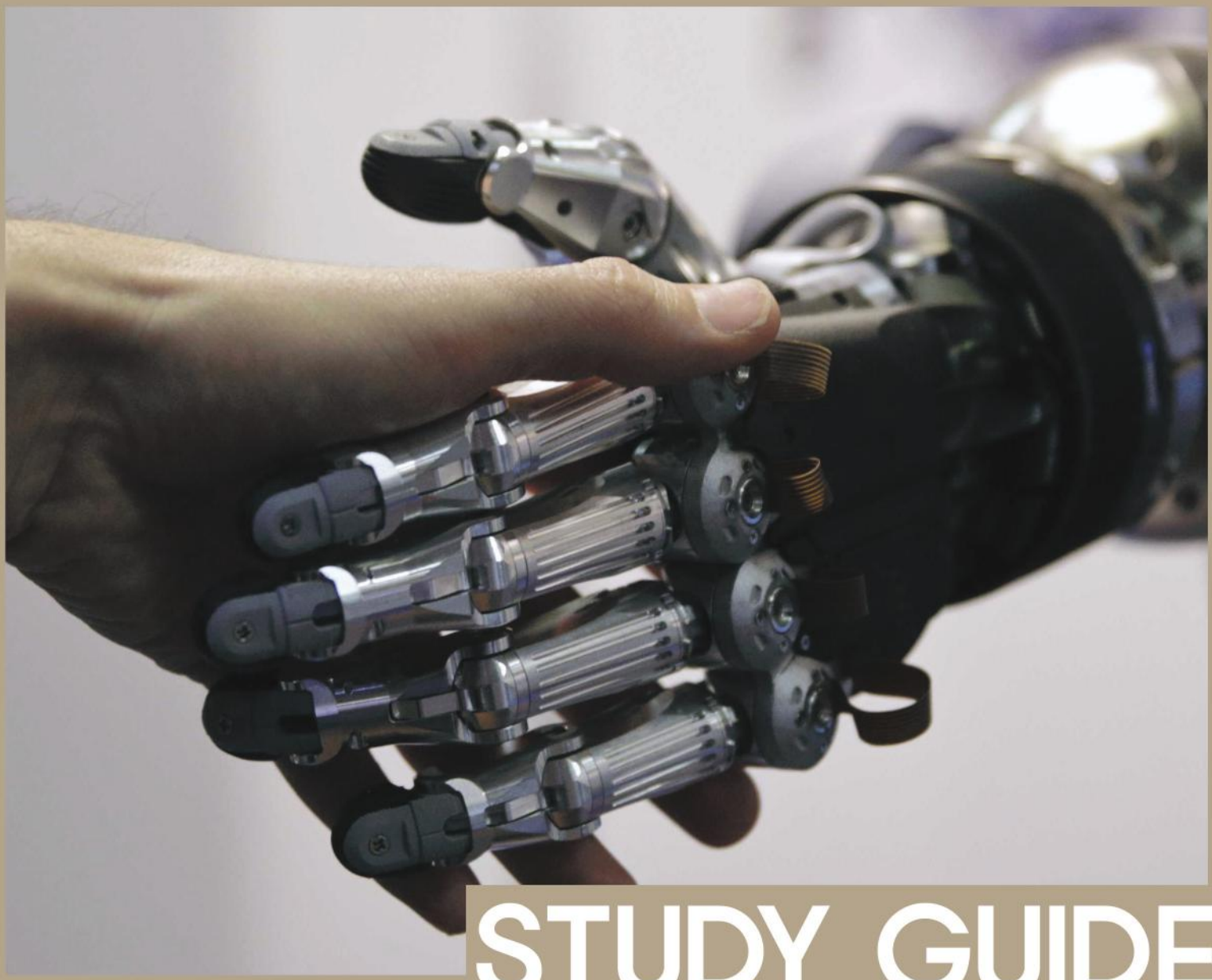
Humanitarian Advancement and Security Committee

Agenda Item 1: Human Cloning and Cybernetic Technology

Agenda Item 2: Colonisation of Mars



STUDY GUIDE

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HASMUN

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Letter from the Secretary-General

Esteemed Participants and Guests,

It is my greatest pleasure to welcome you all to the fourth edition of the Kadir Has University Model United Nations Conference on behalf of the Kadir Has University Model United Nations Club, Organization Team and the Secretariat. My name is Polat Yamaner, I am a junior student at Kadir Has University, Law Faculty; and I serve you as the Secretary-General of this conference. Having witnessed the last two years of the Conference as a proud participant and an academic team member, I can faithfully state that, HASMUN will, once again, host a formidable experience for you to enhance your skills on different perspectives of the global course of events.

Simulations coursing from historical events to the futuristic concepts, the committees of this year's HASMUN will be met under the theme *"Human Rights: From Respect of the States to the Approbation of the Imperative"*. Being one of the few Model UN conferences with a certain theme; this year, we hope to enhance the viewpoint of all the participants, on the fundamental rights and freedoms and human dignity, and its close relation with the international relations, the way of diplomacy, the law, the understanding of security and certainly humanism and humanitarianism.
The Secretariat of HASMUN 2017 had created such committees to actualize our hope and enabled its participants to have a word from the angles of both international and national institutions. I would like to express my gratitude for their intensive work to all Under-Secretaries-General and Academic Assistants who have expanded their efforts much more than me. Without their contribution to the Conference, the very formation of a Model UN conference would not be even possible.

Apart from the exacting and differentiating dimension of the Academia, as one of the Conferences distinguished for its organizational success, I would to thank to the Director-General of the Conference Mr. Alihan Eyüboğlu and his Deputy Ms. Gizem Eşsizoğlu for constituting the organizational basis of the conference with their high-level knowledge and skills that they have presented. Lastly, I would like to thank to the Deputy-Secretary General of the Conference, Mr. Kerem Karaçay for not leaving me alone and enduring all of my anxieties.

Finally, as always, please do not hesitate to contact us with any questions or concerns. The entire staff of HASMUN 2017 and I are committed to create a dynamic and enhancing experience for high-school and university students from all around the world.

Sincerely,

Polat Yamaner
Secretary-General of Kadir Has University Model United Nations Conference 2017

Letter from Under-Secretary-General

Most esteemed delegates of Humanitarian Advancement and Security Committee,

It is my utmost honour to welcome you all to HASCOM, that is, the inaugural edition of the committee in HASMUN'17. This committee will address the new challenges and questions that are brought by the technology of today. The committee will be composed of enterprises and foundations that influence the tomorrow of our World. The delegates will work and cooperate to excel the future of humankind.

I would like to thank Mr. Polat Yamaner for having me as the Under-Secretary-General in his team and Mr. Kerem Karaçay for his never-ending enthusiasm and interest in this committee. I would like to thank my academic assistant, Ms. Ege Sürek for her efforts in this guide.

Sincerely,

Merve Noyan

Under-Secretary-General for HASCOM

1. Introduction to Committee

The world is an ever-changing place. Since the start of the 21st century, human race came across a new dilemma. World was changing, but it was changing too fast. Technology flourished like it never did before. Last 17 years saw more technological advancements that has been seen in the whole 20th century. As technology started to change the way we live our everyday lives, the question of what future will bring entered the minds.

This was one of the main reasons that the leaders and the distinguished members of the society decided to gather and create the Humanitarian Advancement and Security Committee (HAS-COM). Having the representatives from prominent companies, institutions, armies and governments, HAS-COM will be an arena that the matters such as clones, cybernetics, colonization of space, genetical modifications, warfare related technologies and robots going to be discussed. The committee will decide on what action to take for the future usage of these rather controversial technologies.

Members of the HAS-COM will be the ones shaping not only the future of the security, warfare and technology but also the future of civilization , too.

4. Agenda Item: Human Cloning and Cybernetic Technology

a. Glossary

Clone: A cell, cell product, or organism that is genetically identical to the unit or individual from which it was derived. [1]

Bioethics: The ethical concerns raised by the advancement of biology and medicine. Within the scope of the agenda, bioethics perspective of the topic mostly refers to the relationship between cloning and the sciences of philosophy, religion, law, medicine and politics,

Prothesis: an artificial device to replace or augment a missing or impaired part of body. [2]

Stem cells: A cell that has the potential to be used in any part of the body through developing into different type of cells. They are used for repairing the body.[3]

b. Background

Human cloning usually refers to artificial human cloning, which is the production of cells and tissues. Human cloning has been one of the most controversial topics due to moral and religious concerns of States. Human cloning is also a practise that is bound to State legislations, whether if it is allowed or not, or if it is allowed, the restrictions are set by States. Several states passed laws to declare human cloning illegal. There are two types of cloning. One is referred as therapeutic cloning. Therapeutic cloning is the utilization of clone technology for medical purposes, for instance, transplant, stem cell or prothesis technology fall under this category. Reproductive cloning is the

[1] Merriam-Webster Dictionary
[2] Merriam-Webster Dictionary
[3] https://medlineplus.gov/stemcells.html

cloning of an entire human. This agenda item will mainly focus on reproductive cloning, due to the abovementioned concerns and the questions that the technology brings, whether if the clone should be treated as a human or not? There have been several dystopic anticipations, Aldous Huxley's Brave New World could be the best example. Furthermore, it is a well-known fact that genetics can be an extremely dangerous weapon and subject to war crimes, such as Josef Mengele, the mastermind behind the experiments in Auschwitz concentration camps, and consequently, the humankind learnt that there is some knowledge that should not be pursued if it requires the use of immoral means to get it. Since the agenda mostly elaborates on the worst case scenarios of bioethics, consideration of the cases, forecasting and anticipation can be helpful. The agenda item will also address the usage of therapeutic cloning in military. Furthermore, the secretariat will provide you a medical background that is adequate for you to understand the difference between the technologies.

c. Bioethics and Moral Perspective

The reproductive human cloning technology is the one and only issue that is addressed by bioethics in clone technology. Most of the questions raised by bioethics have their origins from religion, however this committee will also tackle other issues regarding bioethics. The humankind has always perceived genetics and cloning in an utilitarian point of view, the chicken that could provide the best egg. The utilitarian approach applied to the reproductive cloning on human beings, is contrary to the religious view that the humankind has a God-given dignity and the we should not utilize them to fulfill our desires. [4] This perspective denies the scientists from producing clones that have lower intelligence from average human, to work in menial labor, as in the dystopic case of Brave New World, or simply producing clones for organ farming, when instead, therapeutic cloning could be helpful. The religious perspective states that all people are special and unique creations of God and should be loved. [5]

Furthermore, the committee should consider the fact that it is an essential human right for a person to not to be produced for medical experimentation. Regardless of the opinions brought on the abortion, the human embryos should not be subjects of experimentation, according to the ethicists and the religious authorities. The status of the embryo has always been a controversial topic for the ethicists. For instance, human embryo in first or second week is considered as pre-embryo. The term "pre-embryo" is mostly used within the context of bioethics, rather than genetics or medicine. The term is originated from botanics, "pro-embryo" and is a criterion that helps scientists decide on the exact time interval that the embryo evolves into the plant, or in the human case, to a human. The usage of the term itself has been always opposed by ethicists and religious authorities. Another dissenting argument is that the identical twins originate from the division of a single embryo in a period that is less than two weeks, before the implantation into the uterus. This behaviour of the embryo has

[4] Yüce Rabbişkom, The Bible (Genesis: 1-26)
[5] https://cbhd.org/content/overview-human-cloning

"proved" that the term "pre-embryo" is void. [6] The restrictions and legitimacy of the experiments in genetics are bound to the aforementioned controversy, whether if the embryo should be treated as a tissue or not.

d. Uses of clone technology

While it is a very controversial issue, there are various arguments in favour of cloning – both reproductive and therapeutic- that should be examined before further discussion on the topic.

To start off with some therapeutic cloning, medical purposes takes the lead. First of all, it can be used for cloning animal models. Animal models are genetically engineered by researchers to carry mutation in their genes, which helps researchers to examine diseases they carry in order to find a cure for the human diseases. However, creating an animal model is a lengthy task and not always very successful. Cloning would make the process very easy and less time consuming and at the end it would help to contribute to the researches on finding cures for various diseases.[7]

Using cloning for making stem cells is also possible. Stem cells are the reason that a human's body can repair itself. It is a natural process for them to do so, however in some diseases (e.g. cancer) stem cells cannot work how they are supposed to. Usually in this situation a healthy stem cell from another person is given to the unhealthy one (e.g. a bone marrow) but the transfers are not always successful since the receiver's body sees the transplant as a foreign object. Hence the cloning, some scientists argue that with cloning, it might be possible to create stem cells that are genetically alike to the unhealthy person. Also, cloning diseased stem cells and studying them would be very beneficial for the scientist to understand the diseases better. [8]

Reviving extinct species and repopulating endangered ones are also some of the goals of cloning. Cloning extinct species is not possible yet -the last nearly successful attempt was made in 2009 when scientist made clones of an extinct wild mountain goat, however it died after birth- but with enough funding and research on the matter it might be possible. Also, cloning can be used for creating more animals who are nearing extinction to help their survival. There are successful applied cases in this and can be considered as a tool for scientists.[9]

Cloning agricultural animals is another usage, however the cloned animals would not be for consumption since cloning is way more expensive than standard breeding. However, usage of this cloned animals for breeding would create numerous high quality animals, for both agriculture and other uses.[10]

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[6] Ashley, Benedict and O'Rourke, Kevin. Ethics of Health Care: An Introductory Textbook, page 127 (Georgetown University Press 2002).
[7] http://learn.genetics.utah.edu/content/cloning/whyclone/
[8] http://learn.genetics.utah.edu/content/cloning/whyclone/
[9] http://learn.genetics.utah.edu/content/cloning/whyclone/
[10] http://learn.genetics.utah.edu/content/cloning/whyclone/

Most of the arguments made on the benefits on human cloning does not have the strong scientific evidence as its other counterparts, due to lack of proper experimentation on the matter. First of all, there are arguments that with cloning, the defective genes that humans have in their body that causes diseases may be countered. It might help reversing heart attacks. Some scientists argue that with cloning healthy heart cells they can counter the damage.[11]

Of course, one of the most known argument for human cloning is to battle infertility. Human cloning may make infertile couples to have children of their own. Also there are arguments that with usage of the human cloning, the women that has a high risk for Down's syndrome can have healthy babies.[12] Some arguments are also made for people who lost their babies in a very early stage and want to have a genetically identical baby as the one they have lost.

The most ambitious argument of all is that with more research and experiments on human cloning, one day humankind might find a way to "reverse the aging process".[13]

E. Usage of Cybernetic Technology

Cybernetics is defined as "the science of communication and control theory that is concerned especially with the comparative study of automatic control systems (as the nervous system and brain and mechanical-electrical communication systems)"[14] In the context, it is not any different from what we see in the science fiction films, for instance, a superhero with enhanced bionic hands, in fact, the word cyborg comes from cybernetic organization.In fact, any human with robotic attachments is considered as cyborg, but in the context of the committee, the cybernetic is enhanced member that could be utilized to make an advance. Currently, many states invest in military technologies, including cybernetic enhancements. The United States Department of Defense and Defense Advanced Research Projects Agency (hereinafter: DARPA) currently tries to find a way to augment enhancements on soldiers, even their brains, as we see in Ghost in the Shell. According to latest updates from United States Air Force scientists, military personnel have been subjected to information processing ability tests and improvements, which include transcranial direct current stimulation; which is to apply low voltage to the certain areas of brain. The authorities also stated that the procedure had increased wakefulness in case of sleep deprivation for more than 36 hours. It is not clear whether if the scientists follow any guidelines, or the procedure which in case this procedure will be forced upon soldiers

[11] Human Cloning Foundation. "The Benefits of Human Cloning." Internet http://www.humancloning.org/benefits.htm, 1998.
[12] Human Cloning Foundation. "The Benefits of Human Cloning." Internet http://www.humancloning.org/benefits.htm, 1998.
[13] Human Cloning Foundation. "The Benefits of Human Cloning." Internet http://www.humancloning.org/benefits.htm, 1998.
[14] Merriam-Webster

without their consent. Furthermore, DARPA's new Neural Engineering System Design, a project within President Barack Obama's Brain Research Advancing Neurotechnologies initiative aims to create a chip that could be placed in soldiers' brains to increase their vision, hearing and receive data, which could make them close to artificial intelligence. Additionally, the chip enables the user to have a magnetic vision, which allows user to see the landmines in a field. [15] Moreover, United States Special Operations Command (hereinafter:SOCOM) currently develops exoskeletons that could be worn by the elite special forces of US army. The suit, called Tactical Assault Light Operator Suit, includes features such as but not limited to, sensor cues to soldiers for injury reduction and emergency aid, flexibility, power generation and visual intelligence. The prototype had been produced in July 2014 and tested. Development of the suit has been a collaboration between 56 corporations, 13 governmental agencies, 10 national laboratories and multiple universities. Development continues, as SOCOM decided to hold a conference to encourage authorities to create more component for exoskeleton, and after it is finished, the permission from Pentagon will be sought. However, the financial outlook and development related issues awakened skepticism amongst the leaders of the defense industry. Officials believe that the suit will not be accomplished until 2026, stating that it will require new technologies to be developed. These technologies include improvement of the ballistic material, wearable computers, thermal management and most importantly, light power generators. Moreover, in 2015, Revision Military, one of the pioneer companies in military technologies had released Kinetic Operations Suit. The suit is a exoskeleton which provides weight balancing, heat maintenance and power assist.

Usage of cybernetic technology for therapeutical means is quite popular. Artifical retinas and cochlear implants provide vision for the blinds and hearing for the deaf. Deep-brain implants help Parkinson's disease sufferers maintain their daily life. Replacement organs and bionic or robotic prosthetics and implants help people restore their lacking bodily functions.

f. Questions raised by humanity

When in 1996, the scientists successfully cloned a mammal, knowns in the world as Dolly the sheep, it raised many ethical questions that led to lots of academic and political debates, with some countries immediately banning cloning.

One of the arguments of course came from religious groups. Pope himself condemned human cloning and said, "When human beings in the weakest and most defenceless stage of their existence are selected, abandoned, killed or used as pure 'biological matter', how can it be denied that they are no longer being treated as 'someone' but as 'something', thus placing the very concept of human dignity in doubt?"[16] However Roman Catholic Church is not the only one, it is also prohibited by the Islam according to the resolution of Islamic Fiqh Academy. Most of the religious counter arguments

[15] http://www.newsweek.com/us-military-plans-cyborg-soldiers-new-darpa-project-418128
[16]http://www.dailymail.co.uk/news/article-511554/Pope-condemns-human-cloning-stem-cell-research.html

are similar, saying that "a clone would not be a real person" or "cloning is playing the God" and "cloning is not natural".[17]

There is also the argument of usage of embryos for harvesting stem cells. If done after a specific time, it would be killing of the cloned embryo to harvest the needed stem cells. Both in science and religion an embryo is the "carrier of life". Also, some people are scared that creating of clone embryos to harvest the needed parts from human body can be turned into business by some people, even might become criminalized, with the person cloned not knowing he or she was being cloned.[18]

The other question is, if human clones are created what would their social status would be. Would they be considered as fully human, with legal rights and citizenship of the country they are cloned or would they have a special status? This takes us to the highly-debated question of are the clones are same with us or not?

Last, but not least, how would a clone be treated in society? Additionally, is it reasonable to expect from a clone to think as if they are the original one? There's another argument that the a clone would not be treated by their own family.

G. Legal Perspective

In United States, there are no laws specifically regarding cloning, due to the fact that federal laws treat human embryo as a human, and there are no federal funds in use for human embryo research. Some states have started to fund their own researchs. So far, there is no legislation yet to pass in the United States and likewise some of the countries, which makes all types of embryonic stem cell research, reproductive and therapeutical cloning legal. Some of the states have decided to make their own legislations to address the cloning. Due to the conservative perception, abortion is also a controversial issue in politics. The anti-abortion community wants all kinds of cloning research and cloning to be banned. The same community do not want the partial ban on therapeutical cloning, since experiment on embryo is concerned as unethical. [19] Other countries' policies vary from complete prohibition to no policy on record. Fifteen countries, such as but not limited to, the United Kingdom, Japan and Israel had allowed therapeutical cloning yet banned reproductive cloning. Since some of the countries' legislations regarding therapeutical cloning was drafted before embryonic stem cells were first produced back in 1998.

[17] Aurelia, E. et al., 2011. Ethical Considerations on Human Cloning. Current health sciences journal, 37(3).
[18] Aurelia, E. et al., 2011. Ethical Considerations on Human Cloning. Current health sciences journal, 37(3).
[19] http://www.npr.org/news/specials/cloning/faq_blanknav.html

World Cloning

	ESC*	Ther.
United States	✓	✓
Canada	✓	✓
Mexico	✓	✓
Costa Rica		
Panama	✓	
Trinidad & Tobago		
Argentina	✓	
Brazil		
Chile	✓	
Columbia	✓	✓
Ecuador		
Peru	✓	
Uruguay	✓	
Austria		
Belgium	✓	✓
Denmark	✓	
Finland	✓	✓
France	✓	
Georgia	✓	
Germany	✓	
Greece	✓	
Hungary	✓	✓
Iceland	✓	
Ireland		
Italy		

	ESC	Ther.
Latvia	✓	
The Netherlands	✓	
Norway		
Poland	✓	✓
Portugal	✓	
Russia	✓	
Slovakia	✓	
Slovenia	✓	
Spain	✓	✓
Sweden	✓	
Switzerland		
UK	✓	✓
China	✓	✓
India	✓	
Japan	✓	✓
Singapore	✓	✓
South Korea	✓	✓
Thailand	✓	✓
Vietnam	✓	
Australia	✓	
New Zealand	✓	✓
Israel	✓	✓
Turkey	✓	✓
South Africa	✓	
Tunisia	✓	

*Some prohibit the derivation of embryonic stem cells, but do not specifically prohibit the research using existing lines.

[20]

United Nations General Assembly Sixth Committee: Legal evaluated two draft resolutions, one proposes banning all kinds of cloning, proposed by delegate of Costa Rica and another, banning only reproductive cloning and permits other countries to decide on therapeutical cloning. Some of the countries perceive therapeutical cloning open for abuse and unethical. It is stated in the report regarding the draft resolution, unfortunately, most of the delegates were unaware of the difference between therapeutical and reproductive cloning. Most of the delegates objected the draft resolution because of the ethical perspective. Draft resolution proposed by the delegate of Costa Rica passed with 69 in favour to 39 against votes and 39 abstentions. [21] In Canada, experimenting on embryo is up to the consent of the donor. Austria allows reproductive cloning if and only if there's an intention of reproduction between heterosexual couples if not possible without any reproductive medicine. In France, human embryonic stem cells research is allowed until the embryo is 6 to 8 days old. In 1998, Council or Europe altered Convention on Human Rights and Biomedicine by issuing an amendment, that prohibits "any intervention seeking to create a human being genetically identical to another human being, whether living or dead.". It ranges from five to ten years that it is expected that a human clone would be born if there will be no global ban issued. Sweden, China and Israel declared that they are not against the usage of clonal embryos for research.

G. Points The Committee Should Address

[20] http://www.ruf.rice.edu/~neal/stemcell/World.pdf
[21] https://www.un.org/press/en/2005/gal3271.doc.htm

- The committee should decide whether if the cloning should be legal or not, or the extent of legalization of the cloning, both in reproductive and therapeutical means.
- The committee should decide whether if a clone should be treated as an individual.
- The committee should decide if the experiments of new technologies in cybernetic area should be applied on humans.
- The committee should decide if the applied technologies in cybernetic area on military personnel should be regulated legally, and decide on the guidelines and the extent of the application.
- The committee should decide the status of embryo that it should be treated as a human.
- The committee should evaluate the perspective that by the time cybernetic enhancements are more accessible, there will be an unfair competition in employability between the enhanced and unenhanced people.
- The regulation of the usage of cybernetic enhancements should be detailed.
- The regulation of the experiment of new biomedical technologies should be addressed.
- The committee should address the points stated in the "Questions Raised by the Humanity" section.

5. Agenda Item 2: Colonisation of Mars

a. Glossary

International Space Station (ISS): The International Space Station is a large spacecraft orbiting around the Earth, which is built by many countries, to be utilized as a science lab, and to accommodate astronauts in space and the observe the effects of space on the human body. [22]

Space Launch System (SLS): Launch vehicle that helps spacecrafts have a lift capability. [23]

Orbiter: a spacecraft designed to orbit a celestial body without landing on its surface, space shuttle

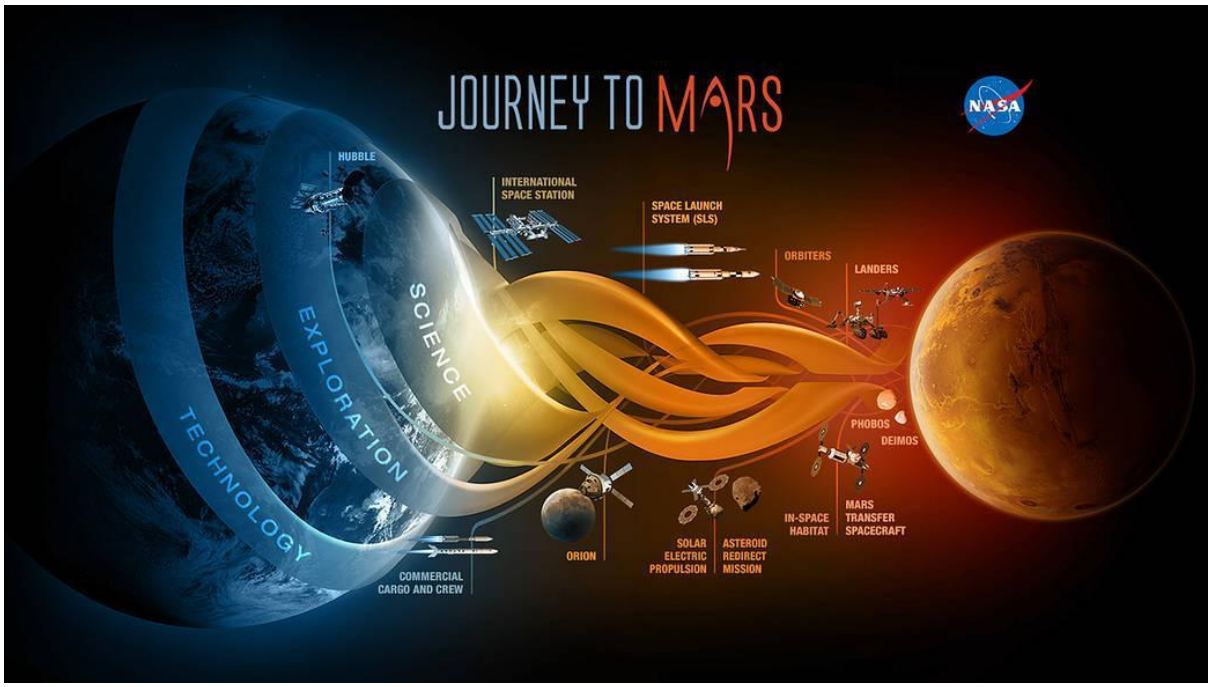
Lander: a space vehicle that is designed to land on a celestial body, such as the moon or a planet

Rover: a vehicle for exploring the surface of an extraterrestrial body, such as Mars or moon [24]

Propulsion Systems: Propulsion systems are the components of the spacecrafts that allow the spacecraft to move in space once they detached from the launch vehicle. [25]

b. Background

[22] https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-the-iss-k4.html
[23] https://www.nasa.gov/sites/default/files/atoms/files/sls_october_2015_fact_sheet.pdf
[24] Merriam-Webster
[25] https://www.nasa.gov/sites/default/files/atoms/files/ps-01987_sep_fact_sheet.pdf



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"We choose to go to the Moon!" Said John F. Kennedy 56 years ago, "We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard; because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one we intend to win".[27]

Since 1961, many thing changed in the world. Humankind did go to moon but humans never stopped searching the further ends of the galaxy. Last decades were full of scientific and technologic advancements, with discoveries of many planets and systems. After the landing on the moon, the eyes were turned to the other planets in our solar system. In addition, question of the sustainability of the planet Earth has compelled the humankind to search for a new home. Twin of the planet Earth, namely, Mars has always been subjected to discoveries. Since 1960s many missions sent to Mars, most of them being unsuccessful. However, in the last decades after these changes, right now there are various operational missions in Mars. Types of missions vary from lander to orbiter to rovers. Regrettably, a human mission to Mars haven't been done yet, but it is in development. This agenda item will address the potential of colonization of Mars, tackling the needs and the risks.

[26]https://www.nasa.gov/content/nasas-journey-to-mars
[27] https://er.jsc.nasa.gov/seh/ricetalk.htm

c. SpaceX Mars Project

SpaceX is one of the companies in Musk Group. The company is established to enable people to live in other planets. [28] SpaceX has three projects, the first one being Dragon. As a private company, SpaceX has become the first company ever to send an aircraft to International Space Station, in 2012. Dragon is now utilized by NASA for cargo resupply missions in Space. In 2013, SpaceX launched Falcon 9. By then, SpaceX had developed drone technology in space missions, advanced various landings and tests. Now, Elon Musk aims to create multiplanetary life possible. SpaceX Mars project has become the most promising Mars project, due to the fact that there are only three, others being Mars One and NASA Mars Project. Recently, Mars One is concluded and understood as a marketing campaign, and it has actually nothing to do with colonization. NASA is a question to be addressed when it comes to colonization of Mars, due to the fact that the budget cuts from Federal Government could jeopardize the progress. Furthermore, it is important to emphasize that the SpaceX Mars Project will only provide logistical support and address transportation between Mars and planet Earth.

Elon Musk announced that the first colony will be consisting of 80,000 settlers by 2030. SpaceX currently develops Mars Colonial Transporter, which is composed of reusable rocket engines, launch vehicles and space capsules, and will be able to transport people to Mars and return to Earth. Moreover, the development of the Raptor rocket engine for the MCT has been concluded with a successful test back in September, 2016.

d. NASA Mars Project

NASA plans to send humans to an asteroid by 2025 and Mars by 2030 as declared in United States National Space Policy and NASA Authorization Act of 2010. For the last 40 years, International Space Station has given the mankind an opportunity to discover life beyond Earth, the way our body reacts to space conditions. Currently, NASA addresses questions of how to test new technologies, such as but not limited to, Solar Electric Propulsion, and to do so, NASA will send a robotic mission to capture an asteroid to orbit the moon. The asteroid will be explored by the astronauts aboard the Orion spacecraft in the 2020s and return to Earth with samples from the asteroid. These missions will be launched by the time that the NASA's Space Launch System will be evolved and rely on the Orion spacecraft that is already in operation. There has been a fleet launched by NASA orbiting and landing on the Mars to enlighten the mankind about the Red Planet. The rovers have been seeking signs of potential former life on Mars, and also, measuring the level of radiation on the planet and sending data, to protect the astronauts. [29]

[28] http://www.spacex.com/about

[29] https://www.nasa.gov/content/nasas-journey-to-mars

e. Boeing "An Affordable Mars Mission Design"

In 2014, 45th Lunar and Planetary Science Conference had been held and "An Affordable Mars Mission Design" had been presented by Boeing Company, which is one of the pioneer companies in colonization of Mars. The project had received tentative support from NASA's Advanced Human Exploration Systems and Operations Mission Director Jason Crusan and Deputy Associate Administrator for Programs James Reuthner. The mission aims to colonize Mars by 2030 and includes plans regarding centrifugal gravity, radiation shielding, in transit consumable resupply and a return lander. The project proposal is as follows:

The project requires Orion, Space Launch System, Transit Habitat, Solar Electric Propulsion Tug, Mars Ascent Vehicle and Mars Lander.The Space Launch System will be used to launch the first Solar Electric Propulsion tug and the cargo lander with the surface habitat. The Solar Electric Propulsion tug will be activated and used to deploy the lander out the translunar assembly area. The second Space Launch System deploys the transit habitat and the return kickstage directly to the gateway. This is the cargo part of the mission. The trip takes approximately 500 days because only the Solar Electric Propulsion tug is used to provide energy for the trip and it is inadequate. The return kick stage will be left in Mars orbit until the crew returns. After the cargo achieves to land in Mars, the Solar Electric Propulsion will be used to descend to 5000 km altitude for cargo lander to enter. This mission will provide the test for the major elements needed to land the crew. The elements needed for the crew mission are assembled at the gateway and the crew will be the last to launch. The Gateway allows NASA and the partner agencies some measure of operational flexibility to resolve off-nominal situations and ensure readiness before the final mission commitment at the trans-Mars injection burn. Once the trans-Mars injection maneuver is performed, the crew will be committed for two years. It will take less time for crew to land Mars, almost half of the time needed for cargo transfer, due to kick stage equipped in the Mars transfer spacecraft. It will be possible for the crew to live on the surface for 450 days, and if the Mars Ascent Vehicle is secured properly. The way back to Earth will last 205 days.

So far, this is one of the most time and cost efficient projects for the Mars mission. [30]

e. Other Projects

Most of the known Mars projects are USA and NASA led. However several agencies in the world have also made considerable advancements that should be taken into account.

MARS-500

The MARS-500 was not an actual space mission, however it contributed into the Mars mission research a lot. The experiment was conducted by European Space Agency (ESA), Russian Federation and P.R. China. Its goal was prepare the agencies for a future long term Mars mission. It lasted four years with a six-person crew. The findings are very beneficial for the planned mission,

[30] AN AFFORDABLE MARS MISSION DESIGN. K.Klaus, M. L. Raftery and K. E. Post, The Boeing Company

since before this experiment, there was not enough data on the effects of long-term close quarters isolation which a human mission to Mars would require.

ESA Aurora programme

ESA had a long term plan to send a human mission to Mars. Project was proposed in 2011 and was expected to ben done in 2033. Unfortunately, objection within the participating states and other problems caused delays and made following the timeline for the project questionable. Nonetheless, ESA sended an orbiter, ExoMars in 2016, which wa made possible with Aurora programme.

China National Space Administration (CNSA)

CNSA stated their intentions to focus on Mars based prıjects in 2006. According to their plan, a mission to mars without a crew would be carried between 2014-2033 and if successful a human mission to Mars would follow it between 2040-2060. Their participation on the MARS-500 experiment was based on their need to gain experience for their future projects.

f. Interplanetary Transport System

Interplanetary Transport System is the ticket to Mars. ITS is designed by Elon Musk as a part of SpaceX Mars Project, and is one of the most afforable ways to colonize Mars. It costs 10 billion per seat and it will transport 1 million people in next 50 to 100 years. Furthermore, liftoff thrust of ITS is 3.6 thrust more powerful than NASA had ever achieved in a launch. The crewed flights will begin in 2024. As a part of Mars Project of Musk group, uncrewed Dragon will be launched in 2018. [31]

g. Important Startups

i. Made In Space

Founded in 2010, Made In Space Inc. mainly focuses on creating manufacturing technology to use in the space. One of their biggest accomplishment is the First Zero-Gravity 3D Printer, which is being used in International Space Station(ISS) currently.[32] 3D printer would enable astronauts to create any replacement part they needed thus making constant shipments from Earth unnecessary.

ii. Ad Astra Rocket Company

Ad Astra offers a new kind of motor technology for space rockets. Instead of using fuel, Ad Astra's rocket thrusters uses electricity, specifically plasma, for the rocket. Usage of this technology in rockets, especially orbiters, could lower the energy cost of the projects by %90.

[31] http://www.space.com/34234-spacex-mars-colony-plan-by-the-numbers.html
[32] http://www.madeinspace.us/projects/

iii. Virgin Galactic

Virgin Galactic prides itself to be the first commercial spaceline of the world.[33] Their goal to make space reachable for everyone. Around 700 people has already paid for the first trip that company is going to make to space. However the date of the trips are not known yet, since there was various delays.

iv. Sierra Nevada Corporation

Sierra Nevada, asides from their normal aviation projects focuses on space transportation, trying to make it less costly and more reliable. Alsa they has been given the project to create a "deep space, long-duration, human habitat design and prototype" for the NASA mission to Mars.[34]

v. Orbital Sciences

Orbital Sciences is a company not only focused on space but also a very important manufacturer of arms and missiles. For their space projects, they mainly focus on manufacturing satellites and small to medium spacecrafts.[35] However they became an important player in space industry when they became the second company (after SpaceX) to start doing cargo shipments to ISS.

vi. Planetary Resources

Planetary Resources defines their vision as "to expand the economy into space".[36] Their projects mainly focuses on asteroids and the resources they can provide. They plan to mine the asteroids to get many resources, from creating energy to extracting water and they could be a vital part of future.

vii. Airbus Defense and Space

Airbus company's special division on defence and space has been supplying NASA and European Space Agency various technologies. One of their biggest accomplishment is the Gaia spacecraft, used as a telescope to map firstly Milky Way in 3D.[37]

h. Habitability of Mars and Possible Risks of the Settlement

i. Overview

Mars is believed to be a likely place for advanced life forms, another home. In 1965, the very first photographs of Mars came when Mariner 4 spacecraft flew over Mars, it was seemed to be a dead planet. Later missions have enlightened humanity about Mars, yet there are many myths and mysteries yet to be discovered. Major question is whether if it could have the right conditions to support microbes. As an overview, Mars is a rocky planet having the

[33] http://www.virgingalactic.com/who-we-are/
[34] https://www.sncorp.com/what-we-do/space-exploration-systems-dream-chaser-space-vehicle/
[35] https://www.orbitalatk.com/about/company-overview/
[36] http://www.planetaryresources.com/company/#team
[37] https://airbusdefenceandspace.com/our-portfolio/space-systems/human-spaceflight/

roughly the half of the size of the Earth, and having craters, volcanoes, crustal movement and atmospheric conditions. Furthermore, Mars' dust storms have been altering the surface. Having two small moons, called Phobos and Deimos, having little mass for gravity, which means that they are not spherical as if our moon. Moreover, Mars experiences seasons due to its axis in the solar system. Comparing to Earth, Mars' orbit is one and a half times farther from the sun, which causes seasons. The polar ice caps alter by seasons, there are layered areas near the poles, which taught us that the planet's climate has been changing repetitively. The craters and highlands show that volcanism was active more the 3 billion years ago. Also, Mars has the largest volcano in the solar system called Olympus Mons as well as Valles Marineris, which is the equatorial canyon. Currently, Mars doesn't seem to have a global magnetic field, however, some of the ares in the martian crust in the southern hemisphere, which indicates that there was a magnetic field 4 billion years ago. [38] Mars has large amounts of radiation and toxic atmosphere, however, since the other planets were quite inappropriate to be an alternate home, Mars has always been an alternative to Earth just in case of a nuclear war, or sustainability related issues.

ii. Radiation

In 2001, NASA equipped Mars Odyssey spacecraft with Martian Radiation Experiment, which was designed to measure the amount of radiation around Mars, which is almost the same as on the surface due to lack of a thick atmosphere. Observed radiation level on a basis of 18 months, is 2.5 times higher than what astronauts are exposed in International Space Station, 22 millirads a day. Furthermore, two solar proton events have been observed in 18 months, which dramatically increased the amount of radiation up to 2,000 millirads a day. If the levels of radiation are to be compared, 0.62 rad is the amount of the radiation experienced in a developed country on Earth per day. The studies show that human body can stand up to 200 rads without any permanent damage, meaning that, prolonged exposure to the radiation in Mars could lead to various damages, and death. [39]Moreover, Curiosity rover's measurements show that an astronaut on a mission consisting of 500 day stay on Mars, 180 day cruise and way back cruise of 180 days would experience 1.01 sieverts of radiation. The European Space Agency restricts its astronauts to a dose of 1 sievert, which causes increment in fatal cancer risk by 5 percent. 1-sievert dose from Mars is in direct violation to NASA's guidelines, which limits the risk of cancer at 3 percent. NASA applies as-long-as-reasonably-achievable protocols to protect astronauts in missions. Furthermore, NASA currently works with National Academies' Institute of Medicine to evaluate what could proper restrictions be for deep-space missions. [40]

[38] https://solarsystem.nasa.gov/planets/mars/indepth
[39] https://www.universetoday.com/14979/mars-radiation1/
[40] http://www.space.com/23875-mars-radiation-life-manned-mission.html

iii. Atmosphere

Atmosphere of the Mars is roughly 100 times thinner than the Earth's, and 95 percent of the atmosphere consists of carbon dioxide, the rest is nitrogen, argon, oxygen, carbon monoxide and minor amounts of nitrogen oxide, water, xenon and neon. The average temperature is minus 60 degrees Celsius, and near the poles, it varies from minus 125 degrees Celsius to 20 degrees Celsius. Mars' surface is made of iron and the dust storms of Mars are the largest known in the whole solar system. [41]

iv. Water on Mars

So far, no liquid water has been observed on the surface of the Mars, however, it is believed by the scientists that Mars had been exposed to huge floods roughly about 3.5 billion years ago. Mars Odyssey orbiter observed large quantities of water ice. It was observed back in 2004 when Rover Opportunity and Spirit found minerals, which indicated that liquid water once existed and signature of ancient water, which two rovers were located halfway around the Mars. However, the cold temperature and thin atmosphere disallowed liquid water to exist. Also, Phoenix lander has found precipitation alongside with the Reconnaissance orbiter. Experiments on soil of the Mars has enlightened that on the landing site of the Phoenix used to have a wetter and warmer climate. Discovering the existence of water in Mars has the utmost importance to understand the planet's resources.

v. Soil

Mars is known to have the essential macronutrients and micronutrients for plantation. The martian soil samples are used to grow potatoes, however, the percentage of the minerals and nutrients depends on the soil where the astronauts have landed. NASA develops a simulant, which replicates the Mars' soil to understand the Martian surface materials. So far, there have been successful experiments . [42]

vi. Gravity

Evolution had altered the human body to survive on Earth, including how our muscles and bones reflect to the gravity. Mars' gravity is .375 that of Earth. On our way to Mars, settlers aboard on ISS are exposed to low gravity, which causes side effects varying from muscle atrophy to osteoporosis and to some extent, cardiovascular system due to adaptation of circulation to the gravity. Furthermore, returning back to Earth needs readaptation since strengthening bones and muscles means basic daily maintenance for astronauts or settlers. NASA has shown that the density of the bones decrease 1% by the time. NASA develops new technologies, such as artificial gravity devices and bisphosphonates drugs to keep the bones and muscles intact.

[41] http://www.space.com/16903-mars-atmosphere-climate-weather.html
[42] https://www.nasa.gov/mission_pages/station/research/news/meals_ready_to_eat/

vii. Extraterrestrial Life

NASA missions have been searching for ancient alien life on the surface of the Mars, given that there are no aliens on the surface of Mars. Recently, Spirit rover has found deposits composed of silica, which is actually an evidence for biosignatures, which is a sign of life. [43] Furthermore, it is stated by NASA that there could be signs of life in subterranean formations of Mars, such as caverns or lava tubes. Even on the surface, samples taken by rovers are quite distinct and whole planet, including subterranean formations' samples are yet to be discovered to find signs of life. [44]

viii. Dust Storms

Mars is infamous for enormous dust storms, that sometimes, they can be seen by telescopes on Earth. Mars also has a global-wise dust storms annually. The dust in Mars is quite sticky; after the mission of Curiosity, the dust coated the whole rover. The dust devils occur on a daily basis. The spacecrafts on the surface of Mars have to wait in case of the annual dust storm occurs, to protect delicate components.The Spirit and Opportunity rovers have landed in 2004 and the have shut down their operations until the planet settled. The annual global dust storm coats the planet that no sunlight can access the surface. Larger storms usually occur in the southern hemisphere of the planet due to the seasonal tilt of the planet. [45]

ix. Communication between Earth and Mars

It's unknown how exact the signal delay between the Earth and the Mars is, due to the fact that two planets have their own axes and distance between them differs by the time. So far, NASA's Deep Space Network, consisting of network antennas placed in various countries on Earth, helped NASA communicate with rovers and orbiters. When Mars turns it's back to Earth, it also takes rovers with herself, and orbiters see the Earth in two-thirds of its orbit, which means 16 hours a day. The signal delay depending on the distance ranges from 3 to 21 minutes, and two way communication doubles the time, however, if the humankind was ever to establish colonies in Mars, it would be impossible to communicate with Earth.

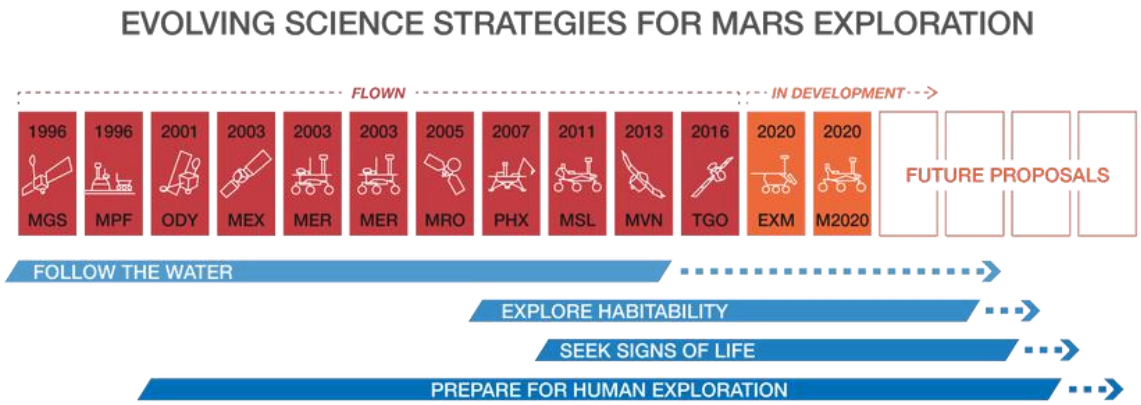
[43] https://www.thesun.co.uk/news/2238954/scientists-discover-evidence-of-ancient-alien-life-on-surface-of-mars/
[44] http://www.space.com/18546-mars-caves-sample-return-mission.html
[45] https://www.nasa.gov/feature/goddard/the-fact-and-fiction-of-martian-dust-storms

i. Risks of a Possible Settlement

i. Radiation

One of the most hindering factors of interplanetary space travel is the risk of cancer caused by the radiation exposed by astronauts in space. Two main reasons postpone the manned interplanetary travel, one is the uncertainty related to the cancer risk estimates, and the unavailability of a complete solution to the radiation shielding. Radiation in Mars would cause acute radiation syndromes due to solar particle events, risk of acute or late central nervous system effects from radiation exposure, risk of degenerative tissue or other health effects, even death. Optimization of space missions, selecting crew members according to age and gender or countermeasures such as radiation shielding could be used, however these are uncertain due to the fact that there is no such case to extract data. Possible mission scenarios prepared by authorities show that astronauts would be prone to 50 to 2,000 milli-Sieverts of radiation. 50 milli-Sieverts is the upper limit for the safe exposure of radiation, such as X rays or Gamma Rays. Survivors of the atomic bomb disasters in Hiroshima and Nagasaki, or workers in nuclear reactor or nuclear weapons productions site, or patients exposed to therapeutic radiation experience up to 2,000 mSv. Radiation above 50 mSv causes higher percentage of cancer risk. Whole body doses of 1 to 2 milli-Sieverts a day in interplanetary space, and half doses on planetary surfaces, on a cumulative basis. Solar particle events in Mars, which exponentially increases the amount of radiation up to 20 Sieverts, is a threat for the astronauts and potential settlers. Radiation shielding is a countermeasure, developed by NASA, however, the particals are strongly penetrative that radiation shielding is able to protect the crew partially. Thicker shielding would cause problems for the launch systems of the spacecraft, therefore, current solutions to the shielding problem is not optimal and is not considered as a complete solution for the radiation problem. Radiation in Mars would cause acute radiation syndromes due to solar particle events, risk of acute or late central nervous system effects from radiation exposure, risk of degenerative tissue or other health effects from radiation exposure.

ii. Colonization Related Issues and Precautions



Before human exploration takes place, radiation shielding, which is one of the main problems for hindering the mission should be fixed. Regions of the planet that are close to water resources should be settlements. In case of a food shortage in Mars, there should be a Mars Ascent Vehicle and a station to return ISS. Precautions to protect from the annual dust storms should be taken.

iii. Health Issues Related to Journey

The astronauts undergo mental issues due to isolation. They also develop sleep disorder due to thrown off circadian rhythm, because of additional 38 minutes in Mars comparing to the Earth. Lack of fresh nutrition causes cognitive decrements. Regardless of the length of the mission, motivation and morale decline in three quarters of the way. In ISS, astronauts are exposed to the radiation that is ten times of the Earth.Exposure to high amounts of radiation increases risk of cancer and lack of gravity causes circulatory and cardiac diseases.

iv. Infrastructure

If human exploration of Mars ever becomes possible, the colonization will be inevitable. The facilities and the infrastructure are planned to be made by the 3D printing technology using Martian soil as the raw material. Recently, NASA held competition for designers to design the “3D Printed Habitat Design”, to imagine how the habitats would look like on Mars. [46] Engineers in NASA has been working on robots that could use 3D printing technology to build basic infrastructure before the astronauts arrive. The sand in the Mars is

[46] https://www.nasa.gov/directorates/spacetech/centennial_challenges/3DPHab/2015winners.html

not exposed to erosion, also lack of atmosphere has its advantages, the buildings will stand dust devils and dust storms.

j. Points the Committee Should Address

The committee should address an exact detailed plan to colonize Mars, if decided to do so.

The details should include,

- The stakeholders from each and every sector of the plan, for instance, in logistics, whether if it is going to be one of the abovementioned competitors, such as SpaceX.
- How to create habitats and sustain life, and convince the concerning authorities to invest in projects.
- Governmental and social structure in Mars, since it is not given in the study guide, it is left to the stakeholders of the plan.
- Required list of criteria to nominate settlers.