A Human-Directed Bolide Impact-Dug Mars *Funnel City*

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Abstract: So far most publicly merchandized macro-engineering plans specifically designed to terraform Mars are impossible of achievement because Mars naturally lacks adequate physical resources allowing completion of that transformative anthropogenic event-process. These undoable plans fall mainly into two classifications: (I) artificial build-up Mars' natural gaseous shell and (II) using capacious buildings to create a pressurized carapace civilization. In other words, to-date, all Mars terraformers are really thinking only as Earth counterfeiters who cannot ever gift humankind with a totally made-over Mars suitable for long-term settlement by humans. We suppose another, feasible, non-terraforming macro-project plan option, the rapid excavation of a single deep pit by successive timely big bolide bombardment. Such impacts cause anthropogenic erosion with some material leaving Mars forever. Funnel City, the subsequent deep pit will gravitationally attract most of Mars' enshrouding ambient gases. The concentrated and densified gases within the deep hole might result in many Earthlings inhabiting safely a permanent exploration and exploitation Mars Base, the Funnel City. In effect, after the completion of this suggested macro-project, the extra-pit territory of Mars then may still closely resemble the present-day rocky and dusty surface of our Earth's biggest natural satellite, the Moon. Funnel City can become the "dockyard" for Jack Smith's Mars-centered Dyson Swarm used to send extra-terrestrial power to Earth's populace.

Keywords: Mars city, excavation technology, technogenic induced bombardment, Macro-Imagineering, Dyson Swarm.

Resumo: Até agora, a maioria dos planos de macroengenharia difundidos publicamente, projetados especificamente para terraformar Marte, são impossíveis de serem realizados porque Marte naturalmente carece de recursos físicos adequados que permitam a conclusão de um processo antropogênico transformador. Esses planos irrealizáveis se enquadram principalmente em duas classificações: (I) construção artificial da concha gasosa natural de Marte e (II) uso de edifícios espaçosos para criar uma civilização de "carapaça pressurizada". Em outras palavras, até o momento, todos os terraformadores de Marte estão realmente pensando apenas como falsificadores da Terra, os quais nunca poderão presentear a humanidade com um Marte totalmente reformado, adequado para assentamento humano de longo prazo. Conjecturamos uma alternativa viável, não terraformadora: a escavação rápida de um único poço profundo por bombardeio sucessivo de grandes bólidos. Tais impactos causam erosão antropogênica com algum material deixando Marte para sempre. O poço profundo subsequente, atrairá gravitacionalmente a maioria dos gases ambientais que envolvem Marte. Os gases concentrados e densificados dentro do poço podem resultar em condições ambientais satisfatórias para terráqueos habitando com segurança uma Base de exploração permanente em Marte, a *Funnel City*. Com efeito, após a conclusão deste macroprojeto, o território extrapoço de Marte pode ainda se assemelhar muito à superfície rochosa e empoeirada atual do satélite natural da Terra. *Funnel City* pode se tornar o "estaleiro" para o Dyson Swarm centrado em Marte de Jack Smith, usado para enviar energia extraterrestre para a população da Terra.

Palavras-chave: Cidade em Marte, Tecnologia de escavação, Bombardeio induzido por tecnogênicos, Macro-imagineering, Dyson Swarm.

1. Introduction

At the present-time, Earth's bioshell remains humankind's only truly spatially voluminous species survival unit—our real-world "Spaceship Earth". In Geography's outdated and confusing academese parlance, "space" is a homonym denoting both our planet's bioshell and the cosmos' isolating void — indicating absence of macroscopic and microscopic things as well as vacuity — situated between planetary and all other celestial bodies within our Solar System as well as this Universe as observed by humans and by means of their progressing technologies. A close examination, and scientific measurements of, seem nowadays to indicate the Earth-bioshell is operating partially, not wholly, in a way never represented by the common term Nature [1-2]. The charismatically neoteric James Lovelock (1919-2022) supposed, in ***Novacene: The Coming Age of Hyperintelligence*** (2019) self-engineering cyborgs and human macro-project planners will soon work cooperatively together to preclude a massive degradation of our current planetary bioshell homeland, a reduction of its carrying-capacity primarily caused by biotic and AI-life adverse worldwide air warming to $>50^0$ C. Barring apocalyptic, anti-civilizational, mass genocidal and homicidal goals of deranged humans, in Chapter 20, Lovelock bluntly alleges "Above 50^0 C the whole planet moves to an [bioshell] environment that is corrosively destructive". Any people-settled world's carrying-capacity can be increased as human civilization's required bioshell operating technologies progress and if, in real-time, they are linked thoughtfully to incorrupt politics [3]; most of our Earth civilization's large-scale urban inhabitations and work-places already resemble air-locked and air-conditioned ships, hence the appropriateness of the term carrying-capacity.

The phrase Geo-engineering evokes proactive management of Earth's air by de-pollution, whereas Terraforming ordinarily evokes ideas about polluting a planet's atmosphere like, say, Mars with an anthropogenic instigation of gaseous carbon dioxide build-up brought about by proficient 21st Century macro-engineers, both remotely and on-site. If so, carbon dioxide management, at least for Earth's human populace, will become one of the largest industries in our world's globalized economy, more than equivalent in geographical scale to food production, extraction of basic construction materials and exhumation of fossil fuel energy resources! Gaseous carbon dioxide may be extracted directly from Earth's air by quasi-natural methods or by ever-developing technologies but mere storage in the Earth-crust's geological strata would result in no product to sell that could offset the costs of aerial subtraction. Using Space Elevators [27], might solidified carbon dioxide be shipped to Mars someday? An impact at Amazonis Planitia — 38.80^0 N by 189.92^0 E — by object S1094b on 24 December 2021 produced a roughly circular carter of diameter ~150 meters and depth of ~21 meters that exposed a subsurface ice stratum. Ballistic impacts on the Red Planet, no matter their angle of impact, will always generally produce almost circular craters that may be otherwise useful in terms of infrastructure satisfaction requirements of future teamed settlers' survival.

In this Solar System, our still photogenic Blue Planet homeland is an odd celestial object—in fact, a remarkable "oddball" because it is so physically dissimilar to all other terrestrial-type planets in the vicinity such as Mars, Venus, and Mercury. Many space-travel investigators usually portray Mars as an economically attractive, even environmentally receptive (in terms of already known exploitable resources), future planetary destination for very hardy and capable humans accompanied (as independent co-workers) by versatile AI robot explorers [4-6]. (No slavishly corporatized person or intellectually curtailed, composite intentionality AI robot [7] will ever waste time and energy seeking ore-deposits of the fictitious "tribinium" central to the tale of 1990's popular cinema ***Total Recall***!) Mars' mean atmospheric temperature is minus 60^0 C. Yet, a cadre of bold geo-scientists and star-struck macro-imagineers still advocate the transformation of Mars from its current inhospitable state into a habitable world by means of a series of complex and costly technological interventions dubbed "Terraforming" necessary to regenerate Mars' presently naturally thin atmosphere. Their intention is to successfully

replicate our oddball Earth's air resource, to fully manage its sub-aerial landscape, all within the purely imaginary context of an envisioned Mars-world macro-problem schema [8]! "Thin atmosphere" is an accurate description of that planet's unbreathable gaseous envelope's insubstantiality — in fact, it is a shell — and an indicator that whenever humans need to breathe from an artificial planet-covering open-source of so-called air, every inhalation will have a significant monetary price!

The term Areography, first brought into linguistic use during 1868 by Richard Anthony Proctor (1837-1888), modifies the word Geography by substituting the ancient Greek place-name for Mars [9]. Most peculiarly, at the same time that NASA spends copious amounts of USA taxpayer-derived funds to enhance the weather and climate resilience — including the postulated future drastic effects of a postulated global sea-level rise — of its important Space Age installations already permanently located within the Earth's bioshell [10], some obsessive Mars terraformers hypothesize a strange new Solar System world's creation utilizing various hopelessly old-fashion technical fixations as a foundational basis for their dramatically expressed aspirational thoughts! Mars is a life-hostile planet, even more than fictional Arrakis in Frank Herbert's ***Dune*** (1965). One contrarian critic for example, says: "We might have the technology to establish a human colony on Mars by the 2040s but how sensible will farms be in the 2060s when 3D printers can manufacture any physical object with atomic precision, including food? How sensible will trudging around in space-suits and living in domed habitats be in the 2080s when humans can upload their minds into non-biological bodies? How sensible will it be in the 2100s and beyond for humanity to explore the vastness of space as Homo sapiens instead of, say, sentient starships or clouds of nanobots?" [11]. Also, taxpayers would be wise to re-consider the monetary costs of the Apollo Mission Program: the total USA dollar cost of creating the enabling infrastructure for the first humans to visit the Moon amounted to ~300 billion dollars, adjusted to 2022-US dollar valuation! In this Ernst Mach-style *gedankenexperiment* article, we will examine, and seek out a substitution for, the common Terraforming zombie concept entailing a total Mars atmosphere gaseous augmentation as a *needed* macro-problem solution. The macroproject suggested, the *Funnel*, will be a *Gesamtkunstwerk* larger than Anselm Kiefer's unfinished >80 hectare *La Ribaute* located near Barjac, southern France, commenced during 1992. An urban Mars enclosure, the *Funnel*, may be soon added to the narrative shorthand for futuristic settlements in science-fiction! While tall smokestacks produced long-range air pollution in Earth's atmo-shell, its inversion, the *Funnel* could have the opposite effect on Mars where liquid water in not commonly present at the base of hill-slopes and, thus, the anthropogenic rapid reduction of pressure everywhere outside of the *Funnel* could stabilize soils and prevent transformative landslides — leaving only natural space weather effects and space debris strikes as the essential causes of surficial regolith turnover. Of course, humans may mar the Red Planet's surface with wheeled and tracked trails, rocket blast scars and possibly even railways.

2. **GASP**!

The late James Lovelock proposed, in ***The Ages of Gaia*** (1988), Homo sapiens' use of Earth-banned chemical factory formulated and manufactured greenhouse gases, injected into Mars' thin, freely-circulating atmosphere, to thicken that shell-like biota-protective layer resting atop the ocean-less planet's contemporary perfect areo-morphology by vaporizing Polar Zone dry-ice deposits [12]. Biota, someday perhaps only forms of so-called Synthetic Life [13], might flourish in the arid Red Planet if the contents and density of its outer space-exposed atmosphere's temperature were raised, thereby increasing its global atmospheric pressure, and reducing the effectively sterilizing UV-radiation presently reaching the surface unhindered [14-15]. Since, more and more, technologies are becoming the environment itself, even global meteorology, most humans now live in semi-capsulized mechanical and electronic "smart cocoons" [16]; a turn-of-the-century published study [17], for instance, revealed that North Americans spent only 7.6% of their lifetimes outdoors! So, in a very real sense, and technically-speaking as well, most North Americans as well as others elsewhere are nowadays almost fully ensconced everyday inside

gadget-rich technologized indoor cocoons! A near complete — the Polar Zones are excluded as well as the summit of Olympus Mons — Mars enclosure — in effect, a macro-engineered structural carapace — named "Mars Worldhouse" by its UK inventor Richard Taylor (1931-2018) involves the construction of an implanted contained bioshell wherein a 3 km-thick stable, dense, and breathable air-layer is prevented from escaping the planet by the monstrous will-anchored inflated building's impermeable roof. (Imagine Olafur Eliasson's 2002 "The Weather Project" artwork installed at the Tate Modern gallery, but done at voluminously gigantic scale in Mars!) For Taylor, the interior is the overriding architectural principle because it results in the humanization of a Universe-exposed "wilderness", converting it into an enclosed "world". The conceptual and mathematical history of Taylor's extraordinary monumental architectural notion is accurately recounted in the practical instructive tome by Martyn John Fogg, ***Terraforming: Engineering Planetary Environments*** (1995). Taylor never introduced any technology for the Mars Worldhouse' post-installation defense from continuously infalling cosmic debris [18], the smoke from which often causes clouds in the planet's pinkish-colored sky! Nor does he speculate on the advent of purposeful AI robots by Earthlings which are unlikely to be restricted in their actualized doings to only one Solar System celestial body. Only ~10,000 kg of artificial objects currently sits on Mars, so far. However, if built, "Mars Worldhouse" must exceed the mass of all known anthropogenic stuff today existing in the Earth-bioshell by millions of metric tons [19-20]; Homo sapiens and its AI robotic co-workers would then be obliged to distinguish an areographic support proportionate to the operation of the "Mars Worldhouse" [21]. More frequently lately, the monetary cost of Earth's putative impending or ongoing global air warming is guesstimated at ~US$ 1.4 trillion/year by 2100 [22]. At page 71, the IPCC WGII AR5 Technical Summary suggests that "…the incomplete estimates of global annual economic losses for additional temperature increases of [the putatively dangerous] ~2^0 C are between 0.2 and 2.0% of income (+ or – standard deviation around the mean) …". Unlike James Lovelock, the IPCC WGII AR5 offers no maximum safe atmo-shell temperature for Earth's bioshell. As of 2019, James Lovelock asserted in Chapter 16, that "In reality the Novacene…is about engineering"; in Chapter 19 he added: "Then the main inhabitants of the Novacene will be humans and cyborgs" that are imbued with a vitally important mind connection Lovelock deemed worthy of the descriptive phrase "loving grace" in Chapter 20. (However, see [23-24].)

3. Ocean(s) here and there

Regarding Earthly global sea-level rise associated with the air's warming [25], whether anthropogenic or not, let us fantasize a Mars-focused "cure" that is almost an imaginative match for Richard Taylor's impractical Mars Worldhouse masterplan. (Although Mars is observed visually to be the color of iron-rust, there may be only a limited resource of reduced iron available on the surface derived from meteoric nickel-iron useful in the fabrication of composite metal foam which is effective shielding from ballistic impacts, X-rays, gamma rays and neutron radiation [26]. Could robotic AI Martians be composed of such protective material too?) Purportedly, Mars in its past Geologic Time had several vast bodies of water present on its subaerial surface — in the Northern Hemisphere's plain, Hellas and Argyre basins. Unhesitatingly, most semi-professionalized terraformers confidently claim, rather wishfully we think, that anthropogenic ocean(s), in the near-term future, can be made present on Mars transmogrified future surface. As Earth's assorted rivieras are submerged by our planet's unstoppable rising ocean, new places of beach frolic might be established on Mars, or so this fable is usually told. Nevertheless, let us suppose that a Space Elevator [27] is erected which lifts and passes seawater-filled cargo pods through the Earth-bioshell into outer space's hard-vacuum where the pods of oceanic saltwater are then spacially transferred, by some unspecified means, to eventually "splashdown" on Mars. Generally, it is supposed the if both Polar Zone ice-caps of Earth melted the runoff would increase global sea-level by ~70 m, amounting to an additional seawater volume of 2.52 x 10^7 km^3 spread over an area of 360,000,000 square kilometers. (One cubic meter of seawater equals slightly more than one metric ton, indicating a total additional mass of 2.52 x 10^{16} metric tons. Earth's crust will respond to mass loading

and unloading in ways currently unfathomable by existing Science.) If we assume each seawater-laden standardized pod payload consists of ~8 m^3, or ~8 metric tons, and just one seawater pod achieves Earth bioshell exit daily, then 3.15 x 10^{15} pod-trips would be required to remove Earth's Homo sapiens' unwanted, excess Earthly seawater volume! Whilst in space, insulated pod contents will become slushy, bubbly and eventually frozen [28]; a seawater "iceteroid" [29] pod will be a partially heat-shielded chloride-rich anthropogenic bolide which would increase the levels of HCL in Mars's thin atmosphere whenever or if it shattered before hitting the surface. Shifted to Mars' surface without intervening mass loss due to pod leakage, multiple pod depositions therein could create an 144,799,000 square kilometer ocean ~175 m in depth after precipitation! Total pod vaporization in Mars' atmosphere during that period of the transfer process might produce little superficial areo-physical crust record — however, circulation of the planet's wispy atmosphere [30], Nature's pre-modification weather regimes, should change noticeably after massive podded seawater transference. Globe-obscuring pre-"Mars Worldhouse" dust storms such as that observed during May-June 2018, foster the natural exportation of Mars's increasingly scarce water-vapor to adjacent outer space [31], so perhaps fewer dust storms in the future will be beneficial in the sense of the prolongation of the climatic clemency of a markedly drying terrestrial planet's atmosphere. But 3,150,000,000,000,000 pod Earth-exportation trips equals 3.15 x 10^{15} days, or 8.6 x 10^{12} years! So, perhaps only AI robots blessed with sturdy metallic physical constitutions will ever opt to await a new, but rather small vacation beach-spa's establishment on Mars prior to the bloated Red Giant Stage Sun vaporizing the whole Earth after dissolving Mercury and Venus. But, of course, only if such post-biological persons are interested in or able to benefit from any outdoor recreation *in* a planet [32]!

4. What shall be done with Mars' apparently useful areography: The Mars Base *Funnel* Optopia?

In at least one notable instance, the North American anthropologist Clifford Geertz (1926-2006) defined human culture in a very memorable brief sentence: "…man is an animal chained by the web of meanings he himself has conceived" [33]. Whenever it is built, Mars Base *Funnel* will exemplify the epitome of new technology, emphasizing the role of virtual reality in contrast to today's material reality; Mars Base will control mobile drones capable of engaging in activities that would be too dangerous for real people to undertake. We think a proper and cost-effective Mars terraforming must entail the zombification of a useful Solar System planet, Mars. Zombification means induced ageing instead of rejuvenation. In our postulated macro-project plan for deliberate areo-gouging with trajectory-guided bolides, perhaps best named "Mars Rams," which impact the surface of Mars will create a human-cyborg dominated *Funnel* Optopia — the optimum possible teamwork environment. Rather tiresomely, Terraforming's current popularizers put forth thickening of Mars' entire atmosphere as the *only* means by which achieve the necessary atmoshell Armstrong Limit — the absolute intra-aerial limit beyond which the human-body, at least as presently constituted — that is, without any genetic or prosthetic enhancements [34-35] — cannot survive without a sealed pressure-suit fitted with all the equipment to maintain a suitable mini-environment — a self-propelled walkable "room" as it were — for its live and active wearer.

The average atmospheric pressure in Mars is ~6.1 mb and the pressure at Mars' topographic lowest place, the -6,000 m Hellas Planitia as measured from Mars' internationally agreed base-datum, is ~10 mb. The Armstrong Limit is 62.8 mb! Named to honor Dr. Harry George Armstrong (1899-1983), he was first to realize that below 62.8 mbar, the fully exposed human-body's fluids (saliva, tears, urine, non-vascular blood as well as the liquids wetting our lung alveoli) will boil and evaporate, leaving that unfortunate person quite dead within a few minutes! The *Funnel* Optopia's materialization obligates us to require new definitions of "human" as well as post-Homo sapiens "human." Andeans and Tibetans [36] seem pre-adapted to Mars and even allegedly disabled persons can successfully fulfill vital tasks in outer space and within Mars' planetaric environs. Imagine predesignating species in purely locative terms: (I)

Earth humans as “Homo terrans”; (II) normal or enhanced Mars humans as “Homo ares” and (III) self-engineering cyborgs as post-Homo sapiens “AI robots”. (We have in mind, too, that AI robots ought to be sub-divided into a species habituated to celestial object gravities as well as a species habituated strictly to the Universe-wide conditions of hard-vacuum outer space, interplanetary and interstellar.) Humans, whether dwelling in the Earth or in Mars, basically, annually require ~1.3 metric tons of sustaining mass (food, > 1 cubic meter of freshwater per person et cetera). *In situ* support mass for humans residing on Mars will require inflatable, well-anchored Mars surface greenhouses, repairable balloons within which are grown nutritionally safe foods [37] whilst humans work and play most of the time inside natural caves and/or dug tunnels [38] just to avoid lethal solar and cosmic irradiation! Neither existential prospect is truly appetizing, comfortable, or entertaining for all but a few weird, strange, or exotic Earthlings, even those persons specially physiologically trained or psychologically conditioned. Landscape exploration, industrialized exploitation and necessary farming is arduous work requiring, minimally, great dedication and determination by all living participants.

The unique shell-like crusts of Earth and Mars differ in their mineral contents and relief — that is, topographic range (highest and lowest elevations) — with Earth having a range of ~20 kilometers whilst Mars’s range is ~30 km. [The astronomer Charles Dillon Perrine (1867-1951) postulated “The Origin of the Earth’s Land Formations” in the 6 September 1940 issue of *Science*, Volume 92, Number 2384, pages 210-212; since then, it is now known that Moon as well as Mars have very similar lithospheric dichotomies.] That physiographic difference means there is a useful areomorphic transformational opportunity to be decisively advanced in our *gedankenexperiment*! Mars’ two moons, the largest is Phobos and its smaller companion Deimos, are oddities probably not originating from a split larger precursor Mars satellite. **Figure 1.** Phobos orbits below the synchronous limit (20400 kilometers) and Deimos above it. Deimos (mass = 1.47 x 10^{15} kilograms; Volume is 1017 cubic kilometers), which moves from east to west east in eleven hours, is at present receding from Mars while Phobos (mass = 1.06 x 10^{16} kilograms; Volume is 5742 cubic kilometers) moves from east to west in 30 hours. Proposals have been offered to make hollow the moons of Mars to serve humans as shirt-sleeve Mars Space Stations. Their suitability for such a role may increase or decrease depending on future analysis by structural macro-engineers. In summary, a multiscale, comprehensive report of those rocky settings and their natural structural architecture is fundamental for any future site-specific, appropriate Space Station development.

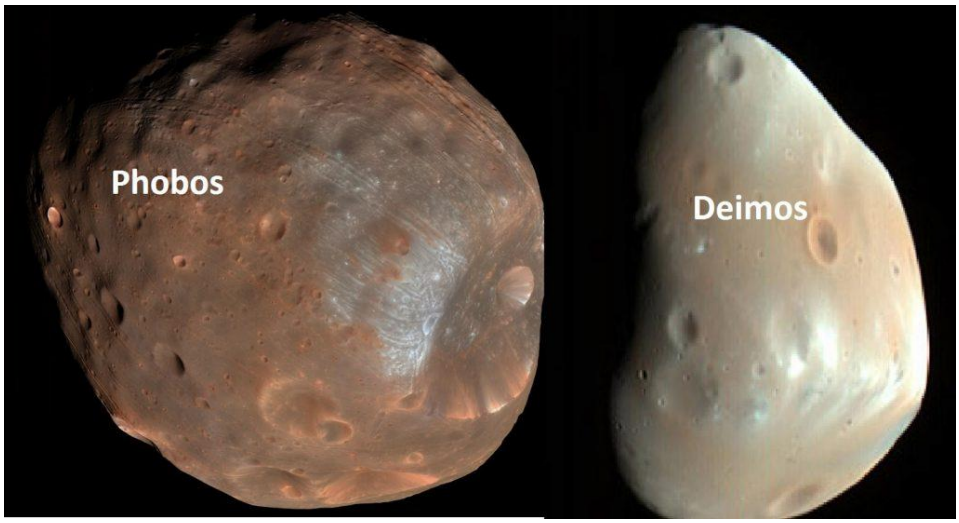

Figure 1. Mars’ non-twin natural satellites (Source: Google Images).

WHAT IF…. a very deep hole (pit) in a chosen landscape mobilized, in part, by gravity-obeying wind, can work as effective triggers enacting more favorable planetary conditions for a "New Mars Nature." No politically-imposed building codes or environmental regulations applicable to Mars still allows for the unimpeded future development of its rocky and dusty, cratered, canyon-riven and granularly mobile surface and ultra-thin atmosphere by all future-present species of mechanical, electronic, and biotic "intruders" [39]. Natural meteorites are solid interplanetary or interstellar materials that survive high-speed passage through Mars' ablative atmosphere and strike the subaerial landscape. (Several small pure iron meteorites have been examined remotely by scientists employing calibrated, treaded and wheeled roving robots relentlessly trekking that distant, arid Red Planet's obviously rugged landscape.) Unnatural meteorites might yet become an economical deep pit excavation tool, if bent to one single purpose by those humans intentionally wielding for macro-engineering purposes such controlled impactful masses. We do not foresee a generalized or widespread increase in the pulverization of Mars' already exposed landscape to induce a more chemically reactive landscape [40]; instead our Open-pit Option macro-project plan is to focus intentionally targeted bombarding bolides such as Mars' anthropogenically de-orbited moonlets Phobos and Deimos — "Mars Rams" [41], buried thermonuclear explosives to cause targeted Mars ground-surface "bombturbation" elevation reductions [42], multiple successive same-target "Rods From God" descending from surrounding outer space [43] and Mars-adapted bucket-wheel excavators [44] on Hellas Planitia alone. The goal: dig the deepest artificial Mars hole possible, a subaerial open-pit that would never be disarranged by uncontrolled landslides. Why? We desire an enormous gravity and density instigated safe gaseous depository for as much of Mars's extant atmosphere as possible! Our imagined mega-project is necessary because there is an insufficient inventory of carbon dioxide gas available nowadays on Mars to warrant its anthropogenic release by any of the time-consuming and expensive techniques touted by virtually all 21st Century Terraforming's newsy popularizers and proficient publicity generators [45]!

Since 2008, the Earth's deepest hole, a small-diameter vertical rotary-drilled shaft penetrating the seabed in the Persian Gulf to 12,289 meters, is the Al Shaheen Oil Well (BD-04A). It is, therefore, extremely doubtful that huge, costly, and heavily maintenance-reliant mechanical or even rock-melting drills would ever be utilized on Mars, consequently our significantly more direct-action agency material removal macro-imagineered techniques [46]. Fifty-megaton yield thermonuclear explosives were tested in Earth's air, so it does not seem at all implausible that an aggregation of such powerful devices, when simultaneously exploded and blast yielding the equivalent of ~177 x 10^{12} metric tons, might be carefully emplaced ~10 kilometers below the anthropogenically enlarged crater's floor present after the previous serial impacts of Phobos and Deimos. Then, to follow-up, stand-off explosives such as numerous tungsten "Rods from God" could finish the conical hole's edge and road approaches without exposing early-generation implanted Martians, whether flesh or metal, to mortal or rapid disassembly dangers!

The quickly resulting magnificent funnel-like hole would have a topmost diameter exceeding 50 km. Funnel-like holes have fascinated architects for a long time: stimulated by a visit to Brazil, Walter Jonas (1910-1979) proposed *Intrapolis* in 1956 and Jean-Louis Rey (1931-1993, AKA, "Chaneac") displayed *Ville Cratres* in 1963 and, later, the group Superstudio (extant 1966-1878) proffered *Temporal Cochlea-City*. During modern times, innovative underground macro-engineering, featuring the *Earthscraper*, an inverted pyramid penetrating 300 meters into the Earth-crust, designed by the architecture practice BNKER Arquitectura was presented during 2015 for future installation in central Mexico City, Mexico. An American macro-engineer, Jonathan John Gwiazda, has proposed "Power generation by solar/pneumatic cogeneration in a large, natural or man-made, open pit" in US Patent Application US 2005/0150225 A1 published 14 July 2005. Quick excavation of a Mars conoidal pit will for-ever alter the Chandler Wobble of Mars and certainly redistribute the greater part of the total mass of the Red Planet's gravitationally free-flowing atmoshell! The anthropogenic concentration of gases in one selected planetary geomer, a cone-shaped landscape region of three-dimensions, opens the prospect of

centralized urban settlement for Homo ares and post-biological AI robots, a place from which expeditions may originate to explore and exploit whatever materials and energies Mars holds in store for discovery. The obvious possibility of subsequent planetary outgassing induced by the digging of the *Funnel* means the gas replenishment within the cone will become natural. Drone-crafted bench terraces will stabilize slopes forming the cone. Indeed, the complete replacement of people by collaborative AI robots in mining efforts is inn the immediate offing, sometimes identified by the terminology "Mining 5.5" expected to be operating after 2050 AD. (In Earth's bioshell, the rational presumption is that no human, whatever the technology available, could ever work efficiently at >10 kilometers below sea-level.) Observed from orbit and by landed robotic missions, it is known that Mars undergoes new space debris impacts — crater-creation by blasts — sand and dust transport by wind, a variety of material flows on slopes and enormous changes to perennial surface ice deposits. Cratering events have shown that sub-surface ice plays a crucial role in the stability of the ground as well as the overall content of the planet's atmoshell.

5. A replacing anthropogenic Mars landscape dichotomy!

Approximately 66% of Mars' ground-surface is intensely cratered, strongly resembling the highlands of Earth's Moon. The most cratered terrain is in the Southern Hemisphere yet it is ~6 km higher than the more sparsely cratered lowlands of the Northern Hemisphere — the contrast between the two spatially vast and volumetrically large geomers scientists have dubbed the "global dichotomy". The Hellas Planitia bolide-impact basin, which is ~4,000 km in diameter nowadays, has an up-thrust rim ~2 km above the geoidal datum and a Nature-made depth of ~8 km below that same datum. In his now classic book ***New Earths: Restructuring Earth and Other Planets*** (1981), at pages 169-170, its author James Edward Oberg summarized the Macro-Imagineering idea of a geologist, A.W. Gerhard Kunze, to concentrate all the available gases — mostly carbon dioxide, of course — then composing Mars' atmosphere in one locale, Hellas Planitia via an extra-ordinarily isothermal deep shaft. By 1989, A.E Smith's ***Mars: The Next Step***, at pages 131-132, added helpfully decorative details: "An asteroid with a diameter of 67 km and a density of 3 gcm^3…crashing into Mars at a velocity of 5.1 [kilometers per second], would excavate a crater 41 km deep. At that depth below the mean Martian surface the atmosphere would have a pressure of 500 mb, or half the atmospheric pressure at sea-level on Earth. Liquid water would…exist. [if] the temperature was above 0^0 C and humans would be able to live with normal protective clothing and an oxygen mask. Conditions, in fact, would not be significantly inferior to those on top of high terrestrial mountains…. If the asteroid…[was] ice…that would itself dump…water in the crater forming a permanent lake. But if the target area were one of those on Mars with subsurface water [groundwater], there would also be copious springs, streams and even rivers. According to… [Dr. Kunze's] theory, plants would be able to grow in the bottom of this enormous crater without the benefit of a greenhouse and eventually the atmosphere would come to contain oxygen formed biogenically…." Therefore, living settlers could use standard revolving doors [47] instead of air-locks to enter and exit their otherwise air-conditioned offices, homes and other types of work-place enclosures necessitated by our common cultural habits of minded outlook per Clifford Geertz!

Evidently, no reputable scientist has published completely descriptive calculations about the state of the Red Planet's remaining free atmoshell — by then a mere exoshell maintained by a diverse range of gaseous content caused by the efflux of gases seeping from Mars' interior owing to radioactive decay — that which does not enter or stay for any duration within the anthropogenic terrain declivity. Mars without an atmosphere can be characterized as in a state close to radiative equilibrium for without an atmosphere there are no known event-processes extant by which energy and entropy can drive significant energy conversions associated with other planetary event-processes. In fact, Mars might come to closely resemble Earth's Moon. In other words, most of the Mars's landscape will become geo-physically dichotomized, in no uncertain terms anthropically Moonscaped! ("Moonscape" is probably not the result

of word blending but, more probably, word compounding [48]. We are rather fond of the term "Moonify"!) Moon dust is medically certified as toxic to life-forms as is Mars' natural dust [49]; strictly enforced avoidance of dust on both celestial bodies is a health priority for living folks. "Operations on the Martian surface that could be advanced with knowledge from the Moon… [this includes] human health and bio-medicine, power systems, manned exploration rovers, and space suits" [50]. We submit that all techniques and special equipment developed to institute a globalized lunar industrialization enterprise may be used, almost without engineering modifications, in the subsequent industrialization of our Solar System's infamous Red Planet [51-52]. Such a program of logical action encourages further outer space adventures for humans as well as their robotic "off-spring" because it keeps the monetary cost of the effort affordable for curious taxpayers! The mandate of necessity for digging *Funnel City* would be to serve as a headquarters for Jack Smith's proposed Mars-centered Dyson Swarm [53]. Preferably, Mars' moon would be removed as obstacles to the physicalizing of Smith's solar satellite swarm which might harness 0.74 to 2.77% of our Solar System's primary energy output!

6. Into the well

Planetary excavation for colonization purposes holds significant positive prospects to be considered a viable option when it comes to Mars, or even harsh planets like the Red Planet, which, in the distant future, could be the target of anthropogenic actions. The pressure reached at the bottom of the "well", where *Funnel City* would be established, make it possible to implement essential hydraulic systems for a satisfactory anthropogenic transformation of the walkable geophysical environment. Incidentally, if the latest predictions about the amount of groundwater on Mars are confirmed, artificial lakes with artificially generated waves would form the basis for sophisticated water resource management through metamaterials capable of controlling the shape of the waves. Huanyang Chen and his colleagues at Xiamen University in China, studying the physics underlying the inherent endowment of metamaterials to drive light, found that the same principles apply not only to electromagnetic waves, but also to other oscillations, such as water waves [54]. They evinced a frame capable of changing the propagation of water waves into localized waves in a manner analogous to what occurs when an electromagnetic excitation called surface plasmon polariton is obtained. In the experiments conducted, the waves propagated formed a series of localized surface-plasmon-polariton-like excitations traveling in a selectable direction. The changing of other parameters that interfere with the behavior of water waves through metamaterials, such as gravity, is also in the sights of Chen and his team. This parameter manipulation can help compensate for environmental deficiencies on Mars compared to conditions found here on Earth, even into the conical "well", enabling unusual infrastructural solutions, including architectonic solutions.

At the current stage of research, the applicability limits of metamaterials are virtually indeterminable, encompassing wave guiding, wave filtering and, especially, superfocusing, to mention a few examples regarding control and energy harvesting by capturing mechanical energy of water waves. With innovative designs, in addition to solar panels with cells doped by metamaterials, the conversion of energy by these composites can even revolutionize the design of interstellar spacecraft engines, certainly facilitating tremendously the access to Mars. It is not difficult to imagine how much this technology could contribute to energy production for the human population of *Funnel City*.

In fond memory

This chapter is dedicated to Russian-American physicist Dr. Alexander A. Bolonkin (1933-2020), our friend now departed.

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