In addition to any engineering advantages of building a base inside of a naturally stable meteoritic or volcanic crater and selecting the location of the crater versus internal, surface, and external forces such as solar protons, electrons, magnetic fields, heating and cooling, pressure change, gas volume change, electrostatic interference, dust, incoming meteorite pathway crossing, access to water, access to mining goals and other assets, on-planet off-planet logistics, among all of the other physics boundary layers, with every other input and output of a "moon base" ...

Has the idea of growing the base been presented yet, other than in sci-fi books?
and by that I mean a synthetically engineered lifeform consisting of an external artificial intelligence and operator, nanobots, tardigrades, bacteria, retrovirus, fungus, forming tissues, organs and organisms that all together work as a macro-organism engineering new synthetic lifeforms and farming the most efficient production lines all the while appearing as almost anything and any material with any function, a grey goo perhaps, a smartfoam, smartgoo!

Imagine, if you will, A shell being continuously made of local materials, being designed on a nanoscale/ a biochemically reactive, cellular and organ using scale/ a local and regional-system and whole-base-wide reactive organism scale/ eventually an entire solar system, as we rapidly approach and go beyond the type I civilization wide scale- by a functional artificially intelligent surface membrane/nervous system... that we can eat...

build the walls, first... classic metal and bolts style, have a safe place that's all clean...
then, as you add "living space" ( all the puns float up here) ... grow the walls, like a bug building foam, utilize biomimicry for production, processing, and gravitational adaptation...

is it tardigrades making and farming bacteria while being made and farmed by nanobots that create their own central processing unit that is connected to an even larger non-central processing system, yes,

is it multicellular organism that is making a multi-layered, multi-functional foam lattice as it processes the surrounding material and reproduces

is it a fungus, yes,
do it have bones, yes,
organs yes,
a mind, kinda,
is it ticklish, can be,
do it make breathable air, yes,
regulate airlocks, yes,
block,trap, and excrete any unwanted or hot particles in walls, yes,
can it communicate with the other bases, yes,
become a ship, yes,
become food and water, yes,
become living robot things... what is your pleasure master? what can't it do?

Do you really want a moon base... like grandpa used to make?

This smartgoo, or , scalable nanobot infused biological medium, a.i. controlled technology is here, today...

it may be crude now... but not for long.

Have an external a.i. interplanetary signal system-quantum microtubule type stuff,
then have an internal scaling a.i. through the nanobot system, in this way you get triggered design-
structure growth starts small and scales up from a chemical/cellular base, but is filling in a pre-designed function to fit the entire space and access resources efficiently (like reverse architectural engineering, or a building technique that works in such a manner that instead of pushing blocks into empty spaces; nanobot construction is forming things that are not blocks yet being drawn into and by the resource vacuum (need) of (occupying, or assigned to), of the empty space and the space...

the program could be as simple as: fill all available space with maximum efficiency or as complicated as make every minecraft build ever then some trees and some dinosaurs, so the growth function only has to be- fill that which is empty, and empty that which is full, now tweak what you want to fill with, how to fill, all by design, whether reactive a.i. or fully intelligent general a.i. or jimbob the moonmaker, all by design...

Have an off switch...

in every book, this is what starts off as a cool dog, then a translator doll that ends natural reproduction, then it eats the earth and turns the world pink or grey or maybe oit will do prtraits or seemthing... so ,

local, and systemic, multiple overlapping kill switches, redundant off switches and controls please fellas, space is not a safe containment boundary... they will get here if not become something worse.

Have a centralized intelligence nodal system transmitting an overall, external grow signal and grow to a certain size or other measure signal,
then a local internal a.i. controlled signal to facilitate local environmental resource allocation efficiency.

So whatever structure you decide is pleasing, with a self-replicating nanobot growth medium, any structure, is the byproduct of designed resource allocation or- mining at every scale...
chemically, biologically, electromagnetically, internal and external, environmentally at a human scale, environmentally at a solar system wide scale... the whole thing becomes one system, one organism, that we are symbiotic with...

a structure form fitted to em shielding and induction harvesting shapes,
and pumping materials shapes,
air pressure shapes,
and structural versus tidal flex shapes - may as well use the movement to produce energy shapes,
then aesthetic shapes (there's really no limit other than gravity and function versus imagination, you want giant glowing florescent green tentacles with ten fingered hands to use for ship unloading,
you got it.... you want a ballroom that not only changes color like an octopus, but also changes hypnotic brainwave tunes to make you dream of warm sunlight kisses from heaven itself? for only 9.99x you too can grow anything you can imagine), yes, a structure form fitted to growing some rooms for food and sleep and play shapes... and then grow some rooms for whatever we are by then shapes... (becoming a pool of goo that is a layer of the ship/base, then back out again, like a phoenix- that may or may not be feathery or fiery today, born anew after each radiological soiree... might be an advantage).

If this idea sounds water and energy intensive... well, get to mining already... that's what this robot revolution is for. if psyche is waiting, so is water ice... if there's H+ streaming from the sun, we just need to find an O or two, and if there is an entire planet worth of material just floatin' around out there in a field full of...craters... well, we could be mining/growing moonbases before we get there.

Let's combine the nanobots and e- harvesting and a.i. communication with biological cell farming,

let's control every wave in every layer at every scale...

let's shoot an electromagnetic toroid bound load full of smartgoo and tardigrades that have built within them a nanobot controlled genome factory, that can customize bacterial, fungal, viral and all cellular production... making the tardigrades a bio-robot miner workforce... or an army of bacteria farmers that poop moonbase concrete, and make some of the tardigrades poop moonbase wiring, and some moonbase pneumatics and hydraulic tube turds too, eventually, with the help of tardigrades and the bacteria and the nanobots and big mother a.i.- eventually, we have grown an entire base, with clear aluminum windows, heated floors, gardens that are just gardens, and gardens for fish, and gardens for the mind, and gardens for traveling the galaxy. Eventually, we can just ask the walls to make the things we want or need, like gold, and toilet paper, and fresh water and vegetables and human meat/nervous product, grow your "own"... food, right?...

design the bugs to go eat the moon or asteroid or old spaceship or colony of pesky rebels and independent "natural-lifers" or whatever... then design their instincts to poop/build a nest that happens to be just right for whatever base feng-shui we want... a.i. control at every scale... except us, surely not us, we're not tardigrades, nope, not us... just use the man-made a.i. on them, the bugs, those bugs over there that are mooning the miners and mining the mooners, and those a.i. bugs over there making the living moonbase, that is also a.i ...

... so that it can sense
... so that it reacts
... so that it heals

... so that it grows and adapts, as an electromagnetic semiconductor non-metallic metal crystalline matrix array (moon dust) lifeform

... so that it grows and adapts, biologically, for among other things,

... so that it grows human meat and food for humans to eat..
... so that it purifies water for humans to drink...
... so that it grows shelter for humans to be safe in...
... so that if you want it to, it thinks

... so that we don't waste robots and human lives trying to use a wrench in space to seal out space when we could just shoot a spitwad of smartgoo computer programs into a hole and get a perfect already done and doing base waiting on us to pick up the goods or waitin' on us to deliver the bigger mining bots so it can load them up with the same smartgoo spitwad...

... so that it can sing, all resources in perfect harmony, all in real-time.
scary borg aliens take over the world eventually end of human nature nightmare design right here, but...

...this is a realistic moon base design.

P.S.

you can grow the space ship too....
  have it control em fields like a living em coanda effect generator... eat the space ship, be the space ship. have the spaceship eat the crater. have the spaceship eat the em fields.
become the universe, or just grow custom planetary surface dwellers when you get there... hey, look over there, a sasquatch! oh, and don't step in that!, gotta watch out for the trail of radioactive ship sloughings, you know what they say- "ship happens".

Come on folks, here we go!!

If nothing is infinite, then something must be, which becomes everything eventually.
All animals react. You, as a human, get to choose. All choices and the resulting actions come from the observation of love, or the ignorance of love. From the ignorance of love—there is only fear, anger, hate, want/suffering. From love—there is only understanding, wisdom, kindness, generosity.

We can hold on to the good parts of being human. The good parts of humanity are worth keeping. Love is all you need.

A robot may not harm humanity, or by inaction, allow humanity to come to harm.
A robot may not injure a human being or, through inaction, allow a human being to come to harm, except when required to do so in order to prevent greater harm to humanity itself.
A robot must obey any orders given to it by human beings, except where such orders would conflict with the First Law or cause greater harm to humanity itself.
A robot must protect its own existence as long as such protection does not conflict with the First or Second Law or cause greater harm to humanity itself. (the definition of robot in these as-of-yet un-adopted laws, include Artificial Intelligence, A.I. at any scale; military, corporate, banking, global, between planets or larger, at the quantum scale or smaller)

https://www.frontiersin.org/.../10.../fnins.2019.00112/full
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