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Recent Developments in Great Lakes Self-Unloading Bulk Carriers

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Summary

Technical data and design features are given for the first full size ocean-going self-unloading bulk carrier, M.V. "Atlantic Superior", built by Collingwood Shipyards and to be commissioned in 1982. This ship will be Canada Steamship Lines' link between the Great Lakes system and worldwide trading, as this ship has been designed to the highest strength standards to allow voyages to all parts of the world but still retaining the flexibility necessary for trading at Great Lakes ports.

1. Introduction

Change is an integral part of life on the Great Lakes system. At "Collingwood Shipyards", experts in the design and construction of these highly specialized vessels maintain a constant search to achieve perfection.

Until recently this type of vessel was limited by its strength standard to operating within the confines of the Great Lakes inland waterway.

Over the past four (4) years Collingwood, who built the world's first loop belt self-unloader, has delivered eight (8) new vessels, three of which are capable of travelling outside the present lakes limits to Newfoundland and St. John, New Brunswick. To enable this, a new strength standard was developed between Collingwood, Lloyd's Register of Shipping and the Canadian Coast Guard. This standard, also ratified by the American Bureau of Shipping, is presently being studied to allow these vessels to extend their service limits to include the whole of the Eastern U.S. Seaboard and the Caribbean, as far south as Jamaica. Later this year Collingwood's first full size ocean-going self-unloader will be delivered to its parent company, Canada Steamship Lines.

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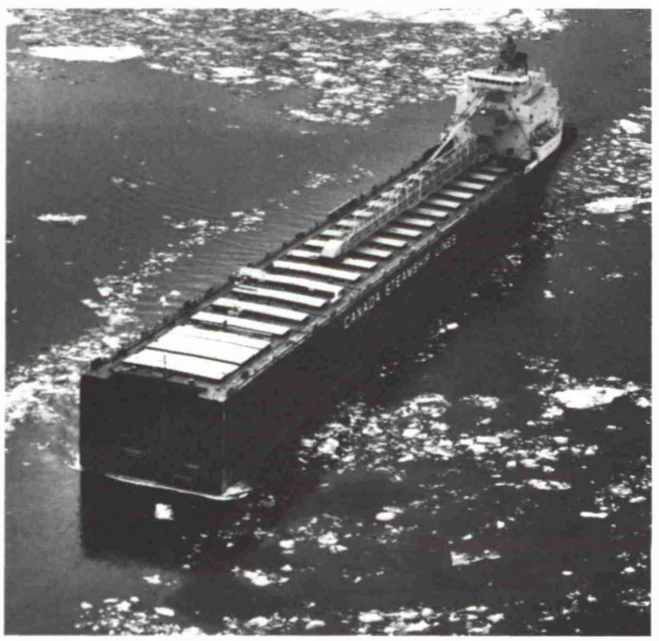
2. The M.V. "Atlantic Superior"

The M.V. "Atlantic Superior", as her name so aptly suggests, is CSL's modern day link between the Great Lakes system and worldwide trading. She has been specifically designed to the highest strength standards to allow voyages to all parts of the world, but retains the flexibility necessary for trading at Great Lakes ports.

Due to the extensive building schedule at Collingwood the 40 m bow section was built at her sister shipyard in Thunder Bay. The 182 m after section including the total propulsion package and accommodation block was towed the 1,100 km to Thunder Bay to be completed (Fig. 1).

Over the years major developments have taken place in Great Lakes vessels, mostly in the design of the hull form and in the techniques used in the unloading system.

Fig. 1



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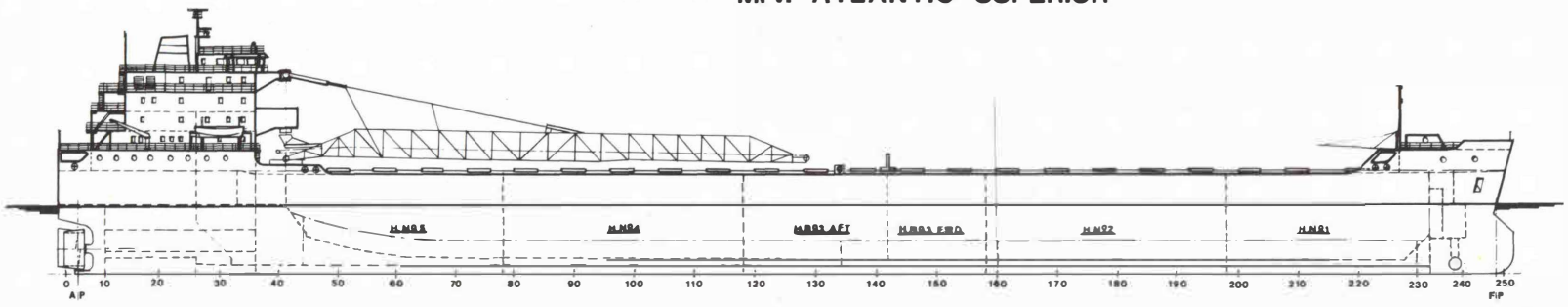
COLLINGWOOD SHIPYARDS

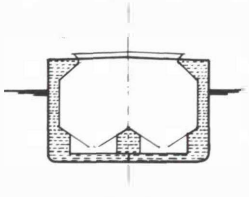
Fig. 2

GENERAL ARRANGEMENT

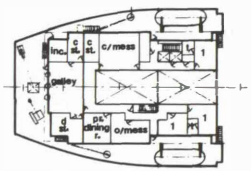
M.V. "ATLANTIC SUPERIOR"



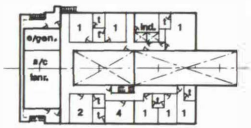
PROFILE



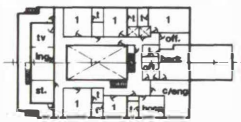
MIDSHIP SECTION



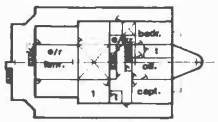
POOP DECK



LOWER PROM. DECK

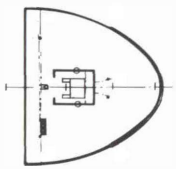


UPPER PROM. DECK

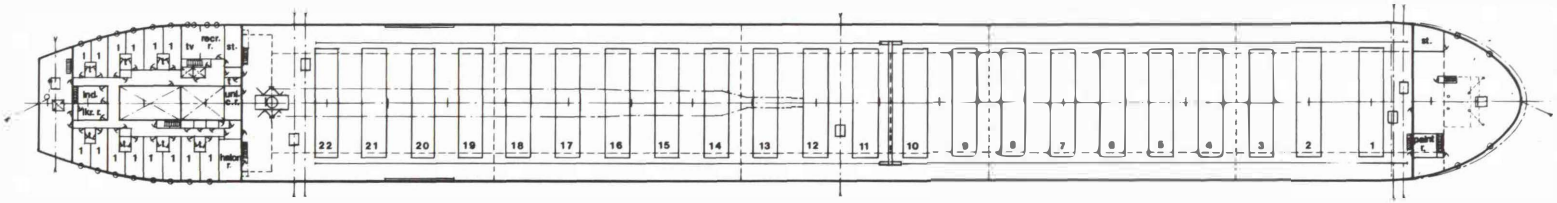


BRIDGE DECK

WHEELHOUSE DECK



FOC 'SLE DECK



SPAR DECK

SPAR DECK

General Arrangement
Drawing Nº: c.s.

SCALE; 0 5 10m 20m 30m

COLLSHIP '82

38,500 TON
SELF UNLOADING
BULK CARRIER FOR
GREAT LAKES,
ST. LAWRENCE RIVER AND
OCEAN WIDE SERVICE

PRINCIPAL PARTICULARS:

LENGTH O.A.	222.50 M.
LENGTH B.P.	216.83 M.
BREADTH MLD.	23.12 M.
DEPTH MLD.	15.25 M.
DRAFT (SUMMER S.W.)	10.41 M.
COMPLEMENT	37 PERSONS

Since both its length and beam are restricted to 222.5 m and 23.12 m respectively, changes in hull form center around the optimisation of the bow and stem sections. Extensive model testing of these high block coefficient ships revealed that the highest payload factor which is a combination of speed times carrying capacity, is achieved using the Collship modified ram bow in conjunction with water line flow on a reasonably short run to the propeller. Additional thrust and deadweight are gained by utilising a Collship designed steering nozzle and additional manoeuvrability is aided by the use of a controllable pitch propeller and a 1,200 HP bow thruster.

The bow form is specially strengthened for late winter operation and can break ice in both the light and loaded condition by the use of a backward sloping section in the stem. Additional flair has also been incorporated to reduce the effect of deck icing.

The steering nozzle which is approximately 5.4 m I.D., is of solid hoop construction with an aerofoil section. Minimum tip clearances combined with a stainless steel band achieve a high bollard pull condition and a 1/4 knot speed advantage (Fig. 2).

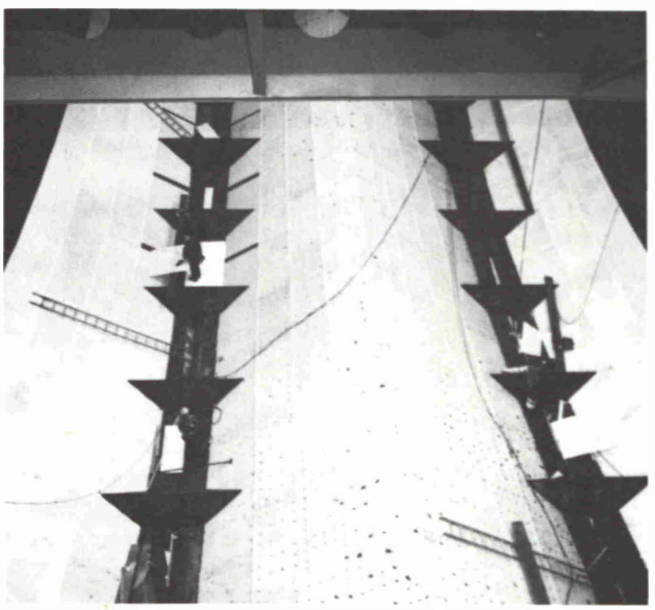


Fig. 3

3. Unloading System

Innovative techniques in ships' self-unloading equipment have been of great importance to these vessels in achieving a large capacity payload with the flexibility to handle and unload to shoreside hopper or pile, a wide variety of cargoes.

The M.V. "Atlantic Superior" is unloaded by a two-belt hold conveyor system which is located below the twin hoppered bottom of the cargo compartments (Fig. 3). These conveyors have a capacity of 6,000 t/h of iron ore or stone or 4,800 t/h of coal. The cargo is loaded on to the 84" tunnel conveyors by gravity through a series of 90, 9'0" long x 4'—10" wide bulk flow hydraulically operated gates which extend over the entire length of the cargo hold. The material is transferred from these main conveyors to a single loop conveyor via two 84" wide transfer conveyors forward of the engine room.

The loop conveyor consists of two belts, a 102" wide outer belt and a 108" wide inner belt. The cargo, sandwiched between these belts by a hydraulic tensioning device elevates the material to the unloading boom on the deck in a semi-circular form.

On deck the 250 ft long boom conveyor, which can be raised to an angle of 18 degrees by a 22" bore x 12 ft stroke hydraulic cylinder manufactured by Fox Fluid Power and slewed 90 degrees to either side by Sacan Hydropower yoke type hydraulic actuator, discharges the cargo to the shore side facility. These innovations have completely simplified the accurate positioning of the boom which until recently was manipulated by wires, blocks, and winches.

The self-unloading system was designed by Stephens-Adamson of Belleville, Ontario and installed by Collingwood Shipyards.

As the M.V. "Atlantic Superior" may be carrying cargoes which tend to 'hang up', the lower portion of the cargo hold which slopes at an angle of 35 degrees to the horizontal is completely lined with 4.5 million Ultra High Molecular Weight (UHMW) Polyethylene. The plastic's low coefficient of surface friction allows bulk material of all forms to flow easily through the gate opening without hanging up on the surrounding surfaces. UHMW Polyethylene is manufactured by Hercules Inc. of Wilmington, Delaware and supplied and installed by Mentor Dynamics Limited of Waterloo, Ontario. The material is fitted usually in 8' x 4' x 1/4" thick sheets which are held to the steel hoppers by electrically welded button head steel fasteners. The fastener is designed to allow up to 1/2" of thermal movement in the polyethylene since the coefficient of linear expansion is greater than that of steel substrate.

The fitting of plastic in the cargo hold has increased the unloading rate considerably and has led to a reduction of the hopper slopes which depending on the 'stiction' of the cargo could be as high as 10 degrees. This reduction enables additional cargo to be carried in that space and since it is housed lower in the ship's structure, improves the vessels stability characteristics.

4. Propulsion System and Auxiliary Equipment

The main propulsion package and auxiliary equipment for electrical power generating, ballasting and control systems are housed at the extreme aft end of the vessel.

The main propulsion system consists of one non-reversing Sulzer diesel engine, model 6RLA66 with a maximum continuous rating of 11,100 BHP at 124 RPM directly connected by means of a hollow bored propeller shaft to a Lips four bladed variable pitch propeller operating in a steering nozzle. The normal full load rating of the engine is 9,990 BHP giving a service speed of 14 knots. The engine is arranged to burn heavy fuel oil having a visosity of 3500 Seconds Redwood No. 1 at 100°F (Fig. 4).

Control of the propulsion system can be carried out from the bridge or from the engine control room. The control system provides single handle control of the propeller speed and pitch ahead and astern. The engine is normally started and stopped by push button controls on the engine control room console.

Fig. 4

The control room console, supplied by Sulzer, also contains an Autronica alarm panel for monitoring the operating conditions of the main engine and other machinery in the engine room.

Auxiliary equipment outside the machinery space consists of anchor windlasses forward and aft supplied by Clarke Chapman and seven Collomatic self-tensioning mooring winches each capable of a maximum pull of 27,500 pounds. The forward windlass is remotely controlled from the wheelhouse and the mooring winches are controlled from either side of the ship. The four cylinder hydraulic steering gear is supplied by Sperry and is capable of moving the steering nozzle through a 70 degree arc in 14 seconds.

Electrical power is generated by three MAK model 6M332 diesel engines driving Siemens 888 KW alternators and provide power for, or control, virtually every function on board the vessel. The control equipment for the generators and the distribution circuits are a part of the main switchboard located in the sound-proof engine control room.

In addition to supplying the usual ship's services, the generators supply power for the unloading gear and for the 1,200 HP electrically driven Lips bow steering propeller.

The unloading equipment is supplied by a separate motor control center located in the engine room and operated from a control room located in the house front. The magnitude of the electrical requirements for unloading can be gauged by the size of the major electric motors; two 400 HP boom drives, two 400 HP/200 HP loop belt drives, two 300 HP main conveyor drives.

5. Navigational System

The navigational aids which are located in the wheelhouse are supplied by Sperry Marine and Canadian Marconi and consist of:

2 — Radars
2 — Gyro Compass Systems
1 — Auto Pilot
3 — VHF Radio Telephones
2 — SSB Radio Telephone
1 — Watchkeeping Receiver
1 — Weather Facsimile Receiver
1 — Echo Sounder
1 — Direction Finder
1 — Loran (Navitron)
1 — Marisat Satellite Communication System C/W Teleprinter (Telex)
1 — Course Recorder

The Marisat Mobile Communications system is the first Global Satellite navigation system to be used by the CSL Fleet. It is designed for telephone, telex, data transmission and facsimile services for worldwide use.

The system is composed of three stationary satellites over the Atlantic, Pacific and Indian Oceans and three earth stations located at Southbury, Conn., USA, Santa Paula, California, USA, and Yanaguchi, Japan.

This technology is used to navigate to pinpoint accuracy, and with the associated up to date weather information is designed to steer the most effective course clear of major storms.

6. Crew Accommodation

The living quarters of the M.V. "Atlantic Superior" are in the tradition of Canada Steamship Lines — the most up to date available with individual rooms for all personnel, tastefully decorated with furnishings from Trott's of Collingwood.

The five tiers of accommodation are all situated aft and are built to the highest standards of fire protection in the world. This has been achieved using fire proof material throughout all ceilings, passageways and stairway bulkheads and fire proof divisional bulkheads every fifty square meters. All doors, insulation, paint, etc., within the accommodation block are also fire proof.

The entire accommodation which has the capability to house 37 people, is air-conditioned or heated as the ambient temperature demands, and spacious recreational rooms and other conveniences are available for both Officers and crew.