Appropriate Spatiotemporal Scope of Automation and Interface Elemants in UAV-Assisted Wilderness Search and Rescue. ***Cooper, J., Goodrich, M., Gerhardt, D., & Morse, B.; Brigham Young University.***

Unmanned Aerial Vehicles are well-suited to support aerial searching. Aerial search has two main subtasks: acquiring and analyzing imagery. At this point, image analysis for search generally remains an intensive task more effectively executed by a human operator than by automation algorithms. Control of flight/search patterns for image acquisition can often be successfully delegated to automation, but still requires frequent human intervention for some types of search.

A number of difficulties arise when attempting UAV-assisted search. UAV systems requiring multiple operators introduce a communication cost and have the obvious disadvantage of drawing more than one person from other tasks. Systems with multiple, separate displays have the disadvantage of dividing operator attention. Although there are many challenges inherent in designing a small system for use by a single operator, we can learn a great deal by exploring such a control paradigm, especially because many other groups are already focusing heavily on multiple operator/display designs.

For Wilderness Search and Rescue (WiSeR), there are specific constraints that must be satisfied. WiSeR team members multi-task, may wish to retain mobility while in the field, and cannot be expected to have extensive pilot training. A well-designed robotic system supports the tasks that the operator will be called to accomplish while using the system even when portions of the task are not directly related to controlling the robot. For example, if a field-based UAV operator must divert attention to another task while flying the craft, the system should have sufficient neglect tolerance to allow this without severe consequences.

A UAV system includes automation and user interface. Automation must provide various helpful flight patterns for image acquisition. The user interface must provide decision support, helping the operator manage automated routines to effectively acquire information and presenting the information in a way that supports analysis.

A critical design variable for both the automation and decision support is spatiotemporal scope: how long and over what distance automation and interface elements are relevant. Experiments varying automation and interface elements both in field and in simulation highlight several principles with respect to this design variable. For automation, we measure the effects of neglect across spatial and temporal horizons. For interfaces, we measure how varying information persistence and navigation aids affects decision support. Combining complicated subtasks such as flight control and image inspection requires the automation and interface layer to work together to provide sufficient spatiotemporal scope to avoid circumstances where the operator must focus on both subtasks simultaneously. With appropriately scaled automation routines and decision support, we move closer to a functional single-operator, single-display UAV system for supporting aerial search in a WiSeR domain.