Singapore Space Challenge 2013 Organized by the Singapore Space and Technology Association (SSTA)

Category 4: Autonomous Systems – Autonomous Space Miner

On 15th August 2013, Team Aion from the National University of Singapore (NUS) Department of Electrical & Computer Engineering (ECE) consisting of **Raymond Kwek Kok Xuan (leader)**, **Goh Yong Liang**, **Lim Dao En Isaiah**, **Mok Siu Pan,** and **Ng Wenbin Reico Maynard** (all year 3 students) supervised by **Dr Pang Chee Khiang, Justin** – won the 1st Prize in the Singapore Space Challenge 2013 under Category 4: Autonomous Systems. Their winning entry, entitled "Autonomous Space Miner," won the first place comprising of a cash prize of S$2,500 and a plaque.

The Singapore Space Challenge (SSC) is an annual prestigious national design competition that challenges student teams to design and develop realistic space-related projects. Organized by the Singapore Space and Technology Association (SSTA), participants work on a variety of projects and complete theoretical models and design prototypes, judged by leaders in the space industry. The

primary goal of the competition is to promote technical and industrial research in space and technology and at the same time, challenge the thinking processes and creativity of students. Through working on industry-linked R&D projects, the competition hopes to give students maximum realism and allow them to explore engineering concepts that further innovations and advancements in space-related technologies.

For the category on Autonomous Systems, the challenge was to design an autonomous space miner that could be used to mine precious resources on planetary bodies. Given the recently strong evidence of ice being present within the polar craters of our moon, Team Aion came up with a nuclear-powered ice coring miner that is capable of star tracking for self-navigation, featuring smart-skin antenna for communications with a deployed lander which also acts as a command center. The miner is designed to be robust and resilient enough to operate autonomously within the permanently dark ice crater, as well as regulating its internal temperature through recycling the heat generated by the radioisotope thermoelectric generator.

The extracted ice cores can then be sent back to Earth for historical research and to analyze their origins. The extraction of lunar ice also raises the future prospect of sustainable space missions, as water can serve as fuel and for consumption should a lunar outpost be constructed in future, mitigating exorbitant launch costs in the space industry.