A Reference Model for Unmanned Systems

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One of the problems when dealing with mission assurance for Unmanned Systems if having common semantics and a common reference model to avoid misunderstandings. This is in fact a pre-requisite for any mission assurance mechanism that can be shared amongst multiple players.

However, there is no universally accepted reference model, and even the names of different types of vehicles and their specific characteristics and capabilities are a source of confusion. Even within well- established communities, such as the one dealing with underwater vehicles, the simple use of terms like AUV (Autonomous Underwater Vehicle), UUV (Unmanned Underwater Vehicles), ROV (Remotely operated Vehicle) and others (many times a mix of these) can lead to misunderstandings. Each term has a specific and intentional meaning, but different sub-communities may have difficulty in communication clearly. When a whole spectrum of heterogeneous vehicles, which we globally call UxV (to include Unmanned Ground Vehicles- UGV, Unmanned Aerial Vehicles-UAV, Unmanned Underwater Vehicles-UUV, or Unmanned Surface Vehicles-USV), each with very specific capabilities and modes of operation, it is important to have a taxonomy where each element can be clearly classified, and to explain its components, some common language or Reference Model is needed. In areas like biology (where the systematic taxonomies date back to the Greek Philosophers and more recently to Linnaeus), or telecommunications (where the CCITT defined a reference model named Open System Interconnect – OSI, in the beginning of the 80s), in robotics no such common model exists. One of the reasons is the great heterogeneity of systems, but biology is a good example of an area were heterogeneity is even greater, and a common taxonomy allows experts to discuss issues with clarity.

In this paper we present a reference model for Unmanned Systems (shown in figure 1), where at a top level there are three “Main Blocks” (the vehicle itself, the communication data link, and the ground segment), each of which composed of several “Main Systems”, and those in tern in further sub- divisions. The main challenge of defining such a reference model is to be broad enough to include all existing systems (and those that we can now envision), yet specific enough to be useful when defining characteristics and components. With such a reference model widely accepted, standards can be adopted to address the different issues involved with identified sub-systems. This avoid a proliferation of propriety standards that may be incompatible with each other, and even difficult to compare. When a sold set of standards, dealing with well identified elements of unmanned systems are defined, then we can work on mission assurance mechanisms that using low-level primitives and provide a high- level understanding of the mission as a whole.

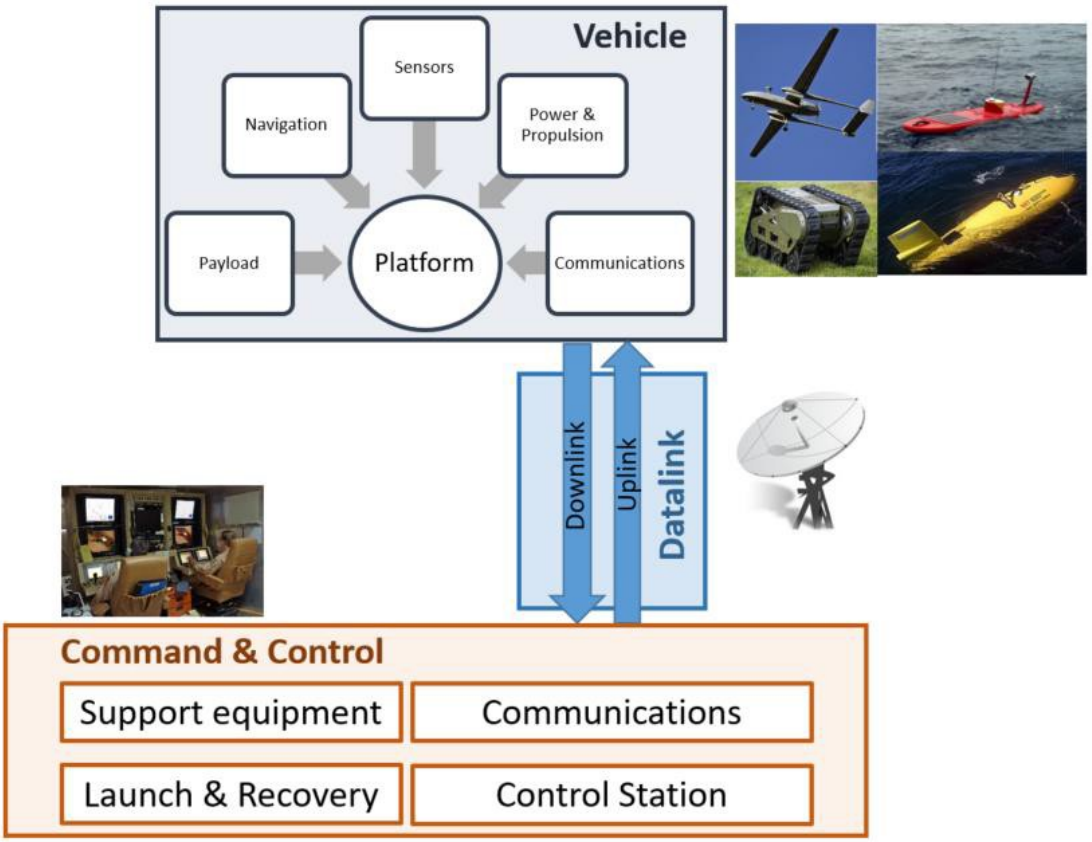

Figure 1 – A reference model for unmanned systems