News Article for RISUD Strategic Focus Area (SFA) Scheme

		Name	Department
1.	**Principal Investigator**:	Prof. Jian-Guo DAI	CEE
2.	**Name of SFA:**	Very Large Floating Structures	
3.	**Project Title:**	High-Performance Materials and Structural Elements for Sustainable Floating Structures	

4. Third Year Progress/Achievement

The current land shortage in Hong Kong has led to various challenges in the society. In 2018, Chief Executive Carrie Lam presented the solution to create new space for her inhabitants involving large scale land reclamation projects called Lantau Tomorrow. The responses from the country are quite diluted and many people are worried on how this large scale project will affect the seawater quality, current flow, marine biology or the national reserves. A methodology for creating new land that is much less invasive is using the very large floating structures (VLFS) technology. Examples of VLFSs include floating islands, floating airports, floating storage structures, floating wind farms and floating solar farms. For these existing floating structures, conventional steel-reinforced concrete (RC) structures, constructed of normal concrete and steel, have been commonly used. Steel floating structures suffer from steel corrosion in the marine environment and should be avoided if possible as regular maintenance using anti-corrosion coatings is expensive; these coatings could also have an adverse effect on marine life. Steel corrosion is also a concern with RC floating structures, where the deterioration due to corrosion of steel reinforcement has been widely recognized as a hugely costly problem. Thus, research on the construction of floating structures with emerging high-performance materials is of great importance to enable coastal cities to benefit effectively from the space and resources offered by oceans.

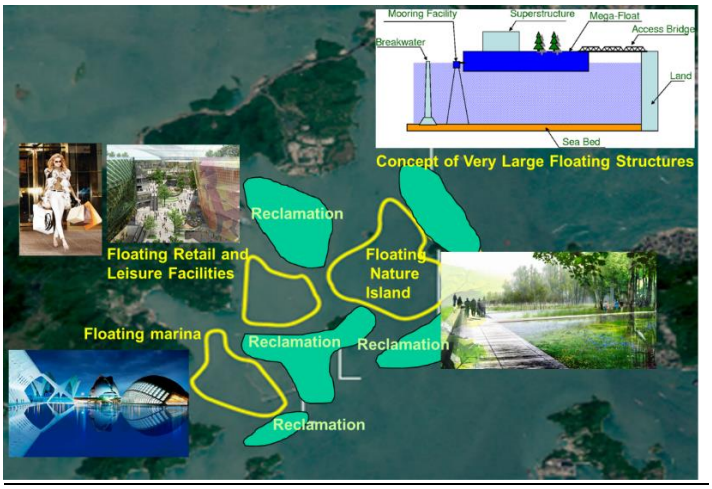

Fig.1 Hybrid reclamation-VLFS approach for Lantau Tomorrow Vision (conceptual drawing)

In this research project, we propose to incorporate VLFS into “Lantau Tomorrow Vision” and form a synergetic combination of reclamation and VLFS for land creation. The existing and reclaimed islands will create calm artificial lakes suitable for VLFSs even in the event of typhoons (Fig.1). The VLFS will comprise clusters of prefabricated buildings to form a platform that provides the buoyancy, which can be made from prestressed concrete and other advanced composite structures. The floating platforms are moored and will be kept in place but allowed to rise and fall as tides change. Each platform is linked to the adjacent one and the whole forms a complex accessible anywhere by foot, or personal mobility device. Self-driving electric vehicles/mega complex drone taxis may be used to get around between clusters. Some of the clusters can be shaped to feature floating shopping malls, performance stage, floating parks etc. on top. The “basement” decks below can be used for storage, waste treatment plant and power plant, other areas below the water will be used as underwater rooms that increase the connection with the marine ecology. A few key scientific and technical issues relevant to the implementation of the synergetic reclamation and VLFS approach in “Lantau Tomorrow Vision” from the perspectives of structural engineering, ocean engineering and geotechnical engineering, have been investigated to support the subsequent planning, design and construction activities:

(1) Development of FRP-reinforced high-strength seawater sea-sand Engineered Cementitious Composites (SS-ECC) for marine and coastal applications. (Fig.2)
(2) Applications of FRP composites in marine geotechnical engineering.
(3) Wave field analysis of based on unconstructed Grid Finite Volume Community Oceam Model (FVCOM). (Fig.3)
(4) Development of advanced platform for numerical simulation of wave-VLFS-foundation interaction.

Fig.2 FRP-reinforced ultra-high-performance seawater sea-sand concrete

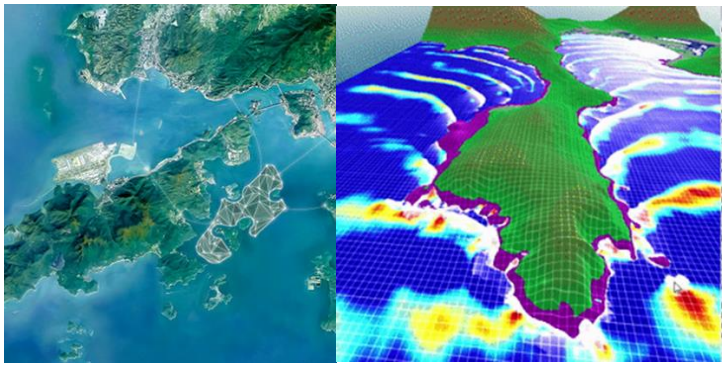

Fig.3 Wave field analysis based on advanced numerical modeling

It is expected that upon the project completion, a solid technical foundation can be formed to support the implementation of the hybrid reclamation-VLFS through material development, understanding of structural behavior and case study.