

Truck Parking and Management in Virginia
(Technical Paper)

Analysis of Martian Colonization through *Mobile Suit Gundam: Iron-Blooded Orphans*
(STS Paper)

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On my honor as a University Student, I have neither given nor received
unauthorized aid on this assignment as defined by the Honor Guidelines
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Introduction:

Space is no longer the final frontier we dream about; it is the current frontier engineers around the world are pushing to both better the lives of us on Earth and explore further beyond. In the past half-century, nations around the world developed new ways to connect each household through radio satellites, built telescopes to observe and learn about the solar system, and even landed objects and humans on other celestial bodies. This paper will tackle both terrestrial application and future exploration considerations.

The spacecraft design capstone focuses on utilizing space-based technologies to conduct remote sensing of truck parking. As illegal truck parking due to poor management is causing traffic and safety issues in Virginia (and other parts of the U.S.), we are partnering with the MITRE Corporation to develop a solution framework with data collection, processing and dissemination. According to a VDOT study in 2018, there is a significant truck parking shortage along the I-81, citing a physical limitation of space and inadequate systems management as key factors (2018). Previous related work in Michigan implemented a system of identifying available truck spaces and is disseminating this information through road signs on I-94 (Woodrooffe, 2016). Our goal is to utilize commercial satellite imagery products, along with software, to identify trucks and empty spots with system integration to provide a seamless experience to truckers in Virginia.

The STS thesis will shift its focus outwards toward Mars and the future. The thesis will tackle the analysis of *Mobile Suit Gundam: Iron-Blooded Orphans* (Okada, 2015) through the lens of Martian colonization's societal, political and economic factors. It is a media analysis of how depictions of future Martian society help us better understand how to approach constructing a sustainable Martian presence. Works such as *The Case for Mars* by Robert Zubrin, in which he

outlines the Mars Direct (Zubrin, 1997), will be utilized, along with its subsequent analysis or critiques of his initial proposals. Other resources include works that dive into the economic and psychological factors of space exploration, with the intent of developing a comprehensive analysis of viewing *Mobile Suit Gundam: Iron-Blooded Orphans* as a source for understanding the future of space colonization.

Technical Topic:

The poor management of truck parking has led to illegal parking and overcrowding, causing traffic and safety issues along major interstate highways in Virginia. Truckers must adhere to legal requirements regarding maximum vehicle operation time, and parking is expected to occur at waypoints and designated locations. However, as there is no centralized system to locate vacancies and relay that information to truckers effectively, parking stations often become overcrowded. This leads drowsy truckers to either illegally park on the highway or continue driving in search of an available space, endangering themselves and other vehicles on the road. The larger issue that has been identified is the lack of total parking spots, for which greater infrastructure changes must be made. For the purposes of this capstone project, the aim is to develop a space-based solution to conduct remote sensing of trucks and parking spots, and then construct a systems architecture to process the data and disseminate it to truckers in a non-intrusive way. We have partnered with the MITRE Corporation under the mentorship of Dr. Cj Rieser and Dr. Michael A. Balazs, as well as our technical advisor Professor Chris Goyne, to investigate and tackle the problem.

We have reached out to the Eastern Transportation Coalition, I-81 Corridor Coalition, Owner-Operated Independent Drivers Association, and the American Transportation Research

Institute. Interviews with the first three have already been conducted, and the common theme regarding the truck parking problem is that there is a lack of initiative from the government despite it being a roadway safety issue. Thus, it falls into the hands of independent research groups to explore this problem. As this problem extends beyond the borders of Virginia (which we defined), a comprehensive solution will take more cooperation and awareness of the issue to implement.

Despite the limitations, past organizations have attempted to remedy the truck parking problem in localized areas using different data collection and management techniques. As part of our process, we conducted research on the state-of-the-art, where current solutions and developments were discussed. Crowd-sourced tracking apps as well as “detectors installed in the ground, and video cameras for additional monitoring” with truck detecting algorithms (see Figure 1 below) are all solutions that are currently commercially available; however, all of these solutions have major inefficiencies (I-95 Corridor Coalition, 2009). The tracking apps require truckers to input and update current data, a method with obvious drawbacks as drivers without the app or infrequent users can lead to outdated data (Woodrooffe, 2016).

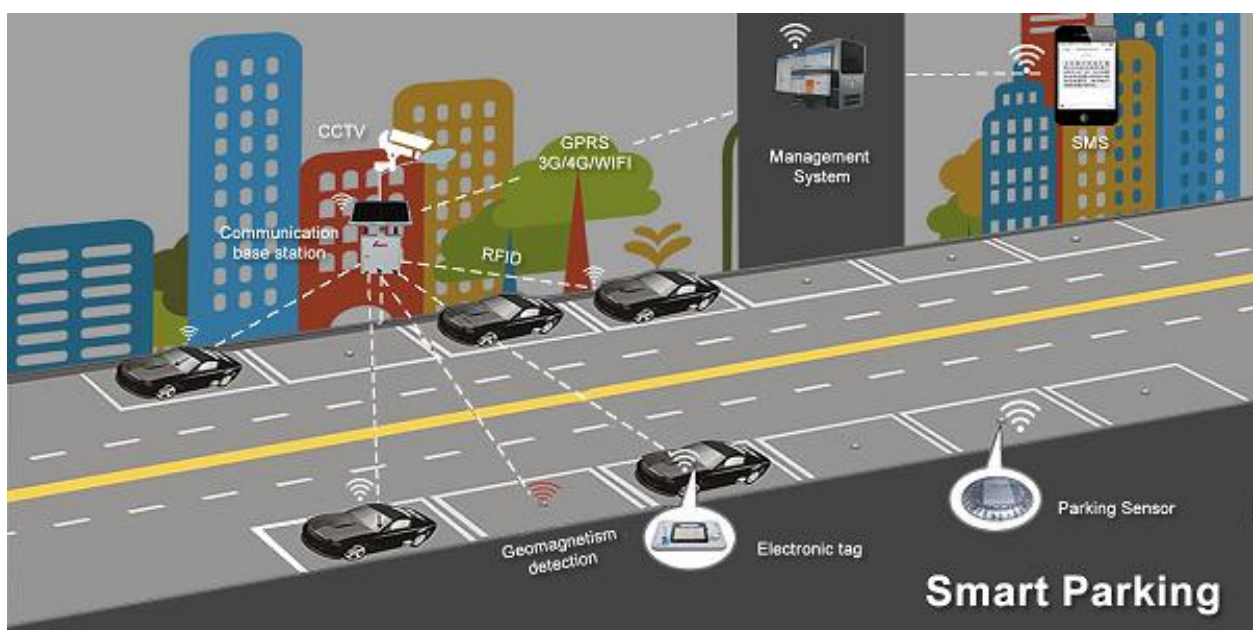


Figure 1: Example of a sensor-based parking system with video cameras to demonstrate the inefficiency of this design. (Research N Reports, 2018)

In an interview with the I-81 Corridor Coalition, the use of in-ground sensors was discouraged due to the Virginia Department of Transportation's (VDOT) apprehension to damage the existing infrastructure - the pavement - to install the sensors. On-site cameras are currently the most favorable solution; however, this still requires the installation of a camera at every parking site and the establishment of a communications network between them (Morris, 2017). From interviews with the organizations listed, and research on current solutions, we have gathered that our solution needs to have a relatively high data collection frequency - as knowing there was a space available hours ago is not useful - and should be widely applicable, avoiding the installation of sensors or cameras at every parking location in the state.

Due to the research and design emphasis of this project, there are minimal initial resource requirements necessary to complete this semester's tasks successfully. One requirement would be ample access to the stakeholders previously mentioned, as they provide first-hand accounts about where the problem lies and what solutions have been implemented in the past.

Additionally, the mentorship of Dr. Cj Rieser and Dr. Michael A. Balazs provides valuable input on gaps in our team's knowledge and on possible shortcomings of proposed space-based solutions. The last resource requirement would be access to literature on the current state-of-the-art.

This capstone project is broken down into, the first three of which contained research and interviews have been completed. The next three regarding solution development will be completed this fall semester, and the final six on solution concepts and refinement will be

completed in the spring semester. Our 11-member team has already presented its initial progress to MITRE and will present again at the end of the semester.

STS Topic:

Images of science fiction have always inspired engineers to push the envelope, and an analytical look at such media may reveal more than predictions of the future. As the STS thesis is a discussion revolving around media, an introduction and summary will be presented first, followed by the discussion of the research question. *Mobile Suit Gundam: Iron-Blooded Orphans* is an independent series in the *Gundam* franchise, first introduced in 1979 by *Mobile Suit Gundam* (What is Gundam). The franchise has a long-standing tradition of depicting warfare in space using mechas, or “humanoid robots” derived from the Japanese transliteration of “mechanical.” Common recurring themes tackle space exploration and colonization, human rights in space, and the evolution of humankind as a result of spacefaring. It became popular among other shows that depicted neo-Tokyo styles of futurism questioning the existential purpose of progress such as *Neon Genesis Evangelion*. *Iron-Blooded Orphans* takes a comparatively grounded approach, introducing the audience to a colonized Mars after a great war 300 years ago between Earth and its space colonies that left Earth under a single military hegemony named Gjallarhorn. The story follows a group of orphans on Mars who rebelled against a private security company to form their own called Tekkadan whose goal in the first season was to escort Kudelia Aina Bernstein, a representative of the Mars autonomous region, back to Earth for discussions of independence. Battles of might, deception and technology occur as Gjallarhorn attempts to block her arrival. Season two follows with Bernstein seeking financial independence for Mars through a mining operation with the protection of Tekkadan. Once again,

Gjallarhorn meddles in the matter and ultimately succeeding in defeating our protagonists. However, due to internal chaos from the incident, including the exposure of corruption and rebellion among the highest ranks, the Martian cities were freed from Earth's control and formed their own union, leading to greater advancements such as the abolishment of human debris– the in universe term for child slavery in space– and removal of other toxic players in the Martian sphere (Okada, 2015).

Although some claim the series is inferior compared to its predecessors, its narrative provides insightful revelations on the future of our own Martian efforts. The issues of economics, politics and governance, human rights, technology application, and warfare are all at play, weaved together to depict a snapshot of the human race once space travel becomes commonplace. If international relations and global commerce is not complicated enough, imagine what the future holds when nations and organizations are no longer limited to Earth, where the logistics of infrastructure development and governance are exponentially more complex than they are now. How could peace be ensured if the sheer vastness of space limits the capability for law enforcement? How can the global community built upon trust function when consequences can be ignored? Most importantly, how can humanity reconcile with emergence of a spacefaring society, one whose norms and beliefs will inevitably clash with Earth dwellers. These are the questions that will need to be answered, and thus, the goal of this thesis is to break down the intertwined factors with a focus on technology and society on Mars to understand how a smooth transition to embracing space could occur.

The STS theories that will be applied are political technology and paradigm shift. Both are relevant and functional frameworks that can be used to characterize the problem. Political technology is the idea that technologies have politics attached to them and being aware of its

origins and its effects are of importance. According to Langdon Winner, artifacts can have politics in two ways: “First are instances in which the invention, design, or arrangement of a specific technical device or system becomes a way of settling an issue in a particular community... Second are cases of what can be called inherently political technologies, man-made systems that appear to require, or to be strongly compatible with, particular kinds of political relationships” (Winner, p. 123). Understanding the ways technology can be political will enable deeper examination of the artifacts. Paradigm shift is a concept that describes a shift in knowledge among the population, such as accepting new science discoveries in a sudden epistemic rejection of archaic worldviews. First formulated by Thomas Kuhn, it was first used to describe changes in the natural sciences before being applied to social science as well. This framework allows different worldviews to exist and claims one to be predominant, thus exposing how such a shift may occur in relation to contrasting beliefs (Kuhn).

The research attempts to understand factors that surround space colonization behavior and attitudes towards this future through an analysis of *Mobile Suit Gundam: Iron-Blooded Orphans*. The research will be conducted firstly by reviewing the anime series to find key moments that can be identified as a cause for the political and economic state of the world. Then technologies that play a role will be identified as well, and thus connections can be drawn between the technologies and the world’s condition. To analyze each connection, the technology in question will be compared to modern day efforts for Mars missions such as in-situ resource utilization (Chen et al., 2020), and the political, economic and social aspects will use evidence from sources that describe how those factors come into play in space exploration. The STS theories of political technology and paradigm shift will be used as a guideline to consider each element from different perspectives, with the goal of breaking down not only the interaction

between technology and society, but its dangers - and in extension, what questions must be answered in order to successfully develop future human space exploration – as well. Specifically, political technologies are known to be pernicious and thus be an underlying root cause for greater surface issues, and paradigm shifts are meant to describe a shift the knowledge base, yet resistance leads to problematic understanding of the world.

Conclusion:

The technical project seeks to develop a solution for truck parking and management in Virginia in collaboration with the MITRE Corporation. Once the solution is formulated and presented, the implementation of this service product will reduce illegal truck parking and overcrowding by enabling truckers to find empty lots through our system that utilizes satellite imaging. If successful, it could be extended to outside of Virginia or be combined with existing on-ground techniques to further enhance the experience.

The STS thesis will identify technologies presented in *Iron-Blooded Orphans* and discuss its relationship to the political, economic and social climate of the series. The analysis enables the understanding of how society might approach future space exploration efforts and establishes key players and factors that are essential to the successful development of human society beyond Earth. The thesis will also prove the utility of science-fiction media, as despite the fictional elements, the relationship between technology and society remain driving forces in narration.

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