EARL DINGMAN'S MOONBASE DESIGNS

Both of my designs make use of INTERMODAL containers. Aluminum containers are lighter in weight and also effective in limiting some forms of radiation. Steel is stronger but has less deflection of radiation and weighs more. I toyed with using an empty rocket cylinder mounted on the top stage, but because it is a cylinder it might roll once on the ground. The shape is also not conducive to front and back walls or doorways.

These containers would be used to bring up equipment and supplies, then turned into shelters. In some instances, they could be prepared for assembly on Earth with cuts made into the sides and back.

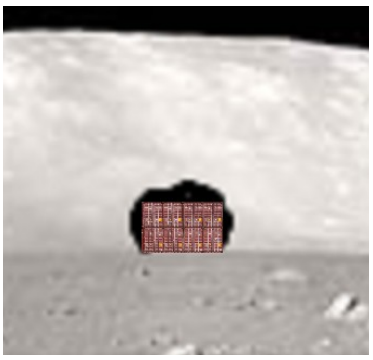
The inside would be made out of paper and aluminum fiberglass insulation and the materials used by Lockheed to make parts of the L-1011. A honeycomb material with something akin to fiberglass on both sides. Strong and lightweight. (Long ago, a Lockheed toolmaker showed this material to me and told me about its tensile strength. It was probably patented and probably isn't made anymore but could be fabricated for use in the future. From what I saw it weighs less than plywood, sheetrock, and wallboard.)

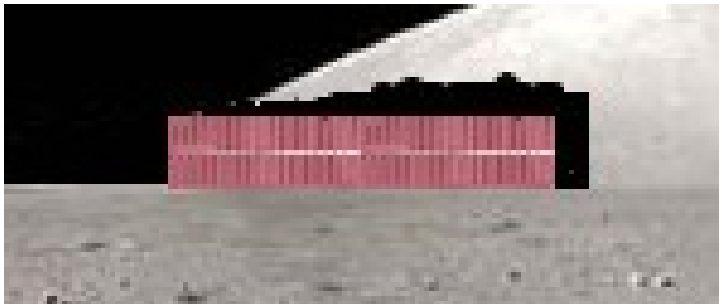
The MOONBASE has to be done in stages. Initially, intermodal containers with airtight construction and insulation would be used as temporary housing. Much like double-wide trailers are used by contractors at construction sites.

Creating this colony calls for a construction and engineering crew instead of astronauts. Astronauts can bring the crew up in ships, but you can't train test pilots to do their type of work.

I have two initial designs: One will only work in granite type mountains, such as the ones on Earth that are cut to make railroad tunnels.

Front View





Side view Cut-away

The first design calls for drilling into the side of the mountain followed by careful blasting with RDX or a similar charge to make a twenty-five-foot high cave that goes in as far as needed.

It requires a small size bulldozer and dump truck to carry the rocks away. This means we need to bring up 15 to 20 tons at one time in a ship, the size of a bulldozer and eventually the size of a crane. These vehicles have to be made to run on oxygen and hydrogen.

One bulldozer and one dump truck should be enough initially to build both base types unless you just want Intermodals on the surface which is faster and cheaper but not as safe.

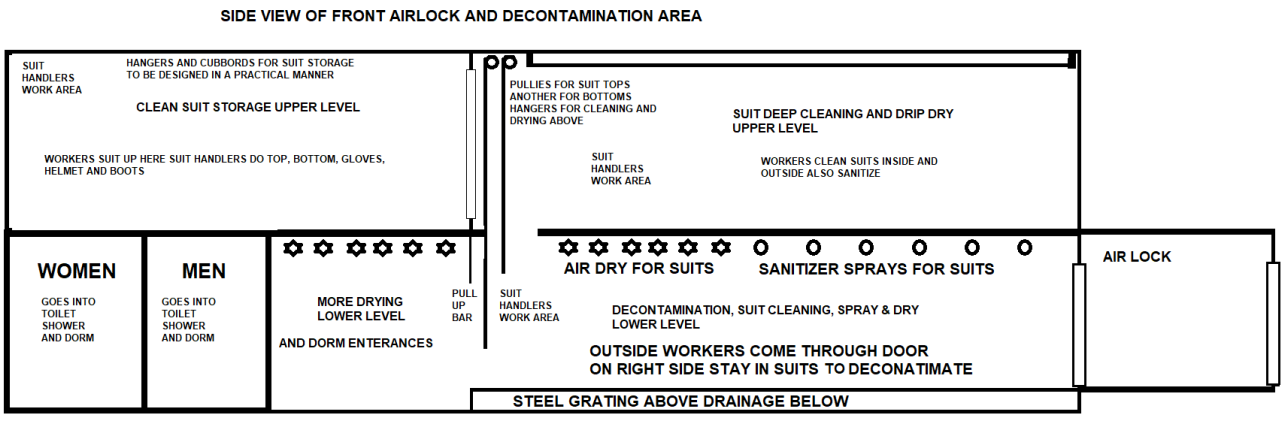
The second design calls for the soil to be dug away. For the first temporary shelters only 30 feet down and two hundred feet around.

This requires a bulldozer with a scoop front and a dump truck. It requires making a 4 to 5% dirt grade from the bottom to the top.

In both of these settings, the Intermodal containers are positioned two tall, two to four across, and two to three back. They would be bolted together and if steel is used seam welded. If aluminum is used steel support frames that are welded could be used, as well as bolts.

Doorways between containers would have to be cut. Ladders or stairs are needed to service the upper level.

Power is obtained by hydrogen and oxygen fuel cells, augmented in daylight by solar panels on the surface. As an alternative, an AC generator can be made to run on hydrogen and oxygen. Atomic batteries can also be used. All of these would be located at a distance from the habitat for obvious safety reasons. (Possibly housed on the surface in other Intermodal containers.) In the future, a small nuclear power plant like the type used in submarines would provide power for many colonists and commercial operations like foundries to make steel beams, sheet steel, and rebar.

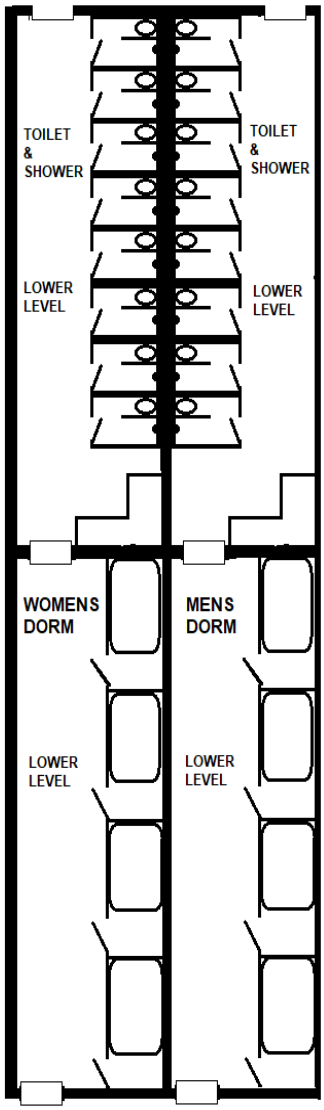


I envisioned a rather sophisticated airlock and suit cleaning area because I’m sure that after a while we’re going to discover there is toxic soil (that could be laced with heavy metals) and slightly

radioactive soil (from the solar winds). Soil clinging to boots and suit fabric needs to be cleaned before anyone can remove a helmet and breathe. Therefore there would be a wash and scrub system, akin to a car wash on Earth. A perforated walkway with cleaning solution draining down below, being sucked and stored in waste tanks. Spinning brushes would remove debris.

Spacesuit handlers wearing PPE with the kind of masks that workers at nuclear plants use would tend to the incoming crew. They would hook lines to the top of the suit and lift it while helping the person inside get their head and hands out. The incoming worker would then use a PULL-UP type bar to get out of the bottom of the suit that also gets hook to lines that will drag it upstairs where it will be deep cleaned inside and out.

The workers who climbed out of the suit are wearing shorts and a T-shirt, “space scrubs,” or some type of flight suit. They will walk further down the corridor (that is in the next intermodal container) and go into either the MEN’S or WOMEN’S shower and dressing area. There will be a guard posted to keep pranksters and hazers under control.



Inside the connecting intermodal is a full shower with a chemical body and hair wash (for two minutes), then five minutes of wash water. Hot air dries the worker with optional towels once we have laundry facilities, otherwise just hot air.

There will be a rack of fresh “space scrubs.” Much like what they provide for doctors and nurses in hospitals. One size fits no one. One-color. Pants, top, soft shoes.

From there the cleaned workers go into the bunk rooms (another intermodal container). Bunk beds, two high with housing for 8 to 16 MEN in one container side and WOMEN in the other container side. A guard will be posted at either side to prevent pranks and hazing. (Women, especially, should feel safe going to sleep at night and taking a shower or potty break.)

By each bunk are lockers for personal items.

Out the back of the dorm would lead to the work areas upstairs or further back behind the dorms. (Remember that I suggested it should be four or more containers wide, two tall, and possibly four to eight more in back.)

The finished containers are then COVERED with sterilized lunar soil on sides and top, leaving a 30-foot excavation that leads from the airlock to the 4 or 5-degree incline going up to the surface. An incline that a Moon Bus, bulldozer, or dump truck could travel with parking near the airlock for all vehicles.

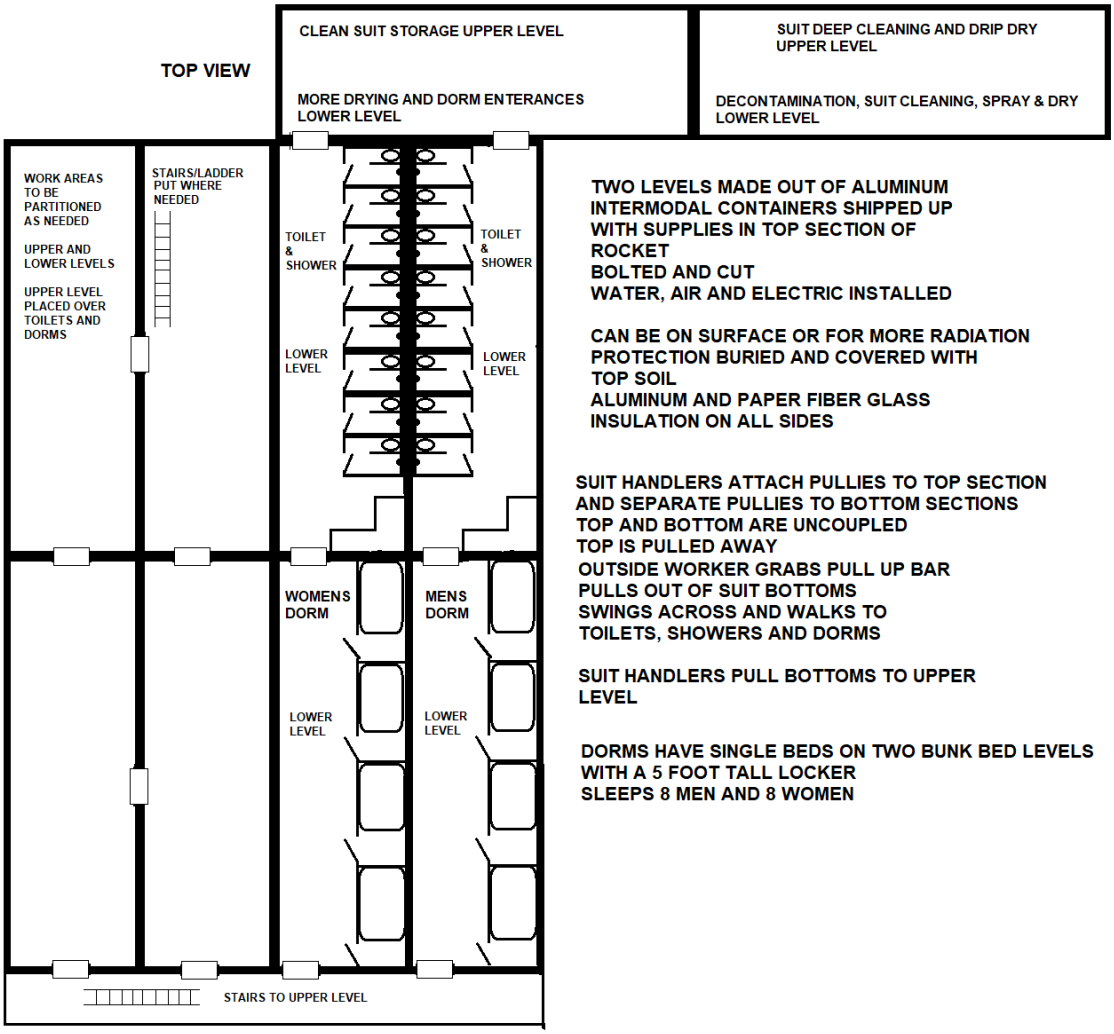
Covering the containers will help protect against Gamma Radiation by offering several feet of soil, along with the steel or aluminum Intermodal containers that will have paper and aluminum foil insulations to limit Alpha and Beta particles. Then the interior walls will be made of the 1-inch L-1011 material as an option.

BACK VIEW

WORK AREAS STAIR AND DOORS TO ENTER VARIOUS AREAS	WORK AREAS STAIR AND DOORS TO ENTER VARIOUS AREAS	WORK AREAS	WORK AREAS STAIR AND DOORS TO ENTER VARIOUS AREAS
WORK AREAS STAIR AND DOORS TO ENTER VARIOUS AREAS	WORK AREAS STAIR AND DOORS TO ENTER VARIOUS AREAS	WOMENS AREA IN LOWER LEVEL TWO INTERMODALS	MENS AREA IN LOWER LEVEL TWO INTERMODALS

BACK VIEW FOUR INTERMODALS WIDE, TWO TALL
A SECOND SET ATTACHED IN FRONT

TOP VIEW



TWO LEVELS MADE OUT OF ALUMINUM
INTERMODAL CONTAINERS SHIPPED UP
WITH SUPPLIES IN TOP SECTION OF
ROCKET
BOLTED AND CUT
WATER, AIR AND ELECTRIC INSTALLED

CAN BE ON SURFACE OR FOR MORE RADIATION
PROTECTION BURIED AND COVERED WITH
TOP SOIL
ALUMINUM AND PAPER FIBER GLASS
INSULATION ON ALL SIDES

SUIT HANDLERS ATTACH PULLIES TO TOP SECTION
AND SEPARATE PULLIES TO BOTTOM SECTIONS
TOP AND BOTTOM ARE UNCOUPLED
TOP IS PULLED AWAY
OUTSIDE WORKER GRABS PULL UP BAR
PULLS OUT OF SUIT BOTTOMS
SWINGS ACROSS AND WALKS TO
TOILETS, SHOWERS AND DORMS

SUIT HANDLERS PULL BOTTOMS TO UPPER
LEVEL

DORMS HAVE SINGLE BEDS ON TWO BUNK BED LEVELS
WITH A 5 FOOT TALL LOCKER
SLEEPS 8 MEN AND 8 WOMEN

This would be the way to go in the next 10 to 30 years. It will not be that glamourous (unless the workers decorate the insides) but it will be functional. These temporary shelters are to house the workers who, over the next 100+ years, would build the permanent colony buildings.

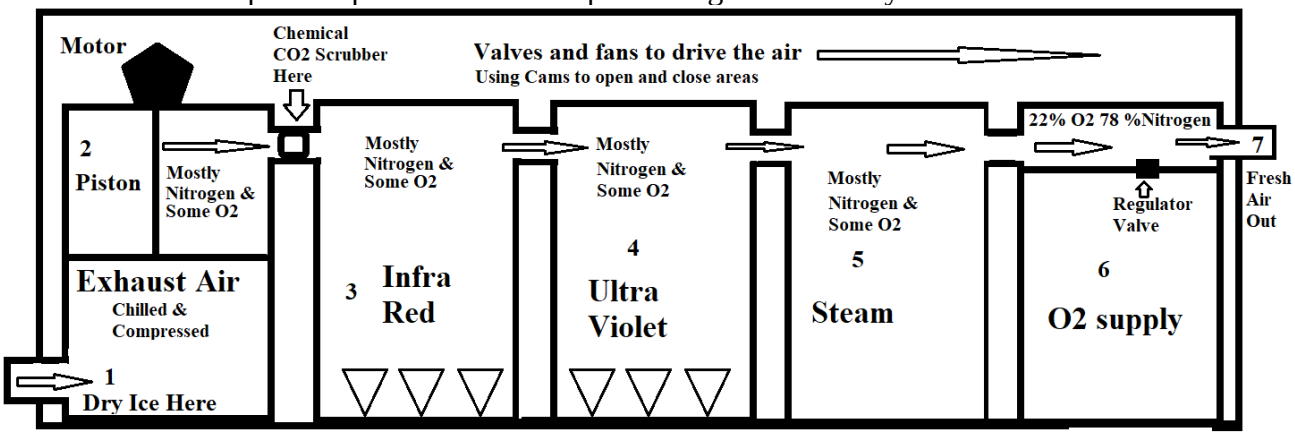
In theory, it would be possible for workers to stay in these shelters for a period of 6 months to a full year. The only hazards might be going outside to work, and a medical team needs to keep track of that.

My view is that surface structures will face radiation and solar winds, not to mention micrometeor strikes that could let the air out of the structure (take note of how many craters and rocks dot the surface of the Moon and how the Earth travels through meteor shower bands almost every month, do we want to gamble with the lives of colonist?). One nickel-iron pebble striking at 25,000 miles per hour could rip a hole through a surface structure.

To dig into the side of mountains or bury containers you have to be able to bring up at 10 to 15-ton bulldozer and a 10 to 15-ton dump truck. To be honest, to build any structure on the Moon or Mars that isn't pre-made like a Quonset hut (or intermodal container) is going to require power equipment and construction equipment. Those will have to be brought up and the power of hundreds of volts and dozens of amps will be needed to run things.

If you cannot bring construction equipment to the Moon and later to Mars there is NO way a colony that is safe for humans can be created based on solar winds gamma radiation, alpha, and beta particles.

You also have to take into account CO2 scrubbing that requires a chemical that must be brought up from Earth until we can manufacture it from lunar chemicals. One of my concepts is a pressure chamber used to compress and chill the CO2 into dry ice (deposition). The pellets, snow, or blocks would be used for either making soft drinks or in the agriculture department for the plants and vegetables. It can also be used as a coolant for food storage, provided there is piping to send the sublimated CO2 back up to the pressure room for processing back into dry ice.



Intermodal Container with CO2 removal system

Since oxygen and nitrogen don't freeze at the same temperature or pressure as CO2 they would be passed through to IR and UV sources to help kill bacteria and finally into a steam chamber where more bacteria will be killed by the near-boiling temperatures. This will also humidify the air that gets passed back into the colony. At this point, O2 would be added to bring air levels up to 22%.

Microbiology and Virology would test the air, food, and water supplies weekly.

With buildings on the surface, you will have limited stay on the Moon because of radiation and solar winds. That means more shuttle trips, more fuel.

Underground or embedded inside a mountain you should be able to stay longer on the Moon, provided the spacesuits are very protective and you limit outside workers to maybe 4 hours a shift.

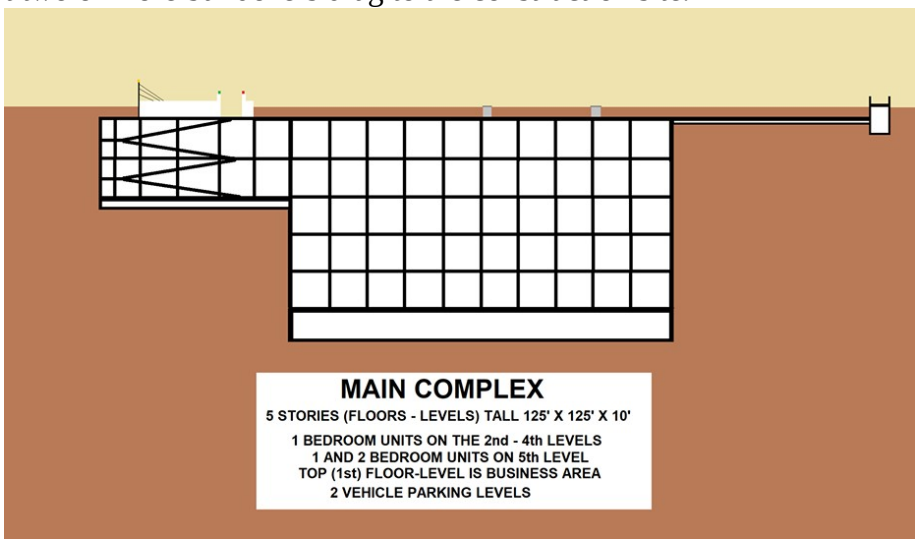
* * *

Over the next hundred years, a permanent colony needs to be constructed by these workers who are living in temporary shelters. Because of working conditions on the Moon, it will probably take four times longer to make a structure than if it were made on Earth. This whole process is based on the first visitors finding iron, chemicals, and sand good enough to make rebar, steel I-beams, and tilt-up walls. That means a metallurgist, geologist (or geophysicist) and chemist must go up on the first trip to determine if the Moon holds promise for mining and manufacturing. Bringing materials up from Earth is not an economical option. Bringing the few things one lacks on the Moon ***is*** a feasible option.

Chemicals and Portland cement from Earth would be required until chemical engineers on the Moon manage to start manufacturing things, and to manufacture things you need buildings, and to make buildings you need rebar and cement.

So, the first buildings will be for soil processing, chemistry, the foundry, and to make cement or concrete. Tilt-up wall construction is required for all buildings and to make these requires that we build a small, temporary tilt-up construction area using alternative materials (such as concrete, cinder blocks, the L-1011 planks, or intermodal containers to create a temperature-controlled environment in which to make several layers of tilt-up walls that a CRANE will have to take out. The tilt-up slabs would be made with rebar webbing laid down as the tilt-up cement is poured. Initially, they would be small, but once other buildings are made the size of the walls can be increased.

The tilt-up construction area would eventually have to be a massive building, probably with an overhead crane or an outside crane that would have to enter through a very tall doorway that is over 25’ wide and 25’ tall. Holes get drilled into the tilt-up slabs. The crane lifts each of them and sets them on a flatbed trailer that two or more bulldozers drag to the construction site.



Tilt-up sections need to be designed to fit in the I-beam lips. I-beam frames would be erected on flat ground or plate steel. A crane would lower the tilt-up wall, slide one between two I-beams, setting it on a ground-level I-beam, then another I-beam would be placed on top of the 20’ tilt-up. Some type of chemical “goop” should be added (that is similar to what is used between freeway sections) to seal the structure and account for thermal changes.

Think of the old Kenner Girder and Panel building sets, but instead of putting panels outside of the girders you slide them down the I-beam tracks that are 2-inches wide and 2-inches thick.

Buildings would be 40 to 120 feet long and wide and 40 to 60 feet tall. Steel I-beams would be inside as well to support the floors and roof.

The roof would be sheet steel and sheet aluminum to protect a little against radiation. Thick enough so a bulldozer can roll over it.

Floors would be a composite of steel grating, aluminum slats, and that L-1011 8’ long by 4’ wide plank that’s 1” thick. Something strong enough to take an electric forklift or a pallet jack.

Before the floors go in, we pressurize the building and see if it is airtight enough to heat. We can use CO2 as atmosphere or nitrogen because we are going to put rebar across the bottom area and make a foundation with concrete and rebar.

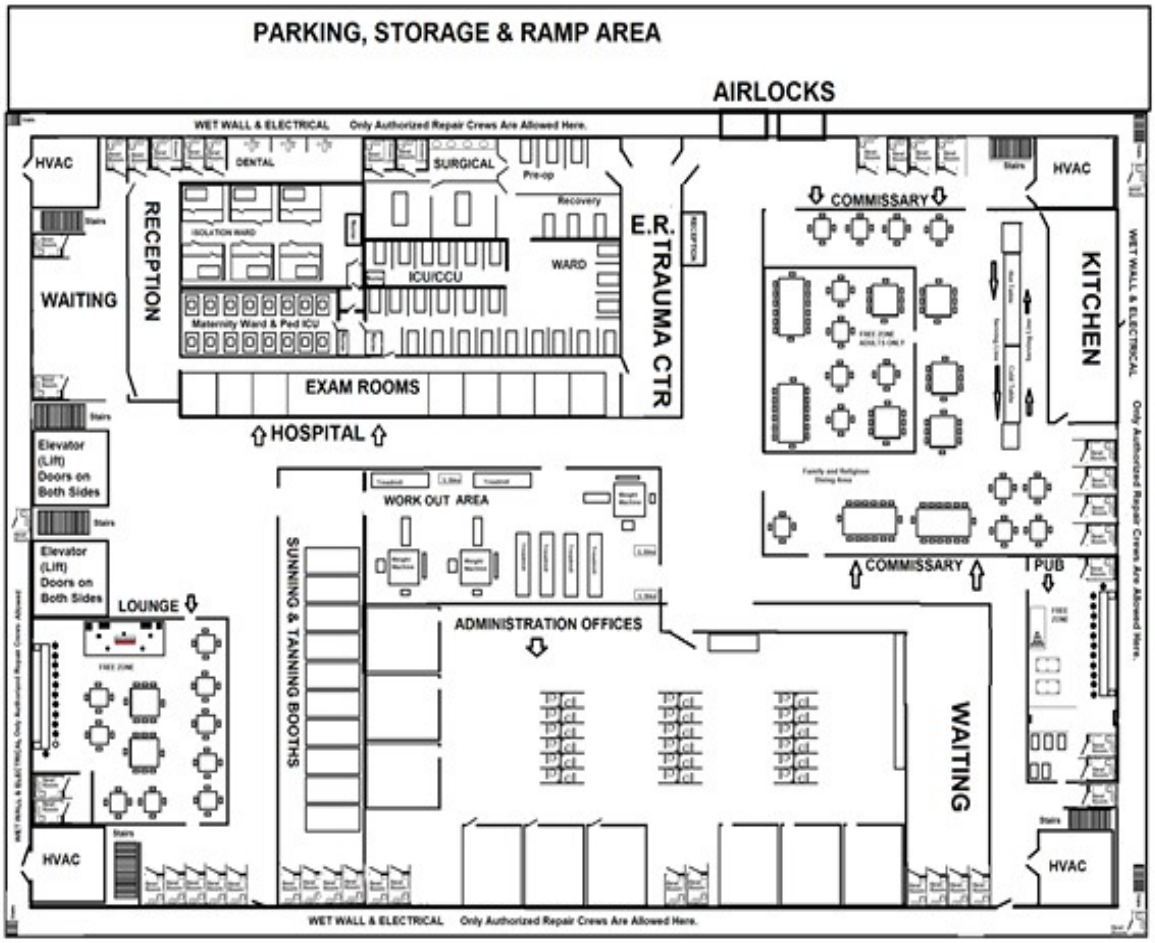
We’ll take more of the L-1011 sheets and make a frame outside of the steel girders, put rebar there, and pour cement in sections from the ground up to make a secondary wall in this 65 to 70-degree temperature-controlled environment.

It would be constructed much like a dam is made across a river. Section by section with rebar sticking out the sides.

Then paper and aluminum fiberglass insulation is put up and another layer of L-1011 walling is placed over that.

Now we start on making the floors, adding plumbing, electrical, air vents, HVACs in every corner on every level. Wet walls will be constructed with access points for maintenance.

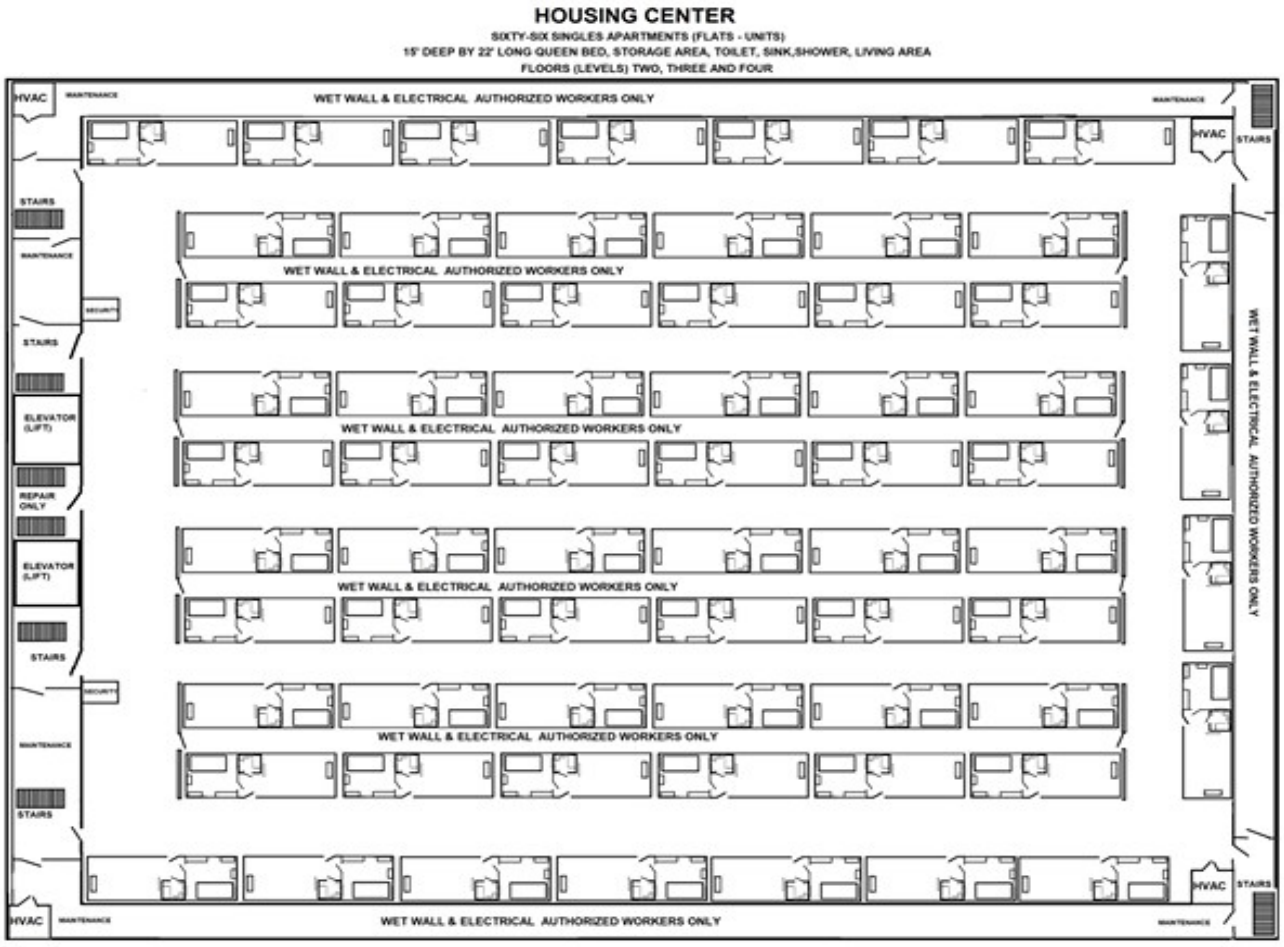
On the top level, we start building a hospital area, offices, commissary, workout rooms, sunrooms, business areas, pubs, lounges, airlocks, and parking for buses.



MAIN COMPLEX TOP FLOOR

We put in elevators (lifts), stairs, and emergency escape towers with ladders going from the ground up to the surface.

On the lower floors, we build apartments. One, two, and three-bedroom with living area, showers, and restrooms. Roughly the size of a typical apartment. 25'x 25' x 35' and 25' x 25' x 50' Wet walls behind. Heating in wet wall areas at the top. O2, CO2, and CO monitors at 2' and 4' levels. Heater sensor 6' up and air return (suction) at the floorboard (to catch CO2 which is heavier than air). Queen or King size beds in all units. Full size in children's rooms.



Guards on every floor to prevent fire, pranks, hazing, and to keep kids in line.

Once the building is finished, it will be covered with soil, to protect the workers from excessive radiation. There will be a cement and steel ramp going up to the surface so that buses can drive in and out of the complex.

Underground facilities with water and sewage pipes overhead and plastic placed above the drop ceiling will resist total Alpha and Beta and reduce Gamma on the upper levels. There will probably be NO gamma on the bottom floor 3 – 6 stories down with all the steel grating and sheet aluminum used for flooring and then the L-1011 planks.

Structural engineers will have to certify the place before use.

It will take TONS of nitrogen and oxygen to seed fill the place and then CO2 has to be removed.

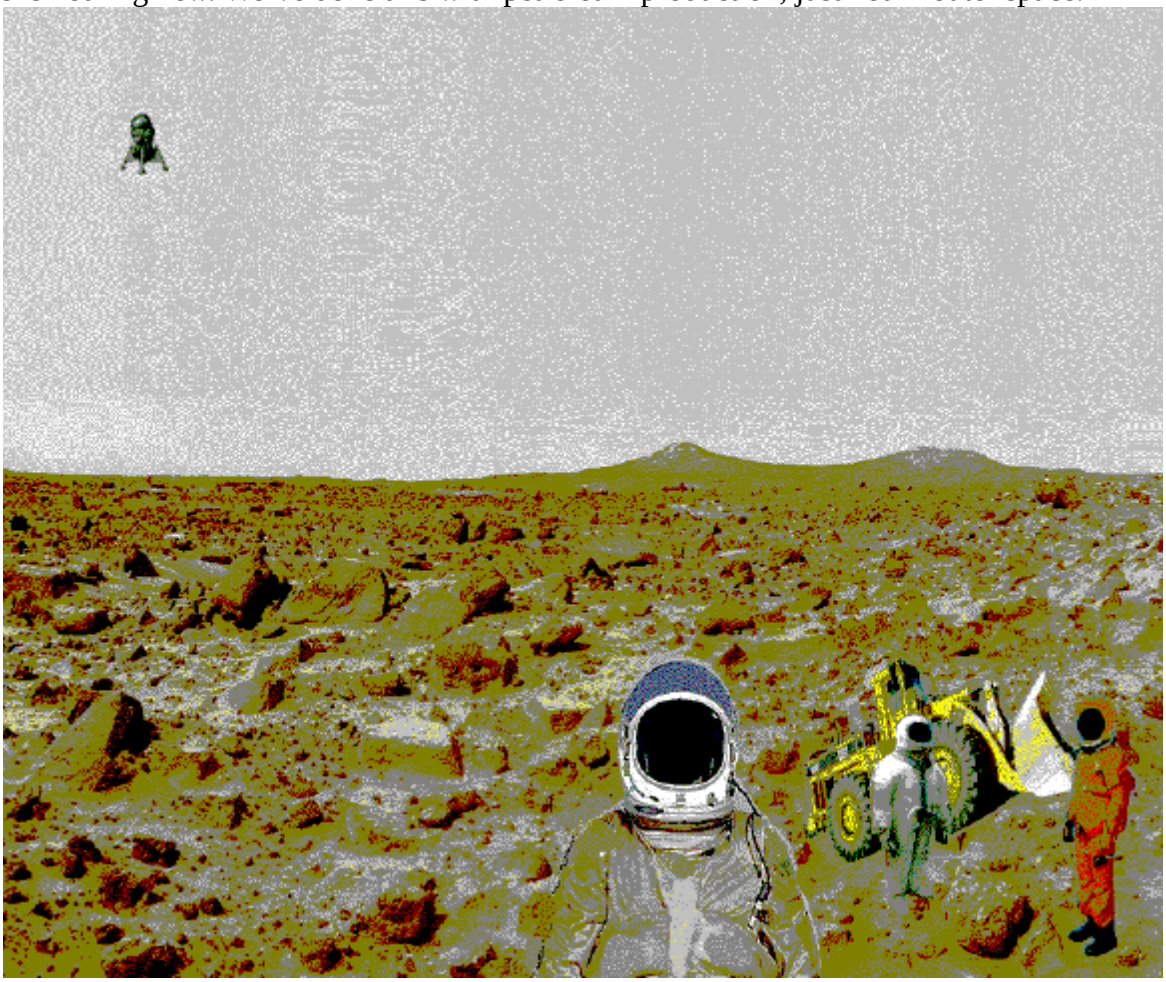
Alarms will be set to warn occupants of excessive CO2 and CO levels.

Showers will use industrial water, mixed with body and hair wash. 7-minute showers at controlled temperature with a 2-minute wash and 5-minute rinse.

To make this practical we have to extract lots of metals and chemicals from the Moon, the Asteroids, Mars, and we have to start mining Jupiter and its moons for Oxygen, Nitrogen, Hydrogen, Waters, and Ices.

This is required to make outer space economically feasible, as relying on Earth for expendables is not a fiscal option. The only place to get fuel and air is either Earth or Jupiter and its moons. Teams of engineers, drone operators, geologists, chemists, chemical engineers, and cryogenic workers need to be sent into Jupiter space to work for one to three years collecting, testing, and refining raw materials. Ultimately a permanent Jovian colony that collects, refines, and ships will the required.

This is nothing new. We've done this with petroleum production, just not in outer space.



Jupiter and its moons have enough hydrogen to supply billions of people with heat and transportation for tens of millions of years and then we have Saturn, Uranus, and Neptune for backup.

These gases and liquids are natural resources, like petroleum. They have to be used if mankind is to survive, as we will be back in the stone age by the year 2300 without a new supply of energy.

On the Moon, we can use solar power for a few weeks at a time. Then we need hydrogen and oxygen power. We need to run the foundry. We need to run the vehicles. We need fuel to power the shuttlecrafts that go from the Moon to the Earth. We need gases to power the tankers that will go from the Earth out to Neptune and back, stopping at space stations made on the Moon or in orbit.

Tourism will play an important part, initially with the rich, as many a person will pay top dollar to see the Rings of Saturn up close and personal. (I propose the rings be preserved as a treasure.)

With unemployment and layoffs construction workers, engineers, miners, chemists, chemical engineers will take entry-level jobs in Space where they will take as long as two years to reach their final destination and stay there ten years.

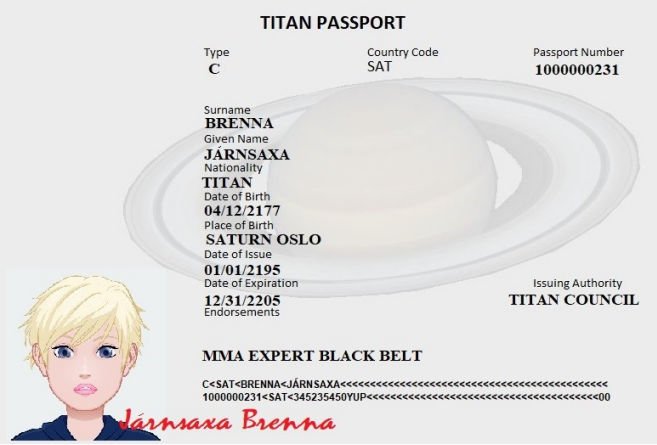
We did that in the Middle East between the 1940s and 1970s. American and British oil workers and engineers worked in Saudi, Iraq, Iran. One of my relatives was an engineer out there in the 1960s.

In space, you get food, health care, an apartment to live in, and no rent. You make money to spend on luxuries and the rest can go to Earth for when you get back if you want to go back.

There will be a limited crime in space because there is NOWHERE to hide and NOWHERE to run. There will be law and order. The locals will get together and decide the rules and regulations of individual conduct.

While individual countries may start colonies, along with a few multi-national operations, the idea of a colony is that ultimately the children become citizens of that planet, moon, asteroid, or space station. They will yearn for independence from the remote nation millions of miles away. If they are smart they would take immigrant workers from ANY country so long as they hold the skills needed by a colony.

There would eventually be Customs offices, Passports, and Visas. There would be restrictions on criminals and violent people. There would hopefully be NO weapons allowed. Eventually, each area would become autonomous, but there does need to be general rules in interplanetary space. Free ports like those found in most of our commercial airports where interplanetary laws exist. And then there would be the colonies with their customized laws and courts.



There should be a type of United Colonies in space. A central location that sets the rules for piloting spacecraft, traffic control (like our ATC on Earth) that assigns frequencies to ships, transponders for all ships, and there should be FREE SPACE that is not controlled or dominated by any nation on Earth nor any Colony of outer space.

Free ports with uniform regulations, laws, and security would be a good idea. In space stations or landing areas on colonies, these free ports would skirt the local rules so long as you stay within those areas.

Eventually, we will see sovereign territories. There will be native Lunar, Martian, Jovian, Saturnian, Uranian, and Neptunian citizens. Children born in space who don't want to be Americans, Canadians, British, Russian, or Chinese. They will have their spheres of influence, rules, regulations, and law enforcement. They may even have weapons, but these should not be brought into FREE SPACE. No weapons should be allowed in FREE SPACE.

Free space starts past sovereign limits and that would be a specific distance from the outermost Moon of a planet or a specific distance from a space station in the asteroid belt. Permission to enter territorial space would be up to the sovereign leaders, with posted rules and regulations.

Free space could have stations positioned just outside of sovereign space. That way shipments of fuel, air, water can be shipped from the sovereign Jupiter or Saturn colony to the Free Space Station where it will be traded for goods and luxuries.

Ships traveling in Free space will be in shipping lanes carrying traded goods back and forth, just like we do on Earth with Container Ships, Tanker ships, Air Cargo planes.

This opens up a tremendous amount of job possibilities on every outpost or colony. Everything from janitors, to engineers, to physicists, to astronomers, to refinery workers, to miners, to pilots, to food services.

There can be private investment opportunities. Developers can create hotels, apartment complexes, restaurants, etc. They will trade for goods and services.

The tourist industry could eventually reach everyone once the cost of going up into space is reduced. There will be ships carrying hydrogen and oxygen from as far away as Neptune back to Earth orbit to refuel the ships that ferry people up to various space stations. Eventually, a cost-effective economic cycle can be achieved.

From manufacturing bases on the Moon, we can send ships to colonize Mars. From there it would be a stepping stone to the great gas giants Jupiter, Saturn, Uranus, and Neptune.

The development of space would be like the North American colonies between 1600 and 1800 or with the Australian colonies of the 1800s to 1900s.

The people who arrived at the Plymouth colony or Botany Bay could never have imagined what we see today in New York City, Sydney, Quebec, Toronto, Vancouver, or Auckland.

To make this happen on the Moon and in outer space requires only the will to do it!