IAF SYMPOSIUM ON COMMERCIAL SPACEFLIGHT SAFETY ISSUES (D6)
Commercial Spaceflight Safety and Emerging Issues (1)

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DEVELOPMENT OF AUTONOMOUS FLIGHT TERMINATION SOFTWARE

Abstract

When launching vehicles, it is necessary to minimize the possibility of hazard to human lives and assets so as to ensure the public safety. Therefore, the flight safety system is required to terminate an off-nominal flight in case of a failure of the vehicle. In Japan, the Flight Safety officer, at the Range Control Centre (RCC), monitors the condition of the vehicle in flight and judges the necessity of the flight termination based on the operational procedures. The flight termination is performed by sending a signal to the vehicle from the RCC. When performing a flight safety from the ground, it is necessary to place the radio stations along the flight path and setup the network connecting the stations. Using the autonomous flight safety system could simplify ground equipment since the system resides in the vehicle.

The autonomous flight safety system monitors the flight path and the health of the vehicle. Since the autonomous flight safety system operates based on the criteria defined in advance, it is essential to establish the judgement criteria that comply with the safety requirement.

The AFTS has been developed by Japan Aerospace Exploration Agency (JAXA). It consists of the onboard Autonomous Flight Termination Computer (AFTC) and the Autonomous Flight Termination Software (AFTSW). The AFTSW has been developed by Space Engineering Development Co., Ltd. (SED) under JAXA's contract. The AFTSW consists of two software layers, namely the multi-user layer and the vehicle-specific layer. The former performs generic functions such as the flight safety judgement and the latter typically handles the interface to the vehicle's hardware. JAXA launched a sounding rocket with the AFTS onboard at December 2, 2023, and demonstrated that the AFTSW worked as intended.

In order to expand the application of the AFTS, it is being considered to apply the AFTS in the recovery phase of the first stage and the reentry phase of the second stage as well as the ascent phase in which the current AFTSW is designed to be used. Furthermore, the flight termination judgement using the Drag Impact Area (DIA), which is debris dispersion area estimated with the atmospheric drag, is also considered. Using the DIA can make the judgement more flexible than using pre-determined destruct lines. We are now revising the criteria and sorting the problems to incorporate the DIA into the AFTSW and to apply it to the recovery phase and reentry phase.