Assessing state-of-the-art mission planning user interfaces for application to next generation fighter concept of operations

Tim Laudien
German Aerospace Center (DLR)
Institute of Flight Guidance
Lilienthalplatz 7, 38108 Braunschweig

In the past years, multiple nations teamed up to research and develop the next generation air combat system. The most well-known programs are the "Future Combat Air System" from Germany, France and Spain, the "Global Combat Air Programme" from the United Kingdom, Italy and Japan, and the US-American initiative "Next Generation Air Dominance". All those programs express the vision of a system-of-systems approach for future air combat operations featuring a central platform, i.e. the next-generation fighter aircraft, and other crewed and uncrewed assets cooperating with it. Those assets will be – among others –current generation fighter aircraft, multi-role tanker transport units, and uncrewed combat aerial vehicles (UCAVs). The latter type is considered to be of particular importance as they are envisaged to be available in multiple sizes, each comprising varying capabilities to accomplish distinct tasks like to reconnoiter, to serve as a decoy or to attack hostile forces.

While it remains yet unclear how automated those "remote carriers" or "adjuncts" called UCAVs will be and, ultimately, what the tasking of those and all the other human parties and technical systems involved will look like, one can imagine that managing a swarm of "remote carriers" will pose a major challenge on those responsible – independent of their own location: either commanded from the pilot onboard the next-generation fighter aircraft or from an operator on ground. For that reason, there is ongoing research on mission planning concepts and tools to cope with guidance of multiple U(C)AVs.

This paper's author envisions the use of virtual reality or mixed reality to create a human-machine interface for mission planning applications with respect to management of multiple UCAVs in a battlespace environment. The goal is to facilitate the planning, re-planning as well as to increase the battlespace awareness. Virtual and mixed reality (in the following subsumed as XR) can have the following advantages compared to a conventional ground controller workplace with mouse, keyboard and screen:

- Three-dimensional visualization of spatial information like trajectories, waypoints and air spaces
- The ability to intuitively adopt a new perspective by moving yourself around the visualization instead of having to move the visualization using complicated keyboard and mouse commands
- Planning and working collaboratively with teammates with the capability to annotate the visualization with three-dimensional sketches

To leverage the idea, this paper describes a literature review on existing user interfaces for mission management and mission planning. Therefore, at first the terms mission planning and re-planning shall be defined and the scope of tasks of a mission planning session will be outlined. After that, the compiled scientific publications and other sources on state-of-the-art mission planning tools – making use of virtual or mixed reality technologies as well as controlled or viewed with conventional tools like screen, mouse and keyboard – will be presented. Based on the found literature, a gap analysis reveals the discrepancy between currently existing (XR) mission planning tools and the previously described planning tool envisioned by the author.

As an outlook, ideas and recommendations for the design and development of a future XR mission planning tool are derived from the conducted gap analysis.