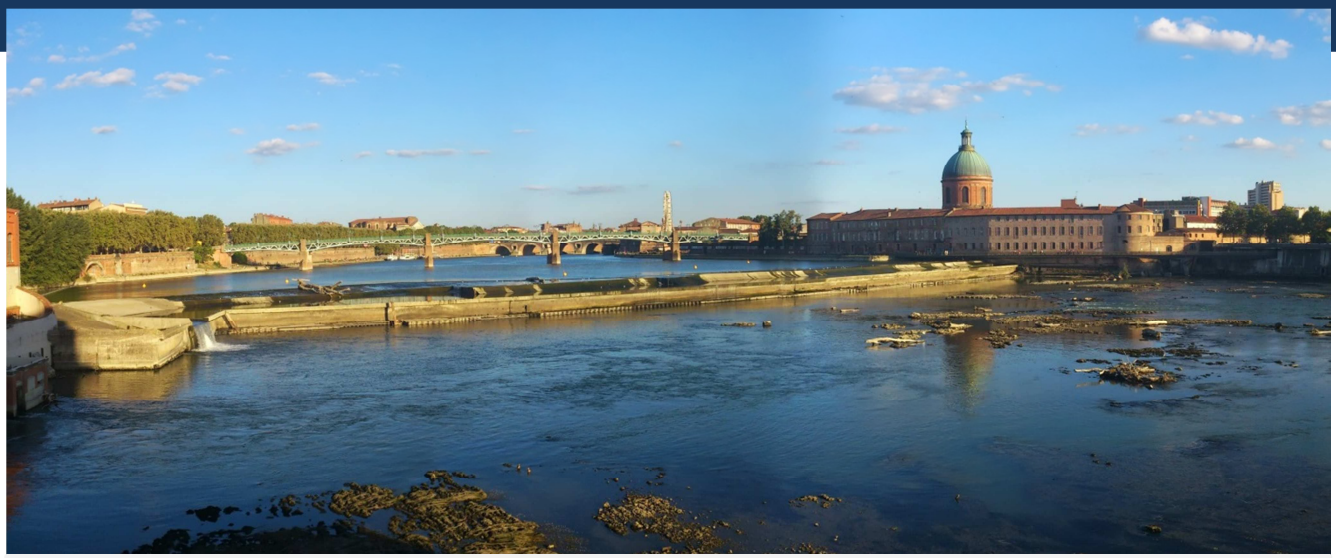

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Challenges, Research Topics and Solutions in Manned-Unmanned Teaming Helicopter Transport Missions

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Content

The proposed presentation gives an overview over the challenges introduced by giving control of multiple Unmanned Aerial Vehicles (UAV) to the two-person crew of a manned transport helicopter, as well as research topics and possible solutions addressing these challenges.
The collaborative deployment of UAV with manned aircraft (Manned-Unmanned Teaming, MUM-T) can increase survivability and mission effectiveness by providing real-time reconnaissance. However, giving control of these UAV to the crew of a manned transport helicopter adds a high number of new tasks to be dealt with by the crew. This poses the threat of introducing a severe amount of additional workload into the cockpit.
The crew can only leverage the capabilities of UAVs in a MUM-T scenario, if existing and newly introduced systems are designed with workload efficiency in mind. This can be achieved by the introduction of high-level, cognitive automation on board the UAV as well as the crewed aircraft. Automation functions of the UAV focus on providing an abstract, high level way to issue tasks (Task-Based Guidance) to the system, as well as automation assisted evaluation and processing of gathered reconnaissance information. Additionally, the UAV are equipped with capabilities to pursue mission objectives in partial autonomy, if a control access by the crew is impossible (e.g. because of interrupted or jammed datalinks). Conventional automation on board the manned aircraft is extended by providing cognitive assistance for mixed-initiative mission planning, reaction to situation changes and system management. Planning will be supported by an automated tactical situation analysis. The key aspect of the onboard assistance is a monitoring of the current workload state of the crew as well as their current task activity. This information is fed back into the automation system to generate assistance only if necessary, avoiding over-automation which might break situational awareness of the crew.
Human-in-the-loop experiments with helicopter pilots were conducted in a full mission helicopter simulator. Currently available missions in the simulator include a variety of material transport missions, combat recovery, medevac, and time-critical extraction and insertion missions. The simulator is which is equipped with the above-mentioned assistance systems, including pilot observation equipment (real-time eye-tracking, physiological sensor to measure respiration, heart rate and galvanic skin response) to estimate the mental state and activity of the crew.
Operational benefits resulting from additional capabilities provided by the deployment of UAVs in a MUM-T scenario where demonstrated, resulting in very positive feedback from experienced military pilots.
MUM-T introduced additional workload and various multi-disciplinary problems, that cannot be neglected but require system (re-)design, leveraging sometime imperfect automation, working synergistically with human team members.

Keywords : Man-machine cooperative techniques