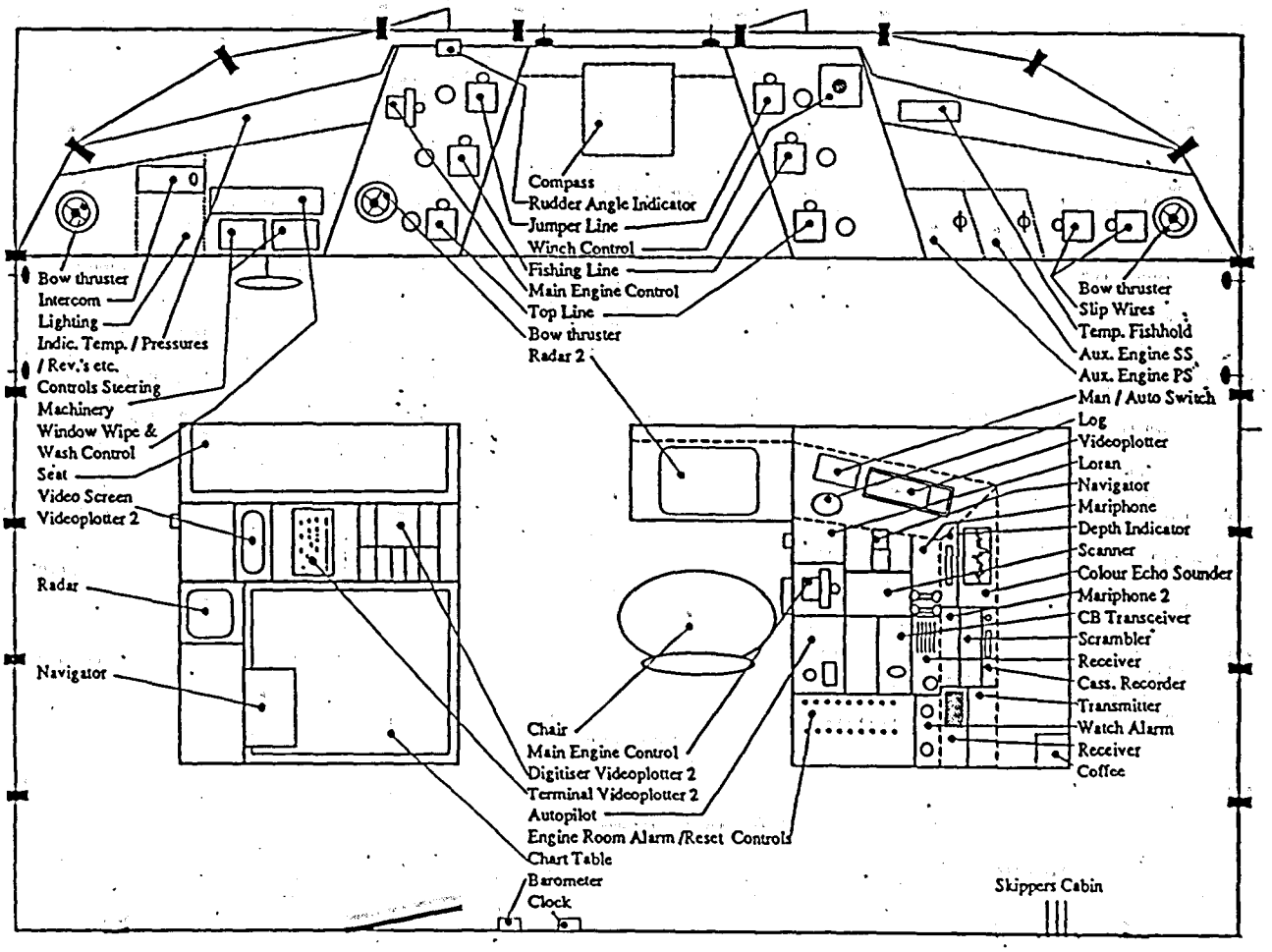


Figure 1: Beamer bridge in the eighties

The equipment used in this bridge has changed through the years.
More and more information is presented on screens.
Units of different origin have their own screen format, unit operation and instructions.
The skipper is surrounded by this equipment. This situation is not optimal in terms of userfriendlyness, safety, ergonomics and efficiency.

The problems regarding this bridge are:

- Separate locations for gear handling mode and fishing / steaming mode.
- Redundant supply of information, in the form of visual and auditive signals, due to overlapping functions of equipment.

- Complex electronic equipment, with diverse operation-structures due to lack of standardisation. Instruction-time needed. Easy introduction of human error.
- Arrangement of equipment is often dictated by personal interest, size of units, and built-in facilities.
- A bad view to the rear, because of the skipper's cabin.
- A bad view to the front, because of the whaleback and gear derricks.
- Annoying daylight reflections on the screens.
- Interfering light from the equipment itself.
- Large number of eye and body movements needed to operate the equipment.

4. The overview display

Modern electronics may add a wide range of extra facilities to equipment. This results in an increased information stream and makes operating the equipment more complex. Interfacing units also creates overlap of information. The outcome of research in the merchant marine was that the presentation and operation of equipment could be improved. One of the suggestions was screen presentation joining several data (formerly from separate units). Only relevant information is shown to the watchman. More detailed information can be called up or will be generated by an alarm system. For the Dutch beamer, research has been carried out in this field. A design for a user interface on a screen has been prepared. This user interface integrates radar, plotter, engine and sounder data on the screen, and offers methods to manipulate this data. This is a kind of ECDIS (Electronic Chart Display System) combined with engine and fishing data.

In 1989/1990, RIVO carried out research to design a fisherman's user interface.
In this attempt, present limitations to electronic technology have been disregarded.
Design criteria were:
- Single-screen presentation.
- Using conventional bridge layout.
- Hierarchic alarms.
- Presentation and operation according to ergonomic principles.

Because of the conventional bridge layout, two units are still needed: a main unit at the workstation for fishing or steaming and a slave unit at the workstation for gear handling. Both units have the same system of data presentation. One proposal is shown in Figure 2. It shows a combined videoplotter and radar presentation field, and two smaller fields on the right-hand side. An alarm field is at the bottom of the screen. The plotter-radar field is continuously in the picture and offers additional information on position, course, speed and identification of objects. The smaller fields are so-called 'browsing pages', and may present information from the radar, engine, fishing gear or echosounder. According to scenarios of stress and boredom of the watchman, a hierarchic information and alarm system will operate. By pressing a button the equipment can be tuned to the actual ship's conditions (scenarios).
The criteria are:
- Good or poor visibility.
- Quiet or busy shipping.
- Skilled or unskilled watchman.
- Fishing or steaming mode

Figure 2 shows the information on the screen in the fishing mode. The watchman in this example is an unskilled one. He aims to follow an existing fishing track.

The slave unit uses the same data, but displays only the most important part. The slave unit is only used during gear handling. Here engine and winch data are given extra emphasis. Navigation tasks, of course, can be performed simultaneously. In case of malfunction of the main unit, the slave unit can take over.

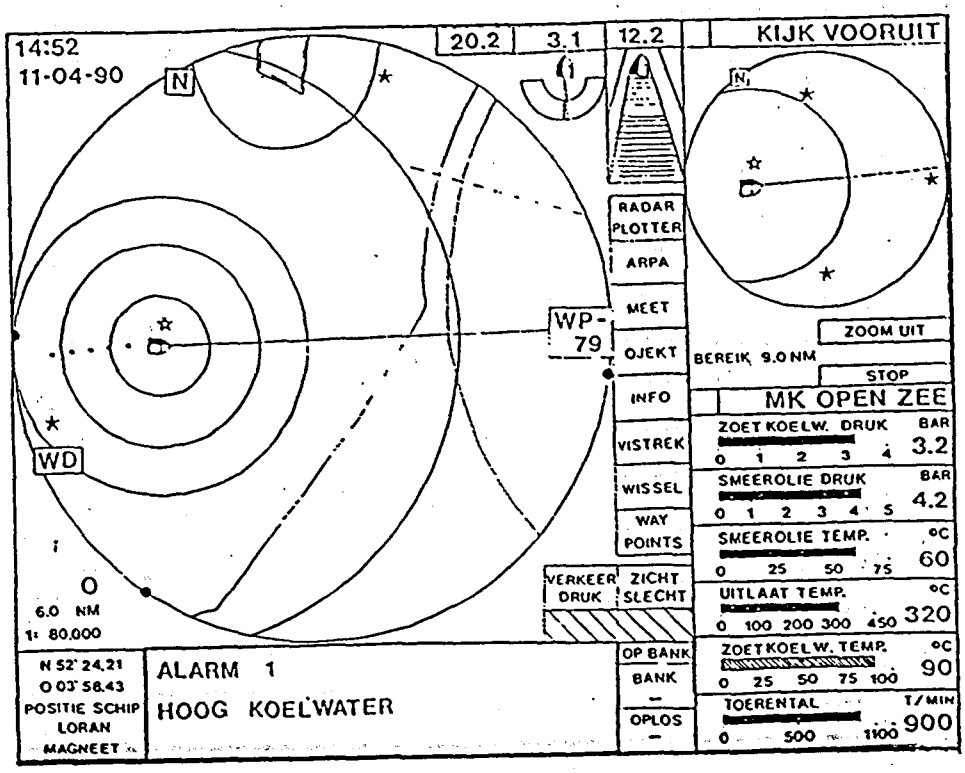


Figure 2: Integrated Navigation display.

Remarks to this design:

- Realisation is not yet possible due to technical limitations, such as integrated mapping of radar and plotter data.
- In spite of hierarchic information presentation, the screen is too full.
- This overview system has not yet been adapted for the new bridge layout.

Eventually, it was found that presentation of data divided over two screens instead of one was preferable. The presentation will be clearer, especially for the plotter-radar field. As a conclusion in this study a setup for two screens at a single workstation was made: one for navigation data and one for engine and fish-hold data etc. Both screen systems have the capacity to take over from the other, in case of malfunction. A system like this requires only a software update to modernize the entire system. A up to date presentation can be garanted in the future.

5. The beamer bridge in the nineties.

With a view to safety and ergonomics the bridge has been redesigned, which will reduce some of the problems early referred to. This bridge contains state-of-the-art equipment, and is characterized by the lack of duplicate equipment. The system is compact and easy to operate (see Figure 3). The console consists of a frame of aluminium. The equipment is built into standardized panels.

Special features are:

- Duplicate operation levers for each fishline winch. The navigation tasks and fishline handling can now be performed simultaneously.
- Due to the aluminium frame system, equipment is easily changed and rearraged.

- A fishline tension-control system has been introduced. The advantage is a better contact with the sea-floor and this equipment will take action in case of nets jamming.
- The console is made according to ergonomic dimensions and colours.
- Infrequently used equipment (not often touched) is built into a ceiling-console.

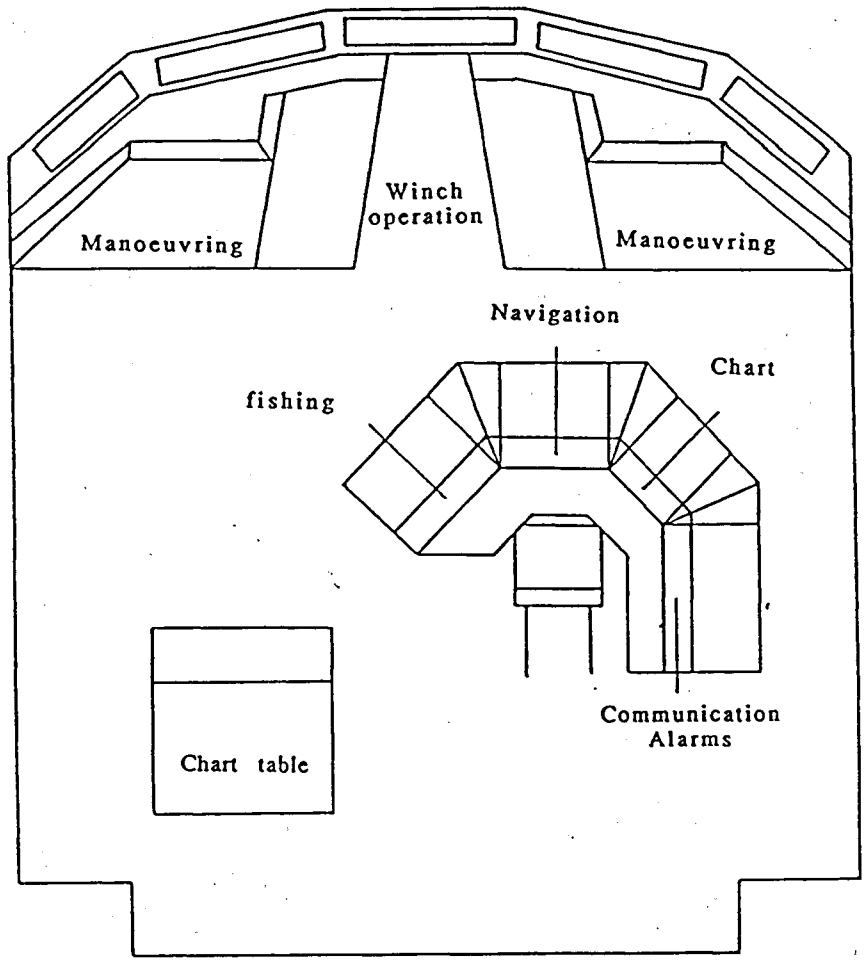


Figure 3: Beamer bridge in the nineties.

The arrangement of the equipment over the different panels is the outcome of an analysis (according to the Woodson method) of the watchman's task.

Fishing panel:
This panel contains the equipment to assist the fishing process, such as an echosounder and a fishline tension-control system. Also the engine is monitored here, by means of visual alarms, meters or computer screen.
In front of this panel, in the desk-top, the controls for shipspeed and fishline winch are situated.

Navigation panel:
This panel directly in front of the watchman contains a radar. The autopilot is on the right-hand side of the radar to prevent masking of the radar during operating of the autopilot. One of the VHFs is also mounted here for direct contact with ships seen on the

radar or with harbours. Besides, a rudder tiller and switches for the steering machines are found.

Videoplotter panel:
Here we find the videoplotter. The positioning equipment used by this videoplotter is mounted near to the chart table or in the ceiling console. Depending on the system used, the controls and keyboard can be placed in or under the table-top.

Communications panel:
Here the radio-equipment is situated.

Ceiling panel:
Infrequently used equipment is found here, such as units for positioning (Decca, GPS), mobile phone and public radio.

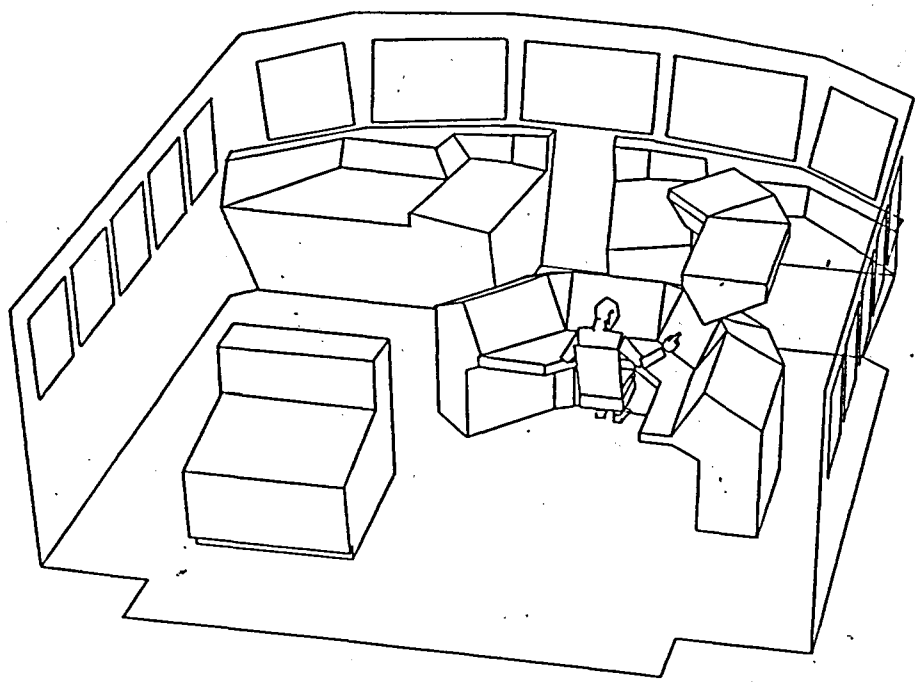


Figure 4: 'Beamer bridge in the nineties' in perspective

The console is placed somewhat to the starboard side, in view of anti-collision rules.

Such a console was constructed in collaboration with the supplier of navigation equipment the Dutch 'Radio Holland Group'. The console has been on show at the exhibition "Binnenvaart en Visserij" (Inland navigation and fishing) at Rotterdam, november 1990.

6. The beamer bridge in the year 2000.

The 'Bridge 2000' idea is a part of the 'Beamer 2000' project. The 'Beamer 2000' project is still running, and envisages a complete beamer redesign, according to safety principles. The 'Beamer 2000' bridge is not only designed to house the integrated equipment; it includes also a complete review of the wheelhouse construction.

Features are (see also Figure 5):

- The bridge is raised by an additional metre. This improves sight to all directions. The space below the bridge is reserved to install equipment, such as power supplies and airconditioning.
- At the front of the bridge, the glass windows are set back. Together with a low mounted window is a good view on deck is provided.
- The navigation equipment is mounted in a console close to the windows. This means that during gear handling the watchman still can keep an eye on his navigation equipment.
- The window area is increased and the windows are mounted at an angle of twenty degrees. This angle prevents disturbing daylight reflections.
- The console in the front of the bridge is divided in two. It provides two workstations, one on the starboard side for the watchman, and one on the port side for an assistant. Both stations contain 19-inch screens, presenting integrated navigation data. Ship's operation controls are also located here.
- Near to the chart table an administration workstation is created. Catch and ship's adminstrations are kept here. Some positioning equipment is built in for easy access during chart handling.
- Navigation data is displayed in the skipper's cabin. Normally the display is idle.

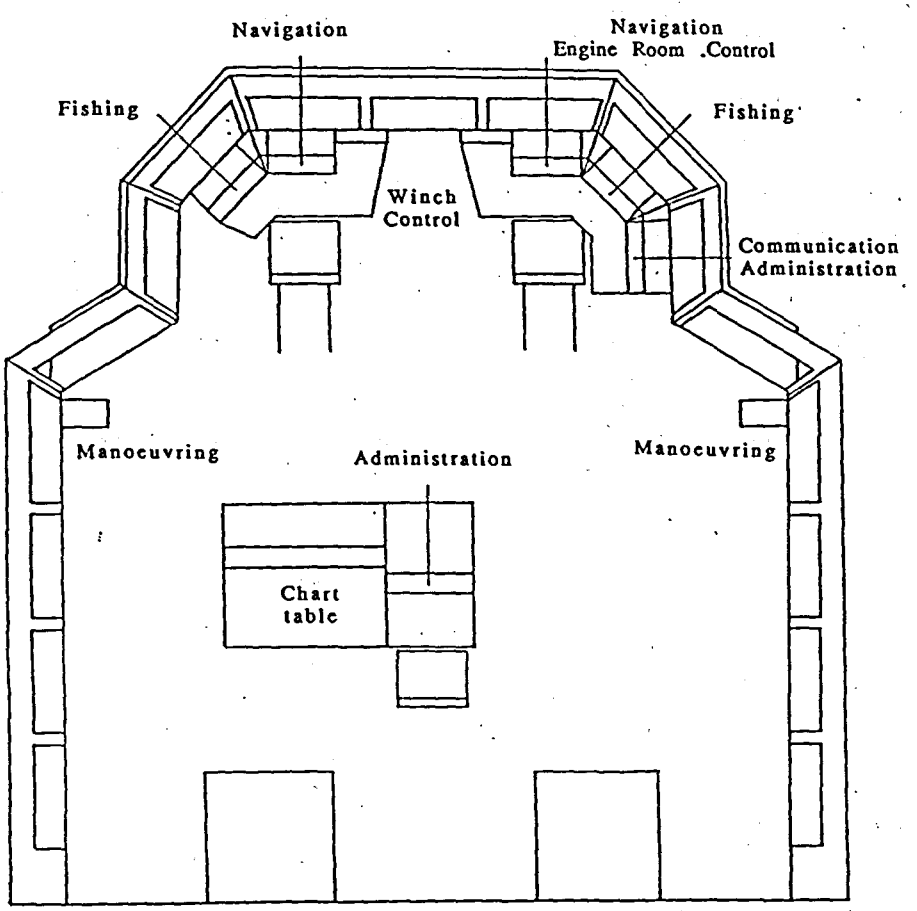


Figure 5: Beamer bridge 2000.

- The number of winch-control handles is decreased by combining functions. Cross-switched handles (joystick switched) have been given double functions.
- Special attention is paid to colours and dimensions.

The 'Bridge 2000' has also been on show at the exhibition "Binnenvaart en Visserij" as a model on a 1 to 10 scale. A perspective look is shown in Figure 6.

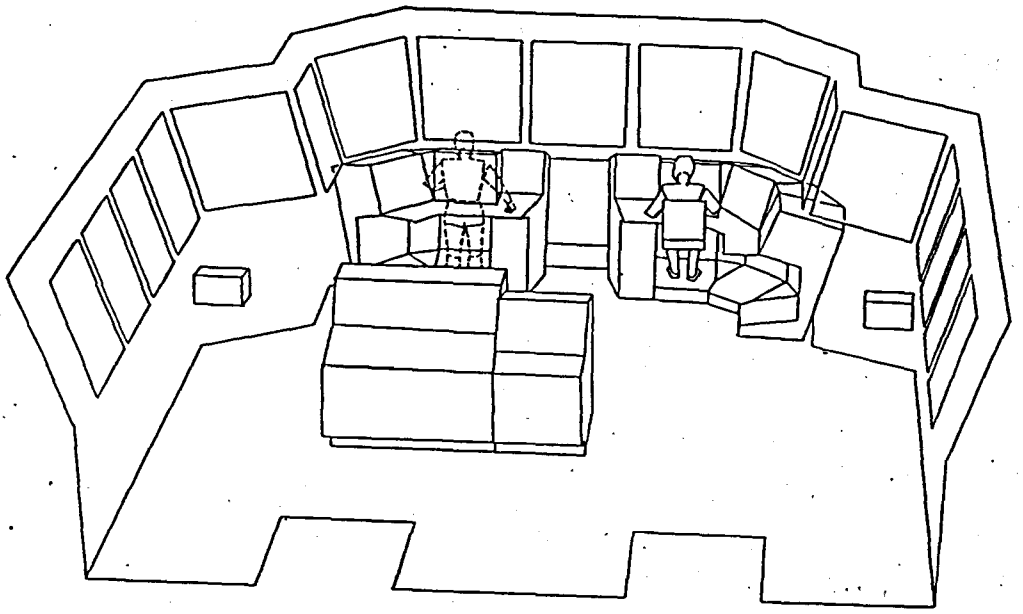


Figure 6: 'Beamer bridge 2000'.in perspective.

Remarks to this design:

- This bridge is only feasible in the case of a new ship. Recalculations must be made for stability, etc.
- Again, the electronic equipment is not dedicated yet for such a design.
- This bridge is a pilot study and should be tested by full scale simulations.

7. Conclusions

Today's beam-trawler bridge is fitted with navigation equipment, in accordance with the wishes of the skipper and the expertise of the shipyard and equipment supplier. This has been the way of bridge construction for many years. In terms of safety and ergonomic principles and the safety-integrated redesign (according to the method 'Kindunos', Dr. ir John Stoop, Delft university of technology)) this is not completely satisfactory.

As a solution a step-by-step plan is presented, which introduces improvements depending on the builder's budget and the age of the ship.

'Bridge in the nineties', provides a better arrangement of existing navigation equipment fitted in a new type of console, with ergonomic colours and dimensions.

'Bridge in the year 2000', requires a completely new wheelhouse structure and not yet existing single screen presentation. So it can be considered only in the case of new construction.

The most important changes are:

- Raised bridge for better view
- Set back windows for better view.
- Screen-presented integrated navigation equipment

- Joystick-switched winchcontrols.
- Assistant workstation.
- Adminstration workstation.

For both concepts aroused professional interest at the exhibition 'Binnenvaart en Visserij' at Rotterdam the Netherlands. The first contacts with shipyards and fishery companies have been establised.

Follow up

Neither of the bridges has yet seen live fishing, so continuation of research is needed. In collaboration with the equipment supplier 'Radio Holland Group', the Technical University at Delft and and RIVO propose simulation experiments at the Institute for Physiologic studies (TNO-IZF). As a part of the 'Beamer 2000' project, this bridge layout study will benefit the safety and work conditions for the crew on board of the Dutch beamtrawlers.

References

- Bruglayout boomkorkotters, een inventarisatie, Saskia Tan, RIVO, 1989.
- Een unit voor de visser, Bob de Vries, RIVO / TU-Delft, 1990.
- Integrated wheelhouse electronics and layout on board dutch beamtrawlers, Ton Buijs, ICES paper 1990 B:18.
- Bruginrichting kotter 2000, Annelieke van der Sluijs, RIVO / TU-Delft, 1991.