

**Hypersonic ReEntry Deployable Glide Experiment (HEDGE) Communications, Ground  
and Space**

**The Consequences of Cooperation and Competition between Nations and their Goals in the  
Space Domain**

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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## **Introduction**

In the past century, we have seen some of the greatest advances in technology, especially in the field of aerospace. This progress is epitomized by the span between the Wright brothers' groundbreaking flight to humanity's first steps on the moon. The time between these two significant historical events is only 66 years. In this short time they have been able to make the tremendous leap of barely getting off the ground to then entirely leaving the atmosphere and getting a man on the moon and back. But what is driving these feats of innovation? There can be many reasons to want to push the boundaries of what is possible, but the manner in which you go about advancing technology can change the speed of the progress. There can be the motivation of competition that increases innovation and growth or there can be the cooperation factor. The goals of nations are also a very important part to look at when seeing the impacts of cooperation and competition. My paper will answer whether cooperation or competition is the better way to advance space research and human progress. In this paper, there will be a look into how competition impacted technology during the space race, and how cooperation nurtured progress such as with the ISS, as well as the factors that drove these different strategies of development due to the goals of the nations involved.

I will accomplish this in this paper by using Actor Network Theory and see how different actors cause change within the technological community, and which actors contribute more to this community based on their respective different situations. I will also be looking at the ethics that go along with competition and cooperation. Such as why would one or the other be particularly good in the area of ethics and morales, and potential pitfalls within each mode of progress.

This research is important to see whether countries, internally and externally, should push for more friendly competition within themselves or work harder to collaborate with each other even if there are obstacles to do so. The question I will answer, with regards to competition and cooperation, is which style of motivation seems to be the most beneficial to research and advances in technology.

### **STS Framework**

As previously mentioned, the main framework used in this research is the Actor Network Theory, or ANT. Andreas Birkbak states that, “agency is not a human privilege, but something that emerges in networks of relations between humans and nonhuman alike, thus the name actor-network theory” (Birkbak, 2023). This means that all actors within a system are related to each other in a network. These connections within the network are what we can look at to observe how the actors behaved. ANT states that actions taken by actors are the direct result of the connections with other actors in their network. Actors can come into that network and evolve connections between relations, which will be important for looking at development of technology with my given certain conditions, competition and cooperation.

There are whole countries full of actors that could be specifically looked at to see what happened during the Space Race and with the coming of the ISS. ANT allows for a broad understanding of events and actors but also can become very personal and on the micro scale. The networks can become very complex with a whole research paper solely focused on the actors just for one spacecraft launch.

This theory is good for this particular project as it allows for a look at the different relations between actors, such as the US and USSR and we can see why they behaved the way they did due to other actors that come into play. After looking at what caused what, it becomes

easier to decide whether a certain form of working, whether it be cooperation or competition, is the better option. While using ANT, one can look at the time frames between actors that were created and use this to see progression of technology. Then, after examining actors that influenced this progression, one can see how exactly the competition or cooperation motivated the progress. I will also look at the actors in the beginning such as the USA and USSR for example and look at how they were doing before and after each network system took place. This allows for a comparison between their technological stature before and after each period. Cooperation can be analyzed in the same way. ANT helps show the intricate networks of actors that work together in order to advance space technology. Overall, ANT can be used to bring in actors, living in non-living, to help show how human technology has changed during times of competition and cooperation, leading to a better understanding of which method of progress could be better.

### **Competition**

Firstly, the competition motivator component will be looked at. The Space Race was a period of high tension and strong drive to dominate the space domain. The actors were set up to compete on a global stage. The two biggest actors being the United States and the Soviet Union. The competition between the US and the USSR had both positive and negative impacts on the development of space technology and the advancement of human knowledge.

What sparked the space race is a complex question and can be attributed to many things. With the ANT framework, we can choose specific actors and see how each one played their part in the overall network of competition and the Space Race. The nuclear bomb, one of the most feared weapons on Earth, was an actor in starting the Space Race. Both sides of the race had achieved successful test and production of atom bombs. Now that both sides had them,

domination seemed more far fetched, as one country could blow up another. Walter McDougall states in, *Sputnik, the Space Race, and the Cold War*, that, “first, the world was entering an era of nuclear stalemate, hence peaceful coexistence, in which Cold War competition would turn on persuasion and influence as much as conquest and subversion” (McDougall, 1985). This means that one would have to find another way besides simply having a bigger bomb to convince the world you were stronger. They had pushed the limits of atomic technology at that time, and now looked into another sector to show their strength, space. Each country felt they had to compete. American capitalism versus Soviet communism. Each side had to show to the globe that their values and way of life was the more advanced and productive way. It seemed like the winner of this realm would convince all the other countries to come join their side against the other. The world was watching.

The main clear actors are of course, the US and USSR. Some smaller non-human actors, that are from the beginning of the space race, are satellites and other early technological innovations. These inventions sparked many significant events in history and are not to be neglected when looking at what happened between the countries that pushed each other to be better and progress in civilization. One of the largest actor-actor interactions is from the USA and Sputnik, a satellite launched by the Soviets in October, 1957 (Getchell, 2024). Sputnik scared the US about how advanced the USSR was. Khan Academy says that, “in response to perceptions of Soviet technological success, the National Aeronautics and Space Administration (NASA) was established on October 1, 1958” (Getchell, 2024). This means that the Sputnik actor affected the US and directly influenced the decision to create NASA. This creation of NASA led to a shift in the trajectory of the US and the world in the area of space. NASA would have most likely come at some point as space travel was inevitable, but the significance of

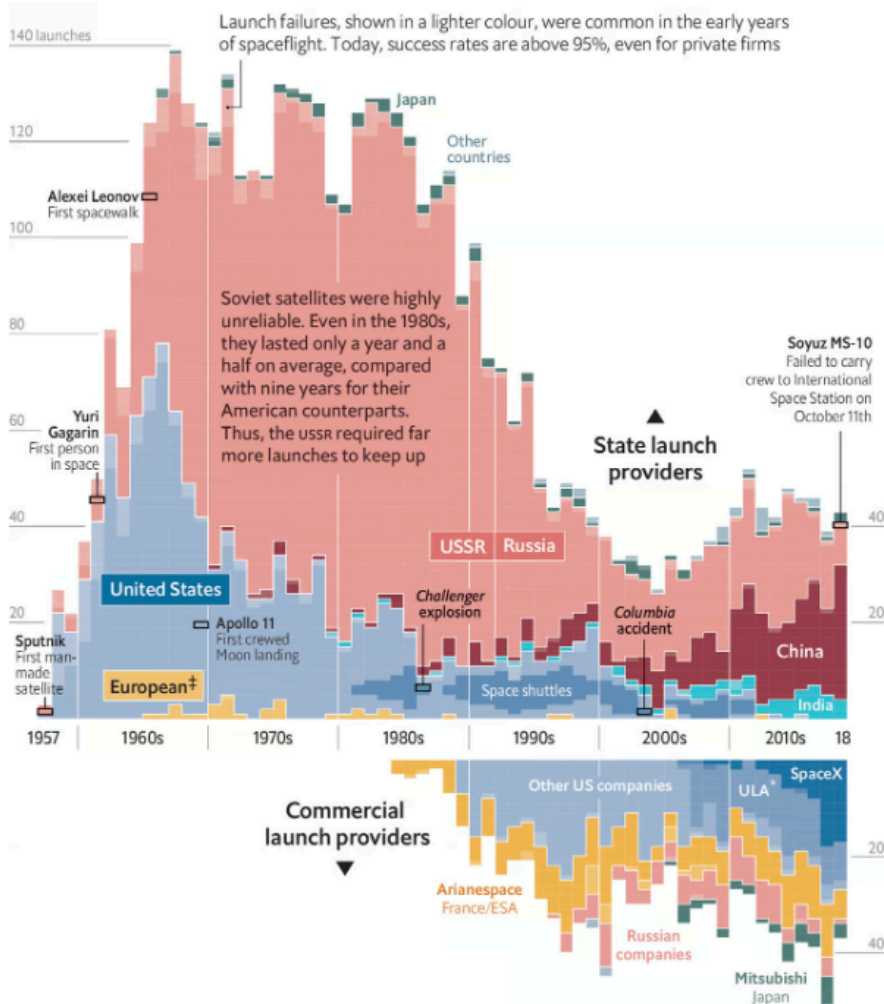
NASA being made in response to the USSR spurred the mission of the organization to have some aspect of competition with this foreign adversary. This competition, in turn, led to many innovations and advancements.

One of the main benefits that come from having competition is the pace at which things happen. When a person is constantly comparing themselves to someone else and sees that they are lacking in one way or another, they do not take time to prove or show that they can do something better or at least be on the same level as the person causing this sort of jealousy. If the fear or somewhat of hatred is strong then the progression or speed at which things happen increases proportionally. We can see this with NASA and how fast it was created after sputnik. Pretty much exactly one year passed after Sputnik for the US to put together and announce a whole organization. But even faster was America's first response to the USSR with the creation of their own satellite which came before NASA was organized. The US ordered the Army to produce Explorer 1. NASA states that, "Explorer 1 was the first satellite launched by the United States when it was sent into space on January 31, 1958" (NASA, 2010). This was a massive turnaround time for a space mission. Around 3 months between launches from the US and USSR. A prime example of how competition drove the US to make something in such a quick amount of time. This is a sign of things to come for the rate at which things would be pushed for within the US.

Emphasizing the increase in spending and speed of launches is a figure put together by The Economist with data from the United Launch Alliance. Figure 1 below, shows the amount of launches to orbit or beyond in an easy to see graph. Each square represents a different space launch, whereas each color represents a different country or company.

## Space launches

To Earth orbit or higher, at October 11th 2018



**Figure 1:** Space launches of different countries and companies up until 2018 (Economist, 2018)

On the very left is the first man-made satellite, Sputnik. Then going to the right there is a significant increase in the amount of launches. This helps demonstrate the fact that there was a driver that caused this increase, that being competition. Then as the Space Race came to a close, so did the amount of state run space launches. One can also notice a drawback of competition

from this figure. The lighter squares in the graph represent launches that were unsuccessful in one way or another. There are much more successful launches in the years after the mass launches during the Space Race. Now this could be caused by many factors such as simply better technology. But it could also be from the fact that things were so rushed to be launched into space that mistakes were made. Deadlines were pushed hard in order to be the ones who innovated faster. Which can often lead to lack of preparedness, unnecessary risk taking, and sub-standard quality checks.

McDougall also stated that John Kennedy, “was sensitive to the importance of U.S. prestige and of reassuring the NATO allies of U.S. technical supremacy” (McDougall, 1985). This highlights another big important actor, which is not directly a part of the US Space Race, but contributes to the drive of the US, NATO. An organization like NATO needs strong members in order to “recruit” countries to their ideals and maintain power. This drives the US to want to stay a strong member and show that countries that are not in NATO or aligned with its values, like the Soviets, are the inferior ones. Along with this, McDougall states that on, “May 25, 1961, Kennedy called for the United States to place a man on the moon before the end of the decade” (McDougall, 1985). A clear example of how competition, and the pressures that come along with it, created a goal and a statement on how advanced US technology is, and will be. With this conviction to be better, things were set in motion to increase space technology so much as to land a man on the moon and then get them back to Earth safely.

### **Today’s Impact**

Looking at how competition has driven industry and technology in the past is interesting, but how does this help us for today’s world? Seeing what increases and what decreases when people are in a competitive environment is very important for determining whether competition



is better than cooperation. There is not a massive competition like the Space Race right now, but there are many competitive environments that could be looked at to see if cooperation would be better. Today, many private companies all compete for a contract from the US government. Is this a good thing, or would it be better for the government to get the companies to work together on a contract. From what we know, competition drives many things up. Production rates increase, as can be seen in Figure 1 when looking at the amount of spacecraft launches. Timeliness increases, as seen with the expedited nature of US's response to Sputnik and their launch of their own Explorer 1 satellite. In terms of competition specifically for a contract, cost also goes down, as the contract likes to go towards the company with the lowest cost for the government.

## **Cooperation**

For the cooperation side, the International Space Station (ISS) is a glowing example of international research and collaboration. Examination of the ISS shows the contributions and advances made to space intelligence from working together, but can also show cooperation could have limited progress during this time. First let's look at why this is such an important case when thinking of what to look at for a model of cooperation. There are many countries that have worked on the station and in it. It is, "the largest space station ever constructed, the ISS continues to be assembled in orbit. It has been visited by astronauts from 18 countries—and counting" (NASA, 2023), NASA says. This is one of the most involved and well known cooperation efforts of history, especially in the area of space, as many who are reading this have probably heard of the ISS.

Identifying the actors involved in the beginning of the ISS involves looking at who was a part of it, what came out of it, and what caused those advancements. The first main obvious

non-human actor is the ISS itself. This spacecraft is quite large and took many years to develop. The official ISS website says that, “The space station is approximately the size of a football field: a 460-ton, permanently crewed platform orbiting 250 miles above Earth. It is about four times as large as the Russian space station Mir and five times as large as the U.S. Skylab”, (ISS, 2024). In this quote we can already see an indicator of how cooperation can affect things. The last sentence about the sizes compared to what each country had by themselves is important to note. From this, cooperation has led to a much larger space station. Size differences in space have a larger impact than size differences on Earth. Every pound of material costs an immense amount of resources to send up to space. Without cooperation, the ISS would be a very impressive but burdensome feat.

The next two actors are the countries that first decided to start the project. They are once again the USA and then Russia this time instead of the USSR. The first ISS segment was launched by Russia in 1998 stemming from construction by the US starting in 1984 by order of Reagan (Uri, 2020). This parallel of main actors from the competition case study helps us maintain some constants while looking at progress of technology for different methods of progression. Since the US and Russia, what was the USSR, are the same for both studies it makes it easier to see what made them change their minds about their different strategies for existing with each other.

One of the reasons for the change of strategy was the change of view of what was seen as strong in a nation in general. War became less popular for many reasons, and international treaties and trades became more desirable. So, the US wanted to continue pursuing the path of being a mediator and a figurehead in international cooperation. Walter McDougall writes in his book, *The Heavens and the Earth, a Political History of the Space Age*, that America wanted more cooperation, “so as to enhance its position as a leader in the peaceful uses of space”

(McDougall, 1997). This position leads to more power to the US. It would give the country more authority to control what gets worked on and will cause large projects to be organized by the US and therefore serve the needs of what they want. Another point from the previous quote is about how cooperation is associated with peace. Peace can be a cause or an effect from cooperation. Regardless, peace is maintained much more sustainable when there are actors that are important to each nation, being controlled partly by the other nation. When there are ties of a large project like the ISS, it brings another factor and complication into play when deciding if you would want to anger or invade that nation. Communication is also nurtured when not in a competitive state of mind. A good piece of relationship advice is to just communicate with your partner. The same holds true for countries. Communication solves many problems.

Cooperation conserves many resources. With the Soviet Union going through a collapse, resources were not as readily available to be spent on space research. With the passing of the Space Race, both actor nations, the US and Russia, decided maybe it was time to spend less money on space domination. With less spending, it does not necessarily mean less progress. As can be seen with all the advancements for humankind that was done on the ISS. Each country spent less money than they would have if they were working alone and against each other, and were able to all share in the benefit.

Cooperation leads to bonding between nations and nurtures relationships. In 2004, Lambright stated that President Bush said that, “We will finish what we started. We will meet our obligations to our 15 international partners” (Lambright, 2019). At this time, many difficulties were plaguing space exploration. If the US was alone in its venture to space, Bush might have scrapped that particular program, but due to the cooperative environment the US felt obligated to continue and push forward. Not only does collaboration lead to bonding, but it also leads to the

union of many smart minds working together. With more freedom to disclose information and the ability for some of the smartest minds in Russia to work with the smartest minds in America.

## **Conclusion**

This paper has looked at different actors within case studies to see how competition and cooperation lead to advancement of technology but also the secondary effects of each. The two case studies of interest were of the ISS for a look at cooperative benefits, and the Space Race for a look at competition benefits. Competition and cooperation both have their pros and cons. Yet which one is better for the advancement of technology? This is a very hard question to answer and requires consideration of many factors. Some factors include the environment and culture of the globe at that time. Sometimes, cooperation will just not be available or feasible. Some countries are closed off to sharing technology or resources or see it as a threat to their public security. Some simply do not want to work together. Like how the US and Soviet Union were. I think that there should be a mix between the two. For example, cooperation should be used on an international level. Relations will improve between nations, cost to each nation goes down, sustainability increases as it's not solely on one country, knowledge of more nations increases, and the best minds from each country can work together. On smaller scales, competition seems like a viable and beneficial idea. Internally, within the US, companies competing against each other will not cause a war or degrade relations within the US or outside the US. It has the benefits of having people still drive for excellence, drive for efficiency, and pushes people to produce quality items on a sometimes condensed time frame. It would be interesting to do further research into how one can initially have competition to decide on a model for a technology, such as a new plane design, and then have companies within the US switch to cooperation and have them all work together saving money and grouping talent together. Complete cooperation

between private companies would merge them all together and would allow for all the resources and talent to be in one place. This however is a monopoly and would cause the US to have to choose this one super company and that company could charge whatever they wanted to the United States government. This would be very not beneficial to enhancing cheap and good progress.

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