BENCHMARK 2

OBJECTIVE 1

In this objective we touched bases on different space programs nations have around the world. You will read about space programs the United States, the Soviet Union and the post Soviet Union now Russia had and have up to now.

Space Programs in The USSR / Russia and the United States

United States

NASA

The National Aeronautics and Space Administration (NASA) was established on October 1, 1958 by Congress and the President of the United States. It was created because of issues dealing with national defense. During the Cold War, space exploration became a major contest between the Soviet Union and the United States and it became known as the "space race". There were several attempts to pursue research and rocketry and upper atmospheric sciences and the Soviet Union was not far behind.

On October 04, 1957 the Soviet Union launched *Sputnik 1*, the world's first artificial satellite. The American public were surprised and even looked down at what seemed like a technological gap in the United States. Soon thereafter on November 03, 1957 the Soviet Union launched Sputnik 2 carrying a living creature, a dog Laika. Immediately after, the United States launched its first satellite, *Explorer 1* on January 31, 1958.

As a result of Sputnik, NASA was created and soon several operations centers were constructed. NASA's first twenty years consisted of several major programs:

- Human space flight initiatives: Mercury's single astronaut space program - to determine if a human can survive in space; Project Gemini - two astronauts practice space operations such as meeting and docking spacecraft and extravehicular activities (EVA); and Project Apollo - to explore the moon.
- "Robotic missions to the moon (*Ranger, Surveyor, and Lunar Orbiter*), Venus (*Pioneer Venus*), Mars (*Mariner 4, Viking 1 and 2*) and the outer planets (*Pioneer 10 and 11, Voyager 1 and 2*)".
- Aeronautics research to improve air transport safety, dependability, efficiency, and speed.
- Remote-sensing Earth satellites for gathering information.
- "Application satellites for communication and weather monitoring."
- Orbital workshop for astronauts, *Skylab.*
- A spacecraft that is reusable for traveling to and from the Earth orbit, the *Space Shuttle.*

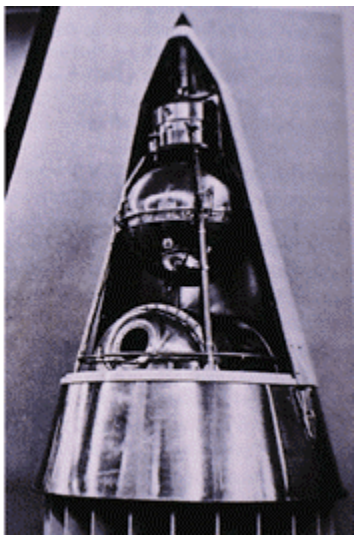
Department of Defense

The Department of Defense handled most of the military space missions. Its activities were not as visible as NASA, but it is an equally substantial program. The purposes consist of developing new early warning and missile tracking satellites and managing military and intelligence activities in space. It also manages launch vehicle development, communications satellites, navigation satellites, weather satellites, reconnaissance satellites, developing capabilities to protect the United States, satellite systems, and deny the use of space to enemies.

DoD initially developed the Delta, Atlas, and Titan. In 1994, the Clinton Administration policy gave DoD the responsibility of maintaining the expendable launch vehicles (ELVs)

Soviet Union

The USSR's quest for supremacy over the military expanded to space. The USSR had launched more than 75 spacecraft per year, which is a rate of four-to-five times that of the United States. The annual payload was ten times more than the United States. This represents how important the Soviets felt their space programs were. However, this also shows weakness when it comes to longevity and flexibility because the rapidness of deployments limited the capabilities of the satellites.



http://www.iee.org/OnComms/Sector/Computing/Article_Display.cfm?ObjectID=B5E30B78-9F2E-4051-A54FCDA38CB803C9

Since the successful launch of *Sputnik 1* in 1957, the Soviets were determined to use space for military purposes. The start of military uses of space by the Soviets started in 1961 when they launched their first photographic reconnaissance satellite. Through the 1960s and 1970s the military space programs expanded. Soon they had the capability to threaten low-altitude US and allied satellites.

USSR invested heavily in three widespread space assembly and launch complexes at Tyuratum, Plesetsk and Kapustin Yar. About 85 percent of the Soviet space launches were exclusively military or joint military/civilian missions.

Soviet manned space missions became increasingly complex and formed the most widespread element of the Soviet space program. The Soviets put seven space stations in orbit.

Some of the USSR's future development of space weapon systems involved a generation of anti-satellite vehicles, and a very large energy research program including the development of laser- beam weapon systems. The ASAT system, which was built by the Soviets was capable of seeking and destroying US space systems in near-earth orbit.

The majority of Soviet military space programs had been designed to support terrestrial military operations. However, the development of anti-satellite system extended to being capable of direct space warfare operations.

The Benefits of the International Space Station

Space has been an area of military competition for sometime but there comes a time and place in which the benefits of a country, and individual mean nothing and the main focus of a mission is how will mankind benefit from this? This is what scientists are doing in the International Space Station or I.S.S; they are conducting experiments as you read this that will forever change the way we live. Imagine a place where viruses are no more; cancers will have a cure, world hunger will be abolished. Such a place sounds delightful to live in, all of this can and is being achieved by the research the International Space Station is fostering.

The I.S.S. has studies involving the growth of complex protein crystals in low gravity environments (Space Station Benefits). All of these studies are mainly done in space due to reduced gravity, here on Earth any crystal growing is affected by gravity. They tend to grow

impurities and imperfections, this takes away from the overall strength crystals will have. The importance of crystals (to the human body) is immense, without them important bodily functions cannot be achieved thus creating complications in how the body works. One way and possibly the only way to be able to grow a crystal free of imperfections and impurities is to grow them in the space where gravity will have a lesser impact in the way the crystal will grow (Protein Crystal Growth). This will give us a more pure crystal, a crystal that has grown to near perfection; a near perfect crystal will benefit us in the following ways:

- Having a near perfect crystal will allow us to gain a deeper understanding on the basic building blocks of life; they might give us answers in how life can be started in different planets or how life got started here on Earth.
- They will give us much more pure pharmaceutical drugs that can help treat illness otherwise untreatable by today's medicine.
- Also, these near perfect crystals will give us a new and more effective way to deal with deadly viruses. (Aerospace/Space Station Benefits)

Having these new advancements will be of great benefit to the masses, just imagine an Earth where AIDS, HIV, and cancers will have a cure, people would be given a second chance to live, there's nothing greater that the gift of life.

Protein crystal growth is not the only focus on the I.S.S., there are also studies that look into how humans react to prolonged stays in space. The main emphasis of this study is to learn about the human body and how it functions, it is known that having prolonged exposure to low gravity does some harm to the human body. For example when astronauts live in space they tend to grow about an inch or two, this happens because of the reduced weight bearing down on the spine. Here on Earth the spine is compressed down because of gravity, so when they are exposed to reduced gravity the spine elongates (Aerospace 101). This of course has no harm on the

human body but other thongs do like the loss of muscle mass and bone mass. Low gravity affects muscles and bones in the following way, the reduced amount of gravity gives the muscles less weight to support as do the bones so in return they lose mass once this happens astronauts get weaker, and their bones become brittle meaning that once they return to Earth they are more likely to break bones. The circulatory system is also affected. The heart has less work to do since it is in space and it is easier to move things around the body, but this causes a problem, the heart shrinks because of a reduced workload. This knowledge is crucial; once humans start colonizing space we must know how to counter the loss of bone, heart, and muscle mass (Living In Space). The research that is being done onboard the I.S.S. will lead the way into future missions to the farthest regions in our solar system.

Apart from all of the benefits that humans are gaining thanks to the I.S.S. something completely different is being researched in the I.S.S. it is the mixing of materials in space. We have all seen salad dressing where the heavier materials sink to the bottom, lighter materials float to the top and there is usually one thing in the middle that is neither heavy nor lighter than the other materials around it. The reason why I put this example in front of you is to illustrate a type of study that is being conducted in the I.S.S. that is called material science. Its main focus is to create better metal alloys and more near perfect materials to use in things such as computer chips (Aerospace 483). The reason why this type of science is mainly done in space is partly due because here on Earth we have this thing called gravity, just like the salad dressing example any two or more materials mixed are affected by gravity, it impedes the materials from mixing properly, thus making the final product weaker if it were a metal or less potent if it were a pharmaceutical product. With every success this science has it means the well being of many humans and the bettering of industries that will benefit from having these near perfect materials and substances.

In conclusion having from the initial construction of the International Space Station, the project would reach goals never before achieved, it has taken the international cooperation of 16 nations throughout the world to construct this laboratory in the heavens. This international cooperation has brought new discoveries to light that benefit all of mankind. Having a better understanding of space will help all of us in future missions that will involve the participation of ordinary people. Having the access to almost perfect crystals will enhance the field of medicine greatly, and as for material science with our society that is obsessed with technology having chips that are built to near perfection will allow us to have faster and more reliable computer components we can trust and depend on. Basically the I.S.S. is allowing scientific breakthroughs and I believe it will to continue to deliver the way it is for years to come.

References:

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"Living In Space." 23 September 2004. 18 March 2007. http://www.esa.int/esaHS/ESAGO90VMOC_astronauts_0.html

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Sellers, Jerry J., et al. Aerospace Science: The Exploration of Space. U.S.A. McGraw-Hill, 2003

OBJECTIVE 2

In this objective treaties and other agreements that deal with space will be examined under the perspective of the two nations we have identified in objective 1.

The 1967 Outer Space Treaty states in simple terms that the use and exploration of space will be conducted for peaceful purposes, as well as that the Moon and other celestial bodies, as well as any region in space, cannot be claimed by any one nation alone. It also states that the use and exploration of space is to be conducted for the benefit and interest of all countries, regardless of their degree of economic or scientific development. The treaty states that States parties, which sign the treaty, will continue to be involved in activities involving the exploration and use of outer space, which correspond with international law, including the Charter of the United Nations in order to maintain and uphold the promotion of international peace and security, as well as international cooperation and understanding.

One of the most notable of the articles in the treaty is Article 4, which states that nations in accordance with the treaty will not place any objects in orbit containing nuclear weapons or other weapons of mass destruction. It also states that nations will not install any such weapons on celestial bodies, or station in space any such weapons in any other manner. It also states that the Moon and other celestial bodies will be used exclusively for peaceful purposes. Finally, the section states that the establishment of military bases and outposts, as well as the use of military personnel for any reasons is strictly prohibited.

The next section, Article 5, states that all astronauts will be respected as envoys of mankind in outer space, and will be rendered all possible assistance in the event of accident distressed or emergency landing on the territory of another state party or on the high seas, regardless of their respect of nation. It also states that the astronauts of one nation will render assistance to the astronauts of another state party. Last, the treaty states that in the event of any phenomena which occurs in outer space, possibly resulting in the death or injury of astronauts that they immediately inform other state parties to the treaty or the secretary general of the United Nations.

Nations that sign the treaty agree to bear national responsibility for any national activities, which take place in space, whether or not these activities are carried on by governmental or nongovernmental agencies.

The outer space treaty of 1967 therefore promotes the overall cooperation between all nations which agreed to comply with the treaty. Therefore, this treaty was able to bring about a new age of cooperation amongst several nations. Among the several nations that agreed to sign the treaty the most prominent of these were the United States, the Soviet Union, China, Japan, Australia, Canada, and many European nations (later members of the ESA). The treaty brought an end to competition amongst nations with space programs, and brought a halt to the direct concept of militarisation of space.

The second thing the treaty brought about was the cooperation of astronauts of different countries in space, as well as an agreement to provide for the needs of all astronauts no matter what their national origin. The signing of the treaty also ensured that only civilian personnel would be sent for research and exploration into space. This helped decrease hostility with the known fact that military personnel would not be able to go into space, potentially starting a new age of space war and competition.

In this sense the treaty was able to provide for peace and security among the citizens of the signing nations. The start of this cooperation made it easier for scientists to consider the benefits science could make for further research in space.

Rescue and Return Agreement, 1968

The articles of the Rescue and Return agreement states that should any nation which is a contracting party discover that the astronauts and personnel of the spacecraft of any nation have suffered or are experiencing any conditions of accident or distress, or that the said group of

personnel has made an emergency or unintentional landing in any place under that nation's sovereignty, on the high seas, or in any area not part of that state's sovereignty, that that nation should immediately take action by notifying the launching authority, making an immediate public announcement, immediately notifying the Secretary General of the United Nations. These articles also state that should the personnel of the spacecraft of any nation land in another nation's territory, that the said nation would render all possible and necessary assistance to them. Also, according to the agreement, the nation will inform the launching authority and the United Nations with the steps that it is taking, as well as the progress it is making to rescue and assist the said astronauts.

In the later articles of the agreement, it is stated that the same actions described in the earlier articles of the agreement will take place in the event that should the space objects of a nation, such as satellites or spacecraft, be discovered by another nation. This includes the recovery and return of any foreign space objects discovered in the territory or on the high seas of any signing party. Finally, it is stated that the expenses of any rescue and return operations shall be borne by the responsible launching party.

The nations that took part in this treaty, therefore, were guaranteed the sound of mind that any astronauts, personnel, or space objects that were captured and recovered by another nation would be returned to their own shores. However, on the contrary, if a nation were to capture the technology of another party, it would not be able to take this technology for use in its own space programs, as all objects from space would be immediately returned to the launching party. Therefore, the Rescue and Return Agreement of 1968 helped to promote peaceful cooperation among nations, but in a sense, limited competition among them.

Convention on International Liability for Damage Caused by Space Objects, 1972

According to the articles found in the convention, it is stated that a nation is absolutely liable for any damages caused by its space object. This consists of any damage caused to the surface of the Earth or to aircraft in flight by a nation's space object. It is stated that should damage be caused elsewhere than the surface of the earth, the damage shall be liable only if the damage is due to the fault of the party held responsible. In the event of joint projects between two or more nations, the nations held responsible will be considered equally liable for the damages caused. In this sense, the convention helped to ensure the compensation of nations that suffered damage from space objects.

Due to the many different scenarios of liability discussed in the convention, nations were ensured that they would be compensated for any damages caused by space objects, to the earth, to aircraft, or to the space objects of other nations. Due to the agreements in this treaty, nations could be safely assured that damages caused by space programs would be held liable. However, by signing this treaty, nations also stated that they would be held responsible for damages caused by their own space programs.

Convention on Registration of Objects Launched into Outer Space

Nations that agreed to this convention stated that they would maintain an appropriate and reliable registration of all objects launched into space. They also agreed to inform the Secretary-General of the United Nations that they had established such a registry. In the event of a joint project between two or more nations, it was agreed that they would decide amongst themselves

which nation would register the said space object. It was also stated that the Secretary-General of the United Nations would maintain a register on space objects with full and open access.

By signing this treaty, all nations who took part in the convention stated that they would keep a written registry of all objects they launched into outer space. It is stated as well that they would inform the Secretary-General of the United Nations of their registries. In agreeing to this treaty, the signing parties eliminated all possible secrecy of objects launched into space between other countries. Therefore, this treaty helped to even further spread cooperation between foreign space programs, and bring it into competition in the final frontier.

US/USSR Agreement

The parties who agreed to the signing of this treaty stated the beginning of an age of cooperation in the use and exploration of outer space for peaceful purposes. The parties who signed (US and USSR) agreed to develop cooperation in the fields of space meteorology, the study of the natural environment, the exploration of near Earth space, as well as the Moon and other planets, and space biology and medicine. They agreed to take all appropriate measures to encourage international cooperation. The parties also agreed to carry on with such cooperation by means of mutual exchanges of scientific information and delegations. Finally, the parties who signed the treaty agreed to carry out projects for developing compatible rendezvous and docking systems of United States and Soviet manned spacecraft and stations in order to enhance the safety of manned flight in space and to provide the opportunity for conducting joint scientific experiments in the future.

When the US and the USSR signed this agreement in 1972, they agreed to encourage international efforts to resolve problems of international law in the exploration and use of outer space for peaceful purposes. This was the final act of a long list of treaties, agreements, and conventions to bring about an age of international cooperation in outer space use, research, and exploration. The treaty also helped to finally end public fears of space competition and confrontation.

Sellers, Jerry J., et al. Aerospace Science: The Exploration of Space. U.S.A. McGraw-Hill, 2003

OBJECTIVE 3

In this objective we examine how we can deal with space security that are not outlined or mentioned in treaties already set into place by nations around the world.

Space Based Weapons

Space Based Weapons are the objects in orbit that can be used to attack targets on the ground or other objects in orbit. They differ from Space Based Defenses in that the Defenses are used to prevent space objects or targets on the ground from being destroyed, and the Weapons are used to destroy these targets. The problem for security and nonproliferation is when 'defenses' acquire offensive capabilities by virtue of their design. Such ambiguity should be avoided because of the desirability of proper classification of space objects.

An example of a space-based weapon is a missile platform capable of targeting objects on the ground or in space. An example of a space-based defense is a missile platform capable of targeting other missiles. The similarity of these two examples presents a problem when classifying space weapons and space defenses. If the so-called 'defensive platform' can target

objects other than missiles, is it not then an offensive platform used in a defensive role? Furthermore, even if the satellite is designed only to target other missiles, some minor reprogramming would no doubt enable it to attack other satellites or even ground targets, (depending of course on the type of missiles used). This does not apply exclusively to missile based satellites either. Any of the orbital weapons now being devised could present a threat, from the 'lasers' to the satellites that launch meteor-like objects. [1] The only real difference is the intent behind the weapon.

1) http://www.space.com/businesstechnology/technology/space_war_020515-1.html

OBJECTIVE 4

Using the treaties we identified in objective 1 we will touch bases on how different nations adopting these treaties feel (from a policy standpoint). The main focus is on the joint projects developed over the years for peaceful purposes.

Current space programs include nations such as the United States, the former Soviet Union (Russia), China, Europe (ESA), Japan, Canada, and Australia. These different nations have each developed their own policies, which correspond, with the many existing space treaties. Some of these respective nations are either helped or limited by the different policies in these space treaties.

The United States, among many nations, is one of the current leaders in the space program community, as well as being one of the main forces behind the development of the space treaties. In response to the growing demand for cooperation in space research, the U.S has jumped aboard several joint projects, such as the MIR space station and the International Space Station.

Russia has also been eager to jump aboard several of these joint projects, most recently the International Space Station. The beginning of this cooperation with other nations began with the rendezvous of the Russian Soyuz 1 and the American Apollo spacecraft in 1975. Later was launch and manning of the MIR space station, which made a rendezvous with an American shuttle in 1995. And more recently is development and deployment of the International Space Station which has been visited on numerous occasions by the US space shuttle and inhabited by US astronauts.

The ESA is yet another of these corresponding organizations. The European Space Agency which was established in 1968, is the joint effort of several European countries. Together, these nations, including predominantly Britain and France, have launched several satellites, using Ariane launchers.

China is a recent addition to the list. With the help of several other nations, the Peoples Republic of China has launched several satellites over the past few years, the first of which is China 1. China was the fifth nation to launch its own satellites.

While Canada is no newcomer to the use and exploration of space, it has had a steadily increasing space program as the fourth nation to launch its own satellites. Canada has been a part of several joint launches with the United States over the past several years. Their main goal is currently geared towards international telecommunications.

By the 1960s, Australia had already become one of the leading nations in space research, becoming the seventh nation with its own satellite in late 1967. Its Woomera test range has been used by several nations for their own space programs. It has continued to be a sight of joint cooperation to this day.

Last but not least, Japan has slowly become a recognizable force in the space industry. Although previously limited by international laws after World War II, Japan did launch “Pencil”,

its first rocket. Japanese goals for the future in space have been clearly shown as peaceful and cooperative with other nations.

Sellers, Jerry J., et al. Aerospace Science: The Exploration of Space. U.S.A. McGraw-Hill, 2003