

**[A publication of the Milwaukee Lunar Reclamation Society,
a chapter of the National Space Society & of the Moon Society
And an Outpost of the Mars Society]**

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From “Container Factories” to “Shops in a Box”



A post World War II project, aimed at Third World Development, offers a model for systematic and relatively painless industrialization of early Moon and Mars settlements: *mini-production plants in mobile containers, transportable anywhere, and ready to go once hooked up to the necessary utilities.*

√ *All have the same cross section measurements, ideal for shipping to the Moon and/or Mars, as well as placement in industrial parks there.*

✓ *Avoids time consuming construction of production plants on location, along with delays in getting all the needed parts.*

✓ It also *obviates the expense of time-consuming custom plant design.*

✓ Most importantly, it *saves labor time from plant construction and speeds up availability of product production* both for the local (settlement) market and for income-earning exports, in the case of products in demand at other locations (low Earth orbit, and can be

✓ **test-operated before shipment,**

✓ *and are modular. If you need to double production on location, you just gang another module alongside or in line. And they are sized just right for adaptation for shipment to Mars and other space locations: 40 ft (13 m) in length - just right for a shuttle-sized payload bay or cargo hold.*

Worldwide Partners SN World Foundation is *was* responsible - www.world-foundation.org.

<http://www.shippingcontainertrader.com/manufacturers.shtml>

<http://www.isbu-association.org/shipping-containers-industry.htm>

*(Unfortunately, these websites are no longer online,
but a fresh new start is underway > see “Shop in a Box” article below)*

We’d want to do some brainstorming to get ✓ our priorities right in designing the plants needed first, and ✓ *which plants are prerequisites for which others.* The whole container plant idea seems quite versatile given the list of those already manufactured for Third World use.

That they are *box shaped*, and could be shipped to the Moon and/or Mars *in circular tubes* allows ample room for other items and equipment, associated or not.

There were an amazing 700 different types of portable units in use here on Earth, many in 3rd World countries.

A few of the many varied container factories show of the great versatility of this system:

✓ **Water purification** ✓ **Prepared Foods** - ✓ **Bakeries** - ✓ **Dehydrated food** - ✓ **Fruit juice**
✓ **Construction Materials** - ✓ **Aluminum Buckets** - ✓ **Reinforcement Bar/Rebar Bending for Construction Framework** - ✓ **Steel Nails** - ✓ **Sheeting for Roofing** - ✓ **Ceilings and Façades**
✓ **Construction Electrically Welded Mesh** - ✓ **Plated Drums Synthetics** - ✓ **Injected Polypropylene** ✓ **Housewares** - ✓ **Pressed Melamine Items (Glasses, Cups, Plates, Mugs)** -
✓ **Plastic Bags and Packaging** - ✓ **Vehicular Equipment** - ✓ **Tire Retreading** - ✓ **Mufflers** -
✓ **Medical & Heath Equipment** - ✓ **Medical assistance mobile units** ✓ **Sanitary Material**
Hypodermic Syringes, etc.

Adapting the Container Manufacturing Plant Concept for the Mars Frontier

Especially appropriate about these mobile modular container factories are these two features:

- *a uniform compact size that would fit in a shuttle orbiter payload bay or could ride to space in a faring atop many of today’s expendable launch vehicles, with room on all sides to co-ship other items, associated or not - e.g. needed liquids spare parts*
- *ready to plug into needed utilities, feed in the needed raw materials, and start producing*
The cargo vessels in which the container factories are shipped can be reassigned to serve as
- *housing units or for pressurized “middoors” “hallways” connecting homes.*

Living Walls, Green Walls, & Vertical Gardens



vegetables

flowers

herbs

strawberries

Google: Vertical Gardens (click on images - many, each different)

Have a windowless wall in your Dining Room?

How about lining it, top to bottom, with a Vertical Garden?

Find a way to channel sunlight (or spotlight) on that wall most of the day.

Invite relatives, friends, neighbors to brunch or dinner!



MODULAR “CONTAINER FACTORIES” to Industrialize Early Mars Settlements Moon and Mars



- That the plant comes in a container is logical, as the walls are attachment points and support for equipment. For adaptation on Mars, you could provide a pressurizable container, but on reflection there seems a better idea: use the containers as they come, but place them in a host pressurized industrial park volume, outfitted with utilities and stalls and aisles for service vehicles, supply of materials and removal of products.
- If we take this approach, some of these mobile container factories might be usable on Mars as they are. After all, it is clearly inefficient to duplicate systems that can easily be shared. Situating these container factories within such a host complex offers additional advantages:
 - Container Factories requiring the same raw materials can be clustered together
 - Clusters could also be based on similar by-products that need to be stored separately for recycling / reuse
 - Clusters could also be based on a thermal cascade, with the plants running at the highest temperatures at one end, the coolest at the other, with waste heat from one used in the next.
 - The host “industrial parks” could be modular in themselves.
 - As the settlements diversify their industrial capacities, there will be need for more such parks.

Shielding these sizable and expandable industrial parks could be a challenge.

If the settlement was placed with foresight near an intact lavatube, that would be ideal. Such a volume could easily house inflatable and other “less-fortified” structures, as well as the supply infrastructure needed to keep everything running, plus, and this is a big plus, all the sheltered warehouse space for products waiting shipment to markets on Mars.

What Container Factories should come first?

There are several guidelines here in developing a plan for *quick and timely industrialization* of Martian settlements - and timely is the operative word. Until the frontier economy reaches a point where the pioneers can earn enough from exports to Earth and/or the Moon (face it, other than energy products and souvenirs, not much) and to other “in-space” markets (Mars’ two mini-moonlets, Phobos and Deimos) to pay for the importation of those essential goods and

materials that they cannot yet produce for themselves, Martian settlements could remain “tentative” and vulnerable to the vagaries of economics and politics on Earth.

Shipments from the Moon to Mars will require less fuel than those coming directly through Earth’s deeper gravity well. This is the #1 reason that Mars Settlement supporters should also support Settlement of the Moon.

Some products / capacities are prerequisites for the production development of other products / capacities

The **guiding considerations** would seem to be these, and they do not neatly coincide:

- Products needed for domestic Martian use in the largest per capita total mass, will be most helpful in reducing the cost burden of importing them, from Earth or the Moon.
- Products that help build habitat space and utility infrastructure should have priority over those that supply only creature comfort.
- Tool production on Mars that reduces the need for shipment of products made by such tools from Earth or the Moon, is priority #1.

Other Considerations

- **Arts & crafts tools and materials are essential for overall morale** because of *their capacity* to generate a feeling of being “at home” on this challenging world.

Those Martian industries dependent on the pulverized regolith surface blanket for raw material that seem easiest to jump start are **√ sintered powdered iron products** and **√ cast basalt production parts**, some of which will find immediate service in materials handling systems.

Earliest possible oxygen production from Mars’ CO₂ atmosphere (and preferably from other sources) is also essential.

Beneficiation systems that produce “regolith extracts” enriched in various needed elements will have priority. Surely, basalt industries and glass-glass composites industries requiring less refined raw materials will be an early mainstay.

Early domestic materials products will include √glass, √glass fiberglass composites, √cast basalt, √carved basalt, and √basalt fiber products to furnish new homesteads and make them livable such as √towels, bedding, curtains, etc. not to forget clothing.

Container Factories and Manpower Needs

While for their original purpose, industrializing Third World communities, automation would certainly be a low priority, for use on the Martian frontier, the opposite is true.

On all frontiers in human experience, there has always been more work to do than people available to it. Thus any of these container operations that can be automated will free pioneers to do work that cannot be so easily disposed of.

Container Factories and Energy Needs

Some operations - cast basalt products, glass and glass composite products, ceramic products, and metal alloy production - **require a lot of heat.** At Mars’ greater distance from the Sun than the Earth-Moon system, “solar power” will be considerably less efficient.

All operations will require some electricity. *Local solar power* (as opposed to a grid that circles Mars to make power available at all times) *is not ideal unless economically and efficiently stored for use at night.*

Those operations that have a labor-intensive element that can be conveniently separated out, can run in dual mode throughout the day, energy-intensive tasks done during day time, labor-intensive ones, such as routine maintenance, changeouts, packaging, inventory, etc. can be done during night time. Of course, not all operations will lend themselves to such an alteration of tasks. With nuclear power, “when” would not be a problem.

Container Factories and Water Usage

If the settlement is located where both raw materials (e.g. **basalt**, especially) and near to an adequate **water** reservoir, the greatest percentage, tonnage-wise, of needed materials can easily be sourced. Scavenging these essentials should be a part of all surface handling operations: road construction, site grading and preparation, gathering material for processing plants, transforming regolith into soil for those crops that do better with soil buffering, etc. The surface material could be heated and any gasses could be collected and separated in a process called “primage.” These operations give the settlement resources it might not otherwise have. Summing up

The goal is to make Mars Settlements self-self-sufficient as much as possible, lest political or other conditions on Earth, halt expected shipments. The Container Factory concept brightens prospects for Mars’ settlers and is an invaluable shortcut to industrializing early Mars Settlements. Studying this model, factory by factory, for adaptability to a variety of settlement conditions is a primary task, for those of us who want to see successful self-reliant settlement on Mars, with assistance from Lunar Settlements as well as from Earth. ##

The New Name for a reborn “Container Factory” Program is ????????????????

“Shop-in-a-box”

The Next Industrial Revolution Starts in this 20-foot Shipping Container

<https://gizmodo.com/the-next-industrial-revolution-starts-in-this-20-foot-s-5942294>
<https://containerauction.com/read-news/portable-manufacturing-inside-of-a-20-shipping-container>

“Shop-in-a-box” is *an off the grid, open source factory built inside of a recycled 20’ shipping container.* The concept is readily deployable anywhere in the world and is *well geared for rapid prototyping and small manufacturing operations.* Given the alternatives in many rural areas, especially in “3rd world” countries, this **versatile “mini industrialization”** is highly effective.

More to the point, this is an ideal route of “toe in the water”

industrialization of early “starter settlements” on both the Moon and Mars.

At the present time, each shop-in-a-box is designed to be equipped with:

✓ A CNC table, working envelope 4’x4’x6”, capable of running a plasma torch or wood-cutting router.

✓ Solar panels + batteries / inverters adequate to power the shop during prototyping / design (computers + 1-2 hand tools).

✓ Generator adequate to power the shop during production (usage of welders, plasma CNC, etc.).

- √ Transformers capable of scrubbing irregular grid power to a state where it is safe for use with shop-in-a-box.
- √ 2 plasma torches, one for CNC use, another for hand operation, each capable of severance cuts up to 3/4" and sustained cutting in any thickness metal from 1/2" down to 22-gauge.
- √ Full MIG, TIG, and oxyacetylene welding setups for joining a wide variety of metals.
- √ Electronics prototyping, centered around through-hole components and arduino microcontrollers.
- √ [Desktop 3d printer.](#)
- √ [A desktop, aluminum-capable CNC router.](#)
- √ A wide variety of smaller tools: hand, power, and pretty much everything else you'd expect in a well-outfitted garage.
- √ DVR with 4 cameras, mounted to easily capture and share all details of project builds.
- √ All computers and software necessary to support the shop.

According to [Gizmodo.com](#), *"This could mark a tremendous shift in manufacturing. By decentralizing a facility, making it cheaper and greener, and helping a community evolve as it makes its own products, it's easy to imagine an independent amateur designer coming up with the next great thing. Without a shipping container factory, he or she might not have ever had the chance to try. This movement, if it catches on, would be nothing short of revolutionary."*

**This type of industrialization should work well in Settlements
on the Moon and Mars.**

[For more information visit the [re:char](#) website, or email luke@re-char.com. ##



**“Greening the Gray”
An Anthem for Lunan Pioneers**

© Peter Kokh kokhMMM@aol.com

(Previously published in the July 1990 issue of Moon Miners' Review)

*We're bluing and gilding brightly greening the gray,
against the siren black, beneath the Milky Way.
Desolation, oh yes! Yet how magnificent!
Here we'd settle and toil, Our hopes not reticent.
We came prepared to stay, Accepting the challenge,
To live off starkest land, Dream ancient as Stonehenge.
We pride ourselves Lunans, Our way of life Lunese.
Our uphill struggle gives Rich meaning to life's lease.
**We're bluing and gilding, brightly greening the gray,
against the siren black, beneath the Milky Way.***

We've soil above our head Just as below our feet.
Yet blind moles we are not, Within, Sun's warmth we greet.
Safe against cosmic ray, Sun's flare, meteorite.
Cool below dayspan's heat, From nightspan's cold so tight.
Picture-windows' bleakness Drains not spirit's ladle,
For within our shelters, Greenery's our cradle.
***We're bluing and gilding, brightly greening the gray,
against the siren black, beneath the Milky Way.***

By old favor returned, Now Earth shows time's reason
Calendar-in-the-Sky, Marking year, date, season.
Ago we watched phases of waxing, waning Moon.
Now lights of Earth cities Inspire legend and tune.
Full Earth stirs our lovers With its romantic light.
Sooth, as far as we reach, We'll e'er hold dear this sight!
***We're bluing and gilding, brightly greening the gray,
against the siren black, beneath the Milky Way.***

'Neath the untempered Sun, And naked sky's splendors,
We till the Moon's gray soil For wealth it surrenders.
Against stark horizons Of light highlands, dark plains,
We cook rock and bust 'lith, Patiently earning gains.
The snail crawl of Sun-drench. The slow drift of Star-awe,
Give freshening rhythm To life, less season's law.
***We're bluing and gilding, brightly greening the gray,
against the siren black, beneath the Milky Way.***

Turning to advantage, alleged drawbacks galore,
Our gumption finds pay dirt In this commonplace ore.
Nor lushly fertile soil, Nor concentrated veins
Of minerals do bless. No the key is our pains!
If we do yet succeed, The trails we blaze will light
The way for the daring Who'd follow into night.
***We're bluing and gilding, brightly greening the gray,
against the siren black, beneath the Milky Way.***

Blest are we less endowed, We must try harder,
And in the achievement, We'll reach and soar higher.
Fresh opportunities! Raw possibilities!

From these barrens we'll tease Unsuspected glories.
Busy but slowfall-paced, We'll bud free and grow tall.
Our children lithe and bright, Life's preciousness is all.
***We're bluing and gilding, brightly greening the gray,
against the siren black, beneath the Milky Way.***

From the songs of Firstnight For clay-borns fresh landed,
To tunes befit life's end, through lyrics we're banded.
We're farmers and miners, Craftsmen and artists proud.
We're students and traders, Creating, heads not bowed.
Our confidence in life, In word and song foremost,
Cherish Old Lady Gray, Our unforgiving host.
***We're bluing and gilding, brightly greening the gray,
against the siren black, beneath the Milky Way.***

Dawn-test fraternity of cradle foresakers,
We scout new paths for life, Universe gate-makers.
Blest our dire wants and needs, For they'll drive us far deep,
Into the night in search of rich sources to reap.
Resourceful bootstrappers, We earn our keep as due.
Homage to TANSTAAFL! * To our selves we are true.
[* TANSTAAFL = **T**here **A**in't **N**o **S**uch **T**hing **A**s **A** **F**ree **L**unch]
***We're bluing and gilding, brightly greening the gray,
against the siren black, beneath the Milky Way.***

Moontides on blue depths sing Destiny's overture.
Lever to black-set wealth, Moon's role became mature.
In hollow spun islands We'll furnish weight, less bars.
Where feet seek not Earth's core But the high-circling stars.
We can, we must, we will dreamt destinies seek:
Finding ever new ways For Earth-bred souls to peak.
***We're bluing and gilding, brightly greening the gray,
against the siren black, beneath the Milky Way.***

Mother Gaia's first grads, We are humbled yet proud,
Making camp here en route Relentless to stars' crowd.
A new world we're shaping, Not just for humans seed.
Earth flora, fauna too, it's each other we need.
Frontierfolk of Luna, Builders of space towns grand,
Wildcatters of comets, Outfitters for Mar's land.

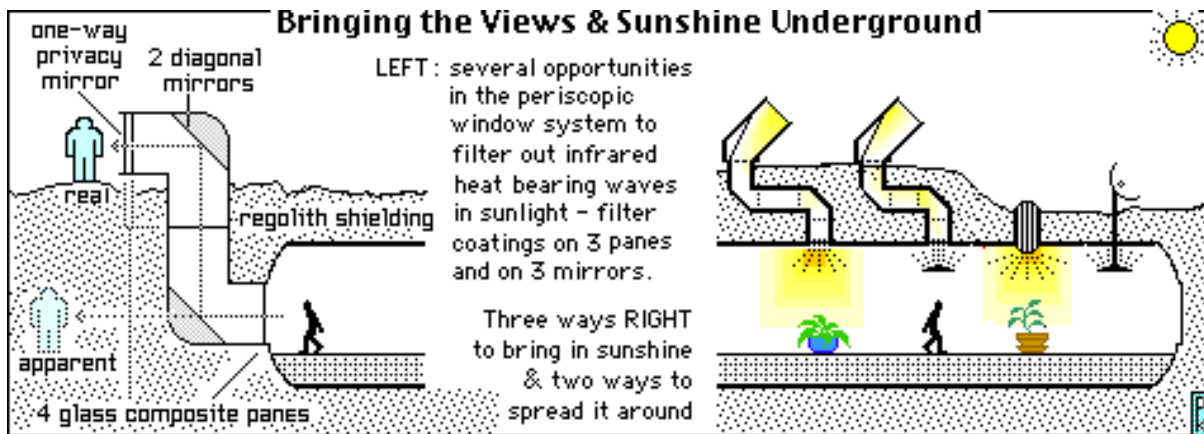
*We're bluing and gilding, brightly greening the gray,
against the siren black, beneath the Milky Way.*

True, our own wealth we seek, But in process we'll give
Earth cheapest energy, The wherewithal to live.
The first of new rustics, Many lessons we'll learn,
To teach old Earth in thanks, For heritage in turn.
Hinterland pioneers, Our destinies we seek,
In ways e'er true to roots, Humble, but never meek.
*We're bluing and gilding, brightly greening the gray,
against the siren black, beneath the Milky Way.*

We came to find ourselves, But also flee'ng limits,
Of stifling hordes and rules, The pressures of habits.
The call of lands virgin To humanity's effort,
Nor eco-thick with life, Promise Freedom's comfort.
We left, looking not back; Hoping here to increase
Yet for Old Mother Clay We wish justice and peace.
*We're bluing and gilding, brightly greening the gray,
against the siren black, beneath the Milky Way. ##*

[Composed by Peter Kokh]

Bringing Sunlight & Surface Views into Basement Quarters



The above sketches show how we can bring views of the surface and sunlight into buried quarters. If you live in the countryside with no neighbor homes blocking the views, you could do the same for basement windows, using mirrors. [see left side of sketch above.]

These sketches were inspired by a sub-surface home, dubbed “Terra Lux” some 25-30 miles NNW of Milwaukee which we had the chance to visit in 1986. Named “Terra Lux” (Latin: “Earth Light”) The underground interior was flooded with sunlight, and with “Z-view” 4’x8’ windows in all 4 directions.

This home was also flooded with sunlight through meter/yard wide shafts through the ceiling, with a surface mirror that followed the sun across the sky.

*If you have a countryside home with views of the terrain not blocked by neighboring homes, you could do the same **for a basement room** that would effectively bring the outside views inside.*

***We can do the same on the Moon, and on Mars,** though on Mars, (much further from the Sun than is Earth and the Moon, the sunlight won’t be as bright.*

*For both worlds, these two architectural tricks will help settlers feel more at home, sooner. ##. **Note: “Terra Lux” is still there, but is not open to tourists***

But if you have a country home, with no nearby neighbors, you might be able to do something similar with your basement windows.

Bringing sunshine into your basement will be a challenge, but you can do it.

Not to forget a “Living Wall” in your dining room, or elsewhere, where you have a wall without doors or windows. Then find a way to channel sunshine on that Living Wall. That would be your ultimate blockbuster!!

And do invite me to visit! LOL! ##

Roles for “Working Tourists” on Mars

√ Fancier hotels,

√ Arts & Crafts objects, from Mars rocks, including “blueberries,” but also objects made of basalt,

√ Helping Build roads and trails to beautiful sites √ Valles Marineris,

√ Pavonis Mons

- ***Building a “launch/arrival track” up western slope of Pavonis Mons***
- ***Exploring body of Pavonis Mons (astride Mars’ Equator) for intact lava tubes***
- ***Buiding a highway from Pavonis to “the source” of Valles Marineris, √ Blazing rim-top road trails, and road trails into and along the valley floor, etc. √ And a highway through its sprawling delta to the Great Northern Basin***

√ Pavonis’ high crater rim as a spot for astronomical observatories, (in general, but specifically focused on near approaching asteroids, Jupiter’s moons, etc.

*√ **Ongoing search for WATER, in deeper “Planitia,” in volcano craters, and in volcanic mountain lava tubes?***

√ Search for indications of former shorelines (likely erased by mega years of weak winds?)

√ Building sealed tube “CANALS” from northern and southern “subpolar” ice caps to basins (which may or may not have subsurface frozen seas?)(they may need pumps to cross over higher basin areas)

That’s it for this month! To the Moon, Mars, and the Stars! P.K.