

GUIDING VISIONS OF THE SPACE AGE:  
HOW IMAGINATIVE EXPECTATIONS  
DIRECTED AN INDUSTRY

by

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*To Annie,  
For your unending love, support and patience.*

*“With a bad telescope and a powerful imagination, there is no saying  
what you may not accomplish.”*

*H. G. Wells, 1898*

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## ABSTRACT

This essay presents a unique historical perspective on the roots of the burgeoning private space industry's fixation with Mars as an inevitable frontier for human settlement. While changing legislation, new innovations and discoveries, and the flux of geopolitics influenced the private space industry, a set of underlying visions – inspired at times by millenarian anticipations as well as techno-utopian expectations and popularized by both science fiction as well as media sensationalism – operated as the subsurface dynamos pushing the space industry into the future. Although a broadly shared ideology of technology steeped in both apocalyptic and transcendent visions for the future emerged over many centuries, this ideology's collision with the Space Age produced a discourse that has influenced the space industry's development in important ways. Comprised of countless science fiction texts, media sensationalism, and futuristic visions put forth by public intellectuals throughout the 19<sup>th</sup>, 20<sup>th</sup> and 21<sup>st</sup> centuries, apocalyptic fears and techno-utopian hopes have consistently defined much of this discourse since its conception. In fundamental ways it has directed the long-term goals of NASA as well as more recent private space companies. In particular, Mars as an assumed *next-step* destination in the progress of humanity's spread into the cosmos grew out of this discourse. This essay shows how this discourse significantly influenced the development of the private space industry and argues that the contemporary private space industry can generate enormous public enthusiasm by making real or *appearing to* make real the public's dreams of eventually accessing space with ease and colonizing Mars.

## INTRODUCTION

The spectacle on February 6<sup>th</sup>, 2018 overran newsfeeds across the world. Headlines describing the first launch of the world's latest and largest private rocket carrying one of the most unusual payloads ever sent to space transfixed the public. Even the President took notice. Of the nearly 37,000 tweets Donald Trump had posted prior to that afternoon, he had almost never mentioned the subject of space.<sup>1</sup> But the launch that day managed to distract President Trump in the midst of his war with Democrats and the FBI, causing him to tweet, "Congratulations @ElonMusk and @SpaceX on the successful #FalconHeavy launch. This achievement, along with @NASA's commercial and international partners, continues to show American ingenuity at its best!" He even included a linked video of the initial launch.<sup>2</sup> Just hours earlier, more than 100,000 onlookers watched SpaceX's first Falcon Heavy ignite at Cape Canaveral's historic Launch Pad 39A and carry SpaceX CEO Elon Musk's red Tesla roadster into space. Joining them, more than 2.3 million screens concurrently broadcasted the launch's livestream on YouTube to viewers throughout the world. As the second most viewed YouTube livestream since the website's first live feeds began a decade earlier, the launch appeared to many as a paradigm shift in the development of the private space industry.<sup>3</sup>

Yet a careful look at the event's technical and material achievements fails to fully justify the claim that the launch represented a significant turning point. If anything, the Falcon Heavy was a kind of final iteration within SpaceX's current technological

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<sup>1</sup> Brendan Brown, "Trump Twitter Archive," Trump Twitter Archive.

<sup>2</sup> Donald Trump, Twitter Post, February 6, 2018, 7:05 pm.

<sup>3</sup> Micah Singleton, "SpaceX's Falcon Heavy Launch Was YouTube's Second Biggest Live Stream Ever," *The Verge*, February 06, 2018.

paradigm rather than the start of a new one. Another common media claim – that the launch signaled a shift away from public ventures like NASA and towards the private industry – fails to acknowledge the long history of the private space industry. In that sense too, the Falcon Heavy was nothing particularly new. Yet these and other vague and unsubstantiated media claims about the event’s paradigm-shifting significance were widespread in the days after the launch. The launch *seemed* and *appeared* significant, even if the very press that covered it failed to fully understand why.

However, a closer look at the ways the Falcon Heavy’s launch generated public enthusiasm offers a clearer explanation for why it *seemed* so important. SpaceX’s first Falcon Heavy launch consciously engaged with the cultural legacy of the Space Age in unique ways. Through the launch’s explicit signaling, SpaceX’s techno-spectacle deeply resonated with the public’s visionary expectations for the future of spaceflight. These expectations derive from a historical process more than a century in the making. This paper articulates the nature of that historical process in order to elucidate why the Falcon Heavy launch excited the media and the public so much.

In the last decades of the 19<sup>th</sup> century, a transformation in news media and fiction literature coupled with new astronomical observations of the planet Mars produced the discourse of the Space Age. This discourse – a combination of science fiction, media sensationalism and futuristic visions put forth by public intellectuals throughout the 20<sup>th</sup> and 21<sup>st</sup> centuries – has evolved in conjunction with scientific and technological advancements in space travel and exploration. Although constantly adapting in response to new scientific understandings and engineering capabilities, the futuristic visions and media sensationalism of the Space Age have long influenced the trajectories of the space

industry itself. In key ways this discourse has guided NASA's long-term plans since the agency's conception. More recent private space companies like SpaceX and Blue Origin have embraced particular visions that grew out of this discourse in order to define their own long-term goals. Additionally, the broader public's fixations with space and especially Mars originate from this enduring dialogue.

The first Falcon Heavy launch generated enormous public enthusiasm through its ability to consciously engage with this discourse. Through its use of pop culture and science fiction references, the communicative technologies it embraced for publicity, as well as the awe-inspiring spectacle it provided, the launch played into the public's expectations for the future in order to generate publicity and even a growing fanbase. Yet precisely how SpaceX and other space companies can and do play into these expectations requires a closer look at the historical development of the Space Age discourse itself as well as its underlying ideological roots.

While SpaceX's Falcon Heavy launch certainly had its fair share of "firsts," the ideological framework the launch played into is nothing new. Refined over centuries, an essential and broadly shared ideology of technology has underpinned both governmental and private space ventures since their beginnings. Although circumstances changed rapidly, especially in the late 20<sup>th</sup> and 21<sup>st</sup> centuries, this base ideology – one that existed long before the space industry and shared broadly albeit mostly subconsciously by the general public – continuously provided space industry participants a foundation of motivations, justifications, and direction. In articulating the nature of this ideology, historian David F. Noble identified its roots as far back as Medieval Christian Europe. Noble argued that "the present enchantment with things technological – the very measure

of modern enlightenment – is rooted in religious myths and ancient imaginings.”<sup>4</sup> Noble further elaborated that, “the religious roots of modern technological enchantment extend a thousand years further back in the formation of Western consciousness, to the time when the useful arts first became implicated in the Christian project of redemption.”<sup>5</sup> Grown from this ideological seed, the mythological perspective that humanity must continue pursuing technological development in order to regain the perfect, divine knowledge Adam possessed before eating from the Tree of Knowledge in the Book of Genesis has shaped how westerners think about and produce technology as well as how they have imagined the future over the last millennium. Widespread views of technology as a double-edged sword capable of both apocalyptic destruction as well as utopian transcendence have been reinforced again and again throughout the 20<sup>th</sup> century. The internal combustion engine could offer speed, freedom and individuality when running an automobile, or it could offer terror, death and destruction when running a World War I tank. Nuclear power could offer cheap, unbounded energy for all and an engine for traveling the cosmos, or it could offer global annihilation. Industrialization as a whole could carry humanity into a utopian future, or it could rupture the planet’s sensitive climactic equilibrium and wreak havoc on its inhabitants. Although imagined futures have changed significantly over time, and although various visions that prioritize different concerns often compete rather than monolithically coalesce, they still share in an ideological framework frequently oscillating between apocalyptic fears and utopian

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<sup>4</sup> David F Noble, *The Religion of Technology: The Divinity of Man and the Spirit of Invention* (New York, NY: Penguin Books, 1999), 3.

<sup>5</sup> *Ibid*, 6.

visions, sometimes consciously, often subconsciously, but all derived from the same mythological wellspring.

In recognizing its pervasiveness, the history of space exploration as well as its surrounding discourse appears steeped in and even directed by this ideology's range of millenarian visions. Despite the secular nature of contemporary space companies like SpaceX, Blue Origin and others, their stated missions and long-term plans coincide with these visions. Additionally, media coverage consistently provides a fuel of sensationalism that stimulates the general public's vacillating visions of a sometimes apocalyptic and sometimes utopian future.

Often directly implicated in these imagined futures, the enigmatic planet Mars has played many roles in an array of visions that have evolved in tandem with 19<sup>th</sup>, 20<sup>th</sup> and 21<sup>st</sup> century scientific discoveries that continually reshape human understandings and perspectives of the planet. Mars has endured as a possible location for extraterrestrial life that could one day answer one of humanity's oldest existential questions – *are we alone?* – and by extension complicate notions of humanity's god-like image; but the planet has also represented everything from a doomsday threat, a prophetic warning to a warming Earth, a second chance for a species still limited to a single planet and at the mercy of some errant asteroid, a frontier opportunity for spacefaring pioneers, as well as an awaiting promised land in the form of a nearly blank planetary canvas holding out for an eventually technologically-transcendent human race to paint itself a new utopian world with the divine power of terraformation. These sometimes terrifying, often idealistic, and always grandiose expectations for the future grew out of a broader and long-enduring

ideology of technology. More importantly, they have directly shaped the trajectory of the space industry itself through the discourse of the Space Age.

Blossoming at the end of the 19<sup>th</sup> century, four elements comprise the Space Age discourse as well as the general public's fixations with the Red Planet: new astronomical observations of Mars, the growth of the telegraph network, the development of rapid news reporting, and the emergence of space-oriented science fiction literature. These four components transformed the ways many in society thought about and imagined Mars and the future. While new albeit inaccurate astronomical observations of Mars in the last decades of the 19<sup>th</sup> century provided the evidentiary seeds through which the public could envisage an extraterrestrial world, the combination of the telegraph and rapid news reporting popularized the subject like never before. At the same time, the birth of space-oriented and especially Mars-oriented science fiction, oftentimes published in newspapers as well, played a key role in shaping the public's expectations for a future that frequently included Mars as a potential threat, a potential opportunity, and above all, a potential destination. The discourse of the Space Age emerged directly from the nexus of these four elements. Their combination set in motion a process of vision formation that has continued ever since.

## CHAPTER ONE

### MARTIAN CANALS AND MEDIA SENSATIONALISM

A transformation in news media occurring between the 1877 and 1892 perihelic oppositions of Mars marked a key starting point in the development of the planet's central legacy within the discourse of the Space Age. While the remarkable astronomical claims of canals on Mars went almost entirely unreported during and after the perihelic opposition of 1877, similar canal claims made during the next perihelic opposition spurred a media sensation still referred to by many historians as the "Great Mars Boom." The contrast in publicity between the two oppositions suggests that something drastic and transformative occurred during the interceding decade: the rise of telegraph-dependent rapid news reporting. The emergence in this period of fast-paced media coverage that sensationalized Mars and space exploration more generally commenced a trend that has continued ever since – evolving later in conjunction with new communication innovations from radio and television to social media and internet livestreams.

The first notions of canals on Mars emerged from the mistranslation of Italian observer Giovanni Schiaparelli's descriptive term *canali*, but news of Schiaparelli's observations hardly reached beyond the small astronomical circles of the time. The transformation in news media that ignited the very public Mars canal debates of the 1890s had not yet taken place. Atop Milan's Brera palace and peering through an 8.6 inch refractor newly manufactured by Bavarian optician George Merz in late September through October of 1877, Schiaparelli decided to test the new telescope's capabilities and turned its lenses to Mars.<sup>6</sup> He wanted to see if the Merz could magnify the planet enough to discern surface details.<sup>7</sup> When Schiaparelli compared his observations with preexisting Mars maps like those of Frederik Kaiser and Joseph Norman Lockyer drawn during the last perihelic opposition in 1862, he saw an opportunity to add his own contributions.<sup>8</sup> Schiaparelli went to work building upon a "maritime" view of Mars that presumed the existence of water in the dark areas of the planet's surface.<sup>9</sup>

Although this maritime view of the Red Planet originated with Sir William Herschell's observations a century earlier, Schiaparelli's additions and in particular the subsequent mistranslation of his fateful word choice had enormous ramifications for the public's perceptions and expectations of Mars later on.<sup>10</sup> Noticing a network of darker lines running across the planet's surface, Schiaparelli borrowed a term first used by

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<sup>6</sup> William Sheehan, "Giovanni Schiaparelli: Visions of a Colour Blind Astronomer," *Journal of the British Astronomical Association* 107, no. 1 (February 1997): 12.

<sup>7</sup> William Sheehan, *The Planet Mars: A History of Observation & Discovery* (Phoenix, AZ: University of Arizona Press, 1996), 67.

<sup>8</sup> Fred W Price, *The Planet Observer's Handbook* (Cambridge, UK: Cambridge University Press, 2000), 150.

<sup>9</sup> Sheehan, "Giovanni Schiaparelli," 12.

<sup>10</sup> "All About Mars: 1700s," NASA Mars Exploration.

Father Angelo Secchi in the 1850s when naming the planet's largest dark area the "Atlantic *Canale*." Schiaparelli broadly applied the term to numerous additional dark streaks he saw through the Merz. Evidenced by his interchanging of the terms *canale* and *fiume* (river) in his published memoir of his observations in the journal *Astronomische Nachrichten*, Schiaparelli had not originally meant to imply an artificial origin for his *canali*.<sup>11</sup> Yet his liberal use of the term as well as his increasingly complex and geometric Mars maps added to with each successive Mars opposition for the next decade suggested that Schiaparelli gradually developed a belief in the canals' artificial origins.

Unsurprisingly, Schiaparelli's *canali* were soon translated to "canals" in English, spurring some of the first speculations that a highly industrious, canal-building civilization existed on the planet. Yet unlike the sensational claims made by astronomers during Mars' next perihelic opposition in 1892, few people beyond the small community of astronomers at the time learned of Schiaparelli's observations for more than a decade. The first mention of Schiaparelli's "canals" in newspapers appeared in a minor article published in the *Adelaide South Australian Registrar* in the summer of 1880, but the article principally concerned the recent visit and lecture by preeminent English astronomer Richard A. Proctor who had mentioned the need for "Australian astronomers to endeavour to verify" the existence of Schiaparelli's "fine canal-like passages."<sup>12</sup> Clearly astronomical circles were discussing Martian canals by 1880, but the debate had

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<sup>11</sup> "Schiaparelli, Giovanni Virginio," *Complete Dictionary of Scientific Biography* (Detroit, MI: Charles Scribner's Sons, 2008), 161.

<sup>12</sup> "Mr. Proctor's Astronomical Lectures: The Planets," *The South Australian Register* (Adelaide), July 20, 1880, 6.

yet to spill forth into the public sphere. No other mention of Schiaparelli's canals appeared again in newspapers until two years later.

In a short article published in the *London Daily Telegraph* in 1882, Schiaparelli's *canale* briefly reemerged. The article described Sciapparelli's "canals" as bearing "the appearance of long seaways, dug through the martial continents, as if a mania for shortcuts had seized the inhabitants of the planet, and everybody residing there had become an active M. de Leaseps."<sup>13</sup> "M. de Leaseps" referred to Ferdinand de Lesseps, the renowned French diplomat and director of the Suez Canal's construction completed just thirteen years earlier in November of 1869.<sup>14</sup> Commonly viewed at the time as a new technological high-water mark for civilization, the implication of the Lesseps reference was clear – whatever advanced societies inhabited Mars, they possessed a formidable technological prowess.

That Schiaparelli's claims were published in the *Telegraph* was also no coincidence. The paper had been rapidly growing its readership since its launch in 1855 with the slogan, "the largest, best, and cheapest newspaper in the world." In its early days, *Telegraph* editor Thornton Leigh Hunt argued that the paper should "report all striking events in science, so told that the intelligent public can understand what has happened and can see its bearing on our daily life and our future."<sup>15</sup> With its forward-looking scientific bent, its cheapness as well as its rapid growth throughout the second

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<sup>13</sup> Robert Crossley, *Imagining Mars: A Literary History* (Middletown, CT: Wesleyan University Press, 2011), 41.

<sup>14</sup> Adrien Dansette, "Ferdinand, Viscount De Lesseps," *Encyclopædia Britannica*, November 15, 2018.

<sup>15</sup> John Simkin, "The Daily Telegraph (1855-1955)," Spartacus Educational, September 1997.

half of the 19<sup>th</sup> century, Schiaparelli's remarkable claims perfectly suited the *Telegraph*. Numerous local papers throughout the United States reprinted the *Telegraph*'s report, exposing many readers to the idea of advanced, canal-building Martians for the first time.

But only ten days after the *Telegraph*'s reporting, *The New York Times* countered with a reprinted letter by Richard Proctor first published in the *Times of London* in which Proctor pointed out that other astronomers with larger telescopes could not corroborate Schiaparelli's observational claims and urged the public not to jump to conclusions. Despite the original *Telegraph* article's sensationalism, the report appears in hindsight as a false start to the frenzy that later erupted in the aftermath of Mars' next perihelic opposition in 1892. Until then, the subject once again disappeared from press headlines.<sup>16</sup> Although newspapers had, by the early 1880s, begun to play into the allures of new scientific discoveries and the exciting adventures of explorers in order to sell more papers, their widespread adoption and strategic use of the telegraph network in order to break news before their competitors had yet to fully emerge. Until the 1890s, Schiaparelli's sensational claims languished in relative obscurity.

The phenomenon occurring in 1892 stood in stark contrast to the minimal publicity Schiaparelli's claims garnered in the prior decade. Between the two oppositions, a revolution in news media had unfolded. Although the technology itself had been around for several decades, only in these later years of the 19<sup>th</sup> century did newspapers begin to fully incorporate dedicated telegraph networks into their reporting strategies. Historian Joshua D. Wolff identified the monopolistic rise of Western Union

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<sup>16</sup> Crossley, *Imagining Mars*, 41.

as a key influencer in the media's transformation.<sup>17</sup> Although media outlets first viewed the telegraph as a threat to business that could make newspapers obsolete, by the 1880s many major outlets had fully embraced the network in their races to break news from around the world first.<sup>18</sup> During this same period, the cost of telegrams declined significantly as Western Union's telegraph network expanded across the globe. Messages transmitted through the growing telegraph network more than doubled between the years of the two oppositions. Between 1870 and 1890, the cost of a telegraph message reduced by more than half. Although Western Union had sent more than 5.8 million messages through its lines in the year of 1867, by 1900 that annual rate had increased to over 63 million messages.<sup>19</sup>

By the end of the 1880s, some media outlets had begun to fully embrace Western Union's telegraph network and in doing so, permanently transformed the news industry. This transformation marked the news media's first significant contributions to the discourse of the coming Space Age. The *New York Herald* in particular started utilizing their extensive and unparalleled network of international reporters in combination with a reliance on Western Union's telegraph system for the rapid transmission of news in an effort to outcompete other papers. Not surprisingly, the *Herald* also provided some of the most significant contributions of speculative Mars hype at the time. In this way, the paper

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<sup>17</sup> Joshua D Wolff, *Western Union and the Creation of the American Corporate Order, 1845-1893* (Cambridge, UK: Cambridge University Press, 2013), 290.

<sup>18</sup> Tom Standage, *The Victorian Internet: The Remarkable Story of the Telegraph and the Nineteenth Century's On-Line Pioneers* (New York, NY: Bloomsbury, 2014), 174.

<sup>19</sup> Tomas Nonnenmacher, "History of the U.S. Telegraph Industry," EH.Net Encyclopedia.

played a key role in igniting the public's interest in Mars during the 1892 opposition.<sup>20</sup> The *Herald's* innovative use of the telegraph and direct involvement in astronomical expeditions provided the spark for the "Great Mars Boom."<sup>21</sup>

Partnering with both Western Union as well as the Harvard College Observatory in anticipation of the solar eclipse of 1889, the *Herald* solidified its close relationship with the telegraph monopoly as well as the observatory's director, Edward C. Pickering and most especially his younger brother and mountaineer, William Pickering in order to provide exclusive coverage of the event. In coordinating with Western Union and the *Herald*, William Pickering linked a private and uninterrupted telegraph line from his temporary observing station below the eclipse's path of totality in California directly to the *Herald's* headquarters in New York. By financing the operation in return for a guaranteed exclusive, the *Herald* had a financial stake in the operation and thus a strong incentive to sensationalize the eclipse to sell as many papers as possible. The arrangement presaged the newspaper's involvement in the construction of the Harvard Observatory's Boyden Fund outstation on the remote mountain of Arequipa, Peru, an observatory key to sparking the Great Mars Boom of 1892.

With a monopoly on cabled news from Arequipa during the opposition of 1892, Pickering telegraphed the *Herald* directly to report his observations of Mars in real time, giving the paper as well as its syndicated affiliates a distinct advantage over other papers. Although Pickering's messages in the late summer of that year included remarkable

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<sup>20</sup> Joshua Nall, "Constructing Canals on Mars: Event Astronomy and the Transmission of International Telegraphic News," *Isis* 108, no. 2 (2017): 285. doi:10.1086/692678.

<sup>21</sup> Michael J. Crow, *The Extraterrestrial Life Debate 1750-1900: The Idea of a Plurality of Worlds from Kant to Lowell* (New York, NY: Cambridge University Press, 1986), 513.

observations of rapid changes on Mars's surface, the existence of melting snow, and apparent rivers and seas, the *Herald* published a reworked version of his account, written with an unmistakable first-person tone of breathless immediacy and confidence. The novel details of William's observations, further exaggerated by the *Herald's* creative ghost-writers and syndicated throughout the *Herald's* network of newspapers across the United States as well as Europe, challenged competing astronomers like Edward Holden, director of California's Lick Observatory, to offer similarly sensational news corroborating Pickering's claims. In an effort to protect the credibility of California's Lick Observatory, its staff, and Holden himself, Holden telegraphed the Associated Press, a primary rival of the *Herald*, and confirmed the existence of "many of the canals on Mars discovered in 1877 by Prof. Schiaparelli."<sup>22</sup>

Despite Holden's confirmation, inconsistencies between the Lick's and Arequipa's descriptions of Mars' canals commenced a heated and widely publicized debate. While the Lick Observatory claimed to see Schiaparelli's canals as "distinctly double," Pickering claimed just one week later that "many of Schiaparelli's canals have been seen single."<sup>23</sup> Understood years later as a varying optical illusion, the confusion over the nature of Mars' surface might have gone unnoticed and confined to scholarly journals had not the news media played such a pivotal role in disseminating astronomers' observations to the public. But with the new emphasis on rapid reporting thanks to the emergence of the telegraph's active use by media outlets like the *Herald* seeking to break

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<sup>22</sup> "At Lick Observatory: Mapping the Canals of Mars," *Los Angeles Times*, 19 Aug. 1892, 2.

<sup>23</sup> *Ibid.*

news first, editors of major newspapers during this period favored speed and sensationalism over accuracy. In some ways this trend never reversed.

Two years later, during Mars' next opposition, one savvy American businessman-turned-self-funded astronomer became the new standard-bearer of the Mars canal hypothesis: Percival Lowell. To the dismay of many disbelieving astronomers whose opinions mostly failed to reach the eyes of the reading public, Lowell's observations of the planet during the opposition of 1894 crystalized for years to come the belief by many in the existence of engineered canals on Mars. Lowell's claims solidified notions of advanced Martian civilizations in the collective imagination well into the middle of the 20<sup>th</sup> century.

In mid-February of 1894, a handful of newspapers across America first reported on Lowell's donation of "a large fund" for the purpose of constructing a new observatory in Flagstaff, Arizona as well as his savvy hiring of William Pickering.<sup>24</sup> By the beginning of the summer, Lowell's first telegraphed observations began reaching news readers. On the morning of June 11<sup>th</sup>, in his hometown's most popular paper, the *Boston Post* reported Lowell's first observations made on the night of the 9<sup>th</sup>. Like the rapid reporting of Pickering's observations from the *Herald* two years earlier, Lowell similarly took advantage of the telegraph's speedy transmissions to Boston for the benefit of his new observatory and the posterity of his hometown. While the brief report described mostly Lowell's supposed sighting of bright mountain slopes near Mars' southern pole, it also

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<sup>24</sup> "Harvard's Observatory: Plans That Will Put the Old College Up Frost," *Defiance Evening News*, February 13, 1894, vol. 2., no. 305, 9., "Mars at Close Range: A Harvard Expedition to Start for Arizona with a Big, Big Telescope," *Trenton Times*, February 13, 1894, 6., "New Harvard Observatory," *Ithaca Cornell Daily Sun*, February 16, 1894, 2.

reported that Lowell “announces that the canals are already beginning to be glimpsed.”<sup>25</sup> Reprintings of Lowell’s first announcement spread until June 23<sup>th</sup> when another widely reported pronouncement read, “the following canals of Mars have already been seen here by observers of the Lowell observatory” and proceeded with a list of ten names.<sup>26</sup> By July, Edward Holden of Mount Hamilton’s Lick Observatory pushed back. Although he too had, under reputational pressure, confirmed Schiaparelli’s “canal marked ‘Ganges [...] to be distinctly double,” back in 1892, by 1894 Holden apparently had had enough of William Pickering’s – and now by extension Lowell’s – highly speculative observations. A long piece featured widely throughout American newspapers harshly criticized Lowell’s approach and “so called canals.” The op-ed even referred back to the opposition of 1892 noting, “telegrams from South America regarding the happenings on ‘Mars’ in the year 1892 were received by the astronomers at the Lick Observatory with a kind of amazement.” The editorial went on to argue for the superior power of the Lick’s 36-inch telescope as compared to Pickering’s 12-inch telescope used in Peru during the previous opposition.<sup>27</sup> Yet Holden’s scathing critique only drew more public attention to the 1894 opposition.

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<sup>25</sup> “Points on Mars: Boston Astronomer Makes Interesting Discoveries,” *Boston Post*, June 11, 1894, 4.

<sup>26</sup> “Canals on Mars,” *Waterloo Daily Courier*, June 23, 1894, 2., “Canals on Mars,” *Hamilton Daily Democrat*, June 23, 1894, 1., “Canals on Mars,” *Huron Daily Huronite*, June 23, 1894, 2., “Canals on Mars,” *Madison Daily Democrat*, June 23, 1894, 1., “Canals of Mars Seen,” *McKinney Democrat*, June 28, 1894, 4., *Humeston New Era*, July 4, 1894, 4.

<sup>27</sup> “The Question Not To Be Settled At Once,” *Syracuse Sunday Herald*, July 8, 1894, 11., “Habitability of the Planets: Bearing of Recent Studies of Jupiter and Mars,” *Philadelphia Inquirer*, July 24, 1894, 2.

Despite the Lick's backlash, Boston papers and others across the country continued reporting on Lowell's and other astronomers' fantastical claims and speculations with sensationalist titles like "Is Mars Signaling Us?" and "More Lights Seen in Mars" throughout the proceeding months.<sup>28</sup> By the end of the year, Lowell started publishing his own series in the *Atlantic Monthly* arguing in favor of the canals as evidence of an active Martian civilization.<sup>29</sup> Over the next four years, Lowell published three books detailing his inhabited-Mars hypothesis, exciting the public's interest well into the first decade of the 20<sup>th</sup> century despite Lowell's diminishing popularity within the far more skeptical international community of astronomers.<sup>30</sup> Ultimately, Pickering, Lowell, the *New York Herald*, the *Boston Post*, and their syndicated networks that relied on Western Union's telegraph monopoly were key players in popularizing Mars and in

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<sup>28</sup> "Odd Items From Everywhere," *Boston Daily Globe*, August 9, 1894, 16., "Is Mars Signaling Us? That Is What Lowell Observatory Astronomers Are Trying to Find Out," *Atchison Daily Globe*, September 3, 1894, 1., "Is Mars Signaling Us? That Is What Lowell Observatory Astronomers Are Trying to Find Out," *Logansport Pharos Tribune*, September 4, 1894, 2., "Is Mars Signaling Us? That Is What Lowell Observatory Astronomers Are Trying to Find Out," *Middletown Daily Argus*, September 6, 1894, 3., "Is Mars Signaling Us? That Is What Lowell Observatory Astronomers Are Trying to Find Out," *Hutchinson News*, September 10, 1894., "Is Mars Signaling Us? That Is What Lowell Observatory Astronomers Are Trying to Find Out," *New Albany Evening Tribune*, September 10, 1894, 2., "Is Mars Signaling Us? That Is What Lowell Observatory Astronomers Are Trying to Find Out," *Fort Wayne Sentinel*, September 14, 1894, 3., "More Lights Seen In Mars," *New York World*, September 16, 1894, 19., "More Lights Seen In Mars," *Brownsville Daily Herald*, September 21, 1894, 1., "The Red Planet," *Bakersfield Daily Californian*, October 22, 1894, 4., "On El Misti: Harvard Observatory at its Very Top," *Boston Daily Globe*, October 24, 1894, 5.

<sup>29</sup> K. Maria D Lane, "Geographers of Mars: Cartographic Inscription and Exploration Narrative in late Victorian Representations of the Red Planet," *Isis* 96, no. 4 (2005): 489. doi:10.1086/498590., Percival Lowell, "Mars (Part 1)," *Atlantic Monthly*, May, 1895., Percival Lowell, "Mars (Part 2)," *Atlantic Monthly*, June, 1895., Percival Lowell, "(Part 3)," *Atlantic Monthly*, July, 1895., Percival Lowell, "Mars (Part 4)," *Atlantic Monthly*, August, 1895.

<sup>30</sup> Ken Crowell, *Planet Quest: The Epic Discovery of Alien Solar Systems* (Oxford: Oxford University Press, 1999), 48.

doing so, launched the news media's participation in the discourse of the Space Age. Yet more than that, they offered a new generation of science fiction writers a planetary setting ripe with imaginative possibilities as well as a broad public audience thirsty for stories from the Red Planet.<sup>31</sup> The science fiction inspired by the Great Mars Boom had a lasting impact on later generations of writers, lecturers, rocketeers and even the CEOs of the 21<sup>st</sup> century private space industry.

## CHAPTER TWO

### SCIENCE FICTION AND THE SPACE AGE DISCOURSE

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<sup>31</sup> William E. Burrows, *This New Ocean: The Story of the First Space Age* (New York, NY: Random House Publishing Group, 1998), 27.

In the afterglow of the media-driven Great Mars Boom, a revolution in science fiction literature that fixated on the Red Planet imprinted itself in the public's imagination. Bridging the divide between fantasy and reality, many of the most popular novels amongst this first wave of Mars-oriented science fiction as well as the first Moon-oriented science fiction novels that preceded them played upon their audience's most grandiose hopes and fears. By intermingling the known with the imagined, by applying scientific knowledge to technological aspirations, and by indulging in both apocalyptic as well as utopian visions of the future, Space Age science fiction directly influenced both the public's expectations for the future as well as the goals of key players in the space industry itself.

Prior to the arrival of Mars in science fiction, earlier Moon-oriented stories laid the foundations for the genre, set the tone for the fictional, visionary element of the Space Age discourse, and in the process inspired some of the world's first and most influential rocket pioneers. Works like George Tucker's 1827 novel *A Voyage to the Moon* and Jules Verne's 1865 novel *From the Earth to the Moon* and its 1870 sequel *Around the Moon* offered insightful glimpses into a future world of space travel. With particular attention to imaginative and yet startlingly accurate details, these novels' inclusions of some of the earliest notions of zero-gravity, orbital mechanics, and the exploration of other celestial bodies and extraterrestrial beings made space travel seem almost real.

Additionally, the combination of these novels set the tone for a later genre that frequently presented critical or satirical commentary on the state of human societies. Early American politician and polymath George Tucker's *A Voyage to the Moon* offered readers an initial taste of this technique. In imagining "Lunarian" society, Tucker's work

used the subject of extraterrestrials on the Moon as a way to satirize his own political contemporaries, commencing a tradition that influenced how science fiction directly impacted the discourse of the Space Age as well as the development of the space industry itself in future decades.<sup>32</sup> Reminiscent of *Gulliver's Travels*, this technique of imagining different societies on different cosmic bodies for satirical purposes shaped later Mars-oriented science fiction in particular. Satire, when applied on a planetary scale, led later writers to probe humanity's greatest problems as well as its most grandiose hopes and, in the process, led authors to explore the things that most threatened humanity in conjunction with societal aspirations for a better future. Nearly forty years after Tucker's work, Jules Verne's sensational novel *From the Earth to the Moon* introduced readers to the physics of orbital mechanics with impressive mathematical accuracy – a technique of bridging the divide between reality and fantasy that greatly influenced science fiction as well as inspired some of the first pioneers of the Space Age.

Commonly considered the grandfathers of modern rocketry – Germany's Hermann Oberth, Russia's Konstantin Tsiolkovsky, and America's Robert Goddard all acknowledged Verne's influence and inspiration. Hermann Oberth's long career in rocketry carried him from Peenemunde to Huntsville, from work on the Nazi's V-2 in the 1940s to Convair's Atlas V in the 1950s, but Oberth himself claimed that he "always had in mind the rockets designed by Jules Verne."<sup>33</sup> With his landmark theoretical mathematic work on rocket propulsion and orbital mechanics, Konstantin Tsoilkovksy too when discussing his own inspirations said that "probably the first seeds of the idea

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<sup>32</sup> George Tucker, *A Voyage to the Moon: With a New Pref. by David G. Hartwell* (Boston, MA: Gregg), 1975.

<sup>33</sup> Burrows, *This New Ocean*, 32.

were sown by that great fantastic author Jules Verne: he directed my thoughts along certain channels, then came a desire, and after that the work of the mind.”<sup>34</sup> Similarly, Robert Goddard, the first pioneer to launch a liquid-fueled rocket in 1926 and prolific inventor of numerous Space Age technologies acknowledged the influences of Verne as well as H. G. Wells in his private diary.<sup>35</sup> In particular, Wells’ influence on Goddard highlighted the inspirational power that the first Mars-oriented science fiction stories had on the discourse of the Space Age as well as on the development of the early space industry. After having read and re-read Wells’ *War of the Worlds* in the summer of 1899, 17-year old Goddard famously placed a ladder against a cherry tree in his family’s orchard and, in envisioning the possibilities of future space travel in the tree’s canopy, “imagined how wonderful it would be to make some device which had even the possibility of ascending to Mars, from the meadow at my feet.”<sup>36</sup> A closer look at *War of the Worlds* presents a clear vector of influence originating first from the media-driven sensationalism of the Great Mars Boom, transferring into the genre of science fiction, and then directly impacting countless readers, some of whom, like Goddard, went on to drive the space industry forward and towards Mars.

The first Mars-oriented science fiction stories arrived in the interval between the oppositions of 1877 and 1892 and further perpetuated Tucker’s and especially Verne’s techniques of attempting to make real the anticipated spacefaring technologies of the future. Yet unlike their predecessors and directly inspired by the Mars canal debate of the

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<sup>34</sup> Ibid.

<sup>35</sup> Ibid.

<sup>36</sup> “Goddard, Robert Hutchings,” National Aviation Hall of Fame.

1890s, these new Martian stories began incorporating utopian as well as apocalyptic themes that came to underlie much of the Space Age discourse's Mars literature.

Although Mars first entered the literary fiction market in 1880 with British author Percy Greg's *Across the Zodiac: The Story of a Wrecked Record*, the utopian and apocalyptic themes that later defined much of the subgenre had yet to emerge until just before, during and after the Great Mars Boom. Notably however, the word "astronaut" first appeared in Greg's novel as the name of the Mars-bound vessel featured in the story. Despite disappearing for fifty years until another science fiction author, Neil R. Jones, reapplied it to refer to human space travelers in his 1930 short story "Death's Head Meteor," even these early and lesser known Mars-oriented works influenced the very language of the Space Age and its subsequent industry.<sup>37</sup>

Utopian themes in Mars-oriented science fiction emerged first. The earliest portrayals of a utopian Mars, often a satirical offshoot similar to Tucker's *A Voyage to the Moon*, appeared in 1889 with Joseph Fraser's *Melbourne and Mars: My Mysterious Life on Two Planets* and Hugh MacColl's *Mr. Stranger's Sealed Packet*.<sup>38</sup> The very next year, Robert Cromie's *A Plunge Into Space* continued the trend, satirizing the corruption and dishonesty of earthly politicians by depicting a utopian Martian society that had no need for them.<sup>39</sup> In 1893, Alice Ilgenfritz Jones' and Ella Merchant's novel *Unveiling a Parallel: A Romance* blended Martian utopianism with feminism, depicting Martian men

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<sup>37</sup> Percy Greg, *Across the Zodiac: The Story of a Wrecked Record* (Hamburg: Karl Grädener, 1880)., Neil R Jones, "Death's Head Meteor," (eStar Books, 1930).

<sup>38</sup> Joseph Fraser, *Melbourne and Mars: My Mysterious Life on Two Planets* (Melbourne: Pater and Knapton, 1889)., Hugh MacColl, *Mr. Strangers Sealed Packet* (London: Chatto and Windus, 1889).

<sup>39</sup> Robert Cromie, *A Plunge into Space* (Amsterdam: Fredonia Books, 2001).

and women as equal, an obvious critical commentary on the late-Victorian period in which they were writing.<sup>40</sup> Just three years later, John McCoy's *A Prophetic Romance: Mars to Earth* continued in the tradition of Jones and Merchant. McCoy's novel, a story of a Martian official journeying to Earth on a mission to report back on the social conditions of the planet envisioned the United States a century into the future as a utopian society rebuilt after a violent revolution. With a female president, equality between the sexes, an economic system that limited the incomes of corporate executives and a technological environment of airplanes, electric cars and widespread vegetarianism, McCoy's work offered readers a progressivist utopian vision well ahead of its time.<sup>41</sup> While this trend in Mars-oriented aspirational utopian science fiction continued and went on to shape many of the visions articulated by future space industry pioneers, the second and far more ominous theme of the genre arrived soon afterwards. Notably, only after claims of advanced, canal-building Martian civilizations appeared in newspapers during the 1892 and 1894 oppositions did this other defining theme – that of fear, war and apocalypse – emerge in Mars-oriented science fiction.

Although not quite apocalyptic like later works, German writer Kurd Laßwitz's 1897 novel *Two Planets* offered readers an early look at science fiction that combined warfare and technologically advanced Martians. Likely the origin for later depictions of aliens as big-eyed and highly intelligent, Laßwitz's novel told the story of German polar explorers stumbling upon a Martian base in the arctic, their eventual escort to a canal-laden Mars by their new alien companions, and the Martians' subsequent assistance

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<sup>40</sup> Alice Ilgenfritz Jones and Ella Merchant, *Unveiling a Parallel: A Romance* (Boston, MA: Arena, 1893).

<sup>41</sup> John F McCoy, *A Prophetic Romance; Mars to Earth* (Boston, MA: Arena, 1896).

helping the Germans destroy the British Navy.<sup>42</sup> Popularly received by German audiences, the book even inspired pioneering rocketeer Wernher Von Braun, one of Oberth's students and later his employer in Huntsville. Among his many engineering achievements working on the Nazi V-2 and later NASA's Mercury, Gemini and Apollo missions, Von Braun published *The Mars Project* in 1952 which offered detailed technical plans for manned missions to the Red Planet. In addition to publicly advocated for traveling to Mars throughout his later career, Von Braun's *The Mars Project*, more than virtually any other text, influenced and informed countless future unmanned missions to Mars.<sup>43</sup> This vector of influence spanning from the Great Mars Boom which Laßwitz followed closely, to his subsequent novel *Two Planets*, to Von Braun's reading of Laßwitz's novel and later advocacy for going to Mars in the midst of his extraordinary career in rocketry provides just one of countless examples of the influential power of the discourse of the Space Age emerging in the 1890s. Despite the cultural impact of *Two Planets*, a different Mars-oriented science fiction novel reaching audiences in the same year as Laßwitz's work more fully formed the subgenre's second theme – apocalyptic fear.

While many astronomers besides Pickering and Lowell at the time sought to move on from the Mars canal fixations of the fin de siècle, H. G. Wells had, not long after the opposition of 1894, found a way to transform Schiapparelli's *canale* into an apocalyptic story of enduring fame with a cultural staying power that profoundly influenced the 20<sup>th</sup>

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<sup>42</sup> Kurd Laßwitz, *Two Planets* (New York, NY: Popular Library, 1973).

<sup>43</sup> Wernher Von Braun, *The Mars Project* (Chicago, IL: University of Illinois Press, 1991)., NASA Johnson Space Center, *Eyes on the Red Planet: Human Mars Mission Planning, 1952-1970*, (Houston, TX: Technical Report, NASA, July 2011), 4.

century's enthusiasm for and imaginings of the Red Planet. Just three years after the *Boston Post's* excited reporting of Lowell's first Mars observations at Flagstaff, H. G. Wells' *The War of the Worlds* appeared in England's *Pearson's Magazine* as well as America's *Cosmopolitan* and soon afterwards arrived on bookstore shelves as a wildly popular hardcover.<sup>44</sup> Perhaps to the dismay of astronomers at Mount Hamilton, the book's first chapter claimed that "During the opposition of 1894 a great light was seen on the illuminated part of the disk [Mars], first at the Lick Observatory" that "English readers" first heard of "in the issue of *Nature* dated August 2."<sup>45</sup> Wells, a devoted reader of *Nature* and close friend to the journal's editor Richard Gregory had certainly closely followed the Mars canal debate leading up to his writing of *The War of the Worlds*.<sup>46</sup> The novel's first chapter went on to describe the light as emanating from a "huge gun." Wells' hook developed immediately into descriptions of a cataclysmic war on Mars by a civilization desperate for resources. Their desperation ultimately drives them to invade Earth. With *War of the Worlds*, Wells had provided readers with one of the first stories of interplanetary war. In hindsight, the book's success and many later spin-offs, reiterations and reinterpretations spoke to the power of science fiction writers like Wells to tell stories that evoked the long enduring fears and fantasies inherent in the ideology of technology. Wells masterfully intertwined the public's frenzied enthusiasm for Lowell's inhabited-

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<sup>44</sup> "The War of the Worlds from Pearson's Magazine," The British Library, February 06, 2014., Peter J Beck, *The War of the Worlds: From H.G. Wells to Orson Wells, Jeff Wayne, Steven Spielberg & Beyond* (New York, NY: Bloomsbury Academic, 2016), xix-4.

<sup>45</sup> H. G. Wells, *The War of the Worlds* (New York, NY: New American Library, [1898] 2007), 7.

<sup>46</sup> Walter H. Haas, "Flashes on Mars observed in 1937 and some random remarks," *Journal of the Association of Lunar and Planetary Observers* 45, no. 1 (Winter 2003): 43.

Mars hypothesis with its already ever-present apocalyptic fears. These apocalyptic anticipations changed with the times throughout the 20<sup>th</sup> and 21<sup>st</sup> centuries, but in the last decade of the 19<sup>th</sup> century, Wells offered a vision directly inspired by Britain's ongoing colonial wars in Africa. When interviewed by a journalist from the *London Daily News* in January of 1898, Wells described his inspiration for the novel saying “‘The War of the Worlds’ originated in a remark made to me some years ago by my brother, as we were walking on Primrose Hill one day, about the bombardment of some village in the South Seas.” Wells continued saying of his brother, “‘How would it be with us,’ he said, ‘if some creatures of a vastly superior power came down upon us and behaved like a drunken man-of-war’s crew let loose among some gentle savages?’”<sup>47</sup> Thus Wells’ initial inspiration derived from his thinking critically about one of the greatest power-differential present in his immediately relevant world – that of Britain’s colonial incursions in Africa. Additionally, Wells described the inspiration for his invaders arriving in “interplanetary cylinders” as “borrowed from their inventor, Jules Verne.”<sup>48</sup> Similar conceptual pathways of inspiration constructed the apocalyptic imaginings of later generations of visionary authors, thinkers, entrepreneurs, and of course the sensationalist media and general public throughout the developing Space Age to come. Wells’ work too, although built on the foundations of earlier authors’ works like those of Verne, spurred a legacy of science fiction writing that exploited popular apocalyptic fears to construct compelling stories that often made the planet Mars a key destination within their plots.

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<sup>47</sup> “The Scientific Novel: A Talk With Mr. H. G. Wells.” *London Daily News*, January 26, 1898, 6.

<sup>48</sup> *Ibid.*

After *War of the Worlds*, other Mars-oriented science fiction works that similarly embraced the apocalyptic theme of interplanetary war or at the very least, Mars as a hostile environment of monsters continued to remind readers of the potential threat the Red Planet could pose, especially if Schiaparelli's and now Lowell's canal claims turned out to be true.<sup>49</sup> More interestingly, novels like Garrett P. Serviss' 1898 work *Edison's Conquest of Mars* managed to combine both the fear of interplanetary war with the aspirational dreams of global peace into a single story. Serviss imagined a world similar to Wells', but in *Edison's Conquest of Mars* nations across the world united to defeat the invading Martians.<sup>50</sup> The intermingling of societal aspirationism and doomsday threats became a common narrative in Space Age science fiction and provided future space companies the underlying justifications for their long-term plans.

Russia's early 20<sup>th</sup> century Mars-oriented science fiction sometimes employed a similar technique, but consistently injected socialist and later communist utopian moral imperatives. Russian contributions to the discourse of the Space Age in this era reflected the movement of Cosmism as well as politically inspired technological utopianism that had spread across the country in the wake of its 19<sup>th</sup> century proponents Nikolai Fyodorov, Nikolai Kibalchich as well as Konstantin Tsiolkovsky himself. While historians like Asif Siddiqi have persuasively argued that a combination of technological utopianism and

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<sup>49</sup> George C Griffith, *A Honeymoon in Space* (London: Gateway, [1901] 2015)., Gustave Le Rouge and Brian M. Stableford, *The Vampires of Mars* (Encino, CA: Black Coat Press, [1906] 2008)., Olaf Stapledon, *Last and First Men & Star Maker: Two Science-Fiction Novels* (New York, NY: Dover Publications, [1930 and 1937] 1968)., Clark Ashton Smith and Steve Behrends, *The Dweller in the Gulf* (West Warwick, RI: Necronomicon Press, [1932] 1993)., Clark Ashton Smith, *The Vaults of Yoh-Vombis* (West Warwick, RI: Necronomicon Press, [1932] 1993).

<sup>50</sup> Garrett Putnam Serviss, *Edisons Conquest Of Mars: The Unauthorized 1888 Sequel to The War of the Worlds* (Cincinnati, OH: F W Media, [1898] 2012).

Cosmism were primary shapers of early Russian enthusiasm for space exploration, these movements' influences on the discourse of the Space Age informed and shared in a broader tradition of techno-utopian and aspirational political thinking.<sup>51</sup> While novels like Russian physician and science fiction author Alexander Bogdanov's 1908 story *Red Star: The First Bolshevik Utopia* envisioned an alien communist utopia on Mars, leftist politics merging with Mars-oriented science fiction spilled out beyond Russia's borders to influence the discourse of the Space Age more generally.<sup>52</sup> For instance, British author Mark Wicks' 1911 work, *To Mars via the Moon: An Astronomical Story* imagined a socialist utopia of superior canal-building Martians on the Red Planet. He even dedicated the book to Perceval Lowell, writing to the astronomer, "To whose careful and painstaking researches, extending over many years, the world owes so much of its knowledge of the planet Mars, this little book is respectfully inscribed by one who has derived infinite pleasure from the perusal of his works on the subject."<sup>53</sup> The book's dedication and political bent highlights the notion that Mars-oriented science fiction at the time reflected a combination of political and ideological influences overlaid upon fixations with Mars in the wake of the Great Mars Boom.

After World War I, an emergence of Mars-oriented science fiction that emphasized humanity's power to bring about both good and evil suggested that a shift in thinking had taken place in the wake of the war. Russian author Aleksey Nikolayevich

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<sup>51</sup> Asif A. Siddiqi, "Imagining the Cosmos: Utopians, Mystics, and the Popular Culture of Spaceflight in Revolutionary Russia," *Osiris* 23 (2008): 260-288.

<sup>52</sup> Aleksandr Bogdanov, with Loren R. Graham, Charles Rougle and Richard Stites, *Red Star: The First Bolshevik Utopia* (Bloomington, IN: Indiana Univ. Press, [1908] 1984).

<sup>53</sup> Mark Wicks, *To Mars via The Moon: An Astronomical Story* (London: Seeley and Limited, 1911). 8.

Tolstoy's 1922 novel *Aelita* overturned the power dynamics of Bogdanov's *Red Star*. Tolstoy's story imagined a Soviet journey to a Mars inhabited by an advanced Martian society, but one defined by class inequality and struggling to survive on a dying planet. Tolstoy's protagonists attempt a communist revolution on Mars, somewhat reversing Bogdanov's narrative.<sup>54</sup>

While notions of Mars as a threat in the vein of Wells' *War of the Worlds* continued well into the 20<sup>th</sup> century with works like Olaf Stapledon's 1930 novel *Last and First Men*, reversals like Tolstoy's also flourished. Perhaps in recognition of humanity's technological capability for destruction as evidenced by the horrors of World War I as well as the influence of growing anticolonial movements at the time, novels like Edmond Hamilton's 1932 work *A Conquest of Two Worlds* in which humans launch a brutal colonial war against more primitive Martians rose in popularity.<sup>55</sup> Later works like C. S. Lewis' 1938 novel *Out of the Silent Planet* shared in this new, self-reflective and morally contemplative element of Mars-oriented science fiction by depicting Martians as both technologically and morally superior, for despite their certain doom remaining on a dying Mars, they refused to invade Earth to save themselves.<sup>56</sup> World War II only further stimulated this moralistic angle on Mars-oriented science fiction with works like Fredric Brown's 1949 novel *What Mad Universe* that, similarly to *A Conquest of Two Worlds*, reversed H. G. Wells' narrative and depicted humans as brutal and dominating invaders

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<sup>54</sup> Aleksey Nikolayevich Tolstoy, with Lucy Flaxman, *Aelita* (Moscow: Raduga, [1923] 1991).

<sup>55</sup> Edmond Hamilton, "A Quest of Two Worlds," in *The Best of Edmond Hamilton*, ed. Leigh Brackett (Rockville, MD: Phoenix Pick, [1932] 1977).

<sup>56</sup> C. S. Lewis, *Out of the Silent Planet* (New York, NY: Macmillan, 1968).

of an innocent Martian world.<sup>57</sup> Moral imperatives justified by underlying apocalyptic fears as well as dreams of a better future went on to shape the dominant visions for space colonization in future decades.

With the emergence of nuclear technology and the Cold War, rising anticolonial movements sweeping Africa and Asia, as well as more advanced observations of Mars that indicated a chilly, desert environment, science fiction by the 1950s took a turn. As science fiction adapted to new understandings of the Red Planet, the range of portrayals of the Martian environment narrowed. American science fiction in particular began adopting new versions of both themes – apocalyptic fear as well as techno-utopian hopes – that often envisioned its protagonists as classic American pioneers seeking to carve out a new life in a desolate, hostile environment ripe for colonization.

At the same time, news media's adoption of live television broadcasting brought the space industry into the intimate spaces of American homes for the first time. The creation of NASA accentuated the sensation that the science fiction of yesterday had suddenly become the technology of today. More importantly, popular imaginings of the future of the Space Age – often derived from science fiction and encouraged by magazines, newspapers, and now television broadcasts – radically shifted away from fantasy and began merging with reality. The discourse of the Space Race, grown from its roots in the 19<sup>th</sup> century, was now directly informing the visions and future plans of the space industry itself. This pivotal period and its influential Space Age discourse inspired a new generation of entrepreneurs to lead the private space industry's most exciting ventures in the early 21<sup>st</sup> century.

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<sup>57</sup> Fredric Brown, *What Mad Universe* (London: Gateway, [1950] 2011).

## CHAPTER THREE

### EMERGING VISIONS IN THE AGE OF APOLLO

The scientific, technological and political developments leading up to and during the 1950s and 1960s reshaped the discourse of the Space Age, providing a more refined ideological framework that significantly influenced entrepreneurs of the future private space industry. First emerging in the 1920s, new scientific understandings of Mars as a barren desert seemingly lacking in water and life transformed the science fiction genre's depictions of the planet's environment. Nuclear technology in the wake of World War II redefined the dominant apocalyptic fears as well as utopian hopes of the broader public and were similarly reflected in the period's science fiction. Additionally, the creation of NASA in 1958 and the television broadcast media's subsequent coverage of the Space Race brought the techno-spectacle element of the Space Age into American living rooms, generating public enthusiasm like never before and inspiring a young generation of TV

watchers to go on and create a new private space industry decades later. NASA's goals and plans were intimately interconnected with the Space Age discourse's apocalyptic fears and utopian hopes as well as its Mars fixations, but unlike science fiction, NASA's achievements were real. Ultimately, two dominant visions of humanity's space fairing future crystalized out of this period. One vision reached towards Mars with dreams of colonization. The other looked down from space at an ecologically imperiled Earth with dreams of rescuing humanity from itself. Both visions incorporated apocalyptic fears as well as utopian hopes. Both fundamentally shaped the ideologies of key players in the early 21<sup>st</sup> century's burgeoning private space industry.

Consistently perceived as an eventual next step destination after reaching the Moon, fictional depictions of Mars in the interwar and especially post-war periods remained popular, but portrayals of the Martian environment rapidly narrowed in response to new scientific observations that came to understand Mars as desolate, cold, seemingly waterless and lifeless, and generally far more inhospitable than previously imagined. As early as 1894, astronomer William W. Campbell argued that Mars' atmosphere lacked water vapor and that earlier detections of a water signature on Mars were mistakenly derived from Earth's atmosphere.<sup>58</sup> Although controversial and mostly overlooked in the midst of the Mars canal debate, Campbell's observations were later confirmed by astronomer Walter S. Adams in 1925 at California's Mount Wilson observatory.<sup>59</sup> At the same observatory one year earlier, astronomers using a vacuum

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<sup>58</sup> V. M. Slipher, "The Spectrum of Mars," *Astrophysical Journal* 28 (December 1908): 397.

<sup>59</sup> David H Devorkin, "W. W. Campbell's Spectroscopic Study of the Martian Atmosphere," *Quarterly Journal of the Royal Astronomical Society* 18 (March 1977): 37.

thermocouple determined Mars' equatorial temperature range – a frigid climate fluctuating between -90 F and 45 F.<sup>60</sup> In the same year, astronomer Carl Otto Lampland along with physicist William Coblentz determined that Mars' temperature fell to more than -120 F at night.<sup>61</sup> By 1926, astronomer Sydney Adams measured the oxygen and water vapor in the Martian atmosphere and deduced that the planet was likely a barren desert.<sup>62</sup> By 1930, Mars-oriented science fiction had already started adapting to the results of this new observational science with the debut of Olaf Stapledon's *Last and First Men* that depicted invading Martians as desperate for air and water. Early in its arrival and clearly far ahead of its time, *Last and First Men* has maintained a powerful legacy in the genre.<sup>63</sup> A story spanning two billion years of “future history,” Stapledon's landmark work influenced later writers such as Brian Aldiss, James Blish, C. S. Lewis, H. P. Lovecraft, John Maynard Smith, and others. Arthur C. Clark said of *Last and First Men* that “no other book before or since has ever had such an impact upon my imagination.”<sup>64</sup> Four years after the book's release, and with the help of astronomer and physicist Theodore Dunham Jr., Sydney Adams calculated Mars' atmospheric oxygen at just 1% of Earth's.<sup>65</sup> The spreading recognition by scientists of Mars' barrenness eroded the likelihood of advanced and threatening or perhaps utopian Martians existing on the

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<sup>60</sup> Edison Pettit and Seth B. Nicholson, “Radiation Measures on the Planet Mars,” *Publications of the Astronomical Society of the Pacific* 36, (October 1924): 269-272.

<sup>61</sup> D.H. Menzel, W. W. Coblentz and C. O. Lampland, “Planetary Temperatures Derived from Water-Cell Transmissions,” *The Astrophysical Journal* 63 (April 1926): 177-87.

<sup>62</sup> F.J.M. Stratton, “Obituary: Walter S. Adams, 1876-1956,” *History Studies International Journal of History* 76 (August 1956): 140.

<sup>63</sup> Stapledon, *Last and First Men*.

<sup>64</sup> “Sir Arthur C Clarke,” Sir Arthur C Clarke.

<sup>65</sup> Walter S. Adams and Theodore Dunham Jr., “The B Band of Oxygen in the Spectrum of Mars,” *The Astrophysical Journal* 79 (April 1934): 308. doi:10.1086/143538.

planet. While those earlier imaginings had aged in the face of new science, fresh ways of thinking about Mars as a hostile natural environment but also one possessing colonizing opportunities emerged. Only a few years after Adams' and Dunham Jr.'s observations, Isaac Asimov's 1941 novel *Heredity* depicted Mars as dusty and dry and also offered one of the first portrayals of future humans farming on the Red Planet.<sup>66</sup> By the end of the 1940s, astronomers understood that Mars' atmosphere also possessed twice the amount of carbon dioxide as Earth's thanks to astronomer Gerard Kuiper's work in October of 1947.<sup>67</sup> Months earlier in February of that year, American writer and former aeronautical engineer Robert Heinlein published "The Green Hills of Earth," a short story in *The Saturday Evening Post* that depicted Mars as both laden with Martian-made canals as well as polluted by the industrialism of human colonization.<sup>68</sup> In combination with his 1949 novel *Red Planet* that depicted humans in a post-colonial Martian world surrounded by ancient frozen canals spread across a cold desert landscape, Heinlein's work marked the transition between the canal-laden Mars of pre-war science fiction and the visions of a new era.<sup>69</sup>

Although often framed as a movement formally emerging with Rachel Carson's 1962 book *Silent Spring*, earlier seeds of environmentalism appeared in Heinlein's stories as a natural extension of the apocalyptic fears that had thematically shaped science fiction

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<sup>66</sup> Isaac Asimov, *The Early Asimov Or, Eleven Years of Trying Volume 2*, (Granada Publishing/Panther Books, 1974), 79.

<sup>67</sup> Walter S. Adams and Theodore Dunham, Jr., "The Concentration of Carbon Dioxide in the Atmosphere of Mars," *Publication: Astrophysical Journal* 121 (March 1955): 548. doi:10.9737/hist.2018.658.

<sup>68</sup> Joyce K. Schiller, "The Green Hills of Earth," The Rockwell Center for American Visual Studies, June 27, 2013., Robert A. Heinlein, "The Green Hills of Earth," *The Saturday Evening Post*, February 8, 1947, 29-48.

<sup>69</sup> Robert A. Heinlein, *Red Planet* (Houston, TX: Virginia Edition, [1949] 2008).

since the 1890s.<sup>70</sup> Thus Heinlein's work also marked the emergence of environmentalism in the discourse of the Space Age. Although the genre of ecofiction existed long before his writings, Heinlein's merging of ecofiction with space-oriented science fiction commenced the long-term development of one of the Space Age discourse's two dominant visions of the future. Although a number of Heinlein's most popular works incorporated Mars, the bifurcating trend in Space Age science fiction that grew out of Heinlein's early environmentalist contributions quickly shifted away from fixations with Mars. The environmental concerns initially expressed by Heinlein had, by the 1970s, developed into a perspective of Earth as imperiled by its own human inhabitants, a fear that focused attention towards using space to solve Earth's problems rather than abandoning humanity's home planet in pursuit of Mars' colonization. This view, one emerging after Heinlein and eventually advocating the imperative that humans must rescue Earth from pollution by relocating civilization's heavy industries into space continues to inform the future visions of key players in the space industry today.

The very next year, Ray Bradbury's *The Martian Chronicles* also embraced a colonizing view of Mars, but additionally it played upon the rising fears of nuclear war that had come to define the anxieties of the Cold War.<sup>71</sup> Earlier visions of Martians as harbingers of a technological apocalypse had mostly disappeared with the growing recognition that Mars' inhospitable climate made such a possibility less and less believable. In contrast, the very real possibility of nuclear war on Earth influenced the

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<sup>70</sup> Rachel Carson, *Silent Spring* (London: Penguin Books, in Association with Hamish Hamilton, [1962] 2015).

<sup>71</sup> Ray Bradbury, *The Martian Chronicles: With a New Introduction by the Author* (New York, NY: William Morrow, [1950] 2006).

reimagining of the apocalyptic theme with anxiety-inducing realism. The peril humanity had placed itself in with the invention of atomic weapons caused many to think of Earth as an imminently sinking ship. These fears extended to viewing Mars as a second chance, a potential life raft amidst a looming doomsday. Popularly received at the time, *The Martian Chronicles* exploration of this scenario through its stories of humans abandoning Earth in the wake of a nuclear war in order to colonize Mars resonated powerfully with the American public. Although fears of nuclear war eventually receded by the end of the Cold War, new doomsday fears replaced them, perpetuating for decades to come the notion of Mars as an appealing escape and opportunity for colonization despite its hostile environment. Most clearly and originally expressed in *The Martian Chronicles* and consistently recurring in science fiction afterwards, this strain of thinking fundamentally influenced the character of the post-war Space Age discourse. If Heinlein's work marked the beginning of one of the discourse's dominant post-war visions, Bradbury's *The Martian Chronicles* marked the beginning of the other vision – one that prioritized the creation of a new world out of Mars rather than a rescuing of Earth. But like Heinlein's *Red Planet*, *The Martian Chronicles* also depicted Mars as crisscrossed by ancient canals and thus similarly reflected the transition between pre-war Mars-oriented science fiction and the new visions of the post-war Space Age.

In the wake of Heinlein's and Bradbury's early works, a flurry of Mars colonization narratives has pervaded the subgenre ever since. The influential power of these stories particularly resonated with an American public that had by the 1950s developed a habit of projecting a national identity of scrappy resourcefulness and survivalist independence. Reflective of the popularity of survival stories in American

culture, a range of both American and British science fiction at the time stranded their protagonists in desperate circumstances on the hostile Red Planet. In the legacy of Daniel Defoe, works like Rex Gordon's 1956 novel *No Man Friday*, later adapted into the 1964 American film *Robinson Crusoe on Mars* appealed to the public's love of both survival stories and science fiction tales on Mars.<sup>72</sup> Just as Defoe's original 1719 novel *Robinson Crusoe* captivated British audiences in the midst of the British Empire's rapid colonial expansion, the merging of survivalist narratives and science fiction in the 1950s and 1960s reflected the period's popularly shared sense of once again being on the cusp of a new colonial frontier.<sup>73</sup> Other non-Mars-oriented Space Age science fiction stories like Golden Key Comics' *Space Family Robinson* published from 1962 to 1969 along with Irwin Allen's *Lost in Space* television program airing from 1965 to 1968 used similar techniques.<sup>74</sup> Drawing inspiration from Johann David Wyss's 1812 novel *Swiss Family Robinson*, these stories also merged earlier survival fiction of the colonial period with Space Age science fiction, appealing to audiences' expectant visions of the near-future settling of space.<sup>75</sup> Thus while the State Department juggled both anti-colonial and anti-communist positions that supported various independence movements throughout Africa and Asia during the 1950s, America's Manifest Destiny-inspired cultural conceptions freely played themselves out in the space-oriented science fiction of the period. By 1966

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<sup>72</sup> Rex Gordon, *No Man Friday* (London: New English Library, [1956] 1977)., *Robinson Crusoe on Mars*, directed by Byron Haskin (United States: Aubrey Schenck Productions, 1964).

<sup>73</sup> Daniel Defoe, *Robinson Crusoe* (Waterville, ME: Thorndike Press, [1719] 2002).

<sup>74</sup> Del Connell, "Space Family Robinson," Comic strip, *Golden Key Comics*, January 1966 to October 1969., *Lost in Space*, created by Irwin Allen, (United States: CBS Television Distribution. 1966-1968).

<sup>75</sup> Johann David Wyss, with Jon Scieszka, and William Henry Giles Kingston, *The Swiss Family Robinson* (London: Puffin Books, [1812] 2016).

the premiere of Gene Roddenberry's *Star Trek* television series capitalized on this notion with its famous opening line: "Space: the final frontier" and even offered audiences of the Vietnam War era an appealing anti-colonial escape into a progressive, egalitarian future reminiscent of the techno-utopian fiction popular in previous decades.<sup>76</sup>

Coupled with the perils of the Cold War as well as rising environmental concerns, American Mars-oriented science fiction at the time also reflected broader ideological tendencies to imagine new technologies as double-edged swords capable of bringing about both a future apocalypse as well as a future techno-utopia. Nuclear technology could bring about catastrophic war, or it could bring about limitless energy and even a propulsion system capable of transporting humans to new star systems. While Mars-oriented science fiction such as Dennis Wheatley's 1952 novel *Star of Ill-Omen* and Philip K Dick's 1968 work *Do Androids Dream of Electric Sheep?* along with a wealth of non-Mars related dystopic science fiction played into the public's nuclear fears, other works envisioned nuclear-powered spaceships spreading humanity into the cosmos.<sup>77</sup> Books like Lester del Rey's 1952 novel *Marooned on Mars* and John D. MacDonald's 1951 story *Wine of the Dreamers* envisioned spacecrafts propelled by nuclear technology.<sup>78</sup> These novels offered visions of nuclear propulsion likely influenced by the speculative papers of Manhattan Project scientists from Enrico Fermi to

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<sup>76</sup> *Star Trek*, created by Gene Roddenberry (United States: CBS Television Distribution, 1966-1968).

<sup>77</sup> Dennis Wheatley, *Star of Ill-Omen* (London: Arrow Books, [1952] 1979.), Philip K. Dick with Tony Parker, Blond and Richard Starkings, *Do Androids Dream of Electric Sheep?* (Los Angeles, CA: Boom! Studios, a Division of Boom Entertainment, [1968] 2017).

<sup>78</sup> Lester Del Rey, *Marooned on Mars* (New York, NY: Rinehart and Winston, [1952] 1969)., John D. MacDonald, *Wine of the Dreamers* (New York, NY: Ballantine, [1951] 1984).

Stanislaw Ulam and Frederic de Hoffman, but they also predated American government projects like Los Alamos' Project Rover in 1955 and the Atomic Energy Commission's Nuclear Engine for Rocket Vehicle Application (NERVA) in 1968 that sought to develop the world's first nuclear thermal rockets. Even private endeavors like General Atomics' Project Orion in 1958 derived its inspirations from early periods in the discourse of the Space Age. Designed to investigate nuclear pulse propulsion – an experimental technology that combined the energetic power of atomic bombs with the idea of using explosions to propel a spacecraft – traces of this notion first appeared as far back as Russian cosmist and revolutionary Nikolai Kibalchich's writings from prison after his involvement in the assassination of Tsar Alexander II in 1881.<sup>79</sup> Executed soon afterwards, Kibalchich described plans for a manned "aerodynamic instrument" that incorporated flight control and a gimbaled engine fueled by the continuous feeding of gunpower to produce explosive propulsion.<sup>80</sup> Writing from prison, Kibalchich stated, "Should my idea, after careful examination by scientific experts, be recognized as feasible, then I would be happy that I have rendered a service to my country and to mankind; I would then meet death peacefully."<sup>81</sup> Although some have argued that Kibalchich had not been envisioning a spacecraft necessarily, decades later the new Bolshevik government found his prison writings and, with the expertise of aeronautics specialist Nikolai Rynin who published an analysis of the idea arguing for its value,

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<sup>79</sup> Asif Siddiqi, "From Cosmic Enthusiasm to Nostalgia for the Future: A Tale of Soviet Space Culture," in *Soviet Space Culture: Cosmic Enthusiasm in Socialist Societies*, ed. Eva Maurer, Julia Richers, Monica R uthers and Carmen Scheide, (Houndmills: Palgrave Macmillan, 2011) 291.

<sup>80</sup> "International Space Hall of Fame: New Mexico Museum of Space History: Inductee Profile," New Mexico Museum of Space History.

<sup>81</sup> Siddiqi, *Soviet Space Culture*, 291.

mythologized Kibalchich as a martyr of the revolution. Kibalchich's plans were incorporated into the period's popular mixture of cosmist and communist visions that imagined an interplanetary utopian future. Notions of propulsion in space derived from controlled explosions remained afloat in the discourse for years but found renewed interest in the 1950s and 1960s during the height of nuclear testing. Project Orion appeared in this context. Along with General Atomics' Ted Taylor, physicist Freeman Dyson helped lead the project.<sup>82</sup> Like so many others, Dyson too envisioned a future of space colonization and even pointed to earlier science fiction author Olaf Stapelton's *Star Marker* as the source of inspiration for his widely popularized "Dyson spheres" – theoretical megastructures that could surround a star to capture its energy in order to fuel space colonization.<sup>83</sup> Projects like Rover, NERVA and Orion grew out of the Space Age discourse's mixture of scientific research papers, ideological visions of the future and even the influence of science fiction literature that offered the public a positive spin on a frightening technology of world-ending capabilities.

Yet while some of the period's science fiction seemed to loosely anticipate future developments in the space industry, *Collier's Magazine's* eight-part series published between 1952 and 1954 put forth a step-by-step vision for human expansion into space that soon afterwards and for years to come significantly influenced the projects NASA pursued. Written by deeply involved and influential aerospace engineer Wernher Von Braun along with astronomer Fred L. Whipple, physicists Joseph Kaplan and Heinz

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<sup>82</sup> George Dyson, *Project Orion: The True Story of the Atomic Spaceship* (New York, NY: Henry Holt and Company, 2002), xiii.

<sup>83</sup> "Freeman Dyson: Imagine...: Interviewed October 1978 by Monte Davis," Archive.org, 1997.

Haber and science writer Willy Ley, the *Collier's* series not only offered a detailed long-term plan for space colonization, it actively advocated for it. The editors' note for the series' first segment in *Collier's* March 22<sup>nd</sup>, 1952 issue entitled "Man Will Conquer Space Soon" told readers, "What you will read here is not science fiction. It is serious fact. Moreover, it is an urgent warning that the U.S. must immediately embark on a long-range development program to secure for the West 'space superiority.'"<sup>84</sup> Playing on the Cold War fears of the Soviet threat, the note claimed that, "A ruthless foe established on a space station could actually subjugate the peoples of the world. [...] Armed with atomic war heads, radar-controlled projectiles could be aimed at any target on the earth's surface with devastating accuracy."<sup>85</sup> The editors' note merged apocalyptic nuclear fears with aspirations of peace to justify "the expenditure of \$4,000,000,000 to produce an instrument which would guarantee the peace of the world."<sup>86</sup> The instrument they envisioned was a space station referred to as a "sentinel in space." Yet the editors' note went beyond simply dreams of peace. It also grandly claimed that "the establishment of a space station would mean the dawning of a new era for mankind. For the first time, full exploration of the heavens would be possible, and the great secrets of the universe would be revealed." From its very first page, the widely-popular series managed to combine the apocalyptic and aspirational themes of the discourse of the Space Age with the authority of well-known scientists, all complimented by the eye-catching artistic work of Chesley Bonestell, Fred Freeman and Rolf Klep that evoked imagery common in the comic books and novel covers of the period's space-oriented science fiction.

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<sup>84</sup> The Editors, "What Are We Waiting For?," *Collier's Magazine*, March 22, 1952, 23.

<sup>85</sup> Ibid.

<sup>86</sup> Ibid.

The series' first article, written by Wernher von Braun and entitled "Crossing the Last Frontier" argued with a utopian flare the benefits of a space station with its introductory line proclaiming, "If we do it, we can not only preserve the peace but we can take a long step toward uniting mankind."<sup>87</sup> After the article's title page, the next page featured a large artist's rendering of a massive earth-orbiting space station in the shape of a rotating wheel along with an additional seven pages of detailed technical descriptions accompanied by illustrations depicting an enormous rocket designed to carry the station's components into space for orbital assembly. The idea for a wheel-shaped space station that rotated to produce centripetal acceleration and provide its occupants a form of artificial gravity had its roots in an international discourse of both Russian cosmism as well as interwar German space societies that extended back more than half a century. First discussed as early as 1883 by Tsiolkovsky, the idea reappeared again and again throughout the discourse of the Space Age. With Hermann Oberth's encouragement, Slovenian rocket engineer Hermann Noordung proposed a similar design in 1928 from within Germany's Verein für Raumfahrt (Spaceflight Society). Near the end of the 1950s, Russian engineers led by soviet rocket pioneer Sergey Korolev were already developing a concept for a manned mission to Mars that incorporated centripetal acceleration albeit in a tether design rather than a wheel. Besides the American public's exposure to the *Collier's* series, the wheel concept reappeared most famously in Arthur C. Clark's 1968 novel *2001: A Space Odyssey* as well as Stanley Kubrick's film

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<sup>87</sup> Wernher Von Braun, "Crossing The Last Frontier," *Collier's Magazine*, March 22, 1952, 24.

adaptation of the story.<sup>88</sup> Despite von Braun's advocacy in *Collier's* as well as afterwards in television news programs and even *The Magical World of Disney's* December 28<sup>th</sup>, 1955 episode entitled "Man and the Moon," the design never came to fruition.<sup>89</sup> Yet even today the concept remains popular – most recently debuted as the preliminary goal of the Gateway Foundation, a young membership-oriented private company hoping to make their "Von Braun Space Station" a reality.<sup>90</sup>

The articles that preceded von Braun's in the series' first installment similarly anticipated and influenced future endeavors of the space industry. A short article by Willy Ley further elaborated on the details of the wheel-shaped station's interior, again accompanied by intricate illustrations.<sup>91</sup> Fred L. Whipple's article "The Heavens Open" followed Ley's and envisioned the opportunities reaching space would present for the field of astronomy. Although Whipple imagined observatories in space as manned by onboard astronauts, his overall vision anticipated a future of observational satellites and telescopes with reasonable accuracy.<sup>92</sup> Of USAF's Department of Space Medicine, Dr. Heinz Haber's article "Can We Survive in Space" soon followed Whipple's and explored the more practical challenges of the overall enterprise, but in doing so made the notion of humans in space more real than ever before for readers of *Collier's*.<sup>93</sup> While Haber's

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<sup>88</sup> Gilles Clément, Angie Buckley and William Paloski, "History of Artificial Gravity," in *Artificial Gravity* (New York, NY: Springer, 2007), 59., Arthur C. Clarke, *2001: A Space Odyssey* (London: Sphere, [1968] 2018)., *2001: A Space Odyssey*, directed by Stanley Kubrick (United States: MGM, 1968).

<sup>89</sup> William Bosche, "The Man and the Moon," In *The Magical World of Disney* (United States: Walt Disney Productions. December 28, 1955).

<sup>90</sup> "Von Braun Station," Gateway Foundation.

<sup>91</sup> Willy Ley, "Station in Space," *Collier's Magazine*, March 22, 1952, 30-31.

<sup>92</sup> Fred L Whipple, "The Heavens Open," *Collier's Magazine*, March 22, 1952, 32-33.

<sup>93</sup> Heinz Haber, "Can We Survive in Space," *Collier's Magazine*, March 22, 1952, 35, 65-67.

article addressed the technological feats required to keep humans alive in space and presented many solutions that became realities by the next decade, the banner illustration that accompanied his article seemed to anticipate the early designs of future space-suits with uncanny precision. Depicted in a white, bulky outfit with accordion-like flexible sleeves for the astronaut's arms and legs as well as a seemingly hard, inflexible torso and integrated helmet, the rendering likely drew inspirations from the Navy's new experimental spacesuit at the time but also looked uncannily similar to Litton Industries' early RX series spacesuit prototypes contracted by NASA more than a decade later.<sup>94</sup> The anticipatory quality of the *Collier's* series in combination with the well-informed views and powerful influence of its writers made for a visually captivating display that had stepped beyond fantasy into a realm where the fictional and the real collided. The Deputy Director of the United Nations' Legal Department, Oscar Schachter's article "Who Owns the Universe" immediately followed Haber's with an accompanying image depicting astronauts on Mars' moon Deimos gazing at the Red Planet that dominated the scene's starry background.<sup>95</sup> Exploring the legal frontier of extraterrestrial real estate, Schachter's treatise coupled with Martian imagery evoked Bradbury's *The Martian Chronicles* published two years earlier along with a wide range of Mars-colonization fiction for years to come. In concluding his discussion on how to address ownership of extraterrestrial land, Schachter wrote, "we would apply a system similar to that followed on the high seas; outer space and the celestial bodies would be the common property of all mankind, and no nation would be permitted to exercise domination over any part of

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<sup>94</sup> Litton Industries Space Suit Collection: 1960-1969, 2010-0015, Box 1, Folder 1: Photo Album, National Air and Space Museum Archives.

<sup>95</sup> Oscar Schachter, "Who Owns the Universe," *Collier's Magazine*, March 22, 1952, 36.

it.”<sup>96</sup> Schachter’s view in conjunction with the nuclear fears outlined in the first installment’s editors’ note seemed to anticipate the necessity of the Outer Space Treaty signed by the United States and the Soviet Union in 1967. In similar language, the treaty later declared, “Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.” Additionally, Article IV of the treaty reaffirmed a UN resolution from 1963 by banning the placement “in orbit around the Earth [of] any objects carrying nuclear weapons or any other kinds of weapons of mass destruction” as well as the installation of “such weapons on celestial bodies, or station such weapons in outer space in any other manner.”<sup>97</sup> The preceding work of Schachter and others provided the foundation upon which the Outer Space Treaty was conceived.<sup>98</sup>

Shorter than the series’ premier, the next seven installments of the *Collier’s* series put forth additional plans for the Space Age after the construction of von Braun’s spinning wheel space station. Entitled, “Man on the Moon,” *Collier’s* second installment in the October 18<sup>th</sup>, 1952 issue envisioned a lunar landing that utilized the same retrograde burn and descent methods of NASA’s Apollo missions seventeen years later. Yet with their plans to first construct a massive space station before venturing further out, the authors anticipated not reaching the Moon until 1977.<sup>99</sup> This timeline coincided with

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<sup>96</sup> Ibid, 67.

<sup>97</sup> U.S. Department of State, *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, (Washington DC: Bureau of Arms Control, Verification and Compliance, 1967).

<sup>98</sup> James A. Vedda, “The Outer Space Treaty: Assessing its Relevance at the 50-Year Mark,” Center for Space Policy and Strategy, June 2017, 2.

<sup>99</sup> The Editors, “Man on the Moon,” *Collier’s Magazine*, October 18, 1952, 51.

Arthur C. Clarke's *Prelude to Space* written just prior to the *Collier's* series in 1951 as well as Robert Heinlein's 1950 short story *The Man Who Sold the Moon* that both depicted a first lunar landing in 1978.<sup>100</sup> Even Isaac Asimov's 1939 short-story "Trends" also anticipated a potential first visit to the Moon in the 1970s.<sup>101</sup> Depicting three lunar landers departing from the space station and carrying fifty people to the Moon's surface for a six week stay, the second installment exposed more of its authors' grand ambitions. Although the landers at a glance looked awkward and ungainly like the Apollo Lunar Module did more than a decade later, the extraordinary scale of the vehicles proposed in the *Collier's* series appear in hindsight as far more akin to science fiction than reality. Yet like the series' first installment, the technical details put forth in the second installment's primary article "The Journey" by von Braun made the proposal more real than typical science fiction of the period.<sup>102</sup> To readers, the article helped transform the fantasy of a landing on the Moon into a future inevitability.

The series' third installment, "The Exploration" continued von Braun's lunar mission narrative, further elaborating on the details of the landers as well as the activities of astronauts on the Moon.<sup>103</sup> Despite the apparent influences of earlier science fiction upon the series' overall vision, few science fiction stories prior to the *Collier's* series discussed a preliminary lunar base as articulated in this third installment. However, much of the Moon-oriented science fiction published in the years immediately after the

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<sup>100</sup> Arthur C. Clarke, *Prelude to Space* (New York, NY: RosettaBooks, [1954] 2012)., Robert A. Heinlein, *The Man Who Sold the Moon* (New York, NY: Baen, [1950] 2007).

<sup>101</sup> Isaac Asimov, "Trends," *Astounding Science Fiction*, July 1939.

<sup>102</sup> Wernher von Braun, "The Journey," *Collier's Magazine*, October 18, 1952, 52.

<sup>103</sup> Fred L. Whipple and Wernher von Braun, "The Exploration," *Collier's Magazine*, October 25, 1952, 38-48.

*Collier's* series did include lunar bases and depictions of lunar colonization.<sup>104</sup> Thus the *Collier's* series offered an impressively detailed vision of the future very early on in the Space Age and likely influenced the visions put forth by science fiction works published afterwards. With the authoritative backing of its well-known authors, the series' impact on the development of the early space industry cannot be overstated.

The *Collier's* series' fourth, fifth and sixth installments all entitled "Man's Survival in Space" further elaborated on the immediate next steps required to get the first human being in space. By merging photographs with artist renderings, they effectively collapsed the divide between fiction and reality. Photographs showing the Navy testing new space suits as well as pictures of the Navy's new human centrifuge for G-force training along with their airplane ejection seat tests accompanied the articles' explanations of the ongoing cutting-edge efforts of the military to eventually put a human safely in space.<sup>105</sup> Besides anticipating future training techniques like parabolic airplane flights for practice in weightlessness as well as imaginatively grand spacecraft flight simulators, these installments articulated the personal qualities of astronauts that came to define what Tom Wolfe famously called "the right stuff."<sup>106</sup>

With the series' consistent emphasis on manned spaceflight, only the seventh installment in the June 27<sup>th</sup>, 1953 issue of *Collier's* discussed an unmanned mission.

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<sup>104</sup> Arthur C. Clarke, *Earthlight* (New York, NY: RosettaBooks, [1955] 2018)., Arthur C. Clarke, *A Fall of Moondust* (New York, NY: RosettaBooks, [1961] 2018)., Isaac Asimov, *The Gods Themselves* (London: Gollancz, [1972] 2013)., Robert A. Heinlein, *The Moon Is a Harsh Mistress* (New York, NY: Ace, [1966] 2018).

<sup>105</sup> Cornelius Ryan, "Picking the Men," *Collier's Magazine*, February 28, 1953, 43-44., Cornelius Ryan, "Testing the Men," *Collier's Magazine*, March 7, 1953, 56,59., Cornelius Ryan, "Emergency!," *Collier's Magazine*, March 14, 1953, 43.

<sup>106</sup> Ryan, "Testing the Men," 46, 62., Tom Wolfe, *The Right Stuff* (New York, NY: Farrar, Straus, Giroux, 1998).

Authored by von Braun and Cornelius Ryan and titled “The Baby Space Station,” it envisioned a first orbital test flight lasting 60 days with no recovery. Yet even this proposed mission included monkeys on board for testing the life support systems needed for future manned missions.<sup>107</sup> Reflective of the U.S. military’s experiments sending various monkey species on suborbital rocket flights since 1948, “The Baby Space Station” mission proposal naturally extended that research towards orbital flights. The overall goal of bringing humans into space and onto other celestial bodies was clear.

The final installment published in the magazine’s April 30<sup>th</sup>, 1954 issue turned readers’ attentions once again towards Mars. Mirroring the newspaper coverage of Mars’ oppositions in the 1890s, the installment’s first article by astronomer Fred L. Whipple discussed that year’s coming opposition as well as the perihelic opposition to follow in 1956. As in the lead-ups to past oppositions, Whipple described the event as an opportunity to learn more about the planet. Whipple also reawakened the Mars canal debate writing, “This year we may get an opportunity to clear up the canal confusion once and for all.”<sup>108</sup> Although few astronomers as late as the 1950s were seriously discussing Martian canals anymore, the subject still garnered public interest. Even after the 1954 opposition, the momentum of the Space Age discourse’s Mars canal fixations managed to survive for at least another decade. Despite Mariner 4’s flyby of Mars and subsequent transmission of photographs capturing the planet’s barren, cratered surface in the summer of 1965, the last remnants of speculations about canals on Mars refused to die. In December of that year, newspapers across the United States widely reported on

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<sup>107</sup> Wernher von Braun with Cornelius Ryan, “Baby Space Station,” *Collier’s Magazine*, June 27, 1953, 30-35, 40.

<sup>108</sup> Fred L Whipple, “Is There Life on Mars?,” *Collier’s Magazine*, April 30, 1954, 21.

astronomer and Pluto discoverer Clyde Tombaugh's claims that evidence of canals and oases could be seen in some of Mariner 4's photos. However, unlike the far more sensational claims of the 19<sup>th</sup> century, Tombaugh speculated that the canals were geological faults and the oases were "impact craters in which moisture gathers and promotes growth of some hardy planet such as moss."<sup>109</sup> Tombaugh was referring to the darker areas of the surface seen in black and white photos that later turned out to be darker dust streaks and impact sites. Transmitted from NASA's Viking 1 and Viking 2 landers in 1976, the first clear images taken from the surface of Mars finally ended the canal debate for good. Yet back in 1954, the possibility of canals on Mars still had relevance.

The *Collier's* series' final article, "Can We Get to Mars?", again authored by von Braun and Cornelius Ryan, proceeded Whipple's and described the perilous obstacles and general requirements for a manned mission to Mars as well as vaguely envisioned a grand first trip.<sup>110</sup> The two-and-a-half-year mission proposal included an eight-month journey to Mars, the establishment of a permanent base over a fifteen-month period on the surface and a subsequent eight-month journey back to Earth. Although the article predicted that humans needed at least a century to develop the necessary technology for a manned mission to Mars, the piece's last line concluded boldly, "All that can be said with certainty today is this: the trip can be made, and will be made... someday."<sup>111</sup> This final definitive statement in the *Collier's* series echoed the broader expectations of the

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<sup>109</sup> "Mars Canals, Oasis Likely, Noted KU Graduate Thinks," *Lawrence Daily Journal-World*, December 30, 1965, 1.

<sup>110</sup> Wernher von Braun with Cornelius Ryan, "Can We Get to Mars?," *Collier's Magazine*, April 30, 1954, 22-29.

<sup>111</sup> *Ibid*, 28.

discourse of the Space Age that had been developing for the better part of a century. The conviction with which von Braun and Ryan predicted a future on Mars as well as the expansive time frame they articulated now appears remarkably prophetic. Yet as readers of and writers for the discourse of the Space Age, their unwavering beliefs fit in with the widely-held assumptions of discourse. That they anticipated a future on Mars with such firmness demonstrated the strength of their faith, a kind of ideological belief system constantly reinforced by the discourse of the Space Age and shared by countless space industry leaders and professionals. That faith has long provided an underlying drive to many in the space industry seeking to transform the discourse's expectations into reality.

The *Collier's* series' detailed, anticipatory vision for the future of the Space Age demonstrates the notion that visions themselves can inform and even direct future developments in the space industry. It offered an early glimpse into the expectations of influential space industry pioneers to go to the Moon and Mars years before President John F. Kennedy made landing on the Moon a national priority. The series' significance in the discourse stemmed from its ability to put forth a vision that deeply resonated with readers by seriously engaging with the popular fears and hopes of broader society at the time. It also exposed the long-term expectations of key players in the Space Race – expectations that extended far beyond any practical Cold War concerns. Although reaching the Moon represented the Space Race's finish line, to those like Von Braun that played important roles in the industry itself, walking on the Moon represented only humanity's first of many giant leaps.

The well-documented events of the Space Race that followed afterwards finally began to fully merge science fiction visions with technological realities on television

screens. Broadcasted into Americans' living rooms by CBS, ABC, and NBC and narrated by beloved news anchors like Walter Cronkite, the public's consumption of live footage from Cape Canaveral, from space and from the Moon's surface helped inspire a new generation of pioneers to transform the space industry in proceeding decades. Imagery like Apollo 8's *Earthrise* and Apollo 17's *Blue Marble* also gave people a new perspective of Earth's finiteness and precarious impermanence in the cosmos.<sup>112</sup> These photos reinforced the period's growing ecological fears and significantly contributed to one of the Space Age discourse's two dominant visions – one that imagined transporting harmful heavy industries off of Earth in order to save the planet. The power of this vision as well as its primary competition – a vision of colonizing of Mars to give humanity a second chance – continued unabated in the discourse of the Space Age long after the public's Apollo-era enthusiasm for NASA had died away. With the agency's glory days seemingly over amid budget cuts and a shift towards the long-term development of a shuttle transport system and low earth orbit space station, the future of the Space Age seemed uncertain by the mid-1970s. After having already walked on the Moon, NASA struggled to recapture the public's enthusiasm. Yet the relentless production and consumption of space-oriented and Mars-oriented science fiction persisted in the post-Apollo era anyway. This inspirational discourse in combination with a widely shared sense of disappointment over NASA's underfunded and directionless future compelled a new generation of rocket pioneers to pursue their Space Age visions through private means. These ambitious dreams for the future of the Space Age in the last decades of the

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<sup>112</sup> "Earthrise," NASA, [December 24, 1968] February 23, 2015., "Blue Marble - Image of the Earth from Apollo 17," NASA, [December 7, 1972] February 27, 2015.

20<sup>th</sup> century directly shaped the emerging private space industry of the post-Shuttle era. Derived from the legacy of the Space Age discourse, the competing visions of billionaire entrepreneurs in the 21<sup>st</sup> century reignited the broader public's enthusiasm once again.

## CHAPTER FOUR

### NEW PIONEERS IN A NEW ERA

Virtually everyone old enough to witness it remembers watching the live broadcast of humanity's first steps on the surface of the Moon. The media coverage of Apollo 11 in July of 1969 imprinted itself into the consciousnesses of the public at large and inspired a new generation to contribute to humanity's space-faring future. For some of those few that grew up to become leaders in the 21<sup>st</sup> century's new private space industry, Apollo 11 provided just the initial spark. Like eye-catching lures drawing people into the Space Age discourse, the techno-spectacles of space agencies and now private companies have played an important role in a feedback loop that drives the space industry forward. Of the space industry's new titans, Amazon and Blue Origin founder Jeff Bezos, Virgin Group founder Richard Branson, X Prize Foundation chairman and founder Peter Diamandis, and late co-founder of Microsoft and Statolaunch Systems Paul Allen all credited the Apollo era and specifically the live broadcast of Apollo 11's Moon landing as well as their early introductions into the Space Age discourse's voluminous science fiction canon with seeding their early passions for space.

The late Paul Allen, born earlier than the rest in 1953, first encountered the discourse in the midst of the Space Race. Robert Heinlein's science fiction novel *Rocket*

*Ship Galileo* and science writer Willey Ley's *Rockets, Missiles and Space Travel* captivated Allen at a young age. As a second-grader in April of 1961 following news reports that Yuri Gagarin had become the first human to reach space, a young Paul Allen looked up at the night sky in wonder. Reflecting in his memoir on the influence of both science fiction and the real events of the rapidly unfolding Space Race, Allen wrote that "Novels were hard-pressed to keep up with reality in those days."<sup>113</sup> The passion-breeding force of the discourse of the Space Age had caught Allen young, and as he got older he "moved on to more sophisticated writers: Arthur C. Clarke and Isaac Asimov and that wonderful stylist and personal favorite, Jack Vance. I especially liked Heinlein's 'hard' science fiction, which paired authentic scientific theories with ray-gun battles."<sup>114</sup> At sixteen years of age, Allen watched Apollo 11's lunar landing and again stared up at the sky that July night and thought, "*There are people from earth up there, walking around.*"<sup>115</sup> Yet a need for glasses ruined his dreams of becoming an astronaut. Meanwhile, growing up with Bill Gates and experimenting with Lakeside School's teletype terminal during their teenage years in Seattle, Allen's early fascination with computers eventually carried him in a different direction. Like most of the other new moguls of the 21<sup>st</sup> century private space industry, Allen's career achievements in space ventures occurred later in life after he had already accrued his fortune by other means. Taking a job with Honeywell in Boston after graduating from Washington State University, Allen eventually convinced Bill Gates – also in Boston attending Harvard at

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<sup>113</sup> Paul Allen, *Idea Man: A Memoir by the Co-founder of Microsoft* (New York, NY: Penguin Group, 2011), 248.

<sup>114</sup> *Ibid*, 250.

<sup>115</sup> *Ibid*, 251.

the time – to drop out and start a company together. Moving to Albuquerque, New Mexico to co-found Microsoft in 1975, both Paul Allen and Bill Gates began their careers worked side-by-side until Allen contracted Hodgkin’s Lymphoma and left Microsoft in 1983. In his memoir, Allen recalled how two years prior, he along with Charles Symonyi, a recent hire of Microsoft developing a new applications group at the time, flew to Florida to witness NASA’s first Space Shuttle launch. Having never witnessed a rocket launch before, Allen described the experience, writing, “As the *Columbia* headed straight up, and the crowd chanted ‘Go!’ I got a lump in my throat. (Rocket takeoffs get me every time, even on television.)”<sup>116</sup> Although Allen remained on Microsoft’s board of directors until his official resignation in 2000, his departure in 1983 along with his eventual overcoming of Lymphoma gave him the flexibility necessary to explore other interests.

Just one year earlier, aerospace engineer Burt Rutan had founded Scaled Composites in Mojave, California, his second aircraft design company. A giant in the aerospace industry, Rutan’s wider claim to fame in the 1980s commenced with the successful 1986 flight of his Rutan Model 76 Voyager aircraft – the first plane to fly around the world without stopping or refueling.<sup>117</sup> With his induction into the National Aviation Hall of Fame in 1995, his reputation preceded him by the time Paul Allen first met him the next year.<sup>118</sup>

Rutan’s and Allen’s goals in the space industry complimented one another. While Rutan hoped to create a commercial space tourism company to bring more civilians beyond Earth’s atmosphere, Allen simply “wanted to do something in rocketry that no

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<sup>116</sup> Ibid, 252.

<sup>117</sup> “Rutan Voyager,” National Air and Space Museum, March 10, 2018.

<sup>118</sup> “Rutan, Richard ‘Dick,’” National Aviation Hall of Fame.

one had done before.”<sup>119</sup> The right vehicle for taking tourists on a suborbital flight needed to be very safe as well as cheap enough to bring to market. A reusable spaceplane seemed the only option. Yet due to the difficulty of the challenge, Allen and Rutan tabled the project for another three years. Allen claimed that in 1999, “Burt had his eureka moment.”<sup>120</sup> Derived from his earlier experiences at Edwards Air Force Base as a flight test project engineer during the military’s experimental X-15 program, Rutan had known for a long time that in order to accomplish his goal, he needed to design an air-launch system similar to the X-15’s. Built by North American in 1959, the X-15 rocket-powered plane required a B-52 to carry it to an altitude of 45,000 feet before it could launch. Upon its mid-air release, the plane’s single XLR-99 rocket engine built by Reaction Motors ignited and propelled the plane to speeds surpassing Mach 6, taking the vehicle more than sixty miles above the Earth’s surface.<sup>121</sup> Yet despite its successes, Rutan knew that a civilian version of the X-15 intended for space tourism could never work. An expensive program at the time, the plane also only seated one pilot and had a temperamental history, even killing test pilot Michael J. Adams in 1967.<sup>122</sup>

By the mid-1980s, Burt Rutan again encountered the air-launch concept, this time while designing the wings of Orbital Science Corporation’s new Pegasus rocket. Founded in 1982 and later developing the rocket through a combination of subcontractors, the Pegasus vehicle air-launched from repurposed commercial jetliners to deliver small

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<sup>119</sup> Allen, *Idea Man*, 252.

<sup>120</sup> *Ibid*, 255.

<sup>121</sup> W. D. Kay, “The X-15 Hypersonic Flight Research Program: Politics and Permutations at NASA,” in *From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners*, ed. Pamela Etter, (Mack. Honolulu, HI: University Press of the Pacific, 2006) 149-164.

<sup>122</sup> “Michael J. Adams,” NASA X-15 Biographies-Pilots.

satellites to LEO by the end of the 1980s. Operating alongside an older, pre-Apollo generation of corporations like Boeing, Lockheed Martin, Northrop Grumman and others, Orbital Sciences Corp. primarily played an important role as a defense contractor launching satellites for the U.S. military and other sectors of the government. Although Orbital Sciences Corp. had successfully commercialized the air-launch technique, it never attempted a manned payload, nor did it ever develop a reusable spaceplane, a far greater challenge.<sup>123</sup>

Despite its inherent difficulties, in 1999 Burt Rutan envisioned a new design – a spaceplane with foldable wings launched from a novel lightweight mothership. With the spaceplane’s wings first in a conventional position, the plane could maintain lift and rocket to the edge of space, but upon its supersonic descent, the planes’ “rear halves would fold upward along a hinge at a 65-degree angle, creating the high drag needed for a carefree reentry” wrote Allen.<sup>124</sup> This insight provided the key innovation necessary for the construction of SpaceShipOne – the eventual winner of the Ansari X Prize on October 4<sup>th</sup>, 2004.

Like Paul Allen, Ansari X Prize creator and X Prize Foundation owner Peter Diamandis also derived his initial inspirations in childhood from watching the Space Race’s techno-spectacles as well as consuming the period’s popular science fiction. Just eight years old in 1969 watching Walter Cronkite live on CBS narrating Apollo 11’s Moon landing, Diamandis, already a passionate fan of space exploration, told his mother

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<sup>123</sup> Orbital Sciences Corporation Records: 1988-1998, 2006-0053, Box 1-3, National Air and Space Museum Archives.

<sup>124</sup> Allen, *Idea Man*, 255.

that night that he would become an astronaut.<sup>125</sup> Like Paul Allen, Diamandis also delved into the science fiction of the era. Speaking to *The Observer* in 2016, Diamandis reflected on his youth saying, “I was a fanatical *Star Trek* fan, and the Moon landing was this epic journey that happened during my most formative years [...] It was a one-two punch that really changed the course of my life.”<sup>126</sup> His passion unabating, by the time Diamandis arrived at MIT after a short stint at Hamilton he had already read books by rocket pioneers Konstantin Tsiolkovsky and Robert Goddard and had learned of Hermann Oberth’s and Wernher von Braun’s contributions to the early Space Age.<sup>127</sup> While at MIT in 1980, Diamandis alongside Robert Richards and Todd Hawley co-founded Students for the Exploration and Development of Space (SEDS), the school’s first space club. Advertising the group’s first meeting with flyers urging, “If you care about your future in space, join me in the student center,” SEDS gained members quickly and soon spread to Princeton and Yale. Yet at Princeton, another group called the L5 Society had already been advocating for human space colonization since 1975. When asked at SEDS’s first meeting if he would consider merging SEDS with the L5 Society, Peter refused stating, “I want an organization for students, run by students.”<sup>128</sup> Had SEDS joined the L5 Society, Diamandis may have likely encountered Princeton physics professor Gerard O’Neill and his utopian proposals for moving humans and their harmful heavy industries

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<sup>125</sup> Julian Guthrie, *How To Make a Spaceship: A Band of Renegades, an Epic Race, and the Birth of Private Spaceflight* (New York, NY: Penguin Books, 2017), 16.

<sup>126</sup> John Bonazzo, “XPrize’s Peter Diamandis: ‘We’re Gonna Be a Multi-Planetary Species,’” *The Observer*, October 14, 2016.

<sup>127</sup> Guthrie, *How to Build A Spaceship*, 24.

<sup>128</sup> *Ibid*, 41.

into space to save Earth from ecological disaster. But instead, Diamandis decided to take SEDS on an independent path.

Within two years, SEDS spread to more than one hundred campuses.<sup>129</sup> Soon afterwards, Diamandis along with Richards and Hawley were invited to the United Nations' conference on space in Vienna.<sup>130</sup> At the Vienna conference the trio met science fiction writer Arthur C. Clarke and managed to have dinner with him the next evening. By the end of the night, Clarke had become an advisor of SEDS at their request.<sup>131</sup> In Diamandis' domain, the world of science fiction and the realities of the Space Age were always interacting and merging with one another. By 1987 and while still in medical school at Harvard after already graduating with an M.S. at MIT, Diamandis cofounded International Space University. In the following years, Diamandis created numerous startup space companies beginning with International MicroSpace, Inc in 1989 followed by Constellation Communications in 1991. In 1994, Gregg Maryniak, a close friend of Diamandis', gave him a copy of Charles Lindbergh's *The Spirit of St. Louis*. Learning of the Orteig Prize that in 1919 offered a \$25,000 reward to the first person to cross the Atlantic on a non-stop flight from New York City to Paris, the book inspired Diamandis to create the X Prize Foundation.<sup>132</sup>

Funded through an insurance policy provided by the Ansari family of Prodea Systems, the X Prize Foundation's first competition, the Ansari X Prize, offered \$10 million to any privately-funded team that could build a reusable manned spaceship

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<sup>129</sup> Ibid, 43.

<sup>130</sup> Ibid, 44.

<sup>131</sup> Ibid, 47.

<sup>132</sup> Peter H. Diamandis, "This Inspired Me...", Peter Diamandis.

capable of carrying three people beyond the 100 kilometer Kármán Line and into space twice in just two weeks. The terms of the prize were intended to promote research in affordable civilian space travel by incentivizing competitors to design and build dependable, reusable spaceships.<sup>133</sup> Reusable spaceships had been a mainstay in science fiction since the 1800's and served as a constant reminder of the industry's shortcomings. Although NASA's Space Shuttle came close to making dreams of reusability a reality, the extensive and costly refurbishment process the vehicle required after each mission as well as its spotty track record – first with the loss of Space Shuttle Columbia and crew in 1986 and later with the loss of Space Shuttle Discovery and crew in 2003 – left many Space Age dreamers wanting something more, something better, something like what science fiction had been depicting for more than a century.

Just nine years after Diamandis' announcement of the Ansari X Prize, Paul Allen's and Burt Rutan's SpaceShipOne, carried into the sky by its mothership, White Knight One, was released at 45,000 feet, ignited its hybrid rocket motor and accelerated into space. The Ansari X Prize was a means to a visionary end long in the making. That vision, one that imagined a future of space tourism not as an exclusive novelty reserved for the mega-rich but rather as a common and popular experience within reach for most people thanks to private industry advances in reusability, provided a fresh perspective on the Space Age discourse's legacy of utopian dreaming.

Diamandis' space-oriented goals also fit into his broader ideology – one that supported and anticipated an eventual technological singularity. First conceived by Hungarian-American polymath John von Neumann, the notion has informed visions of a

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<sup>133</sup> “Ansari XPRIZE: How They Won,” XPRIZE.org.

technological future ever since. When paraphrasing von Neumann’s original idea, Manhattan Project physicist Stanislaw Ulam recalled a conversation with Neumann in the 1950s saying that it “centered on the ever-accelerating progress of technology and changes in the mode of human life, which gives the appearance of approaching some essential singularity in the history of the race beyond which human affairs, as we know them, could not continue.”<sup>134</sup> I. J. Good brought the idea into the discourse with his 1965 paper, “Speculations Concerning the First Ultraintelligent Machine.”<sup>135</sup> A consultant for Stanley Kubrick’s *2001: A Space Odyssey* three years later, Good advised on the film’s representation of HAL 9000, the movie’s super-computer antagonist.<sup>136</sup> As Microsoft’s Paul Allen and Bill Gates battled against Apple’s Steve Jobs to bring more and more advanced personal computers to the world throughout the end of the 1970s and 1980s, notions of a technological singularity began to resonate more widely with the public. The popularization of Moore’s Law throughout this period further encouraged expectations of a looming singularity.<sup>137</sup> By 2005, technologist and futurist Ray Kurzweil’s bestselling book *The Singularity is Near: When Humans Transcend Biology* had moved the idea further into the mainstream.

Like the discourse of the Space Age, visions of the singularity – often imagined as the result of the rise of Artificial General Intelligence (AGI) – consistently bifurcated into apocalyptic as well as utopian scenarios. While many futurists and science fiction writers

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<sup>134</sup> Vernor Vinge, “Technological Singularity,” Field Robotics Center, 1993.

<sup>135</sup> Irving John Good, “Speculations Concerning the First Ultraintelligent Machine,” *Advances in Computers*, 6 (1966): 31-88. doi:10.1016/s0065-2458(08)60418-0.

<sup>136</sup> Kubrick, *2001: A Space Odyssey*, 1968.

<sup>137</sup> *Encyclopædia Britannica*, s.v. “Moore’s Law,” November 16, 2018.

that shared a critical view of humanity as a harmful presence on Earth tended to envision AGI as an unfeeling and unstoppable force that might destroy humans for the good of the planet, other visionaries imagined AGI as a powerful force for good. Peter Diamandis tended to subscribe to this latter view. Envisioning a future of abundance – a popular phrase amongst 21<sup>st</sup> century entrepreneurs in high-tech industries – Diamandis shared Kurzweil’s more optimistic view. Diamandis even credited *The Singularity is Near* for inspiring him to cofound Singularity University with Kurzweil in 2008 at the NASA Research Park near San Jose, California.<sup>138</sup> Since then, Diamandis has cofounded a number of other companies exploring a range of cutting-edge goals from asteroid mining to increasing human longevity. As with other leaders in the new private space industry, Diamandis’ vision – a blend of capitalist entrepreneurialism and technological utopianism – was deeply influenced by the discourse of the Space Age and has actively directed Diamandis’ participation in the space industry since his days at MIT.

Thanks to Diamandis’ X Prize Foundation, Paul Allen’s and Burt Rutan’s SpaceShipOne grabbed media attention around the world in October of 2004, but just months earlier they had also caught the eye of another business magnate and future space industry leader – Richard Branson. Branson, a serial entrepreneur who had started Virgin Group in 1970 as a holding company for Virgin Records and had subsequently grown Virgin Atlantic Airways, Virgin Mobile and hundreds of other smaller companies into a multi-billion-dollar empire, saw another business opportunity when he first learned of SpaceShipOne.<sup>139</sup> In March of 2004, Branson began discussions with Paul Allen to

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<sup>138</sup> Diamandis, “This Inspired Me...”

<sup>139</sup> Nicholas Schmidle, “Virgin Galactic’s Rocket Man,” *The New Yorker*, August 13, 2018.

purchase the design rights to the craft. By June, Burt Rutan presented a slideshow to Allen and Branson over dinner that envisioned the long-term potential of the trio's working relationship – a future of private orbital space taxis and space hotels.<sup>140</sup> Soon after, Allen agreed to Branson's offer to secure design rights to SpaceShipOne for a million dollars. Just one week before Scaled Composites' pilot, Mike Melville competed for the X Prize in SpaceShipOne at the end of September, 2004, Branson announced the creation of Virgin Galactic.<sup>141</sup> Branson also had capitalized on the X Prize's media coverage in the Mojave, parking an airplane plastered with Virgin logos in front of TV cameras the morning of SpaceShipOne's first of two flights. The night before, Branson had paid Paul Allen two million dollars to have Virgin's logo painted on SpaceShipOne's tail.<sup>142</sup> Looking back on the history of Virgin Galactic during the forty-fifth anniversary of Apollo 11's Moon landing, Branson later claimed that "the Moon landing was one of the biggest inspirations behind setting up Virgin Galactic, the world's first commercial spaceline." Yet a more critical view suggests Branson was capitalizing on the anniversary just as he capitalized on Scaled Composite's flights to win the Ansari X Prize in 2004. Less immersed in the discourse of the Space Age than many of his contemporaries in the space industry, Branson's vision to eventually make space accessible to everyone shared a kinship with the visions of Peter Diamandis and the late Paul Allen. However, as an opportunist with virtually no background in the space industry, Branson's lack of connection with the Space Age discourse appears evident in the limited scope of Virgin Galactic's vision. Claiming that they are "helping to create, for the first time, a basic

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<sup>140</sup> Guthrie, *How to Build A Spaceship*, 335.

<sup>141</sup> Schmidle, "Virgin Galactic's Rocket Man."

<sup>142</sup> Guthrie, *How to Build A Spaceship*, 376.

space access infrastructure that will act as an enabler for scientists and entrepreneurs” and that they “will also provide the catalyst for a new age of space exploration which promises enormous positive potential for life on Earth,” Virgin Galactic articulates a somewhat ambiguous vision that stops short of engaging in the apocalyptic and utopian imperatives of the Space Age discourse in any specific and meaningful way.<sup>143</sup>

In contrast, Paul Allen’s and Burt Rutan’s next company - Stratolaunch Systems founded in 2011 and employing a similar air-launch concept to the one that got SpaceShipOne beyond the Kármán Line presents a somewhat more specific vision that engages directly with one of the Space Age discourse’s popular themes. Seeking to bring down the cost of delivering a range of satellites into space “to improve the human condition and safeguard Planet Earth for future generations,” Statolaunch Systems hopes to launch satellites that “can enable advancements in areas as diverse as communication, agriculture, ecology, conservation and navigation.”<sup>144</sup> By playing upon one of the Space Age discourse legacies of protecting a fragile Earth, Statolaunch’s environmentalist angle embraces a vision extending as far back as Robert Heinlein’s proto-environmental concerns in “The Green Hills of Earth.” However, even Statolaunch – a company now struggling in the wake of Paul Allen’s death – put forth a relatively vague vision in comparison to another contemporary space company far more steeped in the legacy of Space Age environmentalism – Jeff Bezos’ Blue Origin.<sup>145</sup>

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<sup>143</sup> “Vision,” Virgin Galactic.

<sup>144</sup> “Getting Big Ideas Off the Ground,” Stratolaunch.

<sup>145</sup> Andrew Liptak, “Stratolaunch Is Scaling Back Operations following the Death of Co-founder Paul Allen,” *The Verge*, January 19, 2019.

Founded in September of 2000, Blue Origin's dream for the future merges reality with one of the Space Age discourse's most dominant post-Apollo themes – the rescuing of Earth from anthropogenic ecological disaster. Blue Origin's stated vision, "a future where millions of people are living and working in space" hinges on an environmentalist imperative, to "preserve Earth, our home, for our grandchildren's grandchildren."<sup>146</sup> The companies goals reflect its founder's forward-looking ideology, one that has been directly shaped by the discourse of the Space Age since the days of Apollo.

Standing before a large group of school children seated on the floor of Seattle's Museum of Flight to present the components of a used Apollo F1 engine which he had recovered from the bottom of the Bermuda Triangle in 2013 and later donated, Jeff Bezos explained his earliest inspirations. "Ever since I was five years old" he said, "when Neil Armstrong stepped onto the surface of the Moon, I've been passionate about space, rockets, rocket engines, space travel." As with other leaders in the space industry, the techno-spectacle of Apollo 11 gave Bezos the initial spark of his passion. "I became a science fiction reader and I've always known that I wanted to do something having to do with space and I've spent a lot of time thinking about it for really almost my whole life" said Bezos.<sup>147</sup> Although primarily known as the founder and CEO of Amazon as well as the current wealthiest person in the world, Jeff Bezos' life-long involvement with the discourse of the Space Age and eventually with the space industry itself has defined much of his ideology. The grandson of Lawrence Preston Gise, the regional manager of the U.S. Atomic Energy Commission in Albuquerque until 1968 and later a Texas cattle

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<sup>146</sup> "Millions of People Living and Working in Space," Blue Origin.

<sup>147</sup> "Jeff Bezos speaks with students at the opening of the Apollo exhibit at The Museum of Flight," YouTube video, 40:18, posted by "GeekWire," May 2017.

rancher in Bezos' youth, Jeff Bezos grew up spending summers in south Texas.<sup>148</sup>

Although isolated, as a child he found an extensive collection of science fiction novels at the county library that according to Bezos, ““started a love affair for me with people like [Robert] Heinlein and [Isaac] Asimov, and all the well-known science fiction authors that persists to this day.”” Like Diamandis, Bezos also watched *Star Trek* and even played a preprogrammed Star Trek game at his elementary school's one mainframe computer in his youth.<sup>149</sup> Yet before Bezos even reached high school, the glory days of Apollo had long ended. Despite that, the Space Age visions of one of Bezos' future professors at Princeton had a lasting impact on Bezos and were eventually embodied in the vision of Blue Origin.

Physicist and space advocate Gerard O'Neill had taken a position as a professor at Princeton in 1956, but his legacy in the discourse of the Space Age commenced with a *The New York Times* article covering a Princeton conference hosted by O'Neill in 1974 followed by his 1977 publishing of *The High Frontier: Human Colonies in Space* and founding of the Space Studies Institute.<sup>150</sup> Drawing off of earlier ideas of using centripetal acceleration to create artificial gravity, *The High Frontier* envisioned enormous rotating cylinders in space that could contain thousands of people. Known afterwards as O'Neill cylinders, they were to be constructed from resources like aluminum and titanium mined from the Moon. Published at a time when NASA's

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<sup>148</sup> Wyatt Bechtel, “World's Richest Man Learned Work Ethic as a Kid on a Cattle Ranch,” *Drovers*, May 22, 2018.

<sup>149</sup> Christian Davenport, *The Space Barons: Elon Musk, Jeff Bezos, and the Quest to Colonize the Cosmos* (New York, NY: PublicAffairs, 2018) 65.

<sup>150</sup> Walter Sullivan, “Proposal for Human Colonies in Space Is Hailed by Scientists as Feasible Now,” *The New York Times*, May 13, 1974., Gerard K. O'Neill, *The High Frontier: Human Colonies in Space* (Burlington: Apogee, 2000).

manned space program languished, the public latched on to *The High Frontier*, turning O'Neill into a popular public intellectual appearing on evening broadcasts like the *Tonight Show* and *60 Minutes*.<sup>151</sup>

O'Neill's popularity derived not simply from his vision's grandiosity, but rather from its direct engagement with the broader public's most immediate anxieties. O'Neill's proposal to reach into the cosmos and take advantage of the plentiful solar energy and minable resources available offered readers a direct answer to the energy crisis plaguing the American economy of the 1970s. Yet there was more to *The High Frontier* than simply a long-term vision in reaction to an immediate and perhaps temporary problem. Coming in the wake of Stanford entomologist Paul Ehrlich's sensational and terrifying 1968 book, *The Population Bomb* and at the height of the initial environmentalist movement, O'Neill's work offered a solution for the doomsday fears of both over-population as well as global ecological disaster.<sup>152</sup> O'Neill's vision sought to bring thousands and eventually millions of people into space, but most importantly it included the removal of Earth's polluting heavy industries into space in order to transform and preserve the planet as an ideal, park-like world. *The High Frontier* even emphasized the unifying power of space colonization, an imaginative salve in the midst of the Cold War. Thus, O'Neill's ecologically friendly utopian vision offered readers a panacea to their numerous apocalyptic fears. By 1977, O'Neill founded the Space Studies Institute (SSI) to help bring about the book's vision through public outreach. In an effort to keep funding SSI, O'Neill waded into the private space industry himself in 1983, founding

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<sup>151</sup> Davenport, *The Space Barons*, 68.

<sup>152</sup> P. R. Ehrlich, *The Population Bomb* (New York, NY: Ballantine Books, 1970).

Geostar Corporation. Seeking to build a Radio Determination Satellite Service (RDSS) to provide satellite tracking and later satellite communications technology, O'Neill hoped that his private venture would generate the funds necessary to maintain and grow SSI.<sup>153</sup> Although Geostar struggled, especially in the face of more dominant competitors like QUALCOMM, the company took part in a trend of the period to bring about a more democratized Space Age through private means.<sup>154</sup>

Less than a year earlier, Space Services Inc. of America, a Houston, Texas aerospace startup operating on what the *New York Times*' front page feature characterized as a "shoestring" had fired the world's first privately-funded rocket beyond the Maginot Line and into space.<sup>155</sup> Led by former Mercury 7 and Apollo/Soyuz astronaut Donald K. "Deke" Slayton, Texas businessman David Hannah Jr. and the company's current CEO Charles M. Chafer, Space Services Inc. christened their first successful rocket Conestoga I.<sup>156</sup> The headlines in mid-September of 1982 looked much the same as those in February of 2018 after SpaceX's Falcon Heavy launch. "Rocket thrusts firm into a new space era" read the *Fort Worth Star-Telegram* on the morning of September 12<sup>th</sup>, 1982.<sup>157</sup> "Another giant leap?" asked an editorial in the *Birmingham Post-Herald* three days

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<sup>153</sup> "History," Space Studies Institute.

<sup>154</sup> Geostar Corporation Records: 1983-1991, 2006-0049, Box 1-2, National Air and Space Museum Archives.

<sup>155</sup> Robert Reinhold, "Texas Rocket Built on 'Shoestring' Carries Free Enterprise Into Space," *New York Times*, September 10, 1982, Space Services Inc. of America (SSI) Records 1979-1991, Box 2, Folder 70, Smithsonian National Air and Space Museum Archives.

<sup>156</sup> "The Launch of Conestoga 1," Celestis.

<sup>157</sup> Doug Clarke, "Firm Steps at New Era with Rocket," *Fort Worth Star-Telegram*, September 12, 1982, Analysis sec., Space Services Inc. of America (SSI) Records 1979-1991, Box 2, Folder 70, Smithsonian National Air and Space Museum Archives.

later.<sup>158</sup> “New space age opens” declared the *Sierra Vista, Arizona Herald-Dispatch*.<sup>159</sup> However, the short-lived publicity of the Conestoga I launch and its attributed significance as the first completely privately-funded rocket to reach space far outstripped its technological significance and usefulness, or lack thereof. With an apogee of only 195 miles, the suborbital Conestoga I carried a simple test payload of forty pounds of water and splashed down in the Gulf of Mexico just 321 miles from its launchpad on Matagorda Island a few miles off the coast of Port O’Connor, Texas.<sup>160</sup> By comparison, more than a year earlier NASA’s reusable shuttle program commenced operations with the launch of the Space Shuttle Columbia, considered even decades later as “the most complex machine ever built”<sup>161</sup> Despite that, Space Services’ launch, like the launch of SpaceX’s first Falcon Heavy thirty-five years later, even caught the attention of the President. In a letter to Mr. Hannah, President Reagan remarked that “in blazing a new trail through the skies, you have shown the potential of private enterprise to perform even the most sophisticated technical feats.”<sup>162</sup> Reagan’s well-meaning comment may have missed the mark however. While Conestoga I certainly “blazed a new trail” for private enterprise through the outdated and ill-equipped bureaucratic obstacle course of government regulations, its successful suborbital launch in no way represented “the

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<sup>158</sup> “Another Giant Leap?,” *Birmingham Post-Herald*, September 15, 1982, Editorial sec, Space Services Inc. of America (SSI) Records 1979-1991, Box 2, Folder 70, Smithsonian National Air and Space Museum Archives.

<sup>159</sup> Dick Holland, “New Space Age Opens,” *Sierra Vista, Arizona Herald-Dispatch*, September 10, 1982, Space Services Inc. of America (SSI) Records 1979-1991, Box 2, Folder 70, Smithsonian National Air and Space Museum Archives.

<sup>160</sup> John C. Abell, “Sept. 9, 1982: 3-2-1 ... Liftoff! The First Private Rocket Launch,” *Wired*, June 04, 2017., “Matagorda Island,” Port O’Connor Chamber of Commerce.

<sup>161</sup> “The 21st Century Space Shuttle,” NASA, January 20, 2010.

<sup>162</sup> “The launch of Conestoga 1,” Celestis.

most sophisticated technical feats” of the era. And for most onlookers, for the broader public, the conquering of bureaucratic hinderances hardly stimulated any enthusiasm. Yet for space advocates like Robert O’Neill and his many followers, Space Services Inc. offered a lesson in the potential of private enterprise to make space more accessible than ever before. These early and fizzling efforts of companies like Space Services Inc. and Geostar Corp. presaged the boom in private space ventures that arrived with the 21<sup>st</sup> century.

Just months before the launch of Conestoga I, high school valedictorian Jeff Bezos’ graduation speech precisely echoed O’Neill’s vision. A follower of O’Neill, Bezos described plans to colonize space, bring millions into the cosmos and rescue Earth from humanity’s dirty industrialism and excessive population growth.<sup>163</sup> In the fall of that year, Bezos attended Princeton where O’Neill still taught. A regular at O’Neill’s lectures, Bezos also joined the SEDS’s Princeton chapter and even became the chapter’s president – all thanks to Peter Diamandis’ efforts to promote the student group beyond the campus of MIT. Many years later in 2014, Bezos gifted what he called the Heinlein Prize, a \$250,000 donation to SEDS.<sup>164</sup> His experience in the organization coupled with his direct exposure to O’Neill had a powerful impact on Bezos’ life-long vision for the future of the Space Age.

When in 2018 *Wired Magazine*’s Steven Levy approached Bezos seeking to interview him and discuss his secretive space company, Bezos agreed, but on the condition that Levy first watch PBS’s 1975 roundtable discussion between Robert

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<sup>163</sup> Davenport, *The Space Barons*, 67.

<sup>164</sup> “Jeff Bezos to Donate \$250K Heinlein Prize to SEDS Student Space Leaders Organization,” SEDS USA, September 15, 2015.

O'Neill and Isaac Asimov. In the black and white PBS special and with Asimov's support, O'Neill articulated his plans for the colonization of space as detailed in *The High Frontier* before a live audience and with the aid of large artist renderings depicting his vision. During the discussion, O'Neill made it clear that his vision did not include colonizing planets like Mars. He reasoned that constructing enclosed living habitats on the surface of an alien planet made little sense. Contending with the force of gravity made constructing surface habitats far more difficult than building space stations. Beyond that, any surface-bound structure had to be very small in comparison to the grand floating cylinders he advocated for. When asked by the program's host Harold Hayes if among his 158 science fiction works Asimov anticipated anything like O'Neill's proposals, Asimov answered saying, "Nobody did really because we've all been planet chauvinists. We've all believed people should live on the surface of a planet, of a world."<sup>165</sup> Hayes then asked O'Neill directly how then he had gotten the idea. O'Neill responded recalling his teaching of a large freshman physics course in 1969 and his efforts to inspire the best students in the class by holding a seminar on the future of space exploration. Claiming that, "Almost by chance and I really can't tell you where it came, I picked the notion – Is it possible to build a habit in space which would have some advantages going with it? We started working on that notion and the seminar never got to any other."<sup>166</sup> Although his vision had a distinct flare of originality, O'Neill's cylinders depended on centripetal acceleration, a notion likely derived from the legacy of von Braun and his predecessors.

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<sup>165</sup> Matt Weinberger, "Here's the Long-lost 1975 TV Episode That Jeff Bezos Makes People Watch to Understand What His Space Company Is All about," *Business Insider*, October 15, 2018., "The Roundtable TV Interview," YouTube video, 49:55, posted by SSI: Space Studies Institute, filmed [1975], posted [May 2018], 11:00.

<sup>166</sup> "The Roundtable TV Interview," 13:00.

And like much of the rest of the discourse, O'Neill's techno-utopian vision also sought to address the fears of the era in which they were conceived. For the 1970s, over-population, energy shortages and ecological catastrophe comprised the most popular concerns. Thus O'Neill's contribution shared in the discourse's traditional themes, albeit with a new spin.

As an O'Neillian disciple, Bezos graduated from Princeton in 1986 and then worked on Wall Street until founding Amazon in 1994. By 1997, Bezos had become a millionaire. By 1999, he was a billionaire.<sup>167</sup> The founding of Blue Origin in 2000, in hindsight an almost predictable result of Bezos' rapidly acquired wealth and life-long immersion in the discourse of the Space Age, began the long process of turning his extensive vision into a reality. Like Paul Allen and Richard Branson, Bezos recognized the necessity of reusable rockets in order to reduce the cost of reaching space. Yet unlike Allen and Branson, Bezos used his enormous and ever-growing wealth to purchase large swaths of Texas acreage so he could safely and secretly develop vertical take-off and landing propulsion systems featuring powerful, liquid-fueled rockets designed entirely in-house.<sup>168</sup> A famously mysterious company, Bezos managed to keep Blue Origin relatively quiet for years, funding the company with one billion-dollar annual investments out of his own pocket.<sup>169</sup> By the last week of November, 2015, Blue Origin finally fired off and successfully landed its first, small, completely reusable rocket booster – New

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<sup>167</sup> Kathleen Elkins, "The Age When 17 Self-Made Billionaires Earned Their First Million," *Inc.com*, February 11, 2016.

<sup>168</sup> Davenport, "A Silly Way to Die," in *The Space Barons*, 11-26.

<sup>169</sup> Prachi Bhardwaj, "Jeff Bezos Says He Liquidates a Whopping \$1 Billion of Amazon Stock Every Year to Pay for His Rocket Company, Blue Origin," *Business Insider*, April 25, 2018.

Shepard 2. Appropriately named after Alan Shepard, the first American to reach suborbital space, New Shepard 2 flew to an altitude of just over 100 km – barely over the Kármán Line – before falling back to the dry scrubland of West Texas. Upon its descent, New Shepard 2 refired its single BE-3 engine as well as extended its eight large drag brakes to rapidly slow its fall. Before reaching the ground, New Shepard 2 deployed its retractable landing gear, four legs extending out and below the base of the booster.<sup>170</sup> Just minutes after reaching space, New Shepard 2 had returned in tact to the surface of the Earth. Less than four years later on January 23<sup>rd</sup>, 2019, Blue Origin relaunched the New Shepard vehicle for its tenth flight. This time, the booster carried Blue Origin’s slick new six seat crew capsule loaded with an experiment from the University of Central Florida designed to analyze the behavior of dust particles in space along with a number of NASA-sponsored payloads. Just one month prior, UCF’s payload had also ridden on Virgin Galactic’s first crewed flight of SpaceShipTwo, the next generation successor to the Ansari X Prize winner of more than a decade ago. Blue Origin and Virgin Galactic are now in a race to bring the first tourists of a new era into space. Yet despite the excitement of competition finally heating up between the two companies, another pioneer of the new private space industry has been stealing the show.

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<sup>170</sup> “New Shepard,” Blue Origin.

## CHAPTER FIVE

## MANUFACTURING THE FUTURE

Elon Musk's SpaceX, short for Space Exploration Technologies Corp. – arguably the most advanced space company of the new private era – has been cleverly playing into the Space Age discourse's other dominant vision for years – the colonization of Mars. The first company to send a privately funded liquid-fueled rocket into orbit in 2008, SpaceX has gone on to develop a rapidly growing cult-like following in conjunction with a reusable orbital rocket that stands apart from the rest of the space industry – the Falcon 9. Infused with its founder and CEO Elon Musk's own personality, marketing genius as well as his personal vision of Martian colonization derived from one of the most popular and long-enduring legacies of the Space Age discourse, SpaceX has tapped into the culture of the Space Age like no other company in the history of the industry.

Born in Praetoria, South Africa in 1971, Elon Musk arrived too late to have witnessed Apollo 11. Just one year old when NASA's final mission to the Moon returned home, Musk grew up in a different time and a different place than Paul Allen, Richard Branson, Peter Diamandis and Jeff Bezos. A tough childhood fraught with bullying coupled with an emotionally abusive father, the experiences of Musk's youth contrast starkly with the privileged upbringings of Bezos, Allen, and Diamandis. As the youngest and smallest at Bryanston High School in Sandton, South Africa, Musk was also an awkward and introverted boy, an easy target for bullying. Once pushed down a flight of

concrete stairs by a group of schoolboys that subsequently beat him until he blacked out and needed to be taken to a hospital, Musk endured a lonely, painful childhood.<sup>171</sup>

Finding solace in computers, science fiction and eventually business, Musk first engaged with the discourse of the Space Age not as a happy, NASA-inspired young boy, but as a struggling kid lacking a sense of identity and desperate for an escape. In discussing Musk's identity struggles, *Esquire's* Tom Junod wrote, "He grew up in South Africa without ever really considering himself South African."<sup>172</sup> After searching in vain at age fourteen for answers from philosophers like Nietzsche and Schopenhauer, Musk turned to science fiction.<sup>173</sup>

His discovery of and long-lasting love for Douglas Adams' 1978 tale, *The Hitchhiker's Guide to the Galaxy* reflected Musk's own sense of alienation, lack of identity and teenage existential angst. The story's protagonist Arthur Dent realizes that the planet he lives on is about to be destroyed by aliens intent on building a new intergalactic highway, so Dent hitches a ride into space only to be abandoned mid-trip somewhere in the Milky Way Galaxy.<sup>174</sup> Dent's struggles to find the meaning of life resonated deeply with a young Elon Musk.<sup>175</sup> Soon he was spending more than ten hours a day devouring popular books in the genre. "I was raised by books. Books, and then my

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<sup>171</sup> Heather Peirce, "As a Child Elon Musk Was Bullied so Severely He Once Had to Be Hospitalized Because of a Beating from Other Students," *Upriser*.

<sup>172</sup> Peirce, "As a Child Elon Must Was Bullied."

<sup>173</sup> Marguerite Ward, "Elon Musk Says Reading This Science-fiction Classic Changed His Life," *CNBC*, June 06, 2017.

<sup>174</sup> Douglas Adams, *The Hitchhiker's Guide to the Galaxy* (New York, NY: Del Rey, [1978] 2017).

<sup>175</sup> Ward, "Elon Musk Says Reading This Science-fiction Classic Changed His Life."

parents,” Musk told *Rolling Stone*.<sup>176</sup> Beyond Douglas Adams’ work, Musk also discovered Isaac Asimov’s *Foundation* series as well as Robert Heinlein’s range of texts among many other works. In discussing the *Foundation* series with *Rolling Stone* in 2017, Musk explained, “The lesson I drew from that is you should try to take the set of actions that are likely to prolong civilization, minimize the probability of a dark age and reduce the length of a dark age if there is one.”<sup>177</sup> The apocalyptic fears and utopian dreams of Space Age science fiction left a deep set of impressions on Musk. Years later, the powerful influence of these texts reappeared in the extensive range of science fiction references suffused into SpaceX’s naming schemes, marketing techniques and long-term plans to colonize Mars.

Through a series of moves after graduating high school, Elon Musk eventually found his way to Stanford University by the mid-1990s. Although pursuing a PhD in energy physics, he soon dropped out to launch his first company, Zip2 Corporation in the midst of the internet boom. Departing from the company in 1999 with \$22 million in his pocket, Musk went on to found X.com which merged with Confinity to create PayPal.<sup>178</sup> Near the end of 2002, eBay purchased PayPal, transforming his initial \$10 million seed investment into a \$165 million fortune.<sup>179</sup> Yet one year prior, Musk had already begun exploring notions of Mars colonization with a project he called Mars Oasis. With Mars Oasis, Musk imagined landing a small greenhouse for growing food crops on the Red

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<sup>176</sup> Zameena Mejia and Marguerite Ward, “Billionaire Elon Musk Says He Was ‘raised by Books’ and Credits His Success to These 8,” *CNBC*, November 16, 2017.

<sup>177</sup> Neil Strauss, “Elon Musk: The Architect of Tomorrow,” *Rolling Stone*, June 25, 2018.

<sup>178</sup> David S. Kidder, *The Startup Playbook: Secrets of the Fastest-Growing Startups From Their Founding Entrepreneurs* (San Francisco, CA: Chronicle Books, 2013).

<sup>179</sup> Securities and Exchange Commission, “Securities and Exchange Commission: Form 10-K: PayPal, Inc,” (Washington DC: Annual Report, 2001).

Planet, complete with images beamed back to Earth that depicted humanity's first step in terraforming a second home. Yet in his efforts to find a cheap launch vehicle to deliver a greenhouse to Mars for \$30 million or less, Musk quickly learned that the industry – hindered by non-competitive cost-plus government contracts and networks of launch contractors and subcontractors prioritizing profits over visions – had kept space travel prohibitively expensive and stuck in the past.<sup>180</sup> Born from his frustrations with the industry coupled with his dreams of terraforming Mars – a notion bolstered by a post-Apollo legacy of science fiction inspired by the many unmanned NASA missions to the planet beginning with Viking 1 and 2 and especially continuing throughout the 1990s and 2000s – Musk founded SpaceX in May of 2002.

Yet as a polyglot quickly becoming known for his enigmatic genius, Musk also founded Tesla Motors just one year later. The vision of Tesla, an electric car company that premiered its first model the Roadster in 2008, sought to transform the auto-industry by replacing the internal combustion engine and its fossil-fuel infrastructure with a closed system of solar power, batteries, a super-charging network across the world, and electric vehicles with no harmful emissions consequences.<sup>181</sup> While SpaceX sought to bring people to Mars in order to create a whole new world, Tesla sought to fix one of the dominant problems still persisting on Earth – the harmful emitting of carbon dioxide and other pollutants. The two companies individually address the post-Apollo discourse's two dominant visions – one concerning Earth's environmental fragility and the other concerning humanity's spread to Mars. Musk's two companies – later complimented by

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<sup>180</sup> Davenport, *The Space Barons*, 39.

<sup>181</sup> "About Tesla: Tesla's mission is to accelerate the world's transition to sustainable energy," Tesla, Inc.

Solar City, The Boring Company, and Musk’s secretive Neuralink that seeks to develop “high bandwidth and safe brain-machine interfaces” – provided the foundations for a technological revolution intimately inspired by science fiction and most especially the discourse of the Space Age.<sup>182</sup> Musk himself has also articulated the fears and dreams inherent in both visions as well as his goals for both Tesla and SpaceX many times. In a 2014 blog post explaining Tesla’s decision to release its electric car patents into the public domain, Musk explained that, “Tesla Motors was created to accelerate the advent of sustainable transport. [...] We believe that Tesla, other companies making electric cars, and the world would all benefit from a common, rapidly-evolving technology platform.”<sup>183</sup> In October of 2018, Musk also tweeted about Tesla’s purpose writing, “Tesla exists to help reduce risk of catastrophic climate change, which affects all species on Earth. Even if your faith in humanity is faltering, this is worth caring about.”<sup>184</sup> Similarly Musk has explained SpaceX as both in service to the vision of Mars colonization as well as an answer to a variety of compelling apocalyptic fears. At the South by Southwest Film Festival in March of 2018, Musk explained that, “It’s important to get a self-sustaining base on Mars because it’s far enough away from earth that [in the event of a war] it’s more likely to survive than a Moon base.” Musk further elaborated that, “If there’s a third world war we want to make sure there’s enough of a seed of human civilization somewhere else to bring it back and shorten the length of the dark ages.”<sup>185</sup> At other times, Musk has described the risks posed by incoming asteroids as

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<sup>182</sup> “Neuralink,” Neuralink.

<sup>183</sup> Elon Musk, “All Our Patent Are Belong To You,” Tesla, Inc., August 19, 2014.

<sup>184</sup> Elon Musk, Twitter Post, October 12, 2018, 11:03 am.

<sup>185</sup> Olivia Solon, “Elon Musk: We Must Colonise Mars to Preserve Our Species in a Third World War,” *The Guardian*, March 11, 2018.

well as climate change to a single-planet species as his reasoning for SpaceX's Mars colonization goals. At the 67<sup>th</sup> annual International Astronautical Congress in September of 2016, Musk explained that, "I really think there are two fundamental paths [for humans]: One path is we stay on Earth forever, and some eventual extinction event wipes us out. [...] The alternative is, become a spacefaring and multi-planetary species."<sup>186</sup> Thus the goals of both Tesla and SpaceX play into the Space Age discourse's most popular apocalyptic fears as well as offer society solutions with long-term techno-utopian implications quintessential to the Space Age discourse. Yet while SpaceX's vision has remained constant since the company's conception, its role in the space industry has greatly expanded since its first successful orbital launch.

In 2008, after several failed attempts, SpaceX launched its first orbital rocket, the two-stage Falcon 1. Deriving its name from *Star Wars*' famous *Millennium Falcon*, the Falcon name became the first of countless science fiction references SpaceX played upon to garner public enthusiasm.<sup>187</sup> The casual and at times humorous naming scheme SpaceX employed marked a significant departure from the serious, mythologically inspired tone of competitors like ULA, Orbital Sciences Corp. and NASA that had been using names like Delta, Saturn, Pegasus, Minotaur and others since the days of the 1950's Jupiter ICBMs. Outside of SpaceX, only NASA's Space Shuttle Enterprise had taken on a name inspired by science fiction. NASA originally intended to name the shuttle Constitution, but before its 1976 debut, a letter-writing campaign to the White House

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<sup>186</sup> Nick Stockton, "Elon Musk Announces His Plan to Colonize Mars and Save Us All." *Wired*, June 03, 2017.

<sup>187</sup> Alasdair Wilkins, "How Elon Musk Names His Inventions," *Inverse*, September 1, 2017.

from *Star Trek* fans convinced then President Gerald Ford to direct NASA to rename the shuttle Enterprise. Although Ford never explicitly acknowledged the letter writing campaign, the tens of thousands if not hundreds of thousands of letters he received likely influenced him to tell then NASA Administrator James Fletcher, “You know, I’m a little partial to the name Enterprise.” Since the starships in “Star Trek” were supposedly named after famous space shuttles of the past, Ford’s decision to name the new shuttle Enterprise paradoxically blurred the lines between science fiction and reality. At the September 17, 1976 unveiling of the Enterprise at Rockwell’s Palmdale, California facility, most of the *Star Trek* cast as well as its creator, Gene Roddenberry made appearances as honored guests.<sup>188</sup> Only decades later did a private company, SpaceX, finally recognize the publicity potential of intermingling Space Age science fiction with real technological development.

During and after the Falcon 1 program, SpaceX was already in the midst of developing its first Falcon 9, a project bolstered after NASA awarded the company along with Orbital Sciences Corp. a shared \$500 million contract under the Commercial Orbital Transportation Services (COTS) program. Designed to fund new commercial launchers that could eventually deliver cargo to the International Space Station (ISS), COTS set SpaceX on a track for success that transformed the space industry.<sup>189</sup>

Like Burt Rutan, Paul Allen, Richard Branson and Jeff Bezos, Elon Musk also understood the necessity of developing a reusable launch vehicle in order to drive down the cost of reaching space. First flown in 2010 using SpaceX’s own Merlin engines, by

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<sup>188</sup> Miss Cellania, “Enterprise: The First Space Shuttle,” *Mental Floss*, July 5, 2011.

<sup>189</sup> Tim Fernholz, *Rocket Billionaires: Elon Musk, Jeff Bezos, and the New Space Race* (New York, NY: Houghton Mifflin Harcourt Trade & Reference Publishers, 2018), 103.

2015 SpaceX had already succeeded in relanding the Falcon 9 after many failed attempts. By then, SpaceX had begun livestreaming its launches on YouTube, the first company to do so. The ability for audiences to tune in to SpaceX's broadcast directly rather than observing it through the coverage of the news media as has been the case for most of the Space Age provided audiences a more intimate sense of connection with the company. While ULA and even Bezos' secretive Blue Origin eventually followed suit, only SpaceX's livestreamed launches are complimented by boisterous fans roaring with enthusiasm. The impact of the cheering crowd draws in viewers like nothing else can. Additionally, SpaceX's infusion of pop culture references seeks to resonate with the broader public in ways no other space company or agency has attempted before. By 2018, SpaceX perfected this technique with the debut its new Falcon Heavy, its largest rocket yet.

The 2018 Falcon Heavy premier launch appeared to offer something entirely new in the history of spaceflight. Frequently described afterwards as a stroke of marketing genius, the launch seemed to signal a bold consumerist entrance into space that shamelessly advertised SpaceX, Tesla, and even the cult of Elon Musk. Its infused literary references played upon the fantasies of science-fiction fans in overt and even humorous ways unlike any prior space endeavor. Its exceedingly complex sequence of engine ignitions, decouplings and booster landings streamed live on YouTube evidenced SpaceX's willingness to take on significant technical and PR risks, a marked departure from the conservative, risk-averse strategies of older aerospace companies like Orbital Sciences Corp. (later Orbital ATK before its purchase by Northrop Grumman in 2018)

and Boeing and Lockheed's United Launch Alliance (ULA).<sup>190</sup> Viewed by a far greater share of the public than any other launch in decades, to many non-space fanatics the event also appeared as a significant technological advance in the aerospace industry.

Yet while certainly the details and particularities of the Falcon Heavy launch, its bizarre payload of Elon Musk's own 2008 Tesla Roaster, its marketing hype and the breadth of its public outreach appeared to mark a significant turning-point in the development of space exploration, the launch's technologies, resource funding and signaling strategies were still built upon and worked within the economic, technical and ideological constraints of a long-enduring, deterministic vision insistent on a future that envisioned humanity on Mars.

The sensational response to the launch of the first Falcon Heavy highlighted a curious and much overlooked phenomenon within the history of the space industry. While the media characterized the event as a paradigm shift, a practical analysis of the Falcon Heavy tells a different story. When considering the historical development as well as future plans of SpaceX, Falcon Heavy appeared more as a near-final iteration within SpaceX's current paradigm rather than the debut of some new era. Clearly the company's ongoing development of its next generation rocket – Starship (in reference to *Star Trek's* numerous spaceships) – that promises to bring the first humans to Mars represents the company's true paradigm shift still in the making. Thus, a closer look at the Falcon Heavy's lack of technological significance as well as the outsized publicity it achieved compared to its other launches sheds light on the disconnect between real, practical

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<sup>190</sup> "Northrop Grumman Completes Orbital ATK Acquisition, Blake Larson Elected to Lead New Innovation Systems Sector," Northrop Grumman Newsroom. June 6, 2018.

technological achievements and those elements of technospectacles that resonate with the public's preconceived notions about how the future *should* look.

Built upon the architecture of SpaceX's main workhorse – the Falcon 9 – the Falcon Heavy is essentially three Falcon 9s strapped together. Thus, in order to understand the Falcon Heavy, one must first consider the Falcon 9. A two-stage rocket first successfully launched in 2010, the Falcon 9's first stage uses nine SpaceX designed Merlin engines running on a mixture of LOX and RP-1 to boost more than 50,000 lbs of payload weight to LEO.<sup>191</sup> After booster separation, the second stage's single vacuum-rated Merlin engine places the vehicle's payload into the desired orbit while the first stage booster plummets back to earth. Unique to SpaceX, the falling booster reignites three of its engines to slow its descent in order to land itself either back near the launch site or upon a waiting drone ship at sea. At just \$62 million per launch, the Falcon 9's \$1,233 per pound to LEO price tag has massively disrupted the launch industry and in technical and economic terms certainly represents a paradigm shift in space launch affordability.

While the Falcon 9's competitiveness has made waves within the space industry, to the broader public the Falcon 9's fame derives from its spectacular booster landings. A techno-spectacle first accomplished in December of 2015, Falcon 9 booster landings have become almost routine. Since its first successful landing, SpaceX has completed more than 30 subsequent Falcon 9 landings. Yet only in May of 2018 did SpaceX finally launch and land a Falcon 9 booster using a Block 5 Merlin engine.

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<sup>191</sup> "Falcon 9," SpaceX, November 16, 2012.

Block 5 Merlin engines had been the ultimate goal of SpaceX's Merlin program all along. Predecessors of the Block 5 served more as proof-of-concept prototypes rather than final iterations. Before Block 5, engines as well as the boosters that housed them required time-consuming and expensive periods of refurbishment between flights. Despite that, these earlier Merlin versions served SpaceX's purposes to conduct extensive testing upon engines that were cheaper to produce than their eventual Block 5 replacements. Thus, although necessary for the development of Block 5, SpaceX had yet to significantly capitalize on the money-saving benefits of rocket reusability until Block 5's maiden voyage on May 11<sup>th</sup>, 2018, more than three months after the Falcon Heavy's first flight using now obsolete Block 4 Merlins.

Unlike their predecessors, Block 5 Merlin engines can reflly up to ten times before needing any refurbishment. According to Musk during the first Falcon 9 Block 5's post-launch press conference, a Block 5 first stage should have the ability to fly 100 times throughout its lifetime. Musk also explained that the Block 5's composite overwrapped pressure vessel (COPV) had a burst pressure of "more than twice what they are actually loaded to on the pad."<sup>192</sup> By ensuring that the COPVs of Block 5s were overengineered, SpaceX could offer NASA one of the safest and most reliable launch systems on the market, a talking point of utmost importance for a government agency dependent on public and congressional support and intent on finding US commercial partners to transport astronauts to and from the International Space Station for the first time since the Space Shuttle program's conclusion in 2011.

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<sup>192</sup> Caleb Henry, "Musk Details Block 5 Improvements to Falcon 9," *SpaceNews.com*, May 25, 2018.

Until December of 2018, no Falcon 9 had reflown more than twice. But on the morning of December 3<sup>rd</sup>, SpaceX's Falcon 9 Block 5, the same vehicle that had first flown on May 11<sup>th</sup> and again in August of that year, flew for the third time. In technical terms, this third launch represented one of the most significant achievements in the history of rocketry. SpaceX's enormous R&D expenditures on Merlin development were finally vindicated. Yet for the broader public and much of the media, this true paradigm shifting moment garnered relatively little attention. Even space industry year-in-review articles published at the end of 2018 overlooked SpaceX's Falcon 9 Block 5 achievement. For instance, *Space.com*'s December 26<sup>th</sup>, 2018 article entitled "The Greatest Spaceflight Stories of 2018!" never mentioned the Falcon 9 Block 5, yet the article's featured image depicted Starman, SpaceX's mascot-like mannequin astronaut inside Musk's red Tesla Roadster set against the background of the Earth, a now famous photograph from the February launch of the first Falcon Heavy.<sup>193</sup>

Comparing the Falcon 9 Block 5's technological significance and lack of publicity with the Falcon Heavy's technological insignificance and sensational publicity illustrates a clear paradox as well as an axiom: technological significance alone does not generate public enthusiasm. So what *does* generate public enthusiasm? What about the first Falcon Heavy launch enthused the public and the media so much?

While the Falcon Heavy offered audiences a complex and entertaining technospectacle, it also expressed an aspirational vision in ways no other launch has. Through a well-choreographed livestream broadcast that showcased the simultaneous ignition of

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<sup>193</sup> Elizabeth Howell, "The Greatest Spaceflight Stories of 2018!," *Space.com*, December 26, 2018.

Falcon Heavy's twenty-seven Merlin engines, the decoupling of the vehicles' two side-boosters, the decoupling of the center-core booster from the vehicle's second stage, the ignition of the second-stage's single vacuum-rated Merlin engine, a spectacular fairing separation that unveiled the rocket's bizarre and awe-inspiring payload, the return and synchronized landings of the rocket's two side boosters back on the Florida mainland, the attempted landing of the center core on a drone ship in the ocean (although this aspect of the launch was unsuccessful), as well as the rocket's overall trajectory – one that traveled fast enough to escape Earth's gravity and in the direction of Mars – the first Falcon Heavy launch offered viewers plenty of action and entertainment. But the event contained more than simply an alluring, viral techno-spectacle. The first Falcon Heavy directly and consciously engaged with the discourse of the Space Age and in doing so, deeply resonated with the public's technological dreams in ways no prior private launch had.

Through its suffusion of references relevant both in pop culture as well as to Space Age science fiction's oldest and most popular aspiration, the launch expressed SpaceX's vision to bring humans into space and eventually to Mars to settle humanity's second home. Watched live by millions both on the ground at Cape Canaveral and online via SpaceX's own livestream complete with enthusiastic narration and a roaring crowd, the first pop culture homages appeared just before the vehicle's fairing separation, only three minutes and forty-five seconds after take-off.<sup>194</sup> Moments before sunlight poured in to unveil Musk's red Tesla Roadster strapped to the front of the vehicle's second stage, the first abrupt chorus notes of David Bowie's rock song "Life On Mars?" played for

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<sup>194</sup> SpaceX. "Falcon Heavy Test Flight," YouTube video, 34:18, posted by "SpaceX," February 6, 2018, 25:45.

viewers both at the Cape and watching by livestream. Having passed away two years prior, the use of Bowie's beloved science fiction song struck a chord with a wide range of viewers. As the onboard camera streaming back to YouTube adjusted to the sunlight, a view of Starman in Musk's Tesla framed perfectly before a deep blue curving Earth and set against the blackness of space dramatically emerged. Even the name "Starman" also derived from Bowie's song of the same name, an additional tribute to the late musician's legacy. The crowd's cheers, louder than ever amid David Bowie's singing sounded more like the climax of a rock concert than a rocket launch. The livestream then flashed to a new camera angle taken from the hood of the car displaying Starman through the windshield with the sparkling Atlantic Ocean far below. An almost familiar and relatable scene were it not for Starman in the drivers' seat and the Earth seen from space in the background, the effect offered viewers a picture that merged a familiar object of their everyday reality, the car, with the techno-environment of the Space Age. Moments later and just four minutes and seventeen seconds into flight, the camera angle changed again. This time viewers could peer over Starman's shoulder into the roadster's carbon-fiber trimmed cockpit, again an almost familiar view were it not for the car's extreme setting. The center console's screen displayed a comical message for all to see reading, "DON'T PANIC!" – a reference to the cover of the guide in Douglas Adams' story *The Hitchhiker's Guide to the Galaxy*.<sup>195</sup> Also on the dashboard, the tiny red Mattel Hot Wheels replica of the Tesla Roadster, a rare special edition first released in stores in 2016, similarly sported an equally miniature Starman at the wheel. One of Hot Wheels'

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<sup>195</sup> Neil Gaiman, *Don't Panic: Douglas Adams & The Hitchhiker's Guide to the Galaxy* (New York, NY: Open Road Media Sci-Fi & Fantasy, 2018) 4.

“Super Secret Treasure Hunt” series – a program introduced in 1995 to produce limited runs of rarer interior and exterior color combination variants for certain models in a marketing effort to garner more collector interest – SpaceX made sure to include the rarer version which also more closely resembled the “midnight cherry” paintjob of the real car in which it was placed. Although retailing at just \$1.09 originally, in the days after the launch of Falcon Heavy eBay listings of the “Super Secret” version of the car were exceeding \$100 asking prices.<sup>196</sup> Although not a science fiction reference, in describing the decision to include the Hot Wheels car during the post-launch press conference, Elon Musk explained, “I mean, it’s kind of silly and fun, [...] silly and fun things are important. [...] And I think that just the imagery of it is something that’s going to get people excited around the world.”<sup>197</sup> As with Bowie’s music, the inclusion of the Hot Wheels model gave viewers an additional foothold of familiarity, relatability, and casualness that stands in stark contrast to the typically serious tone of the space industry.

After the livestream of Falcon Heavy had switched between different views of the Roadster, the view from space was momentarily replaced with a mass of people, fists raised, cheering inside the Kennedy Space Center and beaming into the camera. Seconds later, a new pair of commentators began narrating the livestream as four separate camera views split the screen. The top left box showed an onboard view of the center core’s first stage as it plummeted back to earth while the top right box continued displaying the second-stage’s glowing Merlin engine still accelerating Starman and the Tesla Roadster

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<sup>196</sup> “Elon Musk’s Roadster Launch Sparks Sales of Hot Wheels Toy Tesla,” CollectSPACE.com, February 12, 2018.

<sup>197</sup> Chris DeArmond, “Full Transcript: SpaceX Falcon Heavy Test Flight News Conference,” Expedited Transcripts, March 02, 2018.

deeper into space. The bottom two boxes offered onboard views of the two first stage boosters as they began orienting themselves through a rapid but controlled descent. The spectacle was not over. At T-plus six minutes and forty seconds, with Starman and the sportscar now traveling at more than 10,000 miles per hour, the two boosters could be seen reigniting. Once again, the energy of the crowd reignited with them. Moments later the center core's first stage also reignited as it descended towards a drone ship named "Of Course I Still Love You" waiting off the Florida coast. The unusual name of the drone ship – as well as its twin ship in the Pacific, "Just Read the Instructions" – was imprinted in bold text on the ship's landing pad alongside a stylized X taken from the company's logo and used to "mark the spot." The odd names referenced science fiction writer Lain M. Banks' *Culture* series, a collection of novels taking place in a post-scarcity world long after the technological singularity had already occurred.<sup>198</sup> A portrayal of a utopian future world that appeared to merge the visions of Robert O'Neill and those of Ray Kurzweil, hyper-advanced Artificial Intelligence machines called "the Minds" oversee society yet struggle with the dilemma of managing civilizations that to the AIs often seem more like problems needing extermination rather than precious things worth protecting.<sup>199</sup> SpaceX's drone ships' names come specifically from the series' 1988 novel, *The Player of Games* in which Gurgeh, the book's protagonist encounters a pair of AI ships also named Of Course I Still Love You and Just Read the Instructions. Turning to the ships' friend Chamlis, Gurgeh asks, "They're not warships?" Chamlis responds saying, "With names like that? They're [General Contact Units, a type of ship for exploration and

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<sup>198</sup> Iain Banks, *The Player of Games* (London: Orbit, 2013).

<sup>199</sup> Mordicai Knode, "Iain M. Banks' Culture Spits in the Eye of Nihilism," *Tor.com*, December 15, 2014.

communication], what else?”<sup>200</sup> This obscure reference offered viewers of the Falcon Heavy launch as well as other SpaceX launches yet another set of Space Age homages unique in the industry.

The two boosters’ and center core’s reentry burns were brief, slowing their descents as they fell through the atmosphere. The shape of Cape Canaveral grew rapidly in the background of the two booster’s onboard cameras as their newly deployed waffle shaped fins guided them downwards. At T-plus seven minutes and forty seconds, the pair of boosters slowed below the speed of sound as the top left camera switched to a ground-based view of a broad landing pad. The crowd now began chanting “GO! GO! GO! GO!” Moments later, the landing burn commenced with the reignition once again of each booster’s engines. With the ground approaching at a frighteningly rapid pace, the chant crescendoed into a general roar louder than ever. Suddenly, majestically, spectacularly, both boosters appeared in the top left camera view descending towards their twin landing pads. With near-perfect synchronicity their sets of three landing legs each smoothly deployed, extending below the bottom of the rocket nozzles towards the ground. The top left camera view expanded to show livestreamers a full screen view of the boosters, engines blasting, slowing hypnotically towards the centers of their respective pads. At T-plus eight minutes and eight seconds, both boosters landed simultaneously and powered down their engines. “And the Falcons have landed!” announced one of the commentators. “Wow!” the other commentator could be heard saying. Often considered one of the most visually stunning elements of the Falcon Heavy launch, various media outlets

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<sup>200</sup> Neel V. Patel, “How the SpaceX Droneships Got Their Sci-Fi Names,” *Inverse*, June 23, 2017.

consistently referred to the image of the twin landing as “straight out of science fiction.”<sup>201</sup> While SpaceX had not specifically intended to make sure the boosters landed at the same time, with their identical return trajectories, their simultaneous decouplings, boost-back engine firings and retrograde burns on decent, the result universally awed audiences. The twin booster landing epitomized a successful techno-spectacle, one that gave viewers a sense of science fiction’s merger with reality.

Beyond what could be gleaned from the launch’s livestream, one final addition to the Falcon Heavy payload that the media mostly overlooked further demonstrates SpaceX’s intermingling of its own decisions with the visions of the Space Age discourse. Along with an engraving in the Tesla Roadster’s circuit board reading, “made on Earth by humans” – a message to everyone and to no one in particular – SpaceX also placed a tiny quartz disc drive inside the Tesla. Developed by Peter Kazansky’s team at the University of Southampton, the 3.75 inch diameter disc called “the Arch” utilized 5D optical storage techniques that can achieve a theoretical maximum storage capacity of 360 terabytes. More importantly, because the drive’s quartz silica structure can withstand the cosmic radiation of space without degrading, the uploaded data will continue to be readable for at least the next fourteen billion years. Despite its immense storage capacity, the Arch held only one set of items, Isaac Asimov’s *Foundation* trilogy. As a nod to the series’ impact on Musk, the inclusion of Asimov’s *Foundation* trilogy also begins to make real the trilogy’s notion of an “Encyclopedia Galactica,” a compendium of all

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<sup>201</sup> Alan Yuhas and Richard Luscombe, “Falcon Heavy, World’s Most Powerful Rocket, Launches – as It Happened,” *The Guardian*, February 06, 2018., Danny Paez, “Watch All 21 of SpaceX’s 2018 Rocket Launches in This Beastly Supercut,” *Inverse*, January 6, 2019.

knowledge gathered by a civilization spanning an entire galaxy.<sup>202</sup> Only the first step of the Arch Mission Foundation's overall plan, the foundation's broader vision looks somewhat similar to Asimov's *Encyclopedia Galactica*. The Arch Mission Foundation sees future Archs as "backups" containing the entirety of human knowledge. The foundation hopes to send a number of these "backups" to different locations in space, "preserving the knowledge and biology of our planet in a solar system wide project called The Billion Year Archive."<sup>203</sup> If some day one of the Space Age discourse' apocalyptic scenarios becomes a reality, at least the Archs in space will preserve the knowledge that would otherwise be eternally lost. With SpaceX's February 21<sup>st</sup>, 2019 Falcon 9 launch of Israeli organization SpaceIL's Beresheet lunar lander, a second Arch drive hitched a ride to the Moon's surface. This second Arch drive holds more than thirty million pages of information representing the "building blocks of human civilization."<sup>204</sup> Thus SpaceX continues to support the Arch Foundation's mission and in doing so is turning Asimov's imaginative *Encyclopedia Galactica* into a reality.

Hailed by media outlets around the world as a paradigm shift in the space industry, precisely how Falcon Heavy's launch shifted anything besides the public's increased interest in SpaceX and space exploration in general was never fully explained by journalists, but a careful analysis of the discourse of the Space Age's enduring power to directly shape the space industry offers an answer. The Falcon Heavy seemed like a paradigm shift because it sought to consciously respond to the discourse from which it

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<sup>202</sup> Darrell Etherington, "The Special Data Device SpaceX's Falcon Heavy Sent to Orbit Is Just the Start," *TechCrunch*, February 09, 2018.

<sup>203</sup> "Our Vision," Arch Mission Foundation.

<sup>204</sup> Callum Paton, "First Israeli Spacecraft to Moon Had Secret Mission," *Newsweek*, January 3, 2019.

emerged – something never attempted before. In doing so, the clever homages onboard Starman’s cosmic Tesla Roadster resonated with the public in ways no prior private space launch ever had. Reminiscent of NASA’s pair of spacecraft launched in 1977 that famously included golden records containing music, sounds, greetings in many languages along with pictures and even a cosmic roadmap for reaching Earth as well as simple diagrams representing the human form, Falcon Heavy shared a loose kinship with Voyager 1 and 2. Yet unlike the Voyager missions, Falcon Heavy’s novel payload expressed SpaceX’s self-awareness of its temporal and symbolic position within the discourse. Without the rigid governmental constraints that NASA always had to contend with, SpaceX’s Falcon Heavy had freedom to express the company’s spectacular answer to the Space Age discourse’s range of apocalyptic anxieties and utopian dreams. The Falcon Heavy launch expressed SpaceX’s goal of making space accessible to the broader public through its use of familiar and relatable objects and music as well as its infusion of Space Age discourse references. Likewise, its trajectory in the general direction of Mars in combination with SpaceX’s widely expressed intentions to colonize the Red Planet communicated to audiences the company’s temporal position on the cusp of an interplanetary future. Above all, the Falcon Heavy expressed SpaceX’s awareness of its own power to shape the future of the Space Age. By merging science fiction with reality, by responding self-consciously and directly to the discourse of the Space Age with its own vision of the future, and by embracing the bold use of clever choreography and livestreaming to reach audiences around the world, SpaceX’s Falcon Heavy made a global statement, declaring to all the company’s intentions to carry humanity forward to Mars and beyond.

While the real future of the space industry remains unknowable, this history of the discourse of the Space Age demonstrates how imaginative visions play an important role in shaping reality. The visions of the Space Age discourse, often oscillating between apocalyptic fears and techno-utopian hopes, reflect the times in which they are conceived and consistently influence the choices and goals of the industry's key players. In a new era of vertically integrated, privately funded space companies pursuing the attention of the press and the public, these visions have more potential to shape the future than ever before. More than a century in the making, the legacy of the Space Age discourse continues to offer an ideological network of anxieties and aspirations that perpetually guide the trajectories of the space industry. Yet despite the discourse's influential nature, nothing about the future of the space industry is certain. But with an attention to the most popularly shared fears and hopes of the Space Age discourse, space industry leaders have the potential to deliver a version of the future that resonates with the dreams of millions. In making popular visions into realities, the space industry will inspire a new generation of pioneers to carry humanity even further into the cosmos.

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