The Godfather of Satellites:

Arthur C. Clarke and the Battle for Narrative Space in the Popular Culture of Spaceflight, 1945-1995

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Abstract

In February 1945, Arthur C. Clarke penned a Letter to the Editor of *Wireless World* magazine titled "V2 for Ionospheric Research?" wherein he suggested that the V2 rocket could act as a means to launch an 'artificial satellite' capable of relaying global television coverage. Clarke's envisioning of the geostationary communication satellite earned him the cultural distinction as the "father" or "inventor" of satellites and Clarke, the self-proclaimed "Godfather" of satellites, would remain an avid advocate, advisor, speaker, promoter, and popularizer of satellite technology for the entirety of his career – beginning with this representation of the V2 as a benevolent taxi for imagined television satellites with immense commercial potential.

Human spaceflight and deep space exploration have long controlled the narrative space within the popular culture of spaceflight. Yet the satellite, growing in complexity and necessity year after year, remained largely unknown to the man on the street, its services quickly taken for granted, and Clarke sought to rectify that. But just as the rocket before it, the satellite was born from and was often associated with the military, and Clarke investing decades rejecting the common military rationale for developing space technologies. Rather, Clarke would represent satellites as "weapons of peace," not pieces of weapons, better exploited for the benefit of humanity than national security.

While Clarke's science fiction and work with Kubrick on *2001: A Space Odyssey* has yielded historical attention, his public advocacy has not. Further still, his work specifically popularizing satellites is but a footnote, yet it held a significant proportion of his professional endeavors. Using primary source material from the NASA History Division archives, the Arthur C. Clarke Collection (the "Clarkives") at the Smithsonian National Air and Space Museum, and many of Clarke's publications over the years, the scope and scale of his satellite advocacy becomes clear. Clarke maintained correspondence with NASA Administrators, former astronauts and cosmonauts, Congressional and industry leaders, prominent space scientists, and Walter Cronkite; he spoke before the US Congress, the United Nations, UNESCO, and the Pope; and he wrote in great abundance, with over twenty publications in *Playboy* alone.

Building upon previous work that showcases how the popular culture is an inspiration for and driver of public and private space policy and investment, this analysis will examine: In what ways did Clarke represent satellites and what was his intention for representing them as such? To what extent were his satellite representations integrated into his visions of the human future in space? Who was audience and what outcome, public and policy, was he trying to encourage? And how, and why, his representations evolved over time – from the space age utopian dreams of human space *exploration*, to the globalized, Earthbound post-Apollo Period, into the era of the US Space Shuttle and the *exploitation* of low-Earth orbit.

This thesis will show that throughout his career, Clarke represented the satellite as the *key* to achieving the Space Age dream of solar system colonization. To Clarke, the satellite was the foundational infrastructure necessary for *any* human endeavor in space. Satellites facilitated an internationalized, global space effort and provided achievable short-term projects that yielded tangible down to earth benefits that drove investment and established public need. Clarke worked tirelessly to disassociate the satellite from its affiliation as a piece of Cold War weaponry and recast it as a "weapon of peace" in service of present-day stability and prosperity, and a vital component to the establishment of the limitless frontier of space.

Acknowledgements

Like any grand project, this thesis was the collective effort of numerous individuals who deserve recognition. First and foremost, none of this would have been possible without the mind of my advisor, David Baneke. His contribution began far before this thesis did, back to when he voted for my acceptance into the History and Philosophy of Science program following my interview. And it continued as he enlightened me to all of the nuances of the history of science in the multiple courses he taught in my first year. And by happenstance, we shared an interest in space history, and it was in one of his classes that I was introduced to the concept of astroculture that came to inspire this thesis. When I expressed an interest in applying to an internship at the NASA History Division in Washington, DC, he was there to encourage me, review my resume, and offer a recommendation when called upon. And as my thesis progressed, he offered just the right amount of guidance and freedom to help me create something unique to my strengths and interests.

David has not been the only educator that has left their mark. Daan Wegener was equally responsible for my early education in history of science, co-teaching with David in the introductory course and providing an impactful course on science and the public that has shaped the direction of my research, and career trajectory. Among my sphere of influence at Utrecht University, I want to give a moment of appreciation to the efforts of the Descartes Center, as the many colloquiums, and hosting of the HSS 2019 conference, have exposed me to countless new avenues of thought and encouraged me to view myself as a true member of the academic community. From day one, we *were* historians of science and I appreciated that as I sought to establish my sea legs in a new discipline. This leads me to my cohort, who have never failed to keep me on my toes, endlessly engaging in meaningful conversation and offering assistance at the drop of a hat. A special shoutout to Pim Sierink, who took the time out of his own busy thesis schedule to read through my near completed draft not once, but twice! A favor I look forward to reciprocating.

I can only imagine that David's recommendation to NASA was a good one, as I was lucky enough to become an intern at the NASA History Division in Washington DC during Fall 2019, and my experience could not have been more intellectually engaging. With my desk in eye shot of the treasure trove that is the NASA HQ archives, and the Smithsonian National Air and Space Museum just three blocks away, I was able to spend months in the Mecca of space history. A special thanks to Chief Historian Bill Barry and my supervisor Cat Baldwin, who not only gave me the opportunity but made sure I had all the tools to take full advantage of it, offering me several hours every day to invest in my own research. In fact, a special thanks goes out to the entire team at the NASA HQ History Division; Steven Garber, Craig Haibon, Nadine Andreassen, Robyn Rodgers, Colin Fries, Liz Suchow, and my fellow intern Andrew Parco. Every day spent in the windowless box in the basement was a budding space historian's dream come true. And their enthusiasm, willingness to help, and constructive conversations served as a reminder that I was exactly where I should have been. Further, I must express immense gratitude to the McGuirk family, who graciously kept me warm, dry, and fed during my internship.

As I had mentioned earlier, it was David that introduced me to the work of Alexander Geppert that served as the inspiration for this thesis. By cosmic chance, Alexander too found himself in a temporary office off the Mall,

having been awarded the NASM Lindbergh Chair in Aerospace History. When I reached out to request a moment of his time, he was happy to oblige, and our improbable in-person discussions were enormously helpful. I want to be sure to thank all of the NASM historians and archivists I encountered along the way. I was always warmly welcomed into their colloquiums and they were enthusiastic in assisting me when I began navigating the "Clarkives."

No acknowledgement section is complete without an expression of gratitude to the support system that makes the entire endeavor possible. My wife, Michele Skogerboe, has selflessly facilitated my success for years, and to her, I pour all of my remaining gratitude, and then some. I can imagine she will be grateful to hear about something other than Arthur C. Clarke for a while. That being said, the Godfather and I will meet again soon, as I fully intend to continue treading into the many futures he's imagined.

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[1] NASA, *Photograph of Arthur C. Clarke*, NASA Image: 76-007273, Clarke, Arthur C. (1972 TO 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington DC.

Cover Page Image: Photo Credit Arthur C. Clarke Trust, *Arthur C. Clarke meeting Pope John Paul II in 1984*, Accessed May 6 2020. http://arthurcclarke.org/site/life/life-1980/.

Table of Contents

Introduction

> "I would like to close by mentioning a possibility of the more remote future – perhaps half a century ahead [1995]. An 'artificial satellite' at the correct distance from the earth would make one revolution every 24 hours; i.e., it would remain stationary above the same spot and would be within optical range of nearly half the earth's surface. Three repeater stations, 120 degrees apart in the correct orbit, could give television and microwave coverage to the entire planet. I'm afraid this isn't going to be of the slightest use to our post-war planners, but I think it is the ultimate solution to the problem."[2]
> "V2 for Ionospheric Research?" 1945

The ultimate solution, to what problem? Global communications. And how to utilize the newfound potential of the V2 rocket to achieve that goal without encouraging further development of its military applications. To Clarke, it didn't matter that the "post-war planners" would find his suggestion unhelpful, because he didn't much agree with their desired applications anyhow, and thus he sought to reframe the V2's usage toward peaceful, profitable, and short-term goals in service of the long-term dream of space travel. To achieve that end, Clarke had asked himself "how can rockets make money?" As a benevolent taxi for imagined television satellites with obvious commercial opportunities and public benefits, Clarke would determine, thus jumpstarting decades of effort popularizing and promoting satellite technology and showcasing how military technology can be deployed in a peaceful fashion.[3] Then a radio operator for the British Royal Air Force during WWII, Arthur C. Clarke famously proposed the concept of an 'artificial satellite' in a set of *Wireless World* articles in 1945. The first, quoted above, a letter to the editor titled "V2 for Ionospheric Research?" in February (under the header "Peaceful Uses for V2"), followed by a conceptual breakdown in "Extra-Terrestrial Relays," published in October (the most commonly sighted as Clarke's original conceptualization).[4] In a synthesis of his recent military experience in advanced radar communications, his pre-war involvement in the space boosting British Interplanetary Society, and the wartime emergence of the Nazi V2 rocket, Clarke was able to propose the concept of an 'artificial satellite' ferried into geostationary orbit (which would later be dubbed the "Clarke Orbit") by a future form of the V2.[5] Clarke relayed that three of these satellites, spread equally around the equator, would be capable of providing global television coverage, which he estimated would be possible by 1995.[6] This postulation would earn Clarke the popular cultural distinction as the "father" or "inventor" of

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[2] Arthur C. Clarke, "V2 for Ionospheric Research?" (Letter to the Editor). *Wireless World* 52 (February, 1945): 58.

[3] Neil McAleer, *Sir Arthur C. Clarke: Odyssey of a Visionary*, Arthur C. Clarke Collection (New York: Rosetta Books, 2013), Ebook, chap. 5; due to the electronic format, page numbers for this book were not possible, chapter numbers have been included in replacement*;* This authorized biography served as an invaluable resource for the more obscure events in Clarke's life; De Witt Douglas Kilgore, *Astrofuturism: Science, Race, and Visions of Utopia in Space* (Philadelphia: University of Pennsylvania Press, 2003), 114.

[4] Clarke, "V2 for Ionospheric Research?" 58; Arthur C. Clarke, "Extra-Terrestrial Relays: Can Rocket Stations Give World-wide Radio Coverage?" *Wireless World,* October 1945: 305-308.

[5] "Geostationary" orbit is 22,300mi, or 36,000km above the equator, wherein the satellite's orbital period can be matched to the Earth's and it remains fixed. "Geosynchronous" orbit is the same altitude but can have any inclination. Geostationary orbit would be officially labeled "Clarke Orbit"; see Arthur C. Clarke, *Ascent to Orbit: A Scientific Autobiography: The Technical Writings of Arthur C. Clarke (*Hoboken, New Jersey: John Wiley, 1984), 223-224.

[6] As Clarke would describe geostationary orbit, "In effect, therefore, the laws of celestial mechanics allow us to construct a line of invisible towers, 22,300 miles high, completely around the equator. If we placed them a mile apart, there would be room for 160,000 separate satellites or space stations in this band of sky every one hovering motionless above the hemisphere beneath it, and thus able to watch over, or communicate with, half the planet," see; Clarke, Arthur C. "Epilogue" In: Armstrong, Neil A,

satellites - a title which he rejects.[7] At multiple points throughout his space age spanning career, Clarke attributed the true fathers of satellite communications to be Dr. John Pierce of AT&T's Bell Telephone Laboratory and Dr. Harold Rosen of Hughes Aircraft Company, who actually created the hardware.[8] Clarke was aware that planting the idea was just the first modest step. "There is a vast gulf, almost unimaginable to the layman, between thinking of an idea, and then converting it into detailed engineering blueprints. There is an equally great gulf between the blueprints and the final hardware, so we cannot claim too much credit for our pioneering insight."[9] As Clarke saw it, "What I did was to take two already existing elements [rockets and relay stations], combine them synergistically, and point out the implications of the result."[10] Believing his "efforts to promote and publicize the idea may have been much more important than conceiving it," Clarke concedes that while not the father of satellites, he's "merely the Godfather."[11] As Clarke would note about his popular moniker, "nomenclature is decided not by logic or justice but by accident and convenience. History will settle these matters, as it always does."[12] We shall see.


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Edwin E Aldrin, and Michael Collins, *First on the Moon: A Voyage with Neil Armstrong, Michael Collins, Edwin E. Aldrin Jr.* (Boston: Little, Brown, 1970), 389.

[7] In nearly every instance that Clarke is introduced or referenced (1960s and beyond), a line or two are devoted to establishing his role as the "inventor" or "father" of satellites. Throughout this research, the distinction "father of" appears with surprising regularity, and it appears to act as a label for the individual who first introduced a concept into the official literature. A few examples: Glenn Curtis, "father of commercial aviation"; J.D. Bernal, the "real godfather" of space colonization; Robert Goddard, "father of rocketry"; Hugo Gernsback, "father of pulp science fiction magazines"; and Guglielmo Marconi, "the father of long-distance radio communication."

[8] Arthur C. Clarke, *How the World Was One: Beyond the Global Village* (New York: Bantam, 1992), Ebook, chap. 23; due to the electronic format, page numbers for this book were not possible. Chapter numbers have been included in replacement

[9] Clarke, Arthur C. *Voices from the Sky: Previews of the Coming Space Age* (New York: Harper & Row, 1965), 145.

[10] Clarke, *Ascent to Orbit*, 224.

[11] Arthur C. Clarke, *1984: Spring: A Choice of Futures* (New York: Del Rey/Ballantine, 1984), 29-30; he first referred to himself as the 'Godfather' in testimony before Congress on November 4th, 1977, see *Arthur Clarke Looks at Our Technical Future*, 95th Cong., 1st sess., Congressional Record 123, pt. 29: 37446-37447; In the foreword written by the Director General of INTELSAT for *Ascent to Orbit*, Clarke is referred to as the "grandfather of INTELSAT": "Each year more and more people bestow that recognition in referring to the geosynchronous orbit, where these satellite operate, as the 'Clarke Orbit.' If Arthur Clarke is the father of communications satellites, then surely he must also be the grandfather of INTELSAT," see Clarke, *Ascent to Orbit,* v.

[12] Clarke, *Ascent to Orbit*, 224.

[13] True father of communication satellites, John Pierce; NASA, *John Robinson Pierce circa 1960,* NASA Image: 52-H-001, Accessed June 5 2020. https://www.flickr.com/photos/nasacommons/.

> "Many years ago, I called comsats 'weapons of peace' – necessary, but not in themselves sufficient, tools for the prevention of war. Although, like any medium of communication, they can transmit lies as easily as truth, the diversity of channels created by direct broadcasting makes it impossible even for closed societies to insulate their people from the real world."[14]
> *How the World Was One,* 1992

Weapons of Peace or Pieces of Weapons?

As the decades passed by, satellites grew in complexity and necessity year after year, remaining largely unknown or misunderstood by the public, their benefits quickly taken for granted, and Clarke sought to rectify that. But just as the rocket before it, the satellite was born from and was often associated with the military. As cultural historian Lisa Parks noted: "As satellites entered public consciousness, political jargon, scientific experiments, and military applications, the widespread recognition that satellites—and the rockets that launched them—carried double signification as applied technologies with both military and peaceful purposes became commonplace."[15] A pronounced pacifist who despised war, Clarke rejected the common military rationale for developing space technologies.[16] As astrofuturist literary scholar Kilgore notes, "Clarke's conquest of space is not obsessed with an endless reiteration of the sociomilitary form… Clarke follows H. G. Wells in idealizing Western science and scientists as an open and altruistic discursive community capable of creating a world order that serves all of humanity."[17] As early as 1946, Clarke was already advocating for such a world order. "The United Nations Organization is the last hope of Mankind…. It is therefore necessary to consider in what way the rocket can be used as an instrument of world peace rather than regional security."[18] In just a few decades, the groundwork would be laid with the signing of the 1967 UN Outer Space Treaty, recognizing "the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes."[19] The treaty further agrees that nuclear weapons would not be allowed in orbit, but passive reconnaissance satellites would be tolerated, and thus "regional security" became a veiled aspect of the treaty.[20] Ultimately, all forms of satellites beyond just reconnaissance would remain caught up in this blurry space between peace and war.

As Walter McDougal found in his Pulitzer Prize winning political history of the space age, *The Heavens and the Earth,* "Communications and weather satellites were tools that fit perfectly the hand of technological anticommunism… New global technologies must spawn international organizations, in which the very tendency of bureaucracy to stretch its tentacles might prove a force for transcendence of jealous nationalism, for 'functional

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[14] Clarke, *How the World Was One,* chap. 39.
[15] Lisa Parks and James Schwoch, "Introduction" in *Down to Earth: Satellite Technologies, Industries, and Cultures* (Piscataway: Rutgers University Press, 2012), 7; for more discussion on the dual functionality of space technology for civilian or military purposes, see Roger Handberg, *Seeking New World Vistas: The Militarization of Space* (Westport: Praeger, 2000), 55.
[16] Arthur C. Clarke, *Astounding Days: A Science Fictional Autobiography* (London: Victor Gollancz, 1989), 205.
[17] De Witt Douglas Kilgore, *Astrofuturism: Science, Race, and Visions of Utopia in Space* (Philadelphia: University of Pennsylvania Press, 2003), 111-112; for a closer look at military trends in science fiction, see David Seed, *American Science Fiction and the Cold War* (Edinburgh: Edinburgh University Press, 1999).
[18] Arthur C. Clarke, "The Rocket and the Future of Warfare." *RAF Quarterly*, March 1946, 61–69; quoted from McAleer, *Odyssey of a Visionary*, chap. 29.
[19] "Outer Space Treaty of 1967," NASA, Accessed April 23, 2020, https://www.history.NASA.gov/1967treaty.html.
[20] Tilmann Siebeneichner, "Spacelab: Peace, Progress and European Politics in Outer Space, 1973-85," in *Limiting Outer Space: Astroculture After Apollo*, ed. Alexander Geppert (London, UK: Palgrave Macmillan, 2018), 273.

integration' on a multilateral basis, for world peace."[21] McDougal further asserts "the UN Outer Space Treaty, entering into force almost exactly ten years after Sputnik I, fixed the environment of future spaceflight as one of competition among national technocracies, while the apparent force of 'targeted R&D' drew many nations into the hunt for advantage, not integration, through spaceflight."[22] Clarke was actively engaged in such 'targeted R&D,' even if the goals were nationalistic in nature, and was well versed operating within a *Technocracy,* defined as "the institutionalization of technological change for state purposes," with NASA the posterchild.[23] It thus makes sense why Clarke did his best to normalize the distinction between military and peaceful usage of satellites throughout his work, as "state purposes" could include "foreign aid, education, welfare, urban renewal, and more."[24] Achieving those ends meant legislators and administrators needed to support technology that pursued the peaceful, rather than the military-based "state purposes."[25]

Clarke would play a role in pursuing the 1967 Outer Space Treaty, but also the 1965 formation of COMSAT, the 1971 INTELSAT agreement, and efforts at the second iteration of the Outer Space Treaty in the 1980s. Through these decades, Clarke would represent satellites as tools of peace, not war, better exploited for the benefit of humanity than national security. Clarke went so far as to communicate that he believed satellites would eventually "unite mankind," and he engaged in a battle to gain a greater share of the narrative space within the popular culture, "de-militarizing" public perceptions of satellite technology and encouraging their peaceful applications - and he frequently utilized military jargon to do it.

While a vocal proponent for all forms of satellites, be it reconnaissance, earth resource, or weather, the communication satellite, hereby *comsat,* was Clarke's "special hobby horse."[26] In fact, the 'artificial satellite' Clarke proposed in 1945 was a comsat, its origins derived from Clarke's knowledge of military communications technology. By the 1980s, he would come to represent the comsat as a "Weapon of Peace," a tool to prevent war via improved communication between nations and people, interconnected satellite-based economies, verification of treaties, and expanded accessibility to knowledge.[27] But he also acknowledged that the comsat could be weaponized, as seen in the quote above, with its ability to "transmit lies." Despite this reality, Clarke would come to accept that the pros outweighed the cons, and he knew that without a dedicated effort, these tools for peace could become weapons of war, but if properly utilized, satellites offered limitless potential. While satellites presented obvious military applications, Clarke would remain resolved that their usage as weapons of peace would ultimately prevail. Clarke would even represent the reconnaissance (spy) satellite, the most overtly military of all, as a "Peacesat" due to its stabilizing effect on global politics, but he understands that it, too, "is not a magic solution to all the problems of

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[21] Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985), 344-345.
[22] Ibid., 413.
[23] James A. Vedda, "The Role of Space Development in Globalization" in *Societal Impact of Spaceflight*, eds. Steven J. Dick and Roger D. Launius (Washington, DC: National Aeronautics and Space Administration, 2007), 199.
[24] Ibid., 199.
[25] Ibid., 199.
[26] Clarke, *1984: Spring,* 248; "Tourism: The Challenge of Change" was the title of Clarke's keynote address at Pacific Area Travel Association Workshop, Colombo, 19 January 1978;
[27] Clarke, *How the World Was One,* chap. 39.

peace: there is no such thing."[28] The spy satellite maintaining stability through transparency also means "Big Brother" may be watching, but it's worth it, right? Clarke would argue it was.

> "To those who feel a quite understandable distaste toward the idea of orbiting Big Brothers… Now, however, most law-abiding citizens are happy to know that the cameras are benignly watching over them. And let us face the evidence in our daily newspapers. Planet Earth *is* a high crime area. I wonder how many of the recent massacres would have been prevented if the perpetrators believed (rightly or wrongly – it would make no difference!) that their atrocities were being observed."[29]
> "Letter to His Excellency Ambassador Tissa Jayakoddy," 1983

The Battle for Narrative Space

In essence, spy satellites mean both surveillance and accountability. There is no perfect solution, but Clarke believed the very military applications of satellite technology could be repurposed for peaceful aims. This would be a central point of Clarke's satellite advocacy, a tug of war between popular understanding of satellites as 'weapons of peace' (as he came to represent them in the 1980s) or 'pieces of weapons' (a general abstraction for this analysis meant to represent "association with military applications"). Were satellites weapons of peace or pieces of weapons'? How, and why, did Clarke come to represent satellites in this manner? What public narrative was he trying to establish, and to what was he responding? Who was he trying to persuade and why? What future was he imagining? What future was he trying to avoid? Why did he so frequently utilize military jargon? This paper will seek to find out.

As Clarke would classify it, a "battle for the mind" was taking place, fought silently by satellites in geostationary orbit, and Clarke sought to join the fray.[30] Between 1945 and 1995, satellites went from optimistic vision to established reality, and Clarke offers a unique window into the evolution of how satellites came to be represented and understood in the popular culture of spaceflight, and thus, how humanity opted to exploit them. Building upon scholarship that showcases how images and representations within the popular culture both inspire and motivate space policy and investment, this analysis will examine how and why Clarke configured his representations of satellites in the ways that he did, from *Wireless World* in 1945 to the 50th anniversary of his postulation in 1995, a period of time that saw not only the emergence of satellites, but their establishment as a central component of daily life on Earth and in space.

The efforts the self-proclaimed "Godfather of Satellites" took to promote and publicize satellite technology were widespread, spanning a decades long career as a science fiction and popular science author, as well as vocal advocate and public popularizer for the push into space. While Clarke's human-centric science fiction and work with Kubrick on *2001: A Space Odyssey* has yielded historical attention, his public advocacy and his work beyond the traditional Space Age has not.[31] Further still, his work specifically popularizing satellites and how he represented

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[28] *Arthur Clarke Discusses War and Peace in Space,* 97th Cong., 2nd sess., 1982, Vol. 128, No. 126, E4309; Clarke's speech before the UN Committee on Disarmament in 1982, "War and Peace in the Space Age," was submitted to the Congressional Record on Tuesday, September 21st, 1982.
[29] Clarke, *1984: Spring,* 78-79
[30] Arthur C. Clarke, *The View from Serendip* (New York: Random House, 1977), 260.
[31] The following bibliography of historical scholarship on Clarke's work acted as an excellent source of context, discussion, and fine details for this analysis, but much of it was related to his science fiction, and satellites were not the focus; see; Gary Westfahl, *Arthur C. Clarke. Modern Masters of Science Fiction* (Urbana: University of Illinois Press, 2018) for a comprehensive

them in his work is but a footnote, yet it held a significant proportion of his professional endeavors. This analysis seeks to fill those voids and contribute to better understand the role of space advocates in shaping space and how that shape takes shape in the imagination. Using primary source material from the NASA History Division archives, the Arthur C. Clarke Collection (the 'Clarkives') at the Smithsonian National Air and Space Museum, and many of Clarke's publications over the years, the scope and scale of his satellite advocacy becomes clear. Clarke maintained correspondence with NASA Administrators, former astronauts and cosmonauts, Congressional and industry leaders, prominent space scientists, and Walter Cronkite; he spoke before the US Congress, the United Nations, UNESCO, and world leaders, including the Pope; and he wrote in great abundance, with over twenty publications in *Playboy* alone.

To begin, a brief historiography of both space history at large and the growing history of artificial satellites will be undertaken to bring the history and role of satellites into greater focus - to ask why satellites have been so neglected in the historical and cultural record and how satellites have been represented in science fiction and popular science. This will include an analysis of relevant frameworks, including the human vs. robotic spaceflight debate, the popular culture of spaceflight, or astroculture, astrofuturism, imagination, visions of the future, and representations. Following a closer look at Clarke himself and how he came to conceive of the satellite, this analysis will be broken into three time periods, each section including an analysis of the greater localized context that was dictating decisions at the time and examples of Clarke's representations of satellites therein, linking events and ideas in which Clarke may have been responding and what his aims may have been, granting us a view into the role of space popularizers in shaping the direction of space programs. In what ways did Clarke represent satellites and what was his intention for representing them as such? To what extent were his satellite representations integrated into his visions of the human future in space? How did those representations shape the public's understanding of the future, and the present? Who was his audience and how did he adapt his messaging? And how, and why, did his satellite representations evolve over time? For fifty years - from the Space Age utopian dreams of human space *exploration*, to the globalized, Earthbound Post-Apollo Period, into the militarized era of the Space Shuttle and the commercial *exploitation* of low-Earth orbit - Clarke sought to paint a vivid picture of a satellite rich future, calculating that the pros outweighed the cons, ever pushing forward as peacefully as possible. Early in Clarke's career, he portrayed space travel as inevitable, but how it was to be accomplished remained very much in the air. That is where Clarke made his moves.

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survey of Clarke's science fiction; Helen M. Rozwadowski, "Arthur C. Clarke and the Limitations of the Ocean as a Frontier," *Environmental History* 17, no. 3 (2012): 578-602, for a look at Clarke's work on the ocean and outlook toward exploiting frontiers; Oliver Dunnett, "Patrick Moore, Arthur C. Clarke and 'British Outer Space' in the mid-20th century," *Cultural Geographies* 19, no. 4 (2012): 505-522, for an examination of the British notion of Outer Space and Clarke's very early work; Robert Poole, "The Myth of Progress: *2001 – A Space Odyssey*," in *Limiting Outer Space: Astroculture After Apollo,* for an analysis of *2001: A Space Odyssey* and Clarke's outlook on technological progress*;* Thore Bjørnvig, "Transcendence of Gravity: Arthur C. Clarke and the Apocalypse of Weightlessness," in *Imagining Outer Space*, for an examination of how Clarke utilized the 'apocalyptic sublime' and the sometimes stark future he imagined; McAleer, Neil. *Sir Arthur C. Clarke: Odyssey of a Odyssey of a Visionary*, for a highly thorough biographical account of Clarke's life; Robert Poole, "The Challenge of the Spaceship: Arthur C. Clarke and the History of the Future, 1930-1970." *History and Technology* 28, no. 3 (2012): 255-80, for a closer look at Clarke's very early work and his view on the cycles of rise and fall in civilization; De Witt Douglas Kilgore, *Astrofuturism: Science, Race, and Visions of Utopia in Space*, specifically chapter 4, "Will There Always Be an England? Arthur C. Clarke's New Eden" for an examination of Clarke's views on empire and imperialism; Peter J. Bowler, *A History of the Future: Prophets of Progress from H.G. Wells to Isaac Asimov* (Cambridge, United Kingdom: Cambridge University Press, 2017) for Clarke's work in the larger picture of future imagineers.

> "The pioneers of astronautics used fiction in a deliberate attempt to spread their ideas to the general public. Tsiolkovsky, Oberth, and von Braun all wrote space fiction at one time or another. In so doing, they were not merely predicting the future, they were creating it."[32]
> "Post-Apollo Preface" in *Prelude to Space,* 1977

Satellite Booster

When Clarke imagined the V2 as a benevolent taxi for imagined television satellites, he was intentionally striving to create that future. This effort has been examined in Howard McCurdy's *Space and the American Imagination*, which argued that the US space program emerged from an intentional effort by science fiction and popular science writers, engineers, industrialists, and political leaders to create a popular culture of space exploration grounded in American ideals (such as frontier mythology, terrestrial exploration, cold war fears, national prestige, and the rise of consumer culture) and near future reality.

During the 1950s and 1960s push to legitimize spaceflight, the "golden age of science fiction" largely shaped public understanding of space travel.[33] Clarke played an active role as a "space booster" (also self-referred to as 'Space Cadets'), a collection of space enthusiasts, rocket society members, science fiction and popular science writers, and scientists, who sought to reconfigure the public's understanding of space away from the realm of Buck Rogers space cowboys and alien invaders from Mars.[34] Alongside space popularizers like rocket engineer Wernher von Braun, science fiction author Robert Heinlein, popular science writer Willy Ley, director Stanley Kubrick (with Clarke's guidance), and artist Chesley Bonestell, the space boosters broke from the unscientific 'aliens and intergalactic adventure' representation of space travel toward a more realistic message, one where human spaceflight was imminent.[35] In Clarke's own words: "I write science fiction only about things I know are reasonably true, even though the extrapolations may not be known."[36] From imagination to reality - visions of the future represented within the work of space advocates created with the intention to elicit action.

As McCurdy explained during his analysis, when you form a mental image of an event or a process that is not actually present, you are using your *imagination*.[37] A *vision of the future* is thus a creation of the imagination. In numerous ways, whether through fiction or the visual depiction of an event, *imaginaries*, or mental images, are transmitted through the popular culture.[38] Taken together, the popular culture - here understood as the amalgamation of newspapers, radio broadcasts, TV programs, books, movies, music, paintings, theater, magazines, and even institutional reporting - contains images and representations that have been crafted to not only shape cosmic perspectives, but also encourage policy and public support.[39]

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[32] "Post-Apollo Preface" to 1977 Edition of *Prelude to Space*, June 16, 1977, Folder 6, Box 142, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC, 1.
[33] Howard McCurdy, *Space and the American Imagination* (Washington, DC: Smithsonian Institution Press, 1997), 69.
[34] Ibid., 30.
[35] McCurdy, *Space and the American Imagination,* 32-33;
[36] Arthur Clarke, *Playboy* Interview July 1986: "Arthur C. Clarke: A candid conversation about the future of space travel—and about sex, immortality and 2001—with the witty dean of science-fiction writers," Clarke, Arthur. C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC, 57.
[37] McCurdy, *Space and the American Imagination,* 3.
[38] Ibid., 3.
[39] Ibid., 3.

As the Space Age emerged, stargazers lived in a time and space where the advent of rocketry made it genuinely possible to reach the heavens, and fueled by Cold War fears and narratives of a space race with the Soviet Union, space popularizers like Clarke had an attentive public. The visions of the future, or imaginaries, Clarke and his contemporaries articulated helped the public imagine what the future may hold, and they took hold within the popular culture, driving policymakers, commercial investors, and public engagement alike.[40] In fact, Wernher von Braun would share Clarke's 1951 popular science book *The Exploration of Space* with President John F. Kennedy during his efforts to convince the president that the US not only could, but should, go to the Moon.[41] Clarke's realistic, grounded in science vision of near future space exploration in *The Exploration of Space* is but one example of his work playing a role in shaping space policy. Clarke bore witness to nearly every milestone of the Space Age, which is traditionally considered to have begun with the October 4th, 1957 launch of Sputnik 1, the first satellite.[42] The Space Age, within which Apollo 11 represents one of its most exciting chapters, was a decades long effort of global collaboration, geopolitical maneuvering, and public engagement. The collective work of thousands of individuals toiling together toward an imagined future they sought to make a reality.

> "The prime duty of fiction is to entertain, not to instruct – and still less to propagandise… Nevertheless, I must confess that I have sometimes used fiction to advertise causes which seemed of importance or value – notably that of space travel."[43]
> *How the World Was One,* 1992

Imagination and Public Policy

Clarke became so highly regarded within the space community that he would act as a special analysist alongside Walter Cronkite for the Apollo 11 CBS broadcasts in 1969, live via satellite. Sitting beside Cronkite, and fellow science fiction author and space booster Robert Heinlein, Clarke engaged in a dialogue about humanity's future in space, his forte. After Heinlein remarked that "we're (humans) going out to all of the planets… we're going out to the stars… we're going out indefinitely," Clarke replied, "And when they do go out… they'll forget their original nationalities."[44] The infinite frontier of space was now available, and to Clarke, it would be available for the citizens of Earth, not nations. He had an ambitious vision of the future post-Apollo that was shared by many at the time. "In the next ten years, you're going to have two separate developments: the establishment of manned orbiting stations, space labs, and perhaps the first primitive space factories; simultaneously we'll see the development of the first semi-permanent and permanent bases on the moon, comparable to those in the Antarctic today."[45] Clarke sought to set a realistic expectation, and a moon base resembling an Antarctic base was an imaginable, achievable future. This was Clarke's strategy for motivating forward progress in space, don't forget the here and now when imagining the future.

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[40] Ibid., 3.
[41] McAleer, *Odyssey of a Visionary,* chap. 40.
[42] Steven Dick, "Introduction" in *Remembering the Space Age: Proceedings of the 50th Anniversary Conference,* ed. Steven Dick (Washington DC: NASA, 2008): ix; For purposes of this analysis, the "Space Age" will begin in 1945, but only for a simple framing of time periods.
[43] Clarke, *How the World Was One,* chap. 26.
[44] Richard Salant, *10:56:20 PM EST 7/20/69: The Historic Conquest of the Moon as Reported to the American People by CBS News over the CBS Television Network,* ed. Robert Wussler (Diane Publishing Company, 1970), 107.
[45] Ibid., 22.

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As McCurdy argues, expectations, packaged in the form of visions of the future, sometimes inflame fears and sometimes create mental representations, and these images and representations in turn motivate behavior, from the level of public interest to the focus of policy makers.[47] McCurdy's work found that "As public policies are implemented, they invariably require some sort of reconciliation between vision and reality. Real government policy needs to be entertaining in order to attract public interest but also needs to be authentic. Modern governments require reconciliation of imagination, popular culture, and real events."[48] Ultimately, space historians have joined McCurdy in arguing that the popular culture both inspires and sets the limit to what public officials are able to carry out and that disillusionment with the space program was the result of a widening gap between the dominant trends in science fiction, film, and public understanding and their confirmation in actual events in spaceflight.[49] In essence, the more fantasy-like and unachievable (at least in one lifetime) a popular representation is, the more likely the public will grow disillusionment toward pursuing it. McCurdy asserts that gaps between expectations and reality are formed when policy debates, such as NASA's decision to focus upon human spaceflight in their early history, are driven by a desire to entertain.[50] What McCurdy fails to properly emphasize is that such entertainment was perhaps the most motivating aspect of the new popular culture of spaceflight that propelled Apollo to the Moon, and Clarke's work will show an effort to entertain *and* keep it real. Clarke would strive to keep his imaginings in the realm of

[46] Photo Credit: Arthur C. Clarke Trust, *Clarke live on CBS for the Apollo 11 moon landings alongside Cronkite and Wally Schirra,* Accessed May 9 2020. http://arthurcclarke.org/site/legacy/tv/; Clarke would appear for the live broadcasts on multiple occasions, partnering with both Schirra and Heinlein.
[47] McCurdy, *Space and the American Imagination,* 4, 240.
[48] McCurdy, *Space and the American Imagination,* 2-3.
[49] Roger D. Launius, "Interpreting the Moon Landings: Project Apollo and the Historians." *History and Technology*, 22:3 (2006): 243.
[50] McCurdy, *Space and the American Imagination,* 6-7.

achievable near-future possibilities, and the near future was satellites. But they weren't entertaining, a challenge Clarke would address by attaching the satellite to the human experience, both in space and on Earth. As Launius and McCurdy explain in *Robots in Space,* there is "a substantial literary tradition within the popular culture of space travel in which humans and robots work together as companions in the spacefaring enterprise**.**"[51] But satellites didn't work *with* humans*,* but *for* humans in Clarke's imaginings. Clarke would represent the satellite as one of the "marvelous tools of space" that was "our servant, not our master."**[52]** Clarke would never fail to emphasize the manner in which humans could exploit satellites in both bettering the human condition and laying the foundation for the future of human space travel. Every step of the way, the satellite was the backbone, and the pioneer, for *humanity's* future in space.

> "Well, Europe could have waited five hundred years and sent remote-controlled cameras to survey America. Of course, this is a ridiculous analogy – but then the whole debate is ridiculous. Robots are essential as pioneers, and there are environments which only they can penetrate. But there are also missions where it is far more effective – and even cheaper – to have men in the loop, if only to deal with unexpected emergencies. (Remember the Skylab salvage operation and Apollo 13)."[53]
> "Space Flight – Imagination and Reality," 1982

Popular Culture of Spaceflight

In recent years, former NASA Chief Historian Roger Launius identified a growing trend toward a "New Aerospace History" with a commitment to relating space history "to larger issues of society, politics, and culture."[54] These histories exemplify that imaginings of the future and the popular culture hold a genuine role in the research, development, and implementation of space technology and this analysis will contribute to this trend, and will further showcase how the popular culture shapes space, putting a spotlight on the often unaccounted for "imaginative resources of the 'spacefaring dream'."[55] Images and representations of science and technology are constructed,

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[51] Roger D. Launius and Howard E McCurdy, *Robots in Space: Technology, Evolution, and Interplanetary Travel* (Baltimore: Johns Hopkins University Press, 2012), 113.

[52] Gary Westfahl, *Arthur C. Clarke: Modern Masters of Science Fiction* (Urbana: University of Illinois Press, 2018), 45; Creative Director of AT&T, Bob Olsen asked Clarke to take place in a series of six TV commercials, first aired on January 17th, 1977, wherein he would relay his positive vision of the future of telecommunications in the year 2076.[52] He was introduced as "the man who predicted telecommunications via satellite" and his emphasis on the communication, information, and education rings loudly, "All the knowledge of mankind will be available at the touch of a fingertip through the global electronic library" further adding that "Technology is not an end in itself. It exists to provide us with what we want. It is our servant, not our master," see McAleer, *Odyssey of a Visionary,* chap. 25.

[53] Clarke, *1984: Spring,* 108.

[54] Roger D. Launius, "Climate Change and Spaceflight: An Historiographical Review." *Wiley Interdisciplinary Reviews: Climate Change* 2, no. 3 (2011): 414-415; for Apollo and American Culture, see Matthew D. Tribbe, *No Requiem for the Space Age: The Apollo Moon Landings and American Culture* (New York, NY: Oxford University Press, 2014); for more focus on Soviet society and culture, see Maurer, Eva, Julia Richers, Monica Rüthers, and Carmen Scheide, eds. *Soviet Space Culture: Cosmic Enthusiasm in Socialist Societies* (Hampshire: Palgrave Macmillan, 2011); Asif A Siddiqi and James T Andrews, eds. *Into the Cosmos: Space Exploration and Soviet Culture* (Pittsburgh: University of Pittsburgh Press, 2011); and Asif A. Siddiqi, "Imagining the Cosmos: Utopians, Mystics, and the Popular Culture of Spaceflight in Revolutionary Russia," *Osiris* 23.1 (2008): 260–88.

[55] De Witt Douglas Kilgore, "Exploring Astroculture," *Science Fiction Studies 41*, no. 2 (2014): 448; for discourse strategies on imaginings of utopia, see Ralph Pordzik (ed.) *Futurescapes: Space in Utopian and Science Fiction Discourses* (Amsterdam: Rodopi, 2009); for an examination of how scientists like Carl Sagan and Steven Hawking utilize religious rhetoric when popularizing science, see Lynda Walsh, *Scientists as Prophets: A Rhetorical Genealogy* (New York: Oxford University Press, 2013).

legitimized, and challenged within the popular culture.[56] Scientists and artists convey their imaginaries through visual and mental representations, such as science fiction imaginaries of the future or visualizations of datasets.[57] The study of how and why these images and representations were created and how these imaginaries drove the popular understanding of outer space and spaceflight can be found in the study of *astroculture.* Defined by historian Alexander Geppert, *astroculture* comprises a "heterogenous array of images and artifacts, media and practices that all aim to ascribe meaning to outer space while stirring both the individual and collective imagination."[58] The importance of studying these images and artifacts is all the more important when considering Geppert's assertion that "popular understanding of outer space [and spaceflight] is chiefly a product of images and representations, and their composition into narratives."[59] While it is questionable whether "chiefly" is the proper descriptor given the countless forces at play, space historians have come to showcase that it is a fair assertion that popular images and representations do play a predominant role in shaping individual and collective understanding, and this analysis will contribute to that thesis. Because of the interconnectivity between science fiction, space advocacy, and public policy, the study of astroculture allows for "a productive interchange among science fiction studies, the history of science and technology, and cultural history," and this examination of Clarke's satellite representations will feature an assortment of all of the above, contributing specifically to the growing field of astrocultural analysis, a subset of this new form of aerospace history.[60]

Spaceflight in popular culture is represented in countless ways; from MTV's first broadcast in 1981 featuring a picture of Buzz Aldrin on Apollo 11 superimposed with the MTV logo, to the Golden Records aboard the Voyager spacecrafts that attempted to capture a full representation of human culture into a single object.[61] As defined by Launius and McCurdy, "Popular culture transmits values, assumptions, and practices through the most broadly disseminated forms of entertainment and communication."[62] Therefore, the popular culture of *spaceflight* is the subset of the popular culture focused upon venturing *into* space and space exploration, be it by a human or a robot, or in the imagination. In *Spaceflight and Popular Culture,* historian Ron Miller identifies two important functions of spaceflight in popular culture. "Apart from its entertainment value… First, it served to inspire at a time when the entire notion of traveling into space or to other worlds was an idea beneath the contempt of most scientists and engineers. Second, it acted—and still acts—as a mirror or gauge of both public interest in spaceflight and the state of

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[56] Felicity Mellor, "Between Fact and Fiction: Demarcating Science from Non-Science in Popular Physics Books," *Social Studies of Science* 33, no. 4 (2003): 509.
[57] Michael Lynch and Steve Woolgar, (eds.) *Representation in Scientific Practice* (Cambridge, MA: MIT Press, 1990), 1.
[58] Alexander C. T, Geppert, "Rethinking the Space Age: Astroculture and Technoscience," *History and Technology 28*, no. 3 (2012): 220.
[59] Alexander C. T, Geppert, "European Astrofuturism, Cosmic Provincialism: Historicizing the Space Age." In: *Imagining Outer Space: European Astroculture in the Twentieth Century,* ed. Alexander C. T. Geppert (London, United Kingdom: Palgrave Macmillan, 2018), 8.
[60] Kilgore, "Exploring Astroculture," 447-448; While Geppert's original framing of astroculture was the "popular culture of outer space," he adds the distinction to include "popular culture of spaceflight" as well in the second of his astroculture volumes, *Limiting Outer Space: Astroculture After Apollo*, ed. Alexander Geppert (London, UK: Palgrave Macmillan, 2018).
[61] David A. Mindell, *Digital Apollo: Human and Machine in Spaceflight* (MIT Press, 2011), 8; for work on the creation of NASA's Pioneer Plaque, see William R. Macauley, "Inscribing Scientific Knowledge: Interstellar Communication, NASA's Pioneer Plaque and Contact with Cultures of the Imagination, 1971-72," in *Imagining Outer Space,* ed. Alexander Geppert (London, United Kingdom: Palgrave Macmillan, 2018): 313-334.
[62] Launius and McCurdy, *Robots in Space,* xviii.

contemporary astronautical science."[63] In the United States, the popular culture of spaceflight is the setting for a perpetual dance between the public and NASA for which future we realize in space.

Because space technology is often funded by taxpayers, the project decisions made by NASA are shaped by dominant trends in the popular culture, as evidenced by their decision to focus on human spaceflight rather than robotic spaceflight in their early history. "No Bucks, no Buck Rogers" was an early space program catch phrase that captures the sentiment well. It was believed that human spaceflight was necessary for the continued flow of funding for NASA's endeavors, not because it was cheaper, but because the public and Congress could get behind it.[64] James Van Allen (whose experiment on Explorer 1, the first U.S. satellite, discovered the 'Van Allen' radiation belts), argued in favor of robotic space exploration: "almost all of the space program's important advances in scientific knowledge have been accomplished by hundreds of robotic spacecraft."[65] Homer E. Newell, NASA's director of space science programs between 1958 and 1973, noted frustration in the significant costs of human spaceflight, especially considering his conviction that the scientific community generally understood that automated spacecraft could do everything humans could do, even more in fact, and at a fraction of the cost.[66] But obtaining the maximum yield of scientific knowledge was not a compelling enough argument in a debate dependent upon public support and popular expectations. Van Allen would concede, "There is something about the topic of outer space that induces hyperbolic expectations… The acceptance of such grandiose proposals by otherwise rational individuals stems from the mystique of space flight, as nurtured over many centuries by early writers of science fiction and their present-day counterparts. Indeed, to the ordinary person space flight is synonymous with the flight of human beings."[67]

Human spaceflight has long controlled the narrative space within the popular culture of spaceflight, because popular representations of spaceflight have made it easy and exciting to imagine, full of relatable characters, epic adventures, and intergalactic conflict. Thus, spaceflight being synonymous with *human* spaceflight was born in the popular culture, and it held sway in the decisions of NASA leadership. But Clarke was always wary of this human vs. robotic spaceflight debate, as robotic spaceflight was equally important as human spaceflight, and the distinction was unnecessary. Clarke would argue that there is no "choice" between one or another, both would be needed: "Perhaps I had better spend a few moments here on those strange characters who think that space is the exclusive province of automatic robot probes and that we should stay home and watch TV, as God intended us to. This whole man-machine controversy will seem, in another couple of decades, to be a baffling mental aberration of the Earth Space Age…all really sophisticated space operations will demand human participation. I refer to such activities as assembling and servicing giant applications satellites of the next decade; running orbital observatories, laboratories, hospitals, factories – projects for which there will be such obvious and overwhelming commercial and scientific

[63] Miller, "Spaceflight and Popular Culture," 501.
[64] Roger D. Launius, "NASA's Quest for Human Spaceflight Popular Appeal," *Social Science Quarterly 98*, no. 4 (2017): 1216.
[65] Launius and McCurdy, *Robots in Space,* 2.
[66] Ibid., 19.
[67] Ibid., 69.

benefits that no one will dispute them."[68] Robots were there *for* the humans, and their role was vital. What mattered was using them correctly.


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Like their human spaceflight counterparts, images and representations of robotic spaceflight have also shaped our understanding of outer space in numerous ways.[70] Clarke was in the business of producing and communicating imaginaries, representations, and narratives, as inscribed in his writing and woven into his speeches, in service of driving a romantic vision of future space travel and encouraging the peaceful utilization of satellite technology. A central question in the study of astroculture, and an inspiration for this analysis was posed by Geppert - capturing key considerations in understanding the role of space popularizers like Clarke: "How was outer space [and spaceflight] represented and communicated, imaged, popularized and perceived in media as varied as print and film, as well as a diverse array of narrative conventions including historical fiction and institutional reporting, all in their own ways contributing to the imaginary bestowal of the universe?"[71] Take for example the way Hubble images have contributed to our imaginings of the universe. In *Picturing the Cosmos: Hubble Space Telescope Images and the Astronomical Sublime*, historian Elizabeth Kessler explores how astronomers translated Hubble data into the striking visual representations of the universe that have come to shape how the universe is depicted in the popular culture today, noting how it is now "common in science fiction films, TV shows, and video games, to see spaceships fly through Hubble-inspired scenery."[72] Kessler conducted oral histories with astronomers involved in shaping the appearance of Hubble images, and she identified a "profound commitment of astronomers to conveying the awe

[68] Arthur C. Clarke, *Report on Planet Three and Other Speculations* (New York: Harper & Row, 1972), 74; "This paper was presented as an address to the Fourth International Symposium on Bioastronautics and the Exploration of Space arranged by the Aerospace Medical Division, Brooks Air Force Base, San Antonio, Texas, in June 1968."
[69] NASA, *Hubble Space Telescope after its release from STS-103 Discovery following an update December 25 1999,* NASA Image: STS103-374-026, Accessed June 5 2020. https://www.flickr.com/photos/nasacommons/.
[70] Geppert, "European Astrofuturism," 6.
[71] Ibid., 6.
[72] Elizabeth A. Kessler, *Picturing the Cosmos: Hubble Space Telescope Images and the Astronomical Sublime* (Minneapolis, MN: University of Minnesota Press, 2012), 4.

they feel when observing the cosmos."[73] These astronomers utilized representational conventions that favored saturated colors, high contrast, dramatic lighting, and rich details in an effort to convey a sense of vastness meant to invoke a feeling of sublime, or more specifically, astronomical sublime.[74] These astronomically sublime images were not made to reach scientists, but to encourage continued financial support for the Hubble Space Telescope, NASA, astronomy, and scientific research in space.[75] As Kessler noted, the popularity of Hubble images is a testament to the success of their representational approach. Just as representations of Hubble have contributed to the way humanity imagines the universe, Clarke's representations of satellites have contributed to the way humanity understood the role satellites played in their present and their future.

> "But already the results from weather satellites have been impressive. Years ago one of the greatest hurricanes ever to hit the Gulf of Mexico – Hurricane Camille – did a million dollars' worth of damage. A similar pattern of hurricane earlier in the century took thousands of lives. If Camille had not been trapped by the weather satellites, the loss of life has been estimated, now that the population is so much higher, at about 50,000. A handful of satellites saved the United States the casualties of the Vietnam War in a single night."[76]
> "The Promise of Space" before The Institute of Directors in Australia, 1974

The Satellite

Erik Conway, historian at NASA's Jet Propulsion Laboratory, said it best when he wrote, "As nonhumans, they're [robotic spacecrafts] ignored. It's far easier to write a compelling heroic narrative about human actors than robotic ones, and space history has often been little more than advocacy written in heroic prose."[77] While this is true in many respects, space histories are equally bound to the popular traditions and ideas of the popular culture in which they were written, and as such, human spaceflight remains a predominant force. As exemplified by Kessler's work on Hubble, improvements in camera definition and computer modeling have yielded robotic spaceflight with a larger share of the narrative space, yet it remains the minority. Among the robotic spaceflight family; space telescopes (Hubble), probes (Voyager), landers (Viking), rovers (Opportunity), and orbiters (Pioneer Venus) are the space technologies typically being examined in the popular culture, perhaps because they do their work on distant celestial bodies, exploring new frontiers in humanity's stead. But satellites - a term used since 1957 to define any man-made object in orbit around the Earth – seldom find themselves as the featured character.[78] Yet in form and function, a satellite is hardly distinguishable from its robotic cousins, specifically space telescopes, orbiters, and probes, and the main distinction is the celestial body it orbits: "Earth-orbiting spacecraft are called satellites. While deep-space

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[73] Kessler, *Picturing the Cosmos*, 7-8.
[74] Ibid., 4; The 'astronomical sublime' is just one form of sublime articulated by space historians, see 'cosmic sublime' in Daniel Sage, *How Outer Space Made America: Geography, Organization and the Cosmic Sublime* (Farnham, Surrey, UK: Ashgate, 2014); 'technological sublime' in David E. Nye, *American Technological Sublime* (Cambridge: MIT Press, 1994); and 'apocalyptic sublime' in Thore Bjørnvig, "Transcendence of Gravity: Arthur C. Clarke and the Apocalypse of Weightlessness," In: *Imagining Outer Space: European Astroculture in the Twentieth Century*. ed. Alexander C. T. Geppert (London, United Kingdom: Palgrave Macmillan, 2018): 141-162.
[75] Ibid., 6.
[76] Arthur C. Clarke "The Promise of Space" speech delivered at The Institute of Directors in Australia Fifth National Conference, March 14, 1974, Folder 6, Box 143, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC, 49.
[77] Conway, "Satellites and Security: Space in Service to Humanity," 287.
[78] Paul Dickson, *A Dictionary of the Space Age* (Baltimore, MD: Johns Hopkins University Press, 2009), 172.

vehicles are technically satellites of the Sun or of another planet, or of the galactic center, they are generally called spacecraft instead of satellites."[79] As explained in a glossary produced by NASA's Jet Propulsion Laboratory, (JPL) satellites can be divided into two separate categories: "scientific satellites (which obtain scientific information about the space environment and the Earth)" with Explorer and its gathering of data on the radiation belts in orbit as an example, and "applications satellites (which perform experiments that will have everyday usefulness for humans)" with the Tiros weather satellite and its weather forcasting capabilities as an example.[80] The tasks performed by satellites and deep space spacecraft (probes and orbiters) are notably the same as well. As Erik Conway notes, "planetary sciences are merely the Earth sciences carried out elsewhere" - communication satellites for relaying data, remote sensing satellites for surface research, and meteorological satellites for atmospheric research.[81] Same concept, different celestial body.

As identified by Geppert, "despite their invisible omnipresence in everyday life, the history of artificial satellites is still dramatically under-researched."[82] Historian Asif Siddiqi seconded the notion: "the study of applications satellites (communications, weather, remote sensing, etc.) remains relatively neglected within the space history community, because it lacks the cachet of both human and deep space exploration."[83] Why does satellite technology lack the cachet of both human and deep space exploration? As Siddiqi put it simply, "partly because these satellites carry no people and go nowhere."[84] Perhaps this neglect results from satellites being the opposite of *explorers*; satellites are *exploiters*. Tools humans can use to exploit the resources of a previously explored frontier, and as such, they just don't provide an exciting narrative. But they are valuable, and Clarke would never miss an opportunity to remind his audience of that fact. Not even Manhattan possessed more valuable real estate than the Clarke orbit: "Within the first decade of the space age, overwhelming practical reasons for the exploitation of this new medium [comsats] had been demonstrated. There were even strong indication that no land on Earth – not even

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[79] Ibid., 172.

[80] Helen Wells, Susan Whiteley and Carrie Karegeannes, *Origins of NASA Names*, SP-4402 (Washington: Scientific and Technical Information Office, National Aeronautics and Space Administration, 1976), 31.

[81] Erik M. Conway, *Atmospheric Science at NASA: A History* (Baltimore: Johns Hopkins University Press, 2008), 8.

[82] Alexander C. T. Geppert, "The Post-Apollo Paradox: Envisioning Limits During the Planetized 1970s," In: *Limiting Outer Space: Astroculture After Apollo*, ed. Geppert, Alexander C. T. (London: Palgrave MacMillan, 2018), 11; While this analysis will utilize a number of the existing histories of satellite technology, there remains a number that are worthy of note. For a focus on comsats and the commercial element, see John R. Pierce, *The Beginnings of Satellite Communications,* San Francisco: San Francisco Press, 1968; David J. Whalen, *The Origins of Satellite Communications, 1945-1965* (Washington, DC: Smithsonian Institution Press, 2002); David J. Whalen, *The Rise and Fall of Comsat: Technology, Business, and Government in Satellite Communications* (Basingstoke: Palgrave Macmillan, 2014); for a greater focus on weather satellites, see Helen Gavaghan, *Something New Under the Sun: Satellites and the Beginning of the Space Age* (New York: Copernicus, 1998); for earth resource satellites, see Pamela E. Mack, *Viewing the Earth: The Social Construction of the Landsat Satellite System* (Cambridge, MA: MIT Press, 1990); for more on satellite ground and relay stations, Sunny Tsiao and United States, *"Read You Loud and Clear!": The Story of Nasa's Spaceflight Tracking and Data Network*. SP- 2007-4232 (Washington, DC: National Aeronautics and Space Administration, NASA History Division, Office of External Relations, 2008); Douglas J. Mudgway, *Uplink-Downlink: A History of the Nasa Deep Space Network, 1957-1997*. SP-2001-4227 (Washington, D.C.: National Aeronautics and Space Administration, 2001); for a greater focus on the cold war and reconnaissance satellites, see Laurence Nardon, "Cold War Space Policy and Observation Satellites," *Astropolitics* 5, no. 1 (2007): 29-62; Hugh R. Slotten, "Satellite communications, globalization, and the Cold War," *Technology and Culture 43*, no. 2 (2002): 315-350; and for a closer look at international collaborative satellite projects, see David M. Baneke, "Space for Ambitions: The Dutch Space Program in Changing European and Transatlantic Contexts," *Minerva: A Review of Science, Learning and Policy 52*, no. 1 (2014): 119-40.

[83] Asif Siddiqi, "American Space History: Legacies, Questions, and Opportunities for Future Research," In: *Critical Issues in the History of Spaceflight*, NASA SP-2006-4702, eds. Steven J. Dick and Roger D. Launius (Washington, DC: NASA, 2006), 454.

[84] Ibid., 454-455.

the gilt-edged sidewalks of Manhattan – was as valuable as the unmarked strip of sky exactly 22,300 miles above the equator, where the synchronous satellites hover effortlessly over the same fixed spot on the globe."[85]

Martin Collins, historian and curator of the application satellites collection at the Smithsonian Air and Space Museum in Washington, D.C. notes the trend that the *spaceflight as exploration* narrative "still resonates, but in a much-diminished way."[86] Rather, Collins notes a growing historical realization that it was "spaceflight as *application"* that created the world we know today.[87] The work of Parks and Schwoch is a testament to that realization, arguing that satellites have largely shaped the cultural and economic means of bringing about the global world, because "without satellites it would be impossible to photograph the world as a ''whole earth,'' to watch the same television program at the same time on different continents, to see the earth in a cosmic context."[88] While these recent analyses have begun filling the void in the historical record, Clarke had long communicated these realities, often before they came to fruition, investing a great deal of energy contemplating the social consequences satellites would have on society. Clarke took the spaceflight as *exploitation* narrative very seriously, as he was well aware of the impact satellites would have on human society. We are now seeing histories that acknowledge these facts, and the satellite is beginning to lose its "invisible omnipresence" as scholars come to acknowledge that space history includes much more of satellite history than meets the eye. It took the recent move toward a new aerospace history less transfixed on human glory and more focused on social, cultural, and spaceflight as application considerations to bring the satellite to the forefront. And these works only confirm many of the satellite expectations Clarke sought to establish with his audiences. For example, Parks argued that "Satellites have been delegated so many functions and have become so fundamental to social networks that the more interesting question may be how they came to take on so many functions and have so much force. To name just a few of these, satellites acquire meteorological data, circulate financial flows, uplink and downlink television signals, deliver navigational data, monitor natural resources, and target sites for bombing. They are actors in networks of weather forecasting, international trade, broadcasting, mapping, Earth sciences, and warfare. By delegating so many duties to the satellite, humans have arguably created a satellitarian order in which a large share of daily activities and transactions— whether commerce, automobile navigation, television viewing, or policing—occur via satellite."[89] In many respects, Clarke was striving to create such a "satellitarian order," himself advocating for satellite projects of all varieties. Because of the numerous ways satellite technology could be exploited for humans on Earth, satellites offered Clarke a diversity of achievable projects to advocate for, and the possibilities only increased as the technology improved, access to space was simplified, political winds shifted, and global utilization, and dependence, grew. It thus makes sense why Clarke strove to limit his visions of the future to what was possible within the lifetime of his readers and listeners. To genuinely inspire action that would drive the establishment of humans in space

[85] Clarke, "Epilogue," *First on the Moon,* 387.
[86] Martin Collins, "A Second Nature Rising: Spaceflight in an Era of Representation" in *Remembering the Space Age: Proceedings of the 50th Anniversary Conference,* ed. Steven Dick, (Washington DC: NASA, 2008): 201.
[87] Collins, "A Second Nature Rising: Spaceflight in an Era of Representation," 201.
[88] Parks and Schwoch, "Introduction," *Down to Earth,* 2.
[89] Lisa Parks, "When Satellites Fall: On the Trails of Cosmos 954 and USA 193" in *Down to Earth,* 232.

forward.[90] And satellites were the means: "I would like now to talk about the importance of man's flight in Space. We need men in there because the satellites are becoming so enormous they can only be assembled and serviced by men on the spot. There are $50 million satellite up there right now which are useless because some ridiculous little component broke."[91]

It's a simple calculation to determine that the loss of a $50 million satellite is unacceptable when it could be fixed by replacing a "little component." Problem is, you need to get those technicians into space, and that is precisely what Clarke wanted to encourage. In Clarke's earliest representations, satellites were human-operated platforms that required technicians to switch out the vacuum tubes.[92] In later years, satellites were orbiting machines in need of regular maintenance. Humans were always part of Clarke's satellite story. Reminicing on his early representations decades later, Clarke recalled: "I assumed that comsats would have to be manned, if only because masses of electronic equipment would require regular servicing... If we were still stuck with vacuum tubes, global satellite communications might have been delayed a couple of decades – but *manned* space transportation would now be going full blast."[93] One way or another, Clarke imagined satellites would propel humans into space, and keep them there, all the while showering the Earth with knowledge and interconnectivity that would tangibly benefit everyone in the here and now. Satellites were *infrastructure* in service of *exploration*. Celestial bodies that granted their creators control of their own destiny in space.

> "For thousands of years, men have sought their future in the starry sky. Now this old superstition has at last come true, for our destinies do indeed depend on celestial bodies – those that we have created ourselves. Since the mid-sixties, the highly unadvertised reconnaissance satellites have been quietly preserving the peace of the world, the weather satellites have guarded millions against the furies of Nature, and the communications satellites have acted as message-carriers for half the human race."[94]
> "Schoolmaster Satellite," 1971

Astrofuturism

Expounding upon McCurdy's work, De Witt Douglas Kilgore's *Astrofuturism: Science, Race, and Visions of Utopia in Space* provides an illuminating analysis of the popular culture of spaceflight created by the space boosters.[95] Kilgore defines *astrofuturism* as "the tradition of speculative fiction and science writing inaugurated by scientists and science popularizers during the space race of the 1950s."[96] Clarke was very much an astrofuturist (another way of

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[90] Westfahl, *Arthur C. Clarke,* 72; Westfahl notes that Clarke "probably viewed his space fiction as an extension of his nonfictional proselytizing for space travel, and for that reason he may have been inclined to limit fictional predictions to projects that might be achieved, or at least undertaken, during the lifetimes of his readers…"
[91] Clarke, "The Promise of Space" speech delivered at The Institute of Directors in Australia Fifth National Conference, 51.
[92] Clarke, *Voices from the Sky,* "A Short Pre-History of Comsats," 108; see also Launius and McCurdy, *Robots in Space,* xii.
[93] Clarke, *Astounding Days*; 123; Arthur C. Clarke, *The Other Side of the Sky*, New York: Harcourt, Brace & World, 1958, featured several stories about manned artificial satellites, including "Special Delivery" (26-29), "Feathered Friend" (29-32), Take a Deep Breath" (32-35), "Freedom in Space" (35-38), "Passer-by" (38-41), and "The Call of the Stars" (41-44).
[94] Clarke, *How The World Was One,* chap. 33; First written in 1971 "Schoolmaster Satellite" about the coming SITE experiment and read into the Congressional Record on Jan. 27 1972; see *Promise of Space*, 92nd Cong., 2nd sess., *Congressional Record* 118, pt. 2: 1604-1605.
[95] Kilgore, *Astrofuturism,* 5.
[96] Ibid., 2.

describing "Space Boosters") and as Kilgore argues, their writing and public advocacy has "been instrumental in conceiving the exploration of space, providing the public explication of the sciences and technologies involved, and arguing for the political, economic, even moral benefits of space expansion."[97] Using their platform to advocate for the positive benefits of the deluge of new knowledge and tools made available by the space effort, astrofuturists strove to "make that knowledge accessible, even familiar."[98] As Kilgore postulated, the majority of Clarke's fiction "advocates the idea of a conquest of space, while his nonfiction and popular science extend the scientific and ideological basis for the space future illustrated in his stories and novels."[99] While Clarke did take extra steps to explicitly note the satellite in his fiction, it does remain largely human solar system colonization focused, but his public advocacy and popular science are filled to the brim with representations of satellites as the "scientific and ideological basis" for his visions of the future. As a movement born in a post-war world now armed with nuclear weapons, astrofuturists imagined space as "an endless frontier that would redeem the past and transform the present" and as this analysis will show, Clarke believed satellites were the means to that redemption and that transformation.[100] The very space technology so associated with weaponry could be used for present day peace, but Clarke was aware he had to work with the weapons builders to get anything done. As Clarke said himself in 1992, "You can make a very good case for going back to the moon with existing technology only if its with a smooth transition from the existing weapon builders. Of course, not all of them will be able to convert." [101]

Kilgore characterizes the "narrative genre" of astrofuturist writing found within both fiction and popular science as distinguishable "by its close connections to engineering projects funded by the government and the military."[102] With governments the early patrons for space projects, military spending was inevitable, and it was the reality in which Clarke operated. Clarke would admit his scorn for the military nature of space technology funding during Congressional testimony in 1975. "I am, I guess, a kind of pacifist myself, even though I was in the Royal Air Force, and I'm unhappy about things being done this way. But this, of course, is how space travel began, and how the rocket was funded originally, however deplorable this may be."[103] Although Clarke worked with a number of international organizations and foreign space programs, NASA was where most of Clarke's professional advocacy was focused likely because of NASA's civilian status and commitment to peace in space. But inevitably, NASA's work only serves to benefit the US military's capacity to operate in space. While NASA was Clarke's main target, he invested substantial time and energy expanding interest in satellites beyond governments, acting as a proponent for international bodies that encouraged commercial development in space. As Kilgore argues, "Clarke's vision for the future included a radical internationalization of all aspects of life and politics" largely because he "imagined that the conquest of space was so tremendous a project that no single corporation or country could muster the resources

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[97] Ibid., 5.
[98] Ibid., 3.
[99] Kilgore, *Astrofuturism,* 111.
[100] Ibid., 3.
[101] Arthur Clarke, Interview with Clarke by Andrew Lawler in *Space News* July 6-19 1992, Clarke, Arthur. C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC, 30.
[102] Kilgore, *Astrofuturism,* 2.
[103] *Future Space Programs 1975: Hearings Before the Subcommittee on Space Science and Applications of the Committee on Science and Technology*, 94th Cong., 1st sess., 1975, 203.

necessary to pursue it. If so, any space venture with a hope of success would have to be international in scale."[104] As such, he focused much of his energy working directly with government, private, *and* international organizational leaders and his messaging was in alignment with those audiences, often emphasizing that the technology already existed, so why not give it a try.

> "It is important to realize that we require no hypothetical inventions or breakthroughs – no science-fictional 'spacewarps' or gravity screens – to bring this about. Existing knowledge, materials and fuels are adequate; what is still required is the experience, skill and engineering competence which only time and millions of man-hours can provide."[105]
> "Epilogue" in *First on the Moon,* 1970

Popularization of Science *is* Science

Kilgore's assertion is a good one, arguing that through the work of astrofuturists "science becomes visible to the public and achieves its effects on our culture. The popularization of science as fiction or exposition connects science with the public and scientists with each other" and that these forms of popularizations "are all ways of doing science and making technology."[106] In many respects, Clarke *was* doing science and making technology when he ever-so passionately advocated for the continued development of satellite technology. He scientifically analyzed the satellite concept to begin with, and advocated for the very funding that made "making" satellites possible. This aligns with the concept of the *Social Construction of Technology*, defined by Lambright as technology "constructed by various social groups whose values it comes to embody… Technology passes through stages of initiation, development, and operational use, its proponents and opponents assert their claims. Proponents construct a working consensus and engage in coalition building in hope of advancing their technology."[107] Clarke was engaged in coalition building on many levels and across a diversity of individuals, seeking to encourage others to develop satellites that embodied beneficial rather than destructive applications. Clarke was a leading voice in the creation of coalitions of peacesat proponents.

As Lambright continues "The literature on social construction of technology and actor-network theory suggests that assembling 'coalitions' of support and conveying a certain 'rhetoric' of technology are important to moving technology forward. They are especially crucial strategies for advocates of large-scale, government-supported technologies."[108] Clarke was at the forefront of crafting the rhetorical basis for coalitions aimed at getting government supported for technologies that enhance the human experience and promote peace rather than war. One such form of rhetoric Lambright asserts is described in Latour's *actor-network theory,* which examines the

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[104] Kilgore, *Astrofuturism,* 121; In alignment with Kilgore's assertion, historian Robert Poole would note that "Clarke's ideal community resembles the international organization of scientists and technocrats which was being mooted at the time as a solution to the control of atomic energy," see Poole, Robert. "The Challenge of the Spaceship: Arthur C. Clarke and the History of the Future, 1930-1970." *History and Technology* 28, no. 3 (2012), 262.
[105] Clarke, "Epilogue," *First on the Moon,* 378.
[106] Kilgore, *Astrofuturism,* 5.
[107] Henry W. Lambright, "The Political Construction of Space Satellite Technology," *Science, Technology, & Human Values* 19, no. 1 (1994): 48; for more scholarship along the lines of the social construction of technology, see Sheila Jasanoff and Sang-Hyun Kim, eds. *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power* (Chicago: University of Chicago Press, 2015).
[108] Ibid., 47.

relations between human and nonhuman actors sharing a social network - as humans and satellites certainly do. As Latour explains: "every time you want to know what a nonhuman does, simply imagine what other humans or other nonhumans would have to do were this character not present. This imaginary substitution exactly sizes up the role, or function, of this little character."[109] Clarke would regularly associate the satellite as a tool *for* humans, rather than as an actor themselves, and a significant part of his public advocacy was enlightening the public and policy makers to the reality of *losing* satellite technology, in essence performing such an "imaginary substitution" as a means of explaining the role satellites played in daily life. And he was doing so to build coalitions that together would create the technologies now visible via substitution.

> *"*Not many of you, I suppose, can imagine the time before the satellite relays gave us our present world communications system. When I was a boy, it was impossible to send TV programmes across the oceans, or even to establish reliable radio contact around the curve of the Earth without picking up a fine assortment of crackles and bangs along the way. Yet now we take interference-free circuits for granted, and think nothing of seeing our friends on the other side of the globe as clearly as if we were standing face to face. Indeed, it's a simple fact that without the satellite relays, the whole structure of the world commerce and industry would collapse. Unless we were up here on the space stations to bounce their messages around the globe, how do you think any of the world's big business organizations could keep their widely scattered electronic brains in touch with each other?"[110]
> "Freedom of Space" in *The Other Side of the Sky,* 1958

The Godfather

In the realm of space policy, images and visions of the future in the popular culture play a notable role in determining the direction of national space programs such as NASA, and better understanding the creation and reception of these visions is highly relevant to space today, as new narratives of how we utilize space and how humans fit in are in full swing. Many of the debates in which Clarke would engage throughout his career are ongoing. With the recent establishment of the US Space Force, the debate surrounding the militarization of space is again at the forefront. A recent *Newsweek* article titled "U.S. Space Force Is Building Weapons to Block Russian and Chinese Satellites," outlined the Space Force's first "offensive weapon system," a proverbial 'satellite jammer.'[111] And with the rise of commercial entities like SpaceX, and their reusable Falcon 9 rocket driving the cost of accessing space to historic lows, the economics of space have changed dramatically and inexpensive transportation to space could facilitate exponential growth in the exploitation of space via satellite. SpaceX's Starlink satellite constellation has already begun proliferating the skies, and Clarke would have undoubtedly engaged with the debate. Starlink's directive is to provide "High speed internet access across to globe" via satellite, reaching communities previously

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[109] Bruno Latour, "Where Are the Missing Masses: The Sociology of a Few Mundane Artifacts" in *The Object Reader*, ed. Fiona Candlin and Raiford Guins (London: Routledge, 2009): 155; quoted in Parks, "When Satellites Fall," *Down To Earth,* 231-232.
[110] Arthur C. Clarke, *The Other Side of the Sky* (New York: Harcourt, Brace & World, 1958), 35.
[111] Jason Murdock, "U.S. Space Force Is Building Weapons to Block Russian and Chinese Satellites," *Newsweek*, April 17, 2020, https://www.newsweek.com/space-force-weapons-systems-block-russian-chinese-satellite-communicatons-meadowland-1498576, Accessed May 3rd, 2020; for official reporting from the Space Force, see "Counter Communications System Block 10.2 Achieves IOC, Ready for the Warfighter," Space and Missile Systems Center Public Affairs, United States Space Force, March 13, 2020, Accessed May 3rd, 2020, https://www.spaceforce.mil/News/Article/2113447/counter-communications-system-block-102-achieves-ioc-ready-for-the-warfighter.

without access.[112] In many ways, it is in the next evolution in the "global village" first established by direct satellite broadcasting of television to developing countries with little to no access. Yet Starlink satellites are already raising alarms for ground-based astronomers, and this proliferation of satellites in only expected to grow with the advent of cubesats and their further miniaturized progeny, nanosats, thus increasing the risk of a space junk catastrophe.[113] By better understanding how satellite representations historically engaged with policy decisions and public understanding, we can learn to better shape the way humanity understands satellites in relation to their lives. Are SpaceX's satellites being represented as dangerous additions to a growing space junk problem or harbingers of knowledge via rural satellite-based broadband internet connectivity? Are satellites worth the hinderance to ground-based astronomy? Should the US Space Force militarize its satellite capabilities or maintain the benchmark set forth by the 1967 UN Committee on the Peaceful Uses of Outer Space? Whichever narrative is predominant will likely be of importance to SpaceX, NASA, the policy makers who regulate space, and the public living under a swarm of orbiting, human-made stars.

Thus far, it has been established that forward momentum in space is built, at least in part, by the intentional transmission of representations, images, and visions of the future into the popular culture with a specific audience in mind, and that this popularization of science *is* science in that it connects the public and scientists together, and serves as a mechanism for building coalitions aimed at constructing technology that embodies the group's values. Through the intentional creation of satellite representations, such as "stars," "voices from the sky," "weapons of peace," "peacesats," and "windows to the world," to name a few, Clarke was striving to build coalitions of governments, international organizations, and private sector leaders, and the public, together aimed at investing in the benevolent applications of satellite technology.

Although just a taste of Clarke's overall satellite advocacy has been explored thus far, it has shown how Clarke reframed the V2 as a commercial opportunity, determined intensive space-based reconnaissance to be a worthwhile global stabilizer, justified that education and knowledge outweighed misinformation and propaganda, and tied the futility of space warfare with the loss of the existing space infrastructure. Clarke was aware that the satellite was both a weapon of peace and piece of weaponry, but with enough global attention, international cooperation, accountability, and public engagement, the satellite could be the savior for a world in possession of devastatingly powerful weapons. And not only a savior for life on Earth now, but for life in space later. Despite the vastly different realities of space between 1945 and 1995, Clarke never wavered from his resolve that humans would colonize the solar system, but if humans wanted to live on Mars, they would need satellites. Satellites were nonnegotiable, but how Clarke would communicate that reality was dependent upon the specific time and space in which he inhabited, and thus his representations were adapted as the arrow of time brought about new opportunities and new challenges. 1945-1995 can be broken into three clear periods, and before beginning, a brief

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[112] Starlink, "High Speed Internet Access Across the Globe," Accessed May 5th, 2020, https://www.starlink.com/.
[113] Neil Briscoe, "Elon Musk's Starlink could take wonders of night sky away from us," *The Irish Times,* May 14, 2020, https://www.irishtimes.com/business/innovation/elon-musk-s-starlink-could-take-wonders-of-night-sky-away-from-us-1.4247431, Accessed June 2, 2020; In the article, Biscoe states Musk is "basically taking the ideas originally articulated by the great Arthur C. Clarke – bouncing radio signals off of orbiting communication satellites- and dramatically increasing bandwidth…" explaining that Starlink will "be a nuisance because these things are quite bright" and will obscure observations.

overview of these time periods will help portray why Clarke's representations changed over time, and to what, or to whom, he was adapting.

> "By mapping out possible futures, as well as a good many improbable ones, the science fiction writer does a great service to the community. He encourages in his readers flexibility of mind, readiness to accept and even welcome change—in one word, adaptability. Perhaps no attribute is more important in this age… We shall disappear if we cannot adapt to an environment that now contains spaceships, computers—and thermonuclear weapons."[114]
> "Foreword" in *Science Fiction Quotations,* 2005

Space Age (1945-1972)

The first period will begin with Clarke's imagining of the geostationary communications satellite in 1945 through to 1972, when Apollo 17 marked the end of the traditional Space Age. Satellites were still just *infrastructure,* or, as Collins put it, "the stepchild of the more glamourous meta-narrative of human exploration."[115] Throughout this period, Clarke was part of a passionate community of space boosters pushing for the realization of what was imagined to be a future with infinite possibilities. The communication satellite, hereby *comsat,* was the focus of Clarke's advocacy, wherein he strove to secure both governmental and private investment, pushed for expanded utilization of comsats by private industry, and continually reminded everyone of the satellite's significance. Once the International Geophysical Year (IGY) was announced in 1955, and the related launch of Soviet satellite Sputnik on October 4th, 1957 officially put the major powers "in the satellite business," Clarke's role shifted to facilitating commercial investment, deeper international partnerships, and establishing a social need for the satellite, which he likened to building "the nervous system of mankind," an early representation for his common representation of satellites as the harbinger of the "Global Village."[116]

With the Nixon Administration leaning away from the ambitious, and expensive, space program of the 1960s toward a commercialized Space Shuttle, and a public increasingly distressed with the war in Vietnam and unresolved domenstic issues, public conceptions of space were being reconfigured.[117] Despite NASA's ability to deliver on the dream of human spaceflight, the future of infinite promise that would follow quickly thereafter appeared far less inevitable, with 40% of Americans supporting a reduction in NASA's budget in the late 1960s.[118] NASA did have its funding majorly cut, and the dream of utilizing the momentum toward Moon bases and Mars was seemingly put on indefinite hold.[119] Concurrently, the realization of human spaceflight also meant the development of advanced rockets, which the public perceived would be capable of launching nuclear weapons, feeding into Cold War narratives that kept the public's attention and informed their understanding of spaceflight, but in a more negative

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[114] Arthur C. Clarke, "Foreword" in *Science Fiction Quotations: From the Inner Mind to the Outer Limits*, ed. Gary Westfahl (New Haven: Yale University Press, 2005), xi.
[115] Collins, "A Second Nature Rising: Spaceflight in an Era of Representation," 202.
[116] Clarke, *Voices from the Sky,* "The World of the Communications Satellite," 134.
[117] For a closer analysis of the political transition to Nixon's presidency from a space policy perspective, see John M. Logsdon, *After Apollo? Richard Nixon and the American Space Program,* Palgrave Studies in the History of Science and Technology (New York: Palgrave Macmillan, 2015).
[118] Alan Steinberg, "Space Policy Responsiveness: The Relationship Between Public Opinion and NASA Funding," *Space Policy*, vol. XXVII, no. 4 (Nov. 2011), 241.
[119] Marina Benjamin, *Rocket Dreams: How the Space Age Shaped Our Vision of a World Beyond* (New York: Free Press, 2003), 10.

light.[120] Clarke was perpetually battling for that narrative space, correcting public perceptions that these technologies were weapons, highlighting rather that they could be very much the opposite and were well worth the tax bill, offering an exponential return on investment.

Even while the Apollo missions were taking place, Clarke was already positioning the next space rocket in a similar vein as he did in 1945, as a taxi for satellites. The Space Shuttle (announced in 1969) was going to not only ferry advanced satellites, but also technicians capable of repairing them. Clarke was already imagining the development of an orbiting infrastructure centered on satellite technology. A near-term project in service of a long-term vision. To Clarke, human spaceflight and satellites reinforced one another. Humans would maintain the satellite infrastructure, and satellites would give humans a reason to go, and stay, in space. Further, Clarke was already normalizing the presence of rapidly proliferating reconnaissance satellites, which would be a consistent theme in his work for decades. "One of the prime reasons why there has been no large-scale war in the last decade is the reconnaissance satellite," he would echo repeatedly.[121]

> "Although in my 1945 paper I had suggested that reception from satellites would be possible with parabolic dishes as small as a foot in diameter, the first ground stations were a hundred times that size, and cost millions of dollars. But as the power of satellites steadily increased, and detectors grew ever more sensitive, so ground equipment became smaller and cheaper. By the mid-seventies it could be afforded by many US households – and a new industry was born."[122]
> *How the World Was One,* 1992

Post-Apollo (1973-1980)

By the time Apollo 17 returned to Earth in December 1972, the social and cultural conditions had changed, and Clarke and his peers would need to adapt to a new iteration of the Space Age, the Post-Apollo Period, which begins in 1973 and ends with the first launch of the space shuttle in April 1981.[123] It is within the Post-Apollo Period that the popular culture of spaceflight took a dramatic turn, and robotic space exploration and satellite technology became the primary forms of spaceflight. Wonderful images of the Earth like Earthrise and the Blue Marble altered our understanding of the planet, ushering in the era of "globalization" and the environmental movement.[124] Even further, the world underwent a "telecommunications satellite revolution."[125] Between the launch of Sputnik in October 1957 and 1975, 7,600 satellites were launched, and it has been argued that they provided the infrastructure necessary to facilitate the interconnectedness needed for truly global society.[126] Not only was satellite telecommunications becoming a highly profitable business, but weather and remote sensing satellites became a

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[120] David E. Nye, *American Technological Sublime* (Cambridge: MIT Press, 1994), 226.
[121] Arthur C. Clarke "2002 and Beyond" speech delivered at Playboy International Writers' Convocation, October 6, 1971, Folder 7, Box 143, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC, 5.
[122] Clarke, *How the World Was One,* chap. 35.
[123] See; Geppert, "The Post-Apollo Paradox: Envisioning Limits During the Planetized 1970s." In: *Limiting Outer Space: Astroculture After Apollo*. ed. Geppert, Alexander C. T. Geppert (London: Palgrave MacMillan, 2018): 3-26.
[124] Benjamin, *Rocket Dreams*, 12; see also Robert Poole, *Earthrise: How Man First Saw the Earth* (New Haven: Yale University Press, 2008).
[125] Geppert, "The Post-Apollo Paradox*,"* 11-12.
[126] Ibid., 11-12.

powerful tool for addressing challenges on Earth. Outward thinking turned inward for an increasingly environmentally focused public, and Clarke acted as a vocal advocate for satellites (of all varieties; weather, remote sensing, communications, and reconaissance) as tools for solving Earthly problems, focusing specifically upon education satellites, hereby *edsats*. Through this period though, Clarke became skeptical of the Space Shuttle and its ability to ensure ease of access to space, and began advocating for the "Space Elevator" (a satellite with a cable attached to the Earth's surface) as an alternative. Yet again, a satellite was the solution.

> "These technologies which could destroy us can also be used for our salvation. From their very nature, space systems are uniquely adapted to provide global facilities, equally beneficial to all nations."[127]
> "War and Peace in the Space Age," 1982

Space Shuttle (1981-1995)

The final period will be the Space Shuttle Period, which began upon NASA's first shuttle launch on April 12th, 1981 and for sake of a clean stopping point, will end in 1995, the 50th anniversary of Clarke's *Wireless World* article. In this period, human as "technicians with screwdrivers" arrived as planned and orbiting commercial enterprises hit their stride. This time has been labeled as the late Cold War due to reinvigorated tensions between the two superpowers.[128] Rising concerns of Soviet anti-satellite weapons (ASAT) testing, as well as Soviet concerns about the Space Shuttle's capacity to dock with orbiting satellites raised concerns about "upgrading" or "installing" weapons onto orbiting satellites, or even "space piracy," prompting US President Reagan to introduce the Strategic Defense Initiative (SDI), a shift in US military nuclear strategy, calling for orbiting satellite fortresses capable of shooting down Intercontinental Ballistic Missiles (ICBMs) with lasers.[129] In the popular culture, SDI would be labeled "Star Wars," for its science fiction association with laser guns and space battles. In response to a return to how satellites had been perceived by the public when Sputnik spawned the Space Race and stirred nuclear fears, Clarke went on the defensive, attempting to counter the shifting narrative, representing reconnaissance satellites as *Peacesats*. It is within the debate about the growing militarization of space technology and fears of an arms race that Clarke invested much of his energy. An underlying element to Clarke's anti-SDI rhetoric was its destabilizing nature, as space junk (i.e. shrapnel) and a battlefield in low-Earth orbit would do the opposite of encourage private investment. It would risk the entire existing satellite infrastructure in the process, as the period also features a massive increase in the commercialization of space.[130] Through all of these years, Clarke was engaged in a battle for narrative space for the peaceful uses of the useful pieces of outer space. How and why he came to engage in such a debate is vital to understanding Clarke's position toward satellites throughout his career.

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[127] *Arthur Clarke Discusses War and Peace in Space,* Congressional Record 97th Cong., E4309.
[128] Robert Poole, "The Myth of Progress: 2001 - A Space Odyssey" in *Limiting Outer Space: Astroculture After Apollo*, ed. Alexander C. T. Geppert, (London: Palgrave MacMillan, 2018), 123.
[129] Siebeneichner, "Spacelab," 261.
[130] Lisa Parks, *Cultures in Orbit: Satellites and the Televisual* (Durham: Duke University Press, 2005), 80.

Genesis of the Godfather

> "The discovery of explosives and the invention of artillery shows that there was one way of escaping from the earth and the 'Space Gun' arrived on the scene. The most famous version, or course, is that in Jules Verne's From the Earth to the Moon, (1865), but it was not the first…Because guns are so obviously impractical, there have been many attempts to devise alternative, and less violent, means of escaping from the earth. The American writer Edward E. Hale, author of The Brick Moon (1870) – the very first suggestions ever made for an artificial satellite – proposed giant flywheels that could be brought up to speed over a long period of time."[131]
> "Space Flight – Imagination and Reality," 1982

To begin, it is important to first understand how Clarke came to become the "Godfather of Satellites." His imagining of the geostationary satellite in 1945 was not an isolated incident, but a link in a long chain, and Clarke's namesake vision of the future was a creation of his (technically oriented) imagination, itself driven by the imaginaries, or mental images, Clarke was motivated by the popular culture of his own time and space – one dominated by science fiction and the emergence of rockets.[132] Shy of a century before Arthur C. Clarke would even begin conceiving of the geostationary communication satellite, Clarke's forebears, like Hale, had already began planting satellite imaginaries into the popular culture of outer space. In the nineteenth century, a period when a human presence in space remained solely the realm of the imagination, the authors of the earliest science fiction (or what would become known as science fiction) began conceiving of orbiting bodies and human visitation of other worlds.

American author Edward Everett Hale's short story "The Brick Moon," published in *The Atlantic Monthly* in 1869, depicts the first known imagining of an artificial satellite and a space station, detailing the creation and launch of a 60 meter (200 feet) satellite made of bricks. "The Brick Moon" in the story was designed to be a navigational aid for mariners when the Moon was absent.[133] In a speech Clarke gave in 1971, where he referenced the story as the true "first suggestion for a satellite," he noted that it "was a very farsighted idea because this is happening right now… that our navigational satellites up there which enable ships and aircraft to locate themselves within a few feet anywhere in the world."[134] Clarke felt Hale wasn't *too* far off, his imagination was in the right place.

> "Contrary to a general belief – prediction is not the main purpose of science-fiction writers; few, if any, have ever claimed 'this is how it will be.' Most of them are concerned with the play of ideas, and the exploration of novel concepts in science and discovery. "What if…?" is the thought underlying all writing in this field."[135]
> "Post-Apollo Preface" in *The Prelude to Space,* 1977

Imagining Outer Space

The reconciliation between science and the imagination has been an ever-present debate within the history of science, dating back to Kant and fears of the imagination's delusions.[136] In his work *Imagination and Science in*

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[131] Clarke, *1984: Spring,* 101-102.
[132] McCurdy, *Space and the American Imagination,* 3.
[133] Clarke, *1984: Spring,* 101-102.
[134] Clarke, "2002 and Beyond," 6.
[135] Clarke, "Post-Apollo Preface" to 1977 Edition of *Prelude to Space*, 1.
[136] Richard C. Sha, *Imagination and Science in Romanticism* (Baltimore: Johns Hopkins University Press, 2018), 26.

Romanticism, historian Richard Sha explores how nineteenth century Romantic artists and scientists harnessed the imagination as an "engine of epistemology," that "produces ideas and makes possible comparisons, scientific as well as poetic ones. The imagination generates hypothesis that in order to become scientific must somehow be confirmed."[137] Through discipline and putting "protocols in place to insulate the imagination from delusion," Romantic scientists were able to reap the fruit of the imagination's "generative, spontaneous, and creative powers."[138]

In January 1898, a young Robert Goddard first encountered the "creative powers" of H.G. Wells's *War of the Worlds* and Garrett P. Serviss's *Edison's Conquest of Mars.*[139] Goddard later recalled that his encounters with some of the first forms of science fiction "gripped my imagination tremendously. Wells's true psychology made the thing very vivid, and possible ways and means of accomplishing the physical marvels set forth kept me busy thinking." The following year, Robert Goddard's future as the scientist credited with creating and building the world's first liquid-fueled rocket would-be set-in motion upon an epiphany in a tree: "I imagined how wonderful it would be to make some device which had even the possibility of ascending to Mars and how it would look on a small scale, if sent from the meadow at my feet. I was a different boy when I descended the tree, for existence at last seemed very purposive."[140] Mars was long the dream, and Clarke would long share in that dream.

In *Astounding Wonder: Imagining Science and Science Fiction in Interwar America,* historian John Cheng writes about science fiction's historical emergence, and how "in that intersection of interwar popular science and popular culture, the stories that inspired Goddard and others gained new significance, becoming a recognizable genre, known as science fiction, and cultivating a social and progressive sensibility among its readers and enthusiasts."[141] Cheng argues that imagination, what he defines as "conceiving what was not yet realized or realizable," inspired the young Robert Goddard with the potential of traveling to Mars, and he in turn sought additional knowledge useful toward his imagined future, and pursued a career in science.[142]

When Robert Goddard launched the first liquid-fueled rocket from a farmer's field in central Massachusetts in 1926, the era of modern rocketry was underway, allowing for an imaginative leap in the popular envisioning of space travel.[143] *Amazing Stories*, the first pulp magazine devoted solely to science fiction, was launched in the US by "the father of pulp science fiction magazines" Hugo Gernsback that same year.[144] Gernsback originally called the genre "scientifiction," (which didn't stick around) and he is honored for his efforts to energize the genre today because a "Hugo" award is given to the best story of the year.[145] 1928 saw Edward Elmer (E.E.) Smith's *Skylark of*

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[137] Ibid., 25.
[138] Ibid., 26.
[139] John Cheng, *Astounding Wonder: Imagining Science and Science Fiction in Interwar America* (Philadelphia: University of Pennsylvania Press, 2011), 1.
[140] Ibid., 1.
[141] Ibid., *4.*
[142] Cheng, *Astounding Wonder, 6.*
[143] Launius and McCurdy, *Robots in Space,* 4.
[144] Ibid., 4.
[145] Samuel Mines, Science Fiction Reaches Escape Velocity in *Washington Post* August 6 1972*,* Impact: Science Fiction (through 1979), Record Number 006789, NASA Headquarters Historical Reference Collection, Washington, DC, 10.

Space, a classical saga reminiscent of *The Iliad* and *The Odyssey* on a galactic scale.[146] Smith's saga spawned the "space opera" concept, which Clarke later notes was "brilliantly projected into a new medium by George Lucas."[147] Clarke and Lucas' "Star Wars" will become an important element in this analysis.

As exemplified by Kilgore's *Astrofuturism,* Clarke and fellow *astrofuturists* institutionalized their pro-space movement with the creation of rocket societies the world over. From the German Verein fur Raumschiffarht (Society for Space Travel) in 1927 to the American Interplanetary Society (later named the American Rocket Society) in 1930, founded by David Lasser, editor for Hugo Gernsback's newest science fiction magazine *Science Wonder Stories.*[148] In 1931, David Lasser published *The Conquest of Space,* the first book in English that showcased the concepts of rocketry and spaceflight as serious possibilities.[149] Clarke would later comment that upon reading *The Conquest of Space* as a teenager, "I learned for the first time that space travel was not merely delightful fiction. One day it could really happen… My fate was sealed."[150] Just a year after the founding of the British Interplanetary Society (BIS) in 1933, Secretary Les Johnson received a letter from a sixteen year old Clarke who learned about the society in one of his many science fiction magazines: "Please could you send me particulars about your Society, as I should very much like to join it. I am extremely interested in the whole subject of interplanetary communications and have made some experiments with rockets."[151] Clarke's interest in communications began over a decade before he would "invent" to comsat.


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[146] Launius and McCurdy, *Robots in Space,* 4.
[147] Frederik Pohl, "Astounding Story" in *American Heritage,* September/October 1989, Impact: Science Fiction (1980 - n), Record Number 006788, NASA Headquarters Historical Reference Collection, Washington, DC: 42-54; Clarke, *Astounding Days*, 103.
[148] Launius and McCurdy, *Robots in Space,* 4; Kilgore, *Astrofuturism,* 6.
[149] McAleer, *Odyssey of a Visionary*, chap. 3.
[150] Ibid., chap. 3.
[151] Ibid., chap. 3.
[152] Photo Credit: Arthur C. Clarke Trust, *Clarke in London circa 1937,* Accessed May 9 2020. http://arthurcclarke.org/site/legacy/; Clarke would be roughly twenty years old.

Clarke would join the BIS three years later, in 1936, eventually serving as chairman in from 1946-47 and 1950-1953.[153] In a brochure produced in 1938, Clarke declared the British Interplanetary Society to be "a Society devoted to the study of Astronautics—the science of Space Travel. Since its foundation in 1933 it has done everything in its power to convince the public of the possibility of interplanetary communication, for it believes that the conquest of space could be accomplished to-day by means of the rocket motor and known chemical fuels. The scientific grounds for this belief are indicated at the end of this leaflet, and are the results of research extending over a number of years."[154] The V2 would come to be a dark realization of Clarke's long-held expectations that rockets would initiate space travel. Convincing the public of the achievability of space travel and interplanetary communication was a collective effort undertaken by scientists and science fiction authors alike, and many of the early space boosters held both distinctions. The present historiography recognizes that "science fiction proved to be a powerful force for generating public interest in actual space travel."[155] Just as H.G. Wells had done for Robert Goddard, and David Lasser for Arthur C. Clarke, new generations of space boosters were being recruited via the imagination.

Reflecting on his early high school life in the late 1940s, Carl Sagan recalled "I knew that I was interested in the other planets and I knew that rockets had something to do with getting there. But I had not the foggiest notion about how rockets worked or how their trajectories were determined. Then I came upon an advertisement for a book called *Interplanetary Flight* by one Arthur C. Clarke."[156] Sagan would go on to found another pro-space organization, the Planetary Society in 1980, and in a letter titled "In Praise of Arthur C. Clarke" written in the May/June 1983 edition of *The Planetary Report,* Sagan would remark, "Through his non-fiction books and his science fiction stories and novels, his invention of the communications satellite, his defense of reason against clamors of superstition, his work in more finely honing the British Interplanetary Society, and through his classic motion picture, Arthur has done an enormous global service in preparing the climate for a serious human presence beyond the Earth. I hope that the governments of our epochs will have the sense to continue making Arthur's dream – shared by so many of us – a reality."[157] The minds that brought us into the Space Age were formed during the "golden age of science fiction," and these space boosters made it their mission to deliver a realistic vision, where spaceflight was imminent.[158] But these visions were not solely driven by science fiction. Rather, much of science fiction was driven by the science realities of war.

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[153] Thore Bjørnvig, "Transcendence of Gravity: Arthur C. Clarke and the Apocalypse of Weightlessness" in *Imagining Outer Space: European Astroculture in the Twentieth Century*, ed. Geppert, Alexander C. T., Second ed. European Astroculture, Volume 2. London, United Kingdom: Palgrave Macmillan, 2018: 141.
[154] McAleer, *Odyssey of a Visionary,* chap. 4.
[155] Launius and McCurdy, *Robots in Space,* 96.
[156] Carl Sagan, "In Praise of Arthur C. Clarke," Arthur. C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC, 3; Can also be found in the May/June 1983 *The Planetary Report,* 3.
[157] Ibid., 3.
[158] McCurdy, *Space and the American Imagination,* 32-33.

> "The BIS has now been carefully packed up in cold storage for the duration and until the war is over we have stopped all active work… When we get back again we will start the society going once more, and I'll drop you a line to that effect. Obviously a slight disturbance like the present civil war cannot be permitted to upset the conquest of space!"[159]
> "Letter to John W. Campbell," 1940

Born of the Military

By 1941, with the Nazi Blitz bombing campaign underway, Clarke was aware his involvement in World War Two would soon become mandatory.[160] Hoping to leverage his interest in astronomy into an opportunity to learn celestial navigation, Clarke entered the Royal Air Force (RAF) on March 18th, 1941, becoming an Aircraft Hand Radio Wireless Mechanic/Aircraftsman Class II, "the lowest form of animal life in the RAF" he noted.[161] After basic training, and just days after the last major bombing of London in May 1941, Clarke was ordered to London's still smoldering East End for technical training in electronics.[162] Far from celestial navigation, Clarke was selected for further training in radio direction finding (RDF), or radar.[163] Beginning in September 1941, Clarke would be tasked to focus his energy and mental attention toward all matters related to communication technology for the war effort; microwaves, electrical circuits, and radar.[164]

A highly studious soldier, Clarke spent a great deal of time in the military base's library, earning placement at a radar installation in Lincolnshire in early 1943, working and training alongside scientists on then state-of-the-art technology.[165] Clarke began working on a team led by Nobel Prize-winning physicist Luis W. Alvarez from the Massachusetts Institute of Technology (MIT) Radiation Lab, who had developed Mark I, a prototype Ground Controlled Approach (GCA) radar system.[166] The top-secret GCA was a "blind-approach" radar, a primitive form of air traffic controlling that relied upon a radar set, contained in a mobile vehicle, that tracked an aircraft's exact position within a few feet, allowing a radio operator, positioned in a separate vehicle housing the transmitter antennas, to relay the perfect glide path to pilots attempting to land in low visibility.[167] By wartime happenstance, Clarke found himself immersed in the development of advanced communication technology, later reminiscing that "it would not have been possible to design a more stimulating environment for a would-be science fiction writer. I was *living* what

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[159] Clarke, *Astounding Days*, 250; This quote is from a letter addressed to Campbell in March 1940 from Clarke writing as a representative of the BIS; Clarke continued to write during the war, producing over twenty short stories and articles, including his first sale to Campbell (for the "big money" of $180!), the novella "Recue Party," written in March 1945, "roughly midway between the V2 rocket and the atomic bomb," Clarke, *Astounding Days,* 191.
[160] McAleer, *Odyssey of a Visionary*, chap. 5.
[161] Ibid., chap. 5.
[162] Ibid., chap. 5.
[163] Ibid., chap. 5.
[164] McAleer, *Odyssey of a Visionary*, chap. 5.
[165] Ibid., chap. 5.
[166] Ibid., chap. 5.; Clarke would later note that Alvarez's most famous contribution came near his death in 1988, where, along with his geologist son Walter, the pair proposed that the extinction of the dinosaurs was caused by the impact of a giant meteorite, see Clarke, *How the World Was One,* chap. 24.
[167] Ibid., chap. 5.; Clarke's 1963 novel *Glide* Path described how GCA radar works and included Luis as a character, see Arthur C. Clarke, *Glide Path* (New York: Harcourt Brace Jovanovich, 1963); Clarke further wrote about his experience with GCA in *Ascent to Orbit,* "You're on the Glide Path – I Think," 31-35.

would have been sf [science fiction] only a decade earlier; moreover, for the first time in my life, I was working with real scientist-engineers."[168]

During this time, Clarke engaged in fruitful discussions about the future with his British and American compatriots during precious time not devoted to the development, testing, and training on the Mark I. His American colleague Bert Fowler, one of four who accompanied Luis Alvarez from the MIT Radiation Lab, recalled how Clarke talked "about what it took in the way of thrust to get weight into orbit and about the plans and designs for a colony on the moon and spacesuits which would provide oxygen and protect you against the vacuum… None of us had ever been exposed before to someone who actually thought in technical terms of getting to the moon and what it would take to live there."[169] Always focused on rocketry and space travel, and a known member of the British Interplanetary Society, Clarke received the nickname "Spaceship."[170]

Aside from development and testing, the plan was for the MIT Radiation Lab team to train the RAF unit (which included Clarke) on the maintenance and operation of the Mark I before they returned to the US in late 1943.[171] It was "Spaceship" who would be handed the keys to the Mark I in 1944, maintaining it for the remainder of the war.[172] During his time working with GCA radar while in the RAF, Clarke continued to invest mental energy grappling with the emerging possibilities of space travel and rocketry in tandem with his wartime focus on radar and microwaves. The same year Clarke became a Mark I radar operator, Britain (and the world) was introduced to Wernher von Braun's V2 missiles in horrific fashion. Despite their awful purpose, space enthusiasts like those in the British Interplanetary Society (BIS) were well aware of what the V2 meant for space travel, and they were swift to forgive as a result, as von Braun would be inducted as an honorary member of the BIS in 1949, claiming that the V2 had always been about space travel, "but we're hitting the wrong planet."[173] Ignore the ills to obtain the gains. As the tides of war shifted in the Allied direction, Clarke began correspondence with some of his fellow BIS counterparts to discuss post-war public relations efforts.[174] Germany had proven that large rockets could be flown, but they needed a motivating rationale for why these expensive rockets should be built, and to Clarke, the satellite was the obvious choice: "We 'space cadets' were trying to think of ways of getting space travel on the move and were trying to persuade people to pay for exploration of the moon and planets. Was there any commercial pay-off for space technology? My radar background and my interest in space combined and it occurred to me that satellites would provide the solution to the problem of global communications – particularly global televisions. It occurred to me that if we could put a television transmitter in a satellite, we could, if it were high enough, broadcast to half of the world at one time… It <u>was</u> difficult [to reach such a high orbit] – but it was done, and is now a routine matter."[175]

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[168] Clarke, *Astounding Days*, 214.
[169] McAleer, *Odyssey of a Visionary*, chap. 5.
[170] Ibid., chap. 5.
[171] Ibid., chap. 5.
[172] Clarke, *Astounding Days*, 191.
[173] Robert Poole, "The Challenge of the Spaceship: Arthur C. Clarke and the History of the Future, 1930-1970," *History and Technology* 28, no. 3 (2012): 256.
[174] McAleer, *Odyssey of a Visionary,* chap. 6.
[175] Arthur C. Clarke, "Imagineering in Space" speech delivered at Chris Evans Memorial Lecture Hall, September 10, 1980, Folder 3, Box 143, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC.

In February 1945, months before the publication of the now infamous "Extra-Terrestrial Relays" article, Clarke penned a Letter to the Editor of *Wireless World* titled "Peacetime Uses for V2," highlighting that the V2 could be used for ionosphere research, and later for satellite launches.[176] In 1945, Germany officially capitulated and Wernher von Braun and his team surrendered to the US, sparking a new mission for V2 technology.[177] Not long thereafter, Clarke began expanding upon his satellite concept, drafting "The Future of World Communications," which would later become "Extra-Terrestrial Relays: Can Rocket Stations Give World-Wide Radio Coverage?", an article *Wireless World* paid him $40 to publish in October 1945.[178] Joking later in life that he gave away a multi-billion-dollar concept for just forty bucks, Clarke blamed a lack of imagination for his failure to patent.[179] Further, Clarke felt his "early disclosure may have advanced the cause of space communications by approximately fifteen minutes." [180] Regardless, those fifteen minutes initiated the foundation for the forthcoming satellite telecommunications revolution, and thus the satellite future Clarke envisioned was official under construction.

> "We can now reach the highest possible ground by launching ourselves, with our tools and our instruments, beyond the atmosphere. Artificial satellites can be established in orbits at any angle to the earth's axis, and at any altitude. They can move in paths that are perfectly circular, or highly eccentric – swinging out beyond the moon, and dropping back to within a few hundred miles of the earth. There is an orbit for every taste; but by far the most valuable one is that at a height of 22,300 miles, directly above the equator. For here, and only here, a satellite can be 'geostationary' or synchronous – that is, it can hover motionless over the same spot on the earth. Though this seems like pure magic, it is an elementary consequence of the law of gravity."[181]
> "Epilogue" in *First on the Moon,* 1970

[176] Clarke, "V2 for Ionosphere Research?" 58.
[177] William E. Burrows, *This New Ocean: The Story of the First Space Age* (New York: Random House, 1998), specifically chapter 4 "Missiles for America" for a closer look at von Braun and the V2's transition from German missile to American Moon rocket.
[178] McAleer, *Odyssey of a Visionary,* chap. 5.
[179] Ibid., chap. 5; McDougall, *The Heavens and the Earth,* 352; In a letter to *Astounding Stories* editor John Campbell in March 1968, Clarke would note that in the January 1961 issue of *Analog,* patent lawyer and author Ted Thomas wrote a parody article called "The Lagging Profession" where the character, Arthur C. Clarke, tried to patent the communication satellite and failed, see Clarke, *Astounding Days,* 256-257; For a humorous look at how a lawyer talked Clarke out of the decision to patent the idea, see Arthur C. Clarke, "A Short Pre-History of Comsats, Or: How I Lost a Billion Dollars in My Spare Time" in *Voices from the Sky: Previews of the Coming Space Age*. (New York: Harper & Row, 1965): 105-112.
[180] Ibid., chap. 5.
[181] Clarke, "Epilogue," *First on the Moon,* 389.

Space Age: 1945-1972

"Mightier than the ICBM": The Comsat

> "Living as I do in the Far East, I am constantly reminded of the struggle between the Western World and the USSR for the uncommitted millions of Asia. The printed word plays only a small part in this battle for the minds of the largely illiterate population and even radio is limited in range and impact. But when line of sight TV transmission becomes possible through satellites directly overhead, the propaganda effect may be decisive . . . the impact upon the peoples of Asia and Africa may be overwhelming. It may well determine whether Russian or English is the main language of the future. The TV satellite is mightier than the ICBM."[182]
> "Testimony before the Select Committee on Astronautics and Space Exploration," 1959

While Clarke conceived of the comsat as a means of providing a monetary rationale for the V2 rocket, he believed the comsat itself possessed more power than the ICBM in altering life on Earth and facilitating space travel. Thus the majority of his work during the Space Age was devoted to the comsat. As a radio operator in World War II, Clarke well understood the unreliability of communication technology during the war.[183] The military benefits of the comsat were apparent, and unbeknownst to Clarke, a study on the future uses of rockets and spaceflight conducted by Robert P. Haviland of the US Navy used Clarke's "Extra-Terrestrial Relays" as a valuable resource.[184] When the Los Angeles Times caught wind of Clarke's *Wireless World* article, journalist William S. Barton published apiece on February 3, 1946 titled "Tiny 'Moons' Circling Earth Proposed as Long Distance Broadcasting Aid".[185] Along with explaining the concept, the article stated that the "scientist's" plan was "to solve television, wireless telephone and telegraph long distance broadcasting problems by establishing, with the aid of rockets, manned radio relay stations that would forever circle the earth like tiny moon, is receiving serious consideration."[186] Clarke was already reframing the deadly V2 rocket into terms the public could get behind, because they had something to gain. But the fine line between the military and peaceful uses of satellite technology was already indistinguishable.

> "Although I am certainly not anxious to claim paternity for the doctrine of Mutual Assured Destruction – so amply abbreviated MAD – this may well be its first appearance in print. And let us be fair to MAD; it has maintained such dubious peace as we have enjoyed for the last few decades."[187]
> "Star Wars Star Peace," 1987

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[182] United States, *Next Ten Years in Space, 1959–1969, Staff Report of the Select Committee on Astronautics and Space Exploration,* House document No. 115, 86th Congress, 1st session (Washington DC: GPO, 1959), 32.
[183] Erik Conway, "Satellites and Security: Space in Service to Humanity" in *Societal Impact of Spaceflight*, eds. Steven J. Dick and Roger D. Launius (Washington, DC: National Aeronautics and Space Administration, 2007), 271.
[184] McAleer, *Odyssey of a Visionary,* chap. 5.
[185] Ibid., chap. 5.
[186] Ibid., chap. 5.
[187] Arthur C. Clarke, "Star Wars and Star Peace," *Interdisciplinary Science Reviews* 12, no. 3 (1987): 272.

Mutually Assured Destruction

Despite the end of World War II in Europe, Clarke's military service was not yet complete and the destructive power of the V2 and the emergence of the atomic bomb (and all the fears and anxieties therein) stirred in his mind.[188] Clarke was reconciling these fears with optimism that rockets and the discovery of atomic power had advanced space travel by half a century.[189] In November 1945, Clarke entered an essay competition sponsored by the *Royal Air Force Quarterly*, and won.[190] Published in 1946, his essay "The Rocket and the Future of Warfare" mused on the implications of a nuclear 'radiation war' fought with intercontinental ballistic missiles – notably calling for measures to avoid such a terrifying catastrophe. The essay is said to be the first articulation of the concept of Mutually Assured Destruction (MAD).[191] "One returns to the conclusion that the only defense against the weapons of the future is to prevent them ever being used. In other words, the problem is political and not military at all. A *country's armed forces can no long defend it: the most they can promise is the destruction of the attacker."* [192] If you attack us, we'll attack you. A horrible means of peace indeed. Clarke has noted on many occasions that he held great disdain for war, and if space was the goal, and V2 rocket technology was the means to get there, comsats offered a much better mechanism than nuclear weapons for driving space travel forward.[193] Better yet, space weaponry shouldn't be developed in the first place.

Clarke's military service came to an end on June 21st, 1946, and in October, he began pursuing a Bachelor of Science in physics and mathematics at King's College (astronomy had been his first choice, but it was not available) and simultaneously, Clarke and fellow British Interplanetary Society member Val Cleaver, began the process of reviving the BIS.[194] From 1946-1947, Clarke acted as the BIS Chairman, and with rocketry, an education in science, and public space advocacy front and center in his life, a 29 year-old Clarke would come to write what historian Robert Poole dubs "one of the founding manifestoes of the Space Age" and the work that "helped to establish him as the West's leading techno-prophet."[195]

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[188] Poole, "The Myth of Progress: 2001 - A Space Odyssey," 123.
[189] Poole, "The Challenge of the Spaceship," 256.
[190] McAleer, *Odyssey of a Visionary,* chap. 6.
[191] Clarke, *Astounding Days,* 206; Clarke also made note here that other writers have come to attribute his essay "The Rocket and the Future of Warfare" as the first articulating of MAD, as Science writer Thomas Heppenheimer commented had commented "It was over fifteen years before the doctrine of Mutual Assured Destruction became US policy; yet its essential concept is not only set forth in this article, but emphasized."
[192] Clarke, "Star Wars and Star Peace," 272; Clarke quotes this line from his 1946 essay "The Rocket and the Future of Warfare."
[193] Clarke, *Astounding Days*, 205.
[194] McAleer, *Odyssey of a Visionary,* chap. 6.
[195] Poole, "The Challenge of the Spaceship," 255.

> "It is not easy to see how the more extreme forms of nationalism can long survive when men begin to see the Earth in its true perspective as a single, small globe hanging like a blue orb in space."[196]
> "The Challenge of the Spaceship," 1946

The Global Society

Clarke's *The Challenge of the Spaceship*, subtitled "Astronautics and its Impact Upon Human Society" was published in the British Interplanetary Society's journal in 1946. As Poole argues, Clarke "successful propagated the belief that man's destiny lay in space and that the process was already underway."[197] Showcasing a hard science prowess that would grant him credibility with the pro-space movement, Clarke's stated goal was to develop public awareness of space travel and its implications.[198] As summarized by Poole, Clarke strongly rejected military rationales for space development and his vision in *The Challenge of the Spaceship* saw "space travel as the historic enterprise of the whole human race, and thus as the antithesis of nationalism and war."[199] Clarke explored the ways in which the exploration of space might alter human values, believing a global society will resist war, not encourage it.[200] In the several years following *The Challenge of the Spaceship,* while completing his degree at King's College, Clarke kept writing, mostly short stories, and his anti-war, pro-human unity themes become ever apparent. *Nightfall* (1947) explored a civilization destroyed by nuclear war; *Guardian Angel* (1948) showcased a new, positive evolution for humanity; *Against the Fall of Night* (1948) followed a closed society that rediscovered its "spirit of adventure"; and *The Sentinel* (1948) described the discovery of extraterrestrial technology on the Moon (*The Sentinel* would later be adapted into *2001: A Space Odyssey*).[201] But the satellite was soon to become a fixture in his imaginings.

> "*Prelude to Space* was written just two years after my 1945 paper on synchronous communications satellites and was, therefore, the first work of fiction in which the idea of "comsats" was advocated. I have reason to believe that it had some influence on the men who turned this dream into reality."[202]
> "Post-Apollo Preface" in *Prelude to Space,* 1977

Satellites in the Popular Culture

1951 would prove to be an important year in Clarke's satellite advocacy, notably possessing three major events; the Second International Congress on Astronautics hosted in London by the BIS (which Clarke was chairing at the time), and the publication of two of his renown books on spaceflight, the popular science book *The Exploration of Space,* which sought to relay the necessary steps needed to explore space, and his first science fiction novel, *The Prelude to Space,* set in 1978 as a *commercial* organization begins the human exploration of the solar system.[203] Both of which

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[196] Arthur C. Clarke, "The Challenge of the Spaceship: Astronautics and its Impact upon Human Society," *Journal of the British Interplanetary Society 6*, no. 3 (December 1946): 72-73.
[197] Poole, "The Challenge of the Spaceship," 255.
[198] Poole, "The Challenge of the Spaceship," 258.
[199] Ibid., 261.
[200] Peter Bowler, *A History of the Future: Prophets of Progress from H.G. Wells to Isaac Asimov* (Cambridge, United Kingdom: Cambridge University Press, 2017), 54.
[201] Poole, "The Challenge of the Spaceship," 256.
[202] Clarke, "Post-Apollo Preface" to 1977 Edition of *Prelude to Space*, 3.
[203] Poole, "The Challenge of the Spaceship," 256.

would have long reaching implications, not only for furthering Clarke's vision of the future, but also his popularization of satellites.

The Second International Congress on Astronautics in London was attended by 63 representatives from 10 countries, a far cry from the thousands that attend today.[204] As chair, Clarke proclaimed "spaceflight is likely to be the next major technical achievement of our species," marking the congress' official subject to be the "earth-satellite vehicle."[205] The first paper, "The Importance of Satellite Vehicles to Interplanetary Flight," was written by Wernher von Braun, but due to his pending US citizenship and travel restrictions, it was presented by Frederick C. Durant.[206] The paper, which von Braun expanded upon in his 1952 book *The Mars Project,* outlined how a voyage to Mars could be undertaken, highlighting the potential necessity of 950 trips into Earth orbit.[207] Upon re-reading the papers from this conference years later, Clarke noted, "The main emphasis was on building manned space stations, and refueling in orbit for flights to the planets – probably with nuclear-powered rockets! There was only the briefest mention of communications satellites; as I was chairman of the proceedings, this seems a surprising oversight. However, by this time I took such unexciting trinkets for granted, and was anxious to hurry on to the Moon and Mars."[208] Just six years after his *Wireless World* article, and seven years before Sputnik, Clarke himself lost sight of the satellite, a testament to its hidden position.

The Exploration of Space would attempt to relay the necessary steps needed to explore space, but its contents were reserved less for scientific audiences and more to the public.[209] The book made it into the Book of the Month Club in the US, and in turn expanded Clarke's reach outside of Britain and into a much larger, and more promising market.[210] In the book, Clarke envisioned that space exploration would unfold in seven stages.[211] As McCurdy notes, the long-range plan NASA would adopt upon its inception in 1958 nearly mimics the seven steps explicated in Clarke's imagination.[212]

Prelude to Space was Clarke's first science fiction novel, putting the realism of *The Exploration of Space* into a science fiction narrative, projecting a successful moon landing in 1977 undertaken by three astronauts in a "moonship."[213] In his first foray in advocating for the comsat in a popular representation, Clarke explores a future with a functioning array of commercially operated communication satellites: "The great radio and telegraph companies had to get out into space – it was the only way they could broadcast television over the whole world and provide a universal communication service."[214] Further, the commercial fueled future Clarke is striving to create is

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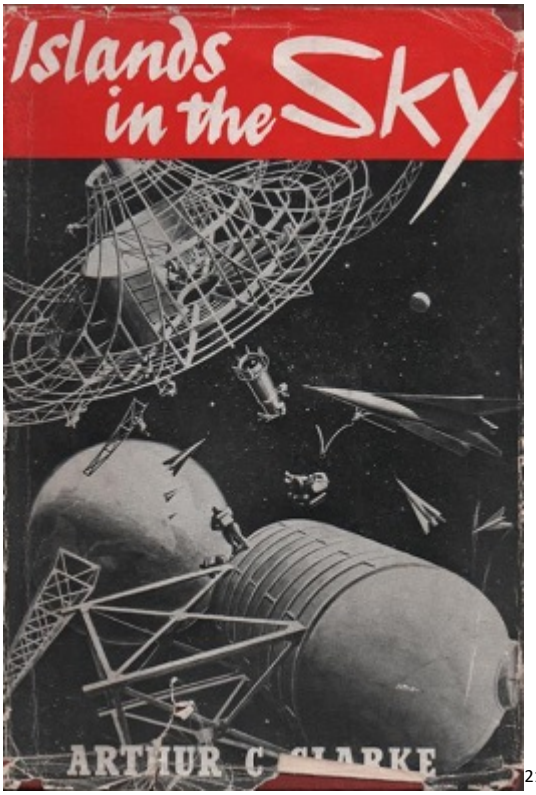
[204] McAleer, *Odyssey of a Visionary,* chap. 6.
[205] Ibid., chap. 6.
[206] Ibid., chap. 6.
[207] Ibid., chap. 6.
[208] Clarke, *How the World Was One,* chap. 27.
[209] Arthur C. Clarke, *The Exploration of Space* (New York: Harper & Brothers, 1951) described both polar and geosynchronous "metsats" (meteorology satellites) as well; see David J. Whalen, "For All Mankind: Societal Impacts of Applications Satellites" in *Societal Impact of Spaceflight*, eds. Steven J. Dick, and Roger D. Launius, (Washington, DC: National Aeronautics and Space Administration, 2007), 297.
[210] Bjørnvig, "Transcendence of Gravity," 141.
[211] McCurdy, *Space and the American Imagination,* 34-35.
[212] Ibid., 34.
[213] McAleer, *Odyssey of a Visionary,* chap. 6.
[214] Arthur C. Clarke, *Prelude to Space* (New York: World Editions, Inc., 1951), 23-24.

evident, as he describes how the mission was funded: "So by about 1970 we had the support of some of the world's biggest technical organization, with virtually unlimited funds."[215] As Clarke describes in an update preface for the 1977 edition, the "novel's main theme is the absurdity of exploiting national rivalries beyond the atmosphere. In 1947, I summed up this concept in the phrase, 'we will take no frontier into space.' Exactly twenty years later, the UN Space Treaty prohibited territorial claims on any celestial bodies."[216] From the very beginning, Clarke was well aware of the importance of keeping space from becoming a battlefield, and international organizations and commercial endeavors would be a force in resisting the militarization of space.

The following year, Clarke would produce his next science fiction novel *Islands in the Sky* (1952), about a teenager who wins a trip into space to visit a number of orbiting space stations, including "relay stations" fixed in an orbit of 22,000 miles, a fictional representation of Clarke's "Extra-Terrestrial Relays."[217] The novel further describes a reusable rocket much like the forthcoming Space Shuttle, later reflecting that "back in 1952 I described a much nicer-looking shuttle than the unendearing space truck that NASA uses; it had four drop-tanks, symmetrically arranged around the main body. You'll find it in the frontispiece of *Islands in the Sky*."[218] As seen on the cover, not only is a space shuttle represented, but it is in the process of building an early imagining of a comsat relay.



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[215] Ibid., 24.
[216] Clarke, "Post-Apollo Preface" to 1977 Edition of *Prelude to Space*, 5.
[217] Oliver Dunnett, "Patrick Moore, Arthur C. Clarke and 'British Outer Space' in the mid-20th century," *Cultural Geographies* 19, no. 4 (2012), 515.
[218] Arthur C. Clarke, "Visions of Space" in *Spaceflight* Vol. 28 May 1986, Clarke, Arthur C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC, 201.
[219] Photo Credit: Arthur C. Clarke Trust, *Cover of Islands in the Sky 1952,* Accessed May 9 2020. http://arthurcclarke.org/site/legacy/fiction/fiction-di/.

At this same time, Clarke's overt representations of satellites were often outliers. The now infamous *Colliers Magazine* series popularized by von Braun and Chesley Bonestell featured many issues intended to claim that "man will conquer space soon."[220] Notably, this series did little to emphasize artificial satellites, with a focus nearly entirely focused on human endeavors.[221] When satellites were part of the narrative, like the June 27th, 1953 *Colliers* issue, they were framed as "baby space stations" meant to study the effects of space on humans.[222] Most imagined robotic endeavors at this time were overshadowed by the prospect of human spaceflight.[223] When Walt Disney partnered with von Braun for the weekly "Man in Space" television series in 1955, roughly 42 million Americans received very similar messaging.[224] Satellite were little more than a side note a much more exciting human story.

In Clarke's imaginings during the 1950s tell a different story. It was still an exciting human story, but satellites were an ever-present fixture in that story, and he worked diligently to advocate for their realization. In 1954, Clarke coordinated the Hayden Planetarium's Third Symposium on Spaceflight in New York City.[225] Seeking scientists to speak at the symposium on the topic of space travel and "world thought," Clarke reached out to Harry Wexler of the US Weather Bureau and a leading meteorological researcher at the time, requesting that Wexler speak on the potential of using satellites for forecasting weather.[226] When Wexler responded that the idea was crazy, Clarke challenged him to then talk about why he thought it was crazy.[227] Wexler would go on to be a leading advocate for using rockets and satellites for weather research and forecasting.[228] In the lead up to the Space Age, before humanity had launched anything into orbit, Clarke advocated for satellites of all varieties, their positive applications acting as the means for propelling the Space Age into reality, and in turn, the future of humanity in space along with it. What was needed first were funders. Wealthy funders, preferably with a peaceful worldview.

> "Just as the V-2, in 1945, marked the end of the first era of astronautics, so the announcement of Project Vanguard, ten years later, marked the end of the second. As far as we old space hands were concerned, the long campaign was over. A major power was now in the satellite business, reluctantly but inescapably."[229]
> "Memoirs of an Armchair Astronaut (Retired)" in *Voices from the Sky,* 1965

The Making of a Moon

While the popular culture was absorbing exciting narratives of humans in space, humanity was still bound by the gravity well. The US Air Force launched the WS-117L program in 1954, seeking to develop a reconnaissance satellite

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[220] Bowler, *A History of the Future,* 233.
[221] Ibid., 233.
[222] McCurdy, *Space and the American Imagination,* 40.
[223] Daniel Sage, "Framing Space: A Popular Geopolitics of American Manifest Destiny in Outer Space," *Geopolitics*, 13 (1) 2008: 39.
[224] Launius, "NASA's Quest for Human Spaceflight Popular Appeal," 1216-17.
[225] McAleer, *Odyssey of a Visionary,* chap. 8.
[226] McAleer, *Odyssey of a Visionary,* chap. 8.
[227] Ibid., chap. 8.
[228] Ibid., chap. 8.
[229] As Clarke noted in *Voices from the Sky* reminiscing about Eisenhower's IGY announcement; see Arthur C. Clarke, "Memoirs of an Armchair Astronaut (Retired)" in *Voices from the Sky: Previews of the Coming Space Age* (New York: Harper & Row, 1965), 153.

capable of taking images from space and relaying them back via radio.[230] With the Cold War in full swing, US President Eisenhower saw satellite reconnaissance as a way to challenge the Soviet military without breaking the bank, and became an advocate for a robotic-focused US space program that would be predominant until the Kennedy Administration.[231] A report submitted by the Technological Capabilities Panel in 1955 determined that reframing the reconnaissance satellites as a "scientific satellite" could allow the US to fly over the USSR without provoking retaliation.[232] The result of this deliberation led to Eisenhower's July 1955 announcement of the International Geophysical Year (IGY) and the US plan to launch an artificial "science satellite" with Project Vanguard, by 1957.[233] The IGY was an 18-month collaborative effort featuring thousands of scientists from over 60 countries with the goal to study the Earth's atmosphere.[234] Set to begin on July 1st, 1957 and end on December 31st 1958, Eisenhower's IGY announcement on July 1st 1955 could be considered the beginning of the space race.[235] While the publicly stated goal was benignly scientific in nature, the intentions behind the IGY were much more militaristic than the public understood, as Eisenhower saw von Braun's rocket and the space program as a means for possibly delivering a nuclear weapon or deploying reconnaissance satellites.[236] Science was a smokescreen for the military intent of early government satellites. For the space boosters who did invest energy on the satellite, they represented more than science. They were part of the adventure of space exploration. When Willy Ley was interviewed about Eisenhower's 1955 announcement, he stated that it "opens the age of space travel," further imagining the soon to be realized view from space. "The third or fourth [satellite] may well carry a television camera to show us what the planet Earth looks like when seen from space… The artificial satellite is going to be a major accomplishment, but its main importance will be that it will be follow by others."[237] And those satellites would be follow by others, and if all went to plan, on it would go.

In the late 1950s, Clarke was established as a popular science/fiction author and increasingly in demand as a lecturer on the space technologies on the horizon.[238] In 1956, Clarke spoke at the World Science Fiction Convention in New York City, encouraging science fiction readers and writers to focus on real science and to educate the public, emphasizing "I am quite sure that by writing about spaceflight we have brought its realization nearer by decades. Perhaps even more important, we have helped the public appreciate what it will mean when it comes."[239] In addition to toggling between Europe and the US, Clarke also moved to the island of Ceylon (now known as Sri Lanka) to feed his infatuation with the scuba diving, a means he explained offered him the chance to experience something

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[230] Robert M. Dienesch, *Eyeing the Red Storm: Eisenhower and the First Attempt to Build a Spy Satellite* (Lincoln, NB: University of Nebraska Press, 2016), xii.
[231] Ibid., xii; McCurdy, *Space and the American Imagination,* 68.
[232] McCurdy, *Space and the American Imagination,* 59.
[233] For Clarke's history of the IGY effort and the Vanguard satellite program, see Arthur C. Clarke, *The Making of a Moon: The Story of the Earth Satellite Program* (New York: Harper & Row, 1957).
[234] Dian Olson Belanger, *Deep Freeze: The United States, the International Geophysical Year, and the Origins of Antarctica's Age of Science* (Boulder, Colo.: University Press of Colorado, 2010), 27.
[235] "July 1955 – International Geophysical Year (IGY) Established," NASA, August 7, 2017, https://www.NASA.gov/directorates/heo/scan/images/history/July1955.html, Accessed November 9 2019.
[236] Sage, "Framing Space," 35.
[237] Jared S. Buss, *Willy Ley: Prophet of the Space Age* (Gainesville, FL: University Press of Florida, 2017), 192.
[238] Kilgore, *Astrofuturism,* 124.
[239] McAleer, *Odyssey of a Visionary,* chap. 11.

akin to "weightlessness."[240] This move would further complicate the identification of Clarke's allegiance, as he found himself a British citizen, living (mostly) in Sri Lanka, and doing much of his work in the United States. In many ways, Clarke himself was trying to represent the global village he was actively trying to create.

Understanding that the IGY would likely see the satellite emerge on the scene, Clarke invested a great deal of effort creating satellite centric content. Early 1957 saw the completion of Clarke's popular science book *The Making of a Moon: The Story of the Earth Satellite Program,* a thorough "prehistory of the Space Age" wherein Clarke performed interviews with scientists and engineers from the IGY-born US satellite program Project Vanguard, on top of exploring the soon-to-be realized benefits of comsats.[241] The book was published in September of 1957 and it ended with these words:

> "The tiny, swiftly moving satellites of today are only a beginning; soon they will be joined by more sedately travelling companions, swinging on wider orbits round the Earth. Many of these will not merely be visible to the naked eye – they will be spectacular objects, far enough out in space to miss Earth's shadow, and able to outshine any of the stars… No one can guess how many satellites our world will have, or how large they will be, when this century draws to a close. Yet, even if they are nothing more substantial than plastic balloons covered with reflecting paint, they will change the pattern of the night sky. This is an awe-inspiring thought, that should bring humility as well as pride. For when the story of our age comes to be told, we will be remembered as the first of all men to put their sign among the stars."[242]

The satellite, a star in the sky, made by humans, for humans. The first step of many. On October 4th, 1957, while in Barcelona attending the International Astronautical Federation conference, Clarke was awoken to the news that the USSR had launched Sputnik, and had become the "first of all men to put their sign among the stars." The space race was on. While Sputnik was little more than a tiny metal ball beeping intermittently, its presence was quickly interpreted as a military threat by the public.[243] Further deepening the issue was the fact that the United States had failed to act first.[244] Recalling the moment years later, Clarke remembered "It was a complete shock; I had not anticipated it in the least. But I knew it would change the modern world."[245] Having released his book *The Making of a Moon* a month prematurely, Clarke updated the ending for the January 1958 printing with a few additional words:

> "For the first time in history, something man-made has become celestial, has passed beyond the realm of mundane affairs into a region which once seemed reserved for the gods. 'Men come and go, but Earth abides.' So it will be with these new creations of our minds and hands. Some of the fragile metal spheres now lying on laboratory benches in Washington and Moscow will still be orbiting this planet ages hence, when the nations

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[240] Kilgore, *Astrofuturism,* 124; See also Bjørnvig, "Transcendence of Gravity" and Rozwadowski, "Arthur C. Clarke and the Limitations of the Ocean as a Frontier" for a deeper analysis of Clarke's infatuation with scuba diving and recreating the weightlessness of space.
[241] Clarke, *How the World Was One,* chap. 27.
[242] Clarke, *The Making of a Moon*, 200; also printed in Clarke, *The View from Serendip*, 10-11; Echo I, the first satellite spearheaded by John Pierce and launched in 1960, was a reflective balloon, see Clarke, *How the World Was One,* chap. 27.
[243] Nye, *American Technological Sublime,* 226.
[244] The Air Force's Project Vanguard was selected over von Braun's Redstone project. When Vanguard failed, von Braun was tasked to launch Explorer I; see; Constance McLaughlin Green and Milton Lomask, *Vanguard: A History* (Washington: NASA, 1970), vi.
[245] McAleer, *Odyssey of a Visionary,* chap. 11.

> which launched them are no more than faint and distance echoes in the memory of Man."[246]

The realization of satellite spaceflight represented a powerful moment for Clarke, and he found newfound energy driving commercial development of satellites to counter the inevitable military developments which would soon follow. Shortly after Sputnik flew, Clarke published a collection of short stories, *The Other Side of the Sky,* which featured a series of stories centered on artificial satellites. Recalling the collection years later, Clarke would note, "Now that satellites were actually orbiting the Earth – though none had yet radioed back anything except scientific data from mankind's new frontier – I once again started to exploit the fictional possibilities of comsats, and in a much more serious vein. 'Special Delivery' and 'The Freedom of Space' had been light-hearted little squibs, intended to amuse as much as to inform a public still not quite accustomed to the idea that the familiar sky was no longer the limit.[247] "Freedom of Space" and "Special Delivery" follow satellite maintenance technicians working in orbit a few decades in the future.[248] "Who's There?" is about an astronaut who retrieves an old satellite preemptively, before it becomes "a menace to navigation."[249] Written at a time when the number of satellites in orbit could be counted on one hand, Clarke was already imagining the possibility of space junk.

> "How often do you stop to think that all your long-distance phone calls, and most of your TV programmes, are routed through one or the other of the satellites? And how often do you give any credit to the meteorologists up here for the fact that weather forecasts are no longer the joke they were to our grandfathers, but are dead accurate ninety-nine percent of the time?"[250]
> "Special Delivery" in *The Other Side of the Sky*, 1958

Sputnik Fever

In Eisenhower's robotic centric space program operated by the US Air Force, the task of fulfilling his 1955 call to launch a satellite was given to Project Vanguard rather than von Braun's Redstone project.[251] Vanguard was wrought with a litany of failures, exploding either on the launch pad or shortly thereafter.[252] Because of Vanguard's failures, von Braun and his team would receive the task of launching the first satellite during the IGY, and using his Juno I rocket, the first US satellite, Explorer I, was launched in January 1958.[253]

With the military and warfare so wrapped up in early Sputnik fervor, the negative narratives in which Clarke would have to maneuver were substantial. Historians have argued that the orbiting Sputnik satellite was psychologically disturbing to the public.[254] The US government had a public relations battle to wage, and if

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[246] As described in Clarke, *The View from Serendip*, 10-11.
[247] Clarke, *How the World Was One,* chap 28.
[248] Clarke, *The Other Side of the Sky*, 26-29, 35-38.
[249] Westfahl, *Arthur C. Clarke,* 55.
[250] Clarke, *The Other Side of the Sky*, 26.
[251] Green and Lomask, *Vanguard: A History*, vi.
[252] McAleer, *Odyssey of a Visionary,* chap. 11.
[253] McCurdy, *Space and the American Imagination,* 56.
[254] Green and Lomask, *Vanguard: A History,* vii; see also Robert A. Divine, *The Sputnik Challenge* (New York: Oxford University Press, 1993).

Eisenhower's efforts to use satellite reconnaissance to monitor their adversaries, satellites would need a peaceful reframing.[255]

Upon the launch of Sputnik, the US Office of Research and Intelligence compiled the *World Opinion and the Soviet Satellite: A Preliminary Evaluation* report, dated October 17th, 1957. The report speaks directly to a need to counter the "myths" that Sputnik will generate: "The particular nature and dramatic appeal of the Sputnik, making its passes over every region of the earth, are likely to give it peculiar impact among those least able to understand it. It will generate myth, legend and enduring superstition of a kind peculiarly difficult to eradicate or modify, which the USSR can exploit to its advantage, among backward, ignorant, and apolitical audiences particularly difficult to reach."[256] Historian Kim McQuaid wrote on the generally understood popular crisis ignited by Sputnik in *Sputnik Reconsidered: Image and Reality in the Early Space Age.* McQuaid argues that public and political support of the US space efforts are assumed in hindsight, as well as concepts that space exploration was a key rationale for Cold War prestige.[257] In fact, he argues, the "media riot" following Sputnik was an orchestrated effort by space exploration advocates who created "elite panic" among high level decision makers.[258] "Elite panic, not mass panic, impelled the priorities and programs of the early space age."[259] McQuaid is arguing that space advocates created panic among high level decision makers, rather than among the public, when using Sputnik as a propagandist tool for furthering the cause of space exploration. Even Clarke would liken the shock of Sputnik to America's "technological Pearl Harbor," a grand representation, but then again, Clarke's optimistic spin makes it all about education, ever toeing the line between peace and war:

> "Indeed, the space program is one of the best things ever happened to the United States educational system, both financially and psychologically. The shock of Sputnik – (America's technological Pearl Harbor)– focused attention on schools and colleges in a way that nothing else could possibly have done."[260]
> "Epilogue" in *First on the Moon,* 1970

The US public relations machine convened the President's Science Advisory Committee, led by Special Assistant for Science and Technology James R. Killian, who produced the "Introduction to Outer Space" brochure, which impressed Eisenhower so much, that he had it printed and shared with the public for 15 cents a copy.[261] The pamphlet states that satellites would soon "be entering into everyday affairs," further espousing the positive benefits of nearly every form of satellite.[262] But the pamphlet also notes that "there are important, foreseeable military uses for space vehicles. These lie, broadly speaking, in the fields of *communication* and *reconnaissance.* To

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[255] McCurdy, *Space and the American Imagination,* 68.
[256] United States Information Agency, "World Opinion and the Soviet Satellite: A Preliminary Evaluation," October 17, 1957 in *NASA's Origins and the Dawn of the Space Age* (Washington, DC.: NASA, 1998), 2-3; This report was initially classified but has since been declassified.
[257] Kim McQuaid, "Sputnik Reconsidered: Image and Reality in the Early Space Age," *Canadian Review of American Studies 37*, no. 3 (2007): 371.
[258] Ibid., 371.
[259] Ibid., 371.
[260] Clarke, "Epilogue," *First on the Moon,* 375-376.
[261] McCurdy, *Space and the American Imagination,* 57.
[262] The President's Science Advisory Committee, *"*Introduction to Outer Space*,"* March 6, 1958 in *NASA's Origins and the Dawn of the Space Age* (Washington, DC: NASA History Division, Office of Policy and Plans, 1998), 11.

this we could add meteorology."[263] All of the forms of satellites would be used for military purposes, but it attempts to shed the satellite as being a weapon itself. "Much has been written about space as a future theater of war, raising such suggestions as satellite bombers, military bases on the moon, and so on."[264] Noting that these arguments don't hold water, a rebuttal is provided, "Take one example, the satellite as a bomb carrier. A satellite cannot simply drop a bomb. An object released from a satellite doesn't fall. So there is no special advantage in being over the target… In short, the earth would appear to be, after all, the best weapons carrier."[265]

The work of this committee also establishes rationale that would come to define the civilian National Aeronautics and Space Administration (NASA), as seen from the pamphlet's introductory statement from President Eisenhower: "This is not science fiction. This is a sober, realistic presentation prepared by leading scientists... This statement of the Science Advisory Committee makes clear the opportunities which developing space technology can provide to extend man's knowledge of the earth, the solar system, and the universe. These opportunities reinforce my conviction that we and other nations have a great responsibility to promote the peaceful use of space and to utilize the new knowledge obtainable from space science and technology for the benefit of all mankind."[266] Whether it was veiled rhetoric or genuine intention, the outlook for space held a decidedly peaceful orientation. Ultimately, NASA was established on July 29th, 1958 to coordinate, at least in part, American endeavors in Space, and not only was a satellite the instigator, but also the focus, at least at first.

The newly formed civilian space agency sought advice on gaining popular support from the onset. Social science advisors concluded military endeavors and Soviet competition were an insufficient basis for justifying an expensive space program.[267] NASA was well aware that it needed to be mindful of "public education, public understanding, and public support."[268] In essence, NASA needed to understand what the public wanted in space. Early advice given to the still narrative-less space program was to focus upon weather and communication satellites, as application satellites offered the public tangible benefits.[269] William Pickering of the Jet Propulsion Laboratory (JPL) argued that satellite infrastructure was the equivalent to a government hydroelectric dam that could show "the man on the street" the advantages of space exploration.[270] Making application satellites the central mission of NASA was complicated by the overwhelming lack of knowledge about satellites among the American public during those years.[271] McQuaid quotes a 1959 public opinion survey, "Only one in ten Americans could specify scientific applications for satellites; one in four knew that any such uses existed; and only one in five were even vaguely aware of new military uses of space."[272] Ultimately, Glennan chose to not make Earth orbiting application satellites NASA's central program. Along with advice from a high-level presidential advisory committee chaired by future President

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[263] Ibid., 11.
[264] Ibid., 12.
[265] Ibid., 12.
[266] Ibid.
[267] Kim McQuaid, "Selling the Space Age: NASA and Earth's Environment, 1958-1990," *Environment and History 12*, no. 2 (2006): 129.
[268] Ibid., 129.
[269] Ibid., 129.
[270] McQuaid, "Selling the Space Age," 133.
[271] Ibid., 130.
[272] Ibid., 130.

Lyndon B. Johnson, then a Senator from Texas, NASA "opted for a Cold War global prestige-based rationale" focused on human spaceflight and the Gemini and Apollo programs.[273] From the start, *human* space exploration dominated NASA decision-making, with space science and technology 'Spin-Offs' the positive bye-products. NASA's mission was to ensure that "activities in space should be devoted to peaceful purposes for the benefit of mankind" and communication satellites were wrapped up directly in that rationale.[274] The first broadcast from a communication satellite came from SCORE (Signal Communication by Orbital Relay Equipment), which broadcast a pre-recorded message by President Eisenhower on December 18th, 1958, making him the first voice broadcast via satellite.[275] His message read as follows: "This is the President of the United States speaking. Through the marvels of scientific advance my voice is coming to you from a satellite circling in outer space. My message is a simple one. Through this unique means I convey to you and to all mankind America's wish for peace on Earth and good will toward men everywhere."[276] Eisenhower was the first true voice from the sky.

> "The impact of this programme [the first live transatlantic TV broadcast on 23 July 1962] was enormous; it was seen, for example, by more than half the population of Great Britain, and huge audiences world-wide. Today, the TV newscasters no longer bother to superimpose 'Live by satellite', because everyone takes this for granted. But thirty years ago, it was still a miracle."[277]
> *How the World Was One,* 1992

Pornographic Propaganda via Satellite

Following the launch of Sputnik, Clarke flew to the US from his newly adopted home in Sri Lanka, beginning 1958 on the lecture circuit, focused mostly upon Earth satellites.[278] In recalling this period of time, Clarke was grateful for "the unexpected cooperation of the Kremlin… Both Sputniks were circling the Earth when I delivered my first talk on satellites; gone forever, consequently, was the opinionated little man in the front row who was quite sure that space travel was impossible—because no one had ever done it before."[279]

It was during this period that satellites began expanding humanity's understanding of the Earth. Explorer-6 took the first (blurry) image of the Earth from space on August 14th, 1959, and by April 1960, TIROS-1 (Television and Infrared Satellite), the first weather satellite, was launched into orbit, providing the first views of clouds and weather patterns on a global scale.[280] Satellite were quickly entering the public consciousness, with the New York Times publishing "cloud pictures" from space and NASA highlighting the benefits of weather forecasting as a means of selling the agency's efforts.[281] It was at this point that Clarke published a short story in the April 1960 *Playboy* titled

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[273] Ibid., 130.
[274] "National Aeronautics and Space Act of 1958," National Archives and Records Administration, Washington, DC.
[275] John M. Logsdon, Roger D. Launius, David H. Onkst, and Stephen J. Garber (eds.), *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Volume III, Using Space*, NASA SP-4407 (Washington, DC: NASA, 1998), 2.
[276] Dwight Eisenhower, "Satellite SCORE Goodwill Message, President Eisenhower's Message is the First Voice to be Transmitted in Space," December 19, 1958, Broadcast via SCORE Satellite, MPEG-4, 00:50, https://www.eisenhowerlibrary.gov/eisenhowers/speeches.
[277] Clarke, *How the World Was One,* chap. 29.
[278] McAleer, *Odyssey of a Visionary,* chap. 12.
[279] Ibid., chap. 12.
[280] Harry Eyres, *Seeing Our Planet Whole: A Cultural and Ethical View of Earth Observation* (Cham: Springer, 2017), 79.
[281] Conway, "Satellites and Security: Space in Service to Humanity," 273-274.

"I Remember Babylon," which explores how communication satellites could be abused.[282] In the story, an American TV executive desires to brainwash and destroy the US through the use of a geostationary comsat that broadcasts uncensored pornography, gore, and communist propaganda.[283] The story was published several months before Echo 1, the first communication satellite, was launched in August of 1960.[284] Clarke was preparing the public for the emergence of global broadcasting, and all that it could entail, later recalling his intentions behind the story: **"**I tried to frighten the United States with satellites myself, back in 1960, when I published a story in *Playboy* ["I Remember Babylon"] about a Chinese plot to brainwash innocent Americans with pornographic TV programs. Perhaps 'frightened' is not the correct verb, and in these permissive days such an idea sounds positively old fashioned. But in 1960 the first regular comsat service was still five years in the future, and this seemed a good gambit for attracting attention to its possibilities."[285] As the antagonist of the story dictated their plan: "History is on our side. We'll be using America's own decadence as a weapon against her, and it's a weapon for which there's no defense. The Air Force won't attempt space piracy by shooting down a satellite nowhere near American territory."[286] Clarke was well aware that even the comsat came with a dual functionality, both a harbinger of knowledge and a powerful weapon of propaganda. For Clarke, the pros nearly always outweighed the cons when it came to satellite technology and knowledge was power, believing that international organizations like the International Telecommunications Union would ultimately reach a consensus "to avoid the worst abuses." [287] But he had his doubts. What if the Nazis had weaponized comsats?

> "Television satellites will also present us… with acute problems in international relations. Suppose country A starts transmitting what the government of country B considers to be subversive propaganda. This is happening all the time, of course, but no one complains too bitterly today because the process is relatively ineffective and is confined to radio. Just imagine, however, what Dr. Goebbels could have done with a chain of global TV stations, perhaps capable of putting down stronger signals in many countries that could be produced by the local transmitters, if any."[288]
> "The Social Consequences of the Communications Satellites" 1961

Giving his speech "The Social Consequences of Communications Satellites" at the Twelfth International Astronautical Congress several months after Yuri Gagarin became the first human to orbit the Earth, Clarke described the future that communication technology would usher in, arguing that Dr. Goebbels would be ineffective in such a global world.[289] "Communication satellites can bring to every home on Earth sadism and pornography,

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[282] "Reading this story more than thirty years later, it seems both hopelessly dated – yet more topical than ever. Two decades later, appropriately enough, the Playboy Channel was on the air – via satellite!" see Clarke, *How the World Was One,* chap. 28.
[283] Clarke, *The View from Serendip*, 260.
[284] Clarke, *Astounding Days*, 149; "In 1955, Pierce would publish "Orbital Radio Relays" in *Jet Propulsion* (April 1955) detailing the engineering required to develop the comsat. A few years later, he would convince NASA to launch a "passive" satellite, a radio-reflecting balloon named Echo I, which Clarke claims "was seen by more human beings than any other artefact in history."
[285] Clarke, *The View from Serendip*, 260; A side note, 1970 saw the launch of the first Chinese satellite, which transmitted the propaganda song "East is Red", see Matthew D. Tribbe, *No Requiem for the Space Age: The Apollo Moon Landings and American Culture,* New York, NY: Oxford University Press, 2014, 244.
[286] Clarke, *How the World Was One,* chap. 28.
[287] Clarke, *The View from Serendip*, 260-261.
[288] Clarke, *Voices from the Sky*, "The Social Consequences of the Communications Satellite," 119.
[289] On April 12th, 1961 Yuri Gagarin became first man in space.

vapid parlor games or inflated egos, all-in wrestling or tub-thumping revivalism. Yet they can also expose lies and spread the truth; no dictatorship can build a wall high enough to stop its citizens' listening to the voices from the stars."[290] Voices from the stars, powerful enough to overcome propaganda and topple dictators. To Clarke, the peaceful form of the comsat would defeat its weaponized form, a position he would have the chance to examine in the 1970s, as direct-broadcast satellites became available. In the conclusion of his address, Clarke represents satellites as the wiring of the global village that will one day achieve his dream: "What we are building now is the nervous system of mankind… The communications network, of which the satellites will be nodal points… They [our grandchildren] will be able to go anywhere and meet anyone, at any time, without stirring from their homes… all the museums and libraries of the world will be extensions of their livings rooms… And it will not matter where those living rooms may be; for on this planet at least, the conquest of space will be complete."[291] It is global communications that will fulfill the human conquest of space, "on this planet at least," as long as the comsat's adversary, propaganda, can be effectively defeated.

> "PRELIMINARY PROSPECTUS DATED MAY 27, 1964 - 10,000,000 SHARES - COMMUNICATIONS SATELLITE CORPORATION: This historic document announced that five million shares at $20 each had been taken up by communications companies… The remaining five million were available to the general public through a long list of underwriters, headed by the inevitable Merrill Lynch. I doubt if even in our wildest moments we pre-World War II interplanetary enthusiasts ever dreamed that $200,000,000 would one day be invested in space – by commercial organizations, and only as a first instalment!"[292]
> *How the World Was One,* 1992

COMSAT and INTELSAT: The Beginning of Commercial Space

With so much broadcast potential, for good or ill, the commercial market for the comsat was immense, and the rapid integration of commercial markets into space surprised Clarke: "In 1945, I certainly never dreamed that the global COMSAT and INTELSAT organizations would be only twenty years ahead."[293] But with a social need comes an incentive to invest. As Clarke described it, "Less than seven years after Sputnik, Wall Street entered the Space Age."[294] In 1960, Eisenhower made a call for the creation of a global communications system to expand America's global outreach, the US Congress would come to pass the Communications Satellite Act in August of 1962.[295] The act created the Communications Satellite Corporation (COMSAT), which split ownership between the American public and a number of telecommunication companies to encourage a more equitable utilization of satellite broadcasting.[296] The passage of the act prompted a request by UNESCO (the parent body of the International

[290] Clarke, *Voices from the Sky*, "The Social Consequences of the Communications Satellite," 120.
[291] Clarke, *Voices from the Sky,* "The World of the Communications Satellite," 134.
[292] Clarke, *How the World Was One,* chap. 30.
[293] Ibid., chap. 36.
[294] Ibid., chap. 30.
[295] Roger D. Launius, "Global Instantaneous Telecommunications and the Development of Satellite Technology" in *NASA Spaceflight: A History of Innovation,* eds. Roger D. Launius and Howard E. McCurdy (Cham, Switzerland: Palgrave Macmillan, 2018), 74.
[296] Launius, "Global Instantaneous Telecommunications and the Development of Satellite Technology," 74.

Telecommunication Union) for Clarke's participation in a special 1963 conference on space communications, where he presented "The World of the Communications Satellite."[297] In his speech, his advocacy for the future "electronic global village" begins to take shape: "The coming of the communication satellite will make it impossible for an human group – indeed, any individual – to be more than a few milliseconds from any other. The social consequences of this, for good or evil, may be as great as those bought about by the printing press or the internal combustion engine. And they will come upon us much more swiftly."[298] Changes were coming, and they weren't all positive, and Clarke was aware that "the political, commercial, and cultural implications of this, however, do not yet seem so thoroughly appreciated."[299] For example, how effective would global communications be if a common language wasn't spoken? Would it be English or Russian? That decision was more substantial than many realized and a Cold War battle for education was underway:

> "Within the next ten years the future language of mankind will be decided, in a bloodless battle twenty-two thousand miles above the equator. This will have all sorts of social and political effects, such as the establishment of transnational cultural groups and the dissolution of national ties. We see this to some extend already in the Jet Set; I suppose I'm an example myself because I am a British citizen, an American resident, and a Ceylon householder."[300]
> "Technology and the Future," 1967

With the rest of world itching to join in the fruits of the comsat revolution, an international governing body was born. On August 20th, 1964, 10 nations, and the Vatican, representing 85% of the telecommunication usage across the world, established the International Telecommunications Satellite Organization (INTELSAT), which would be overseen by COMSAT.[301] November 1964 saw the Relay 1 and Relay 2 communications satellites broadcast European election results, acting as the first time a satellite broadcast political news.[302] In what would be a momentous milestone, just twenty years after Clarke's *Wireless World* article, the first true communication satellite Early Bird (INTELSAL I, which could receive, amplify, and retransmit signals) was launched in April 1965, entering synchronous orbit on June 28th, 1965, resulting in a six-nation conference call.[303] The global village Clarke had imagined would culminate from commercial investment in comsats, and a lot of must-see TV, via satellite. And he would be instrumental in using the opening games of the 1964 Tokyo Olympics as a great comsat advertisement, and a starting point for a commercial satellite broadcasting industry: "My hope that the 1964 Tokyo Olympics would be relayed by satellite was fulfilled by Syncom 3, which could just accommodate one black-and-white channel. However, because of the time differential between Japan and the United States, few networks showed the event 'live', on the assumption that most of their audience would be in bed. They had yet to learn that satellites would

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[297] Published in Clarke, *Voices from the Sky,* "The World of the Communications Satellite," 126-136.
[298] Ibid., 126.
[299] United States, *Next Ten Years in Space*, 32.
[300] Clarke, *Report on Planet Three,* chap. 14.
[301] NASA, *Astronautics and Aeronautics 1964: Chronology of Science, Technology, and Policy,* NASA SP-4005 (Washington DC: NASA, 1965), 293.
[302] Ibid., 373.
[303] NASA, *Astronautics and Aeronautics, 1965: Chronology of Science, Technology,and Policy, NASA SP-4006* (Washington DC: NASA, 1966), 300-301.

teach whole nations how to do without sleep. The time had clearly come to put this new technology on a commercial basis."[304]

Soon thereafter, television broadcasting truly entered the arena. In 1965, INTELSAT and COMSAT were arguing that only four television transponders - one each for ABC, CBS, NBC, and educational programming – would be necessary.[305] NBC argued twenty were needed, for each network needed a different transponder for three different time zones, as well as an additional one for NFL games.[306] The growth was otherworldly, and upwards of 200 transponders carried by more than a dozen satellites were in use just a few years later.[307] In 1967, CBS, one of the channels now broadcasting with commercial comsats, produced a documentary series about the future hosted by Walter Cronkite called "The 21st Century." Broadcast via satellite on January 29th, the first episode, "The Communications Explosion," featured Clarke as the subject matter expert. Speaking passionately about the possibilities of satellite communication technology, Clarke spoke about the global interconnectivity to come: "Then you'll be able to tune in to Russian, Chinese, European broadcasts, TV direct, wherever you are. Well, the effect of this is going to be tremendous in both directions. It means that we can talk to the Chinese and they can talk to us, and nobody on either side can stop it."[308]

When Intelsat III was placed into geosynchronous orbit above the Indian Ocean [joining geosynchronous satellites above the Atlantic and Pacific] in February of 1969, Clarke's vision of a global communication system via "Three repeater stations [artificial satellites], 120 degrees apart in the correct orbit" was official realized.[309] At the 1969 UNESCO Space Communications Conference in Paris, Clarke presented "Beyond Babel: The Century of the Communications Satellite," a passionate exposition of the "peaceful purposes" satellites beheld for a globally-interconnected humanity.[310] "What we are now doing, whether we like it or not – indeed whether we *wish* to or not – is laying the foundation of the first global society."[311] The satellite is the literal foundation of the global world Clarke envisions for the future, a world that may find peace as a result of said satellite infrastructure. "Finally, let us look at our whole world – as we have already done through the eyes of our Moon-bound cameras. I have made it obvious that it will be essentially one world, though I am not foolish or optimistic enough to imagine that it will be free from violence and even war."[312] Despite this, the comsat-based global society Clarke is envisioning would be a world less subject to violence than before, with more access to information than ever before, and the need to maintain their presence will not only give humans a reason to go to space, but also a reason to stay there.

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[304] Clarke, *How the World Was One,* chap. 30.
[305] Whalen, "For All Mankind: Societal Impacts of Applications Satellites," 306.
[306] Ibid., 306-307.
[307] Ibid., 306-307.
[308] McAleer, *Odyssey of a Visionary,* chap. 20; the noted CBS Broadcast, "The Communications Explosion" aired on January 29 1967.
[309] Ibid., chap. 19; Clarke, "V2 for Ionosphere Research?" 58.
[310] The speech was later published in *Report on Planet Three,* chap. 15.
[311] Clarke, *Report on Planet Three,* 163.
[312] Ibid., 164.

> "Why do we need men in space? Well, in the long run, in fact in the not-so-long run, we need men in space because we can't afford anything else; its cheaper. There are millions of dollars of useless junk orbiting now around the Earth that might have been fixed by a man with a screwdriver. In fact, they are now thinking of going back to some of those satellites, when they have the space shuttle, and fixing them. I mentioned…. I was talking about the communications satellite network in which our lives, our business, the running of this planet will depend soon. Imagine the cost of your telephone service here on Earth if once the system was installed it could never be got at to be maintained and faulty equipment could never be replaced, which is the situation now. That's why we have to get men into space as repairmen, servicemen."[313]
> "2002 and Beyond," 1971

The Benevolent Satellite Taxi

From the beginning, Clarke utilized economic rationale to encourage the development of space technology, striving to frame their usage in alignment with their positive human applications. With Apollo missions still on the docket, Clarke was well aware of the limitations of the single use Saturn V rocket for establishing the ease of access to space that would encourage deeper investment.[314] "Today's manned spacecraft evolved from missiles, which from the nature of things are expendable…" Clarke wrote in the Epilogue to the Apollo 11 astronaut's story of their journey *First on the Moon.*[315] "It may well be argued that only the competition of the Cold War forced the development of man-carrying missiles, and that the 'rocket plane' approach was the more natural and rational one. However, it would probably have taken much longer – and might therefore have been more costly – because it requires a much higher level of technical sophistication. We are now approaching this level, as a result of the experience gained with our first-generation vehicles, and can consider the next step forward – the reusable spacecraft, or space shuttle."[316] Clarke anticipated that the reusable shuttle would make travel between the earth and the Moon a commercial standard by the early 2000s.[317] But more importantly, the shuttle was significance for satellite economics. "As satellites grow larger and more complex – and our global society comes to depend upon them more heavily – the stage will very soon be reached when space-borne installation, repair and maintenance crews will be absolutely essential… When they [satellites] are designed for maintenance, and not for indefinite life, the cost of satellites will drop from Rolls-Royce to Volkswagen levels."[318] If the cost of getting to space went down, the cost of satellite technology would go along with it.

Clarke's optimistic vision of the relationship between satellites and the space shuttle stands in contrast to the underlying intentions of the Nixon Administration, who initiated the project in 1969. In *After Apollo? Richard Nixon and the American Space Program,* space historian John M. Logsdon showcased Nixon's aversion to continued space exploration.[319] Much like Clarke, Nixon's vision of the shuttle was also about the establishment of low-Earth orbit, with a number of significant value differences, of course. For Clarke, the shuttle was not only a means to get

[313] Clarke, "2002 and Beyond," 15.
[314] Clarke, "Epilogue," *First on the Moon,* 378.
[315] Ibid., 380.
[316] Ibid., 380.
[317] Ibid., 378.
[318] Ibid., 391.
[319] Siebeneichner, "Spacelab," 263 .

humans into space, but for making real-time improvements on the satellite infrastructure. For Nixon, the shuttle would also be a tool of national security, and satellites were also adversary. A 1969 joint NASA/Department of Defense study stressed the shuttle's capacity to intercept and inspect satellites, with the report noting that "future unknown satellites could operate for days or weeks, posing a threat ranging from intelligence gathering to delivery of a nuclear weapon."[320] The report further suggests that "a national ability to intercept, inspect, and determine the purpose of (as well as destroy, if necessary) unknown satellites is vital."[321] It is unclear if he was aware of these reports, but Clarke was optimistic about the potential "the DC-3 of the space age" would have on the exploitation of space.[322] It was just a matter of time. "Whenever new territory has become available to mankind, it has sooner or later been developed, colonized, or otherwise exploited: there are no exceptions to this rule, if a sufficiently long time scale is adopted."[323] The shuttle was the key to developing, colonizing, and exploiting space.

Clarke's letter "Space Shuttle: Key to Future," (originally published in the *New York* Times on May 22, 1971), was placed into the US Congressional Record on June 23rd, 1971 by Rep. William R. Anderson (who in 1958 commanded the nuclear submarine *Nautilus* on its historic passage through the North Pole).[324] As summarized by Rep. Anderson before Clarke's short letter begins, "The space shuttle offers the means for technicians to check, service, and repair orbiting satellites which are increasing both in numbers and complexity."[325] Because the space shuttle will also allow for the deployment of very large satellites, Clarke's letter advocates for satellites of all varieties, including new earth resource satellites equipped with "spaceborne sensors continually scanning the planet" that would become available in the 1970s.[326] "It must be remembered that comsats are only one of a very large range of application satellites; they may not even be the most important. The Earth Resources satellites will enormously advance our knowledge of this planet's capabilities."[327] But again, the main rationale for why the shuttle may be the key to the future – satellites and their human technicians. Clarke references the Orbiting Astronomical Observatory, a failed $50,000,000 satellite that "A man with a screwdriver might have been able to fix."[328] Clarke advocates for the Space Shuttle not just as a mechanism for developing, colonizing, and exploiting space, but in reality, it was just the taxi, and the satellite and its technicians would be doing the majority of the work. "As our applications satellites become larger and more complex, space shuttles will be essential not only to orbit them, but to carry the technicians who must check, service and repair them."[329] The dramatic Hubble repair mission in the

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[320] Ibid., 263.
[321] Ibid., 263.
[322] Clarke, "Epilogue," *First on the Moon,* 381; The Douglas DC-3 was an early passenger airliner that grew to prominence in the airline industry pre-WWII for its speed and range.
[323] Ibid., 388.
[324] *Space Shuttle: Key to Future*, 92nd Cong., 1st sess., Congressional Record 117, no. 97: E6363; this letter was submitted to Congress on Clarke's behalf by Thomas F. Buck, President of Spaceward Corporation, a space advocacy group started along Clarke. Additionally, the letter was originally published as a *New York Times* Letter to the Editor on May 22, 1971.
[325] Ibid., E6363.
[326] Clarke, *Report on Planet Three,* 156.
[327] Ibid., 156.
[328] *Space Shuttle: Key to Future,* Congressional Record, E6363.
[329] Ibid., E6363.

early 1990s would confirm this projection.[330] To Clarke, humans remained a central element in the proverbial "conquest of space," but rather than leading the charge, they would be the technicians, for now, screwdrivers in hand, ready to climb aboard their shuttle and maintain the orbiting satellite infrastructure.

> "Marshall McLuhan has coined the evocative phrase 'the global village' to describe the coming society. I hope 'the global village' does not really mean a global suburb, covering the planet from pole to pole. Luckily, there will be far more space in the world of the future, because the land liberated at the end of the agricultural age – now coming to a close after ten thousand years – will become available for living purposes. I trust that much of it will be allowed to revert to wilderness, and that through this new wilderness will wander the electronic nomads of the centuries ahead."[331]
> "Beyond Babel," 1969

The First Draft of the Articles of the Federation of the United States of Earth

As the traditional Space Age drew to a close, the satellite hit its stride, and Clarke was unsurprisingly in the center of it all. Clarke had accomplished a number of his goals. He had seen the realization of his imagined television satellite, secured continual investment in satellite development by encouraging a burgeoning commercial satellite industry, normalized the blurry distinction between the military and peaceful applications of satellite technology, and represented the near-future role of humans in space as satellite technicians. The infrastructure Clarke had long advocated had been established and when Armstrong's famous words were spoken on July 20th, 1969, broadcast to over two billion people, live from Earth's satellite, via satellite, the entire world shared in the same technological spectacle, watching it unfold in real time together, and there was no looking back.[332] In his epilogue for *First on the Moon* in 1970, he reminded his readers of the TV satellite world that they were already taking for granted. "It is already hard to remember that, only a few years ago, radio and telephone links across the great oceans were scarce and often unsatisfactory – while TV service was completely impossible. Yet now we take it for granted when we watch an Apollo splashdown, in full color, while it is actually happening in the central Pacific. This is entirely due to the still relatively primitive communication satellites of today."[333] But those primitive satellites would soon become much more advanced. Alongside Mamie Eisenhower, President Eisenhower's widow (Eisenhower had been the first voice heard via a satellite), Clarke was invited by the US State Department as a guest of honor for the August 20th, 1971 signing of the INTELSAT agreement.[334] Clarke was asked to speak directly following Apollo 8 astronaut William Anders, then the Executive Secretary of the National Aeronautics and Space Council and photographer of

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[330] For more about Hubble and the mission to repair its faulty mirror, see David H. DeVorkin and Robert W. Smith, *Hubble: Imaging Space and Time* (Washington, DC: National Geographic, 2013); and Robert Zimmerman, *The Universe in a Mirror: The Saga of the Hubble Telescope and the Visionaries Who Built It* (Princeton, NJ: Princeton University Press, 2008).
[331] Clarke, *Report on Planet Three,* 162.
[332] For a closer analysis of how technological spectacles impart themselves upon American society and culture, see; Nye, *American Technological Sublime;* see also Rodney James Giblett, *Sublime Communication Technologies* (Basingstoke England: Palgrave Macmillan, 2008) for a closer at the concept of sublime and its relation to communication technology such as comsats.
[333] Clarke, "Epilogue," *First on the Moon,* 389.
[334] As stated during Clarke's 1971 *Playboy* speech, Clarke, "2002 and Beyond," 10; for the details of the INTELSAT signing, see *Agreement Relating to the International Telecommunications Satellite Organization "INTELSAT,"* United Nations Treaty Series, No. 19677, Registered by the United States of America on March 27, 1981.

"Earthrise."[335] Clarke invested his short time to highlight the next phase of comsats: "We are now about to witness an interesting situation in which many countries – particularly in Asia and Africa – are going to leapfrog a whole era of communications technology and go straight into the Space Age."[336] Clarke reiterated his belief that "communication satellites can unite mankind" and concluded with a telling sign of the coming era of globalization in the Post-Apollo Period: "You have just signed the first draft of the Articles of Federation of the United States of Earth."[337]

In the decade following the Apollo missions, the satellite would become the main show in town, and Clarke's imaginings would shift from establishment to expansion, seeking to provide the benefits of satellite beyond the borders of the space powers. With the world trending toward the proverbial "global village," Clarke could focus on creating coalitions aimed at turning advanced comsats into education satellites, capable of *direct-broadcasting* into the homes of the Third World, and the economics were an easy sell. In 1969, Clarke would reiterate this point. "The cost of a truly global satellite educational system, broadcasting into all countries, would be quite trivial… Some of the studies of broadcast educational comsats- let us call them edsats – to developing countries indicate that the cost of the hardware may be of the order of $1 per pupil per year."[338] He reiterates that for "a few percent of the monies spent on armaments – one could provide a global edsat system that could drag this whole planet out of ignorance."[339] Alluding to the "forthcoming experimental use of direct broadcast edsats in India in 1974," the Satellite Instructional Television Experiment (SITE), Clarke suggests that everyone "should wish it every success, for even if it is only a primitive prototype, it may herald the global educational system of the future." [340] Clarke would spend the next decade fighting to see such a system come to fruition.

With the infrastructure of the global world in place, signs that the Cold War was coming to an end arose as well. With Apollo 17 scheduled to be the final Apollo mission, the end of the space race seemed to mark the end of the Cold War, with once closed societies begin to show signs of opening up.[341] In "The Last Revolution," a March 1972 speech Clarke gave in Washington, DC, he spoke passionately about the changes to come, brought forth by the comsat revolution. Noting the recent "TV coverage of President Nixon's China trip," Clarke mused on its significance. "It marked the crumbling of the last communications barrier on this Earth. The wiring of the global electronic village is now complete."[342]

> "Tomorrow, as 'comsats' become more powerful and can carry more circuits, they will trigger an accelerating revolution in human affairs, perhaps even exceeding that wrought by the printing press. *Direct* broadcasts into the home will eliminate the need for thousands of ground stations – and so will open up the remotest and most backward parts of this planet to modern communications, with all that this implies for education, culture, business, and politics. A hundred years ago, the electric telegraph made possible, indeed inevitable – the United States of America. The communications satellite will make equally

[335] Clarke, *How the World Was One,* chap. 32.
[336] Ibid., chap. 32.
[337] Ibid., chap. 32.
[338] Clarke, *Report on Planet Three,* 158.
[339] Ibid., 158.
[340] Ibid., 160.
[341] McDougall, *The Heavens and the Earth,* 431.
[342] McAleer, *Odyssey of a Visionary*, chap. 22.

inevitable a United Nations of Earth; let us hope the transition period will not be equally bloody."[343]
"Epilogue" in *First on the Moon,* 1970

[343] Clarke, "Epilogue," *First on the Moon,* 389.

Post-Apollo: 1973-1981

"Missiles into Blackboards": The Edsat

> "The emerging countries of what is called the Third World may need rockets and satellites much more desperately than the advanced nations which built them. Swords into ploughshares is an obsolete metaphor: we can now turn missiles into blackboards."[344]
> "Schoolmaster Satellite," 1971

Speaking at the Future Space Programs hearings before the House Subcommittee on Space Science and Application on July 24th, 1975, Clarke opened his testimony with excerpts from his newest, and forthcoming novel *Imperial Earth* (1976), which ends with protagonist Duncan Makenzie addressing the US Congress on the nation's quincentennial, July 4th, 2276.[345] "In 1976, the conquest of interplanetary space was about to begin…" Makenzie opens, read out loud by Clarke.[346] Clarke's vision of humanity's future colonizing the solar system follows Makenzie on his diplomatic trip from his home on Saturn's moon Titan to Earth to speak before the US Congress. The book has been described as "the closest [Clarke] has come to a traditional utopia," with the human condition vastly improved, overpopulation being solved, and racist-based oppression a thing of the past, resultant from mastering space travel, the knowledge and resources gained as a result, and the Earth's (and Titan's) comsats.[347] Early in the book, it is established that "The communications satellites had made possible, and then inevitable, the creation of the World State in all but name."[348] The comsat was the means to the future "United Nations of Earth," an entity without national borders and a fitting representation of Clarke's attitude toward the Earthbound Post-Apollo Period, which he comes to described as the "electronic global village" in his public lecturing and in *Imperial Earth*, as can be seen in its cover alone.[349]

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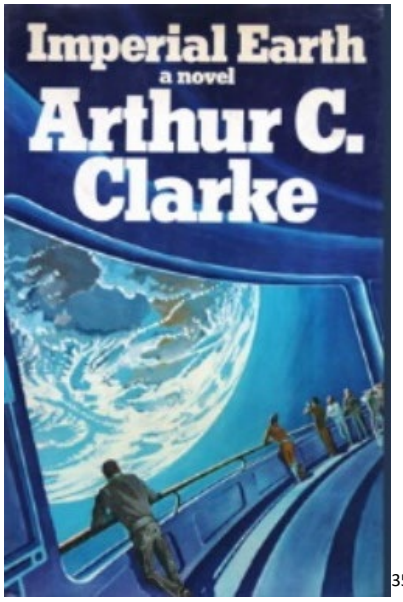
[344] *Promise of Space*, 92nd Cong., 2nd sess., *Congressional Record* 118, pt. 2: 1604; A definition for the "Third World" can be found in Odd Arne Westad, *The Global Cold War: Third World Interventions and the Making of Our Times* (Cambridge: Cambridge University Press, 2007), 2; "The concept 'Third World' came into being in the early 1950s, when leaders from Asia and Africa met for the first large postcolonial summit in 1955.. The 'Third World' implied 'the people' on a world scale, the global majority who had been downtrodden and enslaved through colonialism…. AKA a 'third way', a search for alternatives to capitalism and communism."
[345] *Future Space Programs 1975,* 190.
[346] Ibid., 191.
[347] Westfahl, *Arthur C. Clarke,* 68.
[348] Arthur C. Clarke, *Imperial Earth* (New York: Harcourt Brace Jovanovich, 1976), 22.
[349] Ibid., 22; for another example of Clarke's utilization of "electronic global village," see Clarke, *The View from Serendip*, 249; "[With the coming instant, face-to-face communication] …we have a serious problem – the already annoying matter of time zones. They are going to become quite intolerable in the electronic global village."



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> "Earth, the spaceship Earth, we've got to have this new means of surveillance. Just as aerial camera was a quantum jump and gave us a wholly new view of our world and you couldn't imagine making maps, studying…doing city planning without aerial photographs, in the same way the satellite cameras are going to make another jump to enable us to look after our whole planet."[351]
> "2002 and Beyond," 1971

The Era of Limits

As Geppert argues in *Limiting Outer Space*, the stars were once the limit, but once the classical Space Age ended with the final Moon mission Apollo 17 returning to Earth on December 17th 1972, the 'Post-Apollo Period' began, and "the skies once again became the limit."[352] The limitless possibilities of human spaceflight were dashed by funding cuts to NASA and with human spaceflight relegated to infrequent jaunts into low-Earth orbit, the imaginaries of a rapid human expansion into the solar system were challenged when it became "clear that human life would not be expanding across the solar system any day soon."[353] While six moon landings, the emergence of the first space station, and the onset of the satellite telecommunication revolution alone would seem to indicate that humanity would continue driving in an space-facing trajectory, the reality was far closer to home.[354] This sense of limits coincided with the publication of the Club of Rome's *Limits to Growth* report, which built upon previous books like *The Population Bomb* and *The Coming Dark Age* in painting a pessimistic view on the future of humanity.[355] These

[350] Photo Credit: Arthur C. Clarke Trust, *First Edition cover of Imperial Earth 1976,* Accessed May 9 2020. http://arthurcclarke.org/site/legacy/fiction/fiction-di/.
[351] Clarke, "2002 and Beyond," 10.
[352] Geppert, "Post-Apollo Paradox," 8.
[353] Benjamin, *Rocket Dreams*, 12.
[354] The first space station, the Soviet Union's Salyut 1, was launched on April 19th, 1971 with senior academician in the Soviet Academy of Science, Boris Petrov declaring the beginning of "an epoch of orbital stations and planned research work of men in conditions of space laboratories," see Colin Burgess, *Footprints in the Dust: The Epic Voyages of Apollo, 1969-1975. Outward Odyssey: A People's History of Spaceflight* (Lincoln: University of Nebraska Press, 2010), 199.
[355] Peter Westwick, "From the Club of Rome to Star Wars: The Era of Limits, Space Colonization and the Origins of SDI" in *Limiting Outer Space : Astroculture After Apollo*, ed. Alexander Geppert (London, UK: Palgrave Macmillan, 2018). 284; For the original Limits to Growth report and those that preceded it, see; Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, William W. Behrens III and Club of Rome, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of*

publications relayed ideas that unsustainable population growth and environmental pressures like pollution and energy scarcity would usher in an "era of limits," raising public attention on Earthly concerns on a global scale.[356] In Marina Benjamin's book, *Rocket Dreams: How the Space Age Shaped Our Vision of a World Beyond,* she questions how "Space Age dreamers" (like Clarke) reconciled their outward aspirations with an increasingly Earthbound perspective. What happened to the dreams of those fueled by the Moon landings and space travel?[357] Did those dreams find an alternative means of survival once space travel returned to a long-term proposition?[358]

Clarke certainly had to adapt to this new reality, but his resolve that space travel would be ushered in by the extensive exploitation of satellites remained strong as ever. In fact, Clarke would challenge the very notion of limits by offering satellites as the solution, just as he had painted in *Imperial Earth.* Clarke would not be alone in challenging the notion of limits and offering space technology as the solution. The L5 society, created in 1975 to promote Gerard K. O'Neill's space colony concepts, "quelled the doom-and-gloom talk of the 'era of limits' with their belief that technology could solve existential threats."[359] Clarke would note before Congress in 1975 that the public seemed to gravitate toward O'Neill's ideas, but he didn't take them seriously in the short-term.[360] Space colonies were exciting, worthy long-term goals, but were likely not achievable in one lifetime. Advanced satellites, such as NASA's ATS-6 satellite, were available now, and Clarke believed they offered revolutionary benefits that could be exploited not just in a lifetime, but *in a few years.* Benefits that would trample upon the "era of limits," as the knowledge gained from the satellite communications revolution was a means of *unlimited* growth. "In the long run," Clarke would argue in March 1973, "the gathering and handling of knowledge is the only growth industry – as it should be." [361] Clarke would be given a lofty platform to advocate for his vision of the near future utilization of satellite technology as a mechanism for unlocking the unlimited potential of an educated world, and with the new availability of advanced communication satellites like NASA's ATS-6, capable of broadcasting educational programming directly into the homes of developing nations, Clarke wanted to turn possibilities in realities, and his focus became turning "missiles into blackboards."

The transition from the Apollo to post-Apollo periods in space was well described by Neil Maher: "Space technology that during the late 1960s had been used to *seek and destroy* in the jungles of Vietnam had become by the mid-1970s deployed to *assess and restore*."[362] A newfound "planetary perspective," as Carl Sagan would describe

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Mankind (New York: Universe Books, 1972); Paul R. Ehrlich, *The Population Bomb* (New York: Ballantine Books, 1968); and Roberto Vacca, *The Coming Dark Age* (Garden City: Doubleday, 1973).

[356] Ibid., 283; Siebeneichner, "Spacelab," 261.

[357] Benjamin, *Rocket Dreams*, 11.

[358] Ibid., 11.

[359] Westwick, "From the Club of Rome to Star Wars," 297; O'Neill's space colonization concepts are outlined in his book, Gerard K. O'Neill, *The High Frontier: Human Colonies in Space* (New York: William Morrow, 1976); for a closer look specifically at how O'Neill and the space-colony advocates imagined and popularized space colonies and nanotechnology, see Patrick McCray, *The Visioneers: How a Group of Elite Scientists Pursued Space Colonies, Nanotechnologies, and a Limitless Future* (Princeton: Princeton University Press, 2013).

[360] McAleer, *Odyssey of a Visionary,* chap. 24; Westwick, "From the Club of Rome to Star Wars," 297.

[361] Clarke, *The View from Serendip*, 207; On March 15th, 1973, Clarke spoke at the final (of five) in a series of lectures on "Technology and the Frontiers of Technology" at the Smithsonian National Museum of History and Technology in Washington DC. The invite-only audience included members of the US Congress and NASA officials, and Clarke gave his speech "Technology and the Limits of Knowledge," reprinted in *The View from Serendip.*

[362] Neil M. Maher, *Apollo in the Age of Aquarius* (Cambridge, Massachusetts: Harvard University Press, 2017), 88.

it, and the environmental consciousness it encouraged would set the conditions for Clarke to argue firmly that satellites were a weapon of peace to be utilized to restore rather than destroy.[363] What mattered now was making sure that everyone on Earth had access to the satellites thus far reserved for the Western powers during the 1960s, and it was a matter of life or death: "Now for the first time, the all seeing eye of the meteorological satellites, feeding information to giant computers, gives real hope of dramatic improvements in weather forecasting. But forecasts will be no use unless they get to the farmers in their half a million scattered villages."[364] Simply put, the knowledge available via satellite would save lives, a sharper truth when its realized that the technology exists to accomplish such a goal, it just needed to get done. "The great challenge of the decade to come is freedom from hunger. Yet starvation of the mind will one day be regarded as an evil no less great than starvation of the body. All men deserve to be educated to the limit of their capabilities. If this opportunity is denied them, basic human rights are violated."[365] Collectively, all humans educated to their limit would be limitless.

> "Well, there may be limits to growth, in the sense of physical productivity, though in a properly organized world we would still be nowhere near them. But the expansion of knowledge – of information – is the one type of growth that uses no irreplaceable resources, squanders no energy."[366]
> "Technology and the Limits of Knowledge," 1973

NASA Soul Searching

Much has been written about how post-Apollo, NASA suffered deep budget cuts and they needed to retool their approach.[367] During this period, from 1973 to 1981, between the end of the Apollo missions and the inaugural launch of the Space Shuttle in 1981, NASA was in soul searching mode, seeking ways to maintain relevance and public engagement despite a significantly reduced budget and a lack of human missions on the docket.[368] As Alan Steinberg noted, "Space policy was more or less on autopilot, with NASA's budget remaining nearly unchanged from 1974 to 1982."[369] In these years, human spaceflight took the backseat and robotic spaceflight flourished, with a newfound global perspective leading to a rise in planetary science and the launching of a major planetary probe every year of the 1970s, primarily by NASA.[370] While the period would be driven most intently by robotic spaceflight,

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[363] *Future Space Programs 1975,* 330-331.
[364] *Promise of Space*, *Congressional Record,* 1605.
[365] Clarke, *Report on Planet Three,* 160.
[366] Clarke, *The View from Serendip*, 207.
[367] Much has been written on NASA's transition from Apollo to Post-Apollo, see; Mark E. Byrnes, *Politics and Space: Image Making by NASA* (Westport: Greenwood Publishing Group, 1994) for an analysis of NASA's efforts to craft a new public image; Roger D. Launius, "NASA and the Decision to Build the Space Shuttle, 1969–72," *Historian* 57, no. 1 (1994): 17-34, for rationale behind the Space Shuttle; and Lorenza Sebesta, "The Politics of Technological Cooperation in Space: US-European Negotiations on the Post-Apollo Programme," *History and Technology, an International Journal* 11, no. 2 (1994): 317-341, for a closer look at the diplomatic role NASA played in international affairs.
[368] Henry W. Lambright, *NASA and the Environment: The Case of Ozone Depletion*. Monographs in Aerospace History, No. 38, (Washington, DC: National Aeronautics and Space Administration, 2005), 5.
[369] Steinberg, "Space Policy Responsiveness," 241.
[370] Robert S. Kraemer, *Beyond the Moon: A Golden Age of Planetary Exploration, 1971–1978* (Washington, DC: Smithsonian Institution Press, 2000), x; Robert Kraemer was NASA's Director of Planetary Programs during those years. The annual spacecraft launched during the 1970s listed in Kraemer's book are as follows: Mariner 9 mapped the surface of Mars in 1971; Pioneer 10 proved a spacecraft could cross the asteroid belt and survive Jupiter's gravity in 1972; Pioneer 11 performed a flyby of Jupiter

human spaceflight did not fully relinquish the spotlight. 1973 saw the launch and inhabitation of NASA's first space station, Skylab, and 1975 would see Cold War adversaries collaborate in the Apollo-Soyuz Test Project (ASTP). Despite these highlights in both robotic space exploration and human spaceflight, the period would largely be a decade of satellites, raining information upon an environmentally focused, freshly globalized Earth. Tasked with navigating this newfound budgetary and PR landscape was NASA Administrator James C. Fletcher and Deputy Administrator George M. Low, whom Clarke would work with directly during these years in helping them determine the best path forward.

Throughout the 1970s, Clarke was engaged in the much larger discussion of the post-Apollo period's themes of globalization, environmentalism, and what direction NASA should take. The leading thinkers of the time engaged with Clarke to plot a course for navigating these realities. In a letter to Clarke dated June 25th, 1975 from David R. Scott, Apollo 15 astronaut and the new Director of NASA's Dryden Flight Research Center (he was appointed April 18th, 1975) wrote Clarke to invite him to a private Fairchild Conference (the company that built ATS-6) on "The Manned Exploration of the Moon and Planets."[371] The conference, which Scott described as a means to plan for the future of space exploration, would be "private" with no plan to formally publish proceedings, continuing that "It is merely a gathering of the players as we pass through the door back to the outside world."[372] Scott stated that the 'players' would include, to name a few, VP of Engineering and Development at Fairchild Wernher von Braun, NASA Deputy Administrator George Low, Lunar Scientist Gene Shoemaker, Apollo 17 Astronaut Harrison Schmitt, Apollo 11 Astronaut Neil Armstrong, and Apollo 12 Astronaut Pete Conrad.[373] Prominent company indeed.

Clarke was unable to attend, but Scott sent him a follow up letter on August 18th, 1975 detailing what was discussed. Scott explained that "All participants agreed…there is no question that man will eventually colonize the planets. Between now and then, he should continue to utilize near Earth space to: a) improve the quality of life on Earth, b) develop the technology that will provide the capability to go outward, when the time comes, c) provide an environment in which young minds (and old!) can create, imagine, inspire, and dream new 'things', and d) provide a platform for which the proponents can convince the opponents, and others, of the value of exploration of the planets and space. Then, that is when the social, political, economical, resource, and spiritual factors 'converge', at the proper moment when the spark appears, the kindling and logs will be in place to light the fire. First we must consolidate our foothold in space before making the next major advance into the future home of man."[374] This very much encapsulates the manner in which Clarke would approach his Post-Apollo advocacy: a.) focus on the positive human benefits of satellites, such as access to knowledge; b.) continue developing technology and developing space

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and made the first visit to Saturn in 1973; Helios 1 made the closest yet approach to the sun in 1974; In 1975 Viking 1 and 2, each a rover/orbiter combination, mapped the Martian surface from orbit and accomplished two landings in search of life they did not find; Helios 2 travelled nearly 70% of the distance toward the sun in 1976; In 1977 Voyager 1 and 2 began their Grand Tour of the solar system and would later return high resolution images of Jupiter, Saturn, Uranus, Neptune, and a number of their satellites; and Pioneer Venus 1 and 2 orbited and sent probes into the atmosphere of Venus in 1978.

[371] David R. Scott to Arthur C. Clarke, June 25, 1975, Folder 4, Box 14, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC.

[372] Ibid.

[373] Ibid.

[374] David R. Scott to Arthur C. Clarke, August 18, 1975, Folder 4, Box 14, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC.

infrastructure that facilitates human movement into space, like NASA's ATS-6 satellite; c.) utilize that technology to educate the world, as seen in the 1975 Satellite Instructional Television Experiment (SITE) in India; and d.) build coalitions aimed at similar goals, like the importance of the Shuttle to future space commerce – and then wait patiently for the proverbial stars to align. In sum, Clarke sought to identify and communicate short-term, achievable goals (the majority of which involved satellites) that helped to establish a long-term human presence in space. A forward focused holding pattern, so to speak. And his audience was all ears.

When asked by the Future Space Programs Committee why "There has been a tremendous resistance in the last few years even to listening to the facts on space technology," Clarke responded "people just don't want to hear it, and why this is I don't know. Maybe its part of the general climate of opinion and the difficult times this country's been going through, Vietnam and Watergate and all these things."[375] As the Post-Apollo Period began, Clarke himself had felt this frustration: "It is now obvious – except to the willfully ignorant- that many of the solutions to our present social and environmental problems lie partly in space."[376] In the popular culture, there is only so much space for space, despite the perks.

> "There has been a major failure of communications here between NASA and the public about the real, practical, down-to-earth, if I may say, values of space technology in solving problems here."[377]
> "2002 and Beyond," 1971

Pictorial Riches

A notable problem for NASA, despite all of it robotic success – narratives of robotic exploration and the machine-generated images of planetary probes, failed to make headlines and did not generate excitement in the public like human spaceflight had.[378] Clarke would highlight this point in his July 1975 testimony at the Future Space Programs hearings before the House Subcommittee on Space Science and Application: "the space probes – the Rangers, Orbiters, Mariners, Pioneers… have revolutionized our knowledge of neighboring worlds… But how many people know about the discoveries that these robot explorers – our scouts into the new wilderness – have radioed back from Mars, Mercury, Venus, Jupiter! It is a great tragedy that the United States has lost the most effective medium for spreading news of these adventures in science – you've lost your magazines like *Life* and *Colliers,* which played such an important role in promoting the space age. The pictorial riches stored up in NASA are almost unknown to the general public."[379] While it seems the public lacked enthusiasm for the images radioed back by robotic space explorers, they were very privy to NASA's newfound pictorial riches of the Earth.

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[375] *Future Space Programs 1975,* 201.
[376] *Space Shuttle: Key to Future, Congressional Record,* E6363.
[377] Clarke, "2002 and Beyond," 4; In the introduction given before Clarke's speech, Spectorsky noted that as of October 1971, Clarke had 23 contributions to *Playboy*.
[378] Geppert, "The Post-Apollo Paradox," 10; The lack of attention to robotic spaceflight successes would lead Carl Sagan to co-found the space advocacy organization *The Planetary Society* in 1980 to build support, see Kim McQuaid, "Earthly Environmentalism and the Space Exploration Movement, 1960-1990: a Study in Irresolution," *Space Policy* 26, (2010): 69.
[379] *Future Space Programs 1975,* 194-195.


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As Geppert further describes the Post-Apollo period, "Humankind's outward movement correlated with a new sense of planetized globality" brought about by a sense of cosmic isolation elicited by images of the planet Earth alone in the void, such as Earthrise and the Blue Marble.[383] Further, "the world-encompassing process of international entanglement now usually referred to as globalization finally unfolded with full force."[384] Historian Benjamin Lazier classified the Post-Apollo Period as the *Earthrise Era*, because during these years, Earth became visually represented, and perceived, as a single entity "in the Western pictorial imagination."[385] While the credit for this new perception of the Earth is often given to *Earthrise*, taken by Apollo 8 in 1968 and the *Blue Marble*, taken by Apollo 17 in 1972, the satellite played a much more central role to globalization that is often stated, as it was the Television and Infrared Satellite (TIROS) 1 in 1960 that first viewed Earth's weather system as a whole, it was Lunar Orbiter 1 who in 1966 took the first Earthrise image, and it was ATS-3 that took the first color whole Earth image.[386]

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[380] NASA, *The Blue Marble,* December 7 1972, NASA Image Number: AS17-148-22727, Accessed April 7 2020. https://www.flickr.com/photos/nasacommons/.
[381] NASA, *Earthrise,* December 24 1968, NASA Image Number: AS8-14-2383HR, Accessed April 7 2020. https://www.hq.nasa.gov/office/pao/History/alsj/a410/AS8-14-2383HR.jpg.
[382] NASA, *Earthrise via Lunar Orbiter I,* August 23, 1966, NASA Image Number: SPD-SLRSY-1757, Accessed April 7 2020. https://www.flickr.com/photos/nasacommons/.
[383] Geppert, "The Post-Apollo Paradox," 8, 14.
[384] Ibid., 10.
[385] Benjamin Lazier, "Earthrise; Or, The Globalization of the World Picture," *The American Historical Review* 116, no. 3 (2011): 606; for a closer look at the concept of "Spaceship Earth" see Sabine Höhler, *Spaceship Earth in the Environmental Age, 1960-1990* (London: Pickering & Chatto, 2015).
[386] Harry Eyres, *Seeing Our Planet Whole: A Cultural and Ethical View of Earth Observation,* (Cham: Springer, 2017), 79; see also Conway, "Satellites and Security: Space in Service to Humanity," 275.

But ultimately, it was the images taken by humans that held the most weight, and those images had a strong impact on the popular culture.[387] NASA's photos of the Earth would be used "as a means for changing the way people visualized the planet and thus conceptualized their relationship with it."[388] Further, these images of Earth "served to redirect the space program away from the Moon and the planets, its original goals, and back toward the needs of planet Earth."[389] In the period, NASA would hitch a ride on the environmental and social welfare movements that emerged at this time, soon undertaking a PR campaign that framed the space program "in terms of an environmental theme: the study of the Earth and its Environment," because, as NASA Administrator Fletcher would note, "NASA could be called an environmental agency because space is our environment."[390]

In early 1973, *Playboy* asked Clarke to write a short essay of his choosing, and he produced "The Snows of Olympus," about the discoveries space probe Mariner 9 made in orbit around Mars in 1972, specifically those of *Nix Olympica,* or "The Snows of Olympus" (Olympus Mons), the unimaginably enormous volcano that would span from LA to NYC. Clarke speaks of how Mariner 9 "swept aside the illusions of decades" and showed us the "*real* Mars, not the imaginary one." The more Clarke would learn about Mars over the years, the stronger his resolve would become to drive human expeditions there, but the satellite always came first, as the ultimate purpose of Clarke's short essay was to refocus attention back to satellites post-Apollo. "This news may be received with less than enthusiasm at the very moment when NASA's budget is being cut to the bone and voices everywhere are calling for an attack on the evils and injustices of our own world…True, we must rebuild our cities and our societies and bind up the wounds we have inflicted upon Mother Earth. But to do this, we will need all the marvelous tools of space – the weather and communications and resources satellites that are about to transform the economy of mankind. Even with their aid, it will be a difficult and often discouraging task, with little glamour to fire the imagination."[391]

The scope of effort Clarke undertook to ignite that fire of the imagination, and to emphasize the "marvelous tools of space," especially post-Apollo, were widespread, stretching from *Playboy* all the way to Congressional testimony. In a letter written on November 29th, 1974, NASA Deputy Administrator George Low responded to the editors of *Playboy* after they sent him a preprint of Clarke's "The Snows of Olympus" and asked for his comments. His response is telling of how closely Clarke's work touched high level decision makers like Low: "Arthur Clarke has reminded us again how fortunate we are – fortunate to be alive at a moment in history when humanity's most searching questions about itself and its future are coming within grasp. 'In the Snows of Olympus' he states: 'Where there is no vision, the people perish.' But Clarke, better than most, knows that this vision still exists in our world: The vision to explore the unknown of space – to increase our understanding of the past, present, and future of the universe, and humanity's place in it; and the vision to apply what we learn in space to improve the quality of life on

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[387] The experience felt by astronauts who set eyes upon the Earth from space has been labelled the "Overview Effect," see Frank White, *The Overview Effect: Space Exploration and Human Evolution* (New York: Houghton and Mifflin, 1987).
[388] William Bryant and C. S Lewis, "The Re-Vision of Planet Earth: Space Flight and Environmentalism in Postmodern America," *American Studies 36*, no. 2 (1995): 44-45.
[389] McCurdy, *Space and the American Imagination,* 208.
[390] McQuaid, "Selling the Space Age," 128-129; As Lambright notes, "While NASA seeking to reframe themselves as an environmental agency has the appearance of altruism, historians have pointed out the fact one of the catalysts for action on the environment was triggered by a 1973 report that found the newly approved Shuttle "would release chlorine, a highly reactive element theorized to destroy ozone in the stratosphere," see Lambright, *The Case of Ozone Depletion,* 5.
[391] Republished in Clarke, *The View from Serendip*, 147-149.

Earth with weather, communications, and resource satellites…. Arthur Clarke has done his usual outstanding job of telling us that the real world is stranger than fiction."[392]

> "In 1975 there will be a new Star of India; though it will not be visible to the naked eye, its influence will be greater than that of any zodiacal signs. It will be the satellite ATS-6…"[393]
> "Schoolmaster Satellite," 1971

Arthur C. Clarke's Star

So predominately Clarke would become associated with the ATS-6 satellite that it has been referred to as "Arthur C. Clarke's Star."[394] The Applications Technology Satellite F (ATS-6) was near and dear to Clarke, as it was the very technology which he had so long advocated for, and which stood central to his dreams of a future with *direct* broadcasting into the homes of the developing world. Not just a "voice from the sky," but a "window on the world."[395] But it was almost not meant to be. During their deliberations as Apollo 17 approached its conclusion (as written in Low's personal notes dated December 23rd, 1973), Fletcher and Low had to make a number of difficult choices .[396] In attempting to determine where to apply budget cuts, the two NASA leaders determined: the Viking mission to Mars could not be cut because it was "the only highly visible sign of space exploration in the middle 70's"; although the Apollo-Soyuz Test Project (ASTP) "contributed least to [NASA's] overall program," Nixon felt it should be NASA's highest priority; the Space Shuttle was Nixon's second priority for NASA and would need to remain a major budgetary vampire; and perhaps most importantly for this analysis, Low suggested that NASA leave the communications business because "there now has developed a significant communications satellite capability in private industry" and that it was clear "that communications work will go on whether or not NASA participates."[397] It seemed a major power was going to *leave* the comsat business.

This decision would hold important ramifications for Clarke and his advocacy efforts Post-Apollo, as Low notes that "there are some areas [of communications satellite capability], such as direct broadcasting, which will take much longer without federal government participation."[398] But ultimately, Low deduces that "in other areas of applications, such as earth resources, environmental work, etc., there exists no commercial/industrial capability that will carry on if the federal government gets out of it," but ultimately Low and Fletcher determine that satellites focused on earth resources and the environment/weather would replace communication satellites as their focus of R&D, in closer alignment with their environmental proclamations.[399] Still in development were NASA's advanced

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[392] George Low to Playboy Enterprises, Inc., November 29, 1974, Arthur. C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC.
[393] Clarke, *The View from Serendip*, 109.
[394] W. Moore and W. Prensky (eds.), "Applications Technology Satellite ATS-6 Experiment Check-Out and Continuing Spacecraft Evaluation Report," NASA-TM-X-70812 (Washington, DC: Technical Information Division, Goddard Space Flight Center, 1974), xii.
[395] Clarke, *The View from Serendip*, 116.
[396] Logsdon, Launius, Onkst, and Garber (eds.), *Exploring the Unknown Using Space,* 132; selected documents are the "Personal Notes" of George M. Low, Deputy Administrator, NASA, from December 23, 1972.
[397] Ibid., 132; A NASA press release in 1973 communicated this officially as follows, "Further advances in satellite communications research and development can be accomplished by industry on a commercial basis without government support," see Launius, "Global Instantaneous Telecommunications and the Development of Satellite Technology," 78.
[398] Ibid., 132.
[399] Logsdon, Launius, Onkst, and Garber (eds.), *Exploring the Unknown Using Space,* 132.

direct-broadcast comsats, Applications Technology Satellites 6 and 7, hereby ATS-6 and ATS-7.[400] While ATS-6 would be launched, ATS-7 would fall victim to NASA's decision to pass R&D along to private industry, much to Clarke's chagrin. NASA's R&D was an important element to Clarke's satellite future, and its loss would be felt, later communicating that "NASA was pulled out of this business on the grounds that communication satellites are in use, and it is now up to private industry to make the next step. But private industry can't always afford the new investment in experimental techniques, and is likely instead to make the best use of what already exists. Therefore the program is limited."[401] In short, there were more limitations if NASA wasn't involved, and a brief overview of NASA's ATS program shows just how pivotal it was to the realization of Clarke's imaginings.

NASA's ATS program was born in the 1960s to test and improve upon satellite communications technology, as previous comsats, like Echo, Relay, and Syncom, had been solely researched in low orbits.[402] At these altitudes, only about three percent of the globe could be viewed at any given time.[403] The ATS satellites would be placed into geostationary orbit, allowing 45 percent coverage of the globe.[404] Additionally, they would conduct meteorological, scientific, technical, and later educational and sociological experiments.[405] The first 5 ATS satellites were built by Hughes Aircraft Company.[406] ATS-1 was launched on December 7th, 1966, and it proved a success, showcasing many positive services, including; TV events such as President Johnson's visit to Australia in 1967 following the death of Australia's Prime Minister Holt; relaying emergency communications during the Alaskan flood in August 1967; and broadcasting primary school through college-level courses to Alaska and the Pacific Basin.[407] Additionally, ATS-1 produced the first black and white photo of Earth from geosynchronous orbit, and would be given the moniker 'Peacesat' long before Clarke repurposed it in the 80s.[408] ATS-2, launched April 6th, 1967 suffered a fuel system failure and reentered the atmosphere on September 2nd, 1969.[409] Lessons learned. ATS-3 was put into orbit on November 6th, 1967, and several weeks later performed the first ground-to-spacecraft-to-aircraft communication link.[410] On top of supporting the Apollo missions, the satellite obtained the first color photograph of Earth from space, an image that donned the cover of the counter-culture alternative technology publication *Whole Earth Catalog.*[411] ATS-3 proved to be an extremely useful spacecraft, operating for over 28 years, notably being used to track the spread of volcanic ash after Mt. St. Helens erupted in May of 1980, thus furthering the study of volcanic

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[400] ATS-6 and ATS-7 are used interchangeably with ATS-F and ATS-G.
[401] *Arthur Clarke Looks at Our Technical Future*, 95th Cong., 1st sess., Congressional Record, Vol. 123, pt. 29: 37447.
[402] Moore and Prensky, "Applications Technology Satellite ATS-6 Experiment Check-Out," 1-3.
[403] "Press Kit for Project ATS-F," May 21, 1974 (Washington, D.C.: Scientific and Technical Information Division, National Aeronautics and Space Administration), 10.
[404] Moore and Prensky, "Applications Technology Satellite ATS-6 Experiment Check-Out," 1-3.
[405] Ashok Maharaj, "Satellite Broadcasting in Rural India: The SITE Project" In: *NASA in the World: Fifty Years of International Collaboration in Space,* eds. John Krige, Angelina Long Callahan, and Ashok Maharaj, Palgrave Studies in the History of Science and Technology. New York, NY: Palgrave Macmillan, 2013, 241-242.
[406] Conway, "Satellites and Security: Space in Service to Humanity," 299; Moore and Prensky, "Applications Technology Satellite ATS-6 Experiment Check-Out," 1-1.
[407] "Press Kit for Project ATS-F," 10-11.
[408] Conway, "Satellites and Security: Space in Service to Humanity," 299; Clarke would note that the Pacific Radio Network first used the term 'Peacesat' to describe ATS-1 in his 1982 speech "War and Peace in the Space Age."
[409] "Press Kit for Project ATS-F," 11.
[410] Ibid., 11.
[411] Ibid., 12; Maher, *Apollo in the Age of Aquarius*, 124.

explosions on the global climate.[412] ATS-4, launched August 10th, 1968, but a failure led to its rapid deorbit on October 17th.[413] ATS-5, launched August 12th, 1969, earned less fanfare, as its successes remained highly scientific, improving broadcast frequency capacities and experimenting on auroral particles.[414]

ATS-6 (and ATS-7, which did not see completion) were built by Fairchild Industries, who employed von Braun as VP of Engineering and Development post Apollo, and were the largest, most advanced comsats in NASA's ATS series, with ATS-6 launching on May 30th, 1974.[415] Reporting on the coming launch of ATS-6 by the Baltimore Sun on April 20th, 1974 features an enthusiastic picture of von Braun unveiling the satellite, commenting that "ATS-F could turn out to be the most important advance since movable type as a means of reaching people now separated by vast geographical, economic, and cultural barriers… All you need, basically, is a dish antenna and a television set."[416] The satellite could be put into geosynchronous orbit ensuring widespread global coverage, and had the capacity to deploy onboard thrusters to move its location along the equator.[417] Most importantly, it possessed the capacity to transmit signals directly to small ground stations, which could allow anyone in possession of an antenna, a signal transformer, and television receiver to tune into video programming.[418] In articles published around the launch of ATS-6, headlines were sure to see it as it was: "Satellites to Change Man's Life," "Satellite may aid valley hospitals," "Satellite to Permit More Medical Aid Over TV," "New Satellite to Aid Isolated Areas," "Illiteracy is Satellite Target," "Satellite Launched In Effort to Fight Illiteracy in India," "Versatile satellite set to teach Alaskans," and "ATS-6: Education By Spacial Delivery."[419]

The first course of action for the ATS-6 satellite was to perform a number of health, education, and telecommunication projects in rural areas across the United States, including Appalachia, the Rocky Mountain Region, and the Northwest, including Alaska, to investigate the use of direct broadcasting of education and social services to encourage national development. The first ever educational course taught via space satellite television began at 9:00am ET on July 2nd 1974, with a transmission of color video materials to 700 graduate-level elementary school teachers in Appalachia, wherein they would receive full college credits from the University of Kentucky for completion.[420] Following its educational efforts in the US, NASA directed ATS-6 to its new location above the Indian Ocean, but it would make a momentous pitstop along the way.

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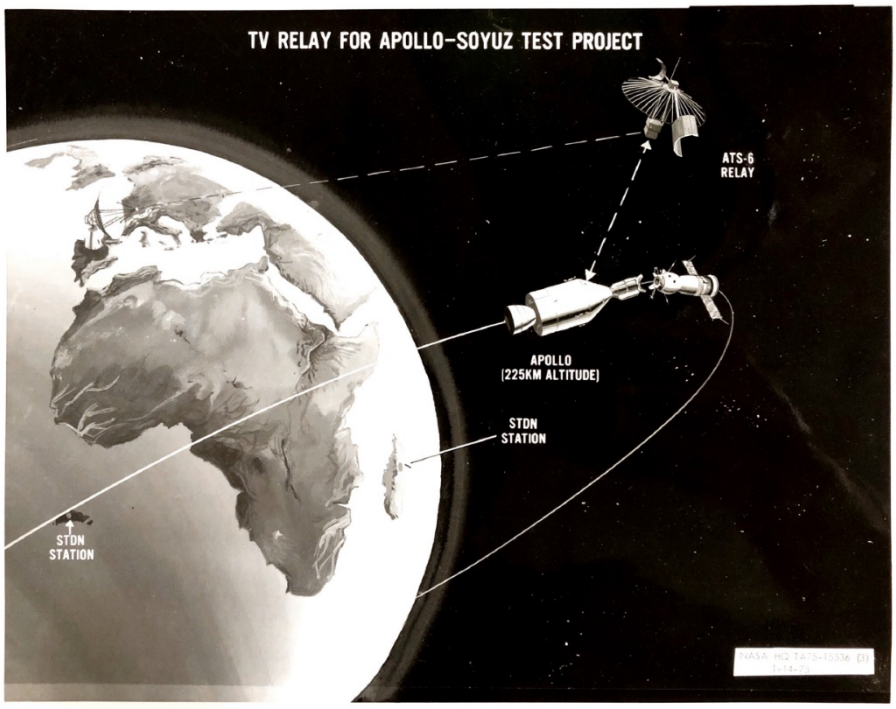
[412] Launius, "Global Instantaneous Telecommunications and the Development of Satellite Technology," 78.
[413] "Press Kit for Project ATS-F," 12.
[414] Moore and Prensky, "Applications Technology Satellite ATS-6 Experiment Check-Out," 1-4.
[415] Maharaj, "Satellite Broadcasting in Rural India: The SITE Project," 241-242; Moore and Prensky, "Applications Technology Satellite ATS-6 Experiment Check-Out," 1-1.
[416] *Baltimore Sun*, "New Satellite Unveiled," April, 20, 1974, Space Flight – Satellites and Probes (1968-1985), Record Number 5652, NASA Headquarters Historical Reference Collection, Washington, DC, A15.
[417] Maharaj, "Satellite Broadcasting in Rural India: The SITE Project," 241.
[418] Ibid., 243.
[419] The following newspaper articles were found in the same archival location, see; Space Flight – Satellites and Probes (1974), ATS-6, Record Number 5656, NASA Headquarters Historical Reference Collection, Washington, DC; *Chicago Tribune,* "Satellites to Change Man's Life," January 26, 1972; *The Times-Herald,* "Satellites May Aid Valley Hospitals," May 22, 1974; *Philadelphia Inquirer*, "Satellite to Permit More Medical Aid Over TV," May 28, 1974; *Washington Star-News*, "New Satellite to Aid Isolated Areas," May 30, 1974; *Philadelphia Inquirer*, "Illiteracy Is Satellite Target," May 31, 1974; *The New York Times*, "Satellite Launched In Effort to Fight Illiteracy in India," May 31, 1974; *The Plain Dealer*, "Versatile Satellite Set to Teach Alaskans," August 14, 1974; *American Education*, "Education By Spacial Delivery," May, 1976.
[420] Howard Allaway and Don Witten, "NASA Release No: 74-172" July 1 1974, ATS-6 30 May 1974 1974-039A, Record Number 5652, NASA Headquarters Historical Reference Collection, Washington, DC.



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> "In one sense, the Apollo Project was indeed a Prelude to Space. Now there will be a short interlude; and sometime in the 1980s, the real story will begin. The hiatus does not disappoint me, for I have already seen achievements beyond my wildest dreams. I have shaken the hands of the first man to orbit the earth, the first man to step out into space, and the first to walk upon the Moon. In the long perspectives of history, it will not matter that two of them were Russian and one was American."[422]
> "Post-Apollo Preface" in *Prelude to Space,* 1977

Apollo-Soyuz Test Project

As a vocal opponent to war, and a vocal advocate for international space cooperation, Clarke held an affinity to the cooling of US-Soviet tensions represented by the ASTP, which took place the same month as the Future of Space Program hearings in July 1975.[423] The ASTP was a convergence of interests and events for Clarke, marking 1975 a significant year for his post-Apollo efforts. For one, Clarke would again join Walter Cronkite, alongside Neil Armstrong, live on CBS, first at launch in Florida on July 15th, followed by the Apollo-Soyuz rendezvous in orbit on July 17th in the New York City studio.[424] Secondly, the very satellite broadcasting the live feed representing an easing of Cold War tensions was relayed by none other than the ATS-6 satellite, as it was being repositioned from the US to the Indian Ocean for use in SITE.[425] The first joint human spaceflight mission between the US and USSR was

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[421] NASA, *TV Relay for Apollo-Soyuz Test Project*, January 14 1975, ATS-6 30 May 1974 1974-039A, Record Number 5652, NASA Headquarters Historical Reference Collection, Washington DC.
[422] Clarke, "Post-Apollo Preface" to 1977 Edition of *Prelude to Space*, 6.
[423] The 1971 US-USSR Science and Applications Agreement, which was resigned in both 1974 and 1977, allowed for the exchange of lunar soil samples, as well as the sharing of research and data. In 1972, President Nixon and Soviet Premier Kosygin agreed to the Summit Agreement Concerning Cooperation in Outer Space for Peaceful Purposes, wherein they officially agreed to conduct the ASTP, see Angelina L. Callahan, "Sustaining Soviet-American Collaboration, 1957-1989" in *NASA in the World: Fifty Years of International Collaboration in Space,* eds. Krige, John, Angelina Long Callahan, and Ashok Maharaj, Palgrave Studies in the History of Science and Technology (New York, NY: Palgrave Macmillan, 2013), 138.
[424] McAleer, *Odyssey of a Visionary,* chap. 24.
[425] Terry White, "NASA Release No: 74-264" October 22 1974, ATS-6 30 May 1974 1974-039A, Record Number 5652, NASA Headquarters Historical Reference Collection, Washington, DC.

broadcast live on a crisp picture, beginning with the words "Moscow is go for docking. Houston is go for docking. Its up to you guys: have fun!"[426]

Clarke is asked by the Committee at the Future of Space Program hearings about Apollo-Soyuz (which had happened just days earlier) and how, from a public point of view, they could shift away from the very defensive attitude between the US and USSR toward "a more broad, open attitude of space-mindedness?"[427] Clarke replied, "Well, the Apollo-Soyuz experiment is of course hopefully the beginning of some such relaxation."[428] Pressed more specifically about how military funding can be rerouted for positive space technologies, he stated matter-of-factly, "Getting money out of the military budget into this – there is one way of doing it… The military depend on research almost more than anybody else… You've got to have something going on. The laser is a good example of this. I mean, we suspect that the laser is going to transform war, and also, as I said earlier, lasers may transform space propulsion. I guess we had better make sure that the military have the money to do the research on lasers that they need."[429] Get the military to develop technology that can be repurposed, a common belief Clarke shared throughout his career. His comment on lasers is of interest, because railing *against* such military laser development would become a centerpiece of his work in the 1980s when Reagan's Strategic Defense Initiative (SDI) would call for that very military research. Further, this statement is exemplative of Clarke's understanding that space technology is born of the military, shapable upon its completion.

Much has been written about the ASTP and to what degree it actually represented détente between the Cold War rivals. In *The Heavens and the Earth,* McDougall observed that the ASTP was a "double boon" for the Soviets, as it provided first hand access to American technology and restored their space program to equal footing with the US.[430] It appears that in reality, the Cold War was still very much alive under the surface, despite the optimistic images relayed via the ATS-6 satellite. But good optics were half the battle. With the historic docking complete, ATS-6 used its onboard thrusters to achieve geostationary orbit above the Indian Ocean to commence what Clarke described as "one of the greatest educational experiments in history."[431]

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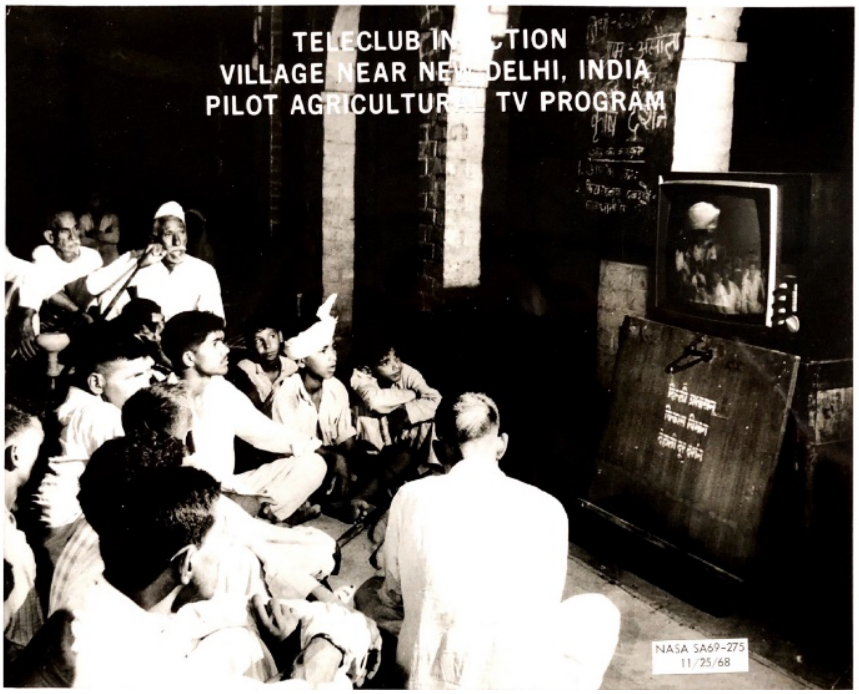
[426] Colin Burgess, *Footprints in the Dust: The Epic Voyages of Apollo, 1969-1975.* Outward Odyssey: A People's History of Spaceflight. (Lincoln: University of Nebraska Press, 2010), 387.
[427] *Future Space Programs 1975,* 203.
[428] Ibid., 203.
[429] Ibid., 203.
[430] Callahan, "Sustaining Soviet-American Collaboration, 1957-1989," 142.
[431] *Future Space Programs 1975,* 193.



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> "SITE was more than an act of great generosity by the United States, and of superb courage and competence by Indian scientists and engineers. During its successful year of operation, it demonstrated enormous potential value of direct broadcast satellites to developing countries. No other technology can distribute information so effectively and cheaply over continent-sized regions, or do so much to reduce the handicaps of the rural masses who still constitute most of mankind. Without satellites, it may well be impossible to win the fateful contest of which H.G. Wells warned us so long ago – the race between education and catastrophe."[433]
> "Letter to the British Council," 1977

Satellite Instructional Television Experiment

On September 18th, 1969, an agreement was reached between Dr. Vikram A. Sarabhai, Chairman of the Indian Space Research Organization, and Dr. Thomas Paine, then NASA Administrator, to engage in a cooperative experiment to broadcast educational television programs from the planned ATS-6 satellite directly to some 5000 Indian villages.[434] This experiment would become known as the Satellite Instructional Television Experiment (SITE). SITE's main objectives were "to educate the financially and academically struggling people of India on various issues via satellite broadcasting, and also to help India gain technical experience in the field of satellite communications."[435] Yet there was a much larger story behind the creation of the experiment. SITE was born from proposals that emerged following the Chinese nuclear test in October of 1964.[436] With US State Department officials seeking to create an

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[432] NASA, *Pilot Agricultural TV Program near New Delhi*, November 25, 1968, NASA Image: SA69-275, ATS-6 30 May 1974 1974-039A, Record Number 5652, NASA Headquarters Historical Reference Collection, Washington DC.
[433] Arthur C. Clarke to British Council, March 16, 1977, Folder 5, Box 142, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC.
[434] NASA, *Astronautics and Aeronautics, 1969: Chronology of Science, Technology, and Policy*. NASA SP-4014 (Washington DC: NASA, *1970),* 310.
[435] Howard L. Galloway Jr., "Satellite Instructional Television Experiment (SITE) Reports from the NASA Resident Representative in India," NASA-TM-X-74146 (Greenbelt, Maryland: Goddard Space Flight Center, 1976).
[436] Maharaj, "Satellite Broadcasting in Rural India: The SITE Project," 236.

Asian counterweight to communist China, the idea of a broadcast satellite for India emerged.[437] "SITE offered the State Department twin benefits: a benign technological tool to offset communist China's influence, and a technology that would help to bring literacy and development to the rural population."[438] It was during this time that communications and media scholars like Marshall McLuhan were promoting the idea that television broadcasting could be utilized as a tool of national development.[439] Even seemingly generous projects like SITE had their roots in Cold War animosities.

In February of 1971, while filming *The Promise of Space,* Clarke visited Sultanpur, one of the TV equipped villages that would receive transmission once SITE commenced.[440] Using a makeshift 10-foot-wide chicken wire receiving dish and a signal from the Delhi transmitter, "standing in for the still unlaunched satellite" they demonstrated what TV broadcasting would be like with a lecture in elementary mechanics, which Clarke remarks "could not have been of overwhelming interest to most of the audience; nevertheless, it seemed to absorb viewers whose ages ranged from under ten to over 70."[441] It was at this moment that Clarke "really began to appreciate what could be done through even the most elementary education at the village level," because "the utility of TV was its appeal to the illiterate and small farmers *whom information somehow just does not trickle."* Those who watched the demonstration were "so impressed by the possibilities of TV education that they plan to build their own station to broadcast to their quarter of a million farmers. They have the money, and they cannot wait for the satellite – though it will reach an audience two thousand times larger, for over 500 *million* people will lie within range of ATS-F."[442]

Clarke was not a fringe character in the global space community. In 1974, shortly following the launch of ATS-6 (while it was performing experiments in the rural US) Clarke's friend von Braun notified him of the possibility of receiving his own ground station in Sri Lanka to be able to tune into the SITE programming, arguing "I think they will agree with us that they could not possibly deprive the inventor of the geosynchronous satellite of the fruits of his own labors!"[443] Von Braun reached out to Dr. Satish Dhawan, the head of the Indian Space Program, on Clarke's behalf, and by April of 1975, several months before SITE would begin, the Government of India gifted Clarke a full ground station for "demonstration purposes," with Yash Pal, the Director of the Indian Space Research Organization, writing Clarke personally with news that they would install a "specifically made community receiving station to enable you to directly participate in the realization of your dream of many years ago."[444] The installation of the ground station at Clarke's Sri Lankan home would mean that he possessed the world's first privately owned Earth

[437] Ibid., 236-237.
[438] Ibid., 238-239.
[439] Ibid., 238-239.
[440] *Promise of Space*, *Congressional Record,* 1605.
[441] Ibid., 1605.
[442] Ibid., 1605.
[443] Wernher von Braun to Arthur C. Clarke, August 5, 1974, Correspondence Jan-Mar, Folder 2, Box 13, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution. Washington, DC.
[444] McAleer, *Odyssey of a Visionary,* chap. 24.

satellite station in the world, and as the experiment commenced, "everyone from the President down is coming to see the excellent pictures form ATS-6."[445]

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SITE officially began on August 1st, once ATS-6 had completed its work with the ASTP. NASA provided the ATS-6 satellite, and the Indian Space Research Organization (ISRO) took care of the rest; from installation and maintenance of the earth stations to design, installation, and maintenance of the augmented community receivers.[447] The four earth stations, located in the Indian cities of Dehli, Nagpur, Ahmedabad, and Amritsar, (the fifth at Clarke's Sri Lankan residence) transmitted signals to the ATS-6 satellite, which amplified them back to television receivers, with a little help from a simple chicken wire antenna.[448] Roughly 2.8 million people, spread over 2300 villages (each with an average size of 1200 inhabitants) viewed regular SITE broadcasts, which aired roughly four hours a day, with each program repeating once in the morning and once in the evening.[449] The Indian response was positive, as was summarized as such: "The immediate visible results of the broadcast, as cited by project evaluators in the rural clusters, was improved school attendance, increased concern for proper nutrition, and an awareness of sanitation and personal hygiene as methods of disease prevention. One of the unanticipated benefits of the program was the electrification of numerous villages, a prerequisite for television reception. For the Indians,

[445] Arthur C. Clarke to David R. Scott, September 15, 1975, Folder 4, Box 14, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC; The letter would note that the visit from the President and Prime Minister of Sri Lanka happened on August 12th, 1975.
[446] Photo Credit: Arthur C. Clarke Trust, *Clarke with his private ground station at his home in Colombo, Sri Lanka 1976,* Accessed May 19 2020. http://arthurcclarke.org/site/life/life-1970/.
[447] Maharaj, "Satellite Broadcasting in Rural India: The SITE Project," 242-243.
[448] Ibid., 242-243.
[449] Ibid., 245.

the visual demonstration galvanized public opinion in favor of a space program focused on socioeconomic needs. It helped the country gain competence in using satellites for mass communication and was a systems management lesson for managing Indian National Satellite (INSAT) systems."[450]

For NASA, SITE's success seemed to rectify the supposed mistake Fletcher and Low had made in the early 1970s of stepping away from comsat R&D. Arnold Frutkin, who served as Deputy Director of the US National Committee for the IGY in the National Academy of Sciences before becoming NASA's Assistant Administrator for International Affairs, was one of NASA's senior negotiators for nearly every international space agreement, including the ASTP and SITE. He enthusiastically embraced the monetary benefits advanced satellites would yield for NASA after the success of SITE: "We took the satellite back. What was the consequence? India contracted with Ford Aerospace for a commercial satellite to continue their programs . . . the point is, this program not only was an educational lift to India and demonstrated what such a satellite could do, but it brought money back into the U.S. commercial contracts for satellites for a number of years."[451] Testifying before Congress in 1976, Fletcher would share a conclusion that "the United States needs to maintain its international leadership in space communications and, therefore, should increase its efforts to advance communications technology and to develop and demonstrate new uses."[452] Certainly a big shift from their determinations just several years previous, when Fletcher and Low ultimately felt that the private sector would be sufficient in advancing communication technology moving forward. But despite this rhetoric, action did not seem to follow, as a nearly completed ATS-7 would not see its completion.

> "After years of delay and dithering, the United States is at last establishing domestic satellite systems; the USSR has had one for almost a decade… Some [of their satellites] are designed for TV relaying to remote parts of the Soviet Union, and I've gently hinted to my friends in Moscow that perhaps they could fill the breach when ATS-6 goes home."[453]
> "The Second Century of the Telephone," 1976

ATS-7

When on the Hill in DC during the Future of Space Programs hearings in July 1975, Clarke had told the Chairman of the House Space Committee, Rep. Don Fuqua that it was "a tragedy" that SITE would end so soon, and he was incensed that he "saw a 70% completed ATS Satellite, all wrapped up and nowhere to go."[454] Unfortunately, Clarke remised, the $30-40 million launch vehicle price tag was the barrier for utilization, further proof of the need for the space shuttle. Exemplifying his desire for an international space effort free of Cold War confrontation, Clarke notes "I said (only half sarcastically) perhaps the Russians could provide the launch vehicle if the Americans can't afford it!"[455]

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[450] Ibid., 235.
[451] Ibid., 245.
[452] *Outlook for Space: Report to the NASA Administration by the Outlook for Space Study Group,* Ames Research Center, (Washington, DC: Scientific and Technical Information Office, National Aeronautics and Space Administration, 1976), 8.
[453] Clarke, *The View from Serendip*, 260.
[454] Arthur C. Clarke to Tim Greve of The Norwegian Nobel Institute, October 28, 1975, Folder 6, Box 14, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC.
[455] Ibid.

In a October 23, 1975 letter written from NASA Assistant Administrator Joseph P. Allen to Clarke, enclosed with a report on the outlook of the ATS program, Allen inscribed a handwritten note below the typescript, that read: "Dear Arthur, I surely enjoyed the chance to visit with you the other day – as always it was just too short though. Please continue your persistent efforts on finding a benevolent 'parent' for the satellite hardware we talked about. I suspect the fate of it is still far from being decided. Best regards, Joe."[456] Clarke was advocating specifically for the continuation of the ATS program, specifically that of utilizing the nearly complete ATS-7, stuck in limbo without a reusable shuttle and enough public support. In his reply, dated November 6th, 1975, Clarke responds that "I am afraid the situation on ATS-7 doesn't look very hopeful, but I will continue agitating."[457]

In Clarke's March 10th, 1976 speech "The Second Century of the Telephone" given at MIT on the one-hundred-year anniversary of Alexander Graham Bell's invention of the telephone on March 10th, 1876, he noted his disappointment. "Unfortunately, on 31 July 1976, the one-year experiment will end; ATS-6 will crawl back along the equator and return to the United States." Worse still, the "three-quarters completed ATS-7" was "sitting mothballed at the Fairchild plant," not flying because "No one could raise the ten million necessary to finish it, or hijack one of the Air Force's numerous Titan 3-C's to get it into orbit." [458] Because of this "great tragedy" as he had previously described it, "in a few months time, millions of people who have had a window opened on marvelous new worlds of culture and education will have it slammed shit in their faces again… Yet I hope that this noble experiment is just the curtain raiser to a truly global educational satellite system. Its cost would be one or two dollars per student per *year.* There could be few better investments in the future health, happiness, and peace of mankind."[459]

Likely not happenstance, the Soviet Union and India reached an agreement in 1977, the year after the ATS-6 loan expired, to coordinate their satellite systems, out of concerns that India's proposed domestic comsat – Insat – would interfere with signals from preexisting Soviet satellite systems.[460] As Walter Dougall noted, "By the early 1970s the USSR made up for its late start in applications by deploying new systems in surveillance, communications, meteorology, navigation, electronic ferreting, and varieties of space science. By any measure, the USSR never stopped racing in space."[461] Just as von Braun had expressed in his written testimony prepared for the Future Space Programs hearings, there was an ongoing space race for education taking place: "Should we now, through neglect, fail to use these new tools to improve our system of providing social services to our people, we will again forfeit our leadership. We may not be able to recover so quickly as we did from the shock of Sputnik."[462] Clarke would agree, the space race for education was on.

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[456] Joseph P. Allen to Arthur C. Clarke, October 23, 1975, Folder 6, Box 14, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC.
[457] Arthur C. Clarke to Joseph P. Allen, November 6, 1975, Folder 6, Box 14, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC.
[458] Clarke, *The View from Serendip*, 241, 259; also reprinted in Clarke, Arthur C, and American Telephone and Telegraph Company, *The Telephone's First Century -- And Beyond: Essays on the Occasion of the 100th Anniversary of Telephone Communication* (New York: Crowell, 1977).
[459] Ibid., 259.
[460] NASA, *Astronautics and Aeronautics 1976: Chronology of Science, Technology, and Policy*. NASA SP-4021. Washington DC: NASA, 1984. 4.
[461] McDougall, *The Heavens and the Earth,* 430.
[462] *Future Space Programs 1975: Report of the Subcommittee on Space Science and Applications of the Committee on Science and Technology*, 94th Cong., 1st sess., vol. 1, 1975, 38.

> "We are now in the early stages of a battle for the mind – or at least the eyes and ears – of the human race, a battle which will be fought thirty-six thousand kilometers above the equator."[463]
> "The Second Century of the Telephone," 1976

The Key to the Future?

In the late 1970s, energy for the future was a hot topic, as the decade had been marred by oil shortages, and Clarke was called upon by Rep. Al Gore to speak about the "Technological Future" in November 1977.[464] Clarke was asked "If the Congress gave you a few billion to devote to immediate increases in space exploration, what would be the most urgent thing you think ought to be done?" Clarke answered that "finding solutions to our domestic problems and problems here on Earth" is the most urgent, but he notes that "balancing immediate needs against future benefits" always presents a problem.[465] But the future benefit need not be exciting space colonization, space industries might suffice. "We must not forget our long-term priorities in space. Some satellites will create industries that we cannot imagine today."[466] This is further exemplified when he was asked to comment on the space shuttle, where he matter-of-factly states, "The Space Shuttle is the key to the future. It is the transportation system that we hope will open up space."[467]

In Clarke's 1975 Future Space Programs testimony, he laid the groundwork for how the space shuttle, satellites, and space industries would converge to open up space. In his testimony, Clarke suggested that thinking should begin on "space villages" which humanity will need "in the quite near future, for the industries and services that will undoubtedly be established in Earth orbit."[468] Near-future human spaceflight would not be the realm of explorers, but of technicians, fixing satellites and building infrastructure. "Some of the reasons why we'll need men in orbit are quite obvious. Much complex scientific equipment can only be assembled, checked, and refurbished if there are men on the spot to supervise operations."[469] Clarke is adamant that the rationale for the Space Shuttle lies in allowing humans to service orbiting satellites, creating the infrastructure needed to facilitate the creation of "space villages" with industry niches to fill. But Clarke expresses his concerns with the present state of the shuttle. "Its unfortunate that the shuttle, once touted as the DC3 of space, has now been degraded for fiscal and other reasons to the DC-1 ½. But it's the only shuttle we've got, and perhaps the only one anybody is likely to have in the 80s, so we must make the most of it… If all goes well, it should provide the final convincing demonstration of the need for men in space, not just on occasional sorties, but as full-time workers. And this, in turn, will create a demand for cheaper and better methods of space transportation, exactly as happened with aviation."[470] But Clarke's

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[463] Clarke, *The View from Serendip*, 260.
[464] *Arthur Clarke Looks at Our Technical Future*, Congressional Record, 37446; "The Distant Future Approaches Quickly" was originally delivered at the Congressional Clearinghouse's "Dialogues on America's Future" series, and was read before Congress by Hon. Albert Gore a short time thereafter.
[465] *Arthur Clarke Looks at Our Technical Future*, Congressional Record, 37447.
[466] Ibid., 37447.
[467] Ibid., 37447.
[468] *Future Space Programs 1975,* 195-196.
[469] Ibid., 195-196.
[470] Ibid., 197.

discontent with the loss of the Shuttle's reusability would lead him to question if the Space Shuttle was actually the key to future, or if a satellite alone could accomplish the same feat, for cheaper, per usual.

> "For those of you who are not familiar with this at-first-sight preposterous idea, let me summarise briefly. It follows from the concept of stationary satellites, which everyone now takes for granted. Clearly, if a satellite can remain poised forever above the same spot on the Equator, then in principle it should be possible to lower a cable from orbit to Earth, performing an Indian Rope Trick 36,000 km high. And if we can do that, we can go further. We can build an elevator system to send payloads into space without rockets, purely by electrical energy. This would totally transform the economics of spaceflight – as you will appreciate when I tell you that the cost, in energy, of carrying a man to the moon is less than ten dollars. The engineering problems are of course enormous, but extensive studies have found no fundamental flaw in the concept…"[471]
> "Space Flight – Imagination and Reality," 1982

The Fountains of Paradise

In 1976, Clarke would send Fletcher an outline for a "Space Elevator," a concept Clarke had been interested in for nearly two decades, which could be used to "replace the noisy, polluting and energy-wasteful rocket by a far more efficient electric elevator system."[472] In Fletcher's October 14th, 1976 response, he agrees that the idea "is theoretically sound and probably technically feasible" but he states that "our planners feel the idea has little practical merit and cost-effectiveness within the framework of our long-range planning."[473] Fletcher concludes that "for prospective future space programs there would clearly be a need for a revolutionary approach to geosynchronous orbit transportation. I know that your creative inventiveness and imagination will continue to support our work on this, and I want you to know that we encourage and appreciate such effort."[474] Clarke's 1979 novel *The Fountains of Paradise* would do just that, following protagonist Vannevar Morgan, an engineer who dreams of creating an "orbital tower" using a satellite in geosynchronous orbit, attached to a tether, attached to the Earth surface.[475] Clarke's real world intention can be heard through the experience of Morgan and those whom he is trying to convince of his plan:

> "Space vehicles are grossly inefficient, even though rockets have reached almost the absolute limits of performance. What is the alternative? Morgan's listeners watched incredulously as he activated the display screen. From a point of light stimulating a satellite in synchronous orbit above the equator, two lines grew on screen – one toward Earth, one toward space – representing the rigid, capsule-carrying tubes. Fusion-powered, the capsules would carry freight and passengers at thousands of kilometers per hour to and from Earth's true spaceport at the far end of the line, where deep-space vessels would load

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[471] Clarke, *1984: Spring*, 109.
[472] James C. Fletcher to Arthur C. Clarke, October 14, 1976, Arthur. C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC; Clarke traces the origins of the space elevator concept in *1984: Spring,* 210-211; the concept was first presented in the February 11th, 1966 issue of *Science* titled "Satellite Elongation into a True Sky Hook" by John D. Isaacs, Hugh Bradner, George E. Backus, and Allyn C. Vine; It was proposed initially in 1960 by Leningrad engineer, Y.N. Artsutanov in *Komsomolskaya Pravda,* 31 July, 1960; Clarke recalled the first time he mentioned the concept in a speech was in May 1967 before the American Institute of Architects, see Clarke, *Report on Planet Three,* "Technology and the Future."
[473] Fletcher to Clarke, May 14, 1976, NASA Headquarters Historical Reference Collection.
[474] Ibid.
[475] Arthur C. Clarke, *The Fountains of Paradise*. New York: Ballantine Books, 1979; Clarke recalled the similarities between his book and one that came out at roughly the same time, "A few months after my novel appeared in 1979 (*Fountains of Paradise),* Charles Sheffield quite independently came out with *The Web Between the Worlds.* There were such striking – yet inevitable-similarities," see Clarke, *Ascent to Orbit,* 183.

> and discharge and begin their epic voyages, free of the need to battle Earth's gravity and atmosphere. Man's way to the stars would be opened at last – by an elevator 50,000 kilometers high!"[476]

While Clarke was writing *The Fountains of Paradise,* he gathered an abundance of technical material and presented it at the Thirteenth Congress of the International Astronautical Federation in Munich in 1979.[477] That address, a highly technical review of space-elevator concepts, was titled "The Space Elevator: 'Thought Experiment', or Key to the Universe?" and it spoke of the concept as a new transportation system to space. "It seems fair to conclude that a small cable could certainly be established from geostationary orbit down to sea level, using materials that may be available in the near future."[478] Clarke, the advocate, was following his own advice from 1945. Give a new idea some serious, scientific thinking, produce a thorough, academic analysis, and share it with those in the position to run with it. Contemplating when this all might be accomplished, he admits, "The Space Elevator will be built about 50 years after everyone stops laughing."[479]

Commenting on issues in space relevant to the late 1970s, Clarke explains, "There are now scores of satellites in the geostationary orbit, and the problem of collision and interference - which not long ago would have seemed an absurd fantasy – is already of practical importance…"[480] With so much activity happening in space, and the numbers of satellites set to grow with the coming Shuttle, new concerns were emerging. The first such paper to explore the genuine possibility that increased activity in space and its associated excesses could yield undesirable outcomes came from Kessler and Cour-Palais in 1978. In what has become known as the "Kessler Syndrome," the worst-case scenario, could result from the destruction of a few satellites, which would expel debris in all directions travelling at thousands of miles per hour, leading to random collisions, which create more debris, wherein a tipping point is reached and an exponentially growing cascade of collisions occur, ultimately encasing the Earth in a blanket of debris and cutting off access to space.[481] In a sense, Clarke's worst nightmare.

Clarke was aware of these debates and offered possible solutions, the included yet another satellite-human symbiosis: "One way of preventing geostationary satellites colliding or drifting around the equator would be to link them together with cables… But why stop there? The next step would be to build a continuous, habitable structure, – a 'Ring City'- right around the Earth."[482] Even further, Clarke imagines that "all the legions of geostationary satellites could be attached to it, and reached for servicing by an internal circular railroad" which, he explains "would be reached, of course, by space elevators, which would take the form of several spokes linking the ring city with the equator."[483] Clarke's attempt to address the prospect of space junk are reflective of events that were happening in

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[476] Clarke, *Fountains of Paradise,* epigraph.
[477] Clarke, *Ascent to Orbit*, 183.
[478] Ibid., 189.
[479] Ibid., 193.
[480] Ibid., 193.
[481] Donald J. Kessler and Burton G Cour-Palais, "Collision Frequency of Artificial Satellites: The Creation of a Debris Belt," *Journal of Geophysical Research: Space Physics 83*, no. A6 (1978): 2637–46.
[482] Clarke, *Ascent to Orbit*, 193; Clarke notes that "A Russian engineer, G. Polyakov had the same idea almost simultaneously, and published a paper with the title 'A space necklace around the Earth.'
[483]Ibid., 193.

the late 1970s, the result of the rapidly growing number of satellites in low-Earth orbit. And with these events, the positive popular perception of satellites that had been building would begin a premature deorbit.

In October of 1977, the North American Aerospace Defense Command (NORAD), who tracks orbiting entities, identified that secret Soviet ocean radar satellite Cosmos 954 (launched September 18th, 1977) had drifted out of orbit and would likely re-enter the atmosphere sometime in April, 1978.[484] Because of the 110 pounds of enriched uranium 235 that it utilized for power, there were officials that feared it's re-entry could cause the "worst nuclear contamination since Hiroshima and Nagasaki."[485] Several months ahead of projections, Cosmos 954 crashed into the sparsely inhabited Great Slave Lake area in the Northwest Territories of Canada on January 24th, 1978, spraying "tens of millions of pepper-flake-sized radioactive particles… over a 124,000 square km crash footprint."[486] As Parks notes, it took only four days for the public to become aware of the "killer satellite," as news agencies referred to it, and "seemingly overnight, a satellite the public had never known to exist became the object of urgent searching, scrutiny, and media spectacle."[487] Author Scott Asnin would publish a 1980 sci-fi novel titled *A Cold Wind from Orion,* about a satellite with nuclear cargo deorbiting prematurely and international fears that if it were to crash in a trouble spot on Earth, a war could erupt.[488] Suddenly, Cold War fears of nuclear contamination and secret spy satellites were reinjected into the popular culture.

Not long thereafter, Skylab, NASA's 1973 space station, which had remained in orbit throughout the 70s (uninhabited from early 1974), was knocked off course by an unexpected amount of solar activity, causing Skylab to deorbit.[489] When Skylab re-entered the atmosphere, it rained debris down upon the Earth. Thankfully, it mostly struck the largely unpopulated land of western Australia on July 11th, 1979.[490] Thus, in a few years time, satellites and orbiting junk were brought loudly back into the public consciousness, and *The Fountains of Paradise,* published that year, explicitly addresses this newfound reality.

Before the citizens of this fictional future Earth were able to build their revolutionary orbital tower, they needed to resolve the mistakes of past generations, and commenced *Operation Cleanup*: "For two hundred years, satellites of all shapes and sizes, from loose nuts and bolts to entire space villages, had been accumulating in Earth orbit. All that came below the extreme elevation of the Tower, at any time, now had to be accounted for, since they created a possible hazard. Three-quarters of this material was abandoned junk, much of it long forgotten. Now it had to be located, and somehow disposed of."[491] In a further foreshadowing of the coming realities of space, most notably those related to SDI and orbiting fortresses with lasers, the method utilized in Project Cleanup is notable: "Fortunately, the old orbital forts were superbly equipped for this task. Their radars - designed to locate oncoming missiles at extreme ranges with no advance warning - could easily pinpoint the debris of the early Space Age. Then

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[484] Parks, "When Satellites Fall," 224.
[485] Ibid., 224.
[486] Ibid., 223-224.
[487] Ibid., 224.
[488] Scott Asnin, *A Cold Wind from Orion,* (New York: Del Ray, 1980).
[489] For a more complete history of Skylab, see; David Hitt, Owen K Garriott, and Joe Kerwin. *Homesteading Space: The Skylab Story*. Outward Odyssey. Lincoln: University of Nebraska Press, 2008.
[490] Hitt, Garriot, and Kerwin, *Homesteading Space,* 456.
[491] Clarke, *Fountains of Paradise,* 200.

their lasers vaporized the smaller satellites, while the larger ones were nudged into higher and harmless orbits."[492] The human relationship with satellites, and the US relationship was the USSR was changing rapidly, and Clarke was well aware and adapting in real time.

> "There is one area, however, in which the Soviet Union is clearly ahead. Photographic or TV reconnaissance is limited by cloud conditions; only radar can give all-weather coverage. And only the USSR has used radar satellites, powered by nuclear reactors, to reconnoiter the movements of ships at sea – as was embarrassingly revealed when Cosmos 954 crashed in Canada in 1978."[493]
> "War and Peace in the Space Age," 1982

The Best is Yet To Come

For the ten year anniversary of Apollo 11, Clarke wrote "The Best Is Yet to Come" for the July, 16th, 1979 issue of *Time Magazine* to mark the occasion." This brief assessment of the near future asserts that in the "era of limits," space was the means to ensure there were no limits. "For the resources of the universe that are now opening up are, by all human standards, infinite. There are no limits to growth among the stars."[494] To Clarke, ensuring that humans can just *get* to space is most important, because once you're there, among the stars, with man-made stars, there are no limits, above and below. Clarke was not one to get ahead of himself, and he maintained his short-term vision and achievable goals for the near future. "Unfortunately, there is a tragic mismatch between our present needs and our capabilities. The conquest of space will not arrive soon enough to save millions from leading starved and stunted lives… Thus it is all the more urgent that we exploit to the utmost the marvelous tools that space technology has already given us" - the satellite - which he notes "few Americans realize" had "paid for themselves many times over, both in hard cash and in human welfare."[495]

In 1975, Clarke had expressed his amazement at the pace of growth in space, stated he "simply did not expect Comsats to be realized in my lifetime… Why was this particular development so extraordinarily swift? Because a primary human need – that of communications – was involved."[496] Clarke notes that when humans find something it must have, it insists on having it, as exemplified by the fact that "All over this planet, TV antennae rear above squalid shacks."[497] Yet he candidly states that humans show less enthusiasm for things that may have even more appeal than comsats, like weather and Earth resources satellites, because "they won't bring Mohammed Ali live from Kuala Lumpur – it is not so easy to convince the skeptical taxpayer of their value."[498] Throughout Clarke's entire career, he had admittedly failed to properly express to the public the value of satellites, and he would remain in that battle for narrative space, suggesting playfully in *Time,* "there should be another UN Committee – on the Useful Pieces of

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[492] Ibid., 200.
[493] Clarke, *1984: Spring,* 47-48.
[494] Arthur Clarke, The Best is Yet to Come, in *Time,* July 16, 1979, Impact: Future (1929 to 1979). Record Number 005930, NASA Headquarters Historical Reference Collection, Washington, DC, 27.
[495] Ibid., 27.
[496] *Future Space Programs 1975,* 192.
[497] Ibid., 192.
[498] Ibid., 193.

Outer Space."[499] There would be, in the form of UNISPACE '82, and Clarke would be there. The quest for public relevance continues.

As the 1970s came to a close, the "era of limits" remained a point of contention for Clarke, but he remained steadfast, exuding confidence that the proper exploitation of satellite technology in increasing access to information and knowledge was the solution to any notion of limits. "Finally, let me say a few words about the gloom and doom brigade which has been galloping off in all directions since the famous report of the Club of Rome on the Limits of Growth. I'm sure that this controversy has been of great value, because it focused attention on vital issues. But as far as all foreseeable human activities are concerned, there aren't any limits to growth. The limits are to the rate of growth."[500] And satellites would determine that rate, and one way or another, whether through an elevator, a shuttle, or the mind, they would elevate humanity to the stars.

> "We need mass education to drag this world out of the Stone Age, and any technology – any machine – that can help to do that is to be welcomed, not feared… We must take the good with the bad."[501]
> "Electronics and Education," 1979)

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[499] Clarke, *Ascent to Orbit*, 192-193.
[500] *Arthur Clarke Looks at Our Technical Future*, Congressional Record, 37447.
[501] Clarke, *1984: Spring,* 69; Clarke's speech, "Electronics and Education," was his first as Chancellor of the University of Moratuwa and was given at its First Convocation on December 10th 1979.
[502] Photo Credit: Arthur C. Clarke Trust, *Prince Claus of the Netherlands presenting Clarke with the Marconi International Fellowship award in 1982,* Accessed May 18 2020. http://arthurcclarke.org/site/life/life-1980/; Clarke was awarded the Marconi Fellowship Award in 1982 for "a lifetime of promoting the benevolent use of advanced space technology, see Clarke, *Ascent to Orbit,* 6; Guglielmo Marconi has been regarded as "the father of long-distance radio communication" for his attempts to establish wireless technology in the late nineteenth century and is understandably the namesake for the Marconi Fellowship Award, see Calvin D. Trowbridge, *Marconi: Father of the Wireless, Grandfather of the Radio, Great-Grandfather of the Cell Phone, the Story of the Race to Control Long-Distance Wireless* (Booksurge, 2009); Along with the award, Clarke would be given $35,000 dollars, which he proposed he would use in establishing a Developing World Communications Centre, a cooperative with the Sri Lankan government and the University of Moratuwa, which he had become Chancellor (in 1984, the Sri Lankan Parliament would pass an Act that created the Arthur C. Clarke Centre for Modern Technologies), see McAleer, *Odyssey of a Visionary,* chap. 30.

Space Shuttle: 1981-1995

"Weapons of Peace": The Peacesat

"It is often impossible to say whether a satellite is military in nature or not… What matters is, again, intention… The new factor which has now entered the discussion is that of deliberately destructive space systems, i.e weapons."[503]
"War and Peace in the Space Age," 1982

"However, we are now reaching the limits of what can be done by purely robot satellites. Comsats as large as tennis courts can just be squeezed into existing launch vehicles, to unfold like glittering metal flowers when they reach space. But in another decade we shall need satellites as big as football fields – ultimately, as large as cities (indeed, some of them will be cities!). They will become possible, thanks to manned transportations systems like the space shuttle, which can carry construction crews and their equipment into orbit."[504]
"New Communications and the Developing World," 1981


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[503] *Arthur Clarke Discusses War and Peace in Space,* Congressional Record, E4309.
[504] Clarke, *1984: Spring*, 17; Address before the UNESCO Conference on the International Programme for the Development of Communications (IPDC), June 16th, 1981.
[505] NASA, *Hubble Repair Mission EVA December 5 1993*, NASA Image: STS061-87-062. Accessed November 10 2019. https://spaceflight.nasa.gov/gallery/images/shuttle/sts-61/html/sts061-87-062.html; "Astronaut F. Story Musgrave (top right center) works with a restraint device near the Hubble Space Telescope (HST) during the first of five STS-61 extravehicular activities (EVA). Astronaut Jeffrey A. Hoffman, who joined Musgrave for three of the five spacewalks, is seen at the bottom of the frame preparing to work with fuse plugs."

Long advocating for a reusable spacecraft able to ferry advanced satellites into orbit alongside their human mechanics, Clarke's imagination was validated on April 12th, 1981, when Commander John Young and pilot Robert Crippen flew NASA's Space Shuttle Columbia on a successful thirty-six orbit, two day test run.[506] Humans would finally have regular access to low-Earth orbit, thus driving down costs, and Clarke's imaginings of space commerce that begins with human satellite technicians was being realized. That year, Walter Cronkite travelled to Sri Lanka to film a feature for his new series "Walter Cronkite's Universe," titled simply "Arthur C. Clarke."[507] Cronkite begins in iconic fashion: "the famed science fiction writer, the man who conceived of the communications satellites – and therein possibly lost a billion dollars. That story and others tonight as we explore our universe."[508] Cronkite continued by referring to the "clusters of satellites in Arthur's orbit," a reference to the newly christened "Clarke's Orbit." By providing "instant worldwide communications," those satellites, Cronkite continued, have laid "the cornerstone for a new era."[509] With the election of President Ronald Reagan on November 4th, 1980 and the "pro-business" stance of his administration, space was being opened up for business, and this "new era" would be one of true global interconnectivity and the commercialization of space via satellite.[510] But with the election of Reagan, space was also being opened up for military development, and the "clusters of satellites" and their new taxi would become the centerpiece of debates about nuclear missile defense and anti-satellite weapons (ASATs) that emerged during the late Cold War. As these two developments converged in orbit, Clarke would maintain his alignment with the goals of commercial enterprise over territorial defense.[511]

A central character in these debates, Clarke would do his best to draw the distinction between public representations of satellites as pieces of weapons (ASATs) and "Weapons of Peace" (Peacesats), regularly reiterating the generally benign nature of most space technology, like satellites and shuttles, and the political decisions to weaponize them. And to Clarke, satellites were the means to achieve peace, for were satellites to become weaponized, a space arms race would follow, and not only the human future in space, but also on Earth, would be put be in great jeopardy. So Clarke sought to stop the weapons from being built in the first place. The inevitability of space travel Clarke characterized in previous decades was facing its first real challenge. As Kilgore argued, by the 1980s, Clarke was being forced to rethink many of his early, optimistic themes that predicted a future in space "as the logical consequence of scientific progress and technological innovation."[512] While the Space Age had exceeded Clarke's wildest dreams and the US and Soviet space programs had proven that technologically, humanity could expand into space, "it became evident that those gains did not guarantee that the species would explore, exploit, and colonize the space frontier."[513] Despite this trepidation, Kilgore would conclude that "Clarke remained optimistic, continuing to profess that science would bring about an almost Utopian future," and this analysis further

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[506] McAleer, *Odyssey of a Visionary,* chap. 26; for an overview on the Space Shuttle, see Malinda K. Goodrich, Alice R. Buchalter and Patrick Miller*, Toward a History of the Space Shuttle: An Annotated Bibliography. Part II: 1992–2011* (Washington, DC: NASA, 2012).
[507] Ibid., chap. 26.
[508] Ibid., chap. 26.
[509] Ibid., chap. 26.
[510] Conway, "Satellites and Security: Space in Service to Humanity," 284.
[511] Conway, "Satellites and Security: Space in Service to Humanity," 284.
[512] Kilgore, *Astrofuturism,* 126.
[513] Ibid., 126-127.

confirms that verdict, but it adds that his optimism would come with the assumption that humanity made the choice to utilize the Peacesat rather than ASAT version of the future.[514] So Clarke proceeded into the Space Shuttle period striving to maintain his optimistic messaging, advocating for the internationally shared peaceful uses of the useful pieces of outer space in service of a utopian future in space.[515] In Clarke's eyes, it would take global peace and international cooperation, facilitated by satellites, to finally rid the world of the specter of nuclear weapons that threatened the future of humanity in space in the first place. Fore if space travel were achieved, resulting from the peaceful exploitation of advanced satellites and reusable rockets, then utopia would be carried along with it, at least in Clarke's imagination.

> "Though it may be an illusion brought on by wishful thinking, it does seem that despite the horrors and miseries of the present time, there are faint signs that the worst of the world's long winter may be over. The pessimism, violence – even despair – so characteristic of the past two decades are no longer quite as fashionable as they use to be. Apocalypse may yet be canceled; let us dare to be hopeful."[516]
> *1984: Spring, a Choice of Futures,* 1984

The Apocalypse May Yet Be Cancelled

In 1985, *Omni Magazine* sent Clarke a list of 50 multiple choice questions of possible futures, and using his answers, published the "2001 Quiz," wherein the reader would select their answers and compare them to Clarke's, to determine if they were "as forward thinking as Arthur C. Clarke?" [517] Clarke's optimistic answers give an interesting view into his expectations, or at least the expectations he wanted to set, for the years beyond the 1980s. Clarke was still very much optimistic that the advent of the Shuttle would usher in the next phase of humans in space (albeit he was disappointment in the final product) - not only would humans be living in space stations and on the moon by July 20th, 2019, they would walk on Mars by 2050.[518] But there remained a caveat to achieving those goals - by 2000, "widespread cooperation, including joint ventures in space and scientific collaborations on Earth" would characterize the Soviet-American relationship.[519] Clarke would engage directly with Cosmonauts and the Soviet space program during this period, doubling as an intermediary during rising tensions with a message that it takes a global village to raise a joint mission to Mars, because a Mars mission was a human, not a national, goal, a goal threatened by nuclear weapons and arms races. In the quiz, Clarke answered "yes," that humanity would do away with nuclear

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[514] Ibid., 127.
[515] An important element in Clarke's life that is not discussed in this analysis but is worth noting when on the subject of his optimism; In 1986, after experiencing difficulty walking and balancing, Clarke was diagnosed with amyotrophic lateral sclerosis (ALS), commonly known as Lou Gehrig's disease, and was given 15 months to live. In a letter Clarke wrote to friends about the somber news: "Saw neuro-specialists who gave gloomy diagnosis. Rather depressed until I reminded myself (a) I'm not a baseball player so my career will be, if anything, assisted, (b) my two typing fingers will be the last to go, (3) a high-tech wheelchair might be fun to play with. (Stephen Hawking is now a source of much inspiration.) Started taking intensive physiotherapy in an attempt to prove the experts wrong." After his condition improved, a second opinion in 1988 would find his ailment was post-polio syndrome, and Clarke noted pleasure that he may yet see the year 2001. He would, dying at age 90 in 2008; see McAleer, *Odyssey of a Visionary,* chap. 31.
[516] Clarke, *Spring: 1984*, ix.
[517] "2001 Quiz" in *Omni Magazine,* 1985, Clarke, Arthur C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC, 40, 90-94.
[518] Ibid., 40, 92, 94.
[519] Ibid., 90-92.

arms by August 6th, 2045 (the 100th anniversary of Hiroshima), but "no" if humans would survive WWIII.[520] The final question is therefore revealing of what Clarke would have to focus on to fulfill his dreams of human colonization of the solar system: What is the most *difficult* perhaps impossible challenge facing man in the twenty first century? "Reducing or eliminating nuclear weapons" he selected.[521] The battle for narrative space during the Space Shuttle period would revolve around this challenge.

> "We are witness the rise of the Global Family – or Tribe, if you like. Its electronically linked members will be scattered across the face of the planet, and its loyalties and interests will transcend all the ancient frontiers. Those frontiers which are so conspicuously absent in the photographs from space: those frontiers which to call 'sacred' in the age of thermonuclear weapons is no longer patriotism – but blasphemy."[522]
> "Space Communications and the Global Family," 1984

End of Détente?

The Strategic Arms Limitation Talks Agreement (SALT I), signed in May 1972, had banned both the use (but consequently not R&D) of antisatellite (A-SAT) systems and any interference with national "means of verification," thus preserving the military reconnaissance satellite monopoly held by the two superpowers.[523] Throughout the 1970s, nuclear arsenals had grown at an alarming rate, with the Soviets surpassing the US nuclear stockpile in 1978 and each nation amassing some 25,000 nuclear weapons. [524] The 1970s also saw evidence of Soviet testing of satellite interceptors, and research into lasers and high-energy particle beams, a so-called "ray gun" which could destroy an ICBM or a satellite.[525] Thus "rumors about the development of so-called killer-satellites and anti-satellite weapons (ASATs) made worldwide headlines in the late 1970s."[526] NASA and the Soviet Academy of Sciences would sign the 1977 Bilateral Agreement in the Peaceful Uses of Outer Space, but rising tensions would derail efforts to reach agreement on SALT 2.[527]

As explored by Walter McDougall, the rival nations discussed banning ASATs in 1978 "but the Soviets insisted that the Shuttle was itself a potential A-SAT system in need of control, and after the invasion of Afghanistan, the talks broke down."[528] This would lead to President Reagan's March 23rd, 1983 announcement of the Strategic Defense Initiative (SDI), given the popular moniker "Star Wars" for its eliciting of imaginings of space warfare. SDI would become a major shift in US nuclear strategy, moving from deterrence to defense.[529] The détente of the Post-Apollo period seen in the ASTP would appear but a blip on the radar, and the growing scale and strength of space

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[520] Ibid., 40.
[521] Ibid., 94.
[522] Clarke, "Star Wars and Star Peace," 277; to conclude this article, Clarke quotes the final words from his 1984 speech "Space Communications and the Global Family," given during the Vatican Study Week, October 1-5, 1984, see Clarke, *How the World Was One,* chap. 36.
[523] McDougall, *The Heavens and the Earth,* 431.
[524] Westwick, "From the Club of Rome to Star Wars," 286.
[525] McDougall, *The Heavens and the Earth,* 433.
[526] Siebeneichner, "Spacelab," 261.
[527] Callahan, "Sustaining Soviet-American Collaboration, 1957-1989," 146.
[528] McDougall, *The Heavens and the Earth,* 433.
[529] Westwick, "From the Club of Rome to Star Wars," 291.

technology made halting an arms race Clarke's urgent short-term goal, and he had his work cut out for him. Nuclear weapons remained an ever-present threat, post-Apollo Cold War détente was but an aberration, and satellites became a central point of attention in the popular culture of spaceflight, shaped by a savvy President and lightsabers. In Reagan's own words: "The Strategic Defense initiative has been labeled, 'Star Wars,' but it isn't about war, it is about peace; it isn't about retaliation, its about prevention; it isn't about fear, its about hope – and in that struggle, if you will pardon my stealing a film line, 'the force is with us'."[530]

> "The science-fiction writers, and the pioneers of astronautics, have imagined human settlements on all the worlds of the Solar System – and even in space itself. They have dreamed that we will extend our commerce beyond the atmosphere, into the final frontier (to coin a phrase). And if anyone thinks that this idea is fantastic, let me remind him that half a century ago a single man in the Atlantic sky was headline news. How many thousands are up there at this very moment, dozing through the in-flight movie?"[531]
> "Space Flight – Imagination and Reality," 1982

Commercial Satellite Futurism

By the 1980s, the proliferation of satellites had ushered in an era of satellite futurism, best exemplified by this scene, described by Gene McCoy, Chief of NASA's Future Programs Office in January 1980: "It's 11pm and you have just tuned in on the late news. A satellite picture of the Earth flips onto the screen – a glorious blue orb, wreathed with lacy white clouds. The camera pans from the view on the screen of NASA's Synchronous Orbital Station to the commentator on board the station. For a moment he gazes 22,000 miles down upon his Mother Earth. Then he turns to his audience, 'Hello tonight from deep space… It looks like you people in Denver are in for more snow as a low pressure front moves into Colorado… Switching into our infrared mode, we can see that the winter wheat crop in the Midwest is in good shape. And the oil slick in the Gulf has been almost completely contained, thanks to our illuminator satellite.' The Camera pans to another screen. Glistening in black space is an enormous circular-shaped satellite, coated with reflective mylar."[532] As McCoy would explain, the scenario he painted would be possible by 2100, and the forthcoming Space Shuttle was just one step toward its realization.[533] "Where government goes, industry will follow…" he continued, "Once the Shuttle has established us in lower space, we've got to blaze the frontier into upper space. That's something industry's not going to do."[534]

As the delegate for Sri Lanka, Clarke joined representatives from over thirty nations for the UNESCO Conference on the International Programme for the Development of Communications (IPDC) in Paris on June 16th,

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[530] President Ronald Reagan remarks at National Space Club Luncheon, March 29, 1985, JGR/Presidential Remarks, [Statements, & Addresses] (03/13/1985-03/31/1985), Box 41, Ronald Reagan Presidential Library Digital Library Collections, 3; On the subject of Reagan's remarks (located in the same archival location): In a March 26 Memorandum to Ben Elliott, Director of Presidential Speechwriting, from John G. Roberts, Associate Counsel to the President, Roberts wrote: "Counsel's Office has reviewed the above-referenced draft remarks. The joke in the first paragraph on page 3 plays into the hands of those who seek to ridicule the Strategic Defense Initiative as 'Star Wars.' It was my understanding that we were trying to avoid use of that label; saying 'the force is with us' hardly helps."
[531] Clarke, *1984: Spring*, 108-109.
[532] David Bailey, "News From Outer Space? – Maybe" in *Today,* January 2, 1980, Impact: Future (1980 to 1993). Record Number 005931, NASA Headquarters Historical Reference Collection, Washington, DC.
[533] Ibid.
[534] Ibid.

1981.[535] A world suddenly interconnected via increasingly affordable satellite communications had generated a newfound debate about the free flow of information, and the UNESCO conference sought to address these concerns.[536] In Clarke's speech, "New Communications and the Developing World", he would reiterate "We are now entering an era when any conceivable type of communication or information could be available to any individual, anywhere on Earth, at any time. The only constraints are economic and political, not technical."[537] As the globalized, environmentally focused Post-Apollo period came to a close and the Space Shuttle era began, the constraints for fully exploiting the existing satellite technology were indeed economic and political, as advanced comsats like ATS-6 had proven their viability.

The massive growth in satellite infrastructure established by government R&D (ATS-6 for example) during the comsat revolution of the previous decade was driving an increase in the commercialization of space, and as Clarke would identify it, the world was now at "the beginning of the DBS – *direct-broadcast satellite* – revolution."[538] As Parks notes, "By 1981, the big three U.S. commercial television networks—ABC, CBS, and NBC—had abandoned the AT&T coaxial cable system for national TV networking in favor of satellite distribution. Everyone was up in space, enjoying the new technologies and new economies of television network satellite distribution from the geosynchronous orbit."[539] As Clarke had written in 1970, "As satellites grow larger and more complex – and our global society comes to depend upon them more heavily – the stage will very soon be reached when space-borne installation, repair and maintenance crews will be absolutely essential… When they [satellites] are designed for maintenance, and not for indefinite life, the cost of satellites will drop from Rolls-Royce to Volkswagen levels."[540] That time had come.

With the Reagan Administration's "pro-business" stance, private investment in space was being encouraged alongside government spending.[541] As Alan Steinberg argued, at the time of the first Space Shuttle launch, "the public mindset was that space was just too nebulous for the private sector; thus it belonged in government hands, despite the private sector playing an increasingly critical role, as 'the private sector cannot undertake some of the basic R&D activities, but can later provide some specified services or provide specific products'."[542] In the early 1980s, these forms of products and services began to trickle into markets. On January 17th, 1984, USA Today published an article titled "Future drivers to use satellite for finding way," which toted the military project NAVSTAR, now known as GPS.[543] A March 1984 *Science Digest* article titled "Skynet 2000. Everybody's Orbiting Databank,"

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[535] McAleer, *Odyssey of a Visionary,* chap. 26.
[536] Ibid., chap. 26.
[537] Clarke, *1984: Spring*, 18-19.
[538] Ibid., 27.
[539] Parks and Schwoch, "Introduction," *Down to Earth,* 9.
[540] Clarke, "Epilogue," *First on the Moon,* 391.
[541] Conway, "Satellites and Security: Space in Service to Humanity," 284.
[542] Steinberg, "Space Policy Responsiveness," 241.
[543] Jeff Levine, "Future Drivers to Use Satellite for Finding Way," in *USA Today,* January 17, 1984, Impact: Future (1980 to 1993), Record Number 005931, NASA Headquarters Historical Reference Collection, Washington, DC; The article noted that the "heart of the plan" to "find locations on paper maps with satellite coordinates or video screens" was found in the NAVSTAR Global Positioning System (GPS), the $3.2 billion military navigation satellite program, reported to become operational for civilian and military purposes by the US Air Force in 1987; In a letter dated November 12, 1975 from Hewlett-Packard Vice-President Bernard Oliver to Clarke, Oliver raised the issue that the proposed NAVSTAR and MARESAT satellite systems would occupy the "water hole," or the frequency band that radio astronomers use as "our gateway to contact with the mainstream of life in the

described former Skylab and Apollo engineer Charles Gould's proposed "communications network that could one day give any individual on Earth direct access to any computer bank on – or more precisely, above, the planet. The key to Gould's system is satellites."[544] The article goes on to describe how ten "data-bank satellites in geostationary orbits," using *laser* communication, would "establish an orderly global information web," continuing that it would be highly useful for the Third World, where "there is no existing communications infrastructure like telephone lines, the satellites would help fill the gap."[545] Clarke's electronic global village, being privately funded before his eyes. Clarke was not wrong to label these years "the beginning of the DBS – *direct-broadcast satellite* – revolution" for the R&D involved in projects like NASA's ATS-6 in India had opened up monetary avenues for furthering satellite and space development.[546]

In 1983, Clarke would advocate for "a telephone in every village," which he argued is "a realistic and (equally important!) desirable goal by the year 2000" – now made possible by just "a handful of satellites in stationary orbit" and "a simple, rugged handset and solar-powered transceiver plus antenna, which could be mass-produced for tens rather than hundreds of dollars."[547] To describe the impact of this satellite communications infrastructure, Clarke uses the military term 'force multipliers'. "A force multiplier is a device which increases, often by a very large factor, the effectiveness of an existing system. For example, it may take fifty old-fashioned bombs to know out a bridge. But if you give them TV guidance, you will need only one or two, though the explosive power per bomb remains exactly the same."[548] Clarke proceeds to suggest that a telephone in the village "would be one of the most effective force multipliers in history" because "unlike its military equivalent, *this* force multiplier would increase the health, wealth and happiness of mankind."[549] Underlying this rhetoric is a consistency with identifying financial rationales for space technology, raising awareness of the foundational role of the satellite in commerce, both in space and on Earth, and using military rhetoric to communicate it.

Space colonization booster and L5 Member Gerard K. O'Neill even joined the orbital gold rush, with the Geostar Satellite System, introduced with the following scenario: "It is late at night. You are walking alone down a dark city street when suddenly a shadowy figure moves toward you…. You are being mugged. Out of sight of your assailant, your fingers punch a few buttons on a calculator size device hidden in your pocket. A moment later, a police cruiser rounds the corner… You have been rescued by a guardian angel of the electronic age: a satellite named

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Galaxy." Concerned for the future of radio astronomy and the Search for Extraterrestrial Intelligence (SETI), Oliver expressed concern that satellite interference may pose a serious problem moving forward and "The thought that we, through our ignorance, may blind ourselves to such contact and condemn the human race to isolation appalls us," see Bernard M. Oliver to Arthur C. Clarke, November 12, 1975, Folder 6, Box 14, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC; In Clarke's reply on December 3rd, 1975, he stated he would try to "work in a reference in my MIT speech" and would later state that he was engaged in an "anti-satellite campaign" regarding NAVSTAR and the potential damage it may cause to SETI, see Arthur C. Clarke to Bernard M. Oliver, December 3, 1975, Folder 6, Box 14, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC.

[544] Jeffrey Kluger, "Skynet 2000: Everybody's Orbiting Data Bank," in *Science Digest,* March 1984, Impact: Future (1980 to 1993), Record Number 005931, NASA Headquarters Historical Reference Collection, Washington, DC. 48.

[545] Ibid., 48.

[546] Clarke, *1984: Spring*, 27.

[547] Ibid., 5.

[548] Ibid., 5.

[549] Clarke, *1984: Spring*, 5-6.

Geostar hovering 22,300 miles overhead."[550] The article suggested that Geostar, the "guardian angel of the electronic age," would offer subscription services, with the $450 battery-powered transceiver relying on Clarke's core postulation from 1945 - "a trio of sophisticated satellites perpetually hovering over fixed group points in geostationary orbits," able to find your "geographic coordinates anywhere in the continental United States," for 40 cents per distress signal.[551] As O'Neill notes: "We think of Geostar as very much a commercial product."[552]

> "For good or ill, the fantasies of my youth had become the international politics of my adult life. To what extent can science fiction be blamed for this tragic – perhaps ultimately fatal – state of affairs? To focus on one issue – would President Reagan even have made his famous "Star Wars" speech on 23 March 1983 if he hadn't seen so many movies? There is enough blame for everyone, starting with H.G. Wells and his Martians. Personally, I have a fairly clear conscience, because only once, in *Earthlight,* have I attempted a full-scale space battle."[553]
> *Astounding Days,* 1989

The Rise of SDI

In 1975, the L5 Society was founded to promote O'Neill's space colony ideas. As Peter Westwick argues, L5 member quelled "the doom-and-gloom talk of the 'era of limits' with their belief that technology could solve existential threats, including those posed by nuclear weapons."[554] In their search for a high tech solution for salvation, "the era of limits gave rise to the vast ambitions of SDI" and contributed to the increased militarization of space in the 1980s.[555] Galvanized by perceived threats to human survival, space-colonization groups like the L5 Society, made up of a number of a number of "exploration by warfare" science fiction writers, including Jerry Pournelle (*Footfall,* 1985), Larry Niven (*Ringworld,* 1971*),* and Robert Heinlein (*Starship Troopers,* 1959), would begin to propose that outer space and space technology become the solution to the "crisis of overpopulation, energy depletion and environmental damage, but also to the possibility of nuclear Armageddon" and "were among the groups that prepared the ground for SDI through public arguments for space-based missile defense."[556]

Following Reagan's election, a group within the L5 Society led by science-fiction author Jerry Pournelle, formed the Citizens Advisory Council on National Space Policy, drafting the 1981 report "Space: The Crucial Frontier," which declared: "Progress is possible. We do not have to accept limits to growth."[557] The report would analyze the prospects of space stations, space solar power satellites, space commerce, a moon colony, and space-

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[550] Randall Black, "The First Pocket Satellite Phone: How it can make your life safer," in *Science Digest,* March 1984, Impact: Future (1980 to 1993), Record Number 005931, NASA Headquarters Historical Reference Collection, Washington, DC, 50.
[551] Ibid., 50.
[552] Ibid., 50.
[553] Clarke, *Astounding Days*, 101.
[554] Westwick, "From the Club of Rome to Star Wars," 297.
[555] Ibid., 283.
[556] Ibid., 283, 293; Kilgore would classify Heinlein, Pournelle, and Niven as possessing an "exploration by warfare" narrative style, see Kilgore, *Astrofuturism,* 131; For literature on militarized science fiction, see Darko Suvin, "Of Starship Troopers and Refuseniks: War and Militarism in U.S. Science Fiction, Part 1," in *New Boundaries in Political Science Fiction*, (eds.) Donald M Hassler and Clyde Wilcox (Columbia: University of South Carolina Press. 2008): 115–144; Suvin would argue that Starship Troopers is the "ancestral text of U.S. science fiction militarism" and that it shaped the debate about the role of the military in society for many years, see p.123.
[557] Ibid., 292-293.

based laser defenses.[558] Robert Heinlein would later claim in 1985: "It was endless effort by a mere handful of us that got the matter to Mr. Reagan's attention and resulted in his 'Star War' speech."[559] Their intention for pushing such a space-weapon systems was to "ensure the growth of infrastructure and enable the establishment of human settlements in space" by driving significant military spending in space technology.[560] Clarke would have the same intention, to "ensure the growth of infrastructure and enable the establishment of human settlements in space," but he would advocate for *commercial* and *civilian* spending in space technology to achieve those ends.

Clarke had long understood that encouraging government R&D was proven to be the most effective strategy for furthering progress in space. And just as Clarke believed, the L5 Society portrayed that "outer space was a frontier not just to explore, but also to settle and exploit."[561] Yet Clarke would find himself at odds with the future imagined by L5, arguing that satellite-based missile defense could very well do the opposite of encourage space exploitation *and* exploitation. Rather, such systems could lead to the loss of the entire human infrastructure in space and thus the end of private development along with it. He firmly communicated that such weapons would be destabilizing, and that an increase in private, commercial development of space alongside civil (NASA) and commercial as opposed to military (US Air Force) space technologies would help avoid the prospect of "a new and deadly space race."[562] Clarke believed that were space to become an unstable battleground, it would wreak havoc on the functionality of society, as the fiber of society sits in that space: "Only through satellites can we establish a global communications system, monitor the resources of land and sea, keep watch on the weather from Pole to Pole… A highly advanced society might be able to do without aeroplanes – as indeed, ours may have to if we cannot overcome our petroleum addiction. But it could not function efficiently without communications satellites."[563]

In the 1970s, the emergent "petroleum addiction" and energy shortages had become a central issue globally, and identifying alternative means of power became important.[564] Attention thus had turned to using satellites to collect solar energy, which would benefit both Earth and prospective space colonies.[565] One L5 Society member, Herman Kahn (whom Kubrick modelled Dr. Strangelove upon due to his time as a nuclear strategist at Rand Corporation and his authorship of *On Thermonuclear War,* published in 1960) founded a futurism think tank called the Hudson Institute.[566] In 1977, Kahn and colleague William Brown, published a report for NASA titled "Long-Term

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[558] Ibid., 292-293.
[559] Ibid., 291-293; Heinlein supported this claim in a 1985 letter to Barney Oliver, SETI scientist and SDI skeptic: "In 1999 science-fiction author Norman Spinrad (1940–) made waves by claiming that his science-fiction colleague Jerry Pournelle (1933–2017) had conceived the crash program for missile defense, sold the Reagan Administration on the idea and even written Reagan's speech. Pournelle replied that he did not write the speech, but otherwise acknowledged that a group he had led, an offshoot of the L5 Society, was indeed the source of SDI," see Westwick, "From the Club of Rome to Star Wars," 286.
[560] Ibid., 295.
[561] Ibid., 296.
[562] Ibid., 287.
[563] Clarke, Arthur C., "Foreword," in *The Illustrated Encyclopedia of Space Technology: A Comprehensive History of Space Exploration*, Gatland, Kenneth William, (New York: Harmony Books, 1981).
[564] As described by Hon. Albert Gore before submitting Clarke's 1977 speech into the Congressional Record, see *Arthur Clarke Looks at Our Technical Future*, Congressional Record, 37446-37447.
[565] Westwick, "From the Club of Rome to Star Wars," 286.
[566] Ibid., 289.

Prospects for Developments in Space (a Scenario Approach)."[567] The report stated that it drew "freely" from the likes of Arthur C. Clarke and Gerard O'Neill in order to develop "various scenarios from the vantage point of a space historian in the year 2077" who then, after examining the past 100 years, "attempts to project the 'next 100 years in space'."[568]

The report focuses primarily upon the technical and economic impacts of space industrialization and exploration, mostly glossing over aspects of the militarization of space, but it does make a few notable statements that are representative of the shifting reality of space.[569] Noting it is of great importance "that over the long term space installations and satellites would be safe from military threats… While space warfare might be preferable to terrestrial warfare, it can hardly but create an atmosphere restrictive to peaceful developments in space."[570] The historian goes on to describe the "Great Space War of 2019," a one day robotic hell storm in orbit, wherein escalations between world powers led to laser-equipped satellites destroying "about 98 percent of all the military satellites and 100 percent of the orbiting military stations" being "reduced to scrap in orbit."[571] Worse still, "about half of the non-military satellites on Earth-oriented missions" were lost as well.[572] The abrupt loss of an entire space-based infrastructure of orbiting satellites as a result of antisatellite defenses was a justified fear as the Space Shuttle drew near. Consistently, Clarke's position would be that "Virtually everyone – except the two principal parties involved – agrees that antisatellite weapons will be destabilizing and will merely add, at enormous expense, to the *insecurity* of all concerned."[573]

As exemplified by these future visions, the writing was on the wall that tensions in space were beginning to ramp up yet again. Satellite defense systems, anti-satellite weapons (ASAT), and laser-beams were being closely scrutinized and as the 1980s began, "outer space became a battlefield in its own right, both in fact and popular fiction."[574] This emergent militarization was exemplified in changes with the L5 Society, who began focused on the threat posed by a population explosion and environmental destruction, before pivoting to the threat of a nuclear arms race. [575] What Reagan proposed with SDI was much aligned with the ambition of the L5 space cadets "who saw outer space as a way to make strategic weapons 'obsolete.' And this ambition, in turn, was energized by the belief, popularized by the Club of Rome, that there was an existential crisis facing humankind."[576]

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[567] William M. Brown, Herman Kahn, and Hudson Institute. *Long-Term Prospects for Developments in Space (a Scenario Approach): Final Report* (Croton-on-Hudson, NY: Hudson Institute, 1977), 1-2.
[568] Ibid., 3.
[569] Westwick, "From the Club of Rome to Star Wars," 290.
[570] Hudson Institute, *Long-Term Prospects for Developments in Space,* 99-100.
[571] Ibid., 221-224.
[572] Ibid., 223.
[573] Clarke, *1984: Spring*, 79, quoted from a letter written to Ambassador Tissa Jayakoddy on a Permanent Mission of Sri Lanka to the United Nations, Geneva, dated March 18th, 1983 (reprinted in *1984: Spring*).
[574] Siebeneichner, "Spacelab," 260.
[575] Westwick, "From the Club of Rome to Star Wars," 286.
[576] Ibid., 295.

> "The analogy may be false; perhaps there is nothing in space to attract more than the occasional scientific mission or asteroid mining consortium. And even if the Solar System is full of opportunity, it may be argued that the enormous cost of escaping from Earth will always place a severe limit on our ability to exploit extraterrestrial resources. Our great airports are already bad enough; even if we could afford it, do we really want a Space Shuttle taking off from somewhere on Earth every few minutes – and, almost as bad, booming back into the atmosphere? Well, there is an alternative – and its not antigravity, which may be impossible even in theory. It's the space elevator, or orbital tower, conceived in 1960 by the Russian engineer Yuro Artsutanov, and since re-invented at least five times."[577]
> "Space Flight – Imagination and Reality," 1982

Benevolent Taxi?

As explored by Tilmann Siebeneichner, the US and USSR found themselves in an escalating late Cold War confrontation in the late 1970s, as outer space became more central to their perceived security interests.[578] Spacelab, a modular laboratory, ultimately the major European contribution to the Space Shuttle (which together comprised the STS, or Space Transportation System) was promoted as a stepping stone to a permanent human presence in space, and "served as a symbol for peace and progress" in Europe, as well as a "tool of peace" in the US (as stated in 1982 by then US Vice President Bush).[579] As Siebeneichner finds, "Early evaluations of the usefulness of the Space Shuttle had stressed its military potential. To reassure both friend and foe that the STS was not merely a 'tool of war' the US government opted for an additional space laboratory."[580] As Logsdon had noted, Nixon's Administration had determined that the Shuttle's "ability to intercept, inspect, and determine the purpose of (as well as destroy, if necessary) unknown satellites" was vital.[581] Ultimately, military considerations would shape the Shuttle's development from the beginning, and not only the public, but the Soviets would take note.[582] When Bush welcomed the first Spacelab from Europe to the US in February of 1982, he stated, "Now man is returning to space once again, this time with all the tools for peace."[583] A 'Tool of Peace' performing science for science's sake. Nothing to see here.

Despite astrocultural representations of Spacelab as a "tool of peace," it found itself mired in associations with the military, largely because, as Siebeneichner explains, in the late 1970s, space "was increasingly perceived as a sphere of permanent crisis and confrontation."[584] Headlines that rose the alarm on "so-called killer-satellites and anti-satellite weapons (ASATs)" came to the surface, and by the early 1980s, "outer space had become a predominantly dystopian sphere, dominated by killer-satellites and laser guns."[585] Hence SDI's popular representation as "Star Wars." Furthermore, the Shuttle fell victim to representations as a vehicle of war, as exemplified by the cover of the German weekly news magazine *Der Speigel*, which depicted "the American Space

[577] Clarke, *1984: Spring* 109.
[578] Siebeneichner, "Spacelab," 260.
[579] Ibid., 274, 260.
[580] Ibid., 274.
[581] Ibid., 263.
[582] Ibid., 263.
[583] Ibid., 264.
[584] Ibid., 261.
[585] Ibid., 261.

Shuttle and the Soviet Soyuz engaged in outer space combat, with the shuttles intercepting one Russian satellite and destroying another."[586] These types of images helped relay representations "of how warfare in outer space might play out in a near future" and satellites and the Shuttle sat central to those public perceptions.[587] But not only the public began to feel the pressure from this new possible form of space warfare, as the Soviets themselves believed the Shuttle to be an anti-satellite weapon itself.[588] Clarke would focus specifically on countering these narratives.

> "This month, at UNISPACE '82, there was some confusion as to precisely what is meant by the 'militarization of space.' There are very few of men's artifacts which cannot be equally well used for peaceful or warlike purposes; what matters is the intention. It is impossible to define a class of devices and say that 'These must not be developed because they can be employed offensively."[589]
> "War and Peace in the Space Age," 1982

War and Peace in the Space Age

Highly sought after for his insights, Clarke spoke at the Second UN Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE '82) in Vienna, inaugurated on August 9th, nearly fifteen years after the first Conference in 1968. The conference convened because of "the increasing use of space - for scientific purposes, experimentation and applications - and the growth of space technology, necessitate a fresh look at possibilities, potentials and implications, including possible new legal procedures and institutions. In particular, while the first outer space Conference did a great deal to promote awareness of the immense promise of space, it is now time to proceed further and take appropriate measures for the wider and fuller utilization of space technology."[590] While the conference did not explicitly have the militarization of space as one its topics, the need to prevent a new arms race in space was noted: "The extension of an arms race into outer space is a matter of grave concern to the international community. It is detrimental to humanity as a whole and therefore should be prevented… The maintenance of peace and security in outer space is of great importance for international peace and security. The prevention of an arms race and hostilities in outer space is an essential condition for the promotion and continuation of international co-operation in the exploration and use of outer space for peaceful purposes."[591] Clarke certainly shared the values expressed by the Conference, and in his speech, he reiterated the ills of extending national borders into space, as expressed in *Prelude to Space.* "I freely admit that I've often used my imagination to do something about reality. And I'd like to give you a couple of examples that are highly relevant to this Conference. Back in 1948, in my first novel *Prelude to Space,* I coined a slogan that Id like to leave with you tonight. Here it is – 'We will take no frontiers into space.'[592]

Nearly a year before President Reagan would unleash SDI fever on the world, Clarke delivered "War and Peace in the Space Age" at the UN Committee on Disarmament on August 31st in Geneva, which he later stated to a

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[586] Ibid., 261.
[587] Siebeneichner, "Spacelab," 261.
[588] Ibid., 263.
[589] Clarke, *1984: Spring,* 45.
[590] *Report of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space*, 1982, 2, 150.
[591] Ibid., 5.
[592] Clarke, *1984: Spring*, 113.

journalist "was probably the most important thing I've ever done."[593] The Committee convened to explore the "prevention of an arms race in outer space," a reaction to the developing tensions between the two world superpowers.[594] Clarke's speech addressed the budding arms race and the implications of a "Star Wars" like vision – that of ASATs and orbital fortresses positioned to intercept enemy ICBMs – as portrayed in General Daniel O. Graham's envisioning of the "next phase of space warfare," the *High Frontier Proposal.*[595] To a war-averse Clarke, much effort was taken to counter the narratives surrounding a satellite-based arms race, reframing the issue as a human choice - between the peaceful and the military utilization of space technology. "Although this meeting is concerned with the prevention of an arms race in outer space, prevention is only one aspect of the problem… I shall also discuss the positive uses of space technology for strengthening international security."[596] To achieve this end, Clarke spoke of the fine line between the military and peaceful applications of space technology, and with the central subject matter revolving around satellite technology, he was in his element.

"Let me give an example: few things would seem more remote from military affairs than the Geodetic Satellite used to detect minute irregularities in the earth's gravitational field…. These subtle variations are of vital concern to the designers of intercontinental missiles… Thus purely scientific satellites, by greatly increasing the accuracy of warheads, can have a major impact on strategy. Yet does anyone suggest they be prohibited? Even meteorological satellites, one of the most benign of all applications of space technology, because they have already saved thousands of lives, are of obvious military importance. Similarly, communications satellites would play an absolutely vital role in military operations. Yet neither represents a direct threat to peace."[597] Clarke reiterates that, with these technologies, "it is impossible to say that one is military and the other is not. What matters is, again, intention."[598] Clarke explains that he is well aware that "all these systems – communications, meteorological, geodetic, reconnaissance, and the Shuttle itself- though they represent some degree of militarization of space are still, for the moment, defensive or even benign… The new factor which has now entered the discussion is that of deliberately destructive space systems, i.e weapons."[599] Better put, the political decision to weaponize these systems.

The entrance of such weapons was deeply troubling to Clarke, and also absurd and irrational. "More confusion has now been created by the American Space Shuttle, which has been heavily criticized in the Soviet Union. It is perfectly true that many of the Shuttle's missions will be military, yet it is as potentially neutral as any

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[593] McAleer, *Odyssey of a Visionary,* chap. 27.
[594] *Report of the Committee on Disarmament*, General Assembly, Official Records: 37th sess., Supplement No. 27 (A/37/27), October 6, 1982, New York: United Nations, 9.
[595] "War and Peace in the Space Age" was placed into the Congressional Record by Rep. George E. Brown of California on September 21, 1982 and is where the quotations were derived, see *Arthur Clarke Discusses War and Peace in Space, Congressional Record.* 97th Cong., 2nd sess., 1982. Vol. 128, No. 126: E4307-E4309; the speech was also reprinted in *1984: Spring;* Clarke would describe *The High Frontier* as follows: "After excoriating the doctrine of Mutually Assured Destruction (MAD) as immoral and militarily bankrupt, it makes a valiant attempt to develop a *defensive, non-nuclear* strategy to counter the threat of Russian ICBMs. This envisages the installation of complex weapons systems in space, beginning with unmanned satellites carrying interceptor vehicles, and leading ultimately to manned battle stations, possible armed with laser beams," see Clarke, *1984: Spring*, 72-73.
[596] *Arthur Clarke Discusses War and Peace in Space,* Congressional Record 97th Cong., E4308.
[597] Clarke, *1984: Spring,* 45-46.
[598] *Arthur Clarke Discusses War and Peace in Space,* Congressional Record 97th Cong., E4308.
[599] Ibid., E4308-E4309.

other vehicle. The one new factor the Shuttle does introduce is that, for the first time, it give space-faring power the ability to examine and perhaps to retrieve, satellites belonging to somebody else, thus opening up prospects of 'space piracy' – as the Soviet Union puts it."[600] It is absurd, Clarke retorts, that this has any validity. "If you do not want anyone to capture your satellite, it is absurdly simple to boobytrap it and thus destroy, with very little trouble, an extremely expensive rival space system."[601] Clarke would describe in subsequent speeches that "a bucket of nails" could destroy any such system.[602] And the initial destruction would only be the beginning of the problems.

Furthermore, Clarke describes the decades old tests of US anti-satellite systems using exploded nuclear warheads in the atmosphere, the project quickly abandoned when it was discovered "that a few nuclear blasts in space could knock out all satellites, simply by the intensity of the radiation pulse… This fact hovers ominously over all discussions of space weapons systems. A desperate country could blind and cripple all its enemy's satellites – as well as everyone else's – by a few large nuclear explosions above the atmosphere."[603] But the age-old cycle continues, and in response to US testing, "the Soviet Union has made more than 20 tests of a non-nuclear anti-satellite destroyer, or ASAT, which hovers near its victim and explodes in a shower of fragments. In June 1982, it tested this satellite system for the first time in conjunction with large scale ballistic missile launched from silos and submarines."[604] Now, Clarke argues, "the United States has not been indifferent to this Russian lead. President Reagan has now announced the development of an ASAT system much more advanced than the Soviet satellite-killers; indeed, it introduces a new dimension into space warfare."[605] Reagan would officially articulate this project to the public as SDI the next year.

Clarke reiterated how "the seeds of a space arms race were planted a quarter of a century ago," the result of the "missile gap," an imagined US deficit in nuclear weapons that became a rallying cry in the Kennedy-Nixon campaign to overcome the Soviet lead.[606] As Clarke relays, "That missile gap was a total illusion – destroyed when American reconnaissance satellites revealed the true extent of Soviet rocket deployment… In any event, the Soviet Union decided it must produce the missiles which, at that time, existed only in the imagination of the Americans."[607] Now, a similar showing of tit for tat was underway, because "If a thing is theoretically possible, and someone needs it badly enough, it will be achieved eventually, whatever the cost. And when one side develops a new system, the

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[600] Ibid., E4308.
[601] *Arthur Clarke Discusses War and Peace in Space,* Congressional Record 97th Cong., E4308.
[602] For the origins of Clarke's "bucket of nails" argument; Clarke gave the speech "Where is Mankind Headed?" on May 25 1983 for the Reader's Digest Worldwide Editorial Conference. In the conference's summary "Memories of Monaco," Clarke's speech was described as follows: "After dinner, Arthur Clarke, the noted British science-fiction writer, spoke on 'The Militarization of Space.' To put nuclear war into perspective, he quoted a chilling statement from Carl Sagan: 'A full-scale thermonuclear exchange would be the equivalent of World War II, once a second, for the length of a lazy summer afternoon.' Clarke went on to demonstrate that there's no security in technology, concluding that the only defense is to prevent weapons from being used. Thus, the problem is political, not military. At one point, he described how a sophisticated, multi-billion-dollar laser weapon system could be destroyed by a bucket of nails," see "Memories of Monaco from Reader's Digest Worldwide Editorial Conference," May 21-28, 1983, Folder 4, Box 144, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC, 14-15.
[603] *Arthur Clarke Discusses War and Peace in Space,* Congressional Record 97th Cong., E4309.
[604] Ibid., E4309.
[605] Ibid., E4309.
[606] Ibid., E4308.
[607] Ibid., E4308.

other will try to outdo it. The two superpowers are both led by intelligent and responsible men, yet they sometimes appear like small boys standing in a pool of gasoline – each trying to acquire more matches than the other, when a single one is more than sufficient."[608]

> "We have already met Darth Vader – and he is us. If we are to survive, we must exorcize the demons of haunted childhood, and grow out of our fascination with 'technoporn' – gleaming weaponry and beautiful explosions. Whatever new armaments may be needed to preserve peace in the immediate future, in the long run only political solutions can save us."[609]
> "Videotaped address before the MIT Club of Washington," 1985

Star Wars

On March 23rd, 1983, President Reagan proposed the creation of a large scale military space-weapon system utilizing defense platforms and ASATs.[610] As Reagan explained it: "Let me share with you a vision of the future which offers hope. It is that we embark on a program to counter the awesome Soviet missile threat with measures that are defensive. Let us turn to the very strengths of society that spawned our great industrial base and that have given us the quality of life we enjoy today."[611] Calling upon "the scientific community who gave us the nuclear weapons to turn their great talents to the cause of mankind and world peace: to give us the means of rendering these nuclear weapons impotent and obsolete."[612] Reagan sought to capture the talents of the many weapons engineers of the United States through the creation of *defensive,* not *offensive* weapons. Because offensive weapons systems "can be viewed as fostering an aggressive politic and no one wants that."[613] And many would agree he was right on that.

This vision of developing defensive weapons to stop nuclear missiles weapons attacks would create a swell of anxiety in Washington, and fearing an impending arms race, the US Senate Committee on Foreign Relations convened the first of two hearings on "Controlling Space Weapons" on Thursday, April 14th, 1983, just weeks after the Star Wars speech. While noting that Reagan's rationale "of moving away from deterrence toward a policy that would end the tyrant of nuclear war" is admirable, the Committee's report expresses deep concerns that the US was descending into "a space weapons race before fully assessing whether such a race is in our interest, or whether a space arms race can be avoided."[614] The report continues "that a space weapons race could have grave consequences and we must not engage it lightly… a move toward space arms represents the most revolutionary shift in strategy since the advent of nuclear weapons."[615] Not only would it be very expensive, but "Given our Nation's dependence on space systems for keeping the peace, space weapons would compromise many valuable US military assets in space."[616] It appears Congress was well aware of US dependence upon satellite technology in nearly every

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[608] Ibid., E4309.
[609] Clarke, *Astounding Days*, 105.
[610] Westwick, "From the Club of Rome to Star Wars," 283.
[611] *Controlling Space Weapons: Hearing before the Committee on Foreign Relations.* Senate. 98th Cong., 1st sess., 1983, 10; the report included excepts from President Reagan's March 23, 1982 "Star Wars" speech.
[612] Ibid., 10.
[613] Ibid., 10.
[614] Ibid., 2.
[615] Ibid., 2.
[616] Ibid., 2.

facet of national functionality: "Besides applications in the military field, satellites are playing important roles in science and in commerce. Space systems are assisting our search for new sources of energy and meteorlogical satellites have aided farm production. Communication satellite not only provide rapid assess to our troops abroad, but they help our business leaders to conduct financial transactions."[617] Just as Clarke relayed in his speech "War and Peace in the Space Age," there is a fine line between military and peaceful usage of satellite technology, and a space arms race threatened all of it. "Once started," the report concludes, "the momentum of a space weapons race will be strong and verification problems could make space arms control agreements extremely difficult, if not impossible to achieve."[618] The hearing yielded two resolutions: S. Res. 43 "Expressing the sense of the Senate that the President of the United States invite the Soviet Union to negotiate a verifiable ban on antisatellite weapons as a first step toward prohibiting all space-based and space-directed weapons; and S.J. Res. 28 "A joint resolution calling for an immediate negotiation for a ban on weapons of any kind in space."[619] Clarke's UN speech "War and Peace in the Space Age" is attached in the appendix, a nod to the influence it had upon the debate, followed by General Graham's "The High Frontier Proposal" which Clarke referenced in his speech.[620]

The *High Frontier Proposal* was completed by The Center for Defense Information, wherein it performed an analysis of "Space-based defense against ballistic missiles."[621] In its conclusions, it finds that a Global Ballistic Missile Defense (GBMD) "will not enhance our national security or secure space for peaceful purposes. Space is not an arena into which man can transfer his vices and ignore the consequences on Earth."[622] Further, if "the arena of initial engagement in a nuclear war" were moved from the earth's surface to space, "Peaceful developments in space will then be more costly and risky. Satellites which serve positive functions such as arms control verification will be jeopardized. Weapons in space will not make space secure – space without weaponry is both possible and far more secure."[623] The result of such weapons, the report outlines, could trap humanity "inside a belt of orbiting garbage" and would "increase the chances of accidental war."[624] Ultimately, it offers a harsh rebuke. "Future generations will suffer unless we act now, before the opportunity evaporates."[625]

> "I apologize for the commercial, but the point I wish to make is that this is the sort of future we should aim for. Exciting fantasies like Star Wars are all very well – I enjoy them as much as anyone, but with a certain feeling of guilt. This Conference may represent mankind's last chance to decide which of the two possible futures in space lies ahead of us. And incidentally, the current success of Steven Spielberg's E.T… the biggest hit in the entire history of movies – may reveal the desire of the American public for peaceful confrontations in space…"[626]
> "Space Flight – Imagination and Reality," 1982

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[617] Ibid., 1.
[618] Ibid., 3.
[619] Ibid., Cover.
[620] See *Controlling Space Weapons,* Appendix, "War and Peace in the Space Age," 167-171; *High Frontier Proposal: A CDI Critique*, 171-173.
[621] Ibid., 171.
[622] Ibid., 173.
[623] Ibid., 172-173.
[624] Ibid., 173.
[625] Ibid., 173.
[626] Clarke, *1984: Spring*, 111.

Heinlein vs. Clarke

In December 1984, Clarke found himself in California for the premiere of the movie adaptation of *2010: Odyssey Two,* titled *2010: The Year We Make Contact* (directed by Peter Hymans, not Kubrick).[627] It was during this trip that Clarke was invited to a December 8th gathering at science fiction author and L5 member Larry Niven's home. Some fifty prominent individuals were present, including Pournelle, Heinlein, the architect of the *High Frontier Proposal* Gen. Graham, and a number of scientists, professors, military officials, and space enthusiasts.[628] The group was largely conservative, and most were members of the Citizens Advisory Council on National Space Policy – the group that shaped portions of Reagan's Star Wars speech and were proponents for a defensive posture in space.[629] By this point, Clarke's "War and Peace in the Space Age" had been reprinted and published in his collection of essays and speeches *1984: Spring* (a title meant to turn the image of a 1984 dystopia on its head), and most of the group had read it. Clarke's presence ended up sparking a heated debate about his recent portrayals of the program they so strongly believe in, SDI. The core of the group's disproval lay in the way Clarke had represented Graham's *High Frontier* study as "a horrifying description of the next phase of space warfare," but also how he described the ease of destroying SDI fortresses with "a bucket of nails," even questioning Clarke's understanding of orbital mechanics.[630] Pournelle would later recall that "Arthur had no defense. He asked several questions, and at the end of it he admitted, 'I clearly was wrong'."[631] Clarke later admits that the ordeal led to him having "a more open mind [now] about the bucket of nails concept," but he maintained his resolve that "even if these systems can work—and I think the reflecting mirrors and the laser stuff is utter nonsense for decades at any rate—they may be a bad idea because of their destabilizing influence."[632]

After the meeting concluded and lunch was being served, an argument broke out between Clarke and Heinlein - who had remained silent through the morning debates.[633] Those who witnessed the outburst recalled feelings of surprise, and discomfort, at the confrontation's public nature and Heinlein's intensity.[634] Heinlein attacked Clarke for his "British arrogance," arguing that the SDI was a matter of United States defense, and that Clarke's meddling in Congressional affairs was undermining American national interests.[635] When Clarke responded that his efforts were aimed at the larger moral issue, Heinlein supposedly erupted, claiming that because Clarke had no stake as a noncitizen, he should not get himself involved in American affairs. As science fiction writer Gregory Benson recalled about the event, "I mean that's what Starship Troopers is all about. You don't get to vote unless you fight. And similarly, you don't get an opinion unless your skin is personally risked."[636] The event really shook Clarke, and unfortunately, the longtime friends would not see each other again, as Heinlein would die several months later,

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[627] Clarke, *Ascent to Orbit,* 225.
[628] McAleer, *Odyssey of a Visionary,* chap. 27.
[629] Ibid., chap. 27.
[630] Ibid., chap. 27.
[631] Ibid., chap. 27.
[632] Ibid., chap. 27.
[633] Ibid., chap. 27.
[634] As recalled by Pournelle, G. Harry Stine, Gregory Benford, and Clarke; see McAleer, *Odyssey of a Visionary,* chap. 27.
[635] McAleer, *Odyssey of a Visionary,* chap. 27.
[636] Ibid., chap. 27.

although they did manage to reconcile.[637] From this point forward, Clarke's aggressive public stance on SDI was greatly dampened, as he explained afterward, "I'm prepared to admit that there are certain aspects of SDI that made sense and, in fact, that may still do so. What I was attacking was the utter nonsense about putting an umbrella over the United States. That was the version I was attacking. You couldn't even put an umbrella over a missile site. You could put a leaky roof over it, which might be worth doing."[638]

> "This is not the place to discuss the pros and cons of SDI; I will merely comment that it comes in at least as many varieties as a well-known condiment. Some make a good deal of sense, but others – especially the much ballyhooed but now discreetly buried vision of an 'umbrella over the United States' – were pure fantasy. (Not, as some critics said, science fiction. In that case they would have been worth taking seriously)."[639]
> *How the World Was One,* 1992

A Martian Odyssey

Clarke would express his concern that the moniker "Star Wars" had distorted the public's opinion of SDI toward one of space warfare.[640] Star Wars was dominating the satellite narrative space, and one of Clarke's counter moves was to shift the focus away from ASATs, and back to the age-old dream of colonizing Mars, and the satellite would come along for the ride, of course. Clarke cancelled a scheduled hearing before the US Senate Foreign Relations Committee set to take place in September 1984 (he would send a videotape in his stead) to accept an invitation to attend the Pontifical Academy of Science Study Week on "The Impact of Space Exploration on Mankind" at the Vatican.[641] The invitation included an audience between the Godfather and *the* Father - Pope John Paul II, whom Clarke gifted a signed copy of his new scientific autobiography, *Ascent to Orbit* "to add to his already rather well-stocked library."[642] Although he had to cancel his appearance before the US Senate Foreign Relations Committee hearing to chat comsats with the Pope, Clarke sent in a 15-minute videotape titled "A Martian Odyssey" which was played before the Committee on September 17th, 1984. The videotape is a good representation of how much relations between the US and USSR had deteriorated since the ASTP in 1975, and how important Clarke saw their partnership in making progress toward establishing space for future generations. The tape takes a strong position in encouraging the superpowers to reverse course from the growing ASAT arms race, which he refers to as "technological obscenities," toward cooperative space missions, or "technological decency," offering a harsh rebuke of SDI's potential to succeed.[643]

Ultimately, Clarke's goal is to advocate for a joint US-USSR mission to Mars, as a means of harnessing the collective energy of each nation toward something much more noble than weapons. "The cost of a manned Mars mission, hopefully a joint venture between the United States and Russia, would be less than just the research into

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[637] Ibid., chap. 27.
[638] Ibid., chap. 27.
[639] Clarke, *How the World Was One,* chap. 40.
[640] Clarke, "Star Wars and Star Peace," 274.
[641] The Impact of Space Exploration on Mankind at Vatican Study Week, October 1-5, 1984, Folder 2, Box 145, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC, 7-9.
[642] Clarke, *How the World Was One,* chap. 36.
[643] McAleer, *Odyssey of a Visionary,* chap. 29.

anti—ICBM systems."[644] Not only would it be economical, but it would be a step toward peace, and perhaps most notably, it would be a mechanism for arousing excitement for space that Clarke sensed was waning as a result of the unrealistic, fantasy-like science fiction emerging at the time. "Though unmanned space missions are essential and often highly cost-effective, they do not fire the imagination. And contrary to what some scientists may have told you, in the long run it is the *manned* missions that will be the most important."[645] Despite the success of robotic space exploration and satellite exploitation through all these years, Clarke was acknowledging that they just don't do enough to engage the level of interest that would be necessary to actually colonize the solar system. "I am not so naive as to imagine that this could be achieved without excruciating difficulty, and major changes in the present political climate. But those changes have to be made, sooner or later, and I commend your Committee for its courage in recognizing this fact."[646] Before his video concludes, which would be followed by an in-person presentation on US-USSR collaboration from Gen. Thomas Stafford, the US Commander of the ASTP, Clarke relays a short-term, achievable goal, that would (partly) be realized. "So is it absurdly optimistic to hope that, by Columbus Day 1992, the United States and the Soviet union will have emerged from their long winter of sterile confrontation? That would be none too soon to start talking seriously about Mankind's next, and greatest adventure."[647]

This brief videotape summarizing Clarke's emerging views on the state of space in the 1980s had an immediate effect. Senator Spark M. Matsunaga, a longtime proponent for expansion into space and the cooling of Cold War tensions, was the Congressman who first introduced S.J.Res. 236 – "A joint resolution relating to cooperative East-West ventures in space as an alternative to a space arms race" – on February 9th, 1984, just weeks after Reagan announced his space station initiative.[648] This resolution would become Public Law 98-562, signed by Reagan on October 30th, 1984 – in effect renewing the 1977 Bilateral Agreement on the Peaceful Sharing of Outer Space and pushing the possible future of a collaborative, global space program one step closer.[649] In an interview with USA Today on December 7th, 1984, Matsunaga gave specific credit to Clarke's videotape speech as a catalyst to Reagan's signing, stating "in fact, an address by Clarke to the Senate Foreign Relations Committee helped persuade President Reagan in October to sign a resolution on cooperative East-West ventures in space."[650]

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[644] Ibid., chap. 29.
[645] Spark M. Matsunaga, *The Mars Project: Journeys Beyond the Cold War* (New York: Hill and Wang, 1986), xviii.
[646] McAleer, *Odyssey of a Visionary,* chap. 29.
[647] Matsunaga, *The Mars Project*, xviii.
[648] U.S. Congress, House, A Joint Resolution Relating to Cooperative East-West Ventures in Space as an Alternative to a Space Arms Race., S.J.Res 236, 98th Cong., 2nd sess., introduced in House February 9, 1984, https://www.congress.gov/bill/98th-congress/senate-joint-resolution/236/summary/00.
[649] Callahan, "Sustaining Soviet-American Collaboration, 1957-1989," 147.
[650] Mei-Mei Chan, "Arthur C. Clarke Orbits the Future: The writer's far-out ideas about space intrigue, NASA, and Hollywood," in *USA Today,* December 7, 1984, Clarke, Arthur C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC.

Clarke's First Law: When a distinguished but elderly scientist states that something is possible, he is almost certainly right. When he states that something is impossible he is very probably wrong.

Clarke's Second Law: The only way to discover the limits of the possible is to go beyond them into the impossible.

Clarke's Third Law: Any sufficiently advanced technology is indistinguishable from magic.[651] ("Technology and the Future," 1967)

To Build or Not to Build

Reagan won re-election and in his January 25th, 1985 State of the Union address, he proclaimed he was "directing NASA to develop a permanently manned space station and to do it within a decade" – the Space Station "Freedom."[652] More notably, and a clear sign of his "pro-business" intent, he continues, "Just as the oceans opened up a new world for clipper ships and Yankee traders, space holds enormous potential for commerce today."[653] Several months later, Reagan referenced Clarke's "Three Laws" in a March 29th, 1985 speech before the National Space Club in a defense of SDI: "Arthur C. Clarke, distinguished author of science and fiction, says ideas often have three stages of reaction: first, its crazy, don't waste my time; second, its possible, but its not worth doing; and finally, I always said it was a good idea."[654]

In a 1986 interview with *Playboy*, Clarke was asked directly how he felt about Reagan quoting him at the National Space Club speech. Clarke answered, "Yeah, he invoked what I call Clarke's Second Law [The only way to discover the limits of the possible is to go beyond them into the impossible], which basically says one should protect oneself. I wish he'd invoked what I call Clarke's First Law… 'When a distinguished and elderly scientist says that something is possible, he's almost certainly correct; when he says something is impossible, he's probably very wrong.' And that's something thats been thrown back at me ever since I criticized Reagan's Star Wars concept to begin with."[655] In essence, Clarke is admitting that despite SDI's flaws, it *is* possible, and thus warrants attention.

The interviewer mentions "your most famous criticism of it [SDI] was a harsh video tape you presented to a US Senate Subcommittee hearing, at its invitations, shortly after Reagan announced SDI."[656] After trying to deflect, the interviewer convinces Clarke to explain his change in position, asking "Are you retreating from the charges you

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[651] Clarke, *Astounding Days,* 207; In Clarke's May 1967 speech before the American Institute of Architects "Technology and the Future," he offers his three laws for as a means of examining possible futures. Regarding the Third Law: "This last law perhaps needs a little more explanation. Imagine what Thomas Edison would think of solid-state electronics, computers, transistorized radios, lasers, or A-bombs. They would be incomprehensible to him – pure magic. In the same way, the really exciting developments of the future are precisely those we can't imagine – so everything I'll tell you is very conservative," see Clarke, *Report on Planet Three,* 138.
[652] NASA, *Astronautics and Aeronautics, 1979-1984: Chronology of Science, Technology, and Policy,* NASA SP-4024 (Washington DC: NASA, 1988), 460; Space Station Freedom was never constructed but did evolve into the ISS, see Howard E. McCurdy, *The Space Station Decision: Incremental Politics and Technological Choice* (Baltimore: Johns Hopkins University Press, 1990).
[653] Ibid., 460.
[654] Reagan remarks at National Space Club March 29 1985, Ronald Reagan Presidential Library, 34.
[655] Arthur Clarke, *Playboy* Interview July 1986: "Arthur C. Clarke: A candid conversation about the future of space travel—and about sex, immortality and 2001—with the witty dean of science-fiction writers," Clarke, Arthur. C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC, 58.
[656] Ibid., 58.

made in your Senate video tape – that the program is a fantastically expensive and unworkable scheme?"[657] Clarke maintains that much of SDI is untenable, further expressing fear that most of people saying "we can do these things" don't grasp the implications.[658] But Clarke admits, "I guess I've changed my attitude quite a bit, yes. I think in the long run, what Reagan did, announcing the SDI, may turn out to be very beneficial just in terms of focusing attention on the practicality of it… I just think Reagan's Star Wars may turn out to be a stroke of political genius, even if his motivations and political conclusions are quite wrong."[659] Ultimately, Clarke agrees with Secretary of Defense Caspar Weinberger's theory that the Soviets were pushing so hard for an end to SDI because their technological deficit was too great.[660] "I think one of the reasons the Russians are so scared of it is that if the Americans do it, the Russians will very rapidly spend a lot of money to get far ahead, spending a lot of money they don't really have; because their economy is in such trouble. There again, it's the big-bluff area."[661] Clarke was admitting that bluffing an arms race may actually have been a decent idea, although far from ideal.

In September 1985, Soviet Foreign Minister Shevardnadze, speaking before the UN, proposed "To counter the sinister plans of 'Star War,' the USSR is putting before the international community a concept of 'Star Peace', an effort, they argued, that would prevent the militarization of outer space through peaceful cooperative space exploration missions with crews of mixed nationalities, providing the third world with the fruit of space technology, and cultural exchanges of scientists and citizens.[662] Shevardnadze does reiterate that 'Star Peace' would only be possible if the US abandons 'Star Wars,' stressing that the Soviet Union would feel threatened if the US succeeded in its satellite missile defense system.[663] The culmination of Matsunaga's bill, now law, calling for East-West cooperation in space for peaceful purposes, resulted in the high profile Geneva Summit between Reagan and Gorbachev on November 19th and 20th of 1985, wherein the two superpowers agreed to authorize "exchange not only in education and the arts but also in medicine, the professions, sports, and television, and included a mandate "to find as yet undiscovered avenues where American and Soviet citizens can cooperate fruitfully for the benefit of mankind."[664] Clarke would jump on this idea, framing the educational exchange program as "hostages of peace" who could provide "far cheaper, and more effective security that any Strategic Defense Initiative."[665]

Charismatic Mikhail Gorbachev became General Secretary of the Communist Party on March 10th, 1985, and US-USSR arms negotiations reconvened two days later in Geneva.[666] At this time, "the Kremlin launched a major initiative to portray itself as the fount of peace, while accusing the United States of an aggressive quest for military

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[657] Ibid., 58.
[658] Ibid., 58.
[659] Ibid., 58.
[660] Ibid.,58; For a closer look at the end years of SDI strategy, see Frances FitzGerald, *Way Out There in the Blue: Reagan, Star Wars, and the End of the Cold War* (New York: Simon & Schuster, 2000).
[661] Ibid., 58.
[662] Cull, Nicholas John Cull, *The Cold War and the United States Information Agency*: *American Propaganda and Public Diplomacy, 1945-1989,* (Cambridge: Cambridge University Press, 2008): 444; For an analysis that focuses more upon why the Soviets reacted so strongly to SDI, see Peter J. Westwick, "'Space-Strike Weapons' and the Soviet Response to SDI," *Diplomatic History* 32.5 (November 2008): 955–79.
[663] Cull, *The Cold War and the United States Information Agency*, 444.
[664] Ibid., 447.
[665] Arthur C. Clarke, "Shaping Peace," *Space Policy 2*, no. 2 (1986): 91-92.
[666] Cull, *The Cold War and the United States Information Agency,* 444.

superiority. Gorbachev stole the headlines by announcing a unilateral moratorium on the deployment of medium-range missiles in Europe until November. He called on the United States to reciprocate and end space-based weapons research." [667] Furthermore, Gorbachev conducted an interview with *Time* Magazine blaming US fixation on "Star Wars" as a cause of increased deterioration of their relationship.[668] Perhaps the aggressive posture was working.

After the summit, Gorbachev would give a speech in January of 1986, continuing his expression of hope that nuclear weapons would be reduced, and the Soviet Embassy in Sri Lanka asked Clarke to comment. His response can be found in the article "Shaping Peace."[669] Clarke begins by first reiterating his desire for joint US-USSR missions and his point that one must be aware of the fine line between the military and peaceful uses of space technology, specifically in the context of reconnaissance and Peacesats: "Although I also share Secretary Gorbachev's hope that the arms race will not be extended into space, it is very important to define what we are talking about here. Paradoxically, the existing military space reconnaissance systems are *benevolent* and have helped to keep the peace for the past two decades. To endanger them would threaten global security."[670] Clarke also notes that Gorbachev wants to ban "space strike weapons" and that Reagan's defensive strategy means that the President is "clearly opposed to 'space strike weapons'!"[671] But Clarke is tired of discussing the machines, "let us not waste time arguing over military hardware when the real problem is human software."[672] For Clarke, the change in his position on SDI can be drawn to his belief that the "only long-term solutions are political – banning the weapons – in the short run, there may be a case for developing, experimenting with and perhaps even deploying some systems." [673] It seems Clarke was finding himself in greater alignment with the L5 Society's aim to encourage military development to further infrastructure in space. Although for Clarke, it was more *accept* it than *encourage* it.

It would take diplomacy, political pressure, intentional research and investment, and perhaps a bluff of sorts, to get the Russians to the negotiating table, and it appeared to be working. When asked to officially nail down his position on SDI in his *Playboy* interview, Clarke responded, "People who do know all the facts should study them dispassionately. I'd call for some benign neglect and a little less religious fervor. That process includes educating the President. There's no human being who can possibly know all the things a President has to know. People make fun of Reagan, but I have a great admiration for him… I think its very appropriate that a movie star should become President of the United States – and I'm *not* joking."[674] Statecraft is a complex contest, no doubt.

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[667] Ibid., 444.
[668] Ibid., 444.
[669] Clarke, "Shaping Peace," 91.
[670] Ibid., 91.
[671] Ibid., 91.
[672] Ibid., 91.
[673] Clarke, *Playboy* Interview July 1986, NASA Headquarters Historical Reference Collection, 58.
[674] Ibid., 59.


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> "For many years I have been interested in the peace-keeping potential of satellites, having been first alerted to this possibility by Howard Kurtz, founder and President of War Control Planners… Although I frequently mentioned the idea in lectures and essays, it took the Strategic Defense Initiative (a.k.a., to George Lucas's annoyance, as 'Star Wars') to start me promoting it seriously."[676]
> *How the World Was One,* 1992

The War Control Planners: A Peacesat Origin Story

On World Communications Day, May 17th, 1983, Rep. Brown of California submitted to the Congressional Record a note: "40 years ago, Arthur C. Clarke stretched our imaginations with a description of how communication satellites might someday be used to make the world a 'global village.' That vision of the future is now becoming a reality – or at least can become a reality if we so choose."[677] Speaking directly to questions that emerged in the early 1980s, Brown asks, "Do we want to extend the arms race into space? What are the proper roles for the public and private sectors in the commercialization of space? Into what sort of international cooperative agreements should the United States enter in telecommunications?"[678] Noting a desire to "remind all of us of the nobler and more humane possibilities for the use of space," Brown submits an alternative "to the 'space wars' vision of President Reagan" in the form of an article produced by Howard and Harriet Kurtz, the longtime champions for the ideas that would

675 Photo Credit: Arthur C. Clarke Trust, *Clarke addressing the UN General Assembly for World Communications Day 1983,* Accessed May 19 2020. http://arthurcclarke.org/site/life/life-1980/.
676 Clarke, *How the World Was One,* chap. 40.
677 *May 17: World Communications Day,* 98th Cong., 1st sess., 1983. Vol. 129, pt. 10, 12666.
678 Ibid., 12666.

become the French UN Initiative that Clarke would represent as Peacesats. In Clarke's word, the initiative "considers the potential benefits to mankind if *all* nations had access to the orbital reconnaissance information now available only to the United States and the Soviet Union."[679]

Howard Kurtz, a former Lt. Col. in the US Air Force, proposed a 'War Control Plan' in the late 1960s, which would use reconnaissance satellites to spot evidence of aggression and confirm arms agreement compliance.[680] Their goal was to encourage President Lyndon B. Johnson to create a new reconnaissance satellite program to be used by all nations.[681] In the 1970s, Howard and Harriet, a minister for the United Church of Christ, proposed the "Global Information Cooperative" to create a pool of data, from earth resource, weather, and search and rescue satellites available to all nations.[682] In an article in *Spectrum* (IEEE) in December, 1973, Kurtz wrote that "The American people through their government could announce to the world a large scale, long-range sustained commitment to build a giant open-to-the-public Global Information Cooperative… linked to a greatly expanded ten year series of earth-orbiting, intelligence-gathering satellites and other global information-gathering sources."[683] As Kurtz was later quoted as saying, "Just having satellites or intelligence wont do anything… you won't have all the other things – arms control, peace – until you have satellites."[684]

It was in the late 1970s, that UN Deputy Secretary General Robert Muller of France, a longtime ally of the Kurtzes, took their idea of a Global Information Cooperative to then President of France, Valery Giscard d'Estaing, who in turn proposed the International Satellite Monitoring Agency (ISMA) to the UN General Assembly in 1978.[685] Giscard called for the creation of a UN global satellite agency to help verify and monitor future peacekeeping through an extension of the benefits of reconnaissance satellites to all countries lacking space capabilities. While the ISMA was opposed by the US and USSR, it did generate support, and an international committee was formed by the UN General assembly, which, chaired by Dr. Hubert G. Bortzmeyer of the French space agency Centre National D'Etudes Spatiales (CNES), performed a feasibility study over three years.[686] The committee completed their report in 1982, but according to a 1983 *Rolling Stone* interview with Dr. Robert Muller, UN Assistant Secretary General, the report's publication was resisted by Russia, eight Communist satellite nations, as well as the United States, Cuba,

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[679] Clarke, *1984: Spring*, 10; The International Monitoring Satellite Agency proposed by the French government in 1978 was the subject of a UN report released 1983, see United Nations Office for Disarmament Affairs, *The Implications of Establishing an International Satellite Monitoring Agency*, Disarmament Study Series, No. 9, UN, New York, 1983.

[680] Keith Suter, "Profile: Harriet and Howard Kurtz, Peace through Security," *One World,* April 1987, Box 13, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC, 8.

[681] Gerard Corrigan, "Spotlight on Peacemakers" *Peace in Action,* June 1988, Box 13, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution. Washington, DC.

[682] Suter, "Profile: Harriet and Howard Kurtz," Archives Department, NASM, SI, 8.

[683] Howard G. Kurtz, "The Peacebuilder," June 1990, Box 13, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC, 7.

[684] Robert Engelman, *The Kansas City Times*, "Keepers of the Peace? Man Campaigns for Satellite Spies to Become International Referees of Nuclear Arms Race," August 9 1982, Box 13, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution. Washington, DC.

[685] Suter, "Profile: Harriet and Howard Kurtz," Archives Department, NASM, SI, 9; Harriet Kurtz died in 1977.

[686] Excerpt from *Rolling Stone,* "The Shootout Fallout…" October 27, 1983 in "Checkpoint." Box 13. Arthur C. Clarke Collection (Acc. 2015-0010). Air and Space Archives, National Air and Space Museum, Smithsonian Institution. Washington, DC.

Afghanistan, Laos, and Vietnam.[687] Clarke would join Kurtz, Rep. Brown, and Muller in using their platform to push (military) satellites for peace and to break the superpower monopoly on satellite information.

At UNISPACE '82 in Vienna, the Soviet and American delegation prevented the French initiative from even appearing on the agenda.[688] Regardless, Rep. Brown spoke of the Peacesat message at the UN conference, intending to "place the United States foremost in world peace initiatives."[689] On November 9th, 1982, at a Strategy for Global Security Conference, both Dr. Robert Muller, Assistant Secretary General of the UN, and Clarke, further advocated for the French Initiative, referring to the work of the War Control Planners directly.[690] Regardless of this advocacy, the US and USSR remained rigid, and as Mueller noted in his *Rolling Stone* article, "[The US and USSR] really don't want to disarm."[691]

At the UN Committee on Disarmament, Clarke touted the 1978 French proposal, wherein he argued such a system "could develop in a non-controversial manner out of what Howard Kurtz, their long-time advocate, has called the Global Information Cooperative. This could be a consortium of agencies for weather, mapping, search and rescue, resources, and pollution monitoring, disaster watch, information retrieval, and of course, communications.**"**[692] It is in this speech that Clarke's representation of the Peacesat emerges as a way to describe the outcomes of such a proposal. "I like the name Peacesat, and although that has already been pre-empted by the Pacific Radio Network using ATS-1, I will use the term, with due acknowledgement for the remainder of this talk."[693] Clarke would use the term for many more years in fact. "The Peacesat is an idea whose time has come… It is not a magic solution to all the problems of peace: there is no such thing. But at least it is worthy of serious consideration, as one way of escape from our present predicament – all of us standing in that pool of gasoline, making our Mutual Assured Destruction ever more assured."[694] He concludes by quoting from the *High Frontier Proposal:* "We should abandon this immoral and militarily bankrupt theory… and move from Mutual Assured Destruction to Assured Survival…"[695] Clarke would define how to get there in his 1983 World Communications Day speech "Beyond the Global Village," concluding that "more and more we must think of the human race as a single unit – and mankind can afford anything it wants, especially if it stops squandering its resources on weapons of destruction. What I have described to you today are the weapons of peace."[696] Peacesats were on the offensive.

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[687]Ibid.
[688] Howard G. Kurtz, "The French Initiative and its Space Policy for Humankind," *Aizen World,* May 1983, Box 13, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC.
[689] Engelman, "Keepers of the Peace?" Archives Department, NASM, SI.
[690] Kurtz, "The French Initiative and its Space Policy for Humankind," Archives Department, NASM, SI.
[691] Excerpt from *Rolling Stone,* "The Shootout Fallout…" Archives Department, NASM, SI.
[692] *Arthur Clarke Discusses War and Peace in Space,* Congressional Record 97th Cong., E4309.
[693] Ibid., E4309.
[694] Ibid., E4309.
[695] Ibid., E4309.
[696] Clarke, *1984: Spring*, 28.

> "The real problem is not military hardware, but human software – though the right kind of hardware can certainly help. A stable peace will never be possible without mutual trust; without that, all agreements and treaties are worse than useless, because they obscure the real issues."[697]
> "Star Wars and Star Peace," 1987

International Space Year

Clarke strongly believed Peacesats could facilitate a new era of US-Soviet cooperation and help achieve both arms race cooling and joint space missions. Travelling as "a British citizen unofficially assisting Sri Lanka on a private visit arranged by my Russian publisher" Clarke made his first of several trips to the USSR in June 1982.[698] His status among the space community to this point was strong enough to garner meetings with INTERSPUTNIK Director General Yuri Krupin and Ministry of Posts and Telecommunications Deputy Minister Zubarev, championing the French proposal with them both.[699] Clarke recalled mentioning his "hope of seeing a serious discussion at UNISPACE of the French control satellite proposal," but as he expected, "no great enthusiasm was evinced, and someone remarked cynically that perhaps the French wanted to sell the hardware. Unfortunately, I didn't think of the right retort. 'So What?'" he had responded.[700] Clarke was also given facetime with the Director of the Institute of Space Research, Academician Sagdeyev, along with his team of scientists, where he also plugged the proposal, "adding that since both the United States *and* the USSR seemed opposed to it, I thought it was probably a good idea."[701] To Clarke, it wasn't about Cold War competition, but doing whatever was necessary to preserve peace and keep progress moving forward in space peacefully, in a globally cooperative manner, because, as Clarke would state before the UN Committee on Disarmament, "who can set a cash value on the price of peace?"[702]

The cherry on top for Clarke's visit behind the iron curtain came with the opportunity to meet both Yuri Artsutanov, the inventor of the space elevator, and Cosmonaut General Alexei Leonov, the Soviet commander of the ASTP.[703] Having just completed his 1982 novel *2010: Odyssey Two,* Clarke recalled in his UNISPACE speech, "the pleasure of telling Alexei that most of the action takes place aboard the spaceship *Cosmonaut Alexei Leonov*. When he heard this, he exclaimed 'Then it must be a good ship.' It is… Still more to the point. Its manned – and womanned – by seven Russians and three Americans, who start off as good friends and end up as even better ones."[704] When Clarke sent in his 1984 videotape "A Martian Odyssey" to US Senate Foreign Relations Committee, he plugged *2010,* telling the Senators it "describes a joint US-USSR mission – though to Jupiter, not Mars!"[705] Sen. Matsunaga had been listening intently.

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[697] Clarke, "Star Wars and Star Peace," 275.
[698] Clarke, *1984: Spring*, 39-40.
[699] Ibid., 39-40; INTERSPUTNIK was the Soviet answer to INTELSAT, see John Downing, "The Intersputnik System and Soviet Television," *Soviet Studies* 37, no. 4 (1985): 465-483.
[700] Ibid., 40.
[701] Ibid., 40.
[702] *Arthur Clarke Discusses War and Peace in Space,* Congressional Record 97th Cong., E4309.
[703] McAleer, *Odyssey of a Visionary,* chap. 25.
[704] Clarke, *1984: Spring*, 111.
[705] McAleer, *Odyssey of a Visionary,* chap. 29; In an interview with historian of science and BBC writer, host, and producer James D. Burke in June 1983, Clarke attributes the creation of *2010: Odyssey Two* to the new images beamed back from the *Voyager* spacecraft in the preceding years, expressing that "*Odyssey 2* was made possible by JPL [Jet Propulsion Laboratory – NASA] and, specifically, by the *Voyager* spacecraft. When Stanley Kubrick and I wrote *2001,* the moons of Jupiter were just points of light

In a letter Matsunaga wrote to Clarke on July 30th, 1985, he relayed how Clarke had inspired a personal project of his, that would ultimately result in the creation of the International Space Year (ISY) in 1992. Matsunaga wrote that he had suggested that both the Astronauts and Cosmonauts of the ASTP mission be invited to the mission's 10th anniversary celebration (July 17th, 1985), and that a commemorative award for international cooperation in space be presented to them.[706] Inspired by the conclusion to Clarke's videotape, quoting "So is it absurdly optimistic to hope that, by Columbus Day 1992, the United States and the Soviet Union will have emerged from their long winter of sterile confrontation," it had dawned on Matsunaga that "1992 was also the 35th anniversary of the IGY!"[707]

Ultimately, Matsunaga felt compelled to propose "an ISY, or International Space Year, in 1992, as a bridge to Mars in a new united context," relaying the he was recently even a guest on the popular NBC morning program "Today" – "touting the ISY as a bridge to Mars."[708] Matsunaga continued that he believed the 1984 renewal of the US-Soviet space cooperation agreement was "a first step and a manned mission to Mars as a long-term goal" while laying "the broadest possible foundation for major cooperative ventures" and establishing a "focused yet comprehensive target toward which the creative energies of all spacefaring nations can be mobilized and with which the general public can identify."[709] Clarke's videotaped speech had spoken of the reality that while robotic missions are essential, "they do not fire the imagination" and that it is the "*manned* missions that will be the most important." Clarke felt that human missions were key, for both public engagement and assurance humans would remain part of the long term plans. Matsunaga parallels Clarke's rationale; maintain focus on the continual expansion of space activities now, and attach it to a shared vision of the long-game, be it Europa or Mars. And success in the generational endeavor depends on peacetime and global partnership, which depends on satellites.

Matsunaga would explain to Clarke how his optimism for Mars came to replace fear of SDI while writing his new book about the ISY and beyond, *The Mars Project* (a nod to von Braun). Matsunaga noted that during the process of writing his book, "the space weapons issue gradually receded into the background and I became more and more absorbed with the drama and potential of the Space Age. To my mind, the Space Age is much less interested in warring against space weapons than it is in realizing itself and in somehow bringing self-absorbed world leaders to look up and see it."[710] The ISY would indeed take place in 1992.[711]

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even with the most powerful telescope. We never imagined that we would know anything about them before our spacecraft, *Discovery* flew to them in 2001. And yet, only a dozen years later, those points of light became worlds in their own right, thanks to the incredibly successful *Voyager* missions," see James D Burke, "A Talk with Arthur C. Clarke" in *The Planetary Report* May/June 1983, Arthur. C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC; Arthur C Clarke, *2010: Odyssey Two* (New York: Del Rey/Ballantine, 1982).

[706] Sen. Spark M. Matsunaga to Arthur C. Clarke, July 30, 1985, Folder 5, Box 13, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC.

[707] Ibid.

[708] Ibid.

[709] Ibid.

[710] Ibid.; in the letter Matsunaga asked Clarke to write an introduction to his new book and Clarke would oblige, see Clarke, "The Snows of Olympus: Foreword" in Matsunaga, *The Mars Project*, xv-xix.

[711] The International Space Year (ISY) would become labelled "Mission to Planet Earth." According its planning report, "the ISY was conceived for the purpose of encouraging nations to cooperate in space in order to meet the unprecedented requirements of space exploration and development" and to "initiate a long-term program of Earth observation mission coordination and worldwide data standardization," see ISY Mission to Planet Earth Conference and Harvey Meyerson (ed.), *Report of the ISY*

> "Could you imagine, twenty years ago, someone in the Pentagon asking his Russian counterpart: 'Would you mind if we photograph the Soviet Union from end to end, at such resolution that we can see everything bigger than a football?'"[712]
> "New Communications and the Developing World," 1981

Sputnik Plus 30

October 4th, 1987 marked the thirtieth anniversary of Sputnik, and Clarke was invited to give an address at the USSR Cultural Center in the Soviet Union. His speech "Sputnik Plus 30" is short, and is notably written in English that would be digestible for a Russian speaking audience. He begins, "Thirty Years Ago this morning… Space Age had opened – and the space race had begun. Fortunately, it's a race with enough prizes for everybody. Hope we're now entering an era of cooperative competition – or should I say competitive cooperation? I'm happy to have played some part in this…"[713] It is no doubt Clarke's goal to strive for bridging the gap between the US and USSR, and at a pivotal point in relations, he is using his platform. "One of the obstacles to that cooperation has been the militarization of space. Millions of words of hypocritical nonsense has been written about this, and I don't intend to add to them. But I would like to make a couple of points…"[714] Clarke goes straight to his promotion of both the fine line between weapons of peace and pieces of weapons and the political nature of that distinction: "Few people realize that most of the satellites up now are military – and given the present state of the world that's not a bad thing. Because they are virtually all passive, reconnaissance satellites, and by monitoring the entire globe they have made possible the arms agreements that now exist – and which we hope will soon be greatly extended."[715] He continues, "The real concern is with satellite weapons – or anti weapons – the so-called Star Wars" but rather than concluding his speech on that subject, he focuses on the Soviet tagline - "Star Peace… the real problem is not military hardware, but human software."[716] The problem wasn't the technology, the problem was how humans used the technology.

> "If not for the tragic *Challenger* disaster, the first deployment of what are now known as 'space tethers' would have been attempted, using the Space Shuttle to tow a payload in the upper atmosphere at the end of a cable some hundreds of kilometers long… There have even been suggestions that the Space Elevator might be built <u>from the ground upwards,</u> with the help of somewhat hair-raising engineering ideas, too complex (and perhaps too confidential) to expound here."[717]
> "Addition to the Afterword" in *The Fountains of Paradise,* 1989

Exploitation Now, Exploration Later

In Clarke's 1989 postscript added to the ten-year anniversary edition of his 1979 novel *The Fountains of Paradise,* Clarke expresses his frustration with the state of the Shuttle and the future of the Space Elevator, which he long

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Mission to Planet Earth Conference: a Planning Meeting for the International Space Year, NASA-CR-188225 (Washington, DC: NASA, 1991); see also "Mission to Planet Earth," *United Nations Chronicle* 29, no. 4 (December 1992).

[712] Clarke, *1984: Spring*, 24.

[713] Arthur C. Clarke, "Sputnik Plus 30" address at the USSR Cultural Centre, October 4, 1987, Folder 5, Box 143, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC.

[714] Ibid.

[715] Ibid.

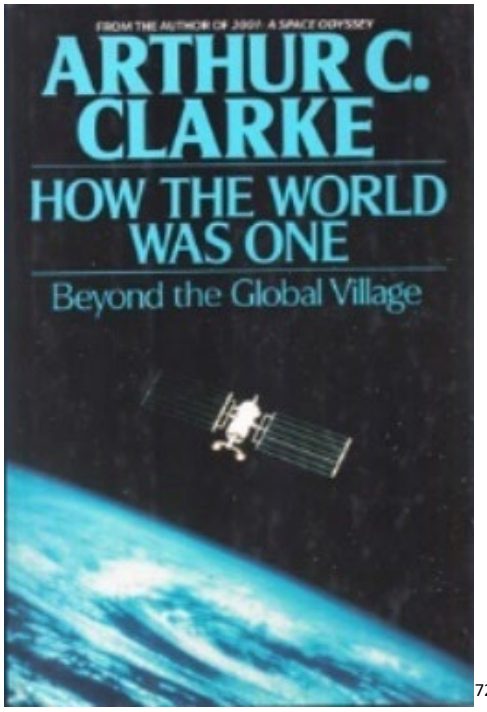
[716] Ibid.

[717] Arthur C. Clarke, *The Fountains of Paradise,* Addition to the Afterword, 1989, Folder 7, Box 113, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum. Smithsonian Institution, Washington, DC.

believed the better solution to the problem of transportation into space. "Well the Space Elevator doesn't seem much closer, and the Shuttle, alas, has turned out to be a technological *tour de force* and an economic disaster. The fault for this may be equally divided between the politicos who thought that bricks could be built without straw, and the engineers who didn't protest strongly enough when Congress whittled down what could have been the DC 3 of space to a DC 1 1/4 ."[718] Clarke had since downgraded the Shuttle from a DC 1.5 to a DC 1.25. So in the postscript, with the shuttle exemplifying to Clarke that it was the wrong solution to fulfilling a vital cog in the future of humans in space (reusable rockets), he poses, and then answers, the question: "So what should we do now?"[719]

First, he reiterates his longtime message and personal mission to "exploit all applications satellites to the utmost – and make sure the public realizes the enormous returns its getting on its investment."[720] To Clarke, public understanding of satellite technology and its impact on their lives will drive more and more investment, as comsats connect the world, edsats educated the world, and Peacesats maintain world stability. "Second, develop a single staged orbital manned spacecraft, with all deliberate speed. The *economic* exploitation of space will remain a drew as long as we throw away expensive hardware on every flight."[721] Lastly, he pushes for an intensified internationalization of space programs, exemplified by the work of Sen. Matsunaga, *The Mars Project,* and the ISY planned for 1992. "Third, set the goal of a manned mission to Mars as a major objective of space exploration in the next century (the Space Station and the Lunar Base may not be essential steps toward this goal)."[722] Clarke explains that Mars is vital because of its potential for harboring life (past or present), and that "Mars is the *only* planet on which human settlements can be established with foreseeable technologies."[723] To Clarke, getting to Mars means capturing the imagination, and harnessing the public infatuation with space colonies and alien contact, while offering a project that the present generation of engineers can fathom, as the technology already exists. Exploration is the dream, exploitation is the means, and satellites and reusable rockets, deployed as weapons of peace, not pieces of weapons, will facilitate the process.

[718] Arthur C. Clarke, "Apollo Plus Twenty: A visionary author adds a postscript to the future, *Ad Astra,* July/August 1989, Clarke, Arthur. C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC, 31.
[719] Ibid., 31.
[720] Ibid., 31.
[721] Ibid., 31.
[722] Ibid., 31.
[723] Ibid., 31.



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> "And I am delighted to read that the enemies of this free flow of information rather wittily denounce such [satellite] antennas as '*paradiabolique*'... *Paradiabolical* – I like that! His heart is in his weapons. That is indeed a chilling indictment. It cannot be denied that satellite technology was born and nurtured in war. Yet out of it may yet come a tool that may save our civilisation, and make this indeed One World – the Peacesat."[725]
> *How the World Was One,* 1992

The World's First Satellite War

As the beginning of the 1990s, Clarke began writing *How the World Was One: Beyond the Global Village,* a history of telecommunications from the laying of the first Atlantic telegraph cables to the rise and establishment of comsats. While writing the book, the Gulf War broke out, which hit close to home, as Clarke shared an "eight-foot-high party wall" with his neighbor "His Excellency the Iraqi Ambassador."[726] The experience of receiving an endless stream of live CNN reporting via satellite was novel, and "like much of the world, I lost a great deal of sleep between January and March 1991."[727] A February 19th, 1991 *Washington Post* article titled "Satellite's Gaze Proves New Look at War" began as follows: "'The world's first satellite war' is how Arthur C. Clarke, science fiction writer and originator of the communications satellite concept, recently described the fighting in the Persian Gulf."[728]

Prompted by Clarke's characterization, Burgess breaks down how deeply the satellite was integrated into the war effort: spy satellites map regions, identify military targets and their movements, and relay their location; the Pentagon utilized a robust array of both military and commercial communications satellites; and weather satellites

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[724] Photo Credit: Arthur C. Clarke Trust, *Cover of How the World Was One 1992,* Accessed May 9 2020. http://arthurcclarke.org/site/legacy/non-fiction/non-fiction-cp/.
[725] Clarke, *How the World Was One,* chap. 39.
[726] Ibid., chap. 39.
[727] Ibid., chap. 39.
[728] John Burgess, "Satellites' Gaze Provides New Look at War," *Washington Post,* February 19, 1991, Clarke, Arthur. C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC, A13.

informed air strikes and located clear skies for jet refueling.[729] He finishes by describing a perfect example of the blurred line between military and peaceful uses of satellites: "Of all the satellites in use, the Navstar Global Positioning System [GPS] is the least-tested in military operations. The system's role is to save allied soldiers from an age-old problem troops face in war: getting lost."[730] This "satellite war" would highlight the truth behind Clarke's claim of the blurred distinction between military and peaceful uses. To reconcile the massive presence of satellites in a war effort, Clarke concludes that in many respects, the satellite did act as a deterrent to a bloodier conflict, as well as a unique new set of eyes that revealed the brutality of war to the public. "The war was fought by satellite as well as viewed by satellites from the public point of view. So there are two aspects. I mean, I'm against all wars in principle. On the other hand, maybe satellites made this a much shorter war than it would have been otherwise. So there is that benefit. The other benefit was that the public saw what war was like – first hand – in a way they've never seen before, even newsreels, sort of in real time. And I think that made a profound difference."[731] In short, extensive utilization of satellites made the war less devastating, and exposed the public to the reality of war. But it was still war, far from Clarke's ideal satellite utilization. Clarke likely engaged in some mental gymnastics identifying the satellite silver lining as the oil wells burned.

It would not be long before conflict was again broadcast live, via satellite. "It is a very weird world now. No one ever dreamed of the collapse of the Red empire" Clarke would note in 1992.[732] Clarke described his experience watching the collapse happen in real-time, via satellite, during the 1991 Soviet coup attempt. In an interview published in the December 1991 *Via Satellite,* titled "The Godfather Speaks," Clarke recalled "everybody was able to watch the coup and see what idiots these people were. You could see their hands shaking on TV while they were being interviewed. And no one took them seriously."[733] "What the [coup] plotters hadn't allowed," Clarke continues, was "something new in the world: satellite broadcasting."[734] Clarke was "delighted to hear" that Alistair Cooke would make "exactly the same point in his regular 'Letter from America (BBC World Service, 24 August 1991)… stating: 'The coup failed because of something new – satellite broadcasting'." [735] And just as Clarke would do, Cook "went on to pay a tribute to CNN, which, as in the Gulf War, once again served as a two-way, interactive medium, creating history even as it reported it."[736] Clarke would relay that during the Gulf War, comsats had become the "conscience of the world" – a role exemplified by global telecasts of aid concerts and collective awareness of the atrocities littering the planet.[737] Clarke warns of the danger of over-exposure to such tragedies and the potential of "compassion fatigue," but in the same breath, he surmises that "the alternative – the indifference of

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[729] Ibid.
[730] Ibid.
[731] David Bross, "The Clarke Interview: The Godfather Speaks," *Via Satellite,* December 1991, Clarke, Arthur. C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC, 40-43; introduced as the "father of the satellite *industry"* (a relevant twist to match the rapid commercialization of space).
[732] Clarke, Interview with Clarke by Andrew Lawler, 30.
[733] Bross, "The Clarke Interview: The Godfather Speaks," NASA Headquarters Historical Reference Collection, 40-43.
[734] Ibid., 43.
[735] Clarke, *How the World Was One,* chap. 39.
[736] Ibid., chap. 39.
[737] Ibid., "Epilogue."

ignorance – is surely worse."[738] Overall, a world without satellites was simple worse off than a world with them, warts and all.

To Clarke, the satellite was truly a device of accountability, a forced function for exposing lies and expanding knowledge and understanding. "For the first time in human history, millions of people were seeing the true horrors of modern mechanized war while they were actually happening. I expressed the hope that the impact would cause such a wave of revulsion that, ultimately, the leaders of our various national tribes would stop paying lip-service to the virtues of peace and actually do something to ensure it."[739] Addressing the pessimists who may take his take as naïve, "I would answer that the world is now much too dangerous for anything short of Utopia. And by Utopia, I mean a world in which all weapons of mass destruction have been eliminated (After Iraq and Kuwait, who needs nukes?)." [740]

> "With increasing power comes growing responsibility. Every great stride forward in the field of telecommunications leads to a great disparity between those who have access to information and entertainment, and those who do not. Today, the Global Village co-exists with the Global Shanty Town. This widening gap results from, and causes, complex problems. Some of these problems can themselves be solved through telecommunications, which can encourage free minds and free markets."[741]
> "Telecommunications Cultures in Transition: The Global Village and Beyond," 1994

May the Best Orbit Win

With the Cold War a thing of the past, and SDI falling to the wayside along with it, the establishment of orbit via commercial and benevolent means was charging forty, but new challenges would emerge, as they always do. With an increase in satellites comes an increase in space junk, and the implications of that could be catastrophic. Clarke unsurprisingly paid close attention to Motorola's Iridium project in the early 1990s, as the venture sought to "provide cellular voice (and some data) communications to any point on the Earth's surface," which would be a first in the history of telecommunications.[742] As historian Martin Collins describes in his work *A Telephone for the World: Iridium, Motorola, and the Making of a Global Age,* Iridium emerged following the collapse of the Soviet Bloc, and as the United States stood as the last superpower standing, it possessed "dominance that was expressed not only through the state but also through an increased emphasis on the role of markets and of US corporations on the global stage."[743] The stage was being set for our present day private space industry.

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[738] Ibid., "Epilogue."
[739] Ibid., chap. 39; for an historical analysis on the effect of viewing war via satellite, see chapter 3 from Parks, *Cultures in Orbit: Satellites and the Televisual,* "Satellite Witnessing: Views and Coverage of the War in Bosnia," 77-108.
[740] Clarke, *How the World Was One*, chap. 39.
[741] AT&T Public Relations Special Communications Programs "Telecommunications Cultures in Transition: The Global Village and Beyond," January 20, 1994, Folder 4, Box 144, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution, Washington, DC.; Clarke's speech "Telecommunications Cultures in Transition: The Global Village and Beyond" take place in part 3 in "Who Are We."
[742] Martin J. Collins, A *Telephone for the World: Iridium, Motorola, and the Making of a Global Age*, (Baltimore: Johns Hopkins University Press, 2018): 8, 1.
[743] Ibid., 1.

Unlike satellites placed in the "Clarke Orbit," Iridium's constellation of 77 satellites ['77' being the atomic number of the element iridium] would utilize low-altitude orbits (which Yash Pal coined the 'anti-Clarke orbits'[744]) with the satellites acting as the equivalent of cellular towers.[745] It seems that Clarke's 1983 call for "a telephone in every village" was increasingly likely to happen, but at what cost? Clarke spent his career weighing the costs and benefits of space endeavors, and a vision realizing project such as Iridium was no different. "I am a little worried about the proliferation of satellites, but low Earth satellites does have the one great advantage of [no] time delay. I say may the best orbit win." [746] Ultimately, Clarke's main objection to Iridium was the risk of space debris: "I mean, when you have all of these satellites going in all directions, you are going to have a hell of a traffic control problem. Its in the first thousand miles or so, which is going to be traveled by manned spacecraft. And if you have things zapping back and forth, its all very well to say, 'We can keep track of them' and then of course, there is all the debris we don't know about – the fragments and bits of debris and bloody Star Wars tests. That's a real menace."[747] The scars of past mistakes.

> "This is Arthur Clarke, sending greetings to you from practically on the Equator. It gives me a nice feeling to know that the Indian Ocean satellite that keeps me in touch with the world is right overhead … And so, by an interesting coincidence, is the most stable point in the Earth's gravitational field. Exhausted geostationary satellites also end up there, milling round and round above Sri Lanka in a celestial Sargasso Sea when they've run out of gas."[748] *How the World Was One,* 1992

Sir Arthur C. Clarke, Commander of the British Empire

In an October 1989 ceremony, Queen Elizabeth would grant Clarke the ceremonial rank of Commander of the British Empire (CBE).[749] The pacifist radical internationalist would become a Commander, and not for his literary successes, but for "British cultural interests in Sri Lanka."[750] In 1994, Clarke would be nominated for a Nobel Peace Prize by the National Space Society, and in 1998, he would knighted *Sir* Arthur C. Clarke.[751] It appears Clarke was culturally

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[744] Clarke, *How the World Was One*, chap. 29.
[745] Collins, A *Telephone for the World,* 6.
[746] Clarke, Interview with Clarke by Andrew Lawler, 30.
[747] Bross, "The Clarke Interview: The Godfather Speaks," NASA Headquarters Historical Reference Collection, 42.
[748] Clarke, *How the World Was One*, chap. 37.
[749] McAleer, *Odyssey of a Visionary*, chap. 33; Clarke was sure to use his new prominence in England to access high-level decision makers pushed his platform for Peacesats directly to the new Prime Minister, John Major. In a letter from the Private Secretary at 10 Downing Street, addressed to Clarke on May 24th, 1991, the Prime Minister Private Secretary sent his response to Clarke's most recent correspondence: "The Prime Minister has asked me to thank you for your letter of 25 April enclosing your thoughts on the peace-keeping potential of satellites… We agree with you that satellites have an important role to play in arms control… We are not so convinced that satellites are a cost effective means of verifying arms control or peace-keeping arrangements across the board," see Wall, J.S., Letter to Clarke from 10 Downing Street, May 24 1991, Folder 4, Box 13, Arthur C. Clarke Collection (Acc. 2015-0010), Air and Space Archives, National Air and Space Museum, Smithsonian Institution. Washington, DC.
[750] Ibid., chap 33.
[751] John F. Burns, "A Nonfiction Journey to a More Peaceful World," *New York Times International,* November 29 1994, Clarke, Arthur. C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC, A4; the article states that "Mr. Clarke was nominated this year for a Nobel Peace Prize… The nominator, Glenn Harlan Roberts, a University of Tennessee law professor, noted that Mr. Clarke is more than a science-fiction writer. Among other things, it said, he is recognized, from a 1945 article for *Wireless World*, as the intellectual father of the fixed-position communications satellite that ushered in a new telecommunications era."

embodying the blurry line between peacetime and military service, just as the satellite he spent a lifetime advocating had.

By 1995, the year Clarke had asserted in his 1945 *Wireless World* publications that three artificial satellites in geostationary orbit could be achieved, had been achieved, three decades earlier than anticipated (officially was achieved in 1965). In the fifty years since his postulation, satellites had become entrenched as a fixture in both Earthbound and space-based life, and Clarke was living peacefully under an orbiting sea of spent satellites expected to remain fixed in position forever. When asked in a 1992 interview how he felt about the progression of satellites in his lifetime, he replied, "The biggest surprise is the speed which it all happened. As soon as a communications device is available, people have got to have it. Who would have dreamed there would be television antennas on all these shacks around the world?" [752] A dream, turned to reality, in service of a dream, and on the fiftieth anniversary of his postulation, Clarke would be recognized for it in a global celebration, via satellite, of course. For Clarke's "contribution over more than half a century to the exploration and development of space" NASA Administrator Dan Goldin presented Clarke with the NASA Distinguished Public Service Medal, the highest award that a non-employee of the US space agency can receive.[753] The ceremony, "Voices from the Sky," featured a real-time demonstration of satellite technology, utilizing four satellites, seven Earth stations, and a mix of fiber optic cables and microwave links, while also spanning 14 time zones – a true electronic global village it would seem.[754] "No writer, living or dead," Goldin continued, "has done more to demonstrate to the general public the practical value and future potential of continued space exploration."[755] Clarke would also receive the British Interplanetary Society's Achievement Medal in a separate, but similar satellite linkup.[756] Despite all the pageantry, there is little doubt that Clarke's advocacy was seen as a significant component of the state of space come 1995.

During the duel between the commercial and militarized space of the Space Shuttle period, Clarke toed the line, understanding that military and government investment was crucial for initial R&D, but also perpetuated tensions that threatened the very future in space (ASATs, Space Piracy). Simultaneously, commercial investment was crucial in developing public need and establishing a permanent presence in space, but it too had elements that threatened the very future in space (space junk). In this period, Clarke would side with the private and civilian developers, and would reason that the pros outweighed the cons, pushing ways to keep costs low, and stop the budding arms race to ensure stability for private investment. As 1995 came near, satellites had made the Gulf War far more efficient, but also shared the war directly into insulated living rooms. Just as Clarke had argued in 1982, "It is often impossible to say whether a satellite is military in nature or not… What matters is, again, intention…"[757] Therefore, it was a political decision what to do with satellite applications, not a technical one, and relaying that point was all the more important. To Clarke, the satellite was the foundational infrastructure necessary for *any* human endeavors in space. Every step of the way the satellite was both the backbone, and the pioneer. "From the

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[752] Clarke, Interview with Clarke by Andrew Lawler, 30.
[753] Kenneth W. Gatland, "Honours for Satellite Visionary From World Space Community" *Spaceflight Vol. 37,* October 1995, Clarke, Arthur. C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC.
[754] Ibid., 329.
[755] Ibid., 329.
[756] Ibid., 329.
[757] *Arthur Clarke Discusses War and Peace in Space,* Congressional Record 97th Cong., E4308.

earliest days of colonisation, lunar networking will be vital, so before long the Moon will have its own chattering subsatellites."[758] The satellite *was* space travel, for it *facilitated* space travel. The satellite was the key to the future.

> "For that matter, many of you carry on your wrists miracles of electronics that would have been beyond belief even twenty years ago. The symbols that flicker across those digital displays now merely give the time and date. When the zeros flash up at the end of the century, they will do far more than that. They will give you direct access to most of the human race, through the invisible network girdling our planet."[759]
> "Beyond the Global Village," 1983

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[758] Clarke, *How the World Was One,* chap. 29.
[759] Clarke, *1984: Spring*, 12.
[760] Photo Credit: Arthur C. Clarke Trust, *Clarke at a book signing circa 1992,* Accessed May 9 2020. http://arthurcclarke.org/site/resources/images/.

Conclusion

> "Ive seen far more happen in my lifetime than I ever dreamed. And the momentary plateau now, well, many of our problems on Earth can only be solved by space technology… When we get out of the present sort of slump and confusion, well, I mean the next step is space. Its inevitable."[761]
> "Interview with Steve Coll," 1992

If Clarke were alive today (he died in 2008 at the age of 90), he would likely be thrilled. On May 30th, 2020, *NASA* astronauts were ferried to the *International* Space Station aboard a *commercially* built *reusable rocket* (and capsule to boot) that now regularly transports dozens of *affordable* satellite ventures made possible by economical ease of access to orbit. By all appearances, Clarke's dream of human space travel via international, civilian, and commercial means is alive and well. Clarke would likely understand that humanity still has a long way to go before a colony on Mars comes to fruition, but he would have reason to be optimistic. Underneath the glamour of human spaceflight triumphs, the satellite reigns supreme, thanklessly orbiting invisibly, facilitating a truly electronic global village so central to our daily existence that it would be unfathomable to conceive of a post-satellite future, because there likely will never be one. More likely than not, satellites will remain because we need them, and we want them, even if we perpetually take them for granted or fail to register their existence. And thus Clarke's mission is accomplished, because we now need satellites, and because their return on investment is so immense, we need space programs, and we need international regulatory bodies, and we need aerospace engineers, and we need reusable rockets, and we need satellite technicians, and we may even need a space elevator. As Clarke would advocate for decades, satellites have provided countless near-term projects to pursue with immediate, often substantial benefits, and collectively, those projects have established the foundational infrastructure for a future space faring generation that Clarke never imagined he would be a part of anyway. Satellites meant that humanity would likely never abandon its endeavors in space, barring an apocalyptic nuclear war, asteroid impact, or "Kessler Syndrome" space junk cascade. And even those challenges offered short-term goals that meant more time and money would be spent building upon that foundation, or at least protecting it. Clarke's career can thus be seen as setting the stage, planting plausible ideas and nurturing their growth, and making sure everyone knew what their efforts today meant for tomorrow. And eventually it would culminate in the realization of his space age dreams. And once a colony rested on the surface of Mars, or Europa, they too would need satellites. It was inevitable. Or was it?

[761] Steve Coll, "Arthur C. Clarke's Red Thumb," *Washington Post,* March 9 1992, Clarke, Arthur. C. (1972 to 1996), Record Number 330, NASA Headquarters Historical Reference Collection, Washington, DC.

> "Do we have the imagination – and the statesmanship – to use this new tool for the benefit of all mankind? Or will it be used merely to peddle detergents and propaganda? I am an optimist; anyone interested in the future has to be... I believe that communication satellites can unite mankind."[762]
> "Speech at signing of INTELSAT Agreement," 1971

Weapons of Peace and Pieces of Weapons

In tracing how, and why, Clarke represented satellites in his work for fifty years, this distinction became central. Did the public perceive of satellites as weapons of peace or pieces of weapons? And did policy makers and administrators prefer one over another? In a career hell bent on building and maintaining momentum, the good needed to be highlighted, and the bad needed to be communicated, and hopefully reoriented. Clarke sought to communicate the reality that satellites had obvious military *and* benevolent applications, and that it was ultimately a political determination as to which took precedence. Satellites were weapons of peace *and* pieces of weapons, and the sooner the public and policy makers understood that fact, the sooner they would (hopefully) join him in the pursuit of the peaceful pathway. As much as Clarke had the reputation as a visionary of the future, he considered himself a pragmatist: "I'm not a dreamer, never have been. I think of myself as somebody who looks at the scientific things, and asks: 'Where can we go with this? How can we use this to make our world better?' And I hope that in some small way I have helped push the process forward."[763] The V2? A benevolent taxi for imagined television satellites. Chinese propaganda via satellite? Overcome by educational programming via satellite. Orbiting big brothers? Peacesats. Star Wars? Star Peace. Clarke was aware there was no perfect solution, but time and again, he determined the pros offered by satellites outweighed the cons. Education would defeat ignorance, unity would vanquish tribalism, accountability would topple dictators. Clarke made numerous value judgements and ultimately accepted the military nature of satellites, understanding the future in space would need the billions of dollars and hours it provided, but he would strive to soften its edges, and perhaps earn a few new recruits to his coalition in the process. Perhaps this is why Clarke so commonly utilized military jargon to represent satellites - to build a bridge for the weapons builders. Or perhaps it was just more exciting.

> "The name 'Star Wars' – deplored both by President Reagan and the indignant George Lucas – has distorted the Strategic Defense Initiative's public image. In particular, it has focused attention on orbiting fortresses using laser beams to zap ICBM's as they rise out of their silos."[764]
> "Star Wars and Star Peace," 1987

The Sci-Fi Playbook

When Clarke was asked in 1987 why the public was failing to re-achieve the 1960s level of interest in space exploration, he replied: "In a way, science fiction writers may be guilty. 'Star Trek'… 'Star Wars' and 'ET' are so much more glamorous than the near term reality."[765] The near term reality in space – satellites, space elevators, space

[762] Clarke, *How the World Was One,* chap. 32.
[763] Burns, "A Nonfiction Journey to a More Peaceful World," Headquarters Historical Reference Collection.
[764] Clarke, "Star Wars and Star Peace," 274.
[765] Clarke, Interview with Andrew Lawler, 30.

trucks, space tugs, satellite repair technicians, commercial investment, arms de-escalation, and the development of international governing bodies – the very foundation for a solar system colonizing society - just failed to elicit adequate public engagement. Clarke's early work had imagined a thrilling human "conquest of space," but as the reality changed, the reality-based science fiction that had propelled the space age into existence could no longer offer its standard fare of human feats in space. Satellite technicians riding a shuttle and robots beaming images from afar just couldn't compete with the excitement within the less and less realistic science fiction that emerged in the 1970s and beyond.[766] As McCurdy had argued, the larger the gap between expectations and their confirmation in reality, the less the public engaged. As an invisible exploiter of space, the satellite certainly lacks the cachet of both human and deep space exploration, but it also offers the most realistic expectations, and their touted benefits can be confirmed in reality, often in a flash, relatively speaking. To overcome the satellite's immense deficit in "glamour" or "cachet," Clarke would utilize a number of representational strategies to carve out a larger slice of the narrative space.

Firstly, he would use military jargon, in effect to achieve what "Star Wars" had done for SDI - attract attention. Comsats were more exciting as "weapons of peace" that were "mightier than the ICBM." Edsats were more important if converting "missiles into blackboards" could decide the "battle for the mind" being fought "thirty-six thousand kilometers above the equator." And reconnaissance satellites were more palpable when seen as "peacesats" that acted as the "watchdog for the world."[767] Secondly, he would attach the satellite to the human experience. A narrative with humans would feature satellites explicitly. Or a representation of a satellite would be associated with its usefulness to humanity, or to peace, or to the space shuttle. Satellites were a tool to achieve human destiny in space and inversely, use space as a tool for humans on Earth. They were *robotic exploitation* in service of *human exploration*. Humans were the main character in Clarke's satellite representations, either physically present, or benefitting directly. This explains Clarke's insistence on a Mars mission, as it gave a science-fiction proven narrative and long-term, realistically achievable human-centric goal to package his less glamorous, short-term satellite infrastructure goals within, and thus give everything a significant lift in public affinity. "Mars" Clarke would state in 1992, "has always had glamour… It is the only place in the solar system we can live without a major hassle, and which we can foresee terraforming, if we want to, in the next few hundred years."[768] Mars offered the full narrative package, as unlike satellites, which did not "fire the imagination," human space exploration did. And lastly, when all else failed, Clarke would perform an "imaginary substitution," and simply remind his audience of all the satellite applications they took for granted, and that they would lose, if satellites were lost. And if satellites were unglamorous, at least they would be needed, their importance would be understood, and their presence would be perpetuated.

[766] Andrew M. Butler, *Solar Flares: Science Fiction in the 1970s* (Liverpool: Liverpool University Press, 2012).
[767] Clarke, "Star Wars and Star Peace," 276.
[768] Clarke, Interview with Clarke by Andrew Lawler, 30.

> "Individuals, as well as societies, need goals to inspire them; otherwise their existence becomes pointless, and the realization of that fact (whether consciously or unconsciously) results in those psychological and social ills with which we are all too familiar. And however much that mythical creature, the hardheaded, practical man-in-the-street may resent the fact, the most inspiring goals often have no obvious connection with the problems of everyday life."[769]
> "Epilogue" in *First on the Moon,* 1970

Shaping Space

Throughout Clarke's life, he genuinely witnessed the pages of science fiction magazines become reality, and he actively played a role in that endeavor. But Clarke's worldview was one of adaptability in the present, not projection into the future. As Clarke had stated before Congress in 1977: "better is the enemy of the good, and can be very inhibiting to realize, when you are struggling to solve some problem with existing tools, that far superior ones will be along in ten or twenty – or a hundred years. What has been called 'nostalgia for the future' can become an enervating disease."[770] In Clarke's mind, expecting the future to solve your problems today is the wrong move, and the key is to utilize the tools available now, and that tool was predominantly the satellite. By the 1990s, he summarized this operating philosophy well: "No one can predict the future… The best we can hope for, to quote [poet Robert] Bridges, is 'the masterful administration of the unforeseen.' Ride the whirlwind. That's the most we can do. I think one should be optimistic. Then one has a better chance of self-fulfilling prophecy."[771] And that is precisely what Clarke did. Adapt to the times and focus energy on the good parts, a simple strategy, proven effective through a lifetime of driving the peaceful uses *of* outer space using the useful pieces *in* outer space. In 1945, Clarke predicted it would take until 1995 to see a trio of geostationary satellites able to provide global television. It happened in 1965. And there was a lot of improvising in between to keep everything moving forward.

> "This development [the end of traffic and business travel], coupled with the communications explosion, means a total change in the structure of society. But because of the intertia of human institutions, and the gigantic capital investments involved, it may take a century or more for the trend to come to its inevitable conclusion. That conclusion is the death of the city."[772]
> "Beyond Babel," 1969

Find Funders

In 1945, new machinery of war offered Clarke an opportunity. An opportunity to perhaps one day stand on the surface of Mars, and compare it to the vision implanted by H.G. Wells. The "artificial satellite" served dual purposes: A rationale for beginning the "conquest of space" and a way to bring a warring world together. How then, would a young space cadet achieve such a grand proposition? Join forces with a coalition of space age dreamers and convince the weapons builders to build it, the international community to regulate it, and the public to imagine it. From the beginning, the comsat was Clarke's focus, and once he claimed victory that "a major power was now in the

[769] Clarke, "Epilogue," *First on the Moon,"* 376.
[770] *Arthur Clarke Looks at Our Technical Future*, Congressional Record, 37446.
[771] Coll, "Arthur C. Clarke's Red Thumb," *Washington Post,* NASA Headquarters Historical Reference Collection.
[772] Clarke, *Report on Planet Three,* 161.

satellite business," he would expend extra energy to extend satellite development beyond governments and into the commercial sphere, whose involvement would better insulate space from further militarization. With the signing of COMSAT, INTELSAT, and the 1967 UN Treaty, the conditions were set for a benevolent future in space, and Clarke would strive to educate the satellite-illiterate public about the implications to come: a global village of instant communications that demolishes the "present office-oriented society" with the motto of the future, "don't commute – communicate"[773]; "the nervous system of mankind" with the knowledge of humanity made available to humanity, directly in the living rooms of houses and huts; and the stability generated by satellite reconnaissance. As would be seen throughout his career, Clarke would either represent the human outcomes of the satellite, rather than the satellite itself, or he would represent how humans interacted with satellites. Even before the Space Shuttle began its early development in 1969, Clarke was already positioning a reusable shuttle as a means for addressing the reality faced by any well-functioning industry, regular maintenance of equipment: "Nevertheless, space communications may not be wholly reliable until we can have men on the spot; a troubleshooter who knows how to replace a component costing a few cents can put a multimillion-dollar satellite back on the air. There are quite a few dead space vehicles in orbit that could be fixed by a screwdriver and a good mechanic, but are now so much junk costing many times their weight in gold."[774] By the time Apollo 17 returned to Earth, the satellite telecommunications revolution Clarke had been advocating for was realized, and human-created stars proliferated orbit. With a wide diversity of stakeholders now involved, and a social need already established, Clarke would shift his energy toward a deeper exploitation of the newer, more advanced comsats, like ATS-6, that would usher in the "direct-broadcast satellite revolution" and help developing nations "leap frog into the space age."

> "It is not merely an adventure of the body, but of the mind and spirit, and no once can say where it will end. We may discover our place in the universe is humble indeed; we should not shrink from the knowledge, if it turns out that we are far nearer the apes than the angels. Even if this is true, a future of infinite promise lies ahead. We may yet have a splendid and inspiring role to play, on a stage wider and more marvelous than ever dreamed of by any poet or dramatist of the past. For it may be that the old astrologers had the truth exactly reversed, when they believed that the stars controlled the destinies of men. The time may come when men control the destines of stars."[775]
> "Epilogue" in *First on the Moon,* 1970

Learn and Expand

With footprints on the Moon and human space exploration proven feasible, the future appeared infinite in promise, but Clarke would find himself among the masses of space professionals scrambling to reorient their efforts, as "No one had ever dreamed that the first chapter of lunar exploration would end after only a dozen men had walked upon the moon."[776] With Nixon turning away from space exploration, the human relationship with space became one of space *exploitation* in the globalized, Earthbound Post-Apollo Period. A spurn for Clarke's advocacy, the satellite was

[773] Clarke, "Epilogue," *First on the Moon,* 390.
[774] Clarke, *Voices from the Sky: Previews of the Coming Space Age.* "A Short Pre-History of Comsats, Or: How I Lost a Billion in My Space Time," 108-109.
[775] Clarke, "Epilogue," *First on the Moon,* 419.
[776] "The Best if Yet to Come," NASA Headquarters Historical Reference Collection, 27.

perfectly suited to fill the financially strapped vacuum left behind by the end of Apollo. Clarke would reiterates from the start of the period, that "we are beginning the greatest communications revolution in human history," which he uses to shift to the need for reusable rockets, which would allow for the revolution to actually take place, shuttling technicians to fix increasingly advanced satellites.[777] His messaging in this regard remains very consistent.

While the period is marked by the pictorial representations of Earth from space that ushered in a globally minded and environmentally consciousness culture, images taken via satellite, and the satellite telecommunications revolution, of which Clarke acted as a major advocate, perhaps held a greater influence on such astrocultural reconfigurations. The constellations of human-created stars were ready to elevate humanity to the stars, and their services would serve as Clarke's counter argument against the notion of "limits" that emerged. To Clarke, "as far as all foreseeable human activities are concerned, there aren't any limits to growth. The limits are to the rate of growth," and satellites were the force multiplier.[778]

Clarke invests a great deal of the early 1970s advocating specifically for NASA's ATS-6 satellite and SITE, "one of the greatest educational experiments in history."[779] His passion is undeniable, as he expressed an intention to recreate the success he had with comsats in the previous decade: "I would like to see educational satellites spread over the world as swiftly as the communication satellites have done."[780] Edsats that provide direct broadcast educational TV programming can abolish artificial barriers, ensure the "free flow of information across frontiers," open a "window on the world," and even save lives. He highlights Hurricane Camille several times, noting that "a handful of satellites saved the US the casualties of the Vietnam War in a single night," but that the warning alarms raised by the weather satellites would have been useless without comsats to relay the messages.[781] Despite these grand proclamations, his fears of propaganda being weaponized via satellite remains in sharp focus, and he began to ponder whether a truly global television service could create "infomaniacs," a term he coined to describe those in the future who may suffer from the most "virulent forms of news addiction," or worse still, individuals stuck "in a state of drugged placidity" via "the lower electronic arts."[782] But ultimately, and continually, he asserts that the knowledge gained from edsats would outweigh the negative social consequences. So confident in the worthiness of this deluge of information via satellite, he would even accept a transition from human to machine teachers: "I remarked earlier that any teacher who could be replaced by a machine, should be. Perhaps the same verdict should apply to any university, however ivy-covered its walls, if it can be replaced by a global electronic network of computers and satellite links."[783] With an interconnected electronic library soon available, and teleworking a near future possibility, Clarke felt even campuses were not going to be necessary.

As the period neared its end and the Space Shuttle was nearing its entrance onto the world stage, Clarke began adapting to a new landscape. The shuttle was no longer a truly reusable spacecraft, as it was intended to be,

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[777] Clarke, "The Promise of Space" speech delivered at The Institute of Directors in Australia Fifth National Conference, 50.
[778] *Arthur Clarke Looks at Our Technical Future*, Congressional Record, 37446.
[779] *Future Space Programs 1975,* 193.
[780] Ibid., 193.
[781] Clarke, "The Promise of Space" speech delivered at The Institute of Directors in Australia Fifth National Conference, 49; Clarke reiterates that point in his 1975 Congressional testimony, see *Future Space Programs 1975,* 193.
[782] Clarke, *The View from Serendip*, 251, 257.
[783] Clarke, *1984: Spring*, 71.

and Clarke would initiate his efforts on a new solution to the access to space issue, as he had in 1945, beginning his advocacy for the space elevator. And as the brief peak of cold war détente exemplified by the ASTP deteriorated quickly, Clarke would need to prepare for a new, more militarized, and more commercialized version of space, and the two were often at odds with one another.

> "No government will be able to conceal, at least for very long, evidence of crimes or atrocities – even from its own people. The very existence of the myriads of new information channels, operating in real time and across all frontiers, will be a powerful influence for civilized behavior. If you are arranging a massacre, it will be useless to shoot the cameraman who has so inconveniently appeared on the scene. His pictures will already be safe in the studio five thousand kilometres away; and his final image may hang you."[784]
> ("Beyond the Global Village," 1983)

Make the Right Choice

While true to life satellite technicians were now available via the "DC 1.5," the excitement was short lived. Clarke's optimism that space travel was inevitable and that satellites would usher in peace was called seriously into question. The Space Shuttle period can be characterized as a begrudging symbiosis of the military and commercial applications of satellite technology. While the commercialization of space was in full force with Reagan's election, so was an increasingly militarized space, and satellites were the central component, acting as both boons to the private utilization of space and weapons for defense in the late Cold War, as seen in SDI. It is within the debate about the growing militarization of space technology and fears of an escalating arms race that Clarke invested much of his energy, clearly communicating the fine line between the military and peaceful applications of satellites, and emphasizing the reality that it was an issue of "human software" (i.e. a political decision) rather than "military hardware."[785]

In the popular culture, SDI would be labeled "Star Wars," for its science fiction association with laser guns and space battles, and Clarke would directly engage in a battle for that narrative space, shifting attention away from such representations. An underlying element to Clarke's anti-SDI rhetoric was its destabilizing nature, as an arms race, space junk (i.e. shrapnel), and a battlefield in low-Earth orbit would do the opposite of encourage private investment. It would create instability that would directly threaten the entire existing satellite infrastructure. Therefore, Clarke's efforts became aimed at pursuing an option he believed infinitely better than SDI for finally ridding the world of nuclear weapons - remove them from the picture all together. And that would be a political decision. As such, Clarke would counter the new narrative by representing comsats as "weapons of peace" and reconnaissance satellites as *Peacesats, or* "necessary, but not in themselves sufficient" tools to prevent war.[786] Clarke would thus focus upon the "Age of Transparency" that would transpire from a world of "orbiting big brothers" that ensure the verification of treaties and hold leaders accountable.[787] And with that stability, the commercial interests in space could continue moving forward uninhibited by the uncertainty of operating in an active battlefield.

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[784] Ibid., 7.
[785] Clarke, "Shaping Peace," 91.
[786] Clarke, *How the World Was One,* chap. 39.
[787] Clarke, *1984: Spring*, 82.

Ultimately, Clarke would opt to flip the entire Cold War script on its head, and would ramp up his insistence on the peacekeeping potential of a US-USSR joint mission to Mars, that would not only serve to de-escalate tensions, but would refocus the efforts of the weapons builders toward a cause that would be sure to "fire the imagination," and hopefully re-capture some of the luster space exploration lost when space exploitation took the reins. While these efforts would help yield the ISY in 1992, the collapse of the Soviet Union would render SDI obsolete, and shelve a Mars project until an indeterminate date. But the end of the USSR did not spell the end of warfare in space, as the Gulf War came to represent how satellites could be used to make war much more efficient, a realization that Clarke would justify as acceptable, as the war was shorter, less bloody, and the public was given a change to develop a disdain for war with their own eyes, in the comfort of their living rooms. But the Gulf War was not fought in space, as SDI had envisioned. Rather, it was overseen from space. And with the US the last superpower standing, the commercialization of space would grow exponentially, and Clarke was all for it. "May the Best Orbit Win," he surmised, despite the real fear of an over-exploitation of space and the junk that could collect as a result, not to mention the interference to ground astronomy. Clarke remained confident that treaties and regulatory bodies would keep everything under control, and he assumed that when presented with indisputable evidence, provided by the weapons of peace, humanity would hold perpetrators accountable. Nuclear weapons remained, but space was free of military domination, for the time being, and would be the realm of industry for the foreseeable future, exactly as Clarke had been striving for.

> "Yet, bombarded with megabytes, we may simply switch off, or not bother to use these wonderful new toys when their initial novelty has been exhausted. Satellite empires have already risen and fallen… fortunes that have evaporated in mergers and launch-pad explosions."[788]
> *How the World Was One,* 1992

Today, Yesterday's World of Tomorrow

Clarke gained such notoriety as a visionary because the visions he communicated were based in reality, utilized existing technology, and were achievable in the near-future, and thus the expectations he set were regularly confirmed in actual events, at least to a degree. From the satellite, to the global village, to instant face-to-face communications, to private industry providing satellite-based products and services, Clarke's pragmatism was his strength, as he certainly helped push the needle toward the unified, peaceful version of space he imagined. Future space popularizers should take note that driving immediate action means that the expectations need to be immediately achievable. But this near-term pragmatism also caused Clarke to struggle at times to effectively communicate the benevolent exploitation of satellite technology to the proverbial "man on the street." It's true that the near-term wasn't as exciting as Star Wars, and inspiring new generations to become satellite technicians was a much harder sell than becoming space explorers, or soldiers in a galactic struggle. So, Clarke used both when he represented the near-future establishment of a satellite infrastructure, attaching it to human space exploration, and utilizing military jargon. The effectiveness of this strategy is certainly up for debate, but history has shown time and

[788] Clarke, *How the World Was One,* "Epilogue."

again that human spaceflight is the dominant trend in the popular culture for a reason, and future space popularizers would be wise to apply this angle, keeping narratives of space centered on the human element, regardless of how uninvolved they may actually be in the short-term. As for utilizing military jargon, that is questionable. Just as SDI being labelled "Star Wars" created misleading mental images of space warfare with the public, it could certainly happen again. If the goal is the peaceful use of outer space, then associations with warfare could have an unexpected, adverse effect downstream. But as Clarke exemplified, satellites that were engaged in battle, rather than silently orbiting, carrying nobody, and going nowhere, were certainly more exciting. This would be an interesting question to explore in further detail. To what extent do representations of warfare in space popularizations encourage development of said representations, even when framed in peaceful terms.

As seen through five decades as a space booster, Clarke possessed a notably optimistic brand and he would admit that his public optimism was intentional. In a 1981 interview Clarke explained, "If you are an optimist, you have a better chance of making a self-fulfilling prophecy… If you say this is a wonderful world and we can make it better, then there is a chance that people will listen to you and do what you say."[789] This raises one of the more significant contradictions in Clarke's work. While Clarke was sure to raise the alarm when a satellite project had concerning elements, such as propaganda, space junk, and surveillance, his brand would turn the attention toward the positive, not desiring to remain too transfixed on the negative, hoping to avoid "making a self-fulfilling prophecy." Further, he was very quick to accept the bad to obtain the good. Clarke's mission was to keep pushing space travel forward, utilizing near-term satellite projects as his catalyst, and he openly accepted the risks. Perhaps he should have accepted his own expectations, that space travel would be a generational endeavor, and that it was ok to take it slow and do it right. Charging forth at warp speed with positivity blinders on may have been effective, but it could be argued that it was also irresponsible. "May the best orbit win" exudes an assumption that uniform corporate responsibility exists and that space junk is a challenge that can be figured out if regulation fails. Clarke was right that the world is dependent upon satellites, and that the present society would struggle mightily to operate without them, so shouldn't there be more emphasis on stopping space junk before it happens, rather than cleaning it up when it does happen – a reality which feels more and more inevitable with each passing SpaceX launch, ferrying hundreds of cubesats into orbits of all varieties.

Clarke was already thinking through the solution to the space junk problem emerging from the massive commercialization of space in the 1990s, and he even suggested using the very laser technology developed during SDI to accomplish it. Military applications turned benevolent…ish. "It is going to be a hell of a cleanup job for the next century. We may have to put large sweepers up there… They will have to clean up various parts of the orbit. It will be a colossal job. Another suggestion, which is quite interesting one, is using lasers to punch them out into higher orbits."[790] Sure, the cleanup will provide a short-term project, but what if it's insufficient? It's an issue of "human software" at the end of the day, right? As Clarke accepted in 1983, "I wish I could claim that improved communications would lead to peace, but the matter is not as simple as that. Excellent communications - even a common language! - have not brought peace to Northern Ireland, to give but one of many possible examples.

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[789] McAleer, *Odyssey of a Visionary,* chap. 27; quoted from an ABC-TV "20/20" interview with Roger Caras in August 1981.
[790] Bross, "The Clarke Interview: The Godfather Speaks," NASA Headquarters Historical Reference Collection, 42.

Nevertheless, good communications of every type, and at all levels, are essential if we are ever to establish peace on this planet. As a mathematician would say – they are necessary, but not sufficient."[791] Necessary, but not sufficient. The satellite is necessary, for improved communications, saving lives, organizing society, improving accountability, fostering peace, encouraging infrastructure development, but it is not sufficient. Ultimately, the satellites Clarke represented in numerous ways all of these years was really just a component of the human story in space. One wherein satellites provided a service that was unquestionably valuable, and that would give humanity control of their own destiny in the process. Or the loss of control. It's a choice humanity is still deliberating.

In 1995, at age 78, Clarke could rest easily knowing that weapons of peace, not pieces of weapons, orbited overhead, for the most part, for now. As he had written in 1970: "The time may come when men control the destines of stars."[792] By 1995, that had somewhat come true, and those stars were "those that we have created ourselves."[793] Looking into the future, Clarke imagined that "The sky will continue to fill with new stars whose names would puzzle the old-time astronomers – Anik, Palapa, Statsionar, Arabsat, Asiasat … Let us use them well – always remembering that information is not knowledge, and knowledge is not wisdom."[794] The human future is a satellite future. May we gaze upon those stars in the night sky as our means to the infinite possibilities of space rather than those that entomb us underneath an unescapable sky.

[791] Clarke, *1984: Spring*, 10.
[792] Clarke, "Epilogue," *First on the Moon,* 419.
[793] Clarke, *How the World Was One*, chap. 32.
[794] Clarke, *How the World Was One*, chap. 32.

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