SUBCOMMITTEE ON AIRCRAFT SAFETY

FINDING: Research and Development Program Strategy and Research Portfolio Assessment: The Subcommittee notes the initiative underway to establish research focus areas to coordinate and communicate the strategic thrust of ongoing and future research. The research focus areas will include Airport Technology, Aircraft Safety Assurance, Digital Systems & Technology, Environment and Weather Impact Mitigation and Human Factors and Aeromedical Factors. A research landscape will be created for each focus area to capture all ongoing research and establish the strategic vision. The Subcommittee agrees with the approach and believes this is an opportunity to assure that the strategic research needs and emerging issues that the subcommittee has defined are captured and continuously reassessed. It has been noted that the funding sources and research topics are sufficiently different between Human Factors and Aeromedical Factors that it may make sense that these not be combined into a single research area.

RECOMMENDATION: The FAA should consider not separating Human Factors and Aeromedical Factors in the new research focus areas.

FAA RESPONSE: The FAA concurs with the Committee's finding and recommendation and is undertaking the following actions to address its recommendation. These two research areas, while distinct disciplines, both focus on the impact and performance of the human operator in the safety of the aerospace system. There have been arguments made to both separate and to combine these human-centered research areas. The maturation and development of the landscapes has highlighted the synergies between these two research areas. When the landscape for Human Factors and Aeromedical Factors is presented at the Spring 2019 REDAC meeting, this approach can be evaluated with input from the industry representatives.

FINDING: FAA Research and Development Landscape - The Subcommittee appreciates the FAA sharing the agency's Research Landscape and Strategic Direction for R&D (Shelley Yak briefing to SAS, 31 July 2018), the draft FY21 Strategic Guidance (Mark Orr briefing to SAS, 31 July 2018, under FAA management review as of 31 July 2018), and the FY19 Aviation Safety Portfolio (document provided to SAS by Mark Orr, 1 August 2018). These materials, plus the FAA's responses to the SAS Spring 2018 Finding "Research Prioritizations", adequately addresses the SAS concern regarding the FAA's process for prioritizing research activities. Further to the subject of the FAA's research prioritization process, the SAS finds that the value of each FAA research activity will be more easily understood by identifying the hazard and/or significant safety risk being addressed by the proposed research. In accomplishing this, SAS encourages the FAA to draw on all available data as the basis for determining benefits. As one example of this, in the SAS review of the FY18 accomplishments, it was noted that reduced research budgets will delay release of an Advisory Circular. No indication was given of the linkage of this Advisory Circular release to the FAA's overall research priorities. Hence the SAS was unable to understand and provide input to the FAA on the implications of the resulting delayed Advisory Circular release.

RECOMMENDATION: In order for the SAS to provide the FAA more meaningful feedback on the proposed research portfolio, we recommend that the FAA convey, for each research activity:

a. The alignment or linkage to the current or emerging hazards with a high likelihood or potential to result in significant safety risks as identified by the FAA's research priorities, and

b. The benefits (e.g., safety improvement) of each research activity, drawing on all available data and reasonable hazard assessment (i.e., going beyond limited-source data such as the Commercial Aviation Safety Team (CAST), General Aviation Joint Steering Committee (GAJSC), or Helicopter Safety Team data).

FAA RESPONSE: The FAA concurs with the Committee's recommendations and with the noted exceptions and clarifications intends to undertake the following actions to address its recommendation(s). The Program Area Report presented to the subcommittee in the spring 2019 meeting will include information on the safety risk that the research in the proposed portfolio is addressing.

As a point of clarification, the Pareto charts included in the FY21 Aviation Safety Strategic Guidance are there as examples of some of the aviation safety hazard and risk data that is used by the major safety teams, reflecting the areas with the greatest fatalities. The Strategic Guidance recognizes in its introductory paragraph that the included data is only a subset of the data the FAA has available for use in decision-making. The Strategic Guidance provides this subset of existing, potential future, and emerging aviation safety risks for the sponsoring offices to consider, that are all based on the available data. The FAA continues to collect data and develop new data sources to use in making decisions.

FINDING: Future Research Needs - In the AVS Research FY 21 Strategic Guidance, AVS has committed to applying SMS principles and is using an evidence-based approach to identify hazards, risks, and safety issues to drive future research needs. These research needs are based on data gathered throughout the National Airspace System (NAS). Some of the data used to support the FY 21 Strategic Guidance is 7 years old. Much has changed in the last 7 years. Additionally, technology is rapidly evolving, which creates new challenges and a very dynamic environment for risk identification and assessment. The subcommittee agrees with and supports the data driven, evidence based approach that AVS is using. However, using old data could lead to research that isn't timely or based on assumptions that are no longer correct. It could also lead to omission of emerging issues when priorities are set. The NAS continuously generates new data. Most of this data is readily available and can be accessed in a timely manner.

RECOMMENDATION: Data that is more up to date should be used when identifying hazards, risks and safety issues analyzing risk in the NAS and identifying strategic research needs

RECOMMENDATION: Advances in data mining and machine learning should be applied to the large set of operational data to identify causal influences and trends in emerging risk areas

FAA RESPONSE [to both recommendations]: The FAA concurs with the Committee's recommendation(s) and with the noted exceptions and clarifications intends to undertake the following actions to address its recommendation(s). The FAA will continue to collect data and develop new data sources to use in making decisions. The Pareto charts included in the FY21 Strategic Guidance show the events with the highest fatality risk in part 121, GA, and Helicopter operations. While the data used to create the charts as shown on their time stamp is older data, the top events remain the top events and are the ones addressed by the Commercial Aviation Safety Team (CAST), General Aviation Joint Steering Committee (GAJSC), and the United States Helicopter Safety Team (USHST). These groups are using the latest available data and tools, including advanced data mining and machine learning capabilities, to identify, analyze, and develop mitigations for the underlying safety hazards, and only a small number of these cases result in the need for research funded through the Aviation Safety Research and Development program.

As an example, CAST monitors risk in commercial aviation by review and analysis of accident data, incident data, and unexpected or unusual findings uncovered during review of operational data. CAST uses these various data sources to identify broad event categories to prioritize resources. These categories reflect internationally adopted taxonomies that allow for mutual understanding and communication of safety agendas throughout the world. US commercial aviation has undergone a sea change in safety in recent years, with only one passenger fatality in nearly a decade's worth of Part 121 air travel. Nonetheless, CAST continues to seek safety improvements by using ASIAS to sift through the vast amounts of operational data and voluntary safety reports to identify emerging hazards, as well as to evaluate the effectiveness of deployed mitigations for known risks. As an evidence of this, note that the twenty-one most recent safety enhancements enacted by CAST have been based on non-accident data. The identified risks represent contributing factors to established accident categories. For example, the recent analytical study of Airplane Sate Awareness (ASA) represents a subset of loss of control (LOC) accident risk. ASIAS detected the presence of underlying contributing factors that could lead to loss of control events based on loss of situational airplane state awareness by the flight crew. Review of the incident data, as well as the operational flight profiles of similar precipitating factors, opened new avenues for potential mitigations. Some of these mitigation strategies involve research; the ASA study team proposed research on enhanced flight display systems to provide better recovery cues for flight crews. These research areas are prioritized within the research processes.

FINDING: Automation and Artificial Intelligence - The Subcommittee notes the high level of industry investment and interest in higher level automation and machine learning for manned and unmanned vehicles (small and large UAV, UAM, Simplified Vehicle Operations, Automated Air Cargo, etc.). This is an emerging issue which the SAS has noted in the past but is becoming more urgent.

RECOMMENDATION: FAA should develop a research plan to develop certification approaches and to support certification criteria and human factors evaluation of advanced automation systems.

FAA RESPONSE: The FAA appreciates the Committee's finding and recommendation on developing a research plan to support airworthiness criteria for advanced automation systems. However, we are not able to pursue this recommendation at this time for the following reasons. The FAA recognizes that automation systems that use machine learning are not supported well by traditional software development and verification standards. Hence, FAA is investigating use of different ways of satisfying the safety goals. EASA's Executive Director and FAA's Associate Administrator for Aviation Safety are already discussing innovative means of software and airborne electronic hardware approval criteria. This initiative would look at development assurance standards, extracting high level objectives to cover, and openly and innovatively look at how to use alternative standards in the aviation domain, when they better match industry technological developments. Consequently, ongoing policy initiatives have a bearing in this area and must be developed first; should those initiatives lead to a need for research in the subject area, then we will consider development of a plan that would allow us to meet our research needs in the most effective manner.

FINDING: Runway Friction Research - The Subcommittee appreciates the briefing on Runway Friction Research and notes that the activity is no longer airport-centric in its nature. The SAS believes that the effort would benefit from REDAC input on the next steps. There is an opportunity to take the data that is available to develop a predictive tool that can be tracked and validated via on board data.

RECOMMENDATION: The FAA should develop a plan to explore data reduction methods and provide the REDAC with an updated research approach including the overall roadmap and strategic plan.

FAA RESPONSE: The FAA concurs with the Committee's finding and recommendation and is undertaking the following actions to address its recommendation. The FAA will reconvene its runway friction research working group, which includes representatives from industry, and will update its runway friction research plan based on SAS recommendation and will submit the updated plan to the SAS sub-committee in the third quarter of FY19.