Miniature Modular Rack Launcher Combo

EML 4551C – Senior Design – Fall 2011
Needs Assessment and Project Scope

Team # 3

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Needs Assessment

Unmanned Aerial Vehicles (UAVs) allow the military to perform reconnaissance as well as attack missions without risking the safety of the operators. These operators conduct these missions in a ground control station, away from any battle zones. Platforms are currently being designed for these UAVs in an effort to have the option of housing different types of weapon systems. These weapon systems will vary depending on the mission type. The purpose of our project is to design and fabricate a launcher for the Tigershark UAV capable of housing multiple types of weapons. Modular type design must be implemented which will allow the launcher to be easily configured for specific weapon loads. A detailed design with a deliverable technical data package must be presented to the ARFL before the prototype is fabricated. A fit check with the Tigershark UAV and a weapon system would complete the integration.

Project Scope

Problem Statement

The emphasis of our project involves the design and fabrication of a launcher for the Tigershark UAV, capable of housing multiple types of weapon systems. The launcher design must meet the requirements specified by the ARFL, and must undergo a critical design review before the prototype is implemented. The finished launcher will then be integrated with the UAV in which a fit check will be performed with different types of weapon systems.

Justification and Background

Unmanned aerial vehicles (UAVs) have become increasingly common on today's battlefield. Since the UAV doesn't need room for a pilot, the aircraft can be much smaller making it difficult to be seen from the ground and does not risk the life of a pilot when flying over hostile territory. In Iraq and Afghanistan, UAVs, such as the Predator and Global Hawk, have assisted ground forces by providing real time video of the battlefield using high resolution cameras. Increasingly common today are UAVs which can carry weapons, such as missiles and bombs.

The Tigershark is a small, cheap, autonomous UAV. Developed by L-3 Unmanned Systems, the Tigershark has a wingspan of 17.5 feet, empty airframe weight of 150 pounds, and a gross takeoff weight of 300 pounds. Currently this UAV is used as a surveillance drone. Our project will entail weaponizing the Tigershark UAV by fitting a Miniature Modular Rack Launcher Combo (MMRLC) to the aircraft. This will allow the Tigershark to become more versatile and further assist ground forces on the battlefield.

Our project is to design a MMRLC positioned beneath the wings that is modular so that different ordnance can be used. The MMRLC will deploy MAVs, Micro Air

Vehicles, which will be dispensed from a canister. The system must also be able to fire Mini Air to Air/Ground Missiles, and have a third possible configuration which involves mounting and deploying a 10 pound bomb or a drop glide weapon. The challenge of this project is to design a MMRLC that can be quickly and easily converted from one module to another. Allowing a single airframe the ability to change mission objectives quickly creates a more cost effective and versatile UAV.

Objective

As a project team we must determine the requirements for the launcher depending on specific weapon loading. We must identify existing mounting hard-points and electrical interfaces when implementing our design. A detailed budget analysis must be included and presented with recommendations. A technical data package must also be presented which meets the requirements specified by the ARFL.

Methodology

There are multiple tasks needed to be done to successfully complete the rack system that is desired by our clients at Eglin Air Force Base. The first task is to communicate with our client to fully understand the product they want. The next step is to do research on all the components related to our project. Some of the topics that will be covered in our background research is on the Tigershark UAV, aerodynamics, and other designs used for larger jets. Once all the background research is completed, our group will begin making preliminary designs. Once all the designs are made, we will begin to analyze and compare the designs to one another. The major considerations in this step will be the flexibility of the designs, weight, drag resistance, and complexity. After a design is selected we will make a prototype and begin testing.

Since our project is going to be attached to the wing of the Tigershark UAV, we will only test fit the rack to the UAV. Given this however, we will test how the rack holds a model of each device that was designated to be launched from the Tigershark. During our testing we will look at how stable the devices are held in the racks at different angles. We will also test how the system releases each device, and how well our safety systems work. Once all of our testing is done, our final design will be presented to our clients at Eglin Air Force Base.

Constraints

There are constraints present during any engineering process. It is important to clearly define the constraints in order to produce an acceptable final product. The single most important constraint for this project will be the timeframe in which is available to complete the project. This constraint will be met by prompt completion of all deliverables. The main design-related constraint is the over-all weight of the launcher. The maximum payload capacity of the Tigershark UAV is 50 pounds. This constraint will be met by designing the launcher with a minimum factor of safety that will ensure reliability and the lightest weight possible. The last main constraint that will be considered is the launcher attachment point. There is one hard-point location per wing to

which the launcher must attach.

Expected Results

Upon project completion, a working modular rack launcher will be delivered that is capable of carrying a variety of weapons. The launcher will be lightweight and strong while maintaining a high level of reliability. It will provide the electrical and mechanical interface to the weapons that are deployed. It will have a modular design that will allow the common structure to be quickly and easily configured to be loaded with specific weapons. The launcher will have a release mechanism; an engineering analysis will be performed to ensure the best release method is determined and implemented. A conceptualized solution will be generated and any revisions will be made as per customer request. Finally, a prototype will be manufactured and test-fitted to the Tigershark UAV with inert weapons.