


# CS486C – Senior Capstone Design in Computer Science

## Project Description

<b>Project Title: Weapon System Support Software</b>	
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### Project Overview:

Weapons systems are getting progressively more complex and as such the digital systems that are integral to them are generating more data leading to more diagnostic complexity. At Northrop Grumman we are innovating and delivering superior armaments and services for those who defend their nation's security. This shows some of the things we do at our Mesa facility: <https://www.northropgrumman.com/what-we-do/advanced-weapons/armament-systems/>.

These weapons systems have an integral controller to drive the weapon at a high rate depending on application. Historically, the controller has been very simple and would indicate to operators either an armed or faulted state. An error code reader was available to get further information but was limited to basic errors. Our latest generation of controllers has many times more fault codes and records some data during operation that could be invaluable in different situations.

Currently, we have engineering tools to interrogate the controller and download data, but we do not have anything that could be considered production worthy. While new systems will integrate the new controller functionality into the vehicle level Fire Control System, existing applications which obtain new controllers through attrition will not have this integration.

The problem we face is that without access to the fault and diagnostic field data we will not be able to easily support our products. While we could provide our engineering tools to the customer, without an easy to use, easy to install, and easy to understand solution our customers will likely not use the SW and simply replace the controller with a spare unit.

### The Envisioned Product:

What we need is an incredibly simple SW package that can connect to our controller to display and download diagnostic and fault data. Furthermore, this SW will need to be able to be installed and operated by a non-technical operator on various platforms. Ideally, this software would install on an OS agnostic laptop without requiring administrative rights or IT interaction and could be simply downloaded and installed at a moment's notice. It should be assumed that the laptop is managed/controlled very tightly by a governmental IT department.

Key features of the solution:

1. Cleaner GUI for install and operation than our existing engineering tools.
2. Mistake proof setup and connection with controller over serial interface.
3. OS agnostic (Can run on older versions of Windows).
4. Install package needs to work with the minimum amount of IT support possible.

- a. Minimum viable solution could require admin rights but provide document outlining approach to update to meet requirement.
5. While not directly addressing cyber concerns with the interface to the controller, the SW will need to be designed in such a way as to make it impossible or very difficult for operators to use the SW for anything other than the limited interface intended. Note that the serial interface can be used for other purposes.

The successful Weapon System Support Software will enable maintenance personnel to easily obtain the best diagnostic data regarding the system. It will also allow vehicle integrators to understand what is possible as they build this functionality into their vehicle. Ultimately, this SW will support the war fighter and provide the Northrop Grumman customer with the best solution possible.

**Knowledge, skills, and expertise required for this project:**

- Students working this project are required have US citizenship.
- Knowledge of modern programming techniques, frameworks, and languages required to develop simple user interfaces.
- Knowledge of serial communication and how PC's enable this interface.
- Programming skills in Python, C/C++, etc.
- Able to learn about SW installation limitations on PC's.

**Equipment Requirements:**

- There may be no equipment or software required other than a development platform and software/tools freely available online.
- NG will provide an abstracted serial protocol so that the team can test the SW without the need for a controller.

**Software and other Deliverables:**

- A strong as-built report detailing the design and implementation of the product in a complete, clear and professional manner. This document should provide a strong basis for future development of the product.
- Complete professionally-documented codebase, delivered both as a repository in GitHub, BitBucket, or some other version control repository; and as a physical archive on a USB drive.