INDUSTRIAL SOLUTIONS LABORATORY

Company Information

Company Name	*NAVAIR Fleet Readiness Center - East*	**Date Submitted**	*4/5/2022*
Project Title	*Design of an Improved C-130 Hercules Propeller Lifting Sling* **(NAV_C130)**	**Planned Starting Semester**	*Fall 2022*

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills.

Discipline	Number	Discipline	Number
Mechanical	6	Electrical	
Computer		Systems	

Company and Project Overview:

For more than 60 years, Fleet Readiness Center East, at Marine Corps Air Station, Cherry Point, N.C., has played an integral role in our national defense. The facility's In-Service Support Center provides multi-disciplinary, engineering services in both design and maintenance. Our workforce has earned a reputation of excellence, providing worldwide support for Navy and Marine Corps aviation.

Fleet Readiness Center East has provided maintenance, repair, and overhaul support to virtually every weapons platform the Marine Corps has flown – from the inverted gull-winged F4U Corsair of World War II fame, to the Corps newest aircraft, the F-35B Lightning II. It is one of eight fleet readiness centers operated by the United States Navy. It is also the Department of Defense Vertical Lift Center of Excellence. FRC East has a workforce of about 3,800 civilian, military, and contractor personnel. It is North Carolina's largest industrial employer east of Interstate 95.

NAVAIR is an active participant in capstone projects for a variety of school and uses said projects as a means for recruiting high achieving engineers.

Project Requirements:

The C-130 Hercules is universally regarded as one of the most versatile and essential aircraft operated by the United States military and commercial/foreign operators worldwide. As the variants of this airframe have progressed through the vast technological advances in the years since its first inception in the 1950s, so too have the engine and propeller combinations responsible for providing the thrust to get and keep it airborne. Of these propulsion modernization efforts, one of the most significant has been the introduction of new propellers incorporating composite blade design and advanced electro-hydraulic control systems, including Dowty R391 propeller on the KC-130J.

By nature of the design and mission of the KC-130J, it often operates out of remote locations where unimproved or unprepared runways may be the only available option. As a result, the propellers routinely sustain damage in the form of rocks or other debris which are kicked up and impact the spinning blades. While numerous design features on the composite blades are intended to mitigate damage of this nature to the best extent possible, extended operation will eventually result in damage beyond allowable limits and the subsequent removal and replacement of the entire propeller rotating assembly.

Replacement of a propeller on an aircraft is a delicate procedure which can often be complicated by environmental factors, aircraft configuration, and/or availability of necessary resources. For this reason, flexibility of the associated tools and handling devices is essential to give the technicians

the best opportunity possible to complete the procedure without inadvertently damaging newly issued replacement parts and subsequently driving additional cost or aircraft down time.

The Prop FST is seeking a redesign of the prop lifting sling utilized for removing and installing R391 propellers on USMC and USN K/C-130J aircraft. While the current sling is simplistic in its design, it does not allow for fine adjustments to ensure exact alignment of the propeller hub on the engine flanged adapter and can therefore lead to propeller hub damage during the installation process. This drives an unnecessary burden on both propeller/aircraft readiness and the supply system as the hub must then be repaired or replaced. Some specific requirements:

-Compatibility with a standard 3 degree of freedom hoist hook

-Utilize existing interface with the propeller assembly (shackle/clamp/collar on propeller cylinder)

-Ability to rotate propeller 90 degrees from flat position on transportation dolly to vertical position for installation/removal

-Ability for maintainers to make slight angle adjustments (+/- 3 degrees) while at vertical position to ensure optimal alignment of propeller hub and engine flanged adapter

-Corrosion/chemical resistance as a primary design consideration

-Design simplicity preferred to ensure maximum operability/supportability/sustainability

-Capable of supporting a minimum of 2000 lb

-Utilize standard/MIL-spec hardware to the fullest extent possible

Expected Deliverables/Results:

-Functional prototype

-Design package including all calculations and analysis

-Illustrated parts breakdown

-Operators manual (to include any required inspection intervals)

Disposition of Deliverables at the End of the Project:

Students are graded based on their display and presentation of their team's work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter's location, it must be returned to campus for the Expo. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be

concluded within 7 days of the Expo.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

ALL Capstone participants STUDENT or FACULTY must have US Citizenship