HARDWARE IN LOOP TESTING METHODOLOGY FOR DYNAMIC EVALUATION OF AIR DATA COMPUTER

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Abstract

The conventional approach being followed for the system level evaluation of the newly developed or newly integrated avionics system (usually called as line replaceable unit-LRU) of an aircraft, in order to define the LRU's production baseline, consists of various phases of system level checks. These testing phases include qualification test, acceptance test, rig integration checks, pre-installation checks, aircraft level checks, and flight test evaluation. In a scenario, wherein the availability of intended aircraft platform is delayed to commence the flight testing of newly developed prototype LRU, an alternate testing methodology is important to expedite the production baseline of such system. An innovative hardware-in-loop testing methodology has been established by stimulating the LRU, in the laboratory, with real flight profile and observing the performance of the LRU by interfacing it with other aircraft systems and recording the input/output parameters simultaneously for further analysis. The flight data of different sorties with different dynamic maneuvering cases have been considered to stimulate the indigenously developed air data computer and validate its hardware and software design configuration to large extent without performing the real flight testing. The pitot-static pressures and static air temperature corresponding to the flight dynamics are recreated using the inverse air data algorithm and necessary test equipments for generating the physical parameters. The latency in the testing philosophy has been well quantified and the latency factors for various cases are considered in the performance analysis. The approach of hardware-in-loop system (HILS) cum flight profile recreation testing methodology has significantly reduced the effort of real flight testing, in terms of time and cost of flight testing. It has helped for early identification of the problems pertaining to the algorithm, software implementation, and hardware configuration; and to improve the system performance. Based on the results of this innovative testing methodology, the software and hardware logics of the prototype LRU have been corrected, re-validated, and the baseline for the production unit has been defined without performing the real flight testing. Further fine tuning of the LRU, if required, will be carried out based on the real flight testing. This novel approach has significantly helped the program of indigenizing air data computer for a modern trainer aircraft.

Keywords: ADC, HILS, Flight Profile Recreation, Comprehensive Evaluation