## Abstract

This study is conducted to quantitatively evaluate the effectiveness of training in CRM (Crew Resource Management). At first, CRM is a management framework to maximize the use of human resources by training pilots, mainly in the aviation industry. The following two benefits are expected from this training. One is the improvement of communication skills. The second is to improve management techniques based on current and future situational awareness. Thus, the essence of CRM is a smooth utilization of the knowledge and experience among crew members in their work.

However, the recent environment surrounding CRM is problematic. Because when it comes to evaluation methods on CRM training, current aviation industry cannot help but rely on the subjective experience of the evaluator. This is because CRM deals with vague concepts such as communication and management. Thus, it makes difficult to evaluate CRM effectiveness quantitatively. Therefore, different evaluators may give different ratings to the same training. This situation is undesirable. According to this situation, the objective of this study is to develop and verify an objective evaluation method that outputs the same results regardless of who does the evaluation.

As a novelty of evaluation method, this study proposes an evaluation method focusing on aircraft trajectories. Previous evaluation studies in CRM training have focused on changes in pilot behavior. This is not surprising from the perspective that CRM drives change in pilots. However, since the goal of conducting CRM training is ultimately to improve operational performance. Therefore, it is worth to be considered.

Based on the above ideas, this study proposes a five-axis evaluation framework that adds a quantitative evaluation axis for communication in addition to the three evaluation axes for aircraft trajectory. Then, comparative experiment will be conducted to verify the effectiveness of this evaluation method. Specifically, the CRM-trained experimental group and control groups will be given a task using a flight simulator and the results will be compared. In this experiment, an artificial authority gradient shall be formed by giving false information to each subject to reproduce the actual cockpit situation. This will be created as an impediment to communication by giving them the role of a supervisor and his subordinate.

The results of the experiment, conducted in pairs, were generally favorable for the validity of this evaluation method. Specifically, the results reflect the effectiveness of CRM training with respect to course-focused evaluations. In the other words, the effectiveness of CRM training, such as task management and planning, was reflected.

However, contradictory results were obtained for some of the evaluation items related to communication. The control group, which had not received CRM training, recorded better performance. In conclusion, the results of the framework verification were generally appropriate, but some of the results left room for improvement.