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Installation of a Tensioned-Fabric Sea Change Screen at Gibraltar Strait – Creation of a "Mediterranean Sea Oceanarium"

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INTRODUCTION

Sequencing the human genome has put our species on a course towards the control of the "environment" within our kind; it follows *Homo sapiens'* discovery of fire, a discovery that kindled all our efforts to macro-engineer the Earth-biosphere. It is on fiery plumes of rocket-engine exhaust that humanity's representatives temporarily visit Outer Space. From space, spationauts (and those watching televised images of our Earth from their exalted viewpoint) may be able to see as much as half of our Earth's Face, or at least its "skin" (air, land and ocean). On 25 March 2001 in Paris, France, at the Fifth Space Arts Workshop, "Outer Space-Cyber Space", conference participants examined the cultural impact of interplanetary space exploration. However, on 26 May 2001, the Train a Grande Vitesse-Mediterranee sped from the English Channel (passing through Paris) to the Marseille-St-Charles Station (situated close to the Mediterranean Sea's northern strand) in only 3.5 hours. Such a record-setting transportation-communication event presages a sweeping cultural impact on the peoples and landscapes of the Mediterranean Sea Basin.

Space Art proponents opt to construct various symbolic artifacts in Outer Space visible to Earth's people.[1] With plastic envelopes, Air Art's proponents exploit the possibilities of compressed air, or the atmosphere's winds.[2] Land Art results from different human interpretations of the significance of sub-aerial Earth-crust segments.[3] The most Romantic work of Land Art is "Spiral Jetty", a 1,460 m-long, 4.5 m-wide rubble-mound causeway at Rozell Point (now submerged by an enlarged Great Salt Lake); built 1969-70 by Robert Smithson (1938-73)[4] of dumped basalt and limestone

rock pieces mined in Utah, it is considered a contemporary artwork.[5] And it is owned by the Dia Center for the Arts[6] in New York who have the option of raising "Spiral Jetty" above the Great Salt Lake's surface. Whilst the artist Christo Jarachev (b. 1935) built eleven island-surrounding pink mats covering 600,000 m^2 of briny lagoon water in Miami's Biscayne Bay during 1983 as his "Surrounded Islands Project", until now no one has formally proposed Ocean Art, a deliberate civil engineering meant to cause a sea change in the elevation and composition of any subdivision of our world's ocean by any peacetime sea terracing macroproject; as proposed herein, Ocean Art may become a fast-track technological fix for unwanted Earth-biosphere changes as well as an extension of Art's geophysical domain.[7]

During 1969, Peter Hutchinson (b. 1930) and Dennis Oppenheim (b. 1938) installed artworks in the coastal waters of Tobago in the West Indies. Subsequently, these installations were labeled "Oceanographic Art".[8] However, the originator of Ocean Art is architect-engineer Frei Otto (b. 1925) who first began to contemplate the concept *circa* 1953. "Oceanographic Art" is a form of decoration whereas "Ocean Art" is a form of sculpting. Without freshwater reservoirs, which were mainly constructed during the 20th Century, our world's ocean would be approximately 3 cm higher; radical Green-activists don't seem to have been bothered by that fact, if it's even known to them, particularly with regard to their social movement's persistent insistence for widespread 21st Century dam de-commissioning.[9] That's an indirect form of "Ocean Art"! Macroengineers ponder the creation of an Ijsselmeer-like freshwater-flooded polder-reservoir supplying northern Europe by isolating the Baltic Sea with a physical barrier to stop all influx from the North Atlantic Ocean[10] as well as an isolation of Long Island

Sound to form a freshwater reservoir for the USA's Northeast.[11] Evidently and prospectively, it is *Homo sapiens'* intention to occupy the land and the ocean; *per contra*, humans can still only use the air. Thus, Frei Otto's "Ocean Art" utility.

"Technological fix", a solution to a macro-problem based on technology, is often offered in a pejorative sense as an apparent, or simplistic technological resolution to a complex human problem whose benefit may be only cosmetic. Technological fixes often have deleterious and unforeseen consequences, but so do "Social Fixes" devised by Social Engineering's advocates! After 1960, some media-savvy Social Engineers promoted the world-public's mindless acceptance of various versions of their Doomsday Equation that predicts Earth's human populace will reach an "infinite number" before AD 2026![12] After 1972, many of these same hysterical persons touted—both in print media and cyberspace—our Earth-biosphere's irrevocable demise at the brutal "hands" of mankind's extensive (constructive and destructive) technology! Alvin Martin Weinberg (b. 1915) claims to be the neologizer of "Technological Fix": the phrase was coined during 1966-68 to "…connote technical inventions that could help resolve *predominantly social* problems".[13]

What's the global social problem that Ocean Art can address after AD 2001? Stakeholder and ideological conflicts resulting from two predicted hyperstatic disaster scenarios ("global warming" or "global cooling"-caused sea-level fluctuations) may be ideal targets for overall Ocean Art cures.[14] Macro-engineering's concern with both a cooling as well as a warming of our common atmosphere—climatic instability resulting from an anthropogenic and/or natural "Greenhouse Effect" change—are not antithetical interpretations of measured climatic alterations; each predicted atmospheric state

represents a different time period and both are considered reasonable interpretations.[15] Ecosystem-nations vulnerable to quirky climatic change event-processes that may obliterate extant spatial and temporal boundaries of vitality (through induced unnatural worldwide chaos) can oscillate between society-wide hope and near-universal human despair! Gloom and doom atmospherics, along with the unproved Gaia Hypothesis, cannot be permitted to drive humanity into making unwise and risky macroproject plans for our Earth-biosphere.[16]

What's the worst that can happen to Earth's land with respect to an anthropogenic increase in the ocean's volume? If all the world's ice were to melt, at first the ocean would inundate ~22.5 x 10^6 km^2 of land, then it would stabilize at ~75 m higher than today's ocean level in its areally enlarged basin. Subsequently, if the entire ocean, from its murky watery surface to its mucky sea-bottom, simultaneously warmed from 15^0 C to 20^0 C then the ocean's level would rise ~3.5-4 m more. These are the maximum oceanic rise effects possible—that is, ~79 m—if the most extreme "Global Warming" scenario becomes geophysical reality. The Mediterranean Sea-Black Sea Basins have undergone great changes in their shape and contents during Geological Time and some of these changes are documented at Mediterranean Prehistory Online.[17]

"Coastal nations of the world should now be planning for one-half to a meter rise in sea level during the next century [AD 2001-2101]".[18] Contemporary informed opinions generally support this more-than-a-decade-old public assertion by two hydraulic specialists. They proposed, and others since have concurred, that there's going to be an "abrupt" anthropogenic change in the Earth-ocean's elevation. But, "abruptness", in a global geoscientific context, "…depends very much on what Man can discern."[19] Highly

tweaked and overly-publicized crude computerized simulations of the future Earth-biosphere are a very popular means to broadcast a particular model—a geopolitical viewpoint, in fact—of our world's anticipated inhabitability. On the other hand, in a sociological context, the future ultimate perfection of Molecular Nanotechnology[20] will demarcate an abrupt historical change for *Homo sapiens* (from an ancient Non-technological Era to the Nanotechnological Era). Nowadays, macroengineers must assess the cost-effectiveness of gigantic macroprojects designed to avert a rise of the ocean.[21] In essence, today's Macro-engineering adds "Proactive Action" to our standard curative options list (Do Nothing, Planned Retreat, Reactive Accommodation and Protect-in-Place). Political and geopolitical decision-makers, as Peter Szanton thoroughly pointed out in Not Well Advised (1981), have vastly different perspectives about Earthly geologic change than macroengineers!

WHO'S "Frei Otto"?

As a consequence of the discovery of electricity and fossil fuels architect-engineers became managers responsible for directing major private-sector companies as well as public-sector organizations in the construction planning industry. During 1952, Frei Otto founded the Institut fur leichte Flachentragwerke in Germany.[22] Like Christo, Otto's a Romantic designer who utilizes the most modern materials (plastics and metals) to realize his innovative Institute for Lightweight Structure conceptions. "In the years after 1970 he concentrated his attention on the analysis of biological phenomena, developing his exploration and analysis of lightweight structures in nature. Because…[Frei Otto] combined research into the optimum shapes for pre-stressed

surface structures with the development of a new technological means for their realization, his innovations have proved of outstanding importance; indeed, it is in large part due to his efforts that the successful revival of the tent has come about…".[23] Well-mastered tensile-fabric structures are his forte professionally.[24] Such structures consist entirely of form-active elements (cables and membranes); they are flexible and, thus, are incapable of taking up other than the form-active shape because they automatically assume that shape when loaded. To perform satisfactorily, Otto's tensile-fabric structures must be capable of achieving a stable state of static equilibrium in response to all gravitational, wind and inertial loads. For the very first time in humanity's history, really large-scale buildings visibly and instantly interacted with their the environments—they respond to precipitation, wind and the warm bodies of living persons. Previously, buildings were chiefly notable for their hardness, opaqueness, immobility, permanence and inertness; Frei Otto's inflatable and tensile-fabric inventions offered different—basically quite oppositional—building characteristics (softness, transparency, portability, temporaries and reactivity).

It is to be hoped the forecasts of Molecular Nanotechnology's elite, which allege that profession's perfection by mid-century, are materialized since such perfection will surely enhance the already vigorous advance into geophysical reality of Otto's ideas! For example, metallurgical engineer David Richard Forrest (b. 1956), a project leader at Baverstam Associates of Newton, Massachusetts, says: "Raw materials such as nitrogen, carbon and hydrogen will be put into a desk-size unit which will rearrange the elements and control the trajectories of all the molecules", resulting in "smart" fabrics that are, at least, 100 times stronger than today's materials. Being "smart", such post-Kevlar fabrics

will detect rips or tears and send out robotic "repair crews" to mend the damaged site.[25] And, Kevlar—invented during 1964 by Stephanie Kwolek (b. 1923)—can suffice for this macroproject, being a more-than-adequate fabric (with zero porosity, it would behave as a film with no open space) for the purposes outlined below.[26]

Cables, the other main ingredient of Frei Otto's structures, may also become significantly stronger than today's steel ropes. Unusual new molecules—long, hollow fibers with unique mechanical properties—have been discovered and fabricated in the chemical laboratories.[27] These "Fullerene Nanotubes", industrially produced in quantity, may offer Macro-engineering super-ropes with real-life strength of 130000 MN/m^2, almost 43 times stronger than steel piano wire (3000 MN/m^2).[28] The NASA prognosticates super-rope use eventually in an Earthly Space Elevator macroproject![29] The NASA hosted a 8-10 June 1999 Advanced Space Infrastructure Workshop on Geostationary Orbiting Tether "Space Elevator" Concepts which by August 2000 resulted in a summary booklet, compiled by David V. Smitherman, "Space Elevators: An Advanced Earth-Space Infrastructure for the New Millennium" (NASA/CP-2000-210429). However, Fullerene Nanotubes merely insure a large practical margin of safety for Frei Otto's already planned tensile-fabric structures![30] They are, in fact, a bonus technology applicable in the future.

Application of a bonus technology at Gibraltar Strait could result in a pontoon bridge spanning that stretch of ocean—something less obstructive than Xerxes needed to transport his army across the Hellespont in 480 BC! Use of at least two super-ropes make it possible to stabilize a pontoon bridge in a fixed geographical position for a long period, especially if any surface water current is present. Even so, such a bridge will

require constant maintenance and be liable to damage from floating debris or severe oceanic storms.

"Non-rigid dams which are shaped like segments of open [that is, topless] circular containers and are provided with membrane partitions, membrane ribs anchored by means of intercepting cables, or anchorage cables attached to individual points…, can be joined together to produce structures of any desired length. With such systems it would even be possible to form large terrace-like enclosed areas of water…for irrigation purposes, hydroelectric or tidal power generation, climate control, etc."[31] Frei Otto has calculated a 20 m-high water-retaining tensioned-fabric dam (to be fitted into a v-shaped valley) that has a built-in conventional civil engineering safety margin. (Super-ropes, of course, could markedly and safely heighten such retention works many fold.) A super-rope barrier ought to be better than a deep-foundation concrete dam at a place where Africa and Europe are slowly closing tectonically (owing to "continental drift").

STRUCTURAL FUNCTION AND DUTY

When defining any structure, Macro-engineering ordinarily examines the "function" (what is it meant to accomplish?) and "duty" (what does the object built have to endure to do its job?). For the entirety of its design life the object is expected to be quasi-static, safely responding to every imposed load. "Duty" demands it successfully respond to dead and live loadings, corrosion, wind forces, fast water currents, tidal rises and falls, thermal expansions and contractions (seasonal and daily) and unexpected loads caused by ship collisions and major earthquakes.

Using a suspended, pre-tensioned uniform network of cables and woven Kevlar fabric, I propose a macroproject to physically separate the Mediterranean Sea from the North Atlantic Ocean. (This exciting proposition of using "Futuristic" technology such as Molecular Nanotechnology won't be examined in this report.) A suspended membrane, laced, braced and anchored by strong steel cables, will more than cope with its self-weight (sag factor)[32] and with its static load uniformly distributed over its vertical plan area: it will terrace the North Atlantic Ocean in the Strait of Gibraltar's vicinity! Securely taut (though usefully flexible) cables affixed to land anchorages and deeply embedded seafloor roots can be used to lock the facility in place because a deep-hole micro-drilling technology developed by the Geoengineering Group at Los Alamos National Laboratory makes it feasible.[33] Kevlar fabric has been manufacturable and marketed since 1971; hung vertically, Kevlar thread has a self-supporting length of ~200 km, almost four times that of drawn steel wire! Seafloor Macro-engineering in the Strait of Gibraltar requires intense site-specific study with the objective of defining all the possible effects of seafloor conditions and processes on the proposed sea-change screen during its anticipated, but as-yet-undetermined, lifetime. There is a chance the Mediterranean Sea can be transformed from an "Oceanarium" into a true "Aquarium".[34] Military engineering offers the truism that "nothing lasts forever": anti-material technology (super-caustic and liquid metal embrittlement chemical agents)[35], high-explosive charges or a nuclear explosive device and focused laser beams can damage or destroy any sea change screen no matter what it's ever constructed of.

WHY BLOCK AN OCEAN GATEWAY?

More and more, Geoscience is producing evidence that rapid regional climate change over as little as a decade's period of Historical Time during the 21st Century is remarkably possible; speculations as to dates of onset in particular Earth-biosphere regions is still very much in the purview of the applied Astrologist.[36] Nevertheless, reputable macroengineers have examined numerous ways to cost-effectively mitigate or totally prevent some unfavorable changes by counter-balancing the post-Industrial Revolution enhanced Greenhouse Effect with careful manipulations of our Earth-biosphere's exchanges of heat, liquids and gases. One pertinent long-term anti-Global Warming/Cooling mitigation technique is a massive dike-weir blocking the Strait of Gibraltar to reduce the average salinity of the North Atlantic Ocean's water. All the scientific reasons adduced in 1997 by its author are equally relevant and useful on which to found this new plan.[37] My only difference with its devisor is that we wish to avoid the sky-high costs, both economic and environmental, which would follow the emplacement there of a huge pile of broken rock to form his dike-weir. Briefly, his dike-weir is a ~300 m-high rubble mound structure design with a low 70 m-wide crest; some sections of it behave like statically stable submerged low-crested breakwaters with their crests above sea-level while other sections act like statically stable submerged breakwaters.[38] All the rocky material rests at a 30^0 angle of repose. (As the structural behavior of the Pyramid of Chephren in Egypt clearly demonstrates, even snuggly-fitted stacked cubic rocks can slip as a result of strong local seismic activity.) Cables and fabric membranes seem a lot more doable and certainly less intrusive on either the seascape of the immediate sea-

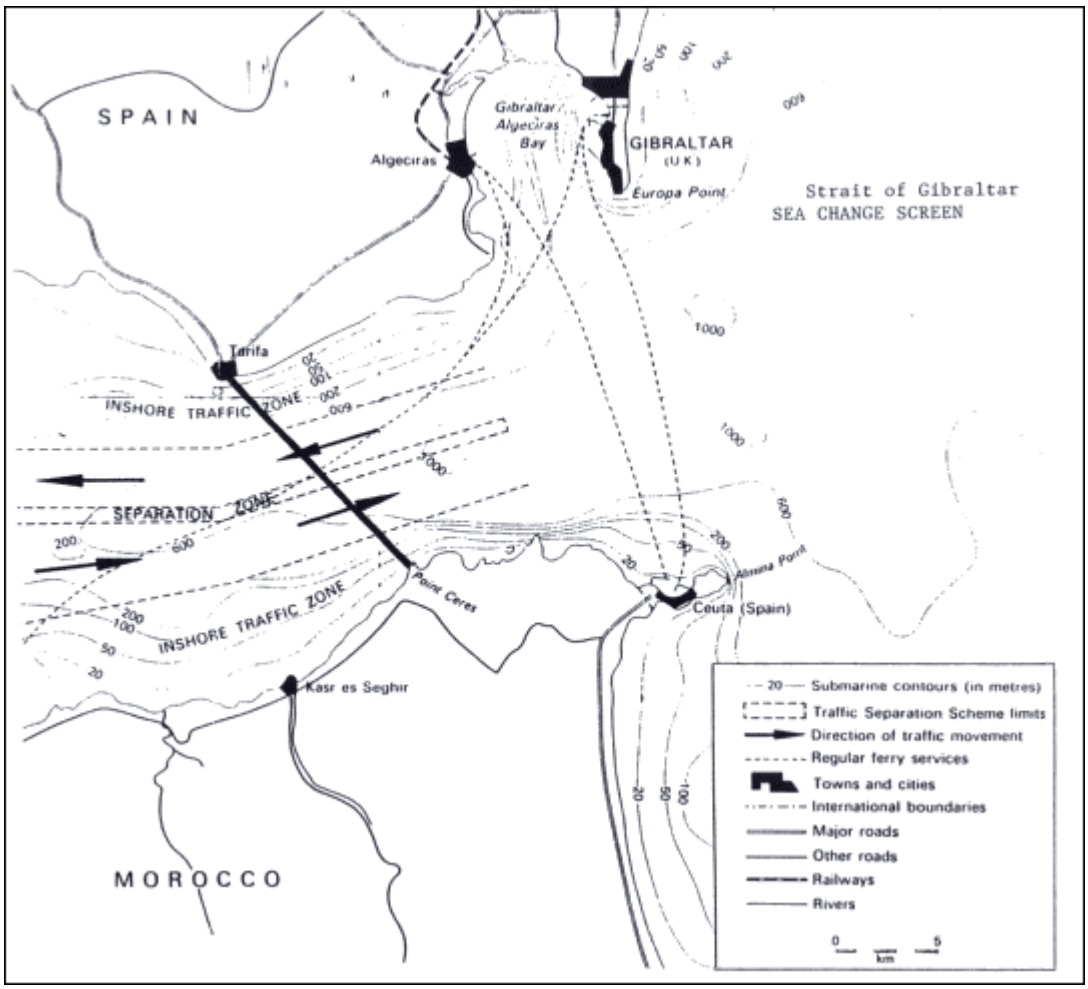
bottom or the adjacent landscapes of Europe and North Africa! The sea-bottom footprint of the dike-weir is very, very big; the roadway alone is 70 m wide and the imposed dike-weir base is enormous (~416.4 m wide); if an imaginary 70 m-wide "monolith" of piled rock—an utterly useless and structurally impossible 273 x 10^6 m^3 vertical-sided slab—were installed at a cost of ~15 USA2001$/$m^3$ it would result in a macroproject cost of USA2001$4,095,000,000. Guesstimating, that might be the post-2001 AD amortized cost of a trans-Gibraltar Strait Tensioned-Fabric Sea Change Screen that is significantly less ecologically degrading of the local seabed. The absence of extra-ordinary local crustal loading means too that life won't be made more difficult for tunnel diggers or bridge builders and major earth tremors won't be induced that might adversely affect real estate prices and pose life-threatening disasters for vulnerable local populations.

In addition, it's important to note some changes within the Mediterranean Sea that are likely to follow whether a suspended membrane screen or his dike-weir is put into Gibraltar Strait. The Mediterranean Sea-Black Sea is ~0.8225% of the Earth-ocean's area and contains 0.3094% of its volume; the Mediterranean Sea-Black Sea is one of the two most land-dominated of all Earth-ocean subdivisions, with a land:ocean area ratio of 4.4. [The other is the Arctic Ocean.] Despite being the first world-ocean region to be studied scientifically, there's still much to be learned about it! Whether blocked or not, most of the freshwater vapor exiting the Mediterranean Sea eventually goes into the North Atlantic Ocean as direct precipitation and continental river runoff—annually, ~1 m is removed by evaporation; such unbalancing reduction in the Mediterranean Sea's volume causes two currents, one super-positioned above the other, to pass through the Gibraltar Strait to restore a hydraulic balance. The North Atlantic Ocean inflow, the

eastward flowing superior (surface) current, moves with a speed of ~1 ms^{-1} while the inferior westward flowing Mediterranean Sea outflow moves at ~5 cms^{-1} at depth.[39]

Stopping the inflow and the outflow currents with an Ocean Art screen means that (1) the Azores Current in the North Atlantic Ocean will radically change its measurable physical features[40]; (2) absence of the incoming tidal wave from the North Atlantic Ocean will detune all Mediterranean Sea tides, doubling the small amplitudes of the semidiurnal tides in the North Aegean Sea[41]; (3) absence of a metal-enriched plume of seawater—caused by local mining wastes—entering the western Mediterranean Sea from the North Atlantic Ocean will be mostly halted and therefore contamination will be curtailed greatly[42]; (4) the Mediterranean Sea's marine bio-diversity will inevitably adjust to novel conditions over time[43]; (5) the Mediterranean Sea will warm and become more saline—warming can result in a rise of sea-level while a salinity increase may lower sea-level—both can cause a purge of alien and native marine flora and fauna. Properly managed, this purging event-process could prove invaluable because it would dissuade extra-Mediterranean Sea-Black Sea creatures from surviving (and causing trouble) in that region of the world-ocean. (If the salinity ever rose to >6%, all life in the enclosed body of water would die—except, perhaps, for some of the archaebacteria. A July 2001 SCIENCE magazine report, consisting of an analysis of the effect of anthropogenic extinction of oceanic species on the intricate food web of coasts in the New World and the Old World demonstrated that humanity has "damaged" the Earth-ocean for at least 10,000 years.)[44] (Subsequent discussion can be found in SCIENCE.)[45]

An approximately ~13 km-long impermeable pelagic drape, hung across the underwater part of the Strait of Gibraltar by "tracing" a direct point-to-point navigational



line extending from Morocco's Point Ceres ($36^{0}04.3$' latitude North by $05^{0}25.7$' longitude West) to Spain's Tarifa ($36^{0}00.2$' latitude North by $05^{0}36.4$' longitude West)—but, actually, bulging or deflecting eastwards in a graceful arc—ought to epitomize form-active behavior. Its vertical surface area ought to be ~25 times the area of the floating Flamingo Pink-colored fabric Christo installed in his famous Florida, USA artwork. Buoys floating attached to the screen's non-gaudy shore-visible rim will take up the slack membrane thereby keeping the North Atlantic Ocean and the Mediterranean Sea at equal levels. However, there are a few more aspects of this all-important membrane we wish to

discuss. For instance, when it is deemed appropriate the cables can be tightened, a shortening will subsequently cause this gigantic enabler of Ocean Art to elevate above the Mediterranean Sea's ambient water level. It is possible to convert this piece of infrastructure from a mere barrier to a true dam: such effort results in the colossal "terracing" of the North Atlantic Ocean, making an enormous West-East elongate "architectural" subdivision of the world-ocean! In effect, it redefines the Earth's "main watershed of the world"—the principle drainage basins of the Atlantic Ocean, Pacific Ocean and Indian Ocean first emphatically noted in 1887 by Aleksei Andreevich von Tillo (1839-99).[46]

Why carry out such an infrastructure-building Macro-engineering task? To "Save" the Mediterranean Sea Basin's beaches, ports and mega-cities from an unnatural 0.5-1 m global sea-level rise as postulated by hydraulic experts is an appealing reason to do so! It may turn out that Venice, Italy, can be "rescued" from its forecast "fate" without any expensive and ugly macroprojects being installed locally that would mar that city's tourism charm![47] The hydrodynamics of the sea-lockless Suez Canal needn't change much either.[48] And, perhaps most importantly, there won't be any need for all Mediterranean Sea Basin-Black Sea Basin ecosystem-nations to convene a delicate and complex UNO conference detailing, discussing, debating and designing new international legal regimes to specifically cope with coastal baseline boundary adjustments caused by either a sea-level rise or a sea-level fall![49] This Tensioned-Fabric Sea Change Screen at Gibraltar Strait won't be as costly as trying to preserve all the major ports and tourist-magnet picturesque towns dotting the Mediterranean's fabled shoreline! [According to The World Tourism Organization, in its Tourism 2020 Vision: Africa issued June 2001,

Morocco and Tunisia alone will double their current annual number of out-of-region visitors by AD 2020 (to ~17.7 million visitors yearly).][50] One might even "voice" the hope that, to chorus Patricia Goldstone (b. 1951), its future construction will be but another aspect of Making the World Safe for Tourism (2001).

MEDITERRANEAN SEA OCEANARIUM

More than 50,000 ocean-going vessels are estimated to transit the Strait of Gibraltar each year. The gateway is still viewed by naval planners as a "choke point"[51] even though the advent of "Super-Panamax" vessels has profoundly influenced their deliberate military assessments because of the simultaneous advent of automated mega-ports.[52] The 400-kV electrical cable interconnection between Spain and Morocco is the first fixed link of its type between Europe and North Africa.[53] Undoubtedly, more submarine electrical cables will follow the shortest sub-sea route between oil and gas-rich North Africa and Europe.[54] Frei Otto anticipated that surface shipping could safely pass over or through his tensile-fabric aquatic installations using a simple sea-lock set-up. Suddenly lowering the Sea Change Screen ~1 m across the 13,000 m breadth of Gibraltar Strait won't be a disaster for the Mediterranean Sea Basin-Black Sea Basin ecosystem-nations; more or less, it'll resemble a bad storm surge event (an unpredicted ~17,680 m^3/s incoming oceanic "tide" rippling eastward across the Mediterranean Sea-Black Sea's weather-system agitated ~2.97 x 10^6 km^2 surface) with no seawater recession following its one-time only influence! Put into proper oceanographic perspective, that's ~15 times the maximum rate of seawater flow that may have abruptly cascaded over the Bosphorus' sill to subsequently and permanently inundate land east of the Mediterranean Sea during

the post-5150 BC Black Sea's legend-inspiring natural creation process.[55] After the barrier is repaired or replaced, it will only require about a year's evaporation of the Mediterranean Sea to restore the former *status quo*. It's worthwhile to note that authorities in The Netherlands (specifically, its National Institute for Coastal and Marine Management in The Hague) claim to "…already have [USA2001$ 2.5 trillion worth of] existing infrastructure."[56] Nothing like that amount of public monies expenditures ought to be needed in the Mediterranean Sea Basin—ever!

What Frei Otto did not foresee are some useful spin-offs from technology invented and tested during recent years. For example, is it possible to maintain today's Mediterranean Sea overall salinity by implanting (appropriately isolated) salt exclusion-filtering membranes within our sea-change screen, thereby admitting freshened water to the compartmentalized lowest "terrace" of the North Atlantic Ocean? Is there any likelihood that osmotic pumps will dot the superficial enclosed Mediterranean Sea?[57] Ought Macro-engineering fund and administer chemical laboratory experiments aimed to market the perfect dialytic battery?[58] (Where rivers flow into the Mediterranean Sea, salinity-gradient energy is renewable and its use at very low efficiencies is defensible—when ~1 m^3/s of freshwater meets brine ~30 MW is releasable.)

Precipitation enhancement—that is, weather modification—over the littoral ecosystem-nations of the eastern Mediterranean Sea Basin can be promoted by vertical mixing of nearby seawater masses, according to Siegfried Fred Singer (b. 1924).[59] Proved wave-driven machines can do the job.[60] Since the water that normally flows into the Mediterranean Sea from the North Atlantic Ocean is nutrient poor, it seems worthwhile to fertilize segments of the screened Mediterranean Sea with iron pellets to

boost phytoplankton ecology (and afterwards the phytoplankton-devouring commercial and sport fish). Capitalist entrepreneurs have undertaken to promote large-scale commercial fish farming on the high seas, while at the same time claiming to help solve—with a "technological fix"—the CO_2 gas buildup macro-problem alleged to cause unhappy future global climate change![61]

Finally, there is one very speculative natural hazard mitigation function for which a super-rope screen might prove useful. On 21 July 365 AD a tsunami generated by an earthquake struck the entire Mediterranean Sea coastline. On 1 November 1755 Lisbon, Portugal endured a powerful earthquake during which a 5.5 m tsunami assaulted Cadiz, Spain as well as affecting the coasts of Spain and northern Africa with a small wave run-up on the land. Nowadays, we have become aware of the likelihood of tsunami produced by the impacts of asteroids—that is, a new kind of natural hazard. Hence, the Torino Impact Hazard Scale logically categorizes the risk assessments.[62] Rene Magritte (1898-1967) painted disquieting visual paradoxes; one of his most Surreal is "La Fleche de Zenon" ["Zeno's Arrow"] which illustrates a huge gray boulder suspended over a frothy and aquamarine-colored ocean like some stop-motion photograph of an incoming asteroid! If an asteroid fell into the central North Atlantic Ocean it would generate a tsunami wave which would radiate outwards in all directions and, in part, move rapidly towards Gibraltar Strait: "The wave enters the Straits of Gibraltar as a hydraulic bore. The width of the bore after it passes through the straits is comparable to that of the straits. Later it disperses laterally to produce tsunami in southern France and northern Morocco."[63] The question that surely needs supercomputer simulation is: What change in the behavior of such a computational model tsunami will occur when a well-secured

sea-change screen exclusively constructed with super-ropes is installed? Guessing, there might merely be a slight slop-over of little consequence to the Mediterranean Sea-Black Sea perhaps accompanied by a somewhat focused reflection of the impacting tsunami—owing to the screen's parabolic plan shape—westwards into the North Atlantic Ocean; such a dissipative rebounding counter-wave is likely to diminish the lesser energy content eastbound following waves of the main tsunami wave!

Science Fiction generally portrays the Earth-ocean from the same vantage that it views Outer Space—as a volume of material and life in which the play of human Science and Technology create our species' future. Thus, for many sound non-fiction scientific reasons, it may be technically desirable for Macro-engineering to professionally utilize its geopolitical knowledge and its planetary-interplanetary work site experience towards the apparently impending task of converting the Mediterranean Sea into a "Mediterranean Sea Oceanarium".[64] Many will agree that public utilities are the defining focus of civilization; it is conceivable that a cross-Gibraltar Strait tension-fabric dam will become a plastic utility operated in real-time, serving millions of customers, just like the World Wide Web!

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