

SPACE OPERATIONS SYMPOSIUM (B6)
Training Relevant for Operations, in particular Human Spaceflight (3)

Author: Dr. Yijing zhang
China Astronaut Research and Training Center, China, zyj.acc@gmail.com

Dr. Zhizhong Li
Tsinghua University, China, zzli@tsinghua.edu.cn
Prof. Bin Wu
China Astronaut Research and Training Center, China, wubinacc@sina.com
Ms. Liujia Shi
China Astronaut Research and Training Center, China, shiliujia@gmail.com
Prof. Su Wu
Tsinghua University, China, wusu@tsinghua.edu.cn

VALIDATION AND APPLICATION OF SPACEFLIGHT OPERATION COMPLEXITY MEASURE IN
CHINESE ASTRONAUTS TRAINING OF EXTRA VEHICULAR ACTIVITY MISSION

Abstract

Abstract: In astronaut training, it would be reasonable to allocate time and resources for a spaceflight operation or task according to its complexity. In this study, an operation complexity measure is proposed by borrowing the idea of Halstead method in software engineering, which indicated that one program with more operators and operands has a more complicated procedure structure. For the spaceflight operations, an operator is defined as an action to be done by an astronaut; an operand is defined as an instrument that is operated by an astronaut. To better reflect the complexity of spaceflight operations, the number of weighted operators and weighted operands were used in the Halstead Volume formula, where operators are weighted based on the McCracken-Aldrich theory and operands are weighted according to the complexity level of operation interfaces. The proposed measure can be used to evaluate operation complexity from both behavior activities and the cognition activities. This measure was validated by the data collected from astronaut training of extra vehicular activity (EVA) mission in China. Totally 28 emergency operation units in EVA mission were selected, the corresponding operation times were picked up. Then, regression analysis was done on operation complexity versus operation time and subjective complexity rating. The results show strong correlation of operation complexity with operation performance and subjective complexity rating. This measure has been used in the design of astronaut training plan and the evaluation of astronaut training.

Keywords: Operation complexity; Astronaut training; Extra vehicular activity; Emergency operation