

**The Evolution of the U.S. Space Program and its Impact on Society**

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Will O’Sullivan Ayscue  
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On my honor as a University Student, I have neither given nor received  
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Signature \_\_\_\_\_ W. Ayscue \_\_\_\_\_ Date \_\_\_\_\_ 5/2/21  
Will O’Sullivan Ayscue

Approved \_\_\_\_\_ Date \_\_\_\_\_  
Tsai-Hsuan Ku, Department of Engineering and Society

This report's general purpose is to identify the shift of the use of space technology for civilian purposes, in the context of global conflicts and power struggles. In addition, the private industry's role in developing space technologies and the evolution of the public-private partnership will be placed in the context of public and private demand for access to space. This will be done by taking a dive into the American media and its coverage of the space program, highlighting new technologies that have arisen, in the order that they have arisen, as a result of the space program. This timeline will provide context for the public-private partnership between NASA and private industry, and vice versa. Space technologies have transformed everyday life with the invention of Global Positioning Systems, global communication, meteorological forecasting, and much more. All of these technologies have fundamentally changed the meaning of outer space, and what it means to Americans. The questions here are, "how has the meaning of space evolved?", "how has the public's view of the space program changed?" and finally, "How has the public-private partnership changed?"

When the Soviet's put Sputnik I into orbit on October 04, 1957,<sup>1</sup> the United States responded by initiating the National Aeronautics and Space Administration (NASA).<sup>2</sup> This new administration was slated to take over the work on the Vanguard satellite that was being developed by the military. Immediately following the initiation, President Eisenhower made a public statement that NASA would serve both civilian and military purposes.<sup>3</sup> This foreshadowed perfectly the next 60 years of NASA's existence, as well as its prerogatives.

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<sup>1</sup> (Round the World: In 96 Minutes, 1957)

<sup>2</sup> (New Agency Given Bulk of Space Work: Control of Projects Transferred From Defense Department New Space Unit Gets Majority of Program, 1958)

<sup>3</sup> (AIR AND SPACE AGENCY TAKES OVER PROJECTS: Ike Gives It Go Sign Ahead of Schedule, 1958)

As early as 1960, proponents of the space program outlined the benefits to civilians and scientific progress in the arena of astronomy and exploration. Sending a satellite into orbit was just the first step towards colonizing a new planet and the moon.<sup>4</sup> However far fetched these ideas seemed at the time, they grabbed ahold of people's fascination in outer space and man's place in it. One strong argument for pursuing space exploration was that it was intended to satisfy the basic human instinct of curiosity and exploration. Space exploration to many, it seems, scratched the same itch that drew people to national parks like Yellowstone: curiosity.<sup>5</sup>

Despite capturing people's fascination, space exploration didn't offer any immediate benefits or impacts on people's daily lives. NASA's supporters had to defend the budget that was being allocated to these far-out technologies, whose benefits were tenuously suggested. A common sentiment expressed among taxpayers was summed up by an anonymous woman who asserted "I don't know why we're spending so much money to find out what's going on up there. It won't do us any good down here!"<sup>6</sup> This suggests that there was a strong cohort of taxpayers that did not agree with the government's allocation of funds for space exploration. It would take a lot of convincing for these people to get behind the space program, and in the end some would still stand opposed.

Perhaps practical technologies like communication, weather forecasting, and navigation were not on the public's mind at first. NASA had to speculate that transatlantic communication would become a reality, as well as greater weather forecasting accuracy, and further down the road, GPS. The first real civilian application was proposed in early 1960 when AT&T claimed it would put a communication relay into orbit, capable of transmitting phone signals across the

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<sup>4</sup> (Man in Space: The Next Ten Years: An astronomer details, step by step, the expansion of man's horizons in prospect. Man in Space, 1960)

<sup>5</sup> (EDITORS TOLD SPACE EFFORT IS WORTH IT: Gains to Be Great Says Expert, 1961)

<sup>6</sup> (HOW SATELLITES WILL CHANGE OUR LIVES, 1961)

Atlantic Ocean to the United Kingdom. NASA and AT&T envisioned global communication, connecting parts of the world that had never been in direct contact before.<sup>7</sup> To further entice the public, the pair promised a future where British television would be broadcasted in the United States via satellite relays. It wouldn't be until 1962 that the first transatlantic broadcast of TV became a reality, via the TELSTAR I satellite relay.<sup>8</sup> This was a large step for proving the practicality of space technologies, but there was still a way to go. Supporters of NASA's mission suggested that TELSTAR I was really just the beginning and that telecommunications and weather forecasting were the real value of the space program. The implications for the private sector, and its intellectual property rights were called into question around this time.

Just like the actual use of space has evolved from the inception of the space program until today, so have the decision makers, and those with access to outer space. The public-private partnership between NASA and the USAF and private industry companies has changed the way that new space technologies are developed and rolled out.

In the 1960's, the early days of the space program, AT&T and Radio Corp. of America scored contracts to work with NASA to develop communication relays.<sup>9</sup> However, because NASA was helping fund those projects, it would retain the rights to them, and the U.S. government would be able to license the technology to any entity. In these early days of access to outer space, NASA was really the only provider of rockets to these private companies. Out of caution (and because this was a new industry) NASA wanted to keep the market open and not grant either company a complete monopoly of space communication relay satellites. However, as

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<sup>7</sup> (NASA Sees World Phone, TV Service, 1960)

<sup>8</sup> (Telstar Launching Is Only a Beginning, 1962)

<sup>9</sup> (Satellite Building Rights Protected: Reimbursed by AT&I, 1961)

we will see, the practice of retaining the rights to inventions developed with NASA's budget through contractors became common.

Claiming that NASA had been 'grabbing' patent rights from inventors, Robert Galvin the president of Motorola, called for a change in 1961.<sup>10</sup> This shows the first clear detractor of NASA's practice of retaining patent rights of inventions that arose out of their contracted work. Using the hot enemy of the day, Galvin calls this practice "communist." This suggests that he believes the free market, the capitalist perspective, would better serve the space program because when individuals or companies are able to retain their intellectual property, it drives innovation and efficiency. A similar sentiment was expressed by one of the officials at NASA, who claimed the free market was the biggest driver and motivator of the space program.<sup>11</sup> Although this is likely true, NASA did not show this through its patent retention policy. For the time being in the 1960's almost all of the technology developed under NASA projects would remain the intellectual property of the U.S. government. At the time, most of the rocket boosters, weather satellites, and other space technologies were developed through NASA contractors like Lockheed, Douglas, General Dynamics, and Pratt & Whitney.<sup>12</sup> All of those technologies and resulting inventions were retained by NASA.

In the 1970's, transatlantic television was an exciting first for many, but because of its inherent entertainment non-value, a more immediate and practical use for space technologies was necessary to get the general public on board with NASA. Weather forecasting was the first real practical application to civilians, and helped NASA garner public support for space exploration. Two years before the television broadcast, the Tiros II sent back images of Earth's atmosphere,

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<sup>10</sup> (Galvin Assails 'Grab' of Electronic Patents, 1961)

<sup>11</sup> (EDITORS TOLD SPACE EFFORT IS WORTH IT: Gains to Be Great Says Expert, 1961)

<sup>12</sup> (Senate Appropriates More Than \$1.7 Billion In New Space Funds: Included Is Additional \$549 Million Kennedy Asked for Putting Man On Moon; Bill Returns to House, 1961)

delivering some of the first visual data of earth from above.<sup>13</sup> While the images were grainy and not extremely helpful, it did prove the feasibility of predicting weather with untold accuracy. By 1970, NASA had announced it would launch new Earth observing satellites equipped with both optical and infrared sensors to provide civilian agencies with better weather data.<sup>14</sup> In addition, space technologies proved that there were civilian possibilities that had never existed before in the realm of global positioning systems. For the first time, in 1969, an Elk was tagged with a transponder that used satellite relay to track it's movements. However scientific and irrelevant that may have seemed to the NASA critics, it proved that GPS technology was on the horizon and would be another unintended consequence of America's space efforts. Despite having incredibly practical applications for civilians' every day lifestyle, there were still many that were unconvinced of NASA's purpose in the early 1960's. The benefits of space exploration seemed to be forced down the throats of American taxpayers who didn't fully agree with the discretionary spending of the government. The government then had to back up it's support for NASA by attaching the defense prerogative to NASA's objectives.

The Soviet Union had a clear edge in the new found Space Race, and many saw them as the eminent threat to American global power. As the only other space-faring nation in the 1960's, they were also the only other nation with intercontinental ballistic missile (ICBM) technology and nuclear warheads.<sup>15</sup> Tone of NASA's goals now, as put by the US government, was to "wrest space leadership from the Soviet Union."<sup>16</sup> This would prove to be a Herculean effort, but one that the United States could reasonable tackle. The Soviets were at least a few years ahead of

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<sup>13</sup> (NEW WEATHER 'MOON' SENDS CLOUD PHOTOS: Balloon Makes Shots for Comparison New Satellite Transmits Photo of Middle West, 1960)

<sup>14</sup> (Hopes for Improved Weather Forecasting Ride With Nimbus 4 Space Shot Tomorrow, 1970)

<sup>15</sup> (Round the World: In 96 Minutes, 1957)

<sup>16</sup> (SPACE UNIT PLANS 10-YEAR PROGRAM: Will Send Up 260 Satellites -- Manned Flight to Moon Envisioned for 1970s SPACE UNIT PLANS 10-YEAR PROGRAM, 1960)

the Americans in the Space Race, but now the space program was considered the nation's top priority. The Eisenhower doubled down on the space program, increasing the funding for the new Saturn project by \$90,000,000.<sup>17</sup> This shows just how important the United States government viewed the space effort. With this significant amount of funding coming so soon after the Soviet Union proved ICBM technology, it is clear that the US was pushing the space program through with one intention being defense capabilities. The same technologies that put a satellite into orbit can be used to launch a missile from North American soil all the way to Soviet territory.

As a matter of fact, the director of Jet Propulsion Lab stated that the scientific gains from the program did not nearly outweigh the costs. He went as far as to say that the only reason the United States was undertaking this program was because the Soviets were, and that it was a matter of national policy.<sup>18</sup> The Cold War aspect was the real motivator of the funding increases, as opposed to the scientific gains. It is enlightening, especially in the year 1960, that the annual budget for the space program was reaching \$1 billion, and shows even further that the United States was willing to go to extreme lengths not for scientific discovery, but to stay on pace with the Soviets.

Keeping up with the Soviet program wasn't a good enough excuse to spend \$1 billion annually on a program that saw no immediate practical application to society. National pride was also bundled into the promotion of the space program. Should the Soviet's manned mission succeed, and NASA's Mercury program fail, it would certainly be a bitter pill for America to swallow.<sup>19</sup> At this juncture, the American space program was at a crossroads. On one hand, the

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<sup>17</sup> (VON BRAUN GLUM OVER SPACE RACE: Says U.S. Won't Overtake Soviet for 'Several Years' Despite Stepped-Up Pace, 1960)

<sup>18</sup> (SWOLLEN U. S. SPACE BUDGET LAID TO REDS: Senators Told Outlay Exceeds Benefits, 1960)

<sup>19</sup> (Big Changes Due In Space Program, 1960)

U.S. felt the pressure to keep up with the Soviets in terms of achievements in space exploration, but also had to develop space-based defense technologies. The U.S. Air Force considered taking on the defense aspect, which would have put NASA in an awkward spot. They would be outplayed by their own country, while they were supposed to be the preeminent leader in space technology. Soon after the Air Force floated this idea, NASA doubled down, claiming that NASA's funding would be critical to the "security and prestige" of the United States.<sup>20</sup> From this, we can see that the defense and national pride are being rolled into one objective that NASA would satiate through the development of its moon-shot program. NASA soon proves it is capable of developing the technologies to satisfy both objectives by helping the Air Force put a spy satellite into orbit.<sup>21</sup> By 1976, the moon landing fervor had gone, but the Cold War was still on. The space program found itself struggling for funds, especially in the civilian sector. The funding seemed to be directed towards keeping up with the Soviet's military technology advances, which the U.S. space program had been able to keep up with. The space technologies were the only thing maintaining the balance of power.<sup>22</sup> The military did have certain technologies that it developed its self, separate from NASA.

Again, in the 1980's defense became a central object of the space program. President Reagan offered the Strategic Defense Initiative to combat the Soviet ICBM capabilities. The Reagan administration green-lit \$26 billion to go towards developing satellites that could essentially shoot down ICBMs, in a plan dubbed by many as Star Wars.<sup>23</sup> It is clear that space as a platform for national defense, and perhaps the next battleground. The United States government continued

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<sup>20</sup> (Space Effort Is Defended By Dryden, 1961)

<sup>21</sup> (U. S. Puts 2 'Spies' in Orbit Same Day: Satellite Transmits Pictures from Space, 1961)

<sup>22</sup> (SOVIET RESEARCH VIEWED AS THREAT: Pentagon Says the Russians May Pass U.S. by 1980's General Conclusion A Broader Search, 1976)

<sup>23</sup> (The Star Wars debate, 1985)



to support the space program for defense purposes, because of the strategic high-ground it offered. The space program as a whole had many facets, and one technology became a game changer, not only giving the United States a competitive military advantage, but had practical civilian applications too.

The global positioning system (GPS) was developed as a military technology, and then slowly released to the public in the 1980's and 90's. In the early 1990's, consumer GPS technology became available (although rather expensive). This new tech unlocked a world of possibilities for the average citizen in terms of navigation. Sailors as well as motorists were able to prevent themselves from getting lost, as they could pinpoint their location.<sup>24</sup> The Los Angeles Fire Department was also an early adopter of GPS technology as a way to better assist in fighting fires.<sup>25</sup> GPS technology was identified as a life-saving technology.<sup>26</sup> These electronics marked the first time that everyday consumers had access to space technologies outside of the satellite communication relays, and had a real impact on people lives, and their safety. Despite the immediate value that private companies like AT&T, and GPS providers had for the American public, their intellectual property rights were still in jeopardy. This set the stage for the ensuing 30 years as we will explore.

It wasn't until the 2010's that the commercialization of space transport became a reality. The Obama Administration proposed that NASA scrap the over-budget Ares I rocket and Orion crew capsule, and instead award contracts at a fixed cost basis to contractors.<sup>27</sup> The goal here was to create a more sustainable future for NASA by driving down its costs and instead of

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<sup>24</sup> (Sailors set a course with satellite navigation: Yachtsmen can now pinpoint their positions at the touch of a button, 1992)

<sup>25</sup> (New Products In Home Audio Light Up Show: REPORTER'S NOTEBOOK, 1992)

<sup>26</sup> (Where on Earth am I?, 1992)

<sup>27</sup> (Obama Plan Privatizes Astronaut Launchings, 2010)

developing new technologies, rely on the private sector. This obviously marks a turning point in the public-private relationship. On the downside, many within NASA opposed this move because it took away from the institutional knowledge and expertise developed over 50 years. Some of those detractors claimed that this move would leave NASA weak, and essentially restart America's space program.<sup>28</sup> This reveals that NASA had enjoyed the benefits of being the superior beneficiary of the existing public-private relationships thus far in its history, and that now that the balance of power was shifting they were struggling to cope.

As new private companies entered the scene, NASA was forced to hitch its wagon to the private industry of space launch technologies. Remarkably, SpaceX's commercial cargo and crew rocket and capsule was delivered for a fraction of what NASA was projected to spend on a similar project.<sup>29</sup> This shows the might of the free market as it relates to space technology. Interesting to note as well is that SpaceX's Falcon 9 rocket was developed to further cut costs by recovering its first stage. This is an innovation that can most accurately be attributed to the free market.

It is important here to look at one of the root causes for this type of innovation. A revision in patent law resulting from the America Invents Act. NASA now evaluates intellectual property rights on a contract-by-contract basis.<sup>30</sup> Doing this allows NASA to negotiate with the contractor and gives the contractor more autonomy with licensing or otherwise profiting off of their invention. The reaction to this seems to be generally positive over the brief existence of this new patent law. One prime example already mentioned is SpaceX's reusable first-stage booster

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<sup>28</sup> (Astronauts Attack Obama's NASA Plan, 2010)

<sup>29</sup> (Liftoff of Private Rocket To Usher In a New Phase, 2010)

<sup>30</sup> (Parrish, 2013)

rocket. Not only does this innovation save NASA money, but it provides greater access to space by companies seeing to access space.

While outer space beyond the stratosphere has physically remained the same empty void as it has since the dawn of time, the past 60 years has filled it with an ever-changing meaning to the United States and humans all over the earth. The United States' space program was conceived out of a military conflict in order to maintain military superiority, but has grown to provide consumer value whether it be communication, media, GPS, or scientific study, all while maintaining a strategic military resource. In addition, the major players in space have shifted from the United States' civilian NASA, to private companies leveraging the innovation of the free market. If the past 60 years is any indicator for the next 60, then we can expect the meaning of space to evolve to new heights as humankind shoots for Mars and beyond.

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