



April 2018

Workshop

HIGHLIGHTS

Human-Automation Interaction Considerations for Unmanned Aerial System Integration into the National Airspace System: Proceedings of a Workshop

What human-systems interaction issues affect the ease and effectiveness of managing and controlling unmanned aerial systems within the complex national airspace system? This question was the motivation for a 2-day workshop in Washington, D.C., in January 2018. The workshop's presentations and discussions are captured in *Human-Automation Interaction Considerations for Unmanned Aerial System Integration into the National Airspace System: Proceedings of a Workshop* (2018). This document describes highlights from that workshop.

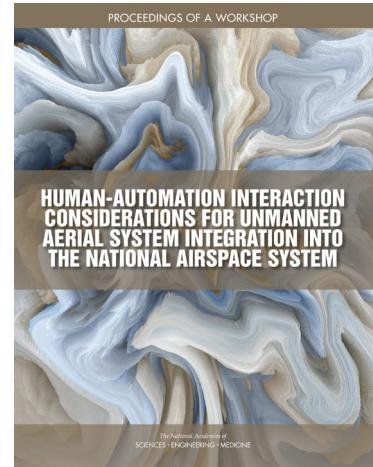
Workshop steering committee chair Nancy Tippins, CEB Valtera, welcomed the participants and explained the workshop's focus on human-systems integration considerations relevant to the design and operations of Unmanned Aerial System (UAS) technology, particularly within the context of implementing automation capabilities within ground-control stations (GCS).

Jay Shively, representing the sponsor National Aeronautics and Space Administration (NASA), laid out the workshop goals from NASA's perspective: (1) identify human-automation issues—current and future, (2) identify future research, and (3) make and solidify connections among participants. Notably, he emphasized the increasing concern about the role of human intervention with automated systems during problem scenarios, calling the rush to “automate everything we can” a “potentially troubling trend” and “not necessarily a great design plan.”

RESEARCH NEEDS AND KNOWLEDGE GAPS

Some highlights of the presentations touched on research needs and skill set identification.

- Kathy Abbott, Federal Aviation Administration, offered a list of lessons learned. First, the role of automation was emphasized in terms of the advantages that have been realized in safety, operational efficiency, and precise management. She also made a distinct argument that there is a significant difference between types of automated systems and that complexity of the automated system can be the issue that requires the most attention. Relying too much on automated capabilities, which may work extremely well during normal situations, can lead to a degradation of human skills that are called upon during abnormal situations. Designing systems to optimize human contributions in every possible situation is a very hard thing to do and caution is warranted moving forward in order to manage risk.



- Mica Endsley, SA Technologies, Inc., discussed human-automation integration research needs. She described research gaps in transparency, predictability, context and consistency, dependence, annoyance, operating at cross purposes, responsibility, and training.
- Missy Cummings, Duke University, said that different skill sets are needed for different types of UAS operations.
- John Hansman, Massachusetts Institute of Technology, concluded by picking up on the point that there are very different types of UAS operations, and human-factors issues will be dependent on the UAS architectures and concepts of operation.

OVERALL THEMES

Workshop steering committee chair Nancy Tippins proposed a list of potential themes that she had heard throughout the presentations and discussions, and she encouraged participants to comment on them. This discussion resulted in four overall themes.

Theme 1: Controllers Must Be Involved in the Solutions. Some participants noted at several points in the discussion that air traffic controllers are a critical part of any solution. There is a perspective, reflected by many participants, that a reflexive approach to thinking about approaches to automation tend to focus on pilots and operators. Participants repeatedly pointed out that the roles of pilot, operator, and air traffic controller are increasingly integrated for UAS operation and, as a result, some of the more important functions that are critical to consider for human-systems interaction design for automation are control-focused activities.

Theme 2: The System Is Changing, Which Requires Planning. Several participants said that the traditional roles of the controller, pilot, and operator are blurring or being subsumed into alternative structures. This change is important to consider from multiple perspectives, including those related to certification, regulation, policy guidance, and the development of mental models that are shared by all the people in the system. The language used to describe human-automation interaction is changing as well, participants noted, perhaps reflecting the changing mental models. Participants also pointed out that all of these issues have implications for the design of new systems, the design of future control structures, and the transition from the existing National Airspace System (NAS) environment to the future NAS environment.

Theme 3: Training and Procedures Will Become Increasingly Important. A few speakers stressed the importance of training and procedures for integrated operations. Some of them also pointed out that designs that are focused on assisting humans to be successful will reduce the need for repetitive training and memorization and will contribute to overall excellence in systemwide performance.

Theme 4: There Will Be Bad Guys, Surprises, and Unexpected Behaviors. A few workshop participants mentioned that illicit use of UASs in controlled airspace needs to be considered. They mentioned recent examples of problems, including hobbyist systems having incursions into controlled airspace, criminals using UAS systems to aid or execute illegal activities, and the use of UASs for violating state and federal laws and social norms, such as privacy.

For More Information . . . This Workshop Highlights was prepared by the Board on Human-Systems Integration (BOHSI) based on *Human-Automation Interaction Considerations for Unmanned Aerial System Integration into the National Airspace System: Proceedings of a Workshop* (2018). The workshop was sponsored by the National Aeronautics and Space Administration. Any opinions, findings, conclusions, or recommendations expressed in this document are those of individual participants and do not necessarily reflect the views of all workshop participants, any organization or agency that provided support for the workshop, the Board on Human-Systems Integration, or the National Academies of Sciences, Engineering, and Medicine. Copies of the workshop proceedings and the report highlights are available from the National Academies Press, (800) 624-6242; <http://www.nap.edu> or via the BOHSI page at http://sites.nationalacademies.org/DBASSE/BOHSI/Human-Automation_Interaction_for_UAS/index.htm.

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