NASA Advisory Council Recommendation

Autonomy Research in Aviation
2012-03-02 (AC-01)

Recommendation:
The Council recommends that the NASA Aeronautics Research Mission Directorate (ARMD) provide strategic Agency and national leadership, in coordination with the private sector and other government agencies, for current and future research activities in intelligent and autonomous aviation technologies. Areas of research would include safe, effective allocation of functions between humans and automation and target development of core technologies in machine intelligence and autonomous systems that address crosscutting technical challenges. The testing and certification of these non-deterministic software systems that are focused on enabling autonomous operations in complex, uncertain environments is a special area of concern and interest. NASA's efforts should generate the knowledge and concepts necessary to inform operations, safety and certification standards and procedures for non-deterministic systems.

Major Reasons for Proposing the Recommendation:
Future aviation vehicles and systems (both manned and unmanned) will be more highly automated, and will require the implementation of software systems of varying degrees of complexity coupled with advanced hardware and communications capabilities. Thus, there is a need for research and development that will lead to an overall aviation system that can be operated safely with vehicle and systems of varying levels of autonomy.

Autonomy has the potential to reduce costs, increase performance, productivity, safety, and efficiency and enable new operational models for aviation. The safe integration of complex software intensive intelligent systems into the current airspace system is a long-term issue that the Council feels NASA is uniquely positioned to take a leadership role in achieving.

Consequences of No Action on the Proposed Recommendation:
Autonomous systems can introduce uncertainties if they are not thoroughly assessed and evaluated under a wide variety of normal and abnormal operating conditions. Without strategic investments in key areas of intelligent and autonomous aviation technologies, the needed capabilities to achieve operational, safety, and certification standards and procedures for such systems will not keep pace with this rapidly evolving technology area.

NASA Response:
NASA concurs with the NAC on NASA ARMD providing national leadership in the strategic area of intelligent and autonomous aviation systems. NASA ARMD agrees that this area has enormous potential to increase the performance and safety of aviation systems if we can address the significant uncertainties surrounding their development and certification. NASA intends to create an internal planning team to lay out the issues and potential NASA approaches to address the following areas: key technical barriers to achieving autonomous systems, such

as machine intelligence and sensor fusion; design issues with the human – machine interface; approaches to test, evaluation, and certification; and National Airspace integration. In addition, NASA intends to fund the National Academy of Sciences to perform a detailed study of the research requirements to achieve autonomous systems from a national perspective, to ensure NASA has the best insight into what is occurring throughout the aerospace and other industries today, and what the full set of research challenges are. NASA ARMD looks forward to continuing to work this subject with the NAC.