Optimizing UAS Mission Training Needs through Tradespace Analysis

Matthew Bearden, Aidan Scribbick, Kristen West, Scott Zapcic, and Jasmine Motupalli

Department of Systems Engineering, United States Military Academy

Corresponding author's Email: matthew.bearden@usma.com

Abstract: The Gray Eagle unmanned aircraft systems (UAS) training program requires the reallocation of multiple fully operational UAS from the operational environment to facilitate training. The UAS Project Management Office (PM UAS) is concerned that this practice lacks efficiency. This study sought to: (1) conduct a comprehensive analysis for resource optimization with respect to achieving essential training tasks across multiple UAS, (2) conduct comprehensive cost-benefit analysis to assess the value of allocating a full-time and Gray Eagle platforms to accomplish training versus part-task trainers, and (3) define and quantify measures of performance and effectiveness. To achieve these objectives, this study implemented a tradespace analysis methodology to produce a discrete-event simulation model and a resource optimization tool. The impacts of this project will result in substantial cost savings per fiscal year, allow the client to forecast the resource needs of the organization effectively, and allow for the proper allocation of these resources.

Keywords: Unmanned Aircraft Systems, Training Resource Allocation, Optimization, Discrete-Event Simulation, Tradespace Analysis, Design of Experiments, Predictive Analytics

1. Introduction

Since the beginning of the 21st century, unmanned aircraft systems (UAS) have become a major asset for the U.S Department of Defense (DOD), primarily due to the ever-changing and dynamic operations that took place during recent campaigns, such as Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF). Before the Global War on Terror, DOD held fewer than fifty UAS; by 2012, however, DOD had rapidly expanded their inventory to over 7,100 UAS (Rostker, et al., 2015). In contrast to manned aircraft, UAS provide a continuous intelligence, surveillance, and reconnaissance (ISR) capability to ground forces at the lowest echelons, while simultaneously mitigating the risk to the operator. Though there are multiple UAS platforms for the Army, this study focused on the Army’s MQ-1C Gray Eagle. More specifically, this study examined the training program and resource allocation procedures used to produce repairers of the MQ-1C Gray Eagle and provided recommendations for improvement to the client, PM UAS.

1.1 Problem Definition

The center for UAS training, also referred to as the schoolhouse, currently uses 11 Gray Eagle platforms; however, PM UAS would like to utilize partial tasks trainers (PTT) at the schoolhouse and reallocate the Gray Eagle platforms to the operational Army. The operational force currently has a shortage of Gray Eagles due, in part, to recent operations tempo and maintenance issues. Furthermore, the repetition of training tasks at the schoolhouse causes deterioration of the fully functioning UAS. Moreover, the schoolhouse sometimes struggles to meet their throughput requirements because of resource availability. As illustrated in Figure 1, nearly 10% of the Gray Eagle platforms are at Fort Huachuca for Gray Eagle Training.