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COMM 100
Speech Outline

Getting to Mars
The Mars Missions of the 2020's and 2030's

- **What is Mars?**

    - Mars is the fourth planet from the Sun and the second smallest planet in the solar system. It has two moons, Phobos and Deimos. Mars is about 1/9th the size of Earth. For comparison, our own moon is 1/50th the size of Earth. Mars is an inner planet, meaning that it is one of the four planets that is within the asteroid belt.
        - 4th Planet from the Sun
        - Second smallest planet after Mercury
        - Two Moons - Phobos and Deimos
        - 1/9th the size of Earth - To compare, our moon is 1/50th the size of Earth
        - Inner Planet - Within Asteroid Belt

    - Mars can be seen with the naked eye and so it was discovered so early that we do not have record of this. The name it is called by today refers to the the Roman God of War, but Mars has been known to mankind long before the Roman empire. In all truth, no one knows when humanity first took notice of Mars, but the strange red planet, whose color is red due to the high count of iron in its soil, has captivated humans for centuries. Evidence suggests Mars was discovered in prehistoric times. - Mars has been known by many different names.
        - Can be seen with the naked eye
        - We do not know who discovered Mars
        - Due to its high visibility, Mars was likely to be noticed when the human eye was first capable of seeing it
        - Others names for Mars:
            - Al-Qahira - Arabic
            - Ares - Greeks
            - Quechua - Inca
            - Bahram - Persians
            - Harmakhis - Ancient Egypt
            - Ma'adim - Hebrew
            - Nirgal - Babylonian
            - Simud - Sumerian
            - Tiu - Old English/West Germanic

- **Why is Mars significant?**

- Mars is significant for many reasons but there is one reason that overshadows all of the others and is the main reason the planet currently captivates the minds of many of our greatest scientists. This is because it is the planet in our solar system that is the most like Earth, and therefore is a potential host of life as we know it. The quest for water on Mars has been a major one, and in September of 2015, NASA Confirmed that water indeed flows today on Mars. The water that flows on Mars flows beneath the surface, and was discovered by analyzing apparent color streaks that could be seen on hillsides on the Martian surface. Using an imaging spectrometer on the Mars Reconnaissance Orbiter, NASA was able to detect signatures of hydrated minerals. NASA confirmed these findings on September 28th, 2015.
    - Mars potentially contains microbial life
    - Mars is appealing because it is similar to Earth
    - Water has been discovered on Mars by NASA on September 2015
    - NASA discovered the water using on the Mars Reconnaissance Orbiter's
    - NASA and the Georgia Institute for Technology reported the findings on September 28th, 2015.

- The most important answer that Mars may hold, is whether life exists on planets other than Earth. If there is indeed life on Mars, we can begin to address the possibility that there is life beyond Mars as well. As of November 24th, 2016, there are currently two scientists from ASU who believe that they have found evidence of biosignatures on Mars, provided by data and images from the Spirit Rover, which was operational on the Martian surface from 2004-2010.
    - Mars holds the most potential to host life as we know it
    - Mars holds the potential to answer if life has developed on celestial
    - Two Scientists from ASU believe they found signs of past microbial life
    - ASU Scientists - Spirit Rover imagery and data of an area on the Martian Surface known as "Home Plate" - Where silica deposits that are present, can only be formed as they are on Earth, through biological systems - the scientists claim.

- **<u>Who has been to Mars?</u>**

    - No human being has set foot on, orbited or has flown-by Mars.

    - Currently only Government space programs have reached Mars with robotic probes, orbiters and landers. As it stands today, successful Mars Missions are as follows:
        - Successful Landings
            - NASA - 8 Successful Robotic Mars Landings
                - Currently Operating Landers:
                    - Opportunity - July 2003

                - Planned Mission of 92.5 Earth Days
                - Current Duration 4690 Earth Days
            - Curiosity - November 2011
                - Nuclear Powered
                - Provides more power for more equipment
                - Size of a small SUV
                - All previous Rovers/Landers were solar
    - Only NASA has successfully landed on Mars

- Successful Orbits
    - NASA - 7 Successful Orbits
        - Currently Operational Orbiters
            - Mars Odyssey - April 2001
            - Mars Reconnaissance Orbiter - August 2005
            - Mars Atmosphere and Volatile Evolution Mission - November 2013

    - ESA - 2 Successful Orbits
            - Mars Express - June 2003
            - ExoMars Trace Gas Orbiter - March 2016 (Collaboration between ESA and Roscosmos)
                - When attempting the lander included by the ESA attempted to land - it crashed and was destroyed.
                - This crash occurred on October 19, 2016.

    - ISRO (India) - 1 Successful Orbit
            - Mars Orbiter Mission - November 2013

    - Soviet Union
        - Three Mostly Successful Orbits
            - Mars 2 - Orbited 362 Orbits - Mapping Mission was unsuccessful due to dust storms.
            - Mars 3 - Orbited 20 Orbits - Mapping Mission was unsuccessful due to dust storms.
            - Fobos 2 - Successful Orbital Operations, Destroyed on Landing Attempt.

        - One Partial Failure
            - Mars 5 - Failed after 9 days in Orbit, returned 180 images.

- **<u>Who is planning to go to Mars?</u>**
    - There are currently three separate groups that are planning serious manned Mars missions to take place in the 2020's and 2030's.
        - NASA / Lockheed Martin - As the official Space Program of the United States of America, NASA is planning a manned Mars mission that includes assistance from several American space-faring and aerospace companies, including Lockheed Martin and Boeing.
            - NASA / Lockheed Martin - Official Space Program of the United States
            - NASA will include Lockheed Martin and other potential partners, such as Boeing.
            - NASA has long been the most successful space program in the history of humanity.
        - Mars One - A non-profit group based out of the Netherlands is an interesting group that is a small player in the Mars game that is often considered to be too ambitious compared to the other contenders.
            - Mars One is often not taken seriously
            - Mars One focuses mostly on the aspect of living on Mars, not getting there.
            - Though small and underfunded, Mars One continues to gain momentum, albeit slowly.
        - Space X - Space X is an American company with a mission to make humankind a multi-planet species. They are currently one of the companies on contract to launch supplies to the International Space Station that orbits Earth.
            - Space X was founded by the creator of Paypal, Elon Musk
            - Space X is an American company
            - The Mission Statement is to make Humanity into a two planet species - with the second planet being Mars
            - Space X currently contracts with NASA to transport cargo to the ISS
            - Space X has developed and successfully used a reusable, vertical landing rocket.
- **<u>What are the different approaches to get there?</u>**
    - **<u>NASA (plans are as per NASA.GOV's Journey To Mars Webpage)</u>**
        - Research and Return

- NASA's philosophy is one of answering questions. Their Mars mission is strictly one of research and scientific study. They intend to send humans to Mars to collect information and study the previously unknown, to return home in the end.
    - Scientific studies and data collection
    - Fact finding missions
    - Expeditions to collect information
    - Will return home

- Plans after this mission are currently unmade, with the mission itself being a major factor in determining what would come next after a successful manned mission.
    - No plans after currently planned Mars mission
    - No plans to develop a permanent base or colony

- The ultimate goal for NASA - Determine if there is life on Mars - to answer the question if there is life beyond Earth.

■ Space Launch System Megarocket and the Orion Capsule
- The SLS Megarocket or the Space Launch System is NASA currently developing super-rocket that will be launch ready in 2018.
    - SLS Megarocket - Largest and most powerful rocket ever built
    - Currently in testing phases
    - There has not yet been a test launch

- The SLS Megarocket supersedes the Space Shuttle Program as the primary system NASA will use for all large scale space travel.
    - NASA Main Spaceship Program
    - Will replace the retired Shuttle Program
    - Will solve current NASA reliance on Russia or Space X - which it currently pays for space launches.

- The SLS is essentially a very large and modernized version of Saturn V rockets used during the Apollo program.
    - SLS is very similar to Apollo Program

- This system uses a Rocket and Capsule design, as NASA chose not to include a Space Plane in this design, as they did with the Shuttle program.
    - Rocket Capsule Design
    - No Shuttle

- The SLS system will be the primary system to eject payloads off of planet Earth.
    - NASA will once again be Space Faring
- The Orion Capsule will serve as the main spacecraft for astronauts, and will most likely be modularly connected to a large ship, for the eventual flight to Mars.
    - Orion Capsule/SLS is designed to be Modular

- Asteroid Capture/Pre-Mars Colony
    - The Asteroid Redirect Mission is a mission planned by NASA to capture an extremely large boulder off of a nearby asteroid, and bring it into orbit of our Moon.
        - Asteroid Redirect Mission
            - Capture Boulder from Asteroid
            - Bring to Moon
            - Put in orbit around Moon
            - Land and test systems using Boulder and Moon

    - This boulder will then be explored by NASA astronauts and used to test and calibrate methods and equipment that will be used to reach, and research Mars.
        - Tests on this mission are designed to simulate similar events that are likely on a Mars mission.
        - Calibration of instruments and equipment that will be used in similar circumstances will be executed here.

    - This mission contains several objectives, as all NASA missions do, with the main goals being to prepare for circumstances that will have to be dealt with by the Mars crews.
        - Will also help prepare crews for ultimate isolation
        - Will test cutting off communications and assistance
        - Will determine if a Mars mission is feasible by testing if humans can withstand the mental challenges that such a mission presents.

- Mars Base Camp
    - NASA will partner with many different American companies - namely Lockheed Martin, to construct what they call “Mars Base Camp.”
    - Mars Base Camp will be a manned space station that will travel to Mars, and orbit the red planet.

- The Mars Base Camp crew will first study Mars from orbit, launching rovers and controlling them from their orbital position.
- Crews will be relieved by new crews coming from earth. A crew will be deployed for 18-20 months after reaching Mars. This does not include the journey that is about six months either way.
- Crews will eventually launch from Mars Base Camp, to the surface, using the Orion spacecraft.

- **Mars One (Plans are as per MARS-ONE.COM Website)**
  - One Way Colonization
    - Mars One intends to colonize Mars, and does not intend to bring anyone home. Those who go, will live and die on Mars.
    - This mission intends to send several missions that include habitats, vehicles and supplies to Mars before the astronauts get there. When the astronauts do arrive, the intention is to have a colony already started for them.
    - Mars One has expressed the idea of documenting the entire mission with hundreds of real-time cameras via live streaming system.

  - Contracted Launch and Transport System
    - Mars One is not an aerospace company and they are very clear about this. They are currently developing logistic methods, habitats, robots and equipment that will be required for their mission.
    - Much of what Mars One is attempting to do is to include other groups in their project through contracts.
    - Mars One will contract a Space Faring company to deliver their missions to Mars. This means they will most likely be relying on NASA, Space X, Boeing or another aerospace company to get them there.
    - Mars One intends to cover all costs of the missions, including paying for the contracts.

  - Constant Addition
    - After the Mars One colony is constructed and manned, Mars One intends to constantly deliver payloads that will expand the size of the colony both in physical structures and supplies as well as colonists.
    - Mars One intends to send astronauts every 18-20 months to join the colony.
    - Mars One plans for the colony to become self sufficient and its existence to be indefinite.

- Outpost One
    - The Colony will consist of habitats, laboratories, greenhouses, vehicles and equipment to help serve the needs of the colonists.
    - The structures of Outpost One are being designed to be modular, meaning that they are to be sent to Mars separately and then pieced together into a closed structure.
    - The Mars One mission is one of exploration and research with the ultimate fate of the colony being open ended, and unwritten.
    - Mars One calls its astronauts, “Pioneers”

- **Space X (Plans are per Elon Musks presentation “Making Humans a Multiplanet Species, which can be viewed on the SpaceX website)**
    - Two Planet Species
        - Space X has a very ambitious plan for Mars. The American company intends by all means to turn Humankind into a two planet species.
        - The colony proposed by Space X will be significantly larger than any other operation currently planned.
        - The founder of Space X has stated that he intends to send millions of people to Mars.
        - The intention of Space X is to create a truly two planet species, where people live and work on Mars, and are able to return home to Earth, and then back to Mars - using an Interplanetary Transport System.
    - Interplanetary Transport System
        - The Interplanetary Transport System (ITS) that is being developed by Space X is a super-massive logistical system that will handle the delivery of colonists and supplies to and from Mars.
        - The system consists of three major parts.
            - The Earth Launch and Return System
            - The Transport System
            - The Mars Launch and Return System
        - The system will work the same on journeys going in either direction.
            - The Launch system will take payloads from the Planet, into orbit.
            - In orbit the payload transfers from the Launch Rocket, to the Interplanetary Transport Ship, the Rocket returns to Earth using a vertical landing.
            - The Transport Ship, when loaded completely, then begins its journey to Mars.

        - When the Transport Ship arrives at Mars, Launch vehicles will launch from Mars, containing new cargo for the return trip.
        - The Mars launch rockets deliver their cargo to the Transport Ship, and the Transport Ship transfers it's payload to to the rockets, that return to Mars using vertical landing.
        - The Transport Ship then returns to Earth, with the cargo it has accepted from the Mars launchers.
        - The cycle continues indefinitely.

    - The Heart of Gold
        - The first of these Interplanetary Transport Ships to carry the colonists to Mars will be named the "Heart of Gold" - after the ship from the book "A Hitchhiker's Guide to the Galaxy".
        - Space X intends for it to be one of many.

    - A New World
        - Space X intends to discover new worlds, and to continue to human tradition of exploration.
        - The founder of Space X, Elon Musk, intends to save Humanity from extinction by ensuring that we are not all dependant on only one planet - which leaves us vulnerable to mass extinction like that of the dinosaurs.
        - Elon Musk himself is quoted as saying, "I would like to die on Mars, Just not on impact."

- **<u>What is Mars?</u>**
    - The fourth planet from the sun. Mars has had a place in the heart of humanity for longer than we know. It has been so far away that it might as well be only a story.

- **<u>Why is Mars Significant?</u>**
    - Mars continues to exist as a mystical and magical far away place. Even today, as the might of human technology prepares to make the faithful leap to Mars, as our robots explore bits of it's surface, it cannot be stressed enough, that humanity has never achieved anything close to such an endeavor.
    - With all the technology we have to today, we have only still enhanced the way we look at Mars, just as our ancestors looked at it for all of time before us.
    - Mars, and the challenge to get to it, is a major and humbling reminder for humanity, that we are still in our technological infancy.

- **<u>Who is planning to go to Mars and how?</u>**

- The future missions to Mars are currently officially being pursued by three different groups, with goals of reaching the red planet for three different reasons.
- As the goal becomes more attainable, perhaps we will see even more interest in Mars.
- For now, we can watch, and wait, and see how the story plays out.

- **<u>What does the future hold?</u>**
  - In our lifetime Human beings will walk on Mars. It will be a moment that will be remembered forever.
  - As human beings, exploration is built into us, it is more than who we are, it is what we are, and it is what we do.
  - In the words of the the astronomer Carl Sagan, when referring to the exploration and colonization of space by human beings, he said:
  - “The cosmos extends, for all practical purposes, forever. After a brief sedentary hiatus, we are resuming our ancient nomadic way of life. Our remote descendants, safely arrayed on many worlds through the solar system and beyond, will be unified by their common heritage, by their regard for their home planet, and by the knowledge that, whatever other life may be, the only humans in all the universe come from Earth.

  - They will gaze up and strain to find the blue dot in their skies. They will love it no less for its obscurity and fragility. They will marvel at how vulnerable the repository of all our potential once was, how perilous our infancy, how humble our beginnings, and how many rivers we had to cross before we found our way.”
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Sources Cited

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