With increasing levels of automation capabilities in the aviation arena, provides unique opportunities and challenges for civil aviation, and the aerial transport communities. Flight will be transformed as these capabilities mature and evolve in to integrated systems. In particular, autonomous and robotic, manned and unmanned civil aircraft systems will lead to a plethora of new markets, vehicle, and missions. These new systems with broad range of capabilities, and a huge diversity of shapes and sizes, must safely utilize the future National Airspace System. Both operational and machine autonomy will require tremendous breakthroughs through the new technology frontiers in machine intelligence, autonomy, robotics, and inter-connections of these technologies. Breakthroughs in these areas could lead to such societal capabilities as autonomous cargo carrying, surveillance, air taxis, small unmanned civil aircraft, Zip aircraft, on-demand VTOL aviation, airborne wind energy platforms and a host of other emerging distributed aviation systems.

The goal of this topic area is to develop technologies and capabilities that will lead to fully autonomous systems that are able to learn and adapt to changes in their environment that were not predicted, and yet still accomplish the mission goals, with minimal or no human involvement required.

For purposes of this solicitation, autonomous vehicles have varying levels of autonomy and range from automated capability to fully autonomous flight where the system has the ability to learn, reason, and adapt. Military applications have demonstrated the ability to do automated flight but their use in civil aviation requires additional research and development. The primary interest of this sub-topic is to advance the technologies for robotic and autonomous vehicle perception, cognition, as well as system integration. Proposals should be written around one of the following themes described below:

- **Autonomous or robotic pilot** - Autonomous systems can be applied far beyond remotely piloted aircraft. Maximum machine effectiveness can only be realized through vehicle autonomous systems ability to learn, reason and adapt. Current practice is to have a reliance on stored information, which is complemented by GPS position information. If there is an on-board, real-time means to sense and react to the local environment (including air and ground features and traffic), then autonomous and robotic air-vehicle can be fully utilized. But addressing how adaptive systems can still be 'trusted' in critical flight environments and achieve FAA certification is a technical issue that must be resolved. Proposals are sought to develop innovate approaches and enabling technologies for autonomous, robotic, and embodied intelligent air-vehicles. Example scenarios could include but are not limited to carrying passengers and cargo through the
NAS, search, rescue, and surveillance operations, and sentries to patrol coastal waters, and land borders. Proposal should consider perception, cognition, as well as GPS enabled, GPS-denied, and cooperating and non-cooperating traffic environments.

- **Autonomy for flight**, the robotic test pilot. Adaptive and robust controllers designed to autonomously fly and optimize around multiple vehicles. Products would be aerodynamic coefficients such as coefficient of lift and drag as well as controller effectiveness.

- **Autonomous intelligence**, surveillance and reconnaissance. A next generation system would entail a "smart payload" with a UAS designed around it to accomplish specific missions. Example missions might include, but are not limited to disaster relief, fire monitoring, launch vehicle tracking, or hurricane tracking. The payload would ultimately permit autonomous target acquisition, tracking, and aircraft attitude/orientation to optimize data collection, or ensuring mission completion. Initial activities would include an assessment of current technology capabilities that could be compared to requirements for a next generation autonomously controlled sensor and platform system to identify technology gaps and lay out a technology development road map. Subsequent activities would include component and system developments and integration in accordance with the road map, leading to the development of a prototype system capable of integrating with a UAS.