Environmental Research, Technology Demonstration and Conference Project

ECF Project:	ECF 2018-37
Project Title:	Drone-based remote sensing of coastal water quality for monitoring of algal blooms
Applicant:	Dr Chan Shu Ning, Department of Civil and Environmental Engineering, The Hong Kong University of Science and Technology
Total Approved Grant:	$499,572
Duration:	1/7/2019 to 31/12/2020
Project Status/Remarks:	Completed
Project Scope:	This research project aims to develop an estimator algorithm for remote sensing of small scale coastal water quality with emphasis on algal blooms, using Unmanned Aerial Vehicles (UAV). Field trials will be conducted in coastal waters of representative fish culture zones in Hong Kong for imaging and water quality sampling to obtain data for calibrating the multi-spectral images with surface chlorophyll and suspended solid concentrations. The measured spatial distribution and temporal variation of chlorophyll concentration will be interpreted using a numerical shallow-water hydrodynamic model. The UAV remote sensing will be supplement the existing man-power driven water quality surveys and benefit stakeholders for early warning and decision making on mitigation of harmful algal blooms impact.
Summary of the Findings/Outcomes:	In sub-tropical coastal waters around Hong Kong, harmful algal blooms (HABs) and red tides are often observed. Under the right environmental conditions, microscopic algae can grow explosively within a short time and causes discoloration of the water, fish kills and beach closures. Large-scale massive HAB events that lasted for months and destructive extensive fisheries occurred in spring 1998 and in winter 2015. Remote sensing of water quality using Unmanned Aerial Vehicles (UAVs) are potentially suitable for supplementing water quality monitoring for mariculture in sheltered coastal bays in subtropical cities affected by often cloud coverage. In this project, field trials were conducted in fish culture zones representative of different water quality characteristics in Hong Kong for near concurrent UAV imaging and water quality sampling. Field data were obtained for developing algorithms to estimate water quality parameters from UAV multi-spectral images with emphasis on chlorophyll-a concentration for algal blooms. The measured spatial distribution and temporal variation of chlorophyll-a concentration have been interpreted using a numerical hydrodynamic model. This “ground-truthed” UAV remote sensing technology will be benefiting the existing man-power driven water quality surveys for early warning and decision making in fisheries and red tide management.