Marshall Problem Statement / Senior Design Topic

Problem Title: **core Flight System (cFS) generic end-effector applications**

MSFC Mentor Name and Organization: **Marlyn Terek, ES52**
Mentor's Contact Information: **office: 256.544.7633 email: marlyn.e.terek@nasa.gov**

Indicate which discipline/s is/are most appropriate to work on this problem, e.g., aerospace, mechanical, electrical, chemical, industrial, civil, computer, physics, materials, test, nuclear, earth science, other

Computer and/or Computer Software Engineering disciplines are most important for this work

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Marshall Problem Statement

Background: The big picture with references to previous work (Why would a senior design student be excited about this work?)

The Flight and Ground Software division within the Space Systems Department at Marshall Space Flight Center (MSFC) contains a wide-range of engineering disciples involved with numerous software projects ranging from Technical Demonstration (Tech Demo) projects to in-house software development of the Space Launch System (SLS) flight software. A significant effort is currently underway to advance core Flight System (cFS) expertise and capabilities to support future NASA missions and partnerships. cFS is an open-source framework, created by NASA Goddard Space Flight Center (GSFC), that is platform and project independent and has been baselined for several future missions, including landers and habitats.

An area of importance that has been identified is to create a library of generic cFS applications with associated documentation for various spacecraft end-effectors that can be re-used on a multitude of projects and extended for specific mission use. Implementation of an end-effector base capability application library would allow software developers to focus on implementation of project specific aspects of end-effectors resulting in a potential reduction cost and schedule of future NASA missions.

Recent/on-going research on the problem (What resources, if any, are available to the senior design team, such as equipment, software, facility utilization)

Software development of cFS applications for specific end-effectors has been done; however, each project determines and selects the best end-effectors needed to achieve their specific mission objectives and goals. Currently, that results in writing specific end-effector cFS applications for each unique piece of hardware. Categories of end-effectors, such as star trackers, have similar base capability but differing models of end-effectors potentially have functional aspects that diverge from the base capability and need to be handled.

The Software team has experience in design and implementation of cFS framework and applications and can act in an advisory role to the senior design team on the intricacies of designing for the proposed project. The core Flight System is an open-source software architecture, and there is a strong community of participation in the project across NASA, academia and industry.

Details of the problem; design constraints, requirements (if any), outcome expected (one semester Senior Design course lasts 15 weeks; two semester course lasts 30 weeks.) (What do you expect the senior design team to accomplish?)

Work will need to be done by the team to complete a comparison of various end-effectors of similar type, identify the common base capabilities, and, following NPR 7150.2C, design, develop, and test a generic end-effector cFS application.

Deliverables of this project would include: a software requirements document, design document, unit/functional test, procedures, and a simple demonstration of the generic cFS application on a representative end-effector.

This work will potentially need to be conducted as part of a two-semester design course as we desire a prototype or demonstration piece by the end of the course.

Senior Design Project Rules:

1. Weekly telecons will be scheduled to maintain proper progress and prevent dead-end ventures.

2. Deliverable/s required - (e.g. end-effector comparison date, software requirements and design documents, final code base, unit/functional tests with results, and a demonstration of working generic cFS application.)