



## THE CLIENT: CSL GROUP INC.

**H**eadquartered in Montreal, Quebec, The CSL Group Inc. (CSL) is a Canadian-based, privately-owned shipping company with affiliate offices in Halifax, Winnipeg, Hamilton (Canada), Beverly (USA), Windsor (UK), Bergen (Norway), Singapore and Sydney (Australia). It is a leading provider of marine dry bulk cargo handling and delivery services and the world's largest owner and operator of self-unloading vessels.

CSL owns and operates a highly diversified fleet of specialized self-unloading vessels, offshore transhippers and handysize bulk carriers. The cargo it transports includes iron ore, grain, coal, salt, aggregates and sugar, among many others. CSL delivers more than 70 million tonnes of dry-bulk cargo a year for customers around the world in industries ranging from construction and steel to energy and agri-food.

### CSL'S NEEDS FOR HARMONIC MITIGATION

CSL had nine Panamax ships being manufactured by Chengxi Shipyard Co. Ltd. of Jiangyin City, China, located 150km south of Shanghai. Panamax ships are designed to pass through the Panama

Canal. Ships in this category fit into a minimum bounding box that matches the dimensions of the canal's smallest locks. They are engineered to move through bottlenecks in the canal while carrying the maximum amount of cargo permitted—hence the suffix “-max”.

For international transport, CSL's Panamax ships were required to meet compliance standards for Lloyds Registry and the American Bureau of Shipping, which call for total harmonic voltage distortion (THD(V) limits on the electrical supply system of less than 5%. During sea trials in China, CSL discovered that the THD(V) limits on its ships exceeded what was permitted by almost 30%.



◀ Baie St Paul one of four (4) Laker Trillium Class. Panamax SU type vessels

### THE MIRUS SOLUTION

After simulation, testing and analysis, MIRUS engineers recommended the LINEATOR Advanced Universal Harmonic Filters for installation in vessels with the largest Variable Frequency Drives (VFD) on board. For CSL's Panamax ships, the MIRUS solution was applied to four vessels with four (4) - 400HP unloading conveyor drives and two (2) - 400 HP ballast pump drives. Five other vessels had four (4) - 400 HP unloading conveyor drives and two (2) - 350 HP ballast pump drives. Computer simulations, using MIRUS' SOLV software, showed that with the LINEATORS installed, the THD(V) on the ships reduced to well within the required limits of <5% THD(V).

CSL's new Panamax ships are currently the most advanced of their kind in the world, equipped to meet evolving business needs and high environmental standards of customers. They feature the most cutting-edge technology available for bulk handling and transportation. Variable Frequency Drives (VFD'S) on thrusters, ballast pumps, SU conveyor machines and ventilation fans increase operation and fuel efficiency.

With the help of Mirus International's world class power quality improvement products for mission critical operations, four of CSL's Panamax vessels are now destined for operation in the Great Lakes seaway, from Duluth, Minnesota to the Gulf of St Lawrence; while five other ships are ocean-bound, for operation in blue water transport around the world.

### MIRUS'S HARMONIC MITIGATION INSIGHTS AND EXPERTISE

CSL asked MIRUS International to provide a harmonic mitigation solution for all of its Panamax vessels. Using its SOLV software, MIRUS proceeded to model the ship's electrical system to simulate THD(V) numbers. CSL also needed actual field measurements, so MIRUS boarded one of the ships and performed tests on-site to measure THD(V). The field test measurements matched closely with the simulated THD(V) numbers, along with CSL's own sea trial measurements.