Thesis Project Portfolio

Satellite Testing: Test Results Database and Python GUI

(Technical Report)

The Failure of the Mars Climate Orbiter Through the Lens of Virtue Ethics

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

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In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

My technical project and my STS research project were directly related through the

impact that a solid computer science education and virtuous work can have on the success of a

NASA mission, and the failures that can result from an inadequate education. The technical

project I worked on, which involved working directly with NASA engineers on modem testing,

highlights some of the ways that the University of Virginia fails to prepare Computer Science

(CS) students to be successful and virtuous workers. In contrast, my STS research project

highlights what can go wrong when software engineers fail to act virtuously, specifically causing

the failure of the Mars Climate Orbiter (MCO). Throughout both of these projects, the

importance of engineers being adequately prepared and acting virtuously were common themes

that I observed.

My technical project involved working with various NASA and NASA contractor

engineers to facilitate ground station modem testing. I used to skills learned throughout my time

at UVA to create a test results database and associated graphical user interface (GUI). My

coworkers were particularly impressed with the ease in which I handled some more difficult

aspects of software engineering, such as Linux/terminal use. Still, while working on this project,

it became evident that there are many flaws in the UVA CS curriculum that made me

inadequately prepared to perform my work. For instance, while there is an intense focus early in

the curriculum on basic programming skills, there is very little in the curriculum dealing with

databases, which are pretty standard in most software industry jobs. Additionally, many of the soft skills, like agile methodologies, are barely touched, only being present in a single core class. My technical project allows me to understand the flaws in the CS curriculum here at UVA, and to propose improvements.

My STS research project focuses on what can go wrong when software engineers are not adequately prepared for their job, and when they don't behave virtuously. In specific, I analyzed the causes of the Mars Climate Orbiter failure, and found that the software engineers that worked on the project were to blame. While many analysts of the incident placed blame on poor management, I attempted to analyze the behavior of the engineers instead. There is an onus upon engineers, as outlined by the virtue ethics framework, to ensure that they communicate effectively, strive for quality, and act professionally. I claim that the software engineers responsible for this project failed to uphold these virtues, and thus their conduct was unacceptable, and led to the failure of the MCO.

Working on these two projects allowed me to see how the limitations of the UVA CS curriculum can lead to disastrous consequences. The technical project I worked on allows me to see what failures are present in the curriculum, and how they can be improved. My STS research project, on the other hand, highlights the issues that occur when engineers are improperly trained and when they don't act virtuously. These two projects showed me that it is of utmost

importance that engineers receive an education that properly trains them for the industry

workplace. If they do, then the chance that they will maintain most or all virtues is increased, and

if they fail to act virtuously, all blame can be placed solely on them, not on the inadequate

education they have received.