

Systems Engineering Best Practices in Science and Technology

Low Altitude Small Unmanned Aircraft System (SUAS) Military Utility Study

Robert E. McCarty
Principal Engineer
robert@syngenics.com
(937) 623-4290
SynGenics Corporation
5190 Olentangy River Road
Delaware, Ohio 43015

National Defense Industrial Association Systems Engineering Conference

Session on Best Practices and Standardization

From both the military and civilian sides of the Air Force, the Air Force Research Laboratory (AFRL) has enjoyed clear direction and policy regarding the application of SE early in the acquisition life cycle. The vision for Air Force Life Cycle Systems Engineering (LCSE) has been embraced by the Secretary of the Air Force for Acquisition Integration (SAF/AQX) with a focus on the Pre-Decisional acquisition phase. SAF/AQX advocates SE for application to a capability pre-Milestone A and pre-Milestone B, referred to as “requirements engineering.” SE in pre-acquisition is viewed as an enabler for “Analysis of Problem” activity as a precursor to the more formal Analysis of Alternatives (AoA). SE processes are perceived to support translation of capability statements into families of concept designs/approaches. Pre-acquisition SE affords trade study processes, provides key ground rules/constraints, determines decision criteria, and offers a methodology for populating the knowledge base. Pre-acquisition SE essentially develops AoA entry criteria and provides more fully integrated concept definitions which address costs, risks, “ilities,” and verification approaches up front. It builds the technical knowledge base for each concept and affords a methodology to migrate that knowledge forward to a program. Pre-acquisition SE establishes “requirements engineering” as a mechanism to drive linkage of concepts to operational architectures (Air Force, Coalition, and Joint), and to facilitate better decision-making at AoAs and MS/KDPs. Pre-acquisition SE is viewed by the Air Force as an investment to reduce risk in later program phases, and as an activity that must

start in the earliest stages of concept development before normal program initiation. Early SE provides operators a tool for informed choices (capability vs. cost vs. time), and it gives the S&T community a collaborative/vetted guide to investment priority decision-making. For both operators and the laboratories, early application of SE fulfills their responsibility for managing expectations of S&T, and it focuses resources on essential technology products. AFRL has established a Systems Engineering Council (SEC) to institutionalize adoption of systems engineering in S&T. Goals of the AFRL SEC are to tailor SE best practices for use in the S&T environment, and to establish an organic AFRL capability for S&T SE. In support of AFRL S&T SE, SynGenics Corporation has developed and refined the Systems Engineering Tailored for Science & Technology (SETFST) process. SETFST is a structured approach to generating optimal solutions to complex problems. SETFST can be applied to emerging technologies, a process that contributes to sound systems engineering over the life cycle of the resulting products. SETFST defines and clarifies requirements and supports good decision-making, even in the absence of complete information at each stage of development. SETFST identifies “*desirements*” and alternatives that might satisfy customer requirements. It evaluates, compares, and ranks them within a consistent framework for subject matter experts (SMEs) and managers to capture, discuss, negotiate, and evolve alternatives toward consensus; and it affords the highest probability of system success. The SETFST process reveals sensitivities and quantifies risk. As more information becomes available, the information from the process is easily updated. This presentation will outline the SETFST process, and discuss its application to the Low Altitude Small Unmanned Aircraft System (SUAS) Military Utility Study. This AFRL project is one which is implementing S&T SE very early in the acquisition life cycle process, and for which S&T SE is contributing to a successful outcome. An Integrated Product Team (IPT) was formed to develop more in-depth understanding of capability needs, and then to establish characteristics of those needs through workshops conducted with study customers and subject matter experts. Characteristics of capability needs were classified as types of desirements; then measures and desirability functions were defined for the desirements, enabling functional decomposition of the capability needs. Next, potential options that could contribute to the most influential functions were brainstormed, and those options were aggregated into a number of alternative solution concepts. Value analysis of the resulting alternatives formed the basis for AFRL S&T investment strategy to define the way ahead for development, maturation and transition of advanced technologies to fulfill customer capability needs. The presentation will advance conference objectives by providing information and lessons learned which will contribute to improved performance of Defense programs through more effective application of systems engineering. The result will be more capable, interoperable, and supportable weapon systems with reduced total ownership costs. Integration of new technologies into operations will improve the ability of the Air Force to meet the changing and more complex security environment with the agility, flexibility and readiness required.