A Shift in Automation Philosophy from Manned to Unmanned Systems

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The current trend in UAV systems design is toward more autonomy and less human interaction. Initial efforts were focused on single aircraft; moving the operator from stick and rudder controller to supervisor. The trend continued in system planning to a single operator controlling multiple aircraft. The rise of automation extends even further to autonomous groups of aircraft that get only high level instructions from the operator and even to flights of aircraft that will automatically and collaboratively modify goals within the mission. There are even visions of UAVs that are capable of locating terrorists, estimating collateral damage and then eliminating them (Bright, 2002)

On one hand this trend is seductive and the perceived benefits, lower operating costs, lower training costs, smaller logistics footprint, have prompted arguments that we must eliminate the humans all together (Clough, 2002). On the other hand, there is a long history automated systems increasing rather than decreasing operator workload and automated system behavior has been difficult to predict. Everyday examples abound, from the clock on your VCR constantly blinking 12:00 (with promises of automated recording of your favorite shows) to the computer program that I'm using to type this that automatically formats the text, but only when I don't want it to.

The most direct examples of automation gone awry, however are from manned aircraft. Pilots operating complex automation are often mistaken about the mode that the system is operating in. For example, pilots of Korean Airlines flight 007 switched the mode control panel from heading hold to inertial navigation mode. However, they didn't meet the entry conditions and remained in heading hold. This less accurate mode allowed them to drift hundreds of miles off course with disastrous consequences. The implications of mode awareness for system design are discussed in detail by Degani (2002).

This mode awareness issue, as well as other concerns such as automation bias Mosier, K. L., Skitka, L. J., Dunbar, M., & McDonnell, L. (2001) have led the manned aviation community to adopt a philosophy of automation that keeps the human squarely in the decision loop. Guidelines for automation implementation have focused on the "human-centered" aspect of the design (Wiener, 1989). More explicitly, Billings (1991) declared that "The human operator must be in command," and that "To command effectively, the human operator must be

involved and informed." In addition, and central to concerns here, "the automated system must be predictable."

UAV system designs are shifting away from this philosophy. How can systems that modify their goals autonomously in the middle of a mission be predictable ? How can an operator controlling swarms of UAVs be involved and informed ? There is a long legacy of research on human interaction with automation and UAV designers need to be aware and take advantage of the lessons learned from this body of work. This presentation will discuss the current shift in automation philosophy, implications of this shift, and potential ways to reverse the trend.