



HAL
open science

Long-endurance UAS operations translated to neuroergonomics

Marcel Hinss, Emilie Jahanpour, Anke Brock, Jean-Paul Imbert, Raphaëlle
Roy

► **To cite this version:**

Marcel Hinss, Emilie Jahanpour, Anke Brock, Jean-Paul Imbert, Raphaëlle Roy. Long-endurance UAS operations translated to neuroergonomics. ICCAS22-International Conference on Cognitive Aircraft Systems, Jun 2022, Toulouse, France. hal-04149728

HAL Id: hal-04149728

<https://hal.science/hal-04149728v1>

Submitted on 5 Jul 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Long-endurance UAS operations translated to neuroergonomics

Introduction

Mental fatigue is developing into an ever more pressing issue as operating complex systems is shifting away from operating towards monitoring systems. Hardly any domain represents this as well as

Long-endurance UAV missions (1)

- 🕒 Over 24h operations
- 📺 Prolonged missions
- 🌙 Night shifts



Objective

Investigate how long endurance UAS missions effect the operators cognition

Methods

3 Interviews with current and former French UAV operators (MQ9 Reaper System)

Results

Cognitive Flexibility

the ability to flexibly switch between tasks (2)

"Changes in mission objective occur as frequent as 2-3 times a week"

"Difficulties with reprioritizing ."

"Not mentally prepared for the change in objective"

Vigilance decrement

decreased cognitive efficiency in response to monotonous stimuli (3)

"Strategies to divert attention away from fatigue"

Cognitive Fatigue

temporary decrease in mental resources over time due to sustained cognitive effort (reaction time & accuracy, 4)

"Sluggishness after intense mission phases"

Situational Awareness

the perception of environmental elements and events with respect to time or space (5)

" Difficulties with reprioritizing ."

"Not mentally prepared for the change in objective"

Top Down Attention

the voluntary allocation of attention to certain features, objects, or regions in space. (7)

"Forgetting to check systems"

" Not reacting to or not attending radio messages "

Errors

(6)

Commission

Incorrect execution of a task

"Fingertrouble"

Omission

not doing a task

"difficulties with following checklists entirely"

"Forgetting to check systems"

"Not reacting to or not attending radio messages"

Legend

- Mental States
- Aspects of Cognition
- Behavior

Conclusion

Mental/Cognitive Fatigue



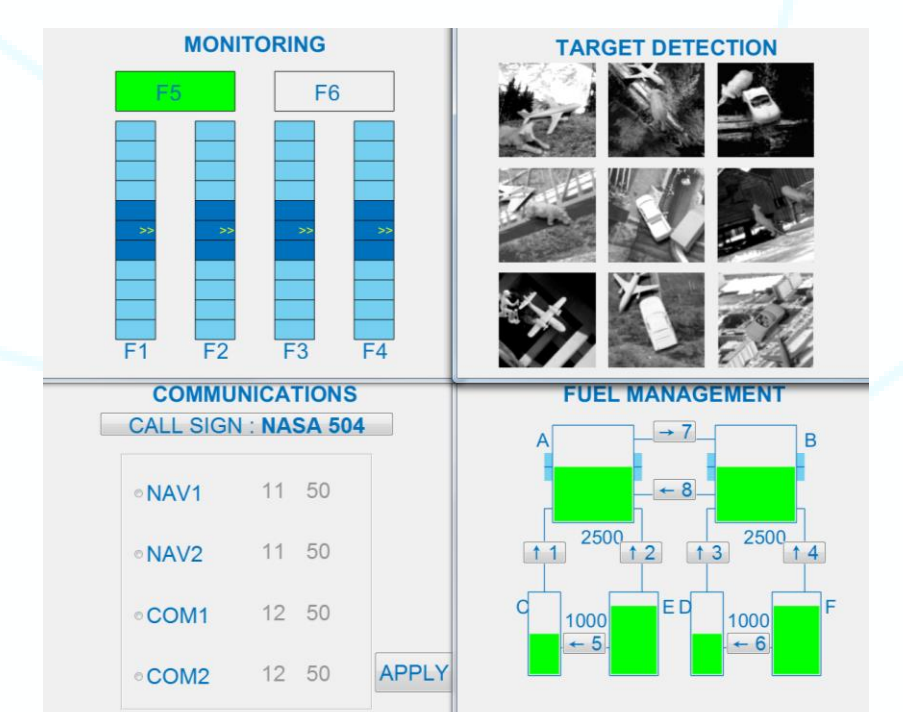
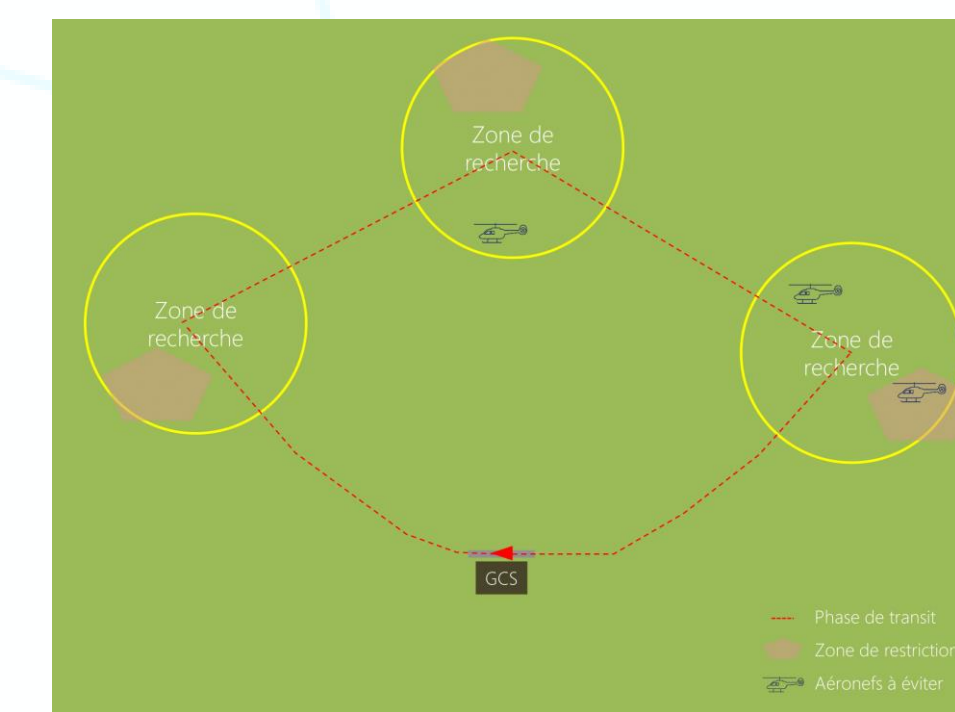
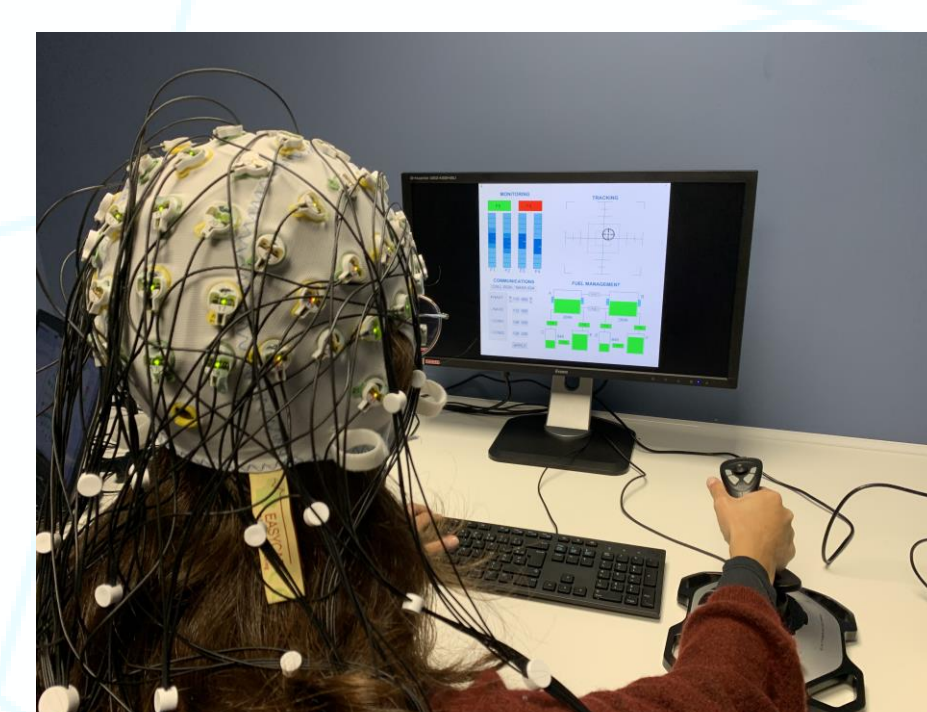
changed cognition



reduced performance

The operation of Long endurance UAV missions is expected to have a multitude of effects on cognition, that may increase the risk of mishaps

Perspectives



Experimental protocol to investigate cognitive/mental fatigue and its physiological markers (EEG, ECG & Eye-tracking) during Long-Endurance UAS missions

References
 (1) Herz, R. P. (2008). Assessing the influence of human factors and experience on predator mishaps. Northcentral University.
 (2) Plukaard, S., Huizinga, M., Krabbendam, L., and Jolles, J. (2015). Cognitive flexibility in healthy students is affected by fatigue: An experimental study. *Learning and Individual Differences* 38, 18–25. 743 doi:10.1016/j.lindif.2015.01.003
 (3) Jahanpour, E. S., Berberian, B., Imbert, J. P., & Roy, R. N. (2020). Cognitive fatigue assessment in operational settings: a review and UAS implications. *IFAC-PapersOnLine*, 53(5), 330-337.
 (4) Chaudhuri, A., & Behan, P. O. (2004). Fatigue in neurological disorders. *The lancet*, 363(9413), 978-988.
 (5) Vijaya K, K., Deepika, D., and Lei, D. (2014). EEG Correlates of Fluctuation in Cognitive Performance in 818 an Air Traffic Control Task , 30
 (6) Leach, F. R., & Plaks, J. E. (2009). Regret for errors of commission and omission in the distant term versus near term: The role of level of abstraction. *Personality and Social Psychology Bulletin*, 35(2), 221-229.
 (7) Holtzer, R., Shuman, M., Mahoney, J. R., Lipton, R., and Verghese, J. (2010). Cognitive Fatigue Defined in 615 the Context of Attention Networks. *Aging Neuropsychology, and Cognition* 18, 108–128. doi:10.1080/ 13825585.2010.517826. Publisher: Routledge eprint:<https://doi.org/10.1080/13825585.2010.517826>
 (8) Holtzer, R., Shuman, M., Mahoney, J. R., Lipton, R., and Verghese, J. (2010). Cognitive Fatigue Defined in 615 the Context of Attention Networks. *Aging ,Neuropsychology, and Cognition* 18, 108–128. doi:10.1080/ 13825585.2010.517826. Publisher: Routledge