REDAC NAS Operations Subcommittee Findings and Recommendations
Fall 2020

1. Research Landscape

The subcommittee received a briefing describing the FAA's progress in developing and exploiting its Research Landscape for the National Airspace System. The briefing included an overview of the purpose and framework for the Landscape, and a view ahead to next steps for the effort.

Finding

The subcommittee appreciates the utility of defining research Drivers and mapping them to the various RE&D activities within the FAA. The organization of the Landscape into four major Driver categories (Advances in New Vehicles / New Missions; Advances in Technology and Materials; Advances in Data and Processing Power; System Wide Advancements / Improvements) is helpful toward understanding how the broad range of RE&D programs span the space of work required to progress beyond NextGen. Some challenges in the roll-out of this process were identified, including the need to better socialize the various Drivers so that program managers understood where their programs would fit within the Landscape, and some practical matters such as requiring the ability to allow program managers to map their work to more than one Driver. We anticipate that those challenges will be easily addressed in the near future. At this time, however, the connection between the Research Landscape and the FAA's research planning process has not been clearly articulated. The subcommittee identified an opportunity to more explicitly connect the Research Landscape to the FAA's RE&D planning and prioritization efforts.

Recommendation

The NAS Operations subcommittee recommends that the FAA more clearly define how the results of the Landscape effort will inform RE&D prioritization, and subsequently report out periodically to the REDAC subcommittees on the prioritization process. By making a connection between Drivers and priorities, we anticipate there will be more utility extracted from the Landscape process beyond its current value in communicating Driver-to-Research mappings. Ideally, the subcommittees would be provided with regular updates on the connections between Drivers, RE&D programs, and their priorities, to build a more holistic understanding of the FAA's research portfolio.

Consequences

A failure to explicitly connect the Research Landscape to RE&D program priorities would limit the utility of the Landscape effort. Lacking that connection would represent a missed opportunity to make full use of the efforts expended in building and maintaining the Landscape.

2. Resilient autonomy in the future NAS

Finding

The subcommittee received briefings on the FAA 2035 Vision and related development of a 2045 Vision by NASA. These invoke a significantly higher degree of autonomy than today's NAS, with machine

learning (ML) and artificial intelligence (AI) supporting a dense operations environment comprised of diverse vehicles and operating entities. These visions allude to the need for operations-recovery constructs and infrastructure resiliency when off-nominal conditions occur. The subcommittee notes, however, that responding to novel, or previously unobserved situations (and recognizing precursors to these) is particularly challenging for ML/AI technology.

Recommendation

Development of strategies for effectively responding-to and recovering-from significant, off-nominal scenarios should be a priority in these future NAS visions. The off-nominal scenarios encompass both unplanned operational events as well as system failures. In system failures, the likelihood that significantly-more-intense operational responsibilities will need to shift back temporarily to the human work force in a graceful manner (airline, air-traffic control and flow-management) during off-nominal situations should be considered. In addition, historical data on these autonomous systems performance and behavior does not exist, and thus a prognostic analytical approach is needed to determine the system health as well as assist in standards development and certification processes. Furthermore, the autonomous systems will need to co-exist and be integrated into the traditional human centric systems. The subcommittee recommends that future versions of these FAA and NASA visions, and their related RE&D efforts, explicitly address strategies for off-nominal event management, recovery, and graceful system degradation, and that these be briefed to the subcommittee when appropriate.

Consequences

If research on autonomous system resilience is not explicitly included in the future NAS vision and its associated RE&D programs, there is a risk that additional costs will be incurred later in the development process to achieve the high levels of safety and efficiency that are required.

3. Flight Deck Data Exchange Requirements Program Coordination

The subcommittee received separate briefings on A11.r Flight Deck Data Exchange Requirements and on Aircraft Systems Information Security Protection (ASISP) research. These presentations described the benefits, initial accomplishments, and anticipated future research in each program.

Finding

Both of these efforts are targeted at identifying and mitigating potential cyber vulnerabilities in aircraft systems including air-ground information exchange. An important part of the cyber analysis process is developing a methodology that is both effective and vetted across multiple stakeholders including the FAA and other government agencies, and industry spanning airframe manufacturers, avionics, ground systems, and data communications systems. The ASISP program has built a strong cyber Safety Risk Assessment (SRA) methodology that has been closely coordinated with industry and government stakeholders including the Cyber Safety Commercial Aviation Team (CS CAT) and broader constituencies such as the tri-agency Aviation Cyber Initiative (ACI) and the international Aviation Information Sharing

and Analysis Center (A-ISAC). ASISP has successfully conducted several cyber system analyses on critical components such as the Flight Management System. In contrast, the cyber analysis process currently being used in A11.r was not explained directly, and it was apparent that this effort is not closely coordinated with or leveraging the methodologies and accomplishments of the ASISP program. Some efforts, such as analysis of Aircraft Information Displays and Flight Management Systems, appear to be duplicative or overlapping with ASISP.

Recommendation

The FAA should ensure that the A11.r research effort is making full use of and closely coordinating with the ASISP program. Findings and methods used in ASISP should be informing the methods used in A11.r, and likewise results from A11.r should be coordinated with ASISP and the broader ACI and A-ISAC communities.

Consequences

A failure to closely coordinate the activities under A11.r and ASISP risks duplicative efforts and reduced progress in the important work required to ensure aviation cyber security. Especially given the limited RE&D budgets available for cyber work, it is important to ensure all efforts are coordinated and augment progress.