UNB EST. 1785 UNIVERSITY OF NEW BRUNSWICK | Off-site Construction Research Centre

PROJECT PROFILE

MALTA INC.

MODULARIZED CONSTRUCTION ANALYSIS OF COMPACT HEAT EXCHANGER TRAINS

Based in Cambridge, Massachusetts, Malta Inc. is the leader in energy go-to-market strategies and has robust engineering talent in industrial-scale power generation systems. The Malta concept is built upon principles in thermodynamics for a system that stores energy as heat and as cold.

PROJECT BACKGROUND

Malta Inc. has identified opportunities in the off-site construction space to modularize portions of its energy storage solutions. The first Malta Inc. PHES system design had large commercial off-the-shelf heat exchangers (HX) that required substantial on-site work. The subsequent Malta PHES system design uses much more compact HXs that are currently being jointly developed with Alfa Laval. It is envisioned that each HX train could be pre-assembled in a factory setting and then shipped to the site, ready to be installed. The organization has engaged the UNB OCRC to investigate, assess and simulate the opportunities of transitioning portions of the process to an off-site solution. This will help to further develop the potential of shortening Malta Inc.'s implementation timeline and increase market opportunities for the organization.

RESULTS

The outcomes of this exploratory phase of the project with Malta Inc. included the development of an evaluation matrix to assess design alternatives, an initial evaluation of the compact Recuperator-Coolant-Heart Rejection (compact RCH) and the off-the-shelf Commercial Solution (CS) design alternatives, and a preliminary construction simulation to demonstrate the on-site constructability.
The evaluation matrix is used to assess design alternatives before moving to the construction simulation phase, ensuring key criteria have been considered in the design and planning phases of the project. The key areas of evaluation included: Design, Planning & Management, Manufacturing, Logistics & Shipping, On-site Construction and Post-Construction.
For the construction simulation, data was collected for the compact RCH and CS design alternatives, including the number of lifts, the weight of the module and the crane requirements. The simulation was completed using Navisworks to show the installation sequence. The result of the simulation of construction activities showed a 38-day duration for the compact RCH alternative, and a 64-day period for the CS alternative. This concluded that the compact RCH alternative was the most construction-efficient option. Once this was identified, the OCRC planned and proposed potential on-site crane locations and executed a rigging analysis to support the planning stages of the on-site construction activities.

RECOMMENDATIONS

Phase 1 of the project work with Malta Inc. was exploratory in nature and gave the OCRC an opportunity to understand the goals of Malta Inc. in their development of the design of compact heat exchangers. The first phase was limited in scope due to the timeline constraints but allowed both organizations to discuss a robust scope for Phase 2 of the project, enabling the OCRC to support Malta Inc. in achieving their end goals.
Based on the results of the project, the OCRC has the following recommendations:

- Malta Inc. should proceed with compacting the RCH design alternative
- A deeper investigation into on-site productivity at a greater level of detail is needed to represent the expected time on-site and simulate construction activities accurately
- For the rigging design, the utilization of standard-size spreader bars and lifting device dimensions should be taken into consideration when finalizing the compact RCH model design
- For on-site lifting purposes, the center of gravity should be a key consideration when determining module dimensions, as well as arrangements of the components inside the modules