

IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
On Track - Undergraduate Space Education (3)

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ACTIVE LEARNING PROGRAM USING PARABOLIC FLIGHT RESULTS OF SPACE EDUCATION
PROGRAM OF TOKYO UNIVERSITY OF SCIENCE AND BEYOND

Abstract

Active learning is an effective method to learn systems engineering. An active learning program based on a space base mission would be effective not only to acquire system management skills for the space mission, but also to learn various systems as space missions have restricted constraints, require high-reliability, and adaptation to failure. Tokyo University of Science (TUS) set up the TUS Space Education Program (T-SEP) funded by the Aerospace Science and Technology Promotion Program of the Ministry of Education, Culture, Sports, Science, and Technology (MEXT). As one of the most important program of the T-SEP, T-SEP conducts special group experience learning using a parabolic flight. A parabolic flight is one of the most conventionally used experimental methods for achieving microgravity conditions. When an airplane flies in a vertical parabolic trajectory, microgravity can be achieved inside the airplane for about 20 s. T-SEP participants were divided into six teams (three university teams and three high school teams) to perform parabolic flight experiments. The experiments performed in parabolic flight need to meet various constraints. For example, (i) experimental equipment should meet the size and weight limitations; (ii) the brief period of microgravity during a parabolic flight is limited to 20 s; therefore, each experiment should be able to achieve results in this short period; (iii) the material that can be utilized for experiments is limited: liquid is limited in volume, and needs to be kept inside the equipment without any leakage. Each team is expected to propose experiments that can be performed under these limitations. Based on their proposal, they then need to design the experiment apparatus. In order to perform the in-flight experiments, team management and schedule management are especially important. The date of the chartered flights is strictly determined beforehand, therefore they cannot perform any experiment if the

preparation of experiments is not finished on the specified day, no matter how important the experiment is. These issues are especially important when performing space missions; therefore, the group experiment on parabolic flight is a good simulation of a space mission and is an effective method to teach the basic processes involved in one. During we perform the 3 years program of T-SEP, we performed more than 18 parabolic flight experiments. Some these experiments have been presented in domestic and international conferences, and have received awards. In this paper, the effectiveness and educational know-how of these active learning program is discussed briefly.