STATENDAM*

CARNIVAL'S GREATEST IMPACT ON HOLLAND AMERICA LINE TO DATE HAS BEEN THE ORDENING OF THREE 55,000GT HIGH-TECHNOLOGY LUXURY CRUISE SHIPS FROM ITALY'S STATE SHIPBUILDING CONCERN FINCANTIERI. THESE SHIPS WILL JOIN THE ROTTERDAM (1959), NIEUW AMSTERDAM (1982), NOORDAM (1983) AND WESTERDAM (1986) IN DIVERSE CRUISE SERVICE RANGING FROM WARM CARIBBEAN CRUISES, ALASKAN VOYAGES AND ROUND THE WORLD ODYSSEYS. THE FIRST OF THE NEW SHIPS, STATENDAM, WAS DELIVERED TO HOLLAND AMERICA LINE ON 11 DECEMBER 1992.

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When Carnival Cruise Lines (CCL) purchased Holland America Line (HAL) towards the end of 1988, loyal HAL passengers and cruise ship enthusiasts feared the worst. The differences in style and operation between the products offered by the respective companies was stark and it was generally thought that Carnival's ruthless pursuit of increasing profit margins would see the old traditions of Holland America falter under the financial constraints imposed by the new parent company. Concern grew when Carnival allowed the letter of intent with Bremer Vulkan for two 60,000gt super Nieuw Amsterdam-type cruise ships, negotiated and signed by the previous owner, to lapse. Additionally, the loss-making Windstar Sail Cruises subsidiary of Holland America Line was put up for sale. Pundits predicted an asset-stripping exercise was imminent.

However, time has shown that quite the reverse has occured. An expensive refit of the veteran Rotterdam was sanctioned by Carnival (1989) at the time when many expected the new owners would dispose of the ship due to her high running costs and the jumboisation of the Westerdam went ahead as planned (1989/90) by the previous owner. Rather than forcing its ideas on Holland America Line, Carnival has adopted several of HAL's practices, one of them being introduction of the senior officer rank of hotel manager, displacing the middle ranking chief purser as head of passenger services on its ships. Windstar Sail Cruises remains with Holland America Line, aggressive marketing ensuring once lacking viability.

The design for the US$ 180 million Statendam evolved jointly between CCL/HAL, Fincantieri and the owner's technical consultants, Technical Marine Planning (TMP). As with other CCL newbuildings, TMP acted as project manager, prepared the technical specification, conducted plan approval and supervised construction. Fincantieri's Monfalcone Shipyard, situated a short distance from the group's Trieste headquarters and technical offices, was chosen to construct the three ships following recent experience with the P&O/Sitmar newbuildings Crown Princess and Regal Princess. The three Holland America Line ships were ordered on 29 November 1989 with deliveries set at yearly intervals; Statendam (NB 5881) late 1992, Maasdam (NB 5882) late 1993 and Ryndam (NB 5883) late 1994.

DESIGN PHILOSOPHY

Statendam was built to Lloyd's Register of Shipping Class ✠ 100A1, ✠ LMC, UMS, Ice Class D, Passenger Ship Unrestricted Service, Underwater Survey and is registered at Nassau, Bahamas. The minimum ice class (D) is a feature considered desirable due to anticipated extensive operations in Alaska in common with other members of the HAL fleet. Frame spacing is generally 700mm with 600mm forward and there are four pillars set transversely across the beam every 5.80m (i.e., two cabin widths) along the ship's length.

The double bottom is set 1.80m from the base line and provides space for ballast, heavy fuel, diesel oil and technical fresh water tankage, mainly within tanks inboard of the B/5 line. Outboard of these tanks void/emergency ballast tanks are arranged. At the design stage it was agreed between owner and builder that these tanks could be used to provide additional ballast capacity for stability purposes if found necessary. At the time there was apprehension regarding the severity of the new SOLAS 90 stability rules but Statendam has proved to be a very stable platform, operating with a normal GM of about 2.0m without the need for these tanks which now remain as voids.

The relatively high GM owes much to the shape of the hull which provides a high waterplane area and hence high BM. The block coefficient of nearly 0.7 and the midships area coefficient of 0.99 are somewhat higher than normally expected for a high performance hull but provide the necessary design displacement of 30,300 tonnes on the modest 7.50m design draught.

Hydrodynamic performance was ensured by an exhaustive series of model tests conducted initially at the Vienna Model Basin (Vienna) and latterly at MARIN (Wageningen). Vienna utilised a wax model of 6.61m (1:28) weighing 1.34 tonnes, whilst MARIN employed a wooden model of 7.83m (1:23.64). The preliminary hull was based upon Fincantieri's design for Costa Cruises' Costa Classica (1991) which was basically of the same dimensions as the Statendam. However, whereas the Costa ship employed aluminium alloy in her upperworks, Statendam's specification prohibited this so a somewhat higher block coefficient was required to provide the necessary buoyancy.

The liner is provided with a large bulbous bow of 7.2m length; two 1,720kW 2.60m diameter KaMeWa high-skew, low-vibration bow thrusters fitted with grids; bilge keels; two high performance single-bearing streamlined Hinze flap rudders of 19.6m^2; enclosed propeller shafts supported by A-brackets; and two 5.3m diameter four-bladed ultra-high-skew KaMeWa cp propellers with an open water efficiency of 0.7. One pair of Fincantieri Riva Trigoso active fin stabilisers and one 1,720kW KaMeWa stern thruster

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without grids complete the fittings. Hull castings were manufactured by Sidermeccanica at Bergamo.

At an early stage of testing it was decided to increase the length oa by 3.0m from 182.0m to 185.0m to increase the waterline length and aid performance. Initial tests indicated that an improvement over the preliminary design of some 20% would be required to achieve the contract speed of 22.6 knots with the available propulsion power of 24MW. Systematic testing and optimatisation brought the contract speed within sight. Efforts to improve performance included providing streamlined bow and stern thruster openings, introducing a modest tunnel by shaping the hull above the propellers, A-bracket and bilge keel orientation, bulb design, rudder position and angle of offset.

Considerable optimatisation differences were obtained from the respective tanks, one interesting contrariety being the offset angles for the A-brackets where the different methods employed by each tank produced quite different results. The ship is provided with two high-holding bow anchors and a single smaller one at the stern.

PRINCIPAL PARTICULARS
STATENDAM

Length, oa	219.30 m
Length, bp	185.00 m
Breadth	30.80 m
Height of top deck from keel	40.00 m
Draught, design	7.50 m
Draught, scantling	7.70 m
Gross	55,000gt
Main engines (diesel-electric plant)	
	2 x Sulzer 12ZA40S
	3 x Sulzer 8ZA40S
Output	2 x 8,640 kW
	3 x 5,760 kW
Electric propulsion motors	2 x ABB
Output	2 x 12,000 kW
Speed, service	20.0 knots
Passengers, lower berths	1,266
Passenger cabins	
Penthouse	1
Suites	28
Deluxe	120
Outside standard	336
Inside standard	148
Total passenger cabins	633
Crew cabins	335
Crew	602

34.56MW DIESEL-ELECTRIC MACHINERY CONFIGURATION

Statendam's machinery installation owes much of its heritage to the CCL cruise ship Fantasy (The Naval Architect, February 1990, page E80*). The unqualified success of the cyclo-converter-based diesel-electric system on the Fantasy led the owner to stipulate a similar plant for the Holland America trio. Once again the installation is based upon Sulzer ZA40S medium-speed diesel engines with ABB Strömberg generating sets, cyclo-converter technology and propulsion motors. Five Sulzer engines are installed providing a total power output for all purposes of 34.56MW. For flexibility and in order to optimise power management two 12-cylinder vee form models and three eight-cylinder in line units are arranged within two adjacent machinery rooms, providing an output of 720kW/cylinder at 514rev/min. The two 12-cylinder engines drive 3-phase 6,600V 60Hz brushless, synchronous ac generators of 12,200kVA, whilst the three smaller engines drive generators of 8,200kVA.

The connection between engine and generator is through flexible couplings supplied by Gieslinger, of Salzburg, Austria. The complete diesel-generating sets are each solidly mounted to a raft structure (integral with the engine lubricating oil sump tank) designed and built by Fincantieri's Diesel Engine Division. The rafts are in turn resiliently mounted with rubber elements to the ship's structure to minimise vibration transmission. Each 12-cylinder generating set weighs 194 tonnes, whilst the eight-cylinder sets weigh 159 tonnes.

The machinery is designed for operation with heavy fuel of up to 700Cst viscosity. Alfa-Laval automatic self-cleaning centrifugal seperators are initially employed to remove fuel impurities and water after setting; subsequently the fuel passes through automatic, self-cleaning Alfa-Laval 10-micron filters. Two fuel booster units are provided on board, one serving the eight-cylinder engines, the other the 12-cylinder units. These incorporate fine filters, heaters, buffer tanks, homogenisers and ITT-VAF Instruments viscosimeters. The latter automatically measure the viscosity of the fuel and control the heaters to ensure that correct operating viscosity (between 17Cst and 14Cst) is maintained.

Maximum use has been made of waste heat from the engines. Each exhaust line is fitted with a Gasinghini boiler producing steam for shipboard services. The engines are provided with two cooling systems, one at low temperature the other at high temperature. The latter provides heat (90°C) for fresh water heating and fresh water production within two fully automatic Alfa-Laval Desalt evaporators of 530 tonnes/day capacity. When necessary at times of low output from the diesel engine cooling system, additional heat can be supplied by steam from the exhaust gas boilers or from two Sunrod oil fired auxiliary boilers. On board fresh water consumption is estimated at about 700 tonnes/day.

Two 12MW ABB Strömberg double-wound, water-cooled, synchronous ac propulsion motors drive Statendam's propellers. These motors each weigh 106 tonnes and can operate at speeds between 50rev/min and 140rev/min. The plant operates at 1,500V and at frequenties up to 14Hz. The propulsion motors are started and controlled via four ABB Strömberg water-cooled cyclo-converter units consisting of six thyristor bridge units rated at a supply voltage of 900V and continuous output current of 2,600A. The converters take the fixed network frequency of 60Hz and convert it to a frequency between 0Hz and 14Hz by the thyristor circuitry. Statendam is unique in having thyristors directly

* Zie ook: SWZ september 1992, blz. 397.

cooled by water in a closed loop, the heat sink being at 'live' voltage. Thrust blocks for the shaft lines were supplied by Michell. This diesel-electric propulsion plant is believed to represent the most advanced state-of-the-art machinery installation on any cruise ship afloat.

COMPREHENSIVE AUTOMATION PLANT

To reap all the advantages and flexibility of a diesel-electric plant a comprehensive power management system is employed. In normal service the power demands of Statendam for propulsion and hotel/ancillary load can be met with only four of the five diesel-alternators in operation (three eight-cylinder plus one 12-cylinder sets). This allows for the redundant fifth unit (i.e., one 12-cylinder unit) to be under maintenance. This arrangement allows for a flexible rotating maintenance schedule to be performed on the machinery. The power management system ensures that the engines that are on line are kept running at their optimum efficiency condition. Simultaneously, stand-by engines (other than those under maintenance) are pre-heated and lubricated to provide for rapid load increases.

An automatic program slowly rotates each stand-by engine for about two minutes every two hours to ensure that cylinder liners and pistons are lubricated and ready for immediate service. Tests have indicated that a stand-by engine can be brought on line within 60 sec of demand. The engine control room is located on the port side two-thirds aft on deck 3 and contains all the alarm and automation control systems for the entire vessel. Machinery automation is provided by a Master-View automation system supplied by ABB. For quick reference a vast mimic mosaic panel installed by ABB provides detailed information for each of the machinery groups such as propulsion plant, generating sets, and air-conditioning. All the requirements for classification unattended machinery space (UMS) are fully met.

Apart from items of equipment already highlighted, ABB Strömberg has supplied the main 6,600V/440V transformers, secondary transformers, rotating converters, the main switchboard (PS1), low voltage switchboards, emergency switchboard, thruster motors, and main and air-conditioning compressor motors.

AUXILIARY MACHINERY INSTALLATIONS

The sophisticated and extensieve four-compressor air-conditioning installation on board Statendam was provided by Fläkt Marine/ABB Stal and incorporates Hamworthy chilled water pumps. Hamworthy also supplied the main salt water circulating pumps on board. Two Hamworthy sewage treatment tanks are situated within a forward compartment on the double bottom, fed by an Evac vacuum collecting system utilising fibreglass tanks. Cabins are outfitted with Evac's Super Silent toilet bowl system which goes a long way in reducing the traditional symphony associated with vacuum toilets!

Two sets of Frydenbø rotary vane steering gears are employed to actuate the flapped Hinze rudders via an Anschütz steering gear control system. Independent or coupled control of the rudders is possible with addition of a self-centring feature when astern thrust is given by the associated propeller.

Deck equipment consisting of mooring winches and windlasses was supplied by Brissonneau & Lotz Marine.

Harding Safety lifeboats of 150 persons capacity (6 boats), 150 person tender/lifeboats (4 boats) and 50 person emergency lifeboats (2 boats) comprise the lifeboat supply. Viking 25 person liferafts are also carried. The total lifesaving complement is for 2,100 persons.

Statendam incorporates one of the most extensive and up-to-date garbage and incinerator plants at sea with an outfit of Norsk Hydro equipment centred around a garbage room starboard side on deck 3. Additionally, a cooled garbage store room is provided adjacent to the garbage plant.

INTERNAL LAYOUT

Above the machinery spaces located on deck 1, deck 2 provides space for dry provision stores at 15°C, the wet and dry cleaning laundries, some workshops and non facility crew accommodation (forward). Deck 3 is the main crew thoroughfare with a wide central passageway running almost the length of the ship. This is primarily designed for fork-lift loading operations in conjunction with the large full beam stores and baggage handling area located two-thirds aft. The main reefer provisions rooms are situated aft.

Off from the central passageway lie various workshops, the engine control room, the crew galley and associated mess rooms, and finally facility officer, staff and petty officer cabins. The hospital is located forward on deck 4 which is the lowest passenger cabin deck. Passenger cabins are also located on decks 5 and 6, the latter also incorporating a wraproud promenade.

The majority of public rooms are situated throughout decks 7 and 8, whilst on decks 9 and 10 higher grades of passenger accommodation are located. The wheelhouse and senior officer accommodation are positioned forward on deck 10. Further public spaces, including a covered lido, are found on deck 11, whilst the majority of deck 12 is passenger open deck space. The house top on deck 13, apart from providing the base for the mast, is to be used as a crew recreation deck.

EXCEPTIONAL ACCOMMODATION STANDARDS

As to be expected from a cruise liner of the pedigree of Statendam, the passenger accommodation is quite exceptional. A total of 633 passenger cabins are arranged on five decks (4, 5, 6, 9 & 10) within five main types: Penthouse Suite, Suite, Deluxe, Outside standard and Inside standard. All cabins within the first three premier grades noted above are provided with a private teaked verandah, those of the suites being very extensive (more than 17m^2) and eminently suitable for private party entertaining on a lavish scale. Mini-bar refrigerators are installed within suites and the deluxe cabins.

All outside cabins feature a tub bath with shower fitting, deluxe and suite grades include whirpool baths, whilst inside cabins have a standard shower. Closed-circuit television, with video recorder in deluxe and suites, is standard. All cabins are provided with worldwide dial telephones connected to an automatic exchange, all supplied by Ericsson. Individual thermostatic control of the air-conditioning is provided within each cabin. Both passenger and crew cabins were installed by Parma OY.

To complement the high standard of passenger cabin accommodation, Statendam incorporates a diverse range of stunning public rooms outfitted in a variety of styles to suit all tastes. Most of the public rooms were designed by the Dutch firm of de Vlaming, Fennis & Dingemans (VFD), a veteran of the Nieuw Amsterdam, Noordam and Westerdam. However, the main lounge (Van Gogh) and the observation lounge/disco (The Crow's Nest) was entrusted to Joseph Farcus, interior designer of the Carnival Cruise Line fleet of newbuildings.

Subcontractors involved in the outfit of public spaces included OC International

(main lounge/disco), Merwede (pool lido), Consorzio NTN (lido restaurant), Cantrisa (dining room), Vitrani (casino/shops), B&B Italia (atrium), Signani (gymnasium/beaty salon), Zago (stairs/cinema/meeting room) and ITA (card room and library).

Highlights of the accommodation include the atrium complete with ornate three-deck-high fountain, two-deck-high show lounge with balcony and terraced seating decorated to the theme of Van Gogh's Starry Night and a double height dining room with continous panoramic windows on three sides on each level. The main galley serves the dining room on two levels with the aid of two escalators provided to reach the upper section. The galley and pantries on board were constructed by Precetti and incorporate Zanussi equipment and hot and cold stainless steel counters manufactured by Navalmar. All arrangements have been designed to exceed US Public Health requirements.

EXTENSIVE VIBRATION STUDIES

The location of the dining room at the stern of the ship was critical to the overall design of the ship and placement of the galley and associated spaces. Naturally, there was some concern that there would be propeller-induced vibrations within the room which would disturb passengers' gourmet activities. To ensure that this was not going to be the case, extensive studies were undertaken to investigate and limit any potential vibrations. The propellers were effectively designed to produce the absolute minimum of pressure pulses on the underside of the hull by introducing greater than normal skew. Additionally, the stern of the ship was comprehensively stiffened to a far greater extent than normally employed on a modern-day passenger ship.

Accommodation areas aft and forward above the bow thruster further benefit from extensive areas of floating floors. All these efforts have paid dividends. At a speed in excess of 20 knots, the highest propeller-induced pressure pulse recorded during sea trials was 1.05kPa, whilst the level of vibration throughout the dining room (and the rest of the ship) was measured at 0.5mm/sec to 1.2mm/sec - to all intents and purposes non-existent!

All outside passenger decks on board Statendam are sheathed with high quality Burmese teak; there are no areas of artificial grass or carpeting that plague most other newbuilding cruise ships. The midships lido (deck 11) is laid with a special non-slip compound supplied by Bolidt with inlaid decorative features. This lido area is usefully covered by a sliding glass roof supplied by Navalimpianti enabling the area to be used as a covered space during inclement weather. Around the funnel house there is an athletic standard running track featuring rubberised Bolidt granules. Statendam retains a wrap-around promenade on deck 6, a traditional feature of Holland America Line and one that will no doubt be much used for daily fitness 'walk-a-thons'. This deck is also used as a lifeboat mustering point.

WHEELHOUSE INSTALLATION

In common with other technological aspects of the ship and as to be expected, Statendam's wheelhouse equipment is based on state-of-the-art systems. The heart of the navigation outfit is centred around an Atlas NACOS 25 integrated bridge package. This system integrates all navigation system radars, echo sounders, sonar Doppler log, wind speed indicator and the various position sensors such as satellite navigation receiver and the Loran C and Decca systems.

Four Atlas 8600 Nav radars are provided within the wheelhouse, each with 16in Rasterscan displays. Any of the ship's antennae can be connected to any of the displays by means of processor-controlled interswitch (pci). This system also incorporates a video map storage facility enabling charts to be displayed on any of the radar indicators. Synchronisation of the maps with the ship's progress is provided enabling narrow channels and other hazards to be easily navigated with the aid of a scaled representation of the ship.

All the main navigational information from the various sensors is displayed at each navigating position on high-resolution colour monitors. This data is continuously fed into an Atlas ARCAP 25 electronic unit which acts as an adaptive radar-controlled autopilot. The system can be pre-programmed to navigate the ship from one point to another using predetermined way points for course or speed changes. Thirty seconds before arrival at each way point an audible warning is given by the system asking for permission to alter course or speed at the forthcoming location. When the alarm is acknowledged, the course change is executed at the correct position. The system is all-embracing and includes functions for economic passage and course plan determined by required time of arrival. The operational modes provided by the ARCAP are as follows:

- Course control with preset radius of turn (true course over the ground or desired heading)
- Radar control of the autopilot for steering along a pre-determined track; this could be used in close coastal water navigation
- Course control by navigational position sensors

The Doppler log is an Atlas Dolog 23 which gives not only ahead and astern ship speed as appropriate but also port and starboard translation at the bow and stern when 'docking mode' is selected. For echo sounding an Atlas Echograph 481 system is employed incorporating four transducer units for incrased safety.

Three KaMeWa joystick units are installed on the bridge, one each at the wings and one at centre. These units simultaneously control the rudders, propellers and thrusters enabling one-hand precise navigation of the ship. As with Carnival's Fantasy, a simulation exercise using joystick control was conducted in Wageningen at MSCN (The Naval Architect, October 1989, page E373). For additional instruction with the joystick and the NACOS system, senior officiers of Statendam were sent for a period on board Silja Line's Silja Serenade travelling on the overnight run between Helsinki and Stockholm (The Naval Architect, February 1991, page H72).

SEA TRIALS REPORT

Statendam proved beyond any question during her two sets of sea trials that she is the world's most technically advanced and optimised cruise ship. Measurements for noise and vibration were considerably lower than experienced on previous Carnival and Holland America Line newbuildings. From a manoeuvring point of view, the performance of the Hinze flap rudders was said to be first class, and fears that the ship would heel dangerously during high-speed turns were unfounded; when slewing around, speed dropped so quickly that the maximum angle of heel was transitory and much less than anticipated. Exceptional rates of turn were measured whilst, manoeuvring with the thrusters and the flap rudders at zero speed is also understood to have achieved results that will enable Statendam to berth and sail under the most difficult conditions. □

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