Aerospace Europe Conference 2023
Joint 10th EUCASS – 9th CEAS Conference

Abstract #XXX *(to be filled by the organizers)*
Preferred Topics: HUMANF
Corresponding author: PRIZIO Francesco Walter
e-mail of corresponding author: francescowalter.prizio@mail.polimi.it
Type: Oral
Status of corresponding author: Student
For student corresponding author: student member of one of the following:
3AF / AAAR / AIAE / AIDAA / CzAeS / DGLR / FTF / NVvL / PSAA / RAeS / SVFW / EUROAVIA

Title

An haptic device embedded in rotorcraft seats for target acquistition and tracking tasks

Authors

Francesco Walter PRIZIO [1], Marek Slawomir LUKASIEWICZ [2], Quiyang XIA[3], Pierre GARBO [4], Giuseppe QUARANTA [5]*

** Corresponding author*

[1] Politecnico di Milano, department of mechanical engineering, 20156 Milano, Italy, francescowalter.prizio@mail.polimi.it

[2] Politecnico di Milano, department of mechanical engineering, 20156 Milano, Italy, marek.lukasiewicz@polimi.it
[3] Politecnico di Milano, department of aerospace Science and Technology, 20156 Milano, Italy, qiuyang.xia@polimi.it
[4] Politecnico di Milano, department of aerospace Science and Technology, 20156 Milano, Italy, pierre.garbo@polimi.it
[5] Politecnico di Milano, department of aerospace Science and Technology, 20156 Milano, Italy, giuseppe.quaranta@polimi.it

Abstract

The goal of this work is the development of a haptic feedback device to be embedded in a helicopter seat and to be tested in a rotorcraft flight simulator, as an auxiliary tool to provide cues for pilots while performing target acquisition and traking tasks.
The haptic system provides a stimulus on the back of the pilot, with an intensity that is proportional to the distance from the target. It is in fact been proven that feedbacks different from the visual ones can improve the pilot's performance [1] [2] and that the haptic channel, if not overloaded, can be a reliable source of information to pilots [3] [4]. Simple preliminary experiments have been performed with pilots in a rotorcraft simulation facility to assess the effect of such feedback. In these experiments it has been asked to pilots to follow a target position with both the cyclic and the collective stick. Target position and current position were shown on a screen while pilots relied on the haptic feedback to evaluate the error with respect to the desired collective position.
Results of test trials performed with different combinations of visual and haptic feedbacks will be presented to properly evaluate the effectiveness of such device. The trials shows that pilots can correctly interpret the haptic feedback and react accordingly. Furthermore, it will be shown how the haptic feedback can be helpful when cyclic control requires more workload, so that the pilot can focus with visual cues on the target, while relying only on haptic feedback for the collective control.

Additionally, the paper will present further trials while flying with a helicopter model in a flight simulator to show the effectiveness of the haptic feedback device while performing precision tracking tasks.

References

[1] Ernst, Johannes Maria, and Lars Ebrecht. "Virtual cockpit instruments on head-worn displays for helicopter offshore operations in confined areas." 2020 AIAA/IEEE 39th Digital Avionics Systems Conference (DASC). IEEE, 2020.
[2] Peinecke, Niklas, et al. "Review of conformal displays: more than a highway in the sky." Optical Engineering 56.5 (2017): 051406.
[3] Friedl, Ken E., and Shinji Suzuki. "HAPTIC HOVERING TEACHING SYSTEM FOR HELICOPTERS." The University of Tokyo (2015).
[4] Chouvardas, Vasilios G., Amalia N. Miliou, and Miltiadis K. Hatalis. "Tactile displays: Overview and recent advances." Displays 29.3 (2008): 185-194.