Changes in Pilot Control Behaviour across Stewart Platform Motion Systems

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Low-cost motion systems have been proposed for certain training tasks that would otherwise be performed on high-performance full flight simulators. These systems have shorter stroke actuators, lower bandwidth, and higher noise. The influence of these characteristics on pilot perception and control behaviour is unknown, and can be investigated by simulating a model of a simulator with limited capabilities on a high-end simulator. The platform limitations, such as a platform filter, time delay, and simulator noise characteristics, can then be removed one by one and their effect on control behaviour studied in isolation. By applying a cybernetic approach, human behaviour can be measured objectively in target-following disturbance-rejection control tasks. Experimental results show that small changes in time delay and simulator noise characteristics do not negatively affect human behaviour in these tasks. However, the motion system bandwidth has a significant effect on performance and control behaviour. Participants barely use motion cues when these have a low bandwidth, and instead rely on visual cues to generate lead to perform the control task. Therefore, simulator motion cues must be considered carefully in piloted control tasks in simulators and measured results depend on simulator characteristics as pilots adapt their control behaviour to the available cues.