

Abstract

The working situation of fighter pilots is often very challenging. The pilots are requested to perform their tasks and make decisions in situations characterised by time-pressure, huge amounts of data and high workload, knowing that wrong decisions might result in fatal consequences. To aid the pilots, several automatic support systems have been implemented in modern fighter aircraft and will continue to be implemented in pace with technological advancements and new demands posed on the pilots. For example, innovations within the information fusion (IF) domain have made it possible to fuse large amounts of data, stemming from different sensors, databases etc., to create a better foundation for making decisions and act than would have been possible if the information sources had been used separately. However, there are both positive and negative effects of automation, such as decreased workload and improved situation awareness on the one hand, but skill degradation and complacent behaviour on the other. To avoid the possible negative consequences of automation, while at the same time ameliorating the positive ones, a human-centred automation (HCA) approach to system design has been proposed as a way of optimizing the collaboration between the human and the machine. As a design approach, HCA stresses the importance of a cooperative human-machine relationship, where the operator is kept in the automation loop. However, how to introduce HCA within the fighter aircraft domain as well as its implications for the interface and automation design of support systems within the field has not been investigated.

This thesis investigates the implications of introducing HCA into the fighter aircraft domain. Through literature surveys and empirical investigations, general and domain specific HCA guidelines have been identified. These advocate, for example, that an indication of the reliability of the information and the recommendations provided by the different aircraft support systems must be given as well as that support for appropriate updates of the pilots' individual and team awareness of the situation must be provided. A demonstrator, mirroring some of the identified guidelines, has been implemented and used to evaluate the guidelines together with system developers within the domain. The evaluation indicated that system developers of modern fighter aircraft implicitly incorporate many of the identified HCA guidelines when designing. However, the evaluation further revealed that to explicitly incorporate these guidelines into the development approach, preferably through the development of a domain specific style guide, would aid the system developers design automated support systems that provide appropriate support for the pilots. The results presented in this thesis are expected to aid developers of modern fighter aircraft support systems by incorporating HCA into the traditional simulator-based design (SBD) approach. This approach is frequently used within the field and stresses early and frequent user-involvement when designing, in which complementary HCA evaluations could be performed to further improve the support systems implemented from an automation perspective. Furthermore, it is expected that the results presented in this thesis will contribute to the research regarding how to incorporate the human operator in the information fusion processes, which has been recognised as a research gap within the IF field. Thus, a further contribution of this thesis is the suggestion of how the HCA development approach could be of aid when improving the interaction between the operator and the automated fusion system.

Keywords: Human-centred automation, fighter aircraft, design guidelines, situation awareness, information fusion, decision support.