



UNINHABITED COMBAT AIR VEHICLES CHALLENGES FOR THE FUTURE

Currently there are a number of programs being pursued by a host of countries to demonstrate the technical feasibility of an Uninhabited Combat Air Vehicle (UCAV) to effectively prosecute lethal strike missions with an acceptable level of autonomy, within the existing and possible future battlespace. Even though they apply force, these systems are being envisioned more as force enablers to the core force providers at least for the next two decades and are then expected to evolve into the broader range of combat missions, dependent on the maturation of emerging technologies.

Although the UCAVs operationally fielded to date are only the first-generation, their advent into the combat arena has initiated a subtle transformation in the conduct of operations not only in the air environment but also of the entire military force. However, this transformation is neither fully apparent nor is it clearly charted in terms of the end state, mainly because there is a great deal of uncertainty regarding the delineation of the roles and missions that can be performed by these systems. The current thinking indicates that UCAVs would be allocated missions that are categorised as 'the dull, the dirty and the dangerous'.

Unmanned airborne systems have been traditionally used as Intelligence, Surveillance and Reconnaissance (ISR) assets; their performance envelope being constantly improved with breakthroughs in sensor technology. Even though they still have some serious limitations to overcome, it is now acknowledged that these systems have primacy in the ISR role over manned and space-based assets. Sensor technology is very advanced,

but it still has not developed sufficiently to facilitate the autonomous conduct of complex battlespace management functions, and therefore manned systems still have the core role to play. Since manned systems are very costly and need self-protection measures to assure their safety, affordability and expendability become the two main factors that support further development in sensors to increase effectiveness of unmanned systems. However, there are lingering doubts and problems regarding the employment of these vehicles in a completely autonomous manner.



Based on the success of a few time-sensitive strikes, a definitive role that has emerged for the UCAVs is that of Suppression of Enemy Air Defences (SEAD), although these are not time-sensitive targets in the normal sense unless they are mobile defences. The improvements in surface-to-air missiles in the recent past have made the SEAD role almost suicidal for manned aircraft and UCAVs are seen as the panacea for this situation. However, it has also to be borne in mind that attrition of the UCAV could be considered acceptable only when the alternative is the loss of a manned aircraft, since they are expensive assets to be

considered totally expendable. This situation argues for the development of a more sophisticated SEAD strategy that should incorporate low-cost decoys to make the location of air defences simpler, followed by the use of stand-off weapons, manned aircraft and/or UCAVs for the strike. The bottom line is that even in this most-dangerous role, the UCAV still cannot operate autonomously with the desired effectiveness.



It is not difficult to imagine this strike role of the UCAV being enlarged to Counter Air missions, once again in a combined strike package that will have the benefit of a manned platform to make the complex decisions and intuitive changes needed to successfully lead and complete complicated multi-aircraft missions. Once again the challenge is for technology to answer the need to have adequate decision-making capability built into the UCAV to permit it to operate with the desired level of autonomy. Development of decision-making artificial intelligence has been ongoing for a number of years, but it has still not reached sufficient maturity, and there is no indication of the time needed to field it operationally. However, this is the key to autonomous performance of UCAVs.

There is a great deal of speculative debate regarding the use of UCAVs in the air superiority role necessitating their employment in air combat missions. This will have to remain in the realm of

futuristic thought at least for the next few decades since it requires a number of elements that artificial intelligence currently does not possess and is unlikely to develop cohesively anytime soon.

Yet another factor that inhibits the autonomous employment of UCAVs, even in strike missions, is the reluctance of the political and military leadership to leave the final 'kill' decision to artificial intelligence. To let a machine make the decision to kill a human is an inherent anathema to human authority. The prospect of even a single such strike going awry would almost completely negate the granting of such autonomy for the foreseeable future. Therefore, command and control of UCAVs will always rest with a manned element within the mission package. If this is the case, then the question begs to be asked as to whether or not more emphasis should be placed on further development of decision-making artificial intelligence or whether the emphasis should be on developing the wherewithal for seamless interoperability between manned and unmanned systems.

UCAVs are a reality and there is no doubt that their mission envelopes will continuously be pushed outwards. It is also a reality that, although a great amount of research and development is currently being undertaken in this field, the fidelity required for independent decision-making using artificial intelligence will not be available in the near future. There is also no certainty regarding the timeframe within which the necessary fidelity would be developed. This uncertainty provides the only certainty that can be deduced from this analysis: that a manned system will continue to form the nucleus in command and control of the battlespace as well as in hard combat situations wherein instinctive and intuitive decision-making will be the winning factor.

New weapons require ... new and imaginative methods. Wars are never won in the past.

- General Douglas MacArthur



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