WATER IMPACT TESTS AND SIMULATIONS FOR CRM SCALED AIRCRAFT MODEL

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ABSTRACT

In Japan, many airports are located in seaside areas which increase the potential for planned aircraft water impact, so-called ditching, or unplanned water contact occur during the approach and departure phases of flight. Thus, it is important that we acquire the ability to estimate hydrodynamic loads and effects on aircraft structure with water impact when we design aircraft structure or simulate aircraft accidents of ditching or unplanned water contact cases. This enables us to attain safer aircraft flights and to improve aircraft water impact crashworthiness. In the estimation, we should estimate hydrodynamic impact states of the elastic full-scale transport fuselage skin from ditching test data of small scaled rigid transport model. Although horizontal flight speed is high, and vertical flight speed is very small during ditching situation, we have already conducted a large of vertical water impact tests in order to be able to acquire a method of estimating hydrodynamic impact on a fuselage surface in the past. In this paper, we present the results of horizontal water impact tests with a scaled configuration model of CRM (Common Research Model of NASA for CFD community). Two types of models are used, one is a scaled fuselage simulating only the aft fuselage outer-mold shape, and the other is a full CRM scaled aircraft. In the test, the model was dropped from the carriage on the National Yokohama University Large Ocean Wave Tank monorail so that it was free to drop onto the water. We conducted towing tests, drop tests onto calm water surface for horizontal impact, and drop tests onto a moving water for investigating wave effects to aircraft during water landing. In these tests, we measured accelerations of articles, pressures on surface, and motion pictures by high-speed digital video cameras. We used these data as correlation data for numerical simulations. We conducted numerical simulations using explicit finite element code LS-DYNA with an arbitrary Lagrangian-Eulerian (ALE) method to simulate the above tests. In this presentation, we show that the numerical simulations acquire accurate estimations of the water impact tests and the simulation is a useful method for estimating behaviour and surface pressure of aircraft during water landing with and without waves.