

REDAC Human Factors Subcommittee
Human Factors Emerging Issues List
March 27, 2018

At the REDAC Human Factors Subcommittee Winter/Spring meeting we identified important emerging issues for research and development. The issues are presented in terms of their timing for need and are all considered high priority and important research and development areas the FAA should consider funding.

Nearer term issues that are urgent and need to be addressed in the next 4 years:

1. HF research will facilitate safe and efficient implementation of UAS in the NAS. Understanding and addressing Human Factors (HF) issues associated with implementation of UAS in the NAS such as:
 - a. Defining standards for safe and efficient operations
 - b. Implementation guidance for all sizes of vehicles
 - c. Integration with other air traffic
 - d. Sense and avoid considerations
2. Increasing complexity of the airspace introduces a number of human factors issues such as integration of NextGen concepts, operational capability variation in the mix of old and new vehicles, growth of vehicle and operations types, distributed responsibility, remote towers, and smartground and air distribution.
 - a. The HF issues challenges associated with implementation of these complexities requires research at the front end to ensure a successful implementation.
 - b. Research is needed for adequate consideration of operational integration, otherwise advances will not show the expected safety and efficiency benefits
3. Information management (operationally approved information vs. certified avionics systems, EFB, maintenance tasks and maintainers)
 - a. Pace of adoption and demand are increasing
 - b. Continued growth is expected to occur rapidly
 - c. Cognitive demand it places on pilot workload
 - d. Inconsistent user interface and interaction with the flight deck interface
4. Training and qualification methods and technologies
 - a. Research is needed on new training methods and technologies for the various user groups (pilots, controllers, tech ops, mx etc.)
 - b. Effectiveness of new training methods and technologies need to be evaluated and standards provided that accounts for changing pilot demographics, distance learning, assessment, and operational validation of procedures.
 - c. FAA may be able to leverage industry for the training design itself but will need to set standards for effectiveness.
5. Trajectory based operations

- a. Initial TBO is expected to be implemented through 2022; important additional caps proposed beyond 2022
- b. A very near term issue so it is hard to see how research slated for 2020 and beyond is helpful.

Longer term issues that are important and need to be addressed in the next 5-10 years:

- 6. Increased automation and autonomy to enable operations with a reduced crew, decision support, distributed responsibility, and human machine teaming.
 - a. This is an important emerging area but it will take time to develop the enabling technologies, certification of them, and their integration into the system.
 - b. HF aspects of integrating UAS into the NAS which would include distributed teaming and machine learning is an urgent emerging issues that should be considered in coordination with issue #1.
- 7. Development and deployment of new and novel interfaces (such as advanced vision systems, speech, AR/VR, etc.)
 - a. The FAA may come to rely on industry to develop these, but the FAA should be setting standards and facilitate efficiency of the certification process.
- 8. Cybersecurity (HF protection and detection, wireless, training for detection)
 - a. Data safety and security concerns while performing maintenance tasks with wireless technologies (e.g., potential hack into airplane operational data).
- 9. Data collection and analysis to enable big data analytics, data fusion, real-time assessments, failure precursors, and human performance monitoring.
 - a. These capabilities will be needed to support large-scale safety assurance systems that monitor conditions, assess potential issues, and mitigate risks through alerting and decision support. Such systems may support operations ranging from an individual flight to the entire National Airspace System.
 - b. Research is needed on the collection and application of human performance indicators that may affect system-level performance.

Consequences of not funding research for these emerging issues:

- Failure to strategize and plan for the above important emerging issues will result in unpreparedness in dealing with increased automation and autonomy, underutilized available and emerging technologies, vulnerability in data safety and security, and underutilization of available data and real-time assessments and monitoring (i.e., not harnessing the power of information).
- Lack of regulatory certainty for large number of diverse operators wishing to implement UAS in the NAS. Operational limitations that prevent realization of potential benefits. Potential suppression of rapidly emerging market (1).
- Airspace system that is not capable of handling some novel operations and vehicles. Lack of airspace access or stringent operational limitations may limit realization of new markets. Without adequate consideration of operational integration, advances will not show the

expected safety and efficiency benefits. The HF issues challenges associated with implementation of these complexities require research at the front end to ensure a successful implementation (2).

- Failure to research HF issues related to information management will result in information and cognitive overload of human operators, which will consequently affect human performance and overall system performance (3).
- Failure to examine training and qualification methods and technologies will exacerbate the shortage of qualified personnel in the various user groups, as well as leave available technologies unleveraged and underutilized (4).
- Lack of regulatory framework to accommodate increasingly autonomous systems. Insufficient awareness of operational risks and potential mitigations arising from implementation of these systems (6).
- Difficulty identifying, collecting, or applying human factors data that can impact system-level safety and operational performance. Failure to consider data from human operators and service providers will adversely affect capabilities of system-wide safety assurance systems (9).