User Experience Design for Human-Machine Teaming in Commanding a Distributed Constellation of Unmanned Assets in Search and Rescue

(Technical Report)

Risk Compensation Leads to Lost Lives

(STS Research Paper)

An Undergraduate Thesis Portfolio
Presented to the Faculty of the
School of Engineering and Applied Science
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Systems Engineering

by

Jonathan Raisigel

May 10, 2021

Preface

With National Park attendance at an all-time high, search and rescue (SAR) experts must better understand SAR requirements and the behavioral factors that contribute to risk taking among hikers. What factors contribute to effective search and rescue?

Unmanned aerial vehicles (UAVs) are increasingly shortening response time, accelerating area coverage, and informing resource allocation for SAR missions. However, interactions of UAVs and human operators pose understandability and trust in automation challenges. This work seeks to facilitate human-machine teaming in designing an on-the-loop user experience with a constellation of UAVs as they locate and triangulate mobile phone signals using dynamic co-fields autonomy. To this end, an abstraction-decomposition hierarchy is built, user interfaces are designed, and user evaluation was conducted with domain and usability experts. Overall, the autonomy and high-level asset control of the interface allowed operators to successfully address non-nominal situations.

Among hikers, given the attractions of risk and the improving capacities of digital navigation and of search-and-rescue techniques, hikers and park authorities must compete to draw the lines between worthy and unworthy hiking risks, and between responsible and irresponsible hiking. In an effort to prevent injuries or fatalities in the outdoors, park authorities are working to shift responsibility for safety to hikers, but some efforts to encourage safe behavior may actually encourage more risk-taking among specific hiking groups.

List of Contents