Qualification and Structural Design Guidelines for Military Unmanned Air Vehicles

Executive Summary / Abstract

Unmanned air vehicles are being developed today at an ever increasing rate. Some are being developed by traditional aircraft development organizations working hard to meet customer needs and desires and producing a large variety of such aircraft. But many of today’s UAVs are being developed by non-traditional aircraft companies, start-ups as well as companies that do not have a long tradition of meeting armed forces level specifications. In many cases the aircraft being fielded today have not had anything like a conventional structural qualification test program, and they are certified to fly by exception to the current rules in restricted and combat airspaces. These aircraft were developed to prove capabilities of such systems, but in doing so provided capabilities that are now considered indispensable in the battlefield, situational awareness unlike anything available in the past, with the ability to pin-point targets as small as individuals in theatre. These systems, however, have not been developed with consideration for durability, damage tolerance, maintainability or repairability. They were short life demonstrators plucked from the test ranges to the combat theatre to meet a need – a need that was considered too great to wait for anything like a traditional qualification test program.

UAVs cover a broader range of the flight spectrum than manned vehicles. Applying traditional manned qualification processes to these vehicles can penalize the capabilities of autonomously controlled vehicles that respond more than fifty times as fast as humans to perturbances in the flight regime. To apply conventional qualification approaches to the very small aircraft coming onto the scene now is simply not justified either for cost or in recognition of the limited flight regime in which such aircraft fly. To develop a set of qualification guidelines that can extend across the panorama of flight from vehicles weighing grams to those crossing the sky at re-entry velocities, from vertical takeoff and landing vehicles to vehicles that remain airborne for weeks at a time has proven a challenge. It caused the Team to seek key parameters of flight and interpret them in new ways so that these vehicles are not over-penalized by legacy standards but still provide the level of safety expected from flight vehicles in today’s environment. In recognition of the progression of many of these vehicles from demonstrator, to limited operational vehicles, to fully operational vehicles, these guidelines were developed to progress through these stages in development and build the qualification tests of previous stages so that none need to be repeated but all contribute to the full qualification of the vehicle when it is accepted into fully operational flight.

Finally, to ensure an equivalent level of safety for all UAVs to today’s manned vehicles, these guidelines must accommodate not only the vehicle, its speeds, its mass, and its operating system, but its weaponry, its lethality to both air and ground personnel (especially in crash situations), and its flight regime or airspace (be it restricted, controlled, or unrestricted). All of these factors have influenced the formation of the categories and qualification recommendations summarized in this report. This report is the work of many individuals from the NATO nations represented within AVT-174, and reflects dialogue with qualification authorities for both military and civilian airspace. These guidelines assume that UAVs will one day have full authority to fly in international airspaces shared with manned aircraft under rules and regulations that assure equivalent safety to those applied to manned aircraft.