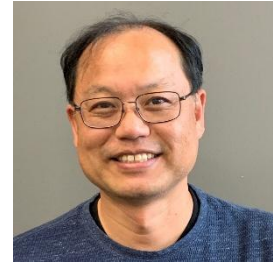


Toyota Mothership Research Project and Marine Applications

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Abstract: Research teams led by Toyota Frontier Research Center in Japan have been investigating the feasibility of a high-altitude aerial platform known as the Mothership. Essentially a large-scale, advanced kite, the Mothership delivers exceptional endurance and station-keeping by harnessing the stronger, more consistent winds found at high altitudes. This technology opens up unprecedented opportunities for innovative applications such as wind energy harvesting, atmospheric data acquisition, and communications.



The Toyota research team in Japan is actively expanding the flight envelope and improving system reliability, recently achieving a milestone altitude of 3,950 meters—surpassing the height of Mount Fuji (approximately 3,776 meters). Meanwhile, the team based in Michigan, USA, is developing fundamental technologies and tools to support this advancement, which includes bio-inspired flight control, wing morphing, wind-adaptive path planning, optical attitude sensor, augmented reality goggle, deformation sensing tape, and advanced inflatable structures.

We recognize significant potential for integrating these advanced kite systems into marine environments, including offshore wind energy harvesting, weather data collection, and even localized weather control.

This talk will provide an overview of Toyota's Mothership research, highlight recent progress on key enabling technologies, and conclude with a discussion on potential marine applications of Toyota's advanced kite systems.

Bio Sketch: Taewoo Nam is a Senior Principal Scientist at Toyota Research Institute of North America (TRINA), leading the High-Altitude Aerial Platform (Mothership) study. Since joining TRINA in 2013, he has focused on future mobility concepts, including dual-mode vehicles and personal air mobility.

Before Toyota, he was a research engineer at Georgia Tech, leading the System Analysis and Vehicle Design branches of the Aerospace Systems Design Laboratory. His research covered multidisciplinary design optimization and probabilistic design, contributing to various advanced air-vehicle concept studies including Boeing's SUGAR project and NASA's Truss-Braced Wing concept. He also participated in ICAO's CO2 emissions standard development through CAEP Working Group 3.

Between his master's and doctoral studies, Nam worked as a senior configuration design engineer at Korea Aerospace Industries, contributing to the T-50 supersonic trainer and Korean Next Generation Fighter (KFX) concept studies. He holds a bachelor's and master's in aerospace engineering from Seoul National University and a Ph.D. from Georgia Tech.