Thesis Portfolio

A SPACE-BASED SOLUTION TO IMPROVE ROADWAY SAFETY AND EFFICIENCY IN VIRGINIA: REAL-TIME WINTER WEATHER DATA FOR NAVIGATION

(Technical Report)

TECHNOLOGICAL MOMENTUM IN THE ASTEROID MINING INDUSTRY

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The main topics of this thesis involve the activities of humans and their technology in space. The technical portion involves developing a novel method for obtaining weather data in order to reduce roadway incidents. By researching the different areas of satellite development and the space mission engineering (SME) process, the team was able to plan for a new constellation of satellites that can better detect climate conditions. Several functional teams were constructed in order to research the elements of SME and the design of the satellite. Through the collaboration between the program management; communications; software and avionics; power, thermal, and environment; attitude determination and control system and orbits (ADACS); structures and integration; and instruments teams, this project came together to create a viable solution for the customer, The Mitre Corporation (MITRE).

By creating a novel solution, the need for the construction of a new satellite constellation is unavoidable; however, there are numerous private companies that offer customers the ability to purchase satellite imaging solutions by way of their existing constellations. This privatization of space does not end with satellite imaging, though, with companies like SpaceX, ULA, Blue Origin and many others offering transportation to space on-board their private launch vehicles. These launch vehicle providers are reducing launch costs for private companies and gaining momentum in an industry that has previously been driven by government contracts.

The social portion of this thesis examines the Technological momentum growing in the private space industry and how it relates to the impending boom of private asteroid mining. Since SpaceX certified its Falcon9 rocket as a reusable launch vehicle, space has become more accessible than ever before. With this new focus in the space industry on reusability and cost reduction, many smaller start-ups are forming that look to exploit the lowered cost of entry. With

the astronomical potential for monetary gain orbiting the Earth in the form of asteroids rich in precious metals, it seems to be only a matter of time before a private space companies finds a way to collect some of these resources by way of asteroid mining. The technical and financial feasibility of establishing an asteroid mining industry, as well as the societal implications of doing so, is explored in the proceeding Research Paper.