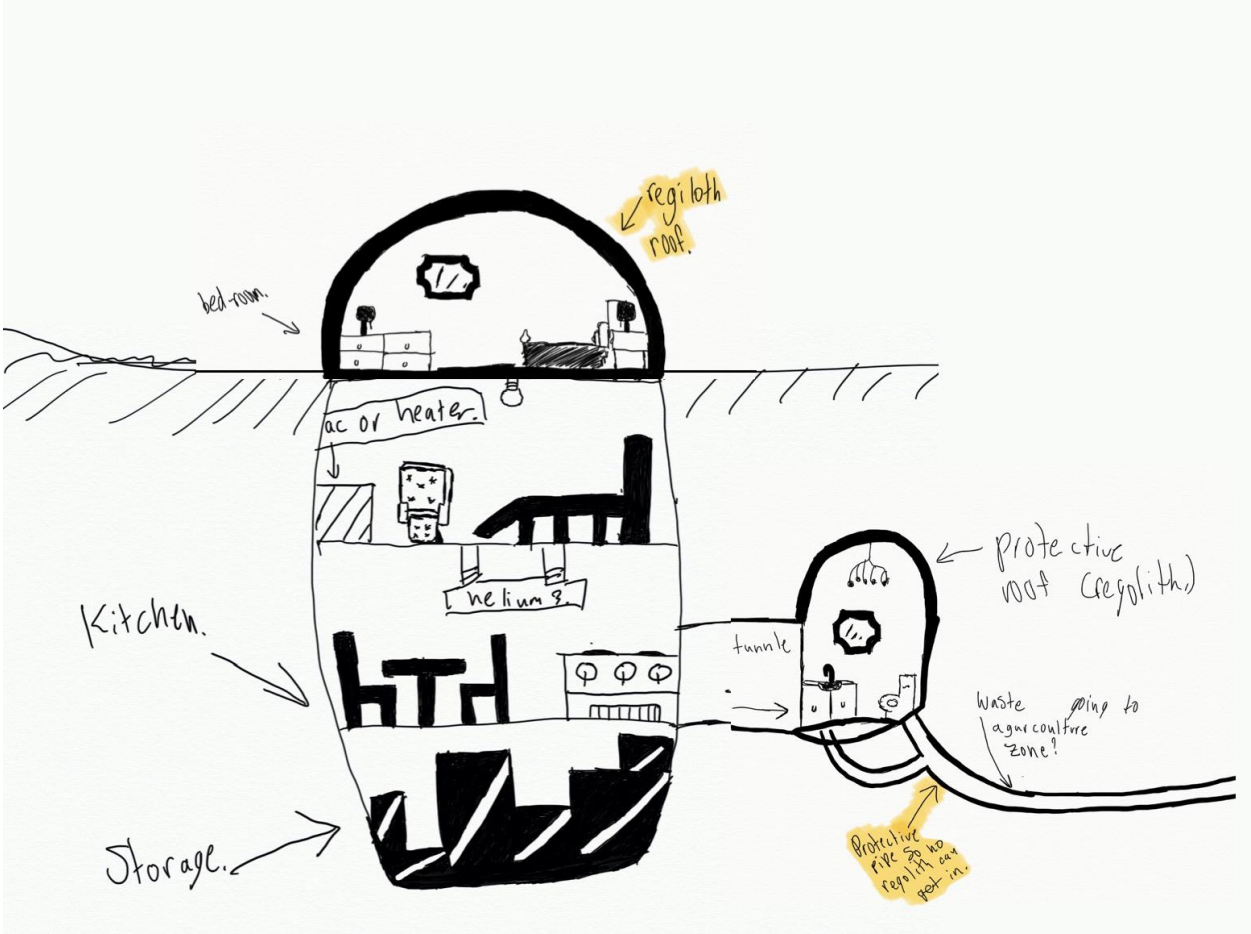
Montropolis

Montropolis is a city of 80,000 people located in the Shackleton crater on the south pole of the moon. This impact crater is 2 miles deep and 12 miles wide. Building on the Shackleton crater has its benefits. A normal moon night lasts two weeks, but on the rim of the crater, there is always light. This helps produce solar energy. The peaks along the crater rim give a good view of the earth and serve as radio telecommunication centers.

The bottom of the crater is very dark and cold (-250deg F) and is a good source of ice. This gives us an abundance of water to drink and use in our aeroponic greenhouses. Water also gets separated into hydrogen and oxygen using electrolysis. We use some of the oxygen to breath, and the rest is stored as rocket fuel. Our Aerospace engineers build big storage containers and send them out into space, creating gas stations around the galaxy for other spaceships. Some are in orbit around earth, and some are further out.

Life on the moon is fun and exciting. Dome shaped lunar houses and buildings made of titanium and regolith (moon dust) bricks provide protection from solar radiation, asteroid showers and extremes of temperature. Futuristic droids called Regobots help melt regolith into bricks and smooth walkways for our city. Occasionally a dome gets punctured, but the emergency team comes and gives you space suits while they rebuild your house. Fire is very bad for moon houses, so everything is flame resistant, so that the risk of fire is very low.



Moon House

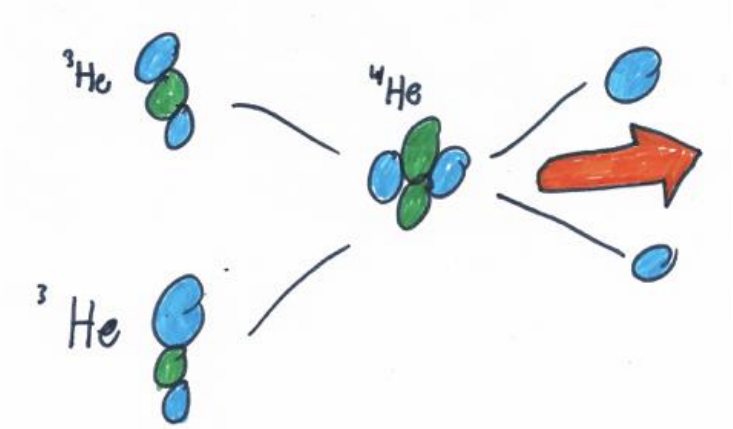
People of all professions live on the moon, however most notable are engineers (metallurgy, aerospace, computer, electrical, mechanical, civil, architectural, environmental) followed by astronauts, healthcare workers, teachers, agriculturalists and first responders. Education carries great importance and there is special emphasis on deep space exploration and foreign languages. Advancements in healthcare include use of computer chips to help the disabled and better cancer treatments. Lunar inhabitants travel using lunar rovers and space capsules through a network of both above ground space tubes and underground lava tubes. Food is grown via hydroponics and aeroponics in special underground greenhouses. This saves space, need for soil and helps recycle human waste and byproducts. To beat the stress of lunar life people engage in fun recreational activities including rego-hockey, rover racing, micro-gravity soccer and lunarcise (lunar gyms for exercise).

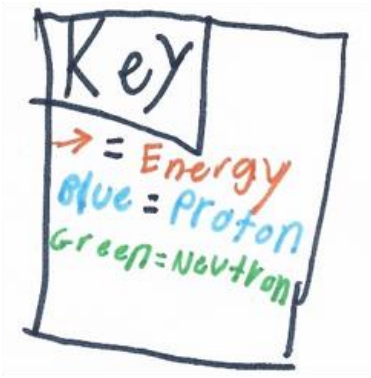
There are many challenges to living on the Moon. The main challenge is regolith or moon dust which is made up of a fine collection of rocks, soil, and mineral particles. It covers nearly the entire surface of the moon. Regolith is not at all like the dust on Earth, in fact, it can be very troublesome. When disturbed, regolith particles get into anything and everything making them a nuisance. It is very abrasive, wears down spacesuits, machines, and electronics. In addition it has many health hazards including eyes irritation and lung problems.

Even though regolith causes many problems, we are able to use it to our benefit. About 42 percent of regolith is oxygen, which is extracted to make breathable air and rocket fuel. When heated it melts to create a resilient solid material offering great protection from the sun's radiation, asteroid showers as well as extremes of temperature. This material is used to make building bricks, roads and solar panels as shipping from earth is very expensive (in 2020 the cost to ship 1kg of material was $2,720)

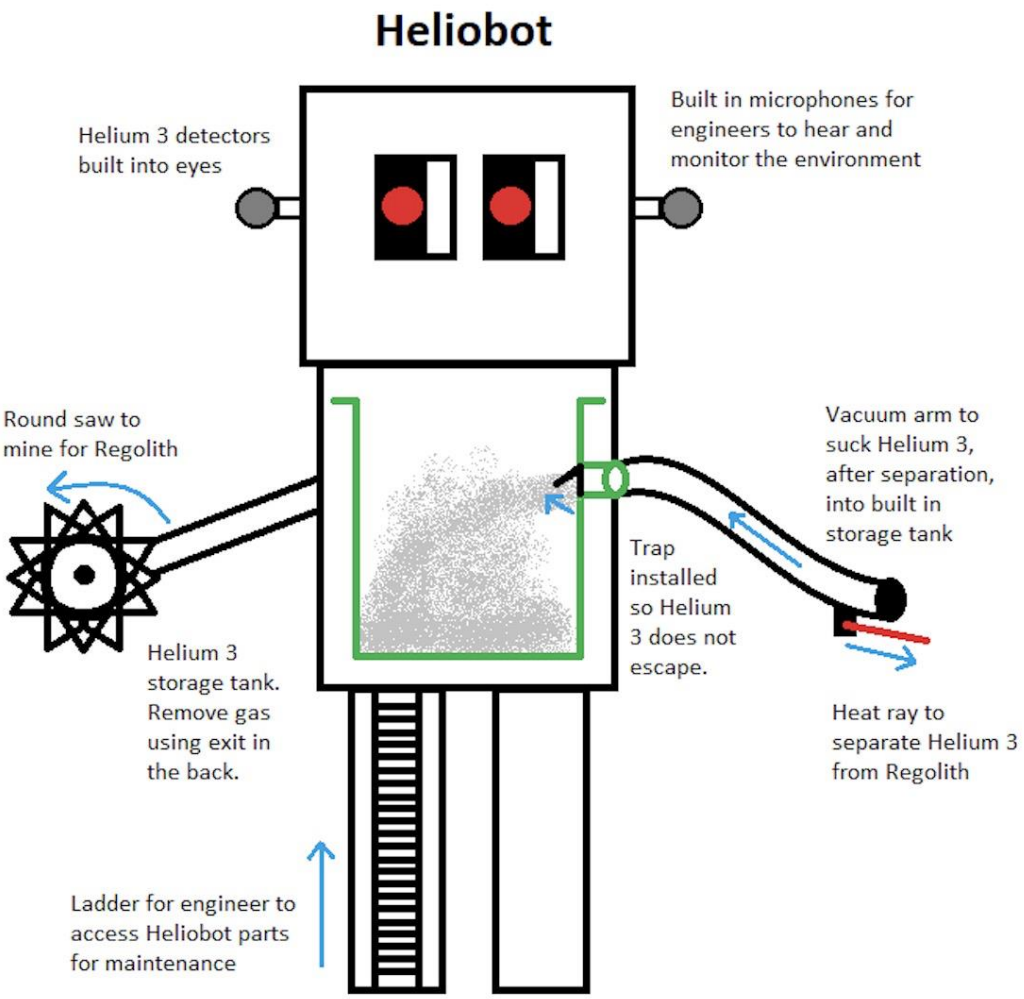
The most important moon resource for our city is Helium3. 50 years ago, Earth ran out of fossil fuels, and really needed a different form of fuel. Using Helium3, Nuclear Engineers created a new type of Nuclear Fusion that provided all the energy the earth needed. There was no Helium3 on the earth, but there is a lot of it on the moon, deposited by the solar winds! We mine Helium3, and send it back to earth. We make lots of money (In 2009 1 ounce of He3 cost $40,000 on Earth) that we use to buy and transport new things to our city, keeping us safe and healthy.

Nuclear fusion happens when you fuse Helium3 together. It makes Helium4 with 2 of the protons flying off, and energy is created. Nuclear fusion does not cause pollution (like fossil fuels) or have radioactive waste (like nuclear fission), so it keeps both the earth and the moon powered with safe clean energy.



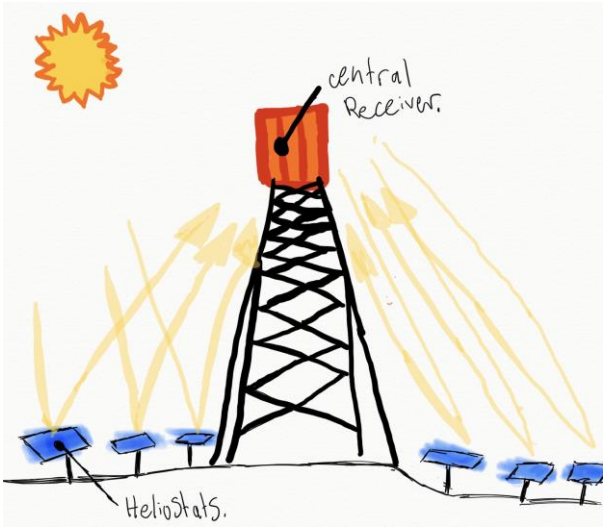


Even though there is a lot of Helium3 on the moon, it is still hard to get. Most of it is scattered through the regolith. Our mechanical engineers created special mining robots called Heliobots, to scoop up Helium3 rocks and dust. The robots bring the rocks back to a solar powered heater, which heats the regolith up to 600 degrees Celsius. At that high temperature, the Helium3 is taken out. The Helium3 is then put into big tanks and frozen for storage and shipment back to Earth.



Heliobot

Robot



Solar Heater

Moving to the moon was a great success! We faced many problems: toxic regolith, extreme temperatures, and meteor showers. But we gained a whole new energy source, Helium3. The future is exciting; come join us here in Montropolis!

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Dusty Dunes

Barton Creek Elementary

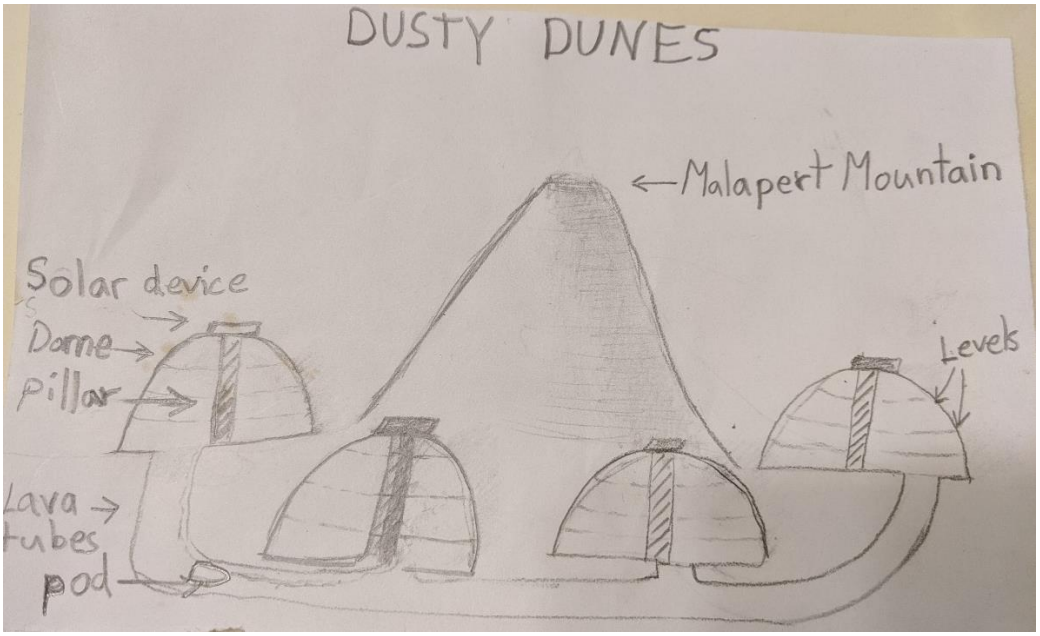
Fourth Grade

Dusty Dunes, our lunar city is located at 43° S, 11° W in the Tycho crater on the near side of the moon. On the outer rim of the crater, there are terrace and dune like shapes and so the name of the city respects its origins. At the center of this city is the tall and majestic Malapert mountain. The advantage of living here is that the mountain is exposed to sunlight most of the year. This helps with the city's solar energy needs and communication to Earth. It also offers a smooth landing for our spaceships from Earth.

The city is close to the South Pole Aitken Basin where there is more water for future needs. The Tycho crater is connected to natural lava tubes so you can evacuate to the tube in case of an emergency. The tubes have roofs that naturally protect people from meteorites and radiation. The crater also has slow cooling and slow heating properties that is unique to this crater. It is useful in keeping temperature costs down. The disadvantage of living in the Tycho crater is that there is no sunlight in the interior and water needs to be used wisely. The other downside is that the Tycho crater can't protect you against radiation and so our engineers had to build some technology. The city has a population of about 10,000.

Location of Tycho Crater

There are 4 main domes around the Malapert mountain. The central mountain is 7 km high and has 300 days of sunlight for collecting solar energy. The existing underground lava tubes are used to connect the domes. This helps with dome to dome transportation and if one dome has an emergency, the others help the broken one.



Dusty Dunes City Plan

The dome was picked because that it is the best shape for holding pressure. Smaller domes are easier to put together and take less energy to build. They are easier to rebuild after a hazard. The dome and its central pillar is the main innovation of our mechanical and electrical engineers. The dome is made from lunar regolith and city waste mixed with water. This mix is fed into 3D printers to make small parts which are assembled to form the dome. The dome shields us from radiation and lunar hazards. The pillar is made up of moon resources like iron and aluminum. It connects the floor of the crater to the dome. It is the lifeline that sources solid ice and minerals from the crater floor. The solid ice is converted to water. Oxygen is sourced which gives breathable atmosphere and moderates temperature. Solar devices at the top of the pillar store solar energy and have back-up cells that feed energy to the pillar and light up the dome. To encourage saving solar power, our city projects Friday night movies on the interior dome walls when we have met our energy goals for the week. The dome walls have sensors for air leaks. There are levels in a dome with each level for different activities like housing, food, education and medical work. One level in the dome has a lunar greenhouse, where gardeners grow plants without soil. Carbon dioxide from ventilation systems within the pillar feed this greenhouse. They use bio waste and use anaerobic bacteria to break it down. Our food consists of produce like kale and lettuce. The pillar also reuses city waste water and directs it to greenhouse. Our researchers have 15G network on Malapert mountain that helps connecting us within our city and to our friends on Earth. The council organizes ‘Malapert Marathons’, ‘Luney Dunes’ and ‘Scavenge the Tube’ to keep our muscles strong. Our anklets monitor our steps to give us energy discounts. Schools have science fairs to encourage energy saving projects.

Another innovation is the transport pod system in the lava tubes. The entry and exit of lava tubes are present in the dome’s lowest level. This protects people from having to be leave the dome and get exposed to external air. Our safety workers created a blowing room and sieve mesh to keep lunar dust out. This also helps when people need to exit the whole city system. The inside of lava tube is already protected from the lunar air and is a clever use of an existing lunar structure. The tunnel is rich in iron. Electrical engineers helped with using the concept of magnetic levitation for the pods. The small pods run on solar energy on overhead rails. The system uses an initial burst of power. It pushes each pod and allows it to glide inside the track. The tracks move the cars with passive magnetic

levitation, so no power is required to keep the pods up and mobile. Every few miles there is a recharge station for another burst of power needed for pod. This system uses two sets of magnets: one set to repel and push the pod and another set to move the pod ahead. The magnets also control the speed. The interconnected tunnels are color coded. Red line goes clockwise and yellow goes anticlockwise.

The tradeoff was that initially not all lava tubes were interconnected. So we needed to interconnect lava tubes by digging small corridors. The dome's solar devices could not feed this system and were drained. We needed stronger cells to store energy. The benefit is that this whole system with the dome, the pillar and the pods is built by putting together small parts. We have a short time to build and replace and reuse parts. Another benefit is that any waste is recycled and reused.

Dusty Dunes is the only non-Earth location in the solar system that is inhabited by people, looking to build a life outside Earth. The use of naturally existing structures and resources has made our city very inviting to people who love local. The city's nature inspired architecture and blend with its surroundings has people just wanting to come experience life here.

Word count = 997 words

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Hale Mahina, Moon

By Vivi Howell, Janelle Lee, and Lindsay Zhang

Fifth Grade

Barton Creek Elementary

The city of Hale Mahina was built in 2050 by a group of refugees who were fed up with the polluted environment of earth and wanted to find a new place to live. The moon citizens managed to settle down on the moon, but they still struggle with the moon's environmental hazards and lack of resources.

Hale Mahina is located on a crater rim near the lunar North Pole. The settlers chose this location because of the availability of ice there which is needed for human survival and the near-constant sunlight. Any other locations would have been too risky due to the drastic changes in temperature. The settlers use the water in the ice there to produce drinking water, extract hydrogen and oxygen, and operate hydroponic farms.

The living modules rotate on the center axes so that some areas receive sunlight during the simulated day hours and others stay in the dark. This makes moon citizens feel like they are back home on Earth. Since there is virtually almost no gravity on the moon, it will take little energy to rotate the modules.

To protect the residents against the extreme temperatures and moon dust, and also to provide a supply of oxygen, capsule or half-sphere-shaped shelters were built which are connected, sealed and filled with breathable air. We used 3D printers to print the wall with super glue and moon dust. Moon dust is very tough and can protect citizens against solar rays and other dangerous environmental hazards. Since cars cannot be used on the moon due to the environment, the moon citizens use lunar roving vehicles.

There are many challenges to living on the moon, including no atmosphere and no oxygen for humans to breathe; the day and night extreme temperatures (+253/-413F); and the two-week long day or night time on much of the surface. Humans and equipment can’t function properly under these circumstances. On top of that, moon dust is also very toxic to human cells, causing fever, watery eyes, and sneezing even with astronaut suits on.

One of the biggest problems is providing enough electricity to heat, cool, and provide power for all the systems. To have enough power for the city, power must be generated there. The best source of power is helium-3 which is rare on Earth. The moon has large amounts of helium-3 in the surface moon soil that has been deposited there for billions of years. Helium-3 holds a huge amount of energy which can be released through nuclear fusion reactions in an aneutronic (power without neutrons) process.

Scientists estimate there to be more than 1.1 million tons of helium-3 on the moon's surface. To get helium-3, moon citizens excavate topsoil from the surface of the moon, heat it up to a super-high temperature of 600 degrees Celsius to extract the helium 3. The scientists and engineers then use the helium 3 in a fusion reactor to release a lot of energy to control the temperature, produce oxygen from water, and operate all the systems of the city and living modules.

Mining and burning moon rock at a super-high temperature to get helium-3 is extremely hard. Large equipment is needed to mine the moon soil and process it. Before the helium 3 can be used in a reactor there has to be enough energy to mine and extract the first batch. Researchers have reported it takes about 1 million tons of lunar sand to produce 70 tons of helium-3. Benefits of using helium-3 are that people have plenty of safe energy to support their lunar living. Once the reactor is generating power, it is self-sustaining so the city can have as much power as it needs. Any extra power

generated from the helium-3 can be laser-beamed back to earth to reduce Earth pollution and earn money to support the city.
Civil engineers help moon citizens build inflatable living modules, nuclear engineers help with building helium-3 fusion reactors and manage fusion reactions, while hydroponics engineers help with plantations without earth soil to grow food. Other non-engineering jobs are also needed by the moon community, such as therapists, firefighters, chefs, and doctors.
Living on the moon can be extremely hard and our goal is to apply new technologies to improve the living conditions over time. While on the moon, the citizens can access valuable resources such as helium-3 and are also able to study the moon and the universe much closer to learn new information that we never knew. People want to live in Hale Mahina because it gives a safe, clean place to live and helps make life on Earth better too.

768 words

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Bonham 2.0

Bonham 2.0 started out as a researching facility, located at Tyco Crater. Bonham 2.0 is located in the southern highland on the near side of the moon. Due to the discovery of a lava tube large enough to fit Houston, Las Angelas, Philadelphia, and Chicago, and more, it became the largest underground settlement on the moon. In May 2151, Bonham 2.0 is set to celebrate 100 of continual settlement on the moon. Today it has grown to be the largest megapolis in the universe with more than 25.5 billion people.

The benefits citizens enjoy because it is located in an underground cavity or lava tube include being shielded from the drastic temperature swings found on the surface, significant protection from space radiation, and protection from micrometeoritic bombardments and sandblasting from rockets as they land and depart from the area. The thick solid layer of basalt located at the top of the lava tube provides a natural barrier to the outside world. To overcome the darkness of underground living residents utilizes solar energy capture from the sun to control lighting. They have a plant on both sides of the moon to ensure electricity is available year-round.

At first, the residents were primarily scientists and engineers concerned with the initial establishment of a permanent settlement on the moon. Today, Bonham 2.0 is home to a diverse society from every corner of the world. Since the United States established Bonham 2.0 the primary language is English. However, the vast majority of the residents can speak at least five languages. They also celebrate many of the same holidays as their ancestors did on Earth including Christmas and Valentine's day.

Structural and Civil Engineers worked together to design sturdy structures that could withstand daily temperature fluctuations for more than 200°F, deadly levels of radiation, low gravity, and micrometeorite impacts. Environmental Engineers and City Planners worked together to create an underground environment like no other in the Universe. Through carefully planned zoning and self-aware habitats that are capable of identifying and diagnosing potential problems in the city, repairs can be made by robots long before the humans living there even know there is a problem. Police, hospitals, and fire protection are connected to this main system. Robots are dispatched to the area with needed help.

Today, humans from all walks of life live cohesively in the democratic republic of Bonham 2.0. Many left Earth because most of the countries had fallen into the control of socialism leaving little to be obtained by working hard. In fact, many of the residents were once small business owners on Earth.

Houses are constructed from materials including aluminum, titanium, and iron. Engineers also use byproducts from the process known as Aquaextraction where water is harvested by heating lunar regolith to 3,500°C in a specialized facility. 3-D printers create homes and businesses using this recycled metal alloy. The residential area is located around the perimeter of the city in pods. Commercial zones are spread across the city to ensure needed supplies are close at hand for all citizens. Manufacturing and Industrial areas are located at the far end of the tunnel away from the hustle and bustle of the city. The recycling center is also located in the deepest part of the tunnel. Here robots sort the garbage into categories and all parts are recycled or burned in the creation of electricity.

Residents of Bonham 2.0 can often be found using telescopes that look out from the skylight located at strategic spots through the city. On a visit to the far side of the Moon, citizens can dabble in radio astronomy using the giant radio telescope to observe low frequencies of radio waves. Others seek to learn more about distant black hoes and supernovas through analyzing lunar regolith as they seek to uncover the history of the universe.

On occasional outings, others choose to go prospecting in a robotic sidekick. One never knows what rare mineral might be found on the crater packed lunar surface. A popular TV show allows viewers to take control of a lunar explorer robot as it travels across the

rough and rocky terrain. They also enjoy the latest in video game technology right from their wrist.

Residents typically live in condominiums designed for single families. Many young adults choose to live in the newly designed SpacePlace Citizen Center which offers a single living space with many amenities including an amusement park, shopping center, educational center, astronomical observatory, and an endless variety of entertainment options. While hothouses and vertical agricultural farms provide a variety of fresh food for the residents of Bonham 2.0, all homes are connected to food printing services. These are 3-D printers that print out whatever citizens want for each meal. Residents push the button and like magic, the food prints out instantly.

Special suits allow citizens to live in the low gravity conditions on the moon. These suits have a built-in monitoring system that sends signals to the command center where medical specialists dispense needed medication. Robots help keep the area clean and safe. Public transportation includes vacuum tubes, space buses that pick up individual pods and deliver them to the desired location, and motion censored sidewalks. Individuals have jet-powered space cars, hoverboards, and solar drones to move about the city.

Education features state-of-the-art study at-home customized to student's needs. Children begin their education at the age of 2 and continue until they have mastered the material needed for their chosen career which they choose by the age of ten. Specialized colleges are available including law, engineering, planetarian geology, and medial fields. Teachers meet with the students through virtual devices in each home.

Overall, Bonham 2.0 provides everything its citizens need. Visitors from Earth come for a long weekend and decide to stay for the rest of their lives. If you happen to be in the area drop in for a cup of coffee or the latest moon drink fad.

Word count 998

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Random City, Alaska

By Samantha N., Tyler R., and Tatum S.

Fourth Grade

R. F. Patterson Elementary

Random City is a very insane place to live. This city was built in 2005. The population is an outstanding 473,810. It's located in Northern Alaska. One fourth of the city is covered in a lake. Random City also produces way too much trash. So we came along and showed them our invention, the Trash Train and the Super Sorter Trash Can!

Every person in Random City produces about one ton of trash every year. So adding up, the entire population produces about 1 billion pounds of trash each year. The Trash Train goes to houses and takes the trash from people. Each pound of trash people make costs them 25 cents. This influences them to stop generating so much trash. When you put your trash in the Trash Train, the train weighs your trash. You have to put the right amount of money in the slot. Once you put the right amount of money in the slot the doors shut and the train leaves. The train goes through that cycle at every house in the neighborhood. The Trash Train is about 3 ½ feet tall and 7 feet long. It has 3 cars. Two of the cars are storage boxes and the first car is the weighing car. There is a suction tube that takes the trash from the weighing car to the storage cars. Once the storages cars are full, the Trash Train goes to the Super Sorter Trash Can to drop off the trash, then it goes around again until it's full again. Inside the Super Sorter Trash Can scanners look at the trash and then the mechanical sorting arms put the trash on the right conveyor belt. The conveyor belt puts the trash in the right bag and the bags are sent to a recycling plant, a farm, or a homeless center. Things that can't be recycled, composted or

reused are sent to the incinerator which burns those things for green energy, reducing the amount of greenhouse gases. The green energy is used to power the hydroelectric turbines, located in the lake, that charge the Trash Trains, the mechanical sorter arms and the conveyor belt. The green energy for turbines is sent through wires that connect to the blades which turn and charge the trains. The leftover green energy is used to power the rest of the city.

The money collected at the Trash Trains is used to pay the people who build the trains, run the power plant and the hydroelectric turbines.

The cost of our system is that, in the beginning, the hydroelectric turbines use non-renewable resources as a power source. The benefit of it all is that Random City doesn't have any more greenhouse gases and that they don't produce much trash.

We chose the hydroelectric engineer to help because he/she can open and close the gates, make sure nothing is blocking the water flow, monitor the amount of electricity each turbine generates, and conduct routine inspections. The electrical engineer can design the Trash Train's remote control front and the radio collar used to track the train.

Random City reduces pollution, reuses and recycles trash for eco-bricks, and uses the rotting food as fertilizer. People live here because it is a safe environment. Random City has clean air, not much trash, and no greenhouse gases. The Super Sorter Trash Can will sort your trash and the Trash Train will take that stinky trash out of your house.

574 words

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574 words

Wet and Wonderful Wichita Falls

Brenna C., Nevyn J., River R.
Fourth Grade
R. F. Patterson Elementary

We chose Wichita Falls because of the drought and we want to help conserve water. Wichita Falls contains 104,000 people. The problem is that the city is having a drought and there is not enough water.

The crop we chose was kale. We chose kale because it is one of the healthiest vegetables and it is a popular vegetable to eat. It is healthy for the citizens of Wichita Falls because it has all the nutrients you need in a vegetable.

Our farming method will successfully grow our crop by using the water from the plants and giving it to the fish. We can grow enough of our crop for the citizens because aquaponics are safe for plants and fish.

It is energy efficient because we use solar power from the sun. We are not using electrical energy for our light source to grow our crops.

The lack of space is one of the risks because we need a lot of space for the fish tanks. One of the risks are the tornados that can take down the farm. Another risk is that there could be too much sunlight and it could kill the fish. A benefit is that you can make the farm inside so it protects the crops and the fish from predators.

The marine architect will help us with our aquaponic tanks because he or she can design vessels to go underwater and collect fish for our tanks. We think the solar energy system engineer would help us by designing a photovoltaic system to use the solar energy. The environmental engineer will help us because he or she can design the fish tanks. The civil

engineer can help us with our building for the fish tanks because they can design buildings that are less likely to be destroyed by tornados.

Our solution will be effective because the water we use is being reused. The plants and fish are cleaning the water because the fish eat the particles the plants produce and the water goes back to the fish. The cycle starts over again. Our overall goal is to help Wichita Falls conserve water and we believe our system will do that.

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Resources

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