OBJECTIVE: Develop innovative software to assist aircrew in loadmaster duties and generate cargo configurations to achieve sufficient cargo restraint for Navy and United States Marine Corps (USMC) aircraft using handheld devices.

DESCRIPTION: The Navy is in need of a software tool that can design, evaluate, and display cargo-loading configurations to ensure restrained cargo is to the Navy required parameters within aircraft. This solution should be capable of autonomously designing the most effective and efficient cargo-loading configuration that meets all loading requirements without the use of additional tools and display this information to the user.

Aircraft cargo transportation is a complex mission requiring an understanding of aircraft limitations, cargo space dimensions, tie-down locations, aircraft center of gravity (CG), equipment limitations, and safety of personnel being transported, each of which are unique to different aircraft. This software must be capable of addressing each of these elements when designing, displaying and evaluating cargo-loading configurations.

The loading considerations listed above are detailed in Cargo Loading Guides (CLG). Crewmembers are trained to varying levels of competence in each platform’s specific CLG. Each platform’s CLG is different, some platforms contain specific cargo configurations, while others detail strategies to meet Navy or Marine Corps cargo requirements. Deficiencies of CLGs, gaps in training, and degradation of skill or knowledge of personnel, may introduce human error to crucial CG and tie down calculations that could result in aircraft damage, cargo damage, passenger injury, crew injury, failure of the mission, or loss of aircraft.

By providing means to evaluate and design cargo configurations within Navy or Marine Corps requirements and display certified cargo loading configurations this project will address the listed deficiencies, improve the safety of crewmembers and cargo, and expedite the cargo transportation process.

The software must provide a graphical user interface (GUI) to input and display air vehicle type and dimensions, cargo type and dimensions, desired cargo storage location within the aircraft, restraint requirements, available restraint equipment, and the location of available tie down rings. This software must integrate onto the Marine Air Ground Tablet (MAGTAB), requiring the software to be built in the Android Knox Software Development Kit (SDK). It must be usable by Navy and Marine Corps services and for heterogeneous platforms, both manned and unmanned.

PHASE I: Develop and demonstrate the feasibility of an innovative software for a handheld device that can display multiple unique aircraft loading spaces and aircraft tie down locations, measure and input unique cargo dimensions and locations within the aircraft, and calculate restraint provided by tie down provisions. Exhibit capability to display CLG publications and use a notepad and calculator tool within the software. Establish performance goals and approach for Phase II with emphasis on user interface and generation of optimized tie down patterns. The Phase I effort will include prototype plans to be developed under Phase II.

PHASE II: Develop a prototype software tool, deployed on a hand-held device and operating system including, but not limited to, Android OS, that can measure a unique cargo’s dimensions, locate its tie down rings, and generate an optimal tie down pattern that meets Navy and Marine Corps requirements and provides cargo placement that does not exceed aircraft limitations, provided by the Government. Exhibit capability to display, evaluate and generate cargo configurations across different cargo loading zones and aircraft requirements. Demonstrate capability to save and display known and newly developed cargo configurations for different aircraft. Develop performance metrics for the prototype and path forward.

PHASE III DUAL-USE APPLICATIONS: Evaluate the ability to integrate adaptive cargo loading analysis capability into software for implementation on the MAGTAB and assess the system performance against the metrics developed during Phase II efforts. Transition to appropriate platforms.
The implementation and improvement of measuring tools integrated onto hand-held devices is a commercially viable product that has use cases not limited to construction, auto mechanics, landscape architecture, landscaping, architecture, asphalt, mechanical contracting, heating, ventilation, and air conditioning (HVAC), industrial engineering, and manufacturing engineering. This project will also have the potential for application to commercial aircraft and transport vehicles with unique cargo loading zones requiring tie downs and weight and balance considerations for shipping companies such as FedEx or United Parcel Service (UPS).

REFERENCES:


KEYWORDS: Cargo; Loading; Tie-Down; Handling; Software; Restraint