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. **First/Second/Third Year Progress/Achievement (***in layman's language, no more than two A4 pages, pls attach a few photos***)**

Land shortage is a significant problem that restrains the living environment improvement and sustainable economic growth in Hong Kong. Traditional large-scale land reclamation has played, and will continue to play, an important role in creating land for urban development in densely populated coastal cities like Hong Kong. However, this solution also attracts criticisms relating to threats to the marine environment, the degradation of water quality, the disruption of current flow, the vast cost relating to the lengthy soil consolidation and construction periods, and the shortage of filling materials for land reclamation. A methodology for creating new land that is much less invasive is using the very large floating structures (VLFS) (see Fig.1 as an example), which usually consist of a floating platform on which superstructures are built with various functionalities. 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., a mooring system for stability and keeping the structure from moving in the horizontal plane and a breakwater system to reduce wave loads on the floating structures.

Fig.1 VLFS (Conceptual drawing: Left; High performance construction materials: Right)

This project aims to address a few key scientific and technical issues relevant to the implementation of the VLFS technology from the perspectives of structural engineering, ocean engineering and geotechnical engineering, to support the subsequent planning, design and construction activities. The major research topics studied in the project included: (1) Development of FRP-reinforced high-strength seawater sea-sand ultra-high performance cementitious composites (UHPC) for marine and coastal applications (see Fig.1 right); (2) Development of innovative FRP-UHPC structural elements; (3) Use of FRP-incorporated technologies in the anchorage systems of the VLFS; (4) to achieve an in-depth understanding of the wave-VLFS interactions considering the benchmark local climate. The project has formed a technical foundation to support the implementation of the VLFS technology through material development, understanding of structural behavior and case studies.