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“Big Tent” SciFi Architecture: A 21<sup>st</sup> Century  
Saharan Tapestry

by

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## **Introduction**

Geoscience-driven public policy issues are rarely the focus of supranational negotiations. A current intimate link, binding geoscientists and geopoliticians, is focused on the Earth-atmosphere's anticipated 21<sup>st</sup> Century anthropogenic warming. Many prominent geoscientists now question the validity of media-disseminated public warnings of the alleged heating of our Earth-biosphere's fundamental ingredient (air).<sup>1</sup> Even proponents of the most radical climate change prognostications unambiguously admit to the world public that an operative international carbon dioxide gas emission control regime cannot soon result in a static Earth-biosphere, and that a naturally dynamic Earth-biosphere requires adoption of a geopolitics emphasizing globally shared Geoscience data. To their current regret, internationalists have previously ignored the rather obvious fatal flaw of their publicly espoused utopic commitment, as long-time adherents of a head-in-the-sand sociological scheme, to metamorphose Homo sapiens (in order to transform Earth's atmosphere)!

Macro-engineering's essence is the integration of planetary geophysical data with its theory of construction and destruction to some palpable purpose. Every completed macroproject must enable our world-civilization's economy and must raise humanity's quality of life and standard of living; the construction, destruction or reconstruction of the "whole site at once" hallmarks Macro-engineering's Space Age professionalism. SciFi Architecture, when wielded by determined applied macroengineers, seeks establishment of geographically large climate-controlled buildings, which can effect an Earth-biosphere remodeling.<sup>2</sup> The gradual emergence of Macro-engineering to amalgamate civil and

military engineering, Geoscience and SciFi Architecture among others, is a case of emergence by integration driven by practical necessity resulting in a new discipline. Whether or not a future catastrophic global climate change occurs, it behooves Macro-engineering to at least dream of possible technology options countering atmospheric warming or cooling, which certainly would cause unsettling sociological events and, as well, to speculate in an informed way about means to make humankind's tenure on a naturally ever-changing Earth ever more comfortable and stable! UK researcher Dr. Martyn J. Fogg, in 1995, elaborated on a macroproject plan to, in future, envelope Mars with a kind of tent that restrains the escape of atmospheric gases to outer space, thereby permitting a peopling of the planet by persons wearing normal outdoor clothing, not spacesuits or pressure suits.<sup>3</sup> However, since nothing under the Sun is really ever “new”, such a proposal can be traced back to 1962, when Frei Otto, in his Zugbeanspruchte Konstruktionen (Ullstein Verlag GmbH, Frankfurt-Berlin, FRG), proposed a “closed envelope surrounding the Earth”! Although this would hardly be of any practical use, we've planned the actual covering with a building of a very large region of Earth's land surface—the Sahara.<sup>4</sup> A materialized SciFi Architecture is a practical cure for a specific unwanted change in our species' milieu caused by our industrialized world-civilization. Today's Sahara, particularly its almost-Mars-like northern half, which is visually quite distinct from its more arid and almost-Moonscape southern half, is an ideal site-region for SciFi Architecture because it is generally unpopulated and technically malleable. Since at least *circa* 1964, Macro-engineering is a “sustainability science”!<sup>5</sup>

Perusal of satellite images provides a further clue for macroengineers as to a proper Northern Hemisphere site for SciFi Architecture's first major installation. A huge

region dark due to the absence of any artificial lighting, the Sahara literally makes no visual impression whatsoever!<sup>6</sup> Ecologists ascribe a significant reduction of rural Europe's biodiversity to far too much primary biological production consigned to human consumption. A feasible remedy might be the European Union's quick initiation of a farmland reversion policy-program—a profoundly expanded NATURA 2000 network<sup>7</sup> based fundamentally on its Directive on the Conservation of Natural Habitats and Wild fauna and Flora—permitting a lot of rural Europe's landscape to become a managed parkland-zoo<sup>8</sup> like the Southern Hemisphere's newly interconnected “Peace Parks”, which are being organized as a huge grazing region serving Africa's migratory fauna.<sup>9</sup> “Peace Parks” are trans-frontier conservation zones. Simultaneously, 50% of the Sahara's  $7 \times 10^6$  km<sup>2</sup> ought to be converted from wasteland to irrigated truck farms, reserved forests and playgrounds protected by a carefully made collection of clustered canopies enclosing ~40% of the Sahara's current atmosphere boundary layer; Earth's planetary boundary layer is the lowest 500 m of the troposphere and is the air mass most strongly influenced by the land or water surface beneath it. A gigantic building's emplacement would create a physically new lower demarcation for the Sahara's part of the boundary layer. This SciFi Architecture proposal to gradually and permanently shift some of Europe's commercial agriculture to North Africa should be coupled with an earlier—but now markedly revised—proposal for inducing the Mediterranean Sea's navigation surface to an elevation lower than today's *via* natural evaporation, followed by a wide-spread use of its enormous harness hydropower. Both macroprojects are today technically doable. Non-polluting electricity production and a linkage to a Sahara with

an artificially altered radiative budget can predictably promote a future prosperity for a very large Earth-biosphere region!

### **Mediterranean Sea Basin-Sahara Geology**

Until ~5.32 million years ago, the Mediterranean Sea was actually a very saline lake, sometimes several lakes, sitting ~2 km below the ambient surface level of today's familiar body of sea water, which is nowadays not isolated from the North Atlantic Ocean at its westernmost extent by a natural Earth-crust protrusion. At times a seafloor desert extended from Spain to Egypt and from northern Italy to Libya. (A SciFi novelist, Harry Norman Turtledove, has imagined everyday human actions within a hot and rugged canyon that would be extant if the Mediterranean Sea had remained a "Lago-Mare".)<sup>10</sup> After its natural refilling with sea water, when the Mediterranean Sea's level was still below today's owing to the existence of Ice Age glaciers, sandy material blown inland off North Africa's exposed continental shelf caused granular material accumulations in some low-lying Sahara valleys.<sup>11</sup> Before mankind's recorded history North Africa bore large freshwater lakes; surrounding grasslands attracted free-roaming grazers and their human predators—in fact, the Sahara was <50% its present-day area! According to modern Geoscience, best purveyed most recently in a November 2000 dedicated issue of Global and Planetary Change (Vol. 26), a long period of drought ensued. Until the Sahara was first traversed (in the 8<sup>th</sup> Century by Sanhaja Berbers), it was a life-killing separation of the various peoples of Equatorial Africa and the peoples of the Mediterranean Sea Basin. Although 21<sup>st</sup> Century North Africa's strand-sited ecosystem-nations must cope with dry landscapes, the present-day Sahara's southern

edge is not currently advancing upon the Equator as it did during the Ice Age. In other words, the Sahara is, more or less, “geographically stable” and therefore available for large-scale economic development our world-civilization.

### **Recent North Africa Dream Macroprojects**

Indisputably, Egypt’s Great Pyramid is North Africa’s most famous building, the subject even of awe from living macroengineers who have investigated this truly enormous monumental cut-stone object by trying to determine how it was economically piled up.<sup>12</sup> Few big buildings or structures have ever been dug or erected on North Africa’s physiologically hostile landscape; world-civilization, however, depends on the 160 km-long Suez Canal (opened in 1869), the best known of the region’s few busy transportation facilities.<sup>13</sup> Since 1999 the Canal passes ships with draughts of 19 m carrying 7% of world trade volume; by 2010 it will be dredged enough to safely pass vessels with maximum permissible draughts of 22 m.<sup>14</sup>

North Africa is an important source of petroleum and natural gas, which fuels its economies, the European Union’s and other world-civilization regions. Tourism is a major national income budget resource for its state-ecosystems; ultimately, some economic development experts forecast North Africa’s “Disneyfication”—that is, North Africa’s future economic resemblance, in economic and social terms, to the USA’s vacationer’s pseudo-“Old West”. “Disneyfication” is a region-wide development stratagem devised to corral foreign and domestic investment in archaeological tourism, outdoor sports facilities, and luxurious casinos (like those in Cairo, Egypt). Nowadays, airlines perform the internationalizing task once imagined to be the province of “The

System of the Mediterranean”, a grandiose Basin-linking railroad-construction/railway interconnection macroproject planned to foster track-gauge compatibility originated by Michael Chevalier (1806-79) in 1832. The UNESCO-financed completed replica of the famed Alexandrian Library examples this noteworthy “Disneyfication” notion of development.<sup>15</sup> By 2020, according to the World Tourism Organization, ~7% of humanity (or, by then, ~1.6 billion persons annually) will travel outside of their homelands and spend about two trillion USA dollars doing so! While the sub-Sahara crustal strata hold important known oil, gas and freshwater deposits, the superficial terrain generates miniscule country-ecosystem incomes.

Macroengineers never approach a vast geographical space with only half-vast ideas, as any visit to Dr. Martyn John Fogg’s comprehensive coverage of Macro-engineering’s two sub-divisions (Geoengineering and Terraforming) “The Terraforming Information Pages” [<http://www.users.globalnet.co.uk/~mfogg/index.htm>] can rather thoroughly demonstrate! And so, speculatively, some macroprojects have been proposed that should increase North Africa’s monetary wealth if these infrastructures were efficiently made concrete in a timely fashion. With 17 times the Great Pyramid’s bulk, the Aswan High Dam causes its reservoir’s sedimentation—so much so that ~530 years hence (all other factors remaining the same) Lake Nasser will be a floodplain demarcated in the north by a large waterfall. Siphoning freshwater from its reservoir, Egypt is currently surveying and laying-out irrigated farms at Toshka, Kharga, Dakhla and Farafra—all places situated within the inhospitable Sahara. Any effort to increase the total runoff of the Nile River from upstream, by any means, will only shorten Lake Nasser’s existence. However, the sediment stored there, if excavated, will make a fine

trainable topmost-soil for bare parts of the Sahara without developable superficial resources or badly leached and dry soil-like topping!<sup>16</sup>

*Via* an east-west pipeline or a lined canal, it is feasible to fill the Qattara Depression with freshwater—either from the Nile River or manufactured cheaply by desalinization. A created lake, floating drilling rigs and tourism-dedicated cruise ships, is a possible future national asset for Egypt. In the late 1920s, macroengineers postulated letting seawater from the Mediterranean Sea flow downhill into the Qattara Depression while, at the same time, such flow generates 10,000 MWe. Hydrologists conclude neither salt water nor fresh water will adversely affect the underground aquifers thereabouts. The air above the sparkling managed lake will humidify and clouds will form—perhaps the dynamics of the devastating khamsin—the annual hot southeasterly wind that blows from the Sahara—will change for the better. Similar immersions (with only sea-water) in Tunisia’s Chott Melrbir and Chott el Jerid can, in effect, created a man-made North Africa Great Lakes System!

In Libya, on a 5<sup>th</sup> Century map there is indicated a major stream, named “Sahabi”, which flowed into the Mediterranean Sea; by the 1<sup>st</sup> Century, its valley had been buried by migrating Saharan sand dunes, making the Sahabi River’s water-eroded relief almost invisible. Might not this interesting feature be technically restored, just like so many Roman Period ruins are, if a reasonable purpose for legitimately doing so could be conceived, and a very cost-effective Libyan macroproject planned? No joke, but instead an innovative idea, this restorative macroproject concept might cause more speculation (intellectual and real estate) than a 1963-published rain-making scheme to pave several wide parallel strips of wasteland with road-quality asphalt to favorably affect moisture-

laden air moving inland from the Mediterranean Sea. Such an air mass will be heated (as it passes over these macadamized strips), rising to release its water vapor on southern Libya's parched land.<sup>17</sup> The Earth-atmosphere's increasing carbon dioxide gas content can lead to faster tree growth in prepared desert climate soils on which few humans live and where today's real estate demand is less than negligible. Therefore, planting trees in the Sahara by aircraft over-flights may drastically alter that region's albedo, and thereby moderate or retard the onset of an anti-biotic global atmospheric warming or cooling of our Earth (Fig. 2a and 2b).<sup>18</sup>

Fresh water supplies experts expect Spain's province of Catalonia will soon have to cope with shortage, a supply shortfall that can be made up by fresh water importation from France's Rhone River. Were a daring water supply investment group, however established and managed, to pursue such a water-resources development strategy, Catalonians risk a frustrating future entanglement in two problematical geo-economic situations. First, they will become enmeshed in an already recognized fresh water pollution and riverbed siltation ecological threat to the Rhone River's delta (complicated by an expected sea-level rise stress factor). Secondly, they will face a very intense buyer's competition with every other real and potential Mediterranean Sea Basin fresh water rival. All those vying for any possible surplus potable and/or irrigation water France may chose to sell at bid/barter auctions, then generously license for transferal, and upon which watery export France at any time may seek to tax, had better be prepared to pay dearly! In dry regions, fresh water is a valuable commodity, as the recently designed 540 km-long immersed pipeline across the Persian Gulf—from Iran to Kuwait—underscores.<sup>19</sup> As long ago as 1975, and again as recently as 1998, some dilettante

macroengineers have plumped for pumped Rhone River water conveyance across the Mediterranean Sea to Algeria. (Ernst G. Frankel, Professor of Ocean Engineering at MIT, touted this undersea pipeline idea in Uwe Kitzinger and E.G. Frankel's Macro-engineering and the Earth: World Projects for the Year 2000 and Beyond (1998, Horwood, UK, at pages. 105-120.) If the Rhone River-Catalonia canal is constructed it will be the first to cross Europe's national boundaries; if the Rhone River underwater aqueduct to Algeria were built, it would be the first to cross an UNO-managed ocean region. Algeria may never again want to become France's "hostage" consumer for a necessity (such as a human, plant and animal life-sustaining fluid)—the Geopolitics of the situation are simply too complex and unfavorable to encourage realistic assessment of this notion.<sup>20</sup>

Undoubtedly, the single most startlingly SciFi-like fresh water resource-providing macroproject yet charted and dedicated to serve the increasing needs of North Africa's populace is that formulated by Heinrich Hemmer, an actively-retired 25-year veteran of an important FRG engineering firm.<sup>21</sup> Hemmer's freshwater harvesting plan entails exportation of runoff from Brazil's Amazon River, then its piped movement across the North Atlantic Ocean to Africa's strand. Hemmer's meticulously designed underwater pipeline—quite similar in its technical specifications to the trans-Mediterranean Sea pipeline—can become a reliable long-distance conveyance for Brazil's surplus. He deems his plan as sufficient to insure that it will be possible to irrigate ~315,000 km<sup>2</sup> of the Sahara (that is, ~8% of the Sahara's 7 x 10<sup>6</sup> km<sup>2</sup>). Also, its dedicated delivery capacity will allow passage of enough fresh water to supply all of the future daily water needs of the Sahara's settlers and their domesticated animal herds. With an adequate

long-term freshwater supply for the full enjoyment and use (at a reasonably high UNO-defined Standard of Living), such wasteland settlers could become proud owners of ~14% of the extant Sahara's total area (that is,  $\sim 1 \times 10^6 \text{ km}^2$ ). Heinrich Hemmer's macroproject involves all of the unusual, but quite basic, constructional challenges posed by earlier macroengineers. His conservative Macro-engineering conclusions concerning wave-power absorption on a line of large submerged horizontal cylinders is patently correct. Unbeknown to him, Roger H. Charlier had earlier mapped a clever routing from a fresh water supertanker's or submarine pipeline's landfall in Mauritania, east across the Sahara to Chad, thence north to Libya's coastal city of Saloum.<sup>22</sup>

### **A Saharan SciFi Architecture Option**

Despite "Globalization"—the reputed creation process for humanity's world-civilization—"The North" is popularly appropriated as the collective appellation for all industrialized nation-ecosystems. "The North" carries with it the clear implication that there is either a consistent socio-economic global trend or some sort of fissure in the relationship between geographical latitude and our species' socio-economic development. North Africa is "The North" and it peacefully shares the Basin of the Mediterranean Sea with Europe; countries comprising North Africa have wealth, some of it untapped still, and are progressing industrially. North Africa has a rapidly proliferating coastal population; UNO demographers foresee Africans as possible future colonizers of Europe. Large-scale migrations originating in North Africa may be stimulated by a "global warming/sea-level rise"<sup>23</sup> Africans may reluctantly or enthusiastically depart their Northern Hemisphere homelands in great numbers by *circa* 2025-2050 if they can then

no longer secure livelihoods because of protracted drought, soil erosion, air and water pollution, and unsettling episodes of stormy weather fomented by unnatural Earth-atmosphere changes. (Two major Basin cities—Athens and Istanbul are both noted for their casino gambling—have had their infrastructures seriously damaged by major earth tremors during 1999 and after.) In brief, millions of persons may eventually seek contentment and health in locales other than their individual personal birth locations.

Before SciFi Architecture can be materialized in the Sahara's northern half, an ongoing debate amongst concerned ecologists over the scope and mandate of Restoration Ecology must be resolved or so publicly muted that a legally-unhindered Macro-engineering can proceed with a UNO-approved landscape-sheltering "Sahara Tent Greenbelt" (STG) macroproject.<sup>24</sup> Restoration Ecology is "Disneyfication" writ geographically large since it encompasses a specialized form of gardening in which the ideal final landscape to which all time and energy has been directed is Homo sapiens' notion of where living and non-living objects were before humanity jumbled them. Official and unofficial negativity—laments voiced in the mass media far too often (about the Industrial Revolution and its aftermath)—really dominates public discourse worldwide nowadays: the truth, whether we wish it so or not, is that all global Nature (the Earth-biosphere) is rapidly becoming a gigantic fake and Restoration Ecology is a confused multiple reflection of variable national artistic tastes apparently displayed by 191+ UNO ecosystem-countries! Humans inadvertently and intentionally transport components of various recognized vegetation types from place to place, sometimes with beneficial, benign or bad impacts; currently the greatest harm is caused by ornamental activities!<sup>25</sup>

The largest Restoration Ecology scheme so far conceived, except for Space Age macroprojects aimed at planetary terraformations of Mars and Venus, is the “Atlantropa Project” of Herman Sorgel (1885-1952) contrived to induce a lowering of the Mediterranean Sea’s level and to reroute Equatorial African rivers northwards to water the Sahara. During 1998, two histories of this landmark macroproject were published in the FRG: Wolfgang Voigt’s Atlantropa. Weltbauen am Mittelmeer—ein Architektentraum der Moderne (Verlag Dölling & Galitz, Hamburg) and Alexander Gall’s Das Atlantropa-Projekt. Die Geschichte einer gescheiterten Vision. Herman Sorgel und die Absenkung des Mittelmeers (Campus Verlag, Frankfurt-Berlin). The main investigation and explication of the “Atlantropa Project” occurred during the period 1929 until 1952. Both Voigt and Gall unearthed the intellectual roots of this unique European planning concept and present their different conclusive tales with care. During 1998-2000, one of us (RBC) advocated adaptation of Atlantropa’s most essential built feature, the Gibraltar Strait Super Dam, to an additional human purpose. Consideration of prevailing Geoscience verity, it then seemed logical to harness its generated hydroelectric power to industrially process carbon dioxide gas extracted from the Earth-atmosphere into a storable solid material, an anthropic rock.<sup>26</sup> By such extraction, it was optimistically hoped a favorable trending atmospheric processes would be instigated. Since early 2001, we no longer think such a colossal scheme of anthropic rock emplacement (concrete etc) is required and, consequently, currently promote a new Gibraltar Strait Super Dam design, a tension-loaded dam of a kind first envisioned by Frei Otto shortly after World War II.<sup>27</sup> Total USA dollar costs for a dam at the Mediterranean Sea’s gateway plummets remarkable when this as yet under-tested technology of Molecular

Nanotechnology (forming very lengthy nanotube strings that are ~100 times stronger than the best modern steel wire and which weigh only one-sixth as much) is utilized!<sup>28</sup> Nanotube ropes achieving strengths of 130 gigapascals will soon be manufacturable, and their subsequent near-term future use—nanotube cables will be the most necessary component of an Earth-to-outer space elevator infrastructure—is eagerly anticipated by the NASA’s knowledgeable “Space Elevator” planners.<sup>29</sup> (Amazingly, Georgii Iosifovich Pokrovsky, a Russian physicist, proposed a “Space Elevator” in 1959 that was really a 160 km-tall pneumatic airship tower! Filled with helium gas, it could hoist to a high altitude an aerostat filled with hydrogen gas. His “Space Lift” system could replace rockets, just like the NASA “Space Elevator”. It would also cast a long daytime shadow on the Equator’s ecosystem-nations.)

A Mediterranean Sea 50 m lower (after an elapse of ~50 years) will be a tad more saline and just a bit hotter than today’s nearly compartmentalized sea; these initial oceanic characteristics will serve to purge the Sea of some of its accidentally imported biotic pests. Where needed, fresh water can be made using large adaptations and spun-off variations of an efficient commercial distillery converting it to fresh water, the floating AquaCone.<sup>30</sup> The Suez Canal will have to be partially rebuilt (locks added) since it will cease to be a sea-level canal. And, obviously, a 50-year period of total Macro-engineering in this Basin will severely impact all precious geologic hazard assessments. Conservatively, humans would be wise to literally create a new margin of safety (against tsunamis caused by earth temblors and volcanic eruptions) for endangered ecosystem-nation infrastructures and population by not permitting settlement on the newly exposed seashore—the equivalent of exclusionary economic development zoning on inland river

floodplains. Normally, with the Strait of Gibraltar open, an exiting sea water current flows into the North Atlantic Ocean which is called the “Mediterranean Outflow Water” (MOW) by Oceanography; the influence of this MOW on the Northern Hemisphere’s climate is unclear still.<sup>31</sup> For sure, a Gibraltar Strait Super Dam will halt the MOW! Should Geoscience experts prove a future global need to remove or to lower this huge tensed-membrane barrier for climate amelioration purposes, this task too could be performed quickly and inexpensively.<sup>32</sup>

“Atlantropa”—meaning a “turning toward the Atlantic Ocean”—is a plan, not a mere design-concept. As a hydraulic head-maker, its head-pond is an “inexhaustible” fluid source at elevation zero (Earth’s ocean) and its tail-water (the enclosed Mediterranean Sea) a regulated body of salt-water whose “perpetual” negative level (ideally, -50 m) is to be entirely sustained by natural evaporation. Under this minus 50 m scenario, the Gibraltar Strait Super Dam should have the turbine capacity to generate ~25% of the European Union’s officially reported AD 2000 electricity consumption at its two land-based powerhouses located on either side of the Strait of Gibraltar! Elsewhere, additional dams and turbines—say, located astride the revived “Sahabi” and on the artificially augmented Nile rivers—may be installed on the numerous small rivers streaming into the reduced Mediterranean Sea, producing low-price electricity for Basin nations.

SciFi Architecture, which presently connotes “Modern”, “Contemporary”, and “Futuristic”, ought to play an important near-future role in the physical assembly of a 21<sup>st</sup> Century “Version -50 m Atlantropa”, which must include a Sahara Tent Greenbelt (STG). Dubbed the “Version 50% Sahara Tent Greenbelt” macroproject, the STG omni-

structure building units can only be affixed to North Africa's landscape if they are provably "good" for our Earth-biosphere, however "good" is reasonably defined by our Space Age Macro-engineering's most aesthetically sensitive civil and military minds. Professionals, perhaps assisted by artificially intelligent (AI) robots, will be instructed only by the soundest of geocybernetic readouts obtained from computer-using simulators.

An STG most resembles the enormous, plain warehouses described in Chapter Nine of Martin Pawley's Terminal Architecture (1998, Reaktion Books). But, our Sahara Tent Greenbelt includes functions, features, and creatures missing from the sterile, dead-end buildings made possible by truck traffic. In fact, the STG is a big city-region object having a volume equal to  $\sim 0.7 \times 10^6 \text{ km}^3$  in which persons, social organizations, and various technologies produce a macroproject "whole". Like its Strait of Gibraltar Super Dam, the complementary STG's cost of construction probably will be approximately one-half trillion USA 2001 dollars. A Steering Task Group should allocate funding, as needed, to realize the STG. It is our intention to enclose  $\sim 3.5 \times 10^6 \text{ km}^2$  of the Sahara with an inflated 200 m-high transparent membrane cover with an albedo 80-90%—about double that of tan-colored rocks, soils and sand—under which forests and crops can be grown by irrigation with pumped groundwater and extra-region fresh water supplies. Ocean water's use in farming is also foreseen.<sup>33</sup>

A "Version 50% Sahara Tent Greenbelt" macroproject may strike some level-headed persons at his Conference as absurdly irrational. Adriaan Beuker and Ed van Hinte, in their Lightness: The Inevitable Renaissance of Minimum Energy Structures (1999, 010 Publishers, 191 pages) and Marc Dessauce (Ed.) in The Inflatable Moment: Pneumatics and Protest in '68 (1999, Princeton Architectural Press, 147 pages) all

strongly suggest that unwanted Earth-biosphere conditions and changes warrant the widespread adoption of programs for reducing or curbing energy consumption. One structure type, the grounded balloon, clearly demonstrates their welcomed criterion for “lightness”. Our STG would involve very minimal excavation and anthropogeomorphological rearrangements of North Africa’s landscape. We’ve simply extended Frei Otto’s post-1946 design arguments as well as those commenced by students and professors of the Institute of Design (founded 1937) at the Illinois Institute of Technology (ITT) during the late 1980s—their marvelous “Project Phoenix”. We seek here to inform the on-line world-public of our further development of ideas from these two main sources *via* a supplemental outline report founded on an academic-styled paper, “Architectural Ecology: A Tentative Sahara Restoration”, presented elsewhere.

We encourage further investigation of ITT’s “Project Phoenix”, a macroproject plan that got its first public airing in December 1990 in a handbook format guided to hardcopy finality by Dr. Charles Lewis Owen, a founder and director of the Institute of Design’s Design Processes Laboratory after he joined ITT’s faculty in 1965.<sup>34</sup> “Project Phoenix” designers proffered a mobile tent-like, air-supported domes, installed first at the windward side of the Sahara near North Africa’s present-day coastline, which were to provide only temporary shelter, while agriculturalists sow seeds and transplants—literally, installing a viable vegetation upon a desert landscape. After the dome-protected vegetation roots, “Project Phoenix” domes would be removed, then re-inflated at the established vegetation’s southernmost edge. Progressing like a line of self-perpetuating sand dunes on the strand moved by a steady onshore wind, “Project Phoenix” domes (each enclosing 0.1624 km<sup>2</sup>) will eventually approach the Sahara’s ultra-arid heartland

south of the Mediterranean Sea. Accordingly, our 21<sup>st</sup> Century Sahara Tent Greenbelt (STG) must be classed as a remarkable variant, perhaps a true spin-off, of “Project Phoenix”.

It would require ~616 permanent “Project Phoenix” domes to shelter 100 km<sup>2</sup> and ~21,560,000 “Project Phoenix” size domes to totally cover one-half of the Sahara permanently. We propose, as an alternative, to shelter an equal area of unused land with a compartmentalized aggregation of 700,000 flat-roofed inflated buildings enclosing ~0.0129% of the troposphere’s volume, only some of which would be greenhouses, forests and wild land. Frei Otto predicted this concept in 1962! His Institute for Lightweight Structures (in Stuttgart, FRG) imagines and examines virtually all technically possible similar structure uses. At least one North African ecosystem-nation leader, Libya’s Colonel Qaddafi, is known to favor tents; his famous “Bedouin” tent is actually an urban tent. However, it is not an inflated building.

Our extensive Sahara Tent Greenbelt will be an effective suppressor of heating and precipitation dust inputs to the turbulent troposphere.<sup>35</sup> And, small radioactive particles blowing off the Sahara since 1960 from France’s former nuclear test sites at Reggan in Algeria<sup>36</sup> and from depositions on vast areas of the Sahara which date from the former USSR’s terrible 1986 Chernobyl nuclear reactor accident<sup>37</sup> can be contained in their current placements with permanent inflated buildings.

An international organization, set up in 1929, undertook a mapping program to accurately delimit the Empire of ancient Rome, which attained its greatest extent *circa* 117 AD. Just suppose Archaeology revives some of the explored North Africa ruins left by Roman settlers, using appropriately refurbished villas and authenticated surplus

antiquities as revenue sources to underwrite the Roman Empire's further examination! Historic settlements (consisting of palaces, spas, villas, theaters and marketplaces) and restored, visibly free-flowing Sahabi River, are bound to excite and entertain, perhaps educated, vacationing persons wielding high disposable incomes from the European Union and elsewhere. Basically, this short-circuits "Disneyfication"—that silly "Modern" architecture selling a pseudo-"Old West" and other such phony fantasy places. The wonderful Barrington Atlas of the Greek and Roman World (2001, Princeton UP), edited by Richard Talbot, comprehensively maps these ancient societies that are heritage tourist attractions; its overworked compilers present ancient topography, as far as it can be known owing to changing sea levels which have inundated some historically important ancient ports!

In future, solar energy will be utilized on a large scale; soil management will become a supreme necessity. The "insol" concept was initiated as a solution to this anticipated macro-problem; "insol" originated at the Institut de l'Energie Solaire de l'Universite d'Alger and, later, at the Laboratoire d'Heliotechnique de la Faculte des Sciences de Marseille in France. The concept's main constraint is the requirement that solar collectors be placed a certain height above the terrain according to absolute geographical location, below a special structural feature identified as the "insol", which consists of (but is not restricted to) transparent walls, both vertical and inclined. The basic Earth-atmosphere interface component of the pellucid "insol" is its material cover. The ground's slope determines the slant and shape of the "insol"; on a horizontal grade, the shape is similar to ordinary industrial sheds (Fig. 1).

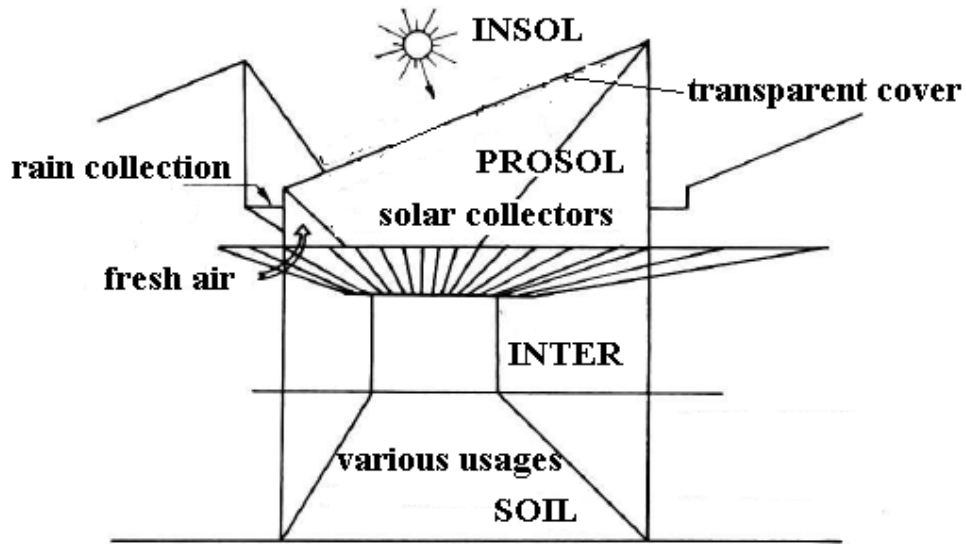


Figure 1. The insol

Figure 2a shows the present-day spatial distribution of mean ambient temperature over North Africa in July. The same distribution is shown in Fig 2b in case the insol is

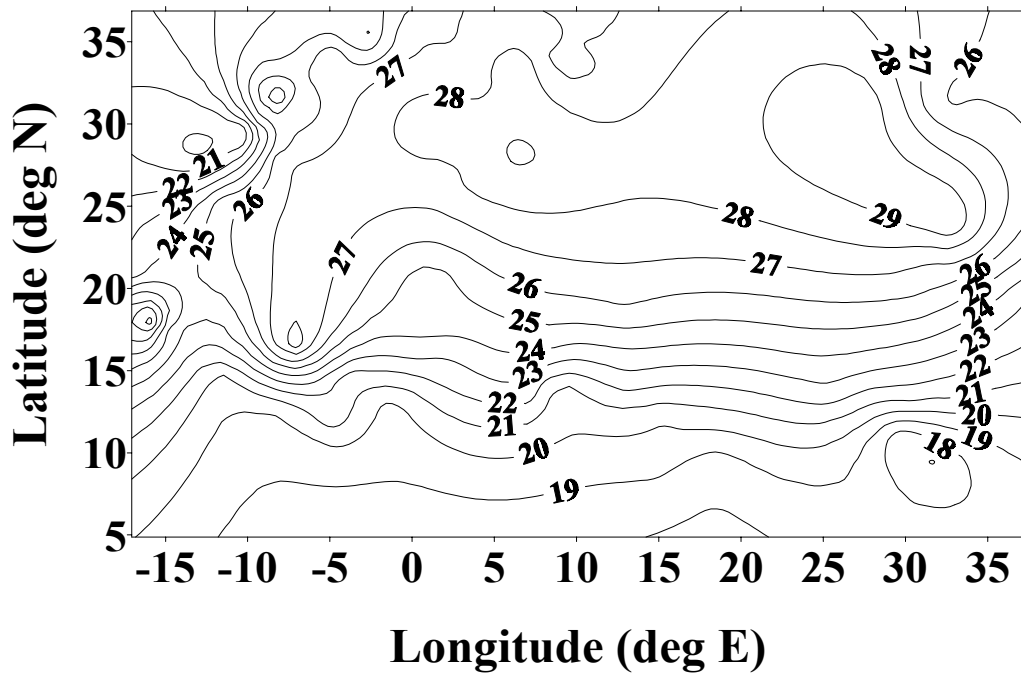


Fig 2a. Mean temperature distribution in Africa (July; degrees Celsius)

installed. For details see Ref. 4.

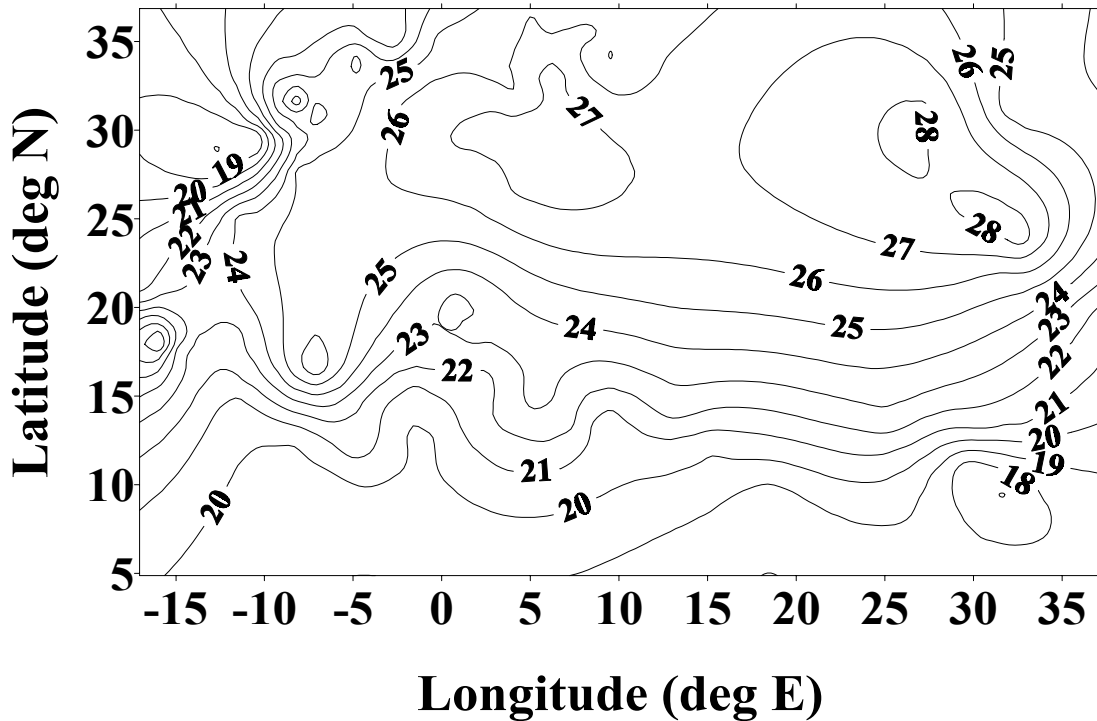


Fig 2b. Mean temperature in Africa after insol's installation (July; degrees Celsius).

### Noopolitik linkage with Sahara Tent Greenbelt

Geoscience and SciFi Architecture, together, are the sturdy foundation of a 21<sup>st</sup> Century (advanced) Noopolitik which offers, in part, a distinctive means to weave peaceful international relationships *via* a no-holds-barred RANDesque touting of persuasive social group thought/belief-modification techniques. Aimed at "...improving the capacity of state and non-state actors to work together to address trans-national problems"<sup>38</sup>, this RAND-advertised idea and its jargon needs remolding if "Noopolitik" is to be at all helpful with Macro-engineering's STG macroproject! The USA's two most popular domestic political parties (Republicans and Democrats) have espoused, at least since 1976, a theory of the "Big Tent"; each party's leaders philosophically claim there is

plenty of room within their respective formal organizations for divergent ideologies. They have often alleged that there should be no “outsiders”! The term “Big Tent” derives from the American-style 3-ring circus wherein several competing acts are ongoing simultaneously as virtually separate public shows! A Sahara Tent Greenbelt could enhance, both culturally and climatically, the goals of honest Noopolitik; the politics and geopolitics of inclusiveness are vital to our world-civilization and to the Earth-biosphere.<sup>39</sup>

AD 1989 marked the year when a vast geopolitical and ideological upheaval occurred. A 50 year-old ideological East-West fracture practically disappeared during July, and (the Old World’s) North-South started a new event-process timeline during November after the Union of the Maghrib/Union du Maghrib Arabe was formed to promote North Africa’s socio-economic development and Europe’s. A North-South dialogue—thought by many to be needed to bridge the gap separating our Earth’s world-civilization geopolitically split by the Tropic of Cancer—commenced during 1964 in Switzerland at a convention of the UNO’s Conference on Trade and Development. Little noticed then, during March 1989, the first organization work was being done at CERN’s Geneva, Switzerland headquarters on what was to become the World Wide Web by 1995! Soon after 2001, the 40,000 km-long Africa ONE undersea fiber-optic cable will be operational, encircling our Earth-biosphere’s second largest continent, approximately 21% of Earth’s land, and connecting all ecosystem-nations of North Africa with the rest of humankind.

Advanced Noopolitik may, ultimately, power a preparation for an Europe-North Africa “mock referendum” of the kind theorized necessary to settle on a common

Mediterranean Sea Basin-wide macroproject plan relating to curtaining our Earth-biosphere's further degradation, a degradation somewhat stimulated by an anthropogenic global buildup of carbon dioxide gas in the planet's atmosphere as well as other deleterious impacts.

Of course, the Sahara is one of our beautiful planet's least explored regions, but what is geographically certain fascinates diverse persons: the pure glass deposit of unknown origin on Egypt's Saad plateau<sup>40</sup> and the Sahara's Holocene megalith astronomical observatories.<sup>41</sup> People dwelling in ancient subterranean homes in southern Tunisia at Matamata can stay where they are without any bother at all. Traders and travelers will move unimpeded by camel caravans throughout the STG; inside the STG, all laid out routes of passenger and freight transportation (maglev<sup>42</sup>, light rail, capsule pipelines<sup>43</sup>, and road-bound electrically-powered vehicles) must miss ecologically valuable places, "outdoor" museums, historic preservation zones and other yet-to-be-delimited conservation and industrial regions. There may be a necessity to establish a dark-sky zone to appease Astronomy-focused social groups concerned by Europe's "light pollution" macro-problem as well as a site dedicated to a "Square Kilometer Array" used by European and African radio astronomers.<sup>44</sup> It would be most unwise to fail to restrict off-road vehicles to other than infrequent trips since the raising of dust clouds within any domical unit of the STG may directly injure, or have a long-term impact on, unmasked persons working or living there.<sup>45</sup> Filtered air may improve the health of those persons desiring to still practice nomadism, a life-style strictly confined to the STG's designated corridors of migration. Air may be conditioned using solar-powered machines, which could be remotely monitored and operated using the Internet.

Once a portion of the Sahara is permanently covered, the “Sahara” would actually cease to exist and might be missed; however, 50% of the “Sahara” would remain and might be a region (like the Sahel) wherein so far unimagined human activities could transpire! The roof of our STG might be painted with a graticule. For orientation purposes, as observed by passing aerospace travelers, this regular grid apprehended as a single geographical feature will be a visible metric graphic showing (1) distances graduated in kilometers and (2) indicator of true North-South and true East-West directions. Still, some macroengineers might prefer to place a monstrous Internet-style “dot”-shaped figure where zero longitude intersects the STG’s southernmost edge.

A finished, yet geographically discontinuous, Sahara Tent Greenbelt will surely present 21<sup>st</sup> Century Space Age tourists orbiting Earth with a spectacularly impressive sight! UK geopoliticians Halford John Mackinder (1861-1947), during World War II, speculated the Sahara might someday provide solar-electricity as a substitute for fuels derived from coal and petroleum.<sup>46</sup> Sometime during the first three decades of the 19<sup>th</sup> Century, Johann von Littrow (1781-1840), Director of the Vienna Observatory, is purported to have proposed a colossal geometrical figure’s construction (either a perfect circle or a perfect square) in the Sahara. His alleged purpose was to visually signal intelligent extra-terrestrials living on the Moon that Homo sapiens existed too! “Onto the waters of the canal kerosene would be poured and set ablaze...[a] striking [nighttime] display of terrestrial intelligence”.<sup>47</sup> So far, no historian has traced where von Littrow may have written about or originally voiced his SciFi-like notion. Johann von Littrow may never have made this macroproject proposal that is so often attributed to him! Shortly after 1846, Abraham Gesner first manufactured kerosene. It was then used

chiefly as lamp-oil. It is almost impossible that von Littrow ever recommended kerosene's use as an illuminant topping a water-filled open canal excavated in the Sahara! Reflecting sunlight upward, the Sahara Tent Greenbelt—so typically North African—will supply a glaring geophysical reminder (to future Space Age tourists, working spationauts, and Moon Base personnel) that humans care for their Earth-biosphere!

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<sup>1</sup> See: <http://www.cei.org/OnPointReader.asp?ID=1477>

<sup>2</sup> Karin Damrau, "Beyond Solidity: Inventions, Spaces and Concepts for the Elements of Air and Water", *Architectural Design* 69: 22-33 (March-April 1999).

<sup>3</sup> M.J. Fogg, *Terraforming: Engineering Planetary Environments* (1995, SAE International, Warrendale, PA) pp. 406-414

<sup>4</sup> R.B. Cathcart and Viorel Badescu, "Architectural Ecology: A Tentative Sahara Restoration", in press.

<sup>5</sup> R.W. Kates et al., "Sustainability Science", *Science* 292: 641-642 (27 April 2001).

<sup>6</sup> See: <http://julius.ngdc.noaa.gov:8080/production/html/BIOMASS/africa.html>

<sup>7</sup> Anon., "The European Union Habitats Directive", *Environment* 43: 34 (June 2001).

<sup>8</sup> Pamela Heck et al., "Climate impacts of European-scale anthropogenic vegetation changes: A sensitivity study using a regional climate model", *Journal of Geophysical Research* 106: 7817-7835 (27 April 2001).

<sup>9</sup> See: <http://ens.lycos.com/ens/nov2000/2000L-11-13-11.html>

<sup>10</sup> H.N. Turtledove, "Down in the Bottomlands", *Analog: Science Fiction and Fact* CXII: 224-302 (January 1993).

<sup>11</sup> Kurt Lambeck and John Chappell, "Sea Level Change Through the Last Glacial Cycle", *Science* 292: 679-686 (27 April 2001).

<sup>12</sup> Craig B. Smith, "Program Management", *Civil Engineering* 69: 34-41 (June 1999).

<sup>13</sup> Tom F. Peters, *Building the Nineteenth Century* (1996, MIT) pp. 178-202.

<sup>14</sup> See: <http://www.worldmarine.gr/egypt/egyguide.htm>

<sup>15</sup> See: <http://www.bibalex.gov.eg>

<sup>16</sup> S. A. Brandt, "A Review of Reservoir Desiltation", *International Journal of Sediment Research* 15: 321-342 (September 2000).

<sup>17</sup> J.F. Black and B.L. Tarmy, "The Use of Asphalt Coatings to Increase Rainfall", *Journal of Applied Meteorology* 2: 557-564 (October 1963).

<sup>18</sup> Robert A. Metzger and Gregory Benford, "Sequestering of atmospheric carbon through permanent disposal of crop residue", *Climatic Change* 49: 11-19 (April 2001).

<sup>19</sup> Anon., "Water line to cross the Persian Gulf", *ENR* 246: 19 (12 March 2001).

<sup>20</sup> Nels Johnson, Carmen Revenga and Jaime Echeverria, "Managing Water for People and Nature", *Science* 292: 1071-1072 (11 May 2001).

<sup>21</sup> H. Hemmer, "Partial irrigation of the Sahara desert", *Speculations in Science and Technology* 16: 65-68 (1993).

<sup>22</sup> R.H. Charlier, "Water for the desert—a viewpoint", *The International Journal of Environmental Studies* 39: 11-35 (1991).

<sup>23</sup> Bo R. Doos, "Can large-scale environmental migrations be predicted?", *Global Environmental Change* 7: 41-61 (April 1997).

<sup>24</sup> See: <http://www.rite.or.jp/english/Welcom/Project/desert.html>

<sup>25</sup> Richard N. Mack and W.M. Lonsdale, "Humans as Global Plant Dispersers: Getting More Than We Bargained For", *BioScience* 51: 95-102 (February 2001).

<sup>26</sup> See: [http://2100.org/text\\_Gibraltar.html](http://2100.org/text_Gibraltar.html)

<sup>27</sup> Frei Otto (Ed.), *Tensile Structures: Volume One: Pneumatic Structures* (1967, MIT) pp. 126-130.

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- <sup>29</sup> See: [http://flightprojects.msfc.nasa.gov/fd02\\_elev.html](http://flightprojects.msfc.nasa.gov/fd02_elev.html)
- <sup>30</sup> See: [www.solarsolns.com](http://www.solarsolns.com)
- <sup>31</sup> C. Mauritzen, Y. Morel, J. Paillet, “On the influence of Mediterranean Water on the Central Waters of the North Atlantic Ocean”, Deep-Sea Research I 48: 347-381 (February 2001).
- <sup>32</sup> See: <http://geology.miningco.com/science/geology/library/weekly/aa072097.htm>
- <sup>33</sup> See: <http://members.home.net/waterplusfood/index.htm>
- <sup>34</sup> See: [http://www.id.iit.edu/people/faculty\\_bios/owen.html](http://www.id.iit.edu/people/faculty_bios/owen.html)
- <sup>35</sup> See: <http://www.pnas.org/cgi/content/abstract/98/11/5975>
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- <sup>43</sup> See: [www.geocities.com/capsulepipelines](http://www.geocities.com/capsulepipelines)
- <sup>44</sup> See: [www.astron.nl/ska](http://www.astron.nl/ska)
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