MACRO-ENGINEERS’ DREAMS

R.B. Cathcart & Viorel Badescu
CANDIDA OANCEA INSTITUTE
Romania

with
Ramesh Radhakrishnan
India
2006
This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 2.5 License. To view a copy of this license, visit http://creativecommons.org/licenses/by-nc-nd/2.5/ or send a letter to Creative Commons, 543 Howard Street, 5th Floor, San Francisco, California, 94105, USA.

You are free:

- to copy, distribute, display, and perform the work

Under the following conditions:

**Attribution.** You must attribute the work in the manner specified by the author or licensor.

**Noncommercial.** You may not use this work for commercial purposes.

**No Derivative Works.** You may not alter, transform, or build upon this work.

- For any reuse or distribution, you must make clear to others the license terms of this work.
- Any of these conditions can be waived if you get permission from the copyright holder.
TABLE OF CONTENTS

Chapter 1: Space Age Electronic Geography

Chapter 2: A World in A Glowing Ball

Chapter 3: Earth’s Societal Core Macroprojects

Chapter 4: Earth Rebuilt

Chapter 5: Re-Macroengineering Regions

Chapter 6: Geo-Economics and Macroprojects

Chapter 7: 21st Century ATLANTROPA

Chapter 8: Indian Ocean Rim Macro-Management

Chapter 9: What Is Earth’s Worth?
Chapter 1
SPACE AGE ELECTRONIC GEOGRAPHY

What will Earth be worth in the 21st century? Speculation about "future history" (by self-proclaimed "futurologists," who are members of a social movement, not of social science) has already been projected via electronic and print media since the end of World War II. Futurologists are popular; they are now, like the royal court astrologers of olden times, an integral part of our culture. However, a majority of present-day Earthlings simply accept our immediate habitat quite by custom. All of our superficial terrain, planetary air, the globe's ocean and all life – in sum, "global Nature" – has been drastically altered since Earth's geological time began. Global Nature was in the past, and still is today, shaped by the Universe's laws and mankind's actions; humans have always changed Earth to suit their collective needs and wants, according to Andrew Shaw Goudie's account, The Human Impact on the Natural Environment (2006). Futurologists may be in fashion, but their books and articles of vividly phrased generalizations, pop jargon and sometimes entertaining anecdotes compare unfavorably to the "real stuff" composed by scientists. Science is master of the future's functional vocabulary. Science ought to always relate to the outside world—exterior to our bodies—and its societal success depends basically on how well its theories correspond with reality.

With its 2 January 1989 issue, Time magazine pictured Earth, using a 40.64-centimeter-diameter Christo artwork ("Wrapped Globe 1988"), as an endangered "Planet of the Year." Trendentious teams of futurologists, cozily housed in publicly- and privately-funded Think Tanks, played some significant role influencing the national weekly's staff writers. Christo's artistic expression does not accurately or proportionately symbolize Earth's "... vulnerability to man's reckless ways." While "hiding" a mass-produced schoolroom globe with commercial see-through plastic wrap, Christo tried to help those who perused the magazine's cover to become more strongly aware of the object contained. A spherical Earth globe, even one that is wrapped Christo-style, offers its owner a God's-eye view of the planet at anytime.

After pre-Homo sapiens invented tools, Homo sapiens became man during the Pleistocene. The Pleistocene was a period in Earth's development that extended from about 2.5 million years ago to 12,000 years ago when the Holocene commenced. The global-mean temperature during the Pleistocene was, probably, about 5.8\(^{\circ}\)C plus or minus 1.4\(^{\circ}\)C cooler than present-day.\(^2\) Time claimed mankind had stolen the whole terrestrial scene in possibly the last act of a dramatic anti-global Nature play. The Pleistocene included the last Ice Age, while the Holocene is mostly post-glacial and may, according to Time, terminate with a too-warm 21\(^{st}\) Century Water Age (excess seawater overflowing the land and precipitation redistributions) caused by our civilization's stimulation of an enhanced greenhouse effect, the infamous “Global Warming”. (Probably only 15-20%—that is about 0.10-0.57\(^{\circ}\)C—of 20\(^{th}\) Century “Global Warming” was caused by the anthropogenic buildup of carbon dioxide gas in the Earth-atmosphere.\(^3\)) In addition to changes wrought by people, our home planet has naturally and continuously remade itself; climates of all the lands, and the global sea level, have varied from those presently extant. Earth merely seems to be a familiar place to its current human inhabitants; however, many Earth facts are still to be unearthed by scientists!

"Life" remains even today a scientifically indefinable term even though mystery-hating biotechnologists and molecular nanotechnologists are strenuously trying to formulate a comprehensive definition. As the division between basic and applied scientific research becomes indistinct (as, for example, because of the progress of molecular nanotechnology), then awarded patent protection increasingly threatens to encroach on research science, making it necessary to work out an accommodation between the two scientific perspectives. During 2006 a new periodical, NanoEthics, commenced its publication run. If the logic of life's processes could be abstracted in computers, then mankind's culture would, for the first time our world's history, be made inherent in artifacts. A computer that relied on organics instead of inorganic elements to manipulate complex calculations would be energy efficient and quite tiny. The near-term future symbiosis of humans and computers is David F. Channell's "vital machine" of The Vital Machine: A Study of Technology and Organic Life (1991). A perfected molecular nanotechnology will produce the ultimate "vital machine," totally integrated organisms and intelligent machines the size of individual molecules. Although almost 40% of the contents of 21st Century USA college-level dictionaries are scientific and technical words, only in AD 1802 did the term "biology" make its first appearance in life science's literature. "Biology" was more or less coined by a French naturalist, Jean Baptiste Lamarck (1744-1829), to mark the inception of a study of global Nature's living matter. Lamarck, in his Hydrogeologie, defined "biology" as the division of "terrestrial physics" that included "all which pertains to living bodies". Biologists have concluded—primarily from fossils laboriously gathered from Earth's crust—that life forms were once non-existent. Indeed, the planet itself formed about 4.55 billion years ago. Since life's "spontaneous" origination +3.5 billion years ago, organisms have, through punctuated organic evolution, filled a significant part of the global system which some old-fashioned geographers called "the surface of the Earth." Earth's culturally diverse peoples—numbering about 6.5 billion persons—share the Earth-biosphere with approximately 3 x 10^{33} other currently living things. Lamarck thus introduced the concept of an Earthly biosphere into life science, social science and physical science. Lamarck had realized the geographical importance of the role played by plants and animals in effecting large-scale changes in the Earth-surface; he was the first to recognize living things as agents for crustal, oceanic and atmospheric alterations—super-mantle geological changes of Earth's biosphere which are attributable only to life's vitality and intelligence.

Towards the 19th Century's end, Eduard Suess (1831-1914) added the term "biosphere" to geology's literature, which practitioners of geography almost instantly adopted. Suess was far ahead of his time. His comprehensive overview of geology, The Face of the Earth, opens with a description of the Earth as first glimpsed by an imaginary interplanetary space traveler. Just as The-Man-in-the-Moon is always seen from an Earth-based perspective, the "face" of the Earth can only be recognized from a viewpoint in outer space, hence Das Antlitz der Erde (1883-1909)! The year 1899 saw the first official introduction of "biosphere"—the domain supporting life—to English-using geographers by Sir John Murray (1841-1914) in a speech before the British Association for the Advancement of Science (organized in 1831). The term literally means "sphere of life" but, in reality, it means that part of Earth in which life can currently exist. Careful geographers use "in the Earth" because those anti-biota conditions of interplanetary space are absolutely deadly for organisms in their native state. Earth's biosphere is a shell (global Nature); therefore, being a noun far more useful than the phrase "Earth's surface" for a volume of space containing solid, liquid, gaseous and living matter. Geographers know that much of the complexity of Earth's biosphere from our species' viewpoint is due to the interactions among the other organisms in our Earth. Earth's biosphere is a global Nature, a dynamic complex of organisms forming a single planetary collection. So far, Earth is the only known spatial context (threedimensional zone) of a settled Homo sapiens. Mankind is a "resource pool" to sociologists but to laypersons it is the largest possible "organization." The special character of being human is the ability
to transform and control local and global Nature. Human organizations are systems for accomplishing work, for using altering techniques on materials (people, symbols, or things). Amazingly, it was only after 1985 that USA university-level business schools first established required environment courses in Master's Degrees in Business Administration studies.

Undeniably a scientifically useful term, "biosphere" is especially so when used in conjunction with other terminology: lithosphere (the planetary crust and uppermost mantle), hydrosphere (mainly the ocean, but also the water vapor of the atmosphere, groundwater, together with rivers and lakes), and atmosphere. The atmospheric boundary separating our troposphere and stratosphere was first examined in a photograph taken on 11 November 1935 from a manned balloon, Explorer II, drifting over the USA. In other words, a near-miracle technique let our world's publics see one of global Nature's boundaries penetrated and topped! (A 28 June 2006 *Nature* cover offered a Meteosat 8 satellite image symbolizing what scientists everywhere were doing to comprehend the Earth on the Northern Hemisphere’s longest day, 21 June.) Of these four nouns, only lithosphere can be regarded as globular.

Many of the ancient Greek philosophers' writings (Aristotle and Hippocrates, for example) contained biological observations and speculation which indicated their keen interest in Earth's biosphere and which were ecological in style. However, those Greek teachers never found a word describing their geographical and biological philosophizing!

German biologist Ernst Haeckel (1834-1919) did coin "ecology" in his *Generelle Morphologie der Organismen* (1866) after first recognizing that Earth's global Nature was a unity of some kind. Haeckel's "oekologie" was Anglicized at the Botanical Congress, which met in Madison, Wisconsin in 1893. Thereafter, "environmentalists" made ecology a vogue term circa 22 April 1970. Counterculturists in the USA and western Europe, that now aged First World culture group of the 1970s, with their tasteless senso-eco-consciousness, aided in the speedy development of an illogical ecology. Anti-pollutionary political organizations, lobbying under the umbrella term "environmentalism" or "Green," foresaw that human life-styles (cultures) would wreck Earth's life-support system (biosphere). (Circa 1969, "Green Revolution" became a popular term describing the successful results of genetic engineering's efforts to obtain inexpensive and high-yield varieties of rice, wheat, and other grains to support the Third World's population growth. Circa 1970, "Green Revolution" became also a descriptive for an overly politicized ecology in the First World! "Ecology," surely one of Fate's odder twists!) Since 16 July 1945, scientists have known that humanity could destroy its only planet-sized biosphere-home via general nuclear war. In other words, propaganda about a near-term future ecocatastrophe has thoroughly permeated mankind's thinking.


---

proposal by crackpots and ecofreaks. As yet, nuclear winter could be caused only by modern macro war (general nuclear warfare), not meso war (conventional war as, for example, 1991 and 2003's conflict in the Persian Gulf) or micro war (terrorism). Terrorist lodges with focused agendas exist and they threaten all humanity. Whatever their terror strategies and tactics, the seemingly unquenchable passion of these lodges is to mock existing noosystems by destroying public as well as private infrastructure and by maiming or murdering persons of high status in particular "target" noosystems. Many of these lodges view the First World as a lootable treasure house. As the First World's native population stabilizes (or falls), per capita wealth increases – except when outright invasion and stealthy Second and Third World illegal immigrants swell the ranks of those people drawing from each First World nation's hoard, which in Chapter Five are called "mass savings accounts."

Before 1901, biologists had yet to study all of our Earth's life, actually observing but a tiny fraction of its species (with a total mass today of $3.6 \times 10^{17}$ grams), which defined its biosphere spatially. The present-day mass of Earth's biosphere is approximately $1.148 \times 10^{19}$ grams. Until the late 20th century, biologists simply did not have full physical access to Earth’s entire zone of life (global Nature). Even nowadays, there are places in the Arctic, the Antarctic, and the abyssal parts of our world's ocean that are yet unseen by visitors with enquiring minds. Compromising with their personal physical limitations, biologists have judiciously adopted a practical methodological approach to the study of Earth's life environment and forms, which was ad hoc and twofold: (1) to view what organized living matter they could in terms of kinds of entities, and (2) to view our global Nature's regions; that is, intellectually convenient geographical volumes of Earth.

Various terms have been proposed over the years for universal designation of such regions, but the term that is most often used in today's informational complex of popular and technical literature is "ecosystem," first suggested by Arthur George Tansley (1871-1955) in 1936, approximately the same year in which John Maynard Keynes conceived Macroeconomics. Since only slightly more than a single human generation had elapsed following Haeckel's coinage, "ecosystem" represented, and still epitomizes, a relatively new concept and, therefore, the concept was and still remains open to quite individual statement, both scientific and political. Some biologists recommend its demotion in comprehensiveness as well as historical application. Many moderns do use the term as a synonym for Earth-biosphere; others restrict its application to variously defined regional subdivisions of our Earth's life-containing zone. Used in its total sense, ecosystem is presumed to denote mankind's only intelligible field for biological and geoscientific investigation since it is the present-day environment of Homo sapiens. When the term "ecosystem" is used in its broadest sense, some kind of globally applicable scientific or philosophical judgment is usually being attempted. Countries, if considered as ecosystems, present scientists and law-making politicians with very clearly demarcated boundaries! Membership in the United Nations General Assembly has increased greatly (from 51 on 15 October 1945) to nearly 200! However, since 1991-1992, several fundamental principles of international relations (such as the sovereignty of the state generally deemed supreme, national borders as sacrosanct, and territorial integrity as basic) are undergoing a redefinition by the United Nations Organization. Nowadays, there is a trend, which may lead to the removal of legitimacy of state governments and result in UNO-fostered changes to the generally accepted legal status of international boundaries, according to an apologia for the UN Organization. It probably is correct to state that no group knows the Earth better than the USA’s military. The USA and the former USSR military organizations, as rival Superpowers, were first to define a biosphere (Earth's) as an "integrated
battlefield," a large geographical area involving the potential wartime use of nuclear, chemical, and conventional weapons! "Traditional" political and military alliances, which have defined the pattern of international relations since World War II, are changing. Economic alliances are now playing an increasingly important role in shaping international relations. As our world's major extant economic alliances gain a fuller identity and mission, they could displace many "traditional" military and political alliances. Eventually, even these powerful economic alliances will wither, transforming into another type of global alliance system during a period of universal opulence made possible by molecular nanotechnology. That future alliance might consist of a single "system thinking" elite that is indifferent to nationalism.

Geoscientists speak concernedly of ecosystems even larger than our Earth's biosphere. Since life in other planets of our Solar System is yet to be ruled out, there may well be a Solar System ecosystem based on energy radiated by our Sun. Our "Earth surface" is embedded in a Solar System habitable zone. Since cosmic radiation and debris from the interstellar medium flow into our Solar System from the Milky Way Galaxy and beyond, there may exist an ecosystem with an almost incomprehensible volume! Our Anthropocosmos is extensible and ours is a world still very much in the making! No professional scientist yet knows of any pressing need to coin terms to signify such gigantic systems, which might exist within our Universe. Of course, geographical (and spatiographical) names are unlimited classes of words. A so-called future practical “Time Travel Machine”, of course, throws all categorical algorithms into chaos!¹⁰ Even the physics of what is “past”, “present” and “future” in basically still more than a little bit uncertain!¹¹

According to most life scientists who subscribe to post-Darwin evolution theories, "rational man" is a product of Earth, and Earth's biosphere is Homo sapiens' territory. According to theological terms, the human body is not a possession; it is an incarnation. The human body contains at least 10²⁷ atoms—any so-called teleportation device or matter transmitter would have to be awfully fast and always perfectly accurate to safely "beam" a human anywhere! The individual human body is, defined in mechanical engineering terms, a 10-cycle, closed-loop, sensing, computing (an ambulatory analog processing and storage mechanism—10 trillion bytes of memory—with a bandwidth of about 50 bits per second), and performance system in a 100-kilogram chassis with a 75-watt motor. Daily muscular energy available from 1,000,000 calories is equivalent to 1.2 kilowatt-hours of electricity. Self-fueling, each meal causes a temporary 1% gain in weight. Architects, meteorologists, and others usually consider a living person as a 120-watt convector heater. Individual human beings – females have a center of gravity 12% lower than males—ordinarily have a "duty cycle" of sixteen hours on to eight hours off and each has a virtually fixed "biological clock." This definition of our naturally intelligent species should serve to develop a reader's perspective on state-of-the-art American geography since the start of the Space Age. United Nations Organization demographers have estimated that our world's human populace exceeded 5.0 billion by mid-1987, or exactly twice what it was thought to be in 1950. Of that 1987 total, about 45% of those economically active persons were then engaged in agriculture, while 55% were industrial ideologues.

When Homo sapiens, a species whose chief characteristic is articulate consciousness, became equipped with culture, humans became an extraordinary group of influential organisms—not only within Earth's biological evolutionary context, but also as a major factor bringing about local and global Nature alterations. Geoscience professionals, during the perilous time when superpower wageoners had first tested fission and fusion bombs, realized that man's relationship with global Nature (and all its

subdivisions) changed fundamentally when nuclear explosives became a military and civilian option. Humanity is an agency of impact and change, which is exemplified by technology responding to people's aspirations or restrained by people's fears. Probably at least 15% of Earth's land is now occupied by engineered buildings and structures; if global urbanization continues at its present rate, then all land may be covered by a conurbation in about 7,500 years. Frank P. Davidson and K.L. Brooke found it necessary to create a two-volume compendium, *Building the World: An Encyclopedia of the Great Engineering Projects in History*, of building projects extending throughout human history. Global Nature's heat flow is only about a factor of 3.1 greater than current human use of harnessed energy.

By change, something considerably more than displacement, replacement, and emplacement of inorganic and organic materials are meant. Included within change is man's creation of new ("unnatural" in their placement) elements—anthropogenic trans-uranium elements. Noteworthy is that the rate of mutation leading to evolution in our Earth-biosphere is affected by radiation, which is nowadays culturally as well as cosmically determined.

Living matter's evolution has given biologists historical perspective on Earth's life forms, especially since the start of the Pleistocene. Much ground yet remains to be sifted for evidence—global Nature's Pleistocene sediments alone amount to about 9 million cubic kilometers—and factual answers to some narrowly phrased final questions may never be forthcoming from our planet's stratigraphical record. Historical perspective on human culture has been provided by the anthropological idea of unwritten human prehistory, essentially the Holocene before 5,000 BC. Since the first appearance of Homo sapiens, a group using narrowly specialized tools in complex systems of usage, and because of humanity's ensuing global migration, biocultural adaptation has enabled man to collect into increasingly larger aggregations and to effect biologic and geological alterations. Technology has lessened man's vulnerability to our globe's changing climatic regimes, whether instigated by global Nature or man-induced.

Hotter or colder/wetter or dryer future climatic regimes (influenced by Homo sapiens and global Nature) will mostly affect those public and private sectors of Earth's national economies that interact with still unmanaged ecosystems. For all ambulatory living things, the trend seems to be away from concourses of earth particles and towards Earth-based corridors of concrete! On 11 August 1992, Mall of America, the largest enclosed shopping mall in the USA, opened for business in Bloomington, Minnesota. Architects consider shopping malls, where unfettered retailing is often mixed with recreation, our Space Age's signature buildings! During August 1992, in the *Journal of the British Interplanetary Society*, cutting-edge planetist Richard L. S. Taylor (1931-), of the United Kingdom's London-based Probability Research Group, put forth a Christo-like plan—in the absence of any official national or UNO Mars environmental mitigation, adaptation, and research strategies program—to package Mars with a mall-like roofed structure called "Worldhouse." Inspired, perhaps, by American architect Paolo Soleri's *Arcology: The City in the Image of Man* (1969) or a humorous science fiction classic, *Mallworld* (1981) by Somtow Sucharitkul or London's famed Crystal Palace existing from 1851 until 1937, in essence, Taylor makes a unique very tall building research funding request for his innovative idea to prevent wastage of a planetary environment (Mars). In other words, at least one living landscape developer has perceived Mars as a not-to-be-forever-ignored planet. One might refer to Taylor as a macro-engineer of esthetic sensation. Would completion of a Mars "Wordlhouse" entitle Taylor to identify his work by "signing" it? A Mars terraformed by Taylor-inspired Tellurians would be a planet halfway to becoming a world without geotechnical problems. Beleaguered maintenance personnel on semi-pristine (unn terraformed) planets might well be green with envy. Is Taylor's "Worldhouse" patentable? Indeed, as an atrium-like building-place encompassing mega-lodgings and
pollutant-free guaranteed weather regimes, Taylor's Red Planet "Worldhouse" would be a human life-sustaining Spaceship Mars offering covered (but vacant) real estate equal in area to Earth's landmass. If properly irrigated, and given enough sunlight, green land plant growth on Mars is possible under an absolute Martian air pressure that is 7-10% of the present-day atmospheric pressure at sea level in Earth's atmosphere (1.013 bar). Here, it is worthwhile to recall the words of John Stuart Mill (1806-1873): “If it became customary to sojourn long in places where the air does not naturally penetrate, as in diving-bells sunk in the sea, a supply of air artificially furnished would, like water conveyed to houses, bear a price: and if from any revolution in nature the atmosphere became too scanty for the [sic] consumption, or could be monopolized, air might acquire a very high market value.” Taylorists will have to pen an often-revised Karl Baedeker-type Guide to Worldhouse Mars, which should definitely include colorful site descriptions of Mars' oddest landscape features (the so-called "face" on Mars)! Taylor's Martian "Worldhouse" macroproject might be funded (constructed and maintained) by a roof tax, not a poll or parcel tax. In other words, the Mars tax base is a roof hence the uncovered Martian poles are zones of "free" real estate. What if Coca-Cola Co. paid generously for the leased use of a part of Taylor's "Worldhouse" roof as an advertising billboard? Try to picture Mars' ceiling as a giant paint-by-numbers-with-oil colors canvas. What about other businesses? How about some groups of people paying not to see propaganda over their regions, leaving the ceiling a raw canvas? Projection television, using the inside of Taylor's Mars Worldhouse roof, might display fluffy clouds familiar to pioneer Mars dwellers recently departed from Earth, a kind of harmless camouflage tending to make restless and uneasy settlers happy in their strange and dangerous new planetary surroundings!

For the first time in human history, a long-term technological fix, "Worldhouse," has been patterned – a sketchy sort of blueprint tailored to solve our Earth-biosphere's forecasted near-term societal level of stress and crisis. Some psychologists think that urbanization and a loss of consistent rural contact will be the big social problem for humankind during the 21st century. Mars calls! Life on Mars would cause changes to our species, such as a skeleton composed of less dense bones and much lighter musculature, creating a need for a Martian human lectotype distinct from Earth's. Almost all humans inhabiting a Tellurian Wordlhouse would live in apartment-like cells in the numerous several-kilometer-tall towers that serve to keep a lid on Mars' atmosphere. Certainly a mannmade Mars garden is preferable to the insane idea advocated by some "ecology" extremists who seem to be wishing for man's removal from Earth's global Nature (because the species is a contaminant) so that the "real" global nature—sans toxicosis—would stand fully revealed. Even so, Tellurian macro-engineers might have to devise some way to protect and/or insure their profession from construction-defect litigation! Mars must become a well-knit New World as Earth becomes a well-ordered Old World. (Since 1992 Christo has planned the installation of his “Over the River, Project for the Arkansas River, Colorado”, a macroproject plan to suspend nylon fabric panels over a 7-to-8-kilometer-long section of a Colorado riverbed under which visitors could stroll. A new post-Christo group might find Christo's successes and failures in developing "Over the River" instructive.) What varieties of social "circus" might appear on a Mars stage beneath a Taylorian "Big Top"? Would "three rings" (First, Second, and Third Worlds) exist enveloped by one tent there, too?

Humans are almost always members of biological systems characterized by a set of behavioral patterns known as cultures. Ideally, a typical national culture gathering is a group of like-minded persons; that is, a voluntary association of persons sharing a viewpoint on other life forms (absolute geographical location), and a common or nearly common technology for living in its distinct regional biosphere place (local Nature). Japan is the most culturally homogeneous of all First World states. Keeping in mind mechanical engineering's definition of a human being, perhaps it would be best to refer to a

culture as a noosystem, a concert of shared consciousness. Noosystems (also known as "national economies") are necessary for our survival because they are resilient, almost autonomous social systems. (Political maps of nations are the most reliable, accurate maps of any kind ever made.) A rudimentary global village does exist, but rare technological failures (such as the breakdown at AT&T's long-distance telephone call service on 13 January 1990 and the 14 August 2003 power grid breakdown in the USA and Canada) demonstrate that modern noosystems have few, if any, time-tested procedures for perfect management of a global village. India has over 50 million Internet users and when the system crashes, such people find themselves intellectually isolated in mere moments! Using various social and technical means, noosystems can integrate their still-separate groups (nations). (One of the most purely ethnocentric ideas bruited is that of a "Greater China Trade Bloc." During a January 1992 meeting in Hong Kong, politicians, business executives, and academics at the first conference on the "Coordination of Chinese Economic Systems" sought agreement on a means to unite Hong Kong, China, Taiwan, and overseas Chinese into a large, viable, and influential trade community. Other such interesting blocs are forming—for Hispanics only, for example, the "Ibero-American bloc," announced during July 1992.

A noosystem is invariably an artificial unit segregated for purposes of intellectual expedience, much as a region of Earth's biosphere. Geography began on the land and encompasses more of our Earth with technical development of every new sensor, tool, and vehicle. The Earth, the Moon and even Mars can nowadays be “explored” by Internet users accessing “Google Earth”! In essence, our biosphere is the current dwelling place and educational schoolroom for more than 6.5 billion persons. (Mars would not be considered a "schoolroom.") Adversity has always been an effective motivator! There is only one geopolitical unit of Earthly global Nature: Homo sapiens' noosystems at all periods of geological time and in all Earth-biosphere geographical places.

Human migration within Earth is determined almost entirely by technology. The European noosystems, beginning about AD 1450, managed to explore completely the homeland of man—with those remarkable exceptions mentioned earlier. "Humanity" is an idea that emerged during the great age of European travel and discovery and is not separable from the activity definitive of that period of history. As a result of extensive (and presently intensive) exploration and printed accounts thereof, Europeans were the first to realize the geographical wholeness of Earth and, consequently, to become aware intellectually of the existence of almost all other noosystems. An Earth-noosphere—that is, an Earth-enveloping set of human biocultural systems)—made feasible by a nearly common transportation and communication technology has been generally recognized as a potential unit of reality since 1945-1949 by geographers and historians.

Herbert Marshall McLuhan (1911-1980) coined "global village" in 1964, identifying a supposition that a single community of human beings, situated in Earth's biosphere, had recently become extant. McLuhan's odd fanatical interest in mass-communications impelled him to arrive at his theoretical concept of a world of only one noosystem. No such completed "global village" exists or is likely to exist anytime soon. Most people will agree that exchanges of information via telecommunications media is a poor substitute for personal contact and, further, that a "global village" might exist one day, but only if an individual were about one hour's physical travel-time away—less if via teleportation—from the physical presence of the other communicant. Our 21st-century world-biosphere, or noosphere, will be a system that is not organized according to conscious belief, as we once knew it; billions of persons (that is, most of humanity) are in violent conflict about the nature of belief. The co-location of man and certain elements of this world ("integration," "networking," "globalization," and so-called "internationalization" has its own built-in problems. As used in our book, the term "world" denotes all of the natural and artificial conditions that exist today within Earth's biosphere that will be affected by
all building and demolition by Homo sapiens or his Tellurian-designated and/or Alien-imposed agents.

"Global interdependence" – surely a keystone concept of modern-day "environmentalism," which virtually requires "interventionism" by the UN Organization and/or the geopolitical superpowers—in our impending age of molecular nanotechnology would seem to be neither necessary or at all desirable. Macro-engineering's big Earth projects could help to maintain regional and global relationships among somewhat self-isolating peoples, according to Viorel Badescu, R.B. Cathcart and R.D. Schuiling’s *Macro-engineering: A Challenge for the Future* (2006).

Many geographers seek to soon discern an organizational trend that will make mankind the social unit of Homo sapiens, and the world (our globalized infrastructure), humankind's only domain. However, social disunity (fueled by Homo sapiens' diverse ethnic, racial, and religious affinities) is most likely to continue, and settlement on other worlds of our Solar System seems to be highly probable, which settlement would maintain a diversity advantageous to our species. Overcrowded humans make each person more indifferent to the rest, less pleased with his own existence, stupid, less human and humane. Our Solar System could have a cortege of three or four noospheres since terrestrial-type planets are now identified as specific engineering-geographical regions with characteristics of favorable and unfavorable conditions of construction and destruction. For example, a technologically tamed Mars would give Homo sapiens another landscape almost the equal of Earth's land area.

Equipped with all of the ingenious fashionings of today's progressing 21st Century technologies, humanity can rather easily survive in every part of our Earthly biosphere, even the most inhospitable parts such as the polar zones and the vast desert lands. Because a living encapsulated person (a spationaut operating an appropriate vehicle or merely space-suited) is a volume-defining organism, it logically follows that the biosphere's limits necessarily follow a person's movements. (Spationauts as every-man/woman.) This is rather picturesquely illustrated by the photographs of the “SuitSat”, a Russian spacesuit discarded from the International Space Station by spationauts that orbited Earth from February to August 2006. What then results are that Earth's shell-like boundaries of biosphere and noosphere will become practically co-terminus, resulting in humankind's Earth-world, a unique bioapparatus! Paleontology's chronologies of the precise time and place of origination of our planet's first human couple have been revised many times. Currently, few dare to speculate on this pre-historical descent problem—it involves bedrock religious questions and is too sexy—in the timid literature of publicly accessible Science. The allure of a perfect near-term future Earth-biosphere has all the geopolitical potential that resides in the continuing Christian vision of a humanity redeemed by Christ and in the recently discarded Communist prophecy of Homo sapiens liberated from injustice.

Although some people dissent from the moment's faddish imagery of Earth as a tiny containership moving through the Universe, most scientists are nowadays calling for controlled planetary renewal efforts, a Macro-engineering-led kind of CPR for our biosphere. During the period 1948-1991, the United States and the former USSR viewed each other exclusively as targets for nuclear and conventional weapons. Controlled planetary renewal is a pleasant prospect for the just-commenced 21st century! Aerospace and space technologies and applications, inherently global, are part of an overall growth in geopolitical information systems and applications that offer macro-engineering many opportunities for planetary and regional management. As we will demonstrate in Chapter Two, certain management systems—such as, for example, Rodoman-ALPS—will afford just about every First World human individual the experience of holding an interactive visual subscription to the *National Geographic* Magazine!

Ten years before his demise, the French naturalist Georges Louis Leclerc, Comte de Buffon, published
his Des Époques de la Nature, in which he arranged our Earth-biosphere's past, present, and future into seven time periods of indeterminate duration. His Seventh Epoch was defined as a portion of geological time begun by the lordship of man and ended by Earth's cooling to a temperature making all life impossible. True, molecular nanotechnologists could create machines (micro-robots) to remove all greenhouse effect-causing gases (not merely carbon dioxide, but water vapor too) so that Earth would very quickly become cold and sterile, thereby exterminating all natural life—meaning, of course, that highly motile artificial life forms such as micro-robots just might continue enjoying a long Earthly existence! (Some philosophers have stated that our species-lifetime may only be about 0.2 to 8.0 million years.) Moderns should not infer—Buffon may not have so implied—that the absence of natural life definitionally annihilates Earth's global nature! At least from 1985 onwards, "environmentalism's theory of a "balance of nature"—a transient life science theory that implied at least two symmetrical parts, in equilibrium, and stasis—has been quietly denounced by most reputable scientists. However "balance of nature" still serves a public propaganda function for environmentalism's upper-level management circles. Unqualified politicians/scientists would be wise not to dictate opinions about Earth's Lovelockian "soul" (Gaia) to Earth worshippers. A stingingly chaotic, barely codified philosophy of biocentrism clashes with modern biology's scientific facts. Thankfully, however, some fanatic biocentrists have publicly revealed terracial personality disorders (regarding the dispensability of Homo sapiens) via this pitiable so-called paradigm of "Earth"-centered biocentrism. Meantime, geographers now fully realize the ecological consequences of Earth collisions with small bodies of the Solar System as well as extra-Solar System, learning just how quickly our Earth-biosphere has changed over its geological time due to common outside influences. And, quite stunningly, just how fast it could change in the future!

Buffon's end to Earth's geological time was answered in March 1942, when a biochemist, Isaac Asimov (1920-1992), published "Runaround" in Astounding magazine. At page 100 of that classic issue, Asimov coined the term "robotics" (implicitly defined as the science and art of robot design, construction, maintenance, and use). Fully autonomous robots are not yet present among us—mankind has so far only used teleoperators. Joseph Deken disclosed the fundamentals of future robots in his Silico Sapiens (1986). Summarized, Deken observes that, when perfected, the developed capabilities of robots will qualify automatons to be accepted as a new life form. Such machines might be considered as "mindkind" on the role model of "humankind". Hans Moravec thinks that robots with human intelligence will be common by AD 2040. How common? In other words, the original macroproject beneficiaries will not automatically be the eternal beneficiaries of an artificial life-creation macroproject. Buffon's anti-greenhouse effect idea, even if organisms created by global Nature (and confined to Earth only) became extinct or are exterminated by some biosphere geopolitical event-geophysical process like Nuclear Winter, is just not acceptable reasoning, Buffon's "époques" seem inappropriate since, properly speaking, epoch denotes the beginning of a new period, a turning point by some specific criterion or criteria. The invention of automatons would shatter Buffon's imaginative schedule, making it open-ended. Molecular nanotechnologists, in particular, intend that future microscopic-sized machines will have macroscopic scenic consequences. In the USA, a Columbia Broadcasting System Television 9 June 1957 program, "See It Now", focused on automation. The show's famous host, Edward R. Murrow (1908-1965), opened the way for a widespread USA public discussion of automation's future effects on industry and life-styles. Artificial life has not yet been effectively portrayed on America's national network television. "Free World" was first popularized in the United States as an antonym for "Communist World" by the 12 December 1949 issue of Time. Since the 1991 collapse of the "Communist World," it may truly seem that geopoliticians would have no further use for "Free World." However, if it comes about that our planet is to sustain two types of life (such as natural and artificial life), then geopoliticians might label the "Free World" as the region dominated by artificial life and be clearly used as an antonym for mankind's "global village."
At a time when geopolitical bloc-busting and bloc-forming budget crises and biosphere challenges present mankind with a relentless series of Hobson's Choices, man will soon have to face up to the embarrassing near-term future reality that most international trade in goods will be unnecessary, since anything—even very large things—can be made via molecular Nanotechnology's tiny computer-machines. In the meantime, the USA and other states do not desire to be surprised by such worldwide developments as technological breakthroughs, new mercantilist strategies, unexpected shortages of raw materials suddenly or unfair or illegal economic practices that disadvantage some countries. 21st-century Earth will be a world of many nations, each maintained by region-specific teams managing molecular-sized nano-machines. Already we can observe the global development of the ideology of national self-sufficiency and the recrudescence of tribal nationalism. It is at least conceivable that "USA" may someday come to mean "ultimate system association (usa)" and be used as a prefix or suffix to a country's internationally recognized name: for example, INDIA.usa. Such a designations seems appropriate for the Age of Google. Whether such independent nations (or regionalized concerts of countries such as Chapter Eight's "Atlantropa") emulate the USA's government is irrelevant, so long as all nations cooperate peacefully to manage Earth's global Nature and our Solar System via circumsolar telepresence ("outer cyberspace"). Today's youngsters, engaged in computer games are already learning to caringly conserve Earth's bioapparatus and to terraform, giving Mars and Venus biospheres. However, today's personal computer-using youngsters are really only playing with a datascape, or bioapparatus, created by successful commercial computer software architects.

One unavoidable outcome of the onset of molecular Nanotechnology's perfected widespread use (by AD 2050?) will be the eradication of world economic cycles such as those theorized by Nikolai Dmitrievich Kondratieff (1892-1931), starting in 1922. Soon, Macro-engineering might take on some of the coloring forestry now enjoys, has yet to address that macro-economic forecast based on simple logic. That the material basis of long economic cycles is the wear and tear, the replacement and the increase of the total fund of basic capital goods, the production of which requires heavy investment and is a lengthy process, was clearly postulated fifty years ago by George Garvy. Globally, the property insurance and reinsurance business will cease to exist for lack of need—nano-machines, constantly repairing and updating mankind's infrastructures would literally stop material degradations and capital investment replacement cycles forever.

Since all the major military superpowers have now publicly endorsed a space-based global antiballistic missile defense system, that means simply that land use planning in the USA and elsewhere can take a different tack. Thomas Hine's *Populuxe* (1986), a book of scholarship and cautious imagination felicitously merged, noted that America's suburbs—commonly referred to as "urban sprawl"—exist due, in part, to the US Government's desire (implemented by Veterans Administration and Federal Housing Administration mortgage slanting), from 1947 to about 1957, to disperse the nation's populace as a form of protection against atomic bombings by an enemy using aircraft. Intercontinental ballistic missiles—and Russian 100 megaton yield nuclear bombs—negated that scientifically myopic Federal Government initiative. What effect would installation of a global antiballistic missile defense screen have on global private and public sector housing and industrialization programs? Federal Government investments made during World War II resulted in regional restructuring of the USA. America's post-World War II urban sprawl is, in effect, a clever long-term countermove to the newly perceived asteroid Earth impact threat! By contrast, crowded India—with 1.08 billion persons—lacks the population dispersal option of "sprawl".

Remarkably little can be said today that is absolutely true of the entire Earth, or of all occupants of its biosphere. It is geography's foregone conclusion that every living organism acts to ensure ecesis, which inevitably and always results in alteration of our planet's organic and inorganic materials. Mankind's history (not all of it recorded by any means) has been a +7,000-year-long story of an Earth-dwelling group of cultured organisms that flourishes by creating and using special tools, the material products of human conceptual thought and substantive industry; manufactured tools are utilized by man to change local and global Nature. Over the years since AD 1760, industrializing mankind continues to propagate its kind; it is predicted that Earth's AD 2150 population will be nearly 12 billion persons, about 50% of whom will be urbanites.

By 2006, probably 80% of Earth's 6.5 billion people live in nations still classified (since 1971 by the United Nations Organization) as Less Developed Countries (LDC); more than ten of the thirteen most populated metropolitan places are located in the Third World. Economically speaking, the Third World (the aggregate of LDC countries) is a region of welfare recipients, sprinkled here and there with a few rich warfare states—paragons of antagonistic acculturation. As yet, we have heard of a better geographical label for LDC states and so will continue to use a perhaps outmoded terminology (First, Second, and Third Worlds). Man does persist to extend geographically and to intensify technologically his Earth-change activities—even to using the recently accomplished breakthroughs in biotechnology. In March 1991, the University of Florida was awarded USA Patent No. 5,000,000 for a microbe created by its Institute of Food and Agricultural Sciences. The microbe, which was created by taking two genes from one bacteria strain (Z. mobilis) and transferring them to another bacteria strain (E. coli), was first used commercially in 1993 by BioEnergy International of Gainesville, Florida, in an American factory producing ethanol fuel. Ethanol fuel could someday replace all fuels derived from petroleum. The patentability of the first synthetic human, owing to the success of the Human Genome Initiative, is bound to arise during the 21st century. Very interestingly, Hughes Aircraft Company was granted USA Patent No. 5,003,186 (on 26 March 1991) for a method to geo-engineer our globe's alleged atmospheric warming problem out of existence.

In partial summary, we have discovered that the European and North American noosystems are greatly in advance of most other noosystems in the pursuit of what has become the common objective of billions of people everywhere; namely, the exploitation of Earth's resources, creation of many separate industrialized societies, and "unification" within a peaceful Earth-biosphere of male and female people dispersed throughout an anthropocentric planet. However, molecular Nanotechnology's most outspoken proponents foresee a near-term future when international trade will become unnecessary—goods transfers will become obsolete (because anything can be produced anywhere from feedstock) and services can be rendered and accomplished via computer-generated artificial worlds. Late 20th Century computers became representation machines—utterly beyond anything previously seen and felt in talking film theaters, live stage auditoria or via reading science fiction novels—that could emulate any known medium, making computers the first meta-medium. Arguably, this addition of a radically new form of physically involving, interactive human experience is a major societal event which may shape our everyday consciousness as much as what has come before. Homo sapiens now appears to be on the eve of a post-biological stage of evolution (creation by humans of self-evolving objects). Therefore, humankind (an obsolete species?) may be considered as handing on all scientific information about our Universe to civilization's machinery. Visualizing mankind's role in a future Earth-world quite different from our present-day surroundings—literally forming an image of it—would be a psychological aid to confidence and achievement by 6.5 billion worried humans living today.
Some indigenously-invented items typical of the USA are: the grid plan for cities, skyscrapers, jazz music, comic strips, TV soap operas, assembly-line production, and chewing gum. To that old list, we add two recent contributions: the cost-benefit test for public policy (embodied in the 1981 U.S. Presidential Executive Order 12291) and the Strategic Defense Initiative, which was publicly instigated 23 March 1983 on nation-wide network television by President Ronald Reagan. The final item of this combined listing—really, the Strategic Defense Initiative Organization (established 1984)—will prove to be more vital than all the others, since Nuclear Winter doomsday makes the man-enhanced greenhouse effect appear like April in Paris. Humans just may find a way to eliminate the undisputed perception of so many nations that they ought to have nuclear, chemical, and biological weapons and their means of delivery to an enemy in order to feel and to be secure.

Near-term future Macro-engineering may become our world's only profession capable of planning the formation of a daisy chain of computers and other devices to prevent an Earth-biosphere disaster. Somewhere, sometime, some leader suffering a serious shortage of the human brain chemical serotonin is going to indulge his/her fantasy of violence upon a world—any world—caught unawares. (Richard L. S. Taylor's vision of an emplaced Mars Worldhouse could not last, or possibly exist, without a quite similar facility, if only because of potential natural small body impact catastrophes.) Artificial life may be born from a government's industrial policy or private sector initiatives begun by people searching for a way to robotically assist some human groups or all mankind to be safe and prosperous. Taylor's Mars Worldhouse might be constructed entirely by robots—certainly a genderless "Adam and Eve" robot on Mars would create a New World for itself and its replicas. Humanity now wants and needs a comfortable planet in which to live and to pursue happiness. This can be accomplished only if Macro-engineering fully uses all available and potential technology and geopolitical techniques.

The American Society for Macro-Engineering was founded in 1982. In reality, it is a battle between a variable human tenaciousness and an ever-present tenuity (outer space), which offers sudden death via Earth-impacting asteroids. Thomas More (1478-1535), who neologized "utopia" in 1516, found it necessary to isolate Utopia via excavation to turn it into an island of safety in the midst of turmoil and sporadic psychological and physical chaos. Should moderns do anything less to reach our goals? Humanity may modify its Earth biosphere, creating new and unique surroundings to comfortably support further transformations by an industrious Homo sapiens desiring future residences in other planets. What milieus will be made by this means? What utopias of landscape and seascape rearrangement?

A human-instigated transformation of Homo sapiens such that, eventually, robotomorphic "humans" are substituted for organics may arise quickly. The psychosocial component of man will gradually "transfer" into machines with artificial intelligence and will become entirely independent of the biological component, a new kind of “outsourcing”. The biological component of man will gradually disappear, and so probably will the majority of Earth's biosphere. Earth's biosphere could become defunct, replaced entirely by a noosphere belonging to artificial life. Such a "gradual" social movement could have its most noticeable onset circa AD 2040-2050: Deken, Moravec, and others thrust this prediction forward most persuasively in their scientific essays. Indeed, these men are cross-training and reinforcing each other's beliefs. It is claimed that 30 to 50 years from now machines are going to be the most intelligent systems in the Earth. Civilized computer-machines? Ray Kurzweil, in The Singularity Is Near (2005) predicts an epoch will occur by 2045 A.D., approximately 30 years after India is predicted to become Asia's economic leader! The "Copernican Cliché" did not “dethrone” Homo sapiens.
sapiens, but robot R&D may do so.

"Role Innovators" mutate business practices in order to change professions (such as geopolitics and macro-engineering), cleverly reconfiguring them to make them more relevant to the constraining problems of civilization globally and societies locally. By adopting a paradigm, a loosely constituted network of scholars may begin to turn into a profession, which performs for the public good. In the USA and India today, applied geography is unprepared to demonstrate its positive planning potential and, therefore, to cope with many of these pressing problems due to a freakish absence of numerous "role innovators." For instance, many living Americans only vaguely recall the 1903 triumph of the Wright Brothers as well as the start of mankind's Space Age, which actually started during World War II, when a V-2 rocket left Earth's atmosphere after being launched from Test Pad 7 at Peenemunde, Germany on 3 October 1942. For sure, mankind's pre-Space Age period ended on 4 October 1957, when an unmanned spacecraft was propelled into Earth orbit. Yet, barely a decade later (1967), only 52.1% of the USA's citizens had any adult experience with our world before that history-making epoch!

Geographical ideas prevalent during previous periods of recorded human history have generally reflected contemporary trends in geophilosophy and transportation mechanics – indeed, until electronic facsimile machines were perfected in 1925 communication and transportation were once inseparable. However, most American geographers (that is, those geographers who have through their apathetic behavior the greatest philosophical and methodological influence on their students partaking of today's knowledge business) have been curiously unresponsive to the Zeitgeist and progressing technology of the recent past (as, for example, the 1982 operational status of America's small Space Shuttle fleet, the present-day US use of hypersonic aircraft and the certain future deployment of civilian and military aerospace planes by half a dozen First World and Second World nations). Technological progress virtually ensures—at least until molecular nano-machines are the world (that is, an Earthly geological time period when everything will be technological and technology will become a completely autonomous force, the Earth above its core and mantle as nanostructure)—that humanity will never arrive at a true, not merely operational, state of global Nature equilibrium.

Components of diverse American statements on the nature of professional Geography are obvious and often unquestioned concessions to human linguistic habits and neurological mechanisms. Until 1969, American professionals were extremely tardy in reviewing and discarding Richard Hartschorne’s 1939 definition of the discipline (moderately "revised and updated" in 1959) formulated in The Nature of Geography. Hartschorne (1899-1992) confined American Geography's focus only to Earth—there is no reference to "biosphere" in his 1939 edict—and ignored existing and forthcoming technology (hypersonic aerospace vehicles, spacecraft, remote sensors, and Macro-engineering's ideas). By doing so, he unilaterally excluded the future by cynical non-acceptance of our Earth-noosphere's evolvement. His high-impact books and articles were refreshingly direct in style, but often bogged down with indulgent portraits of transient personalities and tedious contemporary thinking that still marks much of the pompous writings to be found in geography's dull professional journals.

As a concept, "noosphere" dates from the last half of the 19th Century, when Ivan Petrovich Pavlov (1849-1936) called it the realia of the Anthropogenic Era; however, it was not widely publicized until 1945. Almost as soon as World War II had concluded with the "Dawn of the Atomic Age," Vladimir I. Vernadsky (1863-1945), writing in the January 1945 issue of American Scientist, suggested that the biosphere, which was then still considered as the last dynamic Earth system formed by a very turbulent global Nature, was being replaced by a noosphere. What is Earth, really, but a kind of large, only slightly uncommon, kinetic artwork (a bioapparatus) created by the Universe and/or God? Mightn't
now lifeless celestial bodies (such as Mars, Venus, and our Moon) soon come to be fully appreciated as nearby future "playgrounds," or "sandboxes," which could stimulate the further intellectual growth of our ambitious and curious species? We may really need such otherworldly places to offset the disappearance of ourselves as the predominant life forms in the Earth!

"Noosphere" is comprised of the Greek noos ("mind") and sphere, the last being used in the usual sense of an envelope of our planet. Apparently, during the 1920s, Vernadsky had enthusiastically fostered the unfolding of biogeochemistry with his avid personal interest in the global interfacial role played by living organisms. His death caused some Americans to note the scope of his remarkable work for the first time and, therefore, to recognize that progressive changes in the material and cultural advance of Homo sapiens had, for the very first time in Earth's multi-billion-year existence, enabled one species to become a biosphere dominant, affecting life's future representation in our planet's stratigraphy. Wisely, he foresaw that this geographical fact raised a problem, which could only be resolved by humans, which would entail a reconstruction of the Earth-biosphere in the sole interests of a willful, thinking, motivated, ever-constructing and destroying group of creatures. This new state of Earth's biosphere—on the verge of subjugation by humans—is Vernadsky's "noosphere." Vernadsky's glorious insight was that Homo sapiens was Earth's caretaker and its first truly responsible modernizer. In other words, he predicted the endpoint of Earth's global Nature and the starting point of a humanity-centered world. Soulless humans and artificially intelligent creatures might be said to have brains, but they do not have minds. Yevgeny N. Lazarev formulated a new profession of "anthropodesigner."\(^{17}\) Anthropodesigners participate in a social trend, metadesign, which is applied experimental aesthetics, a modeling of the essence, manifestations and relations of people. Lazarev sees man/machine combinations as a kind of centaur and predicts that electronic culture miniaturizes the world of objects, thereby indirectly increasing human values.

A leading Russian geographer, Inookenti Petrovich Gerasimov (1905-1985), in 1966, coined the phrase "constructive geography" as a description of geography and, thereby, indicated that it should be a professionalized design art. He demanded that all geographers assist in forming a science-art of the planned transformation and complete management of global Nature for the sake of mankind's future. Constructive geography, as elucidated by Gerasimov, sounds very much like what Macro-engineering verges on becoming. To its detriment, Macro-engineering has no snappy bumper sticker slogan. More significantly, it lacks a magisterial English-language statement on our profession's maturing philosophy. Most macro-engineering books and journal reports recite the obvious and use neatly honed catch phrases in stylistically unremarkable packaged prognostications. Regarding the art half of Gerasimov's constructive geography: Aristotle said in his *Poetics* that no sane man would call an object one thousand kilometers long 'beautiful.' But new artists, endowed by various technology with the means to create in unparalleled scale, and with the vision needed to comprehend it, seem quite ready to make that assertion; there is no predicting what kind of geographical scale will be open to tomorrow's artist. We defend here some facets of architectural modernism against the prefix ("post"-modernism, dating from circa 1949) that presumes—very incorrectly—to date it. A determined group of notable businessmen founded the American Geographical Society of New York in 1852 to provide a clearinghouse for accurate economic data on our Earth and its peoples. 1852 was also the founding year for the USA's oldest civil engineering society, located in Boston. Many years later, America's public still awaits their profitable cooperation on behalf of Macro-engineering's professional perfection and recognition. People in India also await such close cooperation amongst professionals.

This theme of mind over mere material bulk had been sounded before. During the English Tudor period

(1485-1603)—before the Industrial Revolution and patents—humanity was regarded as the Universe's very center and purpose: local and global Nature existed for man's prosperity and pleasure. Human pretensions of mastery were later reduced by the inevitable impact of scientific facts. Nevertheless, from that historical period the dominant idea throughout European and North American history has been that wealth and beauty is associated with rural agriculture and industrial productivity of city populations. (Most global Nature lovers and industrialists share at least one common viewpoint: Earthly global Nature is a very large thing.) Since the 19th Century, there have been well-documented warnings of dangerous consequences (for both man and his present-day planetary "household") if such a geophilosophy is adhered with much longer. However, a Society for Ecological Restoration and Management was only established in the USA during 1987. On 14 September 1987, *Fortune* reported that the average American then commanded twice as much buying power as in 1952. By 1987, Japan had become our globe's number one capital lender and robot maker; in 2006, Japan is still a world leader in robot invention and practical use.

As long ago as 1864, George Perkins Marsh (1801-1882), an American preservationist with a globalized outlook, posited the thesis: Has or could man become the architect of his own abiding place? Marsh, Gerasimov, and today's struggling macro-engineers and geopoliticians—all looking at the Big Picture (end-to-end systems Macro-engineering)—answer his two-part query in the affirmative.

Vostok 1, carrying Yuri Aleksetevich Gagarin (1934-1968), was the first manned spacecraft to achieve Earth orbit. On 12 April 1961, Gagarin maintained around himself in Vostok 1 a terrestrial atmosphere and a "Mediterranean climate." On 12 April 1981, the first American Space Shuttle ("Columbia") was launched. It, too, maintained similar Earth-normal conditions for its human passengers. Such small spacecraft have been called "terralla," meaning "little Earths." These few small vehicles, along with the International Space Station, are merely containers temporarily escaping our Spaceship Earth and are not closed biological systems like Earth's newly cherished biosphere. Future spacecraft might not be so huge as to qualify as "Ships of State"! Biotechnology and molecular nanotechnology, effectively harnessed by a new interdisciplinary profession, named by Yevgeny N. Lazarev "anthropodesign," may upgrade Homo sapiens by increasing our species' ability to cope with the Universe's existing and expected conditions. Inescapably, a Solar System-wide political regime—itself interdisciplinary, selective, and fusive—must come into existence.

Europeans and North Americans ordinarily assume a highly parochial viewpoint of recorded history, which is probably best summed up by their pervading attitude that European and Europe-derived persons discovered the other peoples of this globe. In 1522, Enriques, the Malaysian slave of Ferdinand Magellan (1480-1521), was probably the very first human to physically circumnavigate Earth in one trip and, therefore, the first human being to empirically prove the sphericity of Earth. (Magellan was probably the first to do it in more than one trip!) Europeans and North Americans can justly take credit for reaching other places in the Solar System first. This achievement is attributable to our First and Second World noosystems, which are technologically highly developed. Mankind can now select migrants to successfully move away from our ancestral homeland, however mundane the motivation for that future journey! Still, it is possible to envision our Earth-biosphere so riddled with physically and intellectually insurmountable pollution or contamination difficulties (as, for example, a Nuclear Winter) that "environmental refugees" opt for a mass exodus of healthy survivors and planetary colonization of other global features (for instance, the cold desert that is Mars). If these "difficulties" were later to be redefined as "problems," then "solutions" would have to be on the Earth-noosphere's

---


Although it is a wonderful driving problem for science and technology, let us not fatally delude ourselves with the prospects of space travel. It would be grossly irresponsible to focus on the "Conquest of Space," ignoring the absolute necessity to maintain a self-renewing administration of mankind's primary base of operations in the Universe. The uncompleted trend toward global noosystem convergence (instigated mainly by goods and services deals amongst international big business) will strengthen man's resolve not to be tempted by an attitude to our present-day Earth-biosphere that is indulgent and ruinously exploitive. Ironically, the primary lesson garnered by First and Second World noosystems following the 1942-1957 advent of unmanned space probes underlines the enormous importance of every biophysical factor in humanity's welfare and survival into the far future. Such, at least, is the main theme-message from Carl Sagan (1933-1997) in *Pale Blue Dot: A Vision of the Human Future in Space* (1994).

A new Aristotle trying to organize all human knowledge might find no place for a particular study of Earth-like geography. Knowledge cannot be separated, though for convenience it must be segmented. A master geographer, Alexander von Humboldt (1769-1859), published the first modern account of our Universe in historical perspective in his *Kosmos* (1862), establishing the concept of the periodicity of meteor showers, which visibly pepper our defenseless planet constantly, salting its superficial crustal strata with particles from other places in the Universe. Immanuel Kant (1724-1804) said that all the planets have been or will be inhabited; Kant did not foresee that people would become space-faring oecists. Kant did allow, however, that culture would produce in rational human beings an aptitude and capacity for any ends whatsoever of mankind's choosing. "Tomorrow" artificial life will be empowered also. The early stage of "Tomorrow" is fully documented by Robert A. Freitas Jr. and Ralph C. Merkle in *Kinematic Self-Replicating Machines* (2002).

In 1967, Preston Everett James (1899-1985), a figure on equal footing with Richard Hartschorne in America's academic inner circle, still shared the professionally myopic pre-World War II theory of Geography's content forcefully dictated by Hartschorne from 1939 until 1969; for example, James claimed that geographic study, from "whatever point of view and by whatever method, is concerned with areas, or segments of Earth-space." In other words, geography's employable practitioners should deal exclusively with Earth-biosphere regions (local Nature), and nothing else for all time to come!

Another American discipline opinion leader, Edward A. Ackerman (1911-1973), said in 1958—a year after the Space Age truly began and the same year the National Aeronautics and Space Administration (NASA) was organized—that "Geography treats a universe which is finite—the surface of the Earth."\(^{20}\) In a footnote of minuscule print, Ackerman explained further that his "universe" was meant in "the sense of the total field for investigation within which a science actually or potentially may be a valid instrument of inquiry and synthesis." Ackerman's inexplicable dictum sounds a bit like a rehash of John von Neumann's idea of lebensraum as "safety factor" in the June 1955 issue of *Fortune* magazine. The 1958 notion of eternal solitary confinement for Homo sapiens advanced by James is absolutely abhorrent. It would be correct to discard dogma, to convey the truths of geography in proper perspective. Geographers were not the only gelatinous geoscience professionals wearing blinders on their intellectual vision centers. Take, for example, James Frederick McDivitt's rather careless remark of 1965, made several years after the Apollo mission to the Moon had been delineated by NASA, that "The stock [of minerals] which is in the Earth must serve all peoples for all time." Geographers, economic geologists like McDivitt and flaccid geopoliticians who read only their own specialized

---

\(^{20}\) Edward A. Ackerman, “Geography as a Fundamental Research Discipline”, *University of Chicago Department of Geography Research Paper No. 53*, 2 and Footnote No. 4, June 1958.
professional literature will inevitably fall into this kind of thinking trap, as did W. Youngquist in 1997 with his *GeoDestinies: The Inevitable Control of Earth Resources over Nations and Individuals*. So-called “sustainable-development” is a self-contradiction! Even inter-disciplinarians have tunnel vision. For example, Richard C. Duncan, occupying an Institute on Energy and Man niche (in Cambridge, Massachusetts), has developed a predictive theory that "states that the life-expectancy of industrial civilization is less than 100 years." Alas, poor Duncan simply repeats McDivitt's major boo-boo. Certainly, after the start of our species' Space Age, it was exceedingly unwise of those well-trained professionals to prescribe by flawed definitions what their colleagues would work at or what methods they should use. The last American spationaut to walk on the Moon (as a member of the Apollo 17 mission in December 1972), Harrison H. Schmitt, offers the Moon as a near-term future source of energy for “Earthlubbers”. Because of humankind (Homo sapiens + technology), more than ever, Earth and its Moon have become one environmental system.

By 1972, in his monumental history of geographical ideas, *All Possible Worlds*, Preston James successfully evaded that theoretical dead-end in which so many others had needlessly perished: "if people called geographers apply geographical methods to such studies [of other Solar System planets] they will be included in Geography." In other words, James finally subscribed to von Humboldt's vision of geography focused on extra-Earth debris and celestial bodies. Because of intellectual inertia shown by too many mature college professors, and the relative recentness of our historical period (of space and planet explorations), we have begun to realize that geography is saddled with a patently inadequate vocabulary. Two choices are obviously open: (1) simply transfer Earth originated and oriented terminology to interplanetary space and other planet-places (i.e., other global Natures), or (2) create new words, perhaps by neologistical experts familiar with science and art. Realistically, (1) will probably prevail for some time to come until new terms come into use from practical experience, or until wordsmiths attempt to revise definitions or even to resolve the problem in some other way. That 20 July 1969 "One small step for a man, one giant leap for mankind" uttered memorably by Neil A. Armstrong altered the meanings of all English words, by invalidating the assumption that they are used by a forever-Earthbound group of persons. Armstrong's feat—and feet—set Homo sapiens on another global Nature stage. Earlier, it was mentioned that the dawn of the Space Age was a science-making move. What, why, where, and how was science made?

Geography is a protean word with elasticity in terms of definition, just like "ecosystem" and so many others. It is to be hoped that this useful property will enable modern professionals to soon refine an apt and workable disciplinary scope. Harold Leland Goodwin (1915-1990), Director of NASA's Office of Program Development during the early 1960s, believed that “A basis exists in the interpretation of the Greek gaia, from which ‘geo’ is derived. The word means ‘earth’, but it preceded the Hellenic concept of a spherical planet orbiting the Sun. If we assume gaia means simply ‘ground’ and, by extension ‘planetary surface’, the generic interpretation becomes reasonable and ‘geo’ can be applied without restraint.” When Armstrong put his clean left booted foot on the Moon's regolith, he made a first impression on an environment quite remarkably unlike anyplace in the Earth where man has waddled—totally sterile!

The best alternative, the most reasonable, to Goodwin's excellent solution would be to contrive a study of "planetography," subdivided into geography (Earth), areography (Mars), selenography (the Moon), and so on. All of these planet-places are known to have crusts upon which people make walk and even move about in wheeled and tracked surface vehicles. "Anthropos" means "one who walks with his face to the heavens". St. Augustine (AD 354-430) believed that this unique posture was one of the defining

---

features indicating Homo sapiens' uniqueness: "Man was made to walk erect with his eyes on heaven, as though to remind him to keep his thoughts on things above." Johann H. Schroter (1745-1816) coined the term "aerographic" by analogy with "geographic" in his *Aueographische Beitrage zur genauen Kenntnis und Beuteilung des Planeten Mars*, which was posthumously printed in 1881. In 1962, William Bunge, stated in his *Theoretical Geography* that geography's entire subject matter (if the subject truly matters) might well be expanded to include universal and site-specific facts discovered subsequent to our Space Age's onset. That is, since 1957-1969 geography should examine "that portion [Bunge meant "part"] of the Universe directly available to man . . . and to phenomena of human significance."

1957-1969 marked the inception of a new science. Although American geologist and cosmologist Thomas C. Chamberlin (1843-1928) had championed "Earth sciences"—indeed, he was first to give it currency over a century ago—the first school of Earth sciences did not form in the USA until 1965 (at Stanford University in California). Hubertus Strughold (1898-1986), an expert in Space Medicine, suggested that we would need a "topographical" description of interplanetary space (spatiography), which regionalized space using certain borders (physical conditions and/or "landmarks"), and names, special words or phrases to identify useful subdivisions of our Solar System. At a time when macro-engineering is seriously advancing ideas for impressive macroprojects located amidst our Solar System's planets, 70 moons, and odd debris, various sciences and arts should be applied to evaluate known and extrapolatable ambient conditions in the course of locating large-scale projects and determining their effect on mankind's activities in our Solar System. Sometime between 1 April 1955 and 1 December 1959, the US Air Force apparently invented the word "aerospace," as evidenced by its replacement of "air" in AFM 1-2 "United States Air Force Basic Doctrine". A Solar System spatiography would have its point of origin at our Sun's center of mass, since 98% of the Solar System's mass of $1.9927 \times 10^{30}$ kilograms rests in that shining star. Geographers should defer to other, better-trained spationauts, letting them adopt a spacious heavenly realm as their profession's turf. This system of spatial description (geography cooperating with spatiography) deserves promotional publicity in the media! For the most part, people have only vicariously explored other planets – perhaps the most unforgettable recent witnessing was Armstrong's directly-broadcast 20 July 1969 Moon power-strides flickering on televisions screens almost everywhere.

The USA’s Apollo mission spationauts spent little actual time on the Moon and were almost unrecognizably encumbered by clumsy clothing. We prefer to think of those brave men as almost like armchair geographers. Two major colloquia highlighted the 20th anniversary of the Apollo 11 lunar landing and provided a candid evaluation of our world's natural mineral and fuel resources at the 28th International Geological Congress held in Washington, DC during July 1989. With regard to the future manned space flights, the prose of the pro and con debating groups was balanced and informative, yet lacking impact in the public media. Planet-places such as Mars and Venus, which are supposed to be without pre-historic periods, should be explored. Mars and Venus are precisely not classrooms for Homo sapiens, but Earth's opposite and counterpart ("sand boxes" and "playgrounds"). Man needs to investigate this Solar System as soon as possible. Men, women, and machine champions are going to trod Mars' mountains and plains. Earth is too much like a reservation for further advance of humanity's science and art examining what remains of global Nature. Approximately 33% of Earth's land is still called wilderness. Some geographers reckon that if wilderness remains on this planet by 2100 A.D. it will only be because, for the first time in the history of man, we have deliberately chosen that it should be so as a positive benefit rather than an industrial remnant; wilderness will then be protected not by the environmental barriers that have sufficed until now but by proactive legislation barriers endorsed by society.
Those studying Earth have often been forced to accept ad hoc judgments because they lacked comparative data and historical information. Until 1957-1969, the inclusive/exclusive professional phrase "Earth sciences" reflected this spatial restriction to a single Solar System global nature. Much technological innovation is characterized as medical and engineering improvements, but these innovations cannot exist without prior knowledge of universal facts. If the fundamental field of view from which previous scientific facts have been gathered is enlarged and if, on the other hand, all advances of our industrialized economies (First and Second World noosystems) are based upon the discovery of such facts, then the number of applications and benefits to Earth's First, Second, and Third Worlds will be similarly increased.

"Life" appears to be the only truly unique commodity in the Earth. Some smug geographers assert that biogeographers need not worry about extraterrestrial subjects invading their literature—they apparently prefer a no-growth scenario for professional geography! Space travel theoretician Hermann Julius Oberth (1894-1990) announced in the last paragraph of his *Man Into Space* (1957) that Homo sapiens' species-lifetime goals must be: (1) to make available for living organisms every place where life is possible, and (2) to make inhabitable all planets as yet vacant, and (3) to make all life purposeful – that is, to give all life identifiable aims.

Oberth did not advocate mere survival (there are many Third World noosystems in our present-day geopolitically fractured global Nature which exist at a subsistence-level human “Standard of Living” as defined by the UN Organization) but, rather, of settlement—biology’s concept of "ecesis." Oberth-inspired extraterrestrial colonies are desirable and records of settlement will be much better than any previously written. Oberth's purposefulness is a theological and cybernetic question best left to the reader's personal preference since for every word, there is also an anti-term!

Foreseeably, robospheres and noospheres will produce new shells of life (biospheres) surrounding planets visited by naturally and/or artificially intelligent persons. Mars may be colonized slowly and gradually, and not by humanity but through humanity, facilitated by robots. Canny exobiologists will have to form a working partnership with geoscientists to fully evaluate colonial territories. Vernadsky would surely have appreciated the potential impact of introduced microscopic and macroscopic life forms on barren planets (or planets already occupied by less well-adapted biota). Tele-robotic machines anticipated our first manned lunar landing. They have made us generally informed about the geography of the Moon, Mars, Mercury, and Venus. Humankind has come a very long way since 1815, when J. H. Schroter published the very first book devoted to another planet (Mercury)! The most recent Solar System planet to be discovered, Pluto, was found in 1930 by Clyde Tombaugh. The astronomical definition of the term “planet” is being reconsidered since the discovery of other bodies almost the size of Pluto orbiting at the edge of our Solar System.

Even by 2006, a 6.5 billion strong humanity still led a kind of secluded existence in our Solar System, but technology's progress will allow our species to eventually replicate and innovate self-supporting biospheres within our Solar System by giving monetary values to extraterrestrial real estate—that is, Mars and Venus, in particular, will be improved to become as valuable as Earth during the 21st and 22nd Centuries. A just-developed idea of large-scale global Nature transformation, "terraforming," was first presented with utmost clarity and breadth in Martyn J. Fogg’s *Terraforming: Engineering Planetary Environments* (1995). Man-made biosphere formations will very likely be fostered, especially by the progress of Biotechnology, Robotology, and molecular Nanotechnology. In other words, Mars could have a near-term future "invasion" by Homo sapiens and his designated agents, resulting in a contextless layer in its stratigraphical column. Planet-wide applications of macro-engineering and terraforming knowledge offers man the chance to redefine all nine of our Solar...
System's known planet's as human resources. These planets might then be known as LDCs—Localized Development Corporations—and would be vertical Solar System company organizations!

Earthly launch and recovery sites for spacecraft are two new expressions of mankind's growing fund of technology. Decisions for building manned spacecraft launch facilities in Florida and in Kazakhstan took into consideration locative factors for an industrial enterprise never before included in First and Second World geographers decisions; mission requirements such as azimuth angles, geographical latitude and desirable launch times were some of the new location factors that had to be contemplated by macro-engineers prior to construction of these costly government owned and operated facilities. However, spacecraft departure sites, which now include several Third World locations, are not our chief concern—what about the destinations of man and his machine offspring? Homo sapiens first landed artifacts on the Moon in 1959, on Venus in 1966, and on Mars in 1971. America's immensely successful soft-landers on the Moon and on Mars are great data contributors to the advancement of extra-terrestrial Geography. These stable instrumentation platforms, exactly locatable, make almost continuous reports on their immediate surroundings over periods of many months. The "Remote Sensing Committee" of the (US) National Council for Geographic Education has existed only since 1977! India has a vigorous space and planetary exploration program, along with practically useful orbiting satellites.

The scope of such efforts can be expanded soon, but exciting taxpayers to be supportive will not be easy. For man to become established in our Solar System, humans will have to possess the advantages of a very high level of technology in order to successfully transplant natural and artificial organisms anywhere in our Solar System. In a few decades, it is probable that humans may return to the Moon and, eventually, will travel to other planet-places and may one day eventually dwell permanently upon other carefully selected surfaces. Recalling the nearsightedness of Richard Hartschorne-influenced American geographers, is it now opportune to put forth a practical 21st Century definition of geography? Yes, indeed! For example, Jerome E. Dobson offered a definition found useful by us: "Geography is the pursuit of spatial logic . . . [because] both spatial and process logic are necessary to solve complex Earth problems." We sometimes use "event-process" as a synonym for "progress." (The idea of progress—central to the development of science and technology and Earth's nososphere—had its roots in Christian eschatology.) Whether he is aware of the fact or not, Dobson follows in the footsteps of two great geoscience prophets, Thomas Chrowder Chamberlin and Alfred Lother Wegener (1880-1930), and himself pioneers a new trail for moderns to trudge when it comes to future "Earth sciences". The reader of our textbook will be encouraged to wade through a welter of lengthy science fiction analogies, brief technical definitions, and numerous scientific hypotheses/theories before a coherent picture can emerge in Chapter Eight. A unified and consistent vision of Earth's dynamic global Nature, such as von Humboldt once produced, has become impossible in our time of scientific specialists, at any rate for geographical professionals. Ironically enough, the only generalists left are science's media popularizers and the writers of science fiction! In other words, the public "tastes" science after it has been masticated by others (media personalities and truth/falsehood fabricators)! For normal persons, the ultimate in habitability of a planet-place occurs when local or global Nature permits a clothed—but unencapsulated—person comfortable spatial movement. In today's Solar System, only our Earth fits this criterion. Logistics, to use a word that came into widespread use during World War II, is the problem.

In the USA, since the final American manned Moon landing in 1973, there has been summoned forth

---

one really praiseworthy improvement in the format of scholarly writings in geography: the systems approach to Earth's biosphere and its industrialization. This systematic approach was brought to geography from research and development schemes used by American and British specialists in wartime programs dating from 1939. Such plans and projects were typically laden with acronymic labels—the very word "acronym," coined by Basil Davenport, first appeared in print (as a letter to the Editor) in the February 1943 issue of *American Notes and Queries*. The Apollo Project preparations appear to have been a prime source for spreading this idea of systems analysis and synthesis to Geography and Macro-engineering. In terms of their functioning, operation, and lifecycle, museum curator Jack Burnham equates some 20th century mechanical and electrical artworks with "systems" thinking in his *Beyond Modern Sculpture: The Effects of Science and Technology on the Sculpture of this Century* (1968). Too, the very idea of "harmony" in a "Balance of Nature" implies (even requires?) that there are separate parts ("systems") to be harmonized naturally or artificially in our Earth-biosphere. This would seem to indicate that good—not merely successful—Geography /Macro-engineering/Terraforming is not a compromise, that it is a resolution that somehow redefines and unifies the interfacing of the local and global systems of the original planetary macro-problem. Today, mankind's chief geopolitical and macro-engineering goal should be to eventually harness all of the natural Earth-biosphere energy systems. Working for a long time mainly at their places of interfacial system energy exchange, human beings have learned to redefine global Nature's energy-systems, renaming them the energies of Art for Techno-Art! It is often taken as a geographical given that outside the wall of our buildings is a set of integrated, spatially large systems in our planetary biosphere which are used by Homo sapiens as if they were reservoirs. Only just recently has Architecture come to be seen as dealing with a totally man-made set of structural/building mini-reservoirs interconnected with the bioapparatus (Earth).

Our Space Age has seen some geographers, particularly those concerned with landscapes yet unperturbed by the powerful presence of people, examine the Moon and other planet-places, and in cooperation with astronomers, attempting to create clear geographical descriptions of these regions (such as coordinating toponymy and technical jargon). However, the actual number of persons participating in these forward-thinking endeavors must be something less than 5% of the members of the Association of American Geographers—not even close to forming a "critical mass," a strongly innovative minority of at least 15% of all American or Indian geographers. Still, far too many academics have had their brain circuits infected by a 1962 "virus" called the "the post-Industrial perspective." Robots will shape our Earth-world in a post-human labor period of historical time.

Geography's status in the USA declined precipitously after World War II. During 1989, polling of ordinary Superpower citizens proved that almost 15%, two festering "critical masses" of pure ignorance, could not find their own national homelands on a simple world outline map! We can only hope that such appalling geographical ignorance was non-contagious! Practically speaking, however, hope must be tempered with additional American resolve to progress by reforming the USA's 21st Century educational establishment. India’s educational establishment is spreading competency in Geography by means of the Internet. If the alleged "global village" existed as a sociological form, then domestic policy and foreign policy makers would be the same elite. The world’s "boom" and "gloom" futurists make a cloying kind of jargon-filled pap popular and, of course, George Orwell's *Nineteen Eighty-Four*—especially during 1984 and after—made that kind of self-defeating mental outlook remarkably common even in 2006 A.D. It is at least debatable whether our present-day or predicated future global problems are of a Different Order of Magnitude (DOOM!) than those previously encountered by our species. In addition to the increasing use of personal computers, American students

---

now must function in campus intellectual climates that are intolerant of intolerance: political correctness is now officially defined as marked by progressive orthodoxy on issues involving race, gender, sexual affinity or ecology. American taxpayers, more and more, are complaining about the mendacious statements of academia's ignorant Young Turks. India must avoid this bad route to an intellectual dead-end.

America's academic geographers still seem to be victims of groupthink. Irving Janis in 1982 at last furnished observers with an idea of what was wrong with American geography. Too late, perhaps, our teaching academicians have realized that they gave the nation's youth a too-easily learned map—a white sheet of paper or a black television screen! Today's school graduates are much like the ship's crew in the *Hunting of the Snark* (1876) by Lewis Carroll. How many Americans, both children and adults, are even aware that the US Department of State's Geographer has since 1921 provided advice and guidance to the US Secretary of State on matters relating to official foreign policy (maritime and international boundary issues, territorial and legal disputes affecting the USA's global interests, and international issues such as trafficking in narcotics, freshwater management, and much more?) There are useful books such as Darrell Huff's humorous *How to Lie With Statistics* (1954) or Mark Monmonier's serious *How to Lie With Maps* (1991). For geographers, maps are precious documents forming the basis of our profession. And, American Presidents do rely on maps for strategic and tactical planning and for operational information. Let's hope they spurn The Columbia Encyclopedia! Starting during the 1960s, several new professions were formed which India and the USA’s geographers have ignored so far, to their own declining discipline's detriment. Chapter Two hereof will introduce the reader to these promising vocations, which are now ripe for joint action with geography.

Astrophysicist Nikolai S. Kardashev classifies technological mastery (by Terrans and Aliens) of regions of the Universe using a whole-number rating scale. His Type 1 civilization is one that has complete control of the resources of a single global Nature; Type 2 civilizations control all matter and energy of a single solar system; and, a Type 3 civilization commands the resources of a single galaxy. Homo sapiens is now at a 0.3 to 0.7 stage-level in a Type 1 civilization. At the 27th International Geological Congress during 1984, the International Union of Geological Science approved the formation of a Commission of Comparative Planetology. Planets—at least in our Solar System—are no longer viewed by science's professionals as merely astronomical objects studied via telescopes. Percival Lowell (1855-1916) was first to define Planetology as the comparative and interdisciplinary study of planetary history in 1905. More than a century later, Homo sapiens views this Solar System's planets as regions apt to be altered in the near-term future by natural and artificial human (and/or Alien?) macro-engineers and terraformers, on the model of Earth’s deserts irrigated by vast, complex watering systems. Comparing Earth with other planets is an effective method to arrive a “universal ground truth”.

Too many Americans are currently afflicted with a false mystique that has grown up around computers, which is sometimes promoted by movies and high A. C. Nielsen Media Research Co. rating national network television shows—that is, by non-computer science experts. Millions of Americans rely on their impressions of other nation-ecosystems as displayed in such popular magazines as the National Geographic Magazine. Few of those millions of readers are aware that those glossy photographs and satellite images are sometimes quite untrue pictures! For example, the controversial National Geographic Magazine covers pictures of the February and April 1982 issues that were retouched by computer operators. So, it is now a situation whereby digital retouching has terminated photographs and television images as evidence of anything. Pictorial geographical falsity is a big problem for

---

everyone subject to propaganda.

*Capricorn One*, a 1978 American film, posed a catchy film plot twist: a mission to Mars by the NASA space program turns out to be faked, really done in a television studio in the USA. The USA's national security is not threatened by the National Geographic Society's more or less harmless geographic misinformation. However, Americans and Indians must be wary, at the very least suspicious, of the cartographic and real-time imaging products of so-called electronics experts masquerading in public as Space Age geographers! America's "TV Generation," the segment of the baby boom demographics born after 1950, that never knew existence without national network television, was a poorly educated target population vulnerable to verisimilitude. The post-Baby Boom groups are not much better educated unfortunately since cable and satellite broadcast television is not marked better! And, India’s youth are only just now beginning to develop an unhealthy fascination with television in all its forms and affordable small personal computers capable of playing games. The “Worldmapper” website, [http://www.sasi.group.shef.ac.uk/worldmapper/index.html](http://www.sasi.group.shef.ac.uk/worldmapper/index.html), offers exotic cartography based on actual demographic and economic statistics.

That USA TV Generation's desired near-term future state of Earth-world, or goal-state, could be surprisingly transformed into a gaole, or jail-state, a cage for all of Earth's life forms! The American public's appetite has been whetted by fact-based dramas—next come social documentaries in real-time. Over the centuries, a fragmentized Homo sapiens religiously retained many versions of a perceptual world-Earth. Gradually, with the growth of science mainly, those various viewpoints and beliefs coalesced for a short time into a mankind-wide conceptual whole-Earth. But now, however, the global impact of television has been mainly to restore those regionalized viewpoints, not to perpetuate science's globalized outlook. Like the inhabitants of a future USA portrayed in Ray Bradbury's *Fahrenheit 451* (1953), peoples of many present-day Earth-biosphere nations seem happy, if not actually eager, to give up the challenge and responsibility that ever-advancing science's books and articles convey!
Chapter 2

A WORLD IN A GLOWING BALL

In 1968, a full two years after regnant Russian geographer Innokenty Petrovich Gerasimov coined “Constructive Geography”, the American engineering philosopher Frank Paul Davidson began to popularize an at-least-four-year-old UK semantic addition, “Macro-engineering”, because of focused Civil Engineering research that systematically focused on geographically large-scale private-sector and public-sector building projects. Davidson (born 1918) promotes Macro-engineering from his office in Concord, Massachusetts, USA. (In about 1968, Biotechnology—or “Micro-engineering” if you like—became public controversy worldwide.) Properly organized, Macro-engineering should to prove the most immediately stimulating of new professions and should thereby greatly arouse all professional geographers in India and the USA. (The August 2006 issue of Climatic Change was devoted to a rarely covered topic, Geo-engineering.\(^{26}\)) Macroprojects—the concrete emplacements of macro-engineers’ plans—were first organized in the USA by a pioneer Californian, Warren A. Bechtel (1872-1933), according to The Earth Changers (1957) by N.C. Wilson and F.J. Taylor when Hover Dam was built on the Colorado River in the USA during the 1930s.

For public relations reasons alone, the centers for planning of macroprojects and the R&D underpinning planning operations facilitating macroprojects ought to avoid Washington DC (USA) and New Delhi (India). The so-called “Global Warming” macro-problem is a reprehensible example of national geoscience corrupted by centralized funding. In the USA, a community of scientists has formed centered on “Global Warming” as a public issue. Many of these scientists have been well funded for many years by the Federal Government based in Washington DC and, sadly, many of these scientists have invested years in careers that can only be prolonged by such funding—in other words, solving the macro-problem of “Global Warming” as, for instance, via Macro-engineering, is without incentive! Yet, American taxpayers do wish to find proper solutions to the perceived macro-problem! India’s taxpayers, far more than the USA’s, realize they are competing with China.\(^{27}\) India and China must currently sustain 40% of the Earth’s humans.

Edward Norton Lorenz initiated today’s Chaos Theory during 1963. He was the first meteorologist to note the sensitive dependence on initial conditions. Visually, his set of non-linear differential equations describing the flow of air in any planetary atmosphere feature a “strange attractor”, which resembles the flapping of a butterfly’s wings when animated by computer. He characterized the 1963 insight, during his 29 December 1972 speech (“Predictability: Does the Flap of a Butterfly’s Wings in Brazil set off a Tornado in Texas?”) before the American Association for the Advancement of Science in Washington DC, as the “Butterfly Effect”. Lorenz proved that, long-term, Earth’s weather could not be predicted, unlike some linear Earth process-events characterized by “Domino Theory”. Our book, Macro-engineers’ Dreams, is focused on another kind of “Butterfly Effect”: when a caterpillar changes into a lively butterfly the transformation occurs within a chrysalis. The innermost wrapping of a caterpillar’s chrysalis is known as the “knub”, and “knub” is the source for the English word “nub (or

---


core) of an argument”. In the following chapters, the nub of the global debate on human civilization’s means of coping with natural and anthropogenic global change—sometimes by utilizing Caterpillar bulldozers and other earthmoving machines—is forthrightly addressed, with new mitigation, adaptation and cure strategies presented by the authors. In other words, we intend to speak to the “sudden” and “unexpected” Earth changes threatening humanity and the planet that were dramatically announced by a cover story in the 3 April 2006 issue of the USA magazine *Time*! “Save Our Planet”, today’s weird general fossilized subjunctive Green slogan ultimately will be forgotten, made irrelevant by dynamic event-processes undertaken by Macro-engineers working diligently on Mars’ terraformation.

In some way or other—subjectively and mathematically—we will assess various geo-hazard risks intrinsic to the macroprojects proposed. Humanity’s accession to almost unlimited supplies of nuclear energy is offset by the possibility of making Earth uninhabitable, but this potential macro-problem is balanced, as humans continue to explore and exploit our Solar System, by the growing of partly quitting Earth and settling in a sustainable way elsewhere. Science has made this goal realizable because the infrastructure for Macro-engineering innovation fosters societal innovation and technical invention by making it possible to observe and measure with marvelous accuracy and timeliness.

Macro-engineering planners design “macroprojects” (or, synonymously, “megaprojects”) that represent, symbolize and cause a fundamental change in humanity’s planetary outlook. It is the sociological impression on groups of like-minded people—someday, perhaps soon, like-minded machines—that is fundamentally important to our globalized civilization endeavoring to practice Macro-engineering, regionally and worldwide. Some macroprojects are beneficial or essential infrastructures, as portrayed by B. Hayes’s *Infrastructure: A Field Guide to the Industrial Landscape* (2005); other megaprojects are harmful or conceits. Even so, some leading academic Macro-engineering authorities prefer to define this new profession and discipline in purely geographical and economic terminology: “Macro-engineering refers to the process marshalling money, materials, personnel, technology, logistics and opinion on a huge scale to carry out complex projects, often international (or “multi-national”) in nature, that last over along period of time. A macro-engineering project requires massive funding, significant manpower, large-scale equipment and tons of material. Macro-engineering projects extend the state-of-the-art of technology, may take place in difficult and sometimes hostile environments, and require sophisticated project management techniques.”

The earliest print media use of “Macro-engineering” evidently is in the 12 March 1964 *New Scientist* (Vol. 21, No. 382, at page 685). “Macro-engineering’ is a collective English term encompassing several main planning viewpoints: (1) Geoengineering which is basically focused on controlling Earth’s atmosphere according to the *Encyclopedia of Climate and Weather* (1996) edited by S.S. Schneider and (2) Terraforming. Terraforming, derived from Latin “terra”, earth, plus the English verb “form” involves civil and military engineering dedicated to make a planet more like Earth according to Martyn J. Fogg’s *Terraforming: Engineering Planetary Environments* (1995). Using only technologies known now, Mars might be made Earth-like in several thousand years. Cosmic rays and space weather will, however, be major inhibitors of man’s movement into interplanetary space, in the estimation of Barbara B. Poppe’s *Sentinels of the Sun: Forecasting Space Weather* (2006).

---

Truly insightful, rigorously systematic communications media exposes of proposed mitigation and abatement Geoengineering megaprojects affecting the Earth exclusively should be welcomed by the world-public and also the pertinent scientific professions in India and the USA since the nub of the argument about unwanted or unhelpful global change is what, if anything, ought to be done about it by humans utilizing various technologies. Oddly, “Geoengineering” made no appearance in John Maunder’s *Dictionary of Global Climate Change* (1992). Global Warming alarmists have, for years, campaigned against any technical solution to the macro-problem of climate change—except, of course, for their own sociological prescriptions that can be economically ruinous! During a single 20th Century generation, humans have visited (directly and tele-presently) all the planets known to the ancient Greeks! Macro-engineering’s basis lies in human ingenuity, individuals and groups, accurate collections of geographical facts, the efficient manufacture and manipulation of energy, planetary surface reshaping and widespread alteration of surface compositions, and the intentional movement of materials within the Solar System. Obviously, global planning’s negative aspect is its implied control over almost everything and everyone residing within the Earth-biosphere or other inhabited planets; this is comparable to the fate of spationauts confined to the International Space State and their personal, fitted spacesuits.

The presumed antiquity of mankind’s Earth-surface modifications lengthens as concerted investigations into recorded history and archaeology intensify. Thomas Gold (1920-2004) offered that biological contaminants introduced by interstellar picnickers (also known as “Aliens”) may be the cause of life here: “Thus space travelers may have visited the Earth billions of years ago and from their abandoned garbage forms of life have proliferated so that microbes will soon have another agent capable of spreading them further afield”.

Others suggest that intelligent non-Earth life forms genetically manipulated people as a routine procedure for the improvement of the biosphere! Nowadays, humans are capable of genetic manipulations that can greatly alter the planet.

There is another Macro-engineering project type, (3). Some common megaprojects do not have intended or unintended affects on the whole planet but, instead, regional or local effects only. Sometimes such megaprojects are meant as comprehensive regional “technological fixes”, a phrase coined by Alvin Martin Weinberg circa 1966; at other times, such megaprojects are desire improvements of the economic status of particular groups of people in settled long-term contact with a particular region. Our book will offer more than a few examples of such megaprojects.

Before World War II, most megaprojects were derived from the minds of a few oneiric individuals; after World War II the majority of megaprojects seem to stem or emerge from the everyday work of like-minded groups diligently working within established or nascent governmental and corporate bureaucracies. Technology’s continuing formation holds surprises for all humans—especially molecular Nanotechnology. We note—with much approval—Reyner Banham (1922-1988) who opined on 17 April 1958 that indisputable imaginative science is “one of the great mind-stretchers, specialization-smashers of our day…. It is part of the essential education of the imagination of every technologist”.

deliberate intellectual deception of the eventual payers! Financing of global and extra-terrestrial macroprojects—actually, all macroprojects—must never be finessed by dishonest promoters lest extant and predicted life-threatening macro-problems be allowed to fester and even to result in humanity’s termination! Our book attempts, however successfully or unsuccessfully in the beholder’s mind, to bring honest appraisals of some possible beneficial macroproject plans that can make Earth a better-than-today place in which to live as, simultaneously, our selected representatives of humanity and its ever-developing technologies are projected from Earth into the Solar System and its surrounding Universe, the ultimate “Environment”. Greens often proclaim themselves as “Environmentalists”. Since “environs” means the planetary landscape and seascape surrounding a geographical place, not a person, this seems quite strange to us!

The term “Geography” is commonly used with two different special scales of resolution. In the broadest sense, it is synonymous with all “Earth Science”—the study of all matter and energy as it occurs in our current “household”, planet Earth. In its narrowest sense of meaningful use, Geography is the study of accessible materials (organic, inorganic, and transuranic) of Earth’s crust, ocean and atmosphere (global Nature). Sir John Murray (1841-1914), the oceanographer, used its narrow definition (along with “biosphere”) in 1899 to denote Geography’s professional scope. The lexicographer Sir James A.H. Murray (1837-1915) stated, in A New English Dictionary on Historical Principles (1888), that “atmosphere” was first used in its near-modern sense during 1696, and that “hydrosphere” was first utilized in 1887. That same awesome dictionary’s 1933 Supplement and Bibliography gives unambiguous examples from 1887 for the term “lithosphere”. These four husk-like volumes of materials and energy are systems that influence each other along their interfaces of energy and material exchanges. A useful definition of “biosphere” might be “All parts of the Earth, above and below ground, and in its ocean and atmosphere that can support living organisms”. “Biosphere” is the most useful of these terms for present-day and future theoretical and applied geographical transformations. (Of course, the just given definition of Biosphere will change as the concept of what is “living” changes in lockstep with technology’s progress.) As of 2006, Macro-engineering remains an applied form of Geography in the Earth (planned humanization—the process-event of altering our planet’s biosphere and adapting it to the uses of its resident humans), while Terraforming is a theoretical form of Geography (normative goal-oriented planning for the future of our Solar System’s terrestrial-type planets (Mars, Venus especially).

When in the course of time words cease to be jargon (words peculiar to a particular community), then they can be said to be vernacular. “Macro-engineering” and “Terraforming” are still to be considered jargon, just like “Exobiology” (the scientific study of extra-Earth life in the Universe) and “Cryptozoology” (the study of living Earthly creatures whose existence has not yet been scientifically proved). Down-to-Earth print media mainstream publications, which are tightly edited for the public, such as New Scientist, now seems to recognize the exciting potential of Terraforming—“Terraforming” is no longer a nonce word. The ancient Greek inventor Archimedes, with a clever “thought experiment” on levers (“Give where I may stand and [with a lever] I can move the Earth”), expressed in vivid fashion a valid consequence of his theory of static forces and anticipated terraformers and others by about 2,250 years!

Only “lithosphere” denotes a unit of material and energy that is a true, if generally eccentric, spherical shape; “lithosphere”, for our purposes herein, is the Earth’s core, mantle and crust as a single unit. From about 1939 until 1969, American geographers’ formal attention to these interlocking systems was apathetic, and this decline was due to the late Richard Hartschorne’s remarkably deadening uncompetitive theory of Geography prevailing in American academia’s marketplace of ideas. Geography fared a bit better in the UK. For example, in 1981, the British Geomorphological Group (established in 1961) held an international convention focused topically on regional crustal features and their histories through Earth’s Geological Time. That conference eventuated in Mega-geomorphology (1983), which provided landscape and seascape Pleistocene and Holocene changes. Such a basic textbook was needed since all macroprojects have foundations! The 20th Century brought with it skyscrapers, subways, large bridges, tunnels and deep excavations such as thermo-nuclear bomb shelters, super-highways, heavy industrial equipment, international airports, and many other superstructures that stressed the ground beneath the city in a way that was entirely new. Proper assessment and planned use of the city’s foundation was now critical to all this Macro-engineering activity, according to Neil Parkyn’s Superstructures: The World’s Greatest Modern Structures (2004). Ground Engineering—literally—supports the infrastructure assessment, maintenance and construction role of progressive Macro-engineering. It would seem, thus, that only human invention of a device nullifying Earth’s gravity might obviously invalidate our previous statement!

Out Solar System’s boundary relative to the Universe was first accurately mapped in 1984—it is the border based on the orbital motions of our Solar System’s celestial bodies rather than the location of the Sun’s heliopause or Oort’s Cloud. By 2006, the Voyager space probe was 100 Astronomical Units from the Sun. In other words, the Anthropocosmos is increasing in volume! Few geographical textbooks yet contain extended basic discussions of non-Earth surfaces, but at least some geographers and macroengineers do think globally, using data provided by remote sensing technology. Since every map presages some kind of exploitation, it can safely be forecast that geographers will help macroengineers to transform our Earth’s crust and the uppermost parts of the lithospheres of Mars and Venus. Terraforming and Macro-engineering will provide the hard-won expertise necessary for a social macroproject to control global Nature on more than just a single Solar System planet. The early 21st Century, especially in the vicinity of India and China, promises a burst of public works spending that historians may one day compare with the initial building of our world’s railroads or the electrification of Europe and North America. Infrastructure modernization is seen as a means to speed economic unity, while some Third World public works macroprojects are often viewed as an effective tonic to create jobs and to spur foreign financial investment. Country-ecosystems with the most advanced transportation systems (harbors and airports, for example) stand to gain the most from the increase of international trade caused/fostered by globalization.

Without much question, Earth is becoming a human artifact. We live in a time when even horticulturalists and animatronics experts boldly predict that future gardens—Alien Natures of a sort—will be electronic machines (faux plants and cultivars with entirely different origins). Greens might

publicly approve of such an event-process since they could still advertise their (sometimes politically radical) organizations as advocating Homo sapiens as a low-impact gardener species. Even prior to Thomas Gold’s picnickers, some exobiologists have claimed that it is possible Earth has been visited by intelligent organisms and/or machines, Aliens from another part of the Universe. What if some non-Terran species got to Earth even before pre-man became Homo sapiens? If such Aliens did, then “our” Earth could never be a human artifact!

When the USA’s space probe Galileo approached Earth on 8 December 1990, its instruments barely detected a USA-operated scientific research station situated at the South Pole—its images revealed no other man-made features on our planet’s surface.40 If NASA’s image interpreters had not known of the polar camp’s existence, then that single poor-quality image might easily have been dismissed as a mere television vision, an error of electronic transmission. One popular pseudonymous author, George Leonard, in 1976 posited the insupposable thesis that Somebody Else is on the Moon now! A 1987 book, The Monuments of Mars: A City on the Edge of Forever, by Richard C. Hoagland, purveys the notion of long-abandoned, mountainous Alien macroprojects existing on the planet’s surface while David H. Childress’s Extraterrestrial Archaeology (1994) alleges eager-beaver Aliens constructing New York City-style Manhattans on almost every known planet in what we has assumed and hoped was our Solar System! The late 20th Century’s and early 21st Century’s zeitgeist permits the commercial merchandizing of such nonsense.41

During the 1830s, some astronomers thought Mars to be inhabited by Aliens. At that time, J.J. von Littrow (1781-1840) had urged that 32 kilometer-long canals be dug in the Sahara, filled with flammable liquid floating on water, to be ignited at night as a signal to the Martians of our presence in Earth. His canals were to form geometric patterns in the dark desert background recognizable as artificial. In 1947, the artist Isamu Noguchi (1904-1989) modeled a “Sculpture to Be Seen from Mars”, which looked like an abstract human face in topographic relief. Photographs of his proposed artwork maquette are eerily like the discredited Face on Mars first spotted at Cydonia during 1976 by NASA’s Viking 1. The Face on Mars was “defaced” in 1998 by subsequent NASA images. Like the “Man in the Moon”, the “Face on Mars” was a pareidolia, a fanciful perception of pattern in something that is actually ambiguous or random. Since the 1960s humans have had certain data that Martian canals are not visible on Mars’s crust. Today’s Mars atmosphere is so tenuous no unencapsulated human could there survive. Despite some oddballs and pseudo-scientist’s assertions, we are satisfied to think of Homo sapiens as a cosmopolite of one global Nature—Earth’s!

Geoscientists distinguish about seven major man-instigated alterative operations performable on a known planet of our Universe: (1) transform mass into energy; (2) move mass and energy in ocean/crust/atmosphere; (3) subtract mass and energy from a planet; (4) add mass and energy to a planet; (5) demolition of a planet; (6) create a planet by combining discrete solid masses or by mining the Sun’s plasma for mass—mining the Sun’s particle emanation results in the ultimate “particulate region”, an artificial planet;42 (7) move a planet. To date, Mankind—possibly Mindkind’s purely organic precursor—may only have options listed as performances (1) through (4). Indubitably, people

---

and/or their descendents will someday perform alterations (5) through (7). These three available options are not mere ultra-modernistic Space Age chatter. They are true, feasible-in-the-future industrial actions—if our technological capabilities continue to increase.

Post-20th Century people plan achievements that will far surpass our Earthly global Nature’s results owing to the Hydrologic Cycle: aerospace macroengineers intent to mine the Earth’s atmosphere via air-scooping propulsion system such as scramjets for aircraft and spacecraft. Meanwhile, miners have already completed a large-scale Earth-crust lowering beneath a major urban international river in Germany.⁴³ One architect in France has proposed an urban utopia for Parisians. Paul Maymont’s “City Under the Seine Project” (1962) design for 21st Century Paris shows fifteen or more levels of human use underlain by a concentrated pipe network of services. Humanity’s ever-expanding Earth-biosphere impacts are so pervasive and penetrating that living species can no longer be considered the only units of Earthly global Nature that are properly to be considered as evolving. Indeed, in 1969, an American geologist suggested a new term, clearly suggesting a phase transition, to indicate evolving Holocene geologic event-processes: “A look at a few events suggests that some changes in environment wrought by geologic evolution in turn have brought about new geologic processes that have made new changes in Earth. Brief examples: Earth, if it was at one time too hot to have liquid water, at that time had no erosion by running water or waves; until temperatures dropped below freezing there was no frost action; in time when there were no plants, weathering of rocks was probably accomplished principally by water, but later, weathering of some rocks was greatly accelerated by the arrival of land plants and their resultant humic acid. This idea of evolution of geologic processes—that some geologic changes foster new geologic processes that in turn bring about new change…is worthy of a new term, Geoevolutionism.”⁴⁴ In 1978, geographers commenced investigating hypothetical Earth-worlds.⁴⁵

What about hypothetical non-worlds? There are several means by which Earth’s Geological Time could be suddenly terminated and, if all the planets of our Solar System were dealt with similarly, then Astronomical Time for our region of the Milky Way Galaxy could be halted artificially.⁴⁶ Planetary demolitions would be the epoch of mankind’s “Age of Life in Space” (Dosmozoicum). It is quite possible that Earth’s biosphere or future robospheres will be dispersed, recycled industrially, and formed into a Dyson Sphere—see Chapter 9. A postulated man-made or mind-made Dyson Sphere here could be characterized as a manifestation of Harry Donald Goode’s “Geoevolutionism”! All too commonly, geoscience’s operational weltanschauung is often that set of systematically self-constrained statements—supposedly of experimentally and observationally confirmed knowledge—considered, for the moment, much too expensive to change; technology is the performance of a scientific competence. At the moment, Macro-engineering starts with human desire, which is subsequently reduced to a solvable macroproject concept. Current infrastructures are testaments to humanity’s still emerging delight with mastery of structure at all spatial scales—with molecular Nanotechnology the lowest end of that spatial scale. Some Green advocates have announced their belief—it cannot be a thought—that to deform God’s planets with virtually any kind of technology is to present Him to humanity as the ineffectual governor of something not really His own; anthropic fragmentation of His planets does not have such result when something is built subsequently. The Solar System, shattered by intention, could

---

be set free from its speculated bondage of certain future decay owing to the Sun’s aging. A 19th Century UK economist, William Stanley Jevons (1835-1882) propounded a theory of the national trade cycle based on Sun spot fluctuations. Would a Dyson Sphere—see Chapter 9—be influenced by cyclical star-generated radiation?

Too, some Greens deride humans as “Stone Age minds in Stone Age bodies”—that is, Homo sapiens is genetically unprepared for impending Earth-saving or life-preservation tasks; yet, these same Greens desire to disallow any public consideration of human genetic improvement, even after the Human Genome Project’s recent completion. Since we are thinkers—honest persons who confess a lack of complete mental adjustment to Earth—we admit the irrefutably direct precursor to all global contamination and pollution, solid litter from stone-flaking industry, is an indicator/symptom of Homo Sapiens’s Paleolithic Period technology. Macroengineers must never suppress the human imagination. Picture a real solution to Earth’s Global Warming: if Macro-engineering converted all of the Earth-atmosphere’s carbon dioxide gas into an Anthropic Rock via molecular Nanotechnology, it should form a friable global stratum ~2.5 mm thick; by contrast the infamous natural K-T boundary—that is, the global clay layer between the more recent Tertiary and the earlier Cretaceous—is about 12 mm thick. Extraction from air of all carbon dioxide would, inevitably, kill all green plants! Hence, the macroproject does not have our endorsement!

Over the centuries, humans have built many large edifices and transportation systems; more such macro-engineered things are going to be constructed as additions to humanity’s extant infrastructure, despite the harsh negative criticisms coming from anti-industrial reactionaries such as radical Greens. Homo Sapiens’s biggest existing machine is the global telecommunications network. When any of us uses a telephone, we are programming the world’s telephone network. And, since the 1990s, the Internet has grown to equal and surpass the telephone network. The combined global telecommunications network makes it possible to access computers, both public and private, from any place in the Earth, and even from outer space. All actively reporting Solar System space probes should also be included as part of our interplanetary and interstellar telecommunications network. Because of real-time reporting satellites that are accessible at Google Earth, Mankind truly lives in the “Pantopicon” imagined by Jeremy Bentham (1748-1832)!

Because of the computer, visualization has emerged as a distinctive new discipline. Georges Seurat (1859-1891), using a unique painting technique, painted on canvas a pure Nature, free of the “noise” instigated by the human presence and he depicted illusion too.47 For good or evil, visualization experts able to place pixels willfully could become geopolitical image-makers, contriving digital electronic doppelgangers (maps, images)! Because any television monitor that refreshes the visible display at a rate faster than one-fifteenth of a second gives flicker-free and stable images to all sighted humans and also, in part, because real-time computer operates in very tiny units of time—each nanosecond equals a billionth of a second. Falsifiers of “ground truth” could rather easily become docile governmental and corporate employees. Imagine, if you will, elitist television programmers, who are optimistic about the decision-making ability of specially trained elites, designing public presentations to appeal to a mass audience. Electronic experts, lacking optimism about the average person’s ability to make decisions about his/her own life, could play with remote sensor readouts to deceive the sober as well as the half-pixilated. Television cartography led to the topographic and geologic mapping of Mars’ 145,000,000 square kilometer ocean-less surface with data from Viking sensors alone—a first in Cartography’s

47 George F. Jinks, “‘Pointillism’ as Cartographic Technique”, The Professional Geographer, 5, 4-6 (September 1953).
During the mid-1960s, few geographers anywhere could share the vision of a futuristic space-based electronic observation and control system proposed by Boris Borisovich Rodoman. About 1952, he became zealously interested in the logical and cartographical aspects of surveying; and from 1960, Rodoman developed a wider knowledge of theoretical Geography and ecology. During 1986, R.B. Cathcart noted the potential of Rodoman’s call for the development of an Earth satellite constellation of automation of biosphere-wide rationalization of regional economy-ecosystems. Rodoman’s system of data fusion, with the ultimate goal of proceeding from mere “news-casting” to “now-casting”, even today could do little more than produce harmony of integrated yardmasters that take apart or assemble railroad trains and to maintain railroad classification yards in real-time. (Rodoman specifically mentioned rail yards because it was the national railroads which first coordinated space, time, matter and persons in the way we now consider normal and necessary: a timetable for every event-process, a name and/or number bar code for every transported and stored physical object, a common computer clock for all.) There is also the potential for air-traffic control, natural resources management, gathering of news and globalized “electronic brainstorming”. Fully developed, all of Earth’s many real environmental macro-problems could be addressed by geographers and macroengineers in India and the USA who possessed real-time information; consumers worldwide would have rapid access to Earth-biosphere data in digital form for their immediate use with the existence of passive and active devices stowed aboard Rodoman-inspired Earth-orbiting satellites. Through a chain of microwave relay and deciphering telecommunications networks, which would have the capacity to convey satellite-derived tell-tale data within a minute of first being acquired to any authorized agency, company or individual. Though designed and assembled for a different purpose, the USA’s Missile Defense Agency, established by the National Missile Defense of 1999 (Public Law 106-38), has nearly perfected some of the equipment a Rodoman facility might utilize to carry out its postulated mission. India and other states may find this availability of technology to be very timely.

Rodoman foresaw a kind of “simultaneous” modeling (or data fusion) of Earth’s atmosphere, ocean and landscape cast on huge video displays—the “Big Picture” viewpoint—in Biosphere Management Centers. This implies a lessening of state-centered international relations and an emergence of a space-based system of non-territorial central guidance and communitarian organization. At the International Exposition in Tsukuba Science City, during 1985, the Sony Corporation erected its “Jumbotron”, a color television monitor with a screen that measured 25 meters high by 40 meters wide, consisting of 150,000 luminescent pixel elements. Updated technology for Jumbotron-like monitors would surely be adaptable to Rodomanian Electronic Geography! It is also possible to replace television images with the result of computer calculations and manipulations—in other words, the end product of Virtual Reality research. “Virtual Reality”, a term coined by Myron Krueger in 1983, is an oxymoron. Probably it was Krueger’s intention to indicate the completeness of his electronically-created and manipulated “reality”. (“Artificial Reality “is a synonym.) In effect, Virtual (or Artificial) Realities and Cyberspace give humans more “space” in which to conduct economic and social affairs, “space” unlimited by the physicality of our Earth’s biosphere but limited by the characteristics imparted by prevalent technologies. Geographers were tardy in first recognizing that television might be a place.

then they were tardy in realizing that one of the biggest shocks Virtual Reality gives to humans is its sudden absence—that is, a surprising return to physical reality.

From managerial facilities established along Rodoman’s suggested lines, Homo sapiens could control through complex programming all of human significance that transpires at human behest within the largest Earth region—to wit, its planetary biosphere, which is becoming an Earth-robosphere! Data bytes are actually a recordation of our presence in Earth’s biosphere; remotely sensed data are manipulable in computers, producing static and dynamic images of our global homeland. More persons see maps on satellite broadcast and fiber-optic cable television than any other type of cartographical presentation, which means that today’s world population is, in a sense, “pre-adapted” to Rodomanian modes of visual display and interpretation.

William Morris Davis (1850-1934), a leading figure in professional Geography in the USA, examined some aspects of Comparative planetography. In his *Elementary Meteorology* (1894), Davis (at page 120) suggested that the Solar System’s fluid giants be studied to determine the influence of axial tilt upon planetary wind patterns: “We shall not fully appreciate the special features of the winds of our planet until the peculiarities by which they are distinguished from the Jovian and Uranian winds are clearly perceived.” [From 16 until 22 July 1994, more than 21 large fragments of periodic comet Shoemaker-Levy 9 struck Jupiter and visibly altered the pre-existing Jovian wind patterns!] Weather and climate forecasters have long sought an accurate and useful computer model of Earth’s atmosphere. During 1922, Lewis Fry Richardson (1881-1953) proposed to predict Earth’s atmospheric changes via parallel computation using 64,000 human mathematicians and to plot their findings on a forecaster enveloping Rodoman-style world map that can only be called a regionalized electronic georama, or a “womb with a view” perhaps? At the opposite end of the objective dimensional scale J. Andrew Ross proposed a 64 centimeter-diameter schoolroom/home “Globall Hyperatlas”, which he offered in 1991 and which we have adopted to signify Chapter 2 of this book. Although Ross’s “Globall Hyperatlas” is not yet extant, researchers are gradually developing the technologies required. Meanwhile, “Science on a Sphere”, invented by National Oceanic and Atmospheric Administration meteorologist Alexander E. MacDonald in 1995, has been developed and deployed by the Earth System Research Laboratory in Boulder, Colorado (USA). Essentially the “Science on a Sphere” instrument is consists of a suspended white colored 1.8 meter-diameter fiberglass ball on which four or five video projectors cast their images of Earth, Jupiter or any other imaged Solar System planet so that the viewers in the room will apprehend the spherical object as if they were 22,000 above. “Science on a Sphere” installations cost about $USA 180,000 and are being subsidized by the US Government. “Globall Hyperatlas” R&D will surely attain success long before molecular Nanotechnology becomes a dominant factor. In 1965, Ivan Sutherland defined “The Ultimate Display”, in *Proceedings of the International Federation of Information Processing Congress* (1965, pages 506-508) as a “room within which the computer can control the existence of matter”! (Only a perfected molecular Nanotechnology could accomplish what Sutherland wished.)

Foreseeably, humanity’s Earthly infrastructure will be operated by automatons, providing material means to ameliorate social problems and even perfecting robotic and human civilizations. The single most important advantage that automatons will have over humans is that their movements will be

---


spatially limitless—super-mantle conditions and conditions in what we still provincially term “outer space” just won’t matter very much. Barriers like the tropopause, which humans first passed through before World War II, would be insignificant to robots. Robots could form a network of thinkers and doers that would make virtually all macroprojects and terraformation possible. Robots could cause a moral dilemma as profound as slavery did in the 19th Century and, as well, become Homo sapiens’ rival for control of the Earth! Science converts speculation into technology. Extending Sutherland’s desire to the world outside of a room, molecular Nanotechnology could make “planned obsoleteness” of consumer products impossible and all future manufacturing and construction could be, effectively, a matter of software programming!

Arthur Charles Clarke’s *Exploration of Space* (1951) defined “planetary engineering”—like Macro-engineering, an umbrella term for geengineering and terraforming—as “the reshaping of other worlds to suit human needs”. Theoretically and spatially, Macro-engineering encompasses global Nature. The risk of failure is part of the human condition. In arguably our world’s first global environmental impact statement, *The Earth as Modified by Human Action* (1874), George Perkins Marsh wondered if the heights of Europe’s Alps would one day be reduced, diminished to gentle slopes for use by farmers and shepherds by a technically proficient European noosystem. Even a casual glance at the Expressionist plans and artworks of Bruno Taut (1880-1938), especially his truly astounding 1919 urban engineering book, *Alpine Architecture*, gives crystal-clear intimation of parenting Macro-engineering, at least contemporaneously with the organization of Macro-Economics. Not intimidated by the RMS “Titanic” sinking, post-April 1912 Expressionists architects thrived in Germany, Switzerland and the Netherlands. Structurally, beyond the scale of mere buildings and citified collections of assorted roofed structures, some Expressionists considered Earth’s crust to be an object of their contemplation and vigorous sculptural effort! In their view, our Earth’s crust was to become a single industrial region: “Engineering is to fertilize, architecture to glorify the Earth. The program is continental, even planetary”.53 The Netherlands, which expressed the national will via its Zuider Zee Works Act on 14 June 1916, undertook the largest stand-alone reclamation scheme yet attempted in Europe (started during 1923 and largely completed by 28 May 1932), which features many examples of Expressionistic exercise. The Zuider Zee, formed circa AD 1200, was reclaimed under a macroproject plan devised mostly by Cornelis Lely (1854-1929). And, the Netherlands’ Delta Project completed in 1997 is designed to weather the globe’s expected global sea level rise caused by anthropogenic climate changes—the world’s first macroproject planned with that predicted macro-problem in mind, according to *Designed for Dry Feet: Flood Protection and Land Reclamation in the Netherlands* (2006) by Robert Hoeksema, since 27% of that nation-ecosystem already lies below mean sea level!

During 1966, the little-known macroproject historian Igor Ivanovich Adabashev recounted more recent personalities and other macroprojects in *Global Engineering*. Apparently, Adabashev was excited by “The Great Stalin Plan for the Transformation of Nature” endorsed by Joseph Stalin (1879-1953) during the late-1940s and, subsequently, the geographical writings of Innokentiy Petrovich Gerasimov and his like-minded colleagues.54

Unfortunately, few American and Indian geographers are today directly linked with any building projects of great magnitude. Big rearrangements of Earth’s geography are not really popular with the public in either the USA or India. Rodoman Biosphere Management Centers in India and the USA

---

could efficiently and economically direct interactions in real-time—that is, “live”—in a form of omnipresence. Humans, field robots could form a, more or less, Pax Consortia condition of life, fostered by rapid advance in military technology as, for example, anti-ballistic missile defenses. Every noosystem should be protected from attack by aerospace warplanes, aerodynamic missiles and long-range ballistic missiles. When two ecosystem-nations have a joint interest in avoiding mutually undesired events (such as general nuclear war and third part terrorists armed with weapons of mass destruction) that would or may result from their separate unilateral actions, or when joint action offers benefits more delightful than sub-optimal outcomes attainable from independent unilateral actions, it is in the two nations self-interest to agree upon a control regime to avoid such costly dilemmas.

Although video-conferencing has obviated any necessity for great numbers of people to travel long distances by jet aircraft, macroengineers are nevertheless harnessing old and designing new technologies in order to build safe supersonic transports for the long-distance and international commerce carriers. In addition, of course, is the on-going R&D for scramjet aerospace planes. Soon to be a direct result of these aircraft and aerospace plane macroprojects is a planet-sized headache—the global air traffic management macro-problem! There is an obvious need for an internationally owned and operated Aerospace Controlled Traffic System (ACTS) superstructure capable of defending every ecosystem-nation. Perhaps the superstructure could be named “Rodoman-ALPS” with ALPS signifying “accidental launch protection system”? Rodoman-ALPS would be a globalized rented facility, paid for by low-cost national subscriptions. With the emplacement of Rodoman-ALPS, no country, multi-national corporation or macroproject could be blackmailed. Providing a computer track file’s indisputable proof of culpability should an attack or accidental launch ever take place would be a main task of Rodoman-ALPS. Since 2004, the USA’s Missile Defense Agency has made agreements with European and Asian nations to help create an International Missile Defense System before 2015 AD. There are, as of mid-2006, at least 25 nations that possess ballistic missiles. Rodoman-ALPS may even, someday, become configured to provide some useful warning to Earthlings of the approach of dangerous space debris (small asteroids and large pieces of rocket rubbish). Like “integrated battlefield”, “sphere of influence” is one of those infrequent linguistic acknowledgments of the tri-dimensionality of our global Nature. Humanity is still bereft of interplanetary space habitats or terraformed households. In effect, Rodoman-ALPS would enclose Earth in a kind of safe deposit vault.

During World War II, William T.R. Fox (1912-1988) coined the term “Superpower”: “There will be ‘world powers’ and ‘regional powers’. These world powers we shall call ‘super-powers’ in order to distinguish them from the other powers...whose interests are great in only a single theatre of power conflict”\(^{55}\) The USA first became a Superpower at the end of World War II, while India will become a Superpower sometime during the 21\(^{st}\) Century.\(^{56}\) In brief, Rodoman-ALPS would help skilled people to properly manage risks by maintaining geopolitical stability (with added safeguard against misinformation, disinformation, and misjudgment). At its operational commencement, Rodoman-ALPS might be a Superpower monopolium but is would not always be so. It would soon be a shared facility, just like future nuclear fusion reactor technology and the technology of automatons.

We find it very difficult to imagine the economic impact on India’s low-cost labor when manufacturing robots become widespread; people will simply have to do something else with their time and to earn or make a living in another fashion! During late October 2004 at the United Nations Economic

---


Commission for Europe (ECE) conference “A Robot in Every Home?”, the *World Robotics 2004* report, jointly produced by ECE and the International Federation of Robotics, was presented; the report confirms that the prices of robots in proportion to human labor costs has declined from 100 in 1990 to 12 (by 2004). The report documented only macroscopic robots, and ignored unproven microscopic robots (potentially useable molecular Nanotechnology devices) that may revolutionize element separation industrial applications such as Earth-biosphere resource extraction, purification of all kinds of wastes and general anti-pollution efforts.

Toward the close of the 19th Century, a Russian geographer, Peter Kropotkin (1842-1921), said “A study of [global] nature without man is the last tribute paid by modern scientists to their previous scholastic education”. Since ethical geopoliticians should decide where things ought to be located in the Earth, Geography and Macro-engineering practitioners should be mindful of mankind’s basic needs. Ossified academics and vainglorious editors of Geography’s unpopular professional periodicals must step aside, allowing future pleas for peaceful co-existence among contending human and machine noosystems (mankind/mindkind) on a global geographical scale. Mutual understanding amongst our world’s multifarious noosystems will be the most important task that thinkers face during the 21st Century. A mechanical mindkind would always remain inferior to God-created mankind, just as Homo sapiens is superior to all other Earth-biosphere organisms. Indeed, it would seem reasonable for people to expect that a future Earth co-tenancy would, thereby, prevent a human species-wide anomie! Ancient humans practiced transhumance (nomadism). Will future members of our species become transhuman, subsequently associating with contemplative robots and extraterrestrial Aliens? Will all exist under a Pax Scientifica? Space is the Universe, minus “Spaceship Earth”.

---

58 Claes Ramel, “Man as a Biological Species”, *Ambio*, 21, 75-78 (February 1992).
Chapter 3

EARTH’S SOCIETAL CORE MACROPROJECTS

A most fundamental environmental change is the well-reported carbon dioxide buildup in the Earth’s atmosphere caused by industrial use of exhumed fossil fuels (coal and petroleum), vegetation clearance and agriculture.\(^{59}\) Often overlooked, however, are the cyclical atmospheric changes caused directly by the Sun’s variable energy output. It is possible that what global climate degradation alarmists are presently mistaking for global warming induced by enhanced greenhouse gas concentrations is really a normal manifestation of the Sun’s variability. During Solar Cycle 25, peaking around AD 2022, a major subsequent solar energy output decline is forecast between 2035 and 2045, making a “grand minimum” like the Maunder Minimum of 1650-1700 possible. All current climate models are demonstrably deficient in that they do not properly simulate the recorded behavior of the upper ocean and the lower atmosphere. Known solar cycles seem far more likely to occur than numerical readouts from bad climate models!

“In planning the technological marvels of tomorrow, even the geographical future cannot be taken completely for granted.”\(^{60}\) Worldwide, famous ecologists view this event-process from opposing perspectives—quite naturally their views are polarized around a “hot” topic! Some correlate man’s Industrial Revolution with the marked increase of Earth’s human population, maintaining it is a destructive event-process. On the other hand, some say that Earth’s carbon dioxide gas buildup injects energy into our planet’s biosphere (CO\(_2\) Fertilization), thereby opening new opportunities for organic evolution, which is arguably a constructive event-process! Too much carbon dioxide in the air would stimulate a panting reaction in humans and a concentration of the gas in excess of normal (0.03%, equivalent to a partial pressure of 0.23 millimeters of mercury), above 7.0 millimeters of mercury, would cause narcosis. Relentlessly logical terraformers might teach that a predicted extreme buildup could be considered as an event-process favorable to their promotion of planet-altering schemes since—by prospective 21\(^{st}\) Century active migrants only—Mars would be seen as an aspiration region! Rephrased, terraformers might believe that Earth’s anthropogenic Greenhouse Effect is beneficial, or at least stimulating, to future autonomous Mars investments!

Some green plants do thrive in enriched aerial carbon dioxide, so an artificial Earth-atmosphere buildup could help to solve food and fiber shortages. Certainly, an overheating of the Earth’s air—from any cause—causing a mega-Greenhouse Effect, could instigate a significant cause of involuntary birth control not requiring any act of individual willpower by sexually active normal adult humans. Via thermal effects upon maternal core-skin blood flow critical to the survival and normal development of embryos, a mega-Greenhouse Effect (unmitigated by air-conditioning technology) may reduce the flow of blood to the uterine tract and kills mammal embryos.\(^{61}\) This factor would be prevalent, especially, in the Third World but First and Second World populations may also be triggered to collapse, reducing the Earth-biosphere’s ecosystem load further! Such thoughts are fodder for geopolitical Think Tank intellectuals, the staffs of government agencies and others.

It must be noticed, certainly, that policy decision-makers and macroengineers have markedly different perspectives about building and destroying. Geopoliticians, for example, seek approval of their

---

\(^{59}\) R. DeFries and L. Bounoua, “Consequences of land use change for ecosystem services: A future unlike the past”, GeoJournal, 61, 345-351 (December 2004).


superiors (in, say, New Delhi and Washington DC). But elected and appointed policy implementers are involved mainly with near-term future process-events in a global context with fast-paced (sometimes “crisis management”) deductive thinking producing predictable insights expressed in simple language for “best solution” outcomes under prevailing circumstances. Macroengineers, on the other hand, desire the respect of their peers, deal chiefly with mid- and long-term future events in regional contexts resulting in well-considered inductive thinking composed of original insights communicated in abstract language in “multi-possibilities” reports to politicians and geopoliticians. More simply stated, consulting geopoliticians are hired to plan solutions for extra-territorial noosystemic macro-problems as they affect an ecosystem-country’s survival. Macroengineers are employed to construct regional infrastructures, enmeshing their localized public works with known planet-wide geographical ground truth and Ground Engineering and many affected nation-ecosystem economies. A means to unite these geosophical differences is obvious—a fusion of the teaching of decision-makers with that of Macro-engineering and Geography. In Europe, the Candida Oancea Institute in Bucharest, Romania has offered geosophical fusion since 1997, while in the USA, the Center for Macro Projects and Diplomacy (founded 2003) at Roger Williams University in Bristol, Rhode Island helps to bridge the social connectivity gap between Europe and Asia, where Japan, China and India are leading the advancement of Macro-engineering. Macroengineers in India, as well as worldwide, will monitor the 500 billion rupee Mumbai Metro, a network of elevated and underground rail routes nearly 110 kilometers in length upon which construction commenced in 2006 using the “Project Monitor: India’s First Newspaper on Projects” (GOTO: http://www.projectsmonitor.com/index.asp).

Unprejudiced global monitoring organizations, such as our suggested Rodoman-ALPS establishment, will have considerable impact and might even lend some credibility to that hoary buzz phrase, “sustainable global development”, which was coined by Lester Brown in Building a Sustainable Society (1981). (The world’s oldest ecological-agricultural experiment, at The Park Grass Experiment at the Rothamsted Research at Hertfordshire was begun in 1856 to test the effect of fertilizers on UK manures and hay yields.) No meaningful definition of “sustainable” exists, nevertheless its users seem to imply that terraformation of other planets will never be attempted, or if tried, will prove to be unsuccessful. However, when Homo sapiens learned to harness energy and to transform matter, the Earth and other places (Mars and Venus, for instance) became pregnant with new Earths. Brown’s “sustainability” is a synonym for technology’s stagnation and, possibly, regression. The charm of planetary engineering, Terraforming, potential was first brought to the world-public’s attention via James Edward Oberg’s New Earths: Restructuring Earth and Other Planets (1981). With worldwide telecommunications satellites now emplaced, the Holy Grail of Marketing—global advertising—is an everyday reality. Joseph A. Schrumpeter (1883-1950), an economist basing his global economic forecasts on the long-term fluctuations of our biosphere’s “human economy” (N.D. Kondratieff’s cycles), predicted that organizational and technical innovations would periodically rejuvenate globalized corporations. The computer and electronics industries have grown enormously since about 1940, and many brands are now known everywhere thanks to advertising. Schrumpeter’s periods were usually about half a century in duration. It is to be expected that Earth’s late 21st Century populace will come to recognize another Schrumpeterian epoch? Will 21st Century robots form trading cartels on humanly under-populated harsh desert abodes such as Mars and Venus capable of fierce competition with Earth-bound industries, or those operating inside interplanetary Space Habitats? Will future Mars and Venus-based robots adopt a technology transfer policy—that is, making available technological expertise and hardware by those robots who possess it to those humans who do not? Will mindkind use advertisements to entice purchases or barter deals with mankind? Molecular

Nanotechnology will force people to modify their understanding of traditional moral and geophilosophical questions, including the working definition of and value attached to such presumptively non-Homo sapiens concepts as “animal” and “machine”. For Earthlings, it is likely factor and field robots will cause legislation to protect human workers from “unfair” competition because robots do not earn taxable wages or salaries! If, say, populous India, with but 30% of the areal footprint of the USA, fell behind technologically in the invention of practical productive robots, it may have to enforce stringent import laws against low-cost robots and robot-made products in order to maintain some semblance of a stable social milieu.

Approximately 20% (or 29.2 million square kilometers) of Earth’s land surface is classified as arid and about 50% of Earth’s land is water-limited. Discontinuously covering the islands and continents, deserts are the present-day homelands of a scant few persons. In 1980 David Noel made an ingenious suggestion for the collection of freshwater from rainfall occurring over the ocean, which would then be conveyed to water-short land regions. Irrigated lands account for but 2% of the land surface today, yet these regions produce 40% of global food production. Unquestionably, deployment of such an infrastructure, a kind of diaphanous Architecture simulating marine surface films, would pit Earth’s ecofundamentalists against all technofanatics! Still, those of us tentatively occupying the middle ground might find investment in this invention economically attractive. The mean annual oceanic precipitation (between 65° North and 60° South latitude) is about 93 centimeters. Noel proposed a special kind of huge, lily pad-like buoyant collector composed of plastic that would be spread over the ocean’s surface where current climatic regimes produce harvestable rainfall. His device could well prove to be a quite practical floating “collection plate” in the future because, so far, over land cloud chemical treatments for increasing precipitation have been ineffectively sporadic. Earlier, land-based plastic material fresh water distributors had been research thoroughly. For instance, Francisco Alcalde Pacero (1941-2004), speaking only of overland transportation of great quantities of fresh water, opted for gigantic self-rolling water bags. A sea-going blimp analogue—that is, a kilometer-long, 10 meter-diameter, sausage-shaped plastic pod—to serve as a container for enormous quantities of fresh water can connect Noel’s collector with Pacero’s distributor. AD 2005 until 2010 if the UN Organization’s designated “International Decade for Water”. India will need more freshwater after AD 2020 since by then consumer demand will exceed all present-day sources of supply. A single towable pod, with 1,000,000 cubic meters volume could supply the fresh water requirements of 50,000 families annually; 1869 freshwater pods holding one cubic kilometer each would equal the total yearly discharge of all rivers in India! Try to imagine ocean-going pods offloaded by Pacero’s fresh water juggernauts that then regularly fill the many artificial reservoirs in the Madurai-Ramanathapuram tank landscape of southeastern India, near Palk Bay and the Gulf of Mannar. Groundwater in that region is over-exploited and replenishment and substitute sources of fresh water are much needed by the region’s residents. As Gavin Weightman documents in The Frozen-Water Trade (2003), ice-blocks cut from northeastern USA lakes during wintertime were exported to India during the 1800s! Keeping the tanks of southeastern India always filled with fresh water via an interlocked fresh water transportation system requires the investigations of a Think Tank.

---

63 D. Noel, “Fresh Water From the Sea”, Speculations in Science and Technology, 3, 222-223 (June 1980).
American hydrologists claim increasing concern about the future availability of fresh water supplies for Southern California. During 1979, geologists found a young crustal fault beneath the strategic O’Neil Forebay Dam in Central California’s Merced County; catastrophic rupture of this barrier could result in an immediate reduction by 90% of fresh water deliveries to the State Water Project (built 1960-1971) which, together with the Central Valley Project (built 1930s to 1951), furnishes Southern California Metropolitan Water District (establish 1928) with more than 50% of its distributable fresh water. Southern California’s infamous determined efforts to acquire a reliable fresh water supply via transport from fresh water sources to that semi-desert region are legendary. To satiate Southern California’s consumer fresh water demand, even the deliberate movement of Antarctica’s icebergs has been considered. Nowadays, there is no expectation of building new aqueducts and the region’s population is increasing, pressuring water supply bureaucracies to devise new ways of using existing fresh water resources. For the Metropolitan Water District, a key to meeting these needs lies in its attempts to store more fresh water during California’s “wet years”. Fresh water filled floating plastic pods, securely anchored offshore, could provide additional storage capacity. It is even possible to suppose such sea bottom-secured pods will form an effective barrier to tsunamis and storm waves before landfall.

Practical investigation of various aspects of blimp-like fresh water transports has shown that strained, treated and untreated drinking water could, thus, be moved from sites of supply to wherever needed by coastal consumers willing to pay prices required to cover costs plus modest profits. Also, minimally processed urban sewage from coastal cities could be removed elsewhere by dedicated pods for subsequent dumping, dispersed over extensive and appropriate ocean zones. A globalized system of pickups and deliveries—one or more multi-national corporations, perhaps, or a yet-to-be-established UN Organization agency—could holistically plan us of Earth’s ocean. Many local or regional fresh water supply management teams currently have technical staff that lack practical understanding or experience of an extremely stressful high seas work place, nor have they yet devised appropriately engineered equipment to withstand the rigors of the ocean environment. Such Macro-engineering concepts outlined above might well be identified as future core projects, multi-national corporations and international political organizations will need to be wisely advised by a professionalized elite, combining the skills of Geography and Civil/Military Engineering, in order to arrive safely at a terminus of decision-making processes with the most cost-effective, least Earth-biosphere damaging solutions (macroprojects).

Since 1977, Macro-engineering professional symposiums have been included, occasionally, in the annual meetings of the American Society for the Advancement of Science, the same year as the UNO convened two conferences: the Conference on Desertification, held in Africa, and the World Water Conference, held in South America. In majority, those AAAS Symposia were focused on a formulation of management systems for macroprojects, considering particular plans. However, it was not until March 1988, in a RAND Corporation booklet, “Understanding the Outcomes of Mega-Projects: A Quantitative Analysis of Very Large Civilian Projects” (RAND/R-3560-PSSP) by Edward W. Merrow, with Lorraine McDonnell and R. Yilmaz Arguden, that a systematic empirical economic analysis of costs, problems and operations of built macroprojects was published! The report authors concluded that of the numerous finished macroprojects reviewed “most…met their performance goals; many met their schedule goals; few met their cost goals”. (“Time” is a near-obsession with many people today. According to the 11th Edition of the Concise Oxford English Dictionary, “time” leads a list of the 25 most used nouns in 2006, followed by “person”, “year”, “way”, “day” and “thing”.) The RAND study of 1988 was not carried further until two books were published in 2003: Mega-projects: The Changing Politics of Urban Public Investment, by Alan Altshuler an David Luberoff, and Megaprojects and Risk: An Anatomy of Ambition by Bent Flyvbjerg, Nils Bruzelius and Werner
Rothengatter. Obviously, Macro-engineering is still an immature profession and badly needs good teaching literature or it will be saddled with James E. Oberg’s definition (at page 270 in his 1981 book): “MACRO-ENGINEERING—Creation of giant projects lasting for decades and costing appreciable fractions of a society’s gross national product; in general, they are not practical but serve some social, religious, psychological, or other purpose.” Macroengineers are peacefully poaching on the traditional disciplines of History and Science—the word “scientist” first appeared only in 1840 and was coined as a contrast to “artist”—to achieve a workable professional discipline and successful profession.

Macroengineers are often perplexed by the wide variety of macroproject studies conducted and the spread of Indian rupee/USA dollar amounts in financial estimates. Many technically useful sources date back several decades. How does a modern researcher reconcile the equivalent worth in 2006 currency? The Internet, via Google, offers many websites featuring inflation calculators. It must be recalled that “miscalculation or sheer ignorance of cost and difficulties was the key to launching a number of great and successful enterprises, from canals and railroads to mining and manufacture.”

For these macroprojects to ultimately be called successes “there must have been an underestimate of demand at least equal to the underestimate of costs”. The USA’s Erie Canal was one such macroproject, according to Peter L. Berstein’s *Wedding of the Water: The Erie Canal and the Making of a Great Country* (2005).

At the 1977 AAAS meeting, Robert M. Salter presented a thorough outline of his extremely rapid underground rail transportation system, which he calls “Planetran”. Supporting his Planetran study conclusions with basic mathematics, Salter envisioned an intercontinental subway system consisting of vehicles traveling thousands of kilometers per hour, serving only Earth’s Northern Hemisphere. Curiously, however, he failed to acknowledge two previous scientific contributions—Lawrence Knight Edwards had published total macro-engineering studies of a similar gravity-powered system during August 1965 in *Scientific American*. Neither the American Underground-Space Association (founded 1976) nor the Underground Construction Research Council (established 1970) endorsed Salter’s Planetran. The retired-from-service Concorde SSTs were first tested in 1968. Post-Concorde aerospace scramjets are still in the R&D phase of development as are trains that follow a surface network of magnetic-levitation tracks make a costly subterranean Planetran extremely problematical. Planetran, as now sketched out, would move passengers and freight on a single route connecting North America-Russia-Europe, linked by an 86 kilometer-long submarine tunnel across the Bering Strait. James A. Oliver edited *The Bering Strait Project Symposium* (2004). It is a book that outlines macroproject plans for a tunnel or a bridge. According to Salter, a branch line could serve Japan. Salter’s tunnel vision caused him to exclude China and India from the Planetran system and Earth’s Southern Hemisphere population would not receive service by Planetran either. Salter had rather inaccurately called his Planetran system “transplanetary”! Such careless promotion raises images of an absurdly directed transportation technology, a mental image of “Babel reversed”.

How could macroengineers connect Earth’s hemispheres? Would a 21st Century New World Free Trade Area necessitate interconnection? No single answer exists, of course, but one distinct possibility might be a Hovercraft—skirted air-cushion vehicles—crossing Drake Passage, which separates Antarctica and South America, along with construction of a high-speed magnetically levitated railroad linking South, Central and North America. Hovercraft, after passing over Drake Passage, could follow the coast until reaching McMurdo Station thence continue to the South Pole via the extant 1600

---


70 Peter Hall, *Great Planning Disasters* (1982), page 221.
kilometer-long ice-highway Antarctic-1. The Drake Passage Hovercraft Roadway would, purely as a side effect, raise Earth’s sea level—a sea level elevation on top of that already happening owing to various causes, both natural and anthropogenic. Armadas of icebergs would hinder shipping around both Greenland and Antarctica if a future global climate change causes massive deglacialization. An artificial closure of the Drake Passage might, therefore, help to mitigate this geohazard, especially in the South Atlantic Ocean’s trade routes.

Antarctica is a super-pleasant version of an unterraformed Mars. The continent of Antarctica, naturally uninhabited by humans, symbolizes Alien space, the menacing monstrous “Thing” science-fiction writer John W. Campbell (1910-1971) featured in his 1951 short story “Who Goes There?” largely because it is so remarkably different visually from the Arctic. More proof of how alien Antarctica’s landscape is, and how it affects humans, can be found in Bernadette Hince’s *The Antarctic Dictionary: A Complete Guide to Antarctic English* (2000): “greenout”, for example, is sometimes used by scientists to describe the emotion felt on seeing and smelling living green plants after a long period on the icy and cold continent. Not much life exists atop Antarctica’s ice-sheet. And, what life there will still be menaced by an anthropic “Ozone Hole” that forms during spring season, can cause skin cancer, genetic and eye damage, and can harm marine life until about AD 2068.

During 1971, Keiji Higuichi in Japan announced his idea of building a dam-like barrier, composed of icebergs, in the 2500 meter-deep Drake Passage. In his view, the primary purpose of such a physical obstruction would be to separate the South Pacific Ocean from the South Atlantic Ocean in order to induce favorable Southern Hemisphere climatic regime changes, which also includes the Indian Ocean. The Antarctic Circumpolar Current, which is the only current that flows right around our world, is constricted by Drake Passage. The Antarctic Circumpolar Current is directly influenced by human activity. Drake Passage is a choke point in the overall dynamics of the wind-driven seawater circulation in the circumpolar Southern Ocean. The Current would be interrupted by Higuichi’s ice-dam so that the seawater moving around Antarctica would be altered from a vortex to another shape and, accordingly, “may have the effect of changing the general oceanic circulation on the global scale”. Higuichi’s barrier would reinstate a local Nature blockade last emplaced some 35 million years ago, when Antarctica became thermally isolated and the Antarctic Circumpolar Current was created! Computer simulations have never fully calculated a post-construction ocean current pattern. It is known that the Antarctic Circumpolar Current plays a controlling role governing the Earth-ocean’s thermohaline circulation. An open Drake Passage promotes an overturning seawater circulation that favors deep-water mass formation in the Northern Hemisphere; the North Atlantic Ocean’s Deep Water overturn is probably dependent on an open Drake Passage. A closed Drake Passage is likely to cause warmer surface air temperature—possibly as much as 4°C regionally—in the Southern Hemisphere. Redirection of the seawater flow by Higuichi’s iceberg dam would likely terminate the recurrence of El Nino, the stream of warm water Western Pacific Ocean surface water sporadically washing Peru’s

---

74 John C. Fyfe and O.A. Saenko, “Human-Induced Change in the Antarctic Circumpolar Current”, *Journal of Climate*, **18**, 3068-3073.
shore. When the El Nino phenomena happen, they cause great worldwide economic hardships by way of extra-normal weather conditions, extreme climate event-processes regionally. It is likely also that the Benguela Current sweeping Africa’s west coast and the West Australian Current off western Australia would be greatly weakened, or perhaps even terminated as long as an ice-dam existed in Drake Passage. Higuichi’s dam would modify the geostrophic balance, resulting in a greater outflow of Antarctic deep-bottom water to Earth’s ocean and a weakening of the Antarctica Circumpolar Current to such an extent that it may need to be renamed! Modelers have good reason to assume that an enhanced outflow of this deep-bottom water mass from the Antarctic would suppress deep-water production in the North Atlantic Ocean, thereby changing the ocean’s Northern Hemisphere regimes permanently! A teleological geophilosopher might argue that humanity should judge whether a macro-engineering act is good or bad by seeing if a macroproject produces a good or bad result.

Icebergs, which break off naturally from glacial ice-flows on Antarctica, are flat-topped and often enormous in bulk. Changes in Antarctica’s coast have been most pronounced on the Antarctic Peninsula where the Wordie Ice Shelf has all but vanished, the northern part of the Larsen Ice Shelf has virtually disintegrated and other ice shelves are also changing. The enormous icebergs created by break-off event-processes are tracked and their current locations are available on the Internet (GOTO: “NASA Scatterometer Climate Record Pathfinder”, http://www.scp.byu.edu/current_icebergs.html ). Since the ratio of the height of a tabular iceberg’s freeboard above the ocean’s surface is 1:7, Antarctic icebergs with freeboards of 45 meters must extend below sea level about 315 meters! Higuichi calculated that the volume of an ice-dam filling Drake Passage would require the directed emplacement of 3,100 flat top icebergs, each with a volume of two cubic kilometers. Loading these icebergs with soil and rock to sink them in order to forming a causeway seawater current diversion would indeed be a voluminous and spatially huge macroproject affecting more than half the Earth-biosphere. Antarctica’s circumpolar belt of aquatic productivity would be disrupted and the ongoing strengthening of the due to stronger wind-driven circulation could be vastly curtailed.

A potential hovercraft “roadway” could indeed be simultaneously created, but the Macro-engineering task would be completed at enormous cost economically and ecologically. Since approximately 80% of the Southern Hemisphere’s area is ocean, would it really be useful to alter climates in—at the very least—that portion of the Earth-biosphere with such an expensive, time-consuming 1000 kilometer-long ice-dam? Higuichi’s building method is extremely risky, and without any predictably marked perfection of the Southern Hemisphere’s many climate regimes, it would be neither practical nor geopolitically feasible to construct a Drake Passage Hovercraft Roadway. How, then, can we extend the Pan-American Highway, an all-season track begun during 1923, to connect the Americas with the Antarctic Peninsula?

Founded in 1951, Doxiadis Associates, a land use planning team based in Greece, predicted that by AD 2100 the Antarctic Peninsula could support a “low density” extension from South America of “Ecumenopolis”. Coined in 1961, Ecumenopolis is a future city spreading in a continuous carpet-like urban region covering most of the habitable land parts of the Earth-biosphere, a more or less universal settlement (literally, a “Global Village”)! Boris B. Rodoman approved of the Constantinos Apostolou Doxiadis (1913-1975) geographical concept because it would give infrastructure managers their biggest future challenge. Ecumenopolis matches Pietro Passerini’s “Anthropostrome” coinage of 1984 in

breadth, since the meaning of the ancient Greek word “stroma” is “carpet”. The IceCube Neutrino Telescope, a one cubic kilometer ice observatory dedicated to the detection of neutrino particles for outer space with energies above 100GeV, will be completed by 2011 within Antarctica’s ice at the South Pole. Development and population of the rocky Antarctic Peninsula could come about, and be a result of, the 21st Century industrialization of the continent’s icy periphery.

Electrification, and subsequent industrialization, of Antarctic may be fostered by construction of a Bolonkin-Cathcart Antarctic Wind-Power Ring using a continuous Fabric Aerial Dam with air turbines encircling Antarctica. Fishing off the shore and tourism, both based abroad, are Antarctica’s only economic activity currently. During the 2004-05 Antarctic summer, a total of 23,175 tourists visited, attracted by the place’s geographical isolation, romance and Alien oddness. (While the term “Ecotourism” has existed since about 1988, only about 5% of all tourism is of this type. Suggestions have been proffered to designate Antarctica as a “World Park”. High-speed dry katabatic winds blow coastward from the high elevation interior icecap. The winds blow with constancy in direction, often moving at 20-40 meters per second over the smoothest icecap surface but slow about 100 kilometers from the Southern Ocean when they flow over a rougher ice surface. Antarctica has a coastline—it varies with iceberg break-offs—that is about 17000 kilometers in length. Deployment 100 kilometers from the coastline of a Fabric Aerial Dam, in a ring surrounding the continent, would permit generation of approximately 450 Gigawatts of “Green” electricity by the Bolonkin-Cathcart Antarctic Wind-Power Ring. Roughly, that is the output of 225 nuclear fission power plants. The global potential for wind-generated energy is about 72 terawatt. Excess electricity may even be exported to South America by utilizing a submarine High Voltage Direct Current link. Such a link can be considered the final connection in R. Buckminster Fuller’s 1969 macroproject proposal to create an HVDC “Global Energy Electric Grid”.

So far, Antarctica is the only place in our Earth where national sovereignty is not exercised and where there are no skyscrapers. Antarctica’s current geopolitical status is not likely to continue indefinitely, nor is it likely to remain a demilitarized Polar Zone. At least seven nation-ecosystems claim sections of Antarctica. The Antarctic Treaty, which entered force during 1961, revised in 1991, bans mining and oil exploration in Antarctica for fifty years, until AD 2041. The Treaty governs the use of the land and ocean south of the 60th degree of latitude in the Southern Hemisphere. Chile and Argentina are especially interested in maintaining their territorial claims on Antarctica. At Expo '92— the universal exposition in Seville, Spain—Chile’s pavilion contained a 60 tonne iceberg shipped in from the “Chilean Antarctic”. Like Doxiadis, it is possible to envision Chile’s Punta Arenas— currently Earth’s southernmost major city—being in the same class as the Northern Hemisphere’s Oslo, Stockholm and St. Petersburg. Technological progress may embolden Chile and Argentina to press

---

their rights on Antarctica more vigorously. Third World countries, meeting in March 1983 in New Delhi, India requested a study of Antarctica’s geopolitics by the UN Organization, a report that was released in November 1984. Many of the states desiring the report (Malaysia, Barbuda and Antigua, for example) are located far from Antarctica. Indeed, most were poor Tropic Zone countries, unable to exploit effectively their own known natural resources. One reason given by the United Kingdom for recapturing the Falkland Island from Argentine armed forces during their 2 April to 14 June 1982 undeclared war was that a UK loss of bases there would greatly cripple the UK’s efforts to explore and exploit Antarctica. Some Third World ecosystem-nations still urge the UN Organization to assert that a revision of the Antarctic Treaty be made which would subject Antarctica to the direct governance of the UNO—in other words, voting by a majority of countries (the Third World)! The fatal flaw in all proposals for global representational government—a government responsive to the average opinion of human beings—is that most people are ignorant (about themselves, others of their species and even our planet Earth) and are truly provincial!

A Hovercraft-based transportation system would supplement the Salterian “Planetran” and, at the same time, could counteract any Third World noosystem governments that are unambiguously greedy and arrogant. Ironically, the Antarctic Treaty was the first agreement by the immediate post-World War II Superpowers after the Cold War began; Article I specifies that use of the region “shall be for peaceful purposes only” and clearly prohibits military bases, the carrying out of military training maneuvers, or weapons tests. The USA approved of the Antarctic Treaty because it reduced their fears that Antarctica might be used by another military power as a submarine and bomber-cruise missile staging theater that could threaten commerce and military convoys, should the Suez Canal or Panama Canal become operationally disrupted, temporarily closed or destroyed. Earth’s anthropogenically enhanced climate change may render the Arctic Ocean ice-free by AD 2070-2090, while Antarctica will exhibit the effects of the atmosphere’s change too. A North Polar Zone that is without a floe ice cover throughout the year means that naval submarines and civilian commercial surface shipping cannot operate there with any more secrecy that in other parts of the world-ocean. In other words, were not prohibited by the Antarctic Treaty, the South Polar Zone could become a hideout for stealthy warships, a strategic military stronghold.

Global Nature—that is, our Earth’s biosphere—is constantly being re-built by, in part, the work of Homo sapiens. Indeed, it might even be said that our species is creating a “Second global Nature”. Speculatively, mobile man-made ice islands composed of pykrete, architecturally speaking, might even be considered as plug-in cities—maybe replacing the naturally calved iceberg that shaped the now missing “Bay of Whales” (78° 30 South by 164° 20 West)—which can be snuggled to Antarctica’s mainland with hawsers braided of cold-proof artificial fibers tied off to bollards embedded in the mainland’s ice via hot-water heat probes. Since we are Space Age macroengineers, Earth-orbiting sunlight reflectors could be used to energize an expanding biosphere. It is feasible to bring materials to Earth from interplanetary space (harvesting asteroids) and other planet-places. Along with other Solar System objects, Earth’s biosphere suffered and survived devastating blows inflicted by a chaotic Universe; undoubted, it the Earth-biosphere will endure more catastrophes. Future comet and asteroid impacts are almost inevitable. Not even currently inventoried third-generation nuclear weapons and fourth generation nuclear weapons (stockpiled by the USA and Russia, for example) can meaningfully compare to the mass destruction wreaked by our Solar System’s development during its Astronomical

Time. Earth’s bombardment by comets and asteroids has eroded some of its atmosphere and ocean and created gigantic craters in its lithosphere (some on land, some on the ocean’s seabed). “Approximately 25% of the known terrestrial impact craters are associated with some form of economic resources and ~12% currently are exploited or have been exploited in the recent past.”

The Moon, Mars and Venus are heavily cratered. Does that mean rich ores may be found beneath these crustal indentations? Homo sapiens must become prepared to defend out only biosphere and a future Mars “Worldhouse” from rocky death dealing Earth and Mars changers, or risk a possible extermination event-process. A damaged biosphere, disrupted or missing societies and markedly slowed advance of science also may result from less-than-extinction impacts.

“Der Mensch als geologischer Faktor”, a professional journal article by Ernst Fischer, ran systematically through those various effects than mankind’s activities have on Earth’s biosphere, including the atmosphere. He estimated that amount of rock and soil moved in mining, the handling of ores and non-metallic materials, and then went on to public infrastructure (roads, tunnels, dams, canals and the improvement of stream and river courses and shores for navigation). Fischer judged from the obtainable pre-World War I data base the volume of earth materials moved at man’s behest. Nowadays, people shift mechanically about twice as much as global Nature does annually (in the form of solid and dissolved products of land erosion by river, wind and glacial ice flows). In other words, about 20 billion tonnes of earth materials were moved during AD 2005 and the same volume will be moved during 2006, probably. Depending on the state of humanity’s national economies, wars in various regions and other factors, this statistic is probably getting larger at a moderate, if unknown, rate. For other organisms, the statistic is probably declining.

Ernst Fischer also considered the effects of agriculture in changing the chemical character of the soils and, to a limited extent, of relief, as in terracing and empoldering; then went on to the hydrosphere, starting, interestingly enough, with human effects on marine sediments! Fischer included the influence of all ships that have sunk with their cargos, the total of which is very appreciable. Green environmental alarmists use the so-called “Titanic Analogy”—that is, negative criticism of pro-progress persons because of their assumed mindset of “unsinkability”. The first voyage of the liner “Titanic”, which struck an iceberg in the North Atlantic Ocean and sank in April 1912, ended tragically. Because of technology’s progress, that once-lost ship is now visited by tourists since its 1985 rediscovery. “Der Mensch als geologischer Faktor” elucidates our species’ encroachment upon the ocean by diking and reclamations, including coastal preservation by seawalls. Sometimes sea-lane submarine navigational hazards are artificially cured to promote commerce. Since 1921, shipping interests had debated removal of Ripple Rock shoal at Seymour Narrows’ south entrance in Canada’s British Columbia; finally at 9:31:02.05 AM, on 5 April 1958, that massive impediment to safe navigation in the Inside Passage was blown to bits by powerful modern explosives, the history of which is nicely described by Stephen R. Bown’s A Most Damnable Invention: Dynamite, Nitrates, and the Making of the Modern World (2005). (The modern industry involved with the preparation of concrete, an Anthropic Rock, “grew in parallel with the high explosives that made its raw materials affordable.”)

Fischer delved into history’s register of swamp drainage and river canalization with the result that fresh water runoff is greatly hastened; lowering the groundwater table by drainage and

pumping for farming; and, changing the soils’ texture and chemical composition through mixing of natural topsoil horizons by plowing, as well as destruction of original vegetations. Of course, there exists always the possibility of making new land. Coast defense works are today expertly built in many countries by the Netherlands’ macroengineers.

Earth’s anthropogenic atmospheric carbon dioxide buildup was first made public in an 1896 announcement made by Svante A. Arrhenius (1859-1927). Fischer had little to say about the effect on the atmosphere of our existence, only some speculation about a possible increase in the Earth-atmosphere’s content of carbon dioxide and pollution of local air masses as a result of industry’s coal combustion. Arrhenius, in *World in the Making* (1908), had speculated that man’s fossil fuel usage could forestall the onset of another Ice Age, like that of the Pleistocene. Living climatologic experts are observing the onset of the after-effect of atmosphere carbon dioxide buildup. Fischer briefly explicated the effects on vegetations and animals of mankind’s history, citing matters which are familiar to the well-informed, giving particular attention to man’s constant redistribution of biota in transporting domestic animals and cultivated planets throughout our biosphere, along with those pests and weeds which have uncontrollably accompanied Homo sapiens’ global migration. Organisms thriving in and on humans, dogs, apes, plants and insects have also traveled in interplanetary space and survived several years on the Moon! Molecular Nanotechnologists intend taking precautions to prevent runaways from disorganizing Earth’s precious biosphere.

Fischer’s nearly century-old, but still profoundly useful, 1915 literary survey fits into the sequence of similar discussion. He cited several items from the UK geologist Charles Lyell, but Fischer did not mention George P. Marsh, or Elisee Reclus (1830-1905), who paraphrased Marsh for Europeans. Traditional Natural History’s central theme was “balance of Nature”—a theme discarded by Ecology after about 1980, when it was alleged radical Greens that Homo sapiens must reject the possibility of constancy in the Earth-biosphere. Radical Greens subscribe to the notion-belief in a perpetual State of Global Nature; some radical macroengineers subscribe to the notion-belief that they can plan a once-and-for-all-time techno-fix. Science invented “Evolution” and presented modern mankind with powerful tools promoting anthropic changes of Earth-biosphere (global Nature). Hence, humanity’s disturbance of Earth-biosphere regions, though usually small in geographical scale compared to the planet’s total surface area, may have a large outcome by upsetting the existing ecosystems of some regions. Concurrent anthropic changes of many regions could set into motion event-processes of huge spatial scale affecting our planet’s biosphere. (The rapid evaporation of the Aral Sea, and the costly macroprojects commenced to restore it, is a forewarning example of a harshening of the environmental conditions of the region, which has been caused by irrigated rice and cotton-growing.) Those who espouse “Earth System Science” have sometimes allowed religious concepts, such as James Ephraim Lovelock’s overly fashionable 1971 “Gaia Hypothesis”, to intrude upon their secular academic meditations. The “Gaia” idea weaves a post-1970 awakened-to-pollution public concern about the future of the Earth’s biosphere “health” with a benign mysticism. And, Lovelocks’ *The Revenge of Gaia: Earth’s Climate Crisis and the Fate of Humanity* (2006) is simply shocking in its bold assertions the biosphere is verging on collapse and that nuclear power plants might save Homo sapiens from extinction! No fragile “balance of global Nature” exists! The definition of “ecosystem” was only settled generally circa 1901-02. In Fischer’s time, the idea of a planetary biophysical “balance of life” was just beginning to be scientifically documented. Ecology’s “balance of global Nature” propaganda line, formed during 1779 by Jan Ingen-Housz (1730-1799) when he discovered photosynthesis and conceptualized a harmonious Earth-biosphere balance of animal respiration and plant transpiration, is a misleading concept. Geoscientists are yet to finish that formidable task of finding truth to the complete satisfaction of many legitimate 21st Century biologists.
Until the Space Age, Earth’s biosphere was the planetary region of ultimate pollution dissipation and also the region of penultimate energy dissipation. Simple human noosystems became technologically complex over Geological Time (only part of it was Historical Time) as the amount of energy harnessed per capita annually increased, or as the efficiency of use increased—a scheme of thought borrowed from Leslie Alvin White (1900-1975). Fischer evinced a belief that irreparable damage had been done—by 1914-15—to some parts of our biosphere (the Mediterranean Sea Basin, for example) and that Homo sapiens was negatively affecting the ocean’s wildlife. As long as some part of our world’s human economy progresses, the remainder will not lapse into a stagnant state that could stall our world’s economic growth. But, the major economies today find themselves in a simultaneous global slump or global boom period of economic state because of “globalization” that is increasingly underpinned by the Internet. Doom-laden biosphere forecasts projected worldwide by the global media may prove harmful and certainly could make any bad economic situation worse. Some propagandists, for ideological reasons chiefly, plus the intensity of our geographical studies, created a new scale of Earth-biosphere viewing, a new scale of opinion.

Scaling our Macro-engineering project appraisals of Earth remains confused by our inconsistent professional vocabulary. Outside of Geography, colleagues use “large scale” to refer to a big enterprise and “small scale” the reverse. Inside Geography, “large scale” means a limited area viewed in great cartographic detail while “small scale” maps portray big areas in limited detail. C.A. Doxiadis’ “Ekistics logarithmic scale” is a scale designed for the classification of mankind’s settlements, running from Man (unit 1) as the smallest unit of measurement to the whole Earth (unit 15). Another scale, the G-Scale is based on the area of Earth (Ga). The G-Scale was derived by successive subdivisions of this standard area by the power of 10; the G-Scale resembles \textit{Powers of Ten} (1962) by Philip Morrison. Terraforming could find these two comparative geographical scales quite useful during the 21st Century.

The ever-enlarging “Anthropocosmos” has replaced “Earth” as our known absolute region of species containment. And, “Terraforming” has, in some respects, entered our everyday thinking. Data gathered and divulged during the 20th Century has formed and squarely set a viewing framework for our Solar System’s planets. Future mindkind may make it much less essential that people procreate to dominate additional, artificial biospheres—in other words, bluntly said, a human “reproductive imperative” (and its co-instantaneous “territorial imperative”) is not a constraining commandment.

Should our Earth be made more massive? How might Homo sapiens deposit additional materials, applying extra-terrestrially garnered matter to our global Nature? Launchings of fabricated objects into interplanetary and interstellar space must be considered as an entirely new kind of erosion process-event, which thereby reduces artificially our world’s mass by newsworthy subtraction. Since 1957, Spacefaring nations have managed to place thousands of tonnes of materials into outer space. “Currently, more than 9,000 Earth-orbiting man-made objects (including many breakup fragments), with a combined mass exceeding 5 million [kilogram], are tracked by the U.S. Space Surveillance Network maintained in the U.S. satellite catalog.” Meanwhile, small-sized bits of cosmic debris, which naturally falls into Earth, amounts to over 30000 tonnes daily! Most of these debris pieces reach our ocean and land as a dust-fall. Homo sapiens has yet to tip decisively global Nature’s so-called balance in terms of input/output trends.

NASA’s 1977 \textit{Special Publication 413}, “Space Settlements: A Design Study”, suggested the manufacture of capacious lifting body flight vehicles to convey to Earthlings bulky cargoes of

---

processed ore originating at open-pit mines on the Moon. Such robotic re-entry vehicles-containers would then be retrieved (from their Southern Hemisphere splashdown sites) and towed, like the fresh water bags, by ocean-going tugboats to seaport-served industrial complex. NASA’s 1979 *Special Publication 428*, “Space Resources and Space Settlements” made no further mention of this exciting resource acquisition and delivery macroproject idea. There is also the possibility for extracting valuable metals from near-Earth resources such as metalliferous asteroids\(^97\) and bringing the harvested materials to Earth for further industrial processing.\(^98\)

Our Solar System contains asteroids that cross the orbits of Earth, Mars and Venus; it is probable that, someday, an asteroid may be observed colliding with Earth, Mars and Venus. For Earth, the Torino Impact Hazard Scale\(^99\) has been devised to rate the danger posed by asteroid and comet impacts predicted to hit the our homeland. The Torino Impact Hazard Scale functions in a way comparable to the famed Richter Earthquake Scale that rates the strength of temblors. The Minor Planets Center (in Cambridge, Massachusetts, USA) currently lists 783 Potential Hazardous Asteroids that pose a threat to Earth’s life forms. A 300 meter-diameter asteroid, 99942 Apophis, will pass within 32000 kilometers of Earth on 13 April 2029. 21st Century geoscientist think in terms of “Socio-meteoritics”, the investigation of meteorite, asteroid and comet impact with human noosystems.\(^100\) Even geophilosopher J.E. Lovelock, in *Gaia: A New Look at Life on Earth* (1979), felt that Homo sapiens was charged with the responsibility of protecting the planet’s future, extending its Geological Time in the Universe, through “cognitive anticipation” (deflecting or destroying comets and asteroids the might strike our Earth-biosphere, for instance). Who or what imposed on mankind the obligatory duty J.E. Lovelock says we must perform? Interestingly, some close-to-Earth asteroids are benign. For example, the 100 meter-wide Asteroid 2002 AA29 is the only known object in a companion orbit; in 2600 AD and in 3880 AD it will for a while become a true satellite of Earth, remaining a second Earth “Moon” for about 50 years each time before it escapes. There are no existing compositional data tabulated for Asteroid 2002 AA29.

Samuel Herrick (1911-1974) proposed that a huge chunk of the asteroid “1620 Geographos”, a 5.1 kilometer-long and 1.8 kilometer-wide macro-object that may or may not be a single coherent asteroid.\(^101\) It was discovered on 31 August 1951 and named in tribute to the USA’s famous National Geographic Society. Herrick proposed a macroproject to use Geographos 1620 as a Directed Meteorite Excavator (DME) to create an Interocianic Crater-Canal on the Atrato River in northwestern Columbia. Utilizing a DME extracted from that ill-define piece of natural space debris, Herrick stated in March 1971, to very rapidly dig a new sea-level canal traversing the northern part of South America, to complement, supplement or supplant the Central American canal located in Panama. “1620 Geographos” crosses the orbits of the Earth and Mars; therefore, “1620 Geographos” might be tailored for use by a coterie of future Mars terraformers!

Elements of both Herrick’s and NASA’s ideas should be blended. DME use in wastelands (like Chad, in Africa’s Sahara) would be a cheap means of bringing construction and industrial materials to isolated noosystems tied to marginal landscapes; locally collected solar energy, especially in the Sahara and the southern boundary region known as the Sahel, could become the main source of


transformational power. Macroengineers would never plan a simultaneous arrival of Directed Meteorite Excavators such that their dust-generating and dispersed explosive touchdowns would come close to equaling the 100 megaton’s calculated by Nuclear Winter experts to be a threshold level. “Nuclear Winterists”, circa 1982-83, came to chilling conclusions about general thermonuclear warfare: that post-World War III survivors would witness severe temperature decreases (as low as –25°C) in the Northern Hemisphere, and that dwellers in Earth’s Southern Hemisphere would have to endure sub-freezing temperatures! In other words, Nevel Shute Norway (1899-1960), in his 1957 novel and 1959 film On the Beach, got only half the post-World War III story! We foresee that Herrick and NASA-style Macro-engineering will, inevitably, foster Rodoman-ALPS, the scheme mentioned in Chapter 2; Rodoman-ALPS would merely need to be functionally augments to a slight degree. Mining of asteroids and comets that pose a geohazard to the biosphere of Earth, sending its riches piecemeal to a mankind, could be accomplished—in other words we might simply reduce the mass of the asteroid by mining it. Imagine if a swarm of space-faring molecular Nanotechnology miners consumed the threatening asteroid! Space tugs are another feasible option for directing asteroids.

Although people cannot as yet control the amount of energy that the Sun gives forth, macroengineers could control how much sunlight reaches Earth and is usefully captured. Herman Oberth’s 1923 pamphlet, Die Rakete zu den Planetenraum, proposed construction of orbiting sunlight reflector satellites with diameters of 100 kilometers. Oberth (1894-1989) claimed that focused sunlight from a single such mirrored satellite “could make large areas of the North [Arctic Zone] inhabitable; in the middle latitudes [Temperate Zone] it could prevent sudden drops of temperature…prevent freezing temperatures at night”. It could melt snow, which is complex and short-lived sediment with many effects on the natural and anthropogenic surfaces upon which it comes to rest. He might easily have also claimed that orbital mirror satellites could replace artificial street lighting, replacing electricity using outdoor urban lamps. Incautious use of space mirror at night could cause damage to human eyesight.

Barring similar—genetically related?—Aliens living in another Solar System somewhere in the Milky Way Galaxy, our unique species has been extending its domain in Earth on both sides of a systemic interface (between the lithosphere-ocean-atmosphere) since Homo sapiens first became a building and digger. Crustal excavation is a special aspect of man’s intra-terrestrial activities and imaginative descriptions of trips to Earth’s interior are often loaded with deep psychological implications. The mass of the Earth-crust is about 0.71% of the mass of the Earth’s mantle.
and core) is a kind of very hot, circulating fluid, then ownership has no significance below the lithosphere’s crust until technology is available to extract energy or materials (methane gas)\textsuperscript{107} from the mantle and core. In that event-process, humans would be tapping global Nature’s basement! We can find not geoscience literature dealing with ownership of bounded volumes of the world-ocean, except what is presented in the text of the 1982 United Nations Law of the Sea Treaty. “Outer space” is internationally regulated, but the boundary between air and space remains legally confused. Clearly, an international legal regime is needed if Space Elevators, as technically presented by Bradley C. Edwards and Eric A. Westling in \textit{The Space Elevator: A revolutionary Earth-to-space transportation system} (2002), are ever to be constructed to serve Earthlings’ purposes! For many years, NASA has proceeded on the logical assumption that as the number of space-faring peoples and orbiting spacecraft increases during the 21\textsuperscript{st} Century, it will be desirable to develop an international strategy to coordinate, monitor and control interactions of spacecraft in orbit.\textsuperscript{108}

SYNCOM II became mankind’s first geosynchronous artificial Earth satellite during 1963. A geosynchronous satellite has an orbital period synchronized with the planet’s axial rotation. A 266000 kilometer-long geosynchronous orbit is roughly circular, about 35900 kilometers above Earth’s equator, and a geosynchronous satellite there appears stationary over one place on the Earth’s surface. A carbon nanotube cable-anchored satellite of this type would eliminate the need for fiery rockets to take payloads and people into Earth orbit and would also reduce the need for that rather spectacular, and potentially fatal, heat-shielded atmospheric entry of homeward-bound Space Shuttles and future aerospace planes. In addition, scientific instruments and tourists could be made immobile at any altitude over Earth’s equator, or the equator of the Moon or any planet in our Anthropocosmos that is penetrated by a Space Elevator. One can only pity those future hearty souls who could endure several days of piped in Muzak!\textsuperscript{109} The Base Station for a Space Elevator can be on land or on a self-positioned, wave-stabilized floating sea platform. Practitioners of Macro-engineering envision land Base Stations on Africa, South America and sea Base Stations on the world-ocean. Near Jarvis Island (0° 22 South latitude by 160° 03 West longitude) a large surface Base Station could be kept operational without much difficulty and it could prove to be an ideal tourist and worker quarantine facility since it is land. Jarvis Island is central to the region often referred to as “The Pacific Rim”. Space Elevators are being made possible by the fact that science and technology R&D has brought humans to a time when we can design materials with predictable properties. Space Elevators would constitute a new kind of urban development, a vertical city form (of almost unlimited extent) on a much grander scale than mere skyscraper clumps such as New York City’s Manhattan Island.

G.F. Khil’mi announced (in \textit{Voprosy filosofii No. 12}) in 1962: “...in the foreseeable future the surface of the Earth, the atmosphere, hydrosphere and biosphere will be so saturated with technological devices and large-scale Man-made structures that the outer envelopes of the Earth will become a new object of reality that will develop according to its distinctive, yet unknown laws”. Is he speaking of the Earth’s crust totally restructured by molecular Nanotechnology? Khil’mi is a foreseer! He advocates the activation of supra-mantle/sub-geosynchronous orbit things by means of human-managed dynamic-constructive systems of Earth bioapparatus operation. Molecular Nanotechnology’s future techno-wizardry promises to make Khil’mi’s shell-shaped mantle enveloping zone a place of only two kinds of nano-machines, the operational and the non-functional. Mankind’s immediate planetary spatial context won’t be global Nature (biosphere), as formerly, but organization (of self-controlled matter). Even

living persons could be constantly enduring repair work and, therefore, be considered as (120 kilogram) masses of biological material separating nano-sized robots! Earth’s future robosphere could be penetrated by Space Elevators and, in addition, be a field of activity for molecular Nanotechnology. Eventually, we suspect, all human industrial production and all human consumption would possess essentially the same ideology—molecular Nanotechnology’s programming governed by mankind’s artistic sensibilities. Rodoman-ALPS seems to fit into Khíl’mi’s concept in that unarmed automations able to select and destroy their targets with non-explosive warheads using guidance or direct assistance from other spacecraft or ground-based controllers. Rodoman-ALPS will, perhaps, first participate in the clearance from Earth orbit all the non-functional satellites and rubbish such as SuitSat, which today forms an unwanted shell of man-made debris posing a calculable hazard to aerospace planes, Space Shuttles, and other spacecraft. Uncontrolled space debris would pose a supra-stratospheric collision threat to extra-atmospheric parts of all Space Elevators above an altitude of 50 kilometers. Rodoman-ALPS is one possible solution to the problem of how to destroy this “cloud” of useless, misplaced stuff, which is beginning to envelope Earthly global Nature. Very litter-wary spationauts appreciate a clean vacuum during their danger-filled travels in outer space!

How might geoscientists examine any proposed grounding site for Space Elevators? In the seismic field, computers and remote sensors may allow an envisionable worldscape of seeing (Virtual Reality) the Earth’s lithosphere, in part or whole. A cartographer, David Greenwood predicted “Some day there will be geological mapping from the core of the Earth outward”. The center of the Earth is a geographical place. Perhaps the most plausible macroproject yet proposed to reveal Earth’s innards is “Project GEOSCAN”—the remote sensing of Earth’s sub-surface leading to maps illustrating its lithosphere from the planet’s center of mass outwards to the underside of all man-made Earth-crust deposits (cities et cetera) via neutrino tomography. The USA’s National Science Foundation funded the basic R&D (with a 1982 Grant #PHY-82-15249) for this huge remote sensor system, consisting of receivers and computer signal processors that would be stimulated by a proposed neutron ejector-machine called a “Geotron”. Project GEOSCAN was aimed at the determination of the true density profile of global Nature’s lithosphere. Another procedure postulated for the unbuilt Geotron, Project GENIUS, would have allowed stratigraphical exploration indirectly, by neutrino-induced underground excitation of matter resulting in sound emissions, to search for petroleum, natural gas fields and ore deposits at large distances from the Geotron. The propagation of neutrinos is affected by the presence of Earth matter through neutrino absorption and attenuation. Perhaps such exploration will confirm the prediction of Thomas Gold (1920-2004), made most fully in his Power from the Earth (1987), that gigantic reserves of methane in deep crustal strata could fuel our planetary civilization for centuries. Such a fully globalized Earth-mantle methane gas energy supply system would naturally make world petroleum and world gas pricing/gas production no longer assuredly sustainable. If wholesale price determination were wrested from the control of a few countries and a few international organizations, the very raison d’être for their existence would be dissolved. Methane gas extraction, unlike fluid and gas withdrawals from the Earth’s crust or surface rock quarrying, is unlikely to cause earthquakes. A follow-up to Project GENIUS might be used to monitor vulnerable regions of future withdrawals.

---


115 Walter Winter, “Neutrino tomography”, Earth, Moon, and Planets, ??, ??? (2006?).
A Geotron could be floated and moored anywhere within or on the world-ocean, “covering” a circular area of perhaps 700 square kilometers and tiltable up to 90° from the vertical. If a Geotron were located in the Indian Ocean, at 106° 3 East Longitude by 40° 45 South Latitude, then it could investigate an antipodal site—the point on the exact opposite side of the Earth—such as New York City’s famous Times Square, recently recounted by Marshall Berman’s *On the Town: One Hundred Years of Spectacle in Times Square* (2006). Besides “x-raying” Earth, experimental physicists had predicted in 1979 that the neutrino could be the basis for a revolution in telecommunications in which messages, perhaps even picture signals, could be sent via collimated neutrino beams shooting through the lithosphere. Since 2000, the future possibility of neutrino beam telecommunication has been pursued exclusively in Italy. Neutrino beams directed in a straight line, or otherwise, would not be a health hazard and could be sent with no loss of power through thousands of kilometers of earth stuff (solid, liquid, hot, living, or whatever) as though it were non-existent to precisely picked receiver target arrays where the cycle of transubstantiation is completed; a decided advantage over laser beams, microwave beams, or other electromagnetic transmissions. Communications, therefore, could be totally secure and very flexible in routing—certainly more so than fiber-optic cables strung across the landmasses and draped on the ocean’s seafloor. (Telegraph lines between North America and Europe were severed in 1929 by an undersea landslide.)

James Graham Ballard’s pithy anti-utopian “New Wave” science fictions are still remarkably popular. The spirit of that genre is iconoclastic, nihilistic and pessimistic and his short story, “Build-up: (New Worlds, 19, 52-70, January 1957), set three million years in Earth’s future Geological Time, plays with a future exacerbation of our post-World War II problems, such as concretized bureaucracies, uncontrolled urbanization and over-population. (It is worth noting that about 50% of India’s 2006 GDP is generated by people living in cities despite the fact that a minority of Indians are urbanites.) His truly sad story—“sad” because it is a symbol of disunion between humans and the Divine—centripieces a single monstrous building, a virtual Megastructural hive, unaffected by crustal tectonic stresses and earthquakes, entirely covering our planet’s lithosphere, which is many storeys high and populated by multitudinous humans. Ballard’s building, which we have dubbed “Ballardia”, covers not only the land—that is, 29% of the Earth’s surface—but the ocean too. Conceptually it is markedly outdoes Richard L.S. Taylor’s proposal for a Mars Worldhouse which is planned to be a 100% enclosure. (Mars’ surface equals only 28.3% Earth’s.) Ballard’s anthropogenic material mega-formation is entirely devoid of geotechnical macro-problems. Apparently, people first went into Ballardia to escape the non-functioning mess they had made of Earth’s global Nature! Occupants of this unitary building would no longer experience the 0.5% weight change present-day persons “feel” as they move about from place to place on the surface of our crust and ocean owing to different values of gravity; agoraphobic humans housed inside Ballardia would no longer experience the 0.03% weight change Terrans feel which is caused by air masses moving geographically to make our planet’s weather. The ultimate geopolis, it gives new meaning to the ancient Greek phrase, “he oikomene ge” (meaning, “the inhabited earth”)! Were this immense multi-level apocalyptic skyscraper extant, a special Papal benediction (“urbi et orbi”—meaning “to the city and to the world”) might require another title to reduce popular confusion! Manhattan, a 41 cubic kilometer section of New York City, for 2006 property taxation purposes, was valued at about USA$100000000. If macro-economists assume, then, that Manhattan is very small fraction (in the billionths) of Ballardia, then a built Ballardia would be real estate valued at USA$50000000000000000000000! James Graham Ballard’s future humans have become trapped within themselves, in a stark cellularized worldscape, an unhealthy state

of affairs. The inhabitants and combatants of this huge tenement have become entirely ignorant of the existence of what remained of a global Nature technologically un-interfered with by Earth’s humans. Like all peoples without their feet on the ground, Ballard’s populace lacks common sense. Ballardia could be called the equivalent of a womb except that it is the walls, floors, ceilings and roof that what truly matters in J.G. Ballard’s presumptuous, far-from-junior-grade tale! A building that excludes Earth’s global Nature enlarges the many nameless persons kept within and emphasizes the very smallness of the living space allotted to each peripatetic human is the ultimate security, a completely governable and controllable “bioapparatus”, a multi-storey graveyard or tomb! In essence, Ballardia is equivalent to the Club of Rome’s idea of our Earth-world as a single finite system, which it most definitely is not. In his narration, J.G. Ballard goes beyond mere lampooning; Ballard shocks his readers with a potential reality. Ballardia could be seen as a second choice in a logical dichotomy of technological methods for maintaining our Earth-biosphere: continuing our futile labors to artificially maintain a complex genetic biodiversity or, in future, devising a single technical fix via a huge dwelling’s construction.118 (A vast majority of geographers agree the anthropogenic factor in Earth has become the master factor of our planet’s present-day biosphere since, already, by one direct and/or indirect means or another, Homo sapiens has virtually attained operational control of the Earth’s unique Hydrologic Cycle.119) Ballardia’s timid populace has never visited its roof and, as a consequence, they are incognizant of the Solar System’s existence. (Ballardia’s basement would have to be a “15” on C.A. Doxiadis’ “Ekistics logarithmic scale”!) A cowed population’s total lack of knowledge of the sub-basement level—the planet’s mantle and core—is astounding to contemplate. All future construction, truly in a Macro-engineering matrix, that is ever attempted would use recycled materials except if molecular Nanotechnology permitted reconstitution of matter caused by stacked nano-machines since even unstoppable natural space debris (dust et cetera) is added to Ballardia without the knowledge or understanding of Ballardia’s populace. J.G. Ballard’s lethargic fictional people are unaware they are dwelling inside anything, the building has no discernable architecture, and their geopolitics would take on the character of domestic relations. Unprotected from colliding asteroids and comets, Ballardia is a passive bunker. Lewis Mumford (1895-1990) warned that Manhattan would become so crowded with buildings that Architecture would someday cease to matter.

Better than any other imagery we can recall, Ballardia symbolizes R. Buckminster Fuller’s “Spaceship Earth”. Buildings function as second skins, protecting people from weather, storing food, and regulating internal temperature. Because of buildings, Homo sapiens has become a super-organism, capable of adapting to conditions on other planets such as Mars. Wyville Thomson (1830-1882), author of The Depths of the Sea (1873), is the most successful claimant to the honor of being the first writer of a modern oceanographic textbook. Who will be the last?120

Cargo can be containerized for shipment. Can a planet be “containerized”? That is the question Viorel Badescu and R.B. Cathcart, both members of the Candida Oancea Institute in Bucharest, Romania, answered affirmatively! Earth’s human population is now about 6.5 billions, more than twice what is was during 1964 when the UK physicist John Heaver Fremlin (1913-1995) speculated on the ultimate technical limits to human population increase in New Scientist. On 29 October 1964, Fremlin asserted his unpublished back-of-the-envelope calculated for his figment of imagination—perhaps better termed a “phantasmagoria”—showed that, in less than 1000 years, 20000000 times as

many persons could be alive then as were alive in 1964. He further stated that all people alive near the
end of the Third Millennia would be adequately fed and housed! Re-examining Fremlin’s work,
Badescu and Cathcart found that Fremlin was essentially correct: the “maximum world population
ranges from 1,600 to 4,000 million millions for various cases detailed” in their report. Humans of the
far future may dwell inside a 2000 storey building covering the entire Earth-surface. As a
consequence, Earth will give off an entirely anthropogenic radiation signature owing to civilization’s
encasement. Aliens with SETI programs surely will take notice! This building, as yet unnamed, would
be a true solar-powered machine for living. Interestingly, Badescu and Cathcart suspect that J.H.
Fremlin may have been influenced to advance this big architectural idea by a 1957 science fiction short

Advocates of “ecological foot printing”—that is, the calculation of carrying capacity to provide
Earthlings with a near-mandatory final target population—usually exclude the ocean and few such
advocates even bother to guess or estimate what global Nature’s tolerance for Homo sapiens might be.
However, most settle on “about 2 billion” naturists. Still, macroengineers like Cesare Marchetti
proposed “from a technological point of view, a trillion people can live beautifully on the Earth, for an
unlimited time and without exhausting any primary resource and without overloading the
environment”.\textsuperscript{121} Chapter 3 has dealt only with macroprojects of such grand scale (and, usually,
promoted the leading personalities of Macro-engineering) that they would encompass our planet and
nearly every living person therein. Chapter 4 hereafter will focus on local societal core macroprojects
primarily of interest to regional Earth-noosystems.

\textsuperscript{121} C. Marchetti, “10\textsuperscript{12}: A Check on the Earth-Carrying Capacity for Man”, \textit{Energy}, \textbf{4}, 1107-1117 (1979).
Chapter 4

EARTH REBUILT

Our pre-human and human ancestors freed our species from Earth’s presumed slow pace of biological change, surviving by gaining control of ever-larger units of an Earthly global Nature. Homo sapiens needed technology as a shield between itself and every single bit of our biosphere—a biosphere that is ever more frequently described in untold computer bytes resulting in a globalized “datascape” and regionalized “datascapes”. Mankind’s technological shield if formed by Science that may be underpinned by religions and society churning geopolitical ideologies. Science seeks to manipulate Earthly global Nature’s forces according to our will in the interests of species comfort, health, longevity and full satisfaction of inborn curiosity. Today, man’s noosphere ranges from Earth’s geosynchronous orbit to a maximum depth of 12-13 kilometers in the lithosphere, so that the living contents of the man-expanded Earth-biosphere operate through a vertical cross-section almost 35915 kilometers thick. (Human alterations of rainfall patterns and land erosion above tectonic plate boundaries, it is alleged, ultimately could influence deep Earth geology122; such would also be the case, possibly, for terraformation, even on planets without known tectonic plates.) Our world’s Earth-biosphere can only be enlarged by downward extension. So far, we have not penetrated deeper than jet airliners fly above us! In all Earth’s existence, a single species has achieved global dominance of its biosphere, creating a world from a given globe for the first time in our Solar System’s Astrological Time.

During the late-20th Century, however, geographers came to realize that technology, by itself, was a reorganizer of the Earth-biosphere: “it is not premature to investigate the idea that the habitable area of the world itself may be in the process of being reduced quantitatively and qualitatively through impact of modern technology. Machine space, or territory devoted primarily to the use of machines, shall be so designated when machines have priority over people in the use of territory”.123 These comments converge on North America’s urban carnage created by cars, not on future autonomous machines and the potential creations of molecular Nanotechnology. Another geographer, William Bunge, in 1988, offered the extreme admonishment that science’s “progress” is machinekind-evolving, not mankind-evolving. Will there ever be a time when robots replace people?

Amongst macroengineers, it is an old drollery to wish for a wonderful construction material called “Unobtainium”, a material that is weightless, costs nothing, and it capable of being shaped by childish technicians. It might conceivably exist but, of course, it is unprocurable, except in Hollywood science fiction films such as *The Core* (2003) where it was invoked to allow a manned vehicle to travel in the Earth’s mantle material! It is also an excuse for non-delivery. However, 21st Century molecular Nanotechnology promises Homo sapiens the capability to build molecules atom by atom —“Unobtainium” could, indeed, one day be manufacturable! (The National Nanotechnology Initiative was instituted in the USA during 2000.124) In other words, professionals of all scientific persuasions must learn to appraise, predict and direct all future planet-based macroprojects attempted by Homo sapiens-made organisms—macroprojects reorganizing Earth and other suitable planets of this Solar System. Even if large-scale human migration to unterraformed planets and moons never takes place, it could well be that Mars and Venus are converted from people-less orbs into phytotrons feeding food,

fiber, substances and energy to Earth’s life and robots. Such macroprojects might justify mankind’s (and/or mindkind’s) pharaonic investments of money (or merely time and energy) in extra-Earth macroprojects.

While William Bunge assessed this kind of technological progress as probable (but undesirable), others have often (and rather emotionally too) claimed future mindkind an “unnatural” and its likely geographical impact as “nil”. Why “unnatural” should always be as—as “un-Earthly” is not—a reprobative term is difficult to understand. Until mindkind begins directing its own non-biological evolution via technological progress, these creatures cannot be considered as much more than extensions of our bodies and present-day machinery. Bodies, buildings, succeeded by mindkind embodiments—that seems to be a reasonable natural progression! Planet-altering mindkind—the sturdier offshoots of mankind, or possibly sub-species of Homo sapiens, is well along towards full materialization. As long ago as he 17th Century, Robert Boyle (1627-1691) perceived Earthly global Nature as a “great…pregnant automaton”.

“Infrastructure” is a vogue word, yet it serves a very useful function; its retention is vital to any discussion of Geopolitics, Macro-engineering and Terraforming. As recently as 1950, “infrastructure” meant fixed facilities supporting military plans and operations. More recently, the term is defined as referring to geographically fixed facilities on which a community’s continuance and future spatial enlargement depends. As hinted by Ronald J. Horvath, molecular Nanotechnology’s creations will not be static or geographically fixed; yet they too will become a significant part of early the 21st Century’s Homo sapiens infrastructure. K. Eric Drexler, in 1986, first voiced the idea that, over a period of a single decade, molecular Nanotechnology could reverse the carbon dioxide gas buildup in the Earth’s atmosphere—thereby eliminating “global warming” as a macro-problem for mankind! Such an event-process could be molecular Nanotechnology’s 21st Century answer to a misguided international, “Green”, 20th Century sententious cult slogan “think global, act local”, derived from E.F. Schumacher’s Small is Beautiful: Economics as if People Mattered (1973). “Think global, act local” is an excellent motto for molecular Nanotechnology and Macro-engineering practitioners should probably continue to parrot Schumacher and the growing ranks of molecular Nanotechnology practitioners, at least until a better phrased slogan is found and adopted. In any case, the Earth atmosphere can be scrubbed clean of all anthropogenic carbon dioxide with chemistry magic alone. Imagine no future restrictions, a la a Kyoto Treaty that expires in 2012 AD, on fossil fuel usage and no global warming!

Antarctica—our planet’s largest contiguous icescape—contains 91% of our planet’s glacier ice. Melting of mountain glaciers and non-floe ice located at the Polar Zones could raise the global ocean level; future sea level change could hasten the melting of Earth’s glacierized regions. After 2100, the ocean could “suddenly” rise five to six meters, if the West Antarctic ice-sheet—Earth’s only remaining marine ice-sheet and approximately 10% of the Antarctic ice-sheet—slid into the ocean. An ocean level change of this magnitude would not adversely affect the Suez Canal’s operations for, with appropriate improvements by the Egyptian Government, the canal could pass larger draft shipping. But a higher sea level could cause a radical reorganization of the Panama Canal, which since 1 January 2000 is Panama’s military and commercial liability. Post-Panamax container ships cannot use the

Panama Canal and the present canal could reach its maximum capacity by 2010; the nature of shipping after 2010 is a very big question for macroengineers since new ship types are will assuredly emerge from the world’s shipyards. In April 2006 a USA$5.2 billion canal modernization was unveiled that may result in the digging of a new set of locks and a new navigation channel by 2014.

Panama Canal (completed in 1914) is located near the equator (at 9° North latitude) where a rise of global sea level would be exaggerated by Earth’s rotational dynamics. Mean sea level at the existing Pacific Ocean terminus is higher than at the Atlantic Ocean end. The local tidal range for the Pacific Ocean is quite big—so great, in fact, that even a new, sea level canal would require some kind of tidal lock system—and this geographical fact could become of critical importance when our globe’s ocean becomes more voluminous! The existing Panama Canal infrastructure is obsolete. True, the Canal’s lock miter gates—designed during 1906-1914 by Henry Goldmark (1857-1914)—are almost a century old and possibly mechanically unsound owing to loading cycles; gate failure at Pedro Miguel Locks, or Gatun Locks, could drain Gatun Lake, catastrophically closing down all trans-Panama movement for a long time—some ship’s cargos would spoil, rot, become outdated or even dangerously unstable until lock repair and lake refilling could be accomplished by jittery macroengineers! To speed recovery, cloud seeding could be carried out to enhance local rainfall. Fresh water-carrying plastic pods, earlier proposed for India’s use, could import enough fluid to artificially fill reservoirs. Realistically, since prolonged lake draining kills the vegetation and fish, it may be feasible to simply fill the supra-Panama Canal service lakes with pumped seawater. And, seawater would kill off the clogging aquatic weed hydrilla verticillata, which is a major problem in the Panama Canal Zone. Accomplishment of this effort would affect infra-service lake groundwater paths, biodiversity and watershed erosion. A worldwide rise of sea level would reduce lock-cycling times (at the Miraflores Locks and at the lowest of the Gatun Locks), since a reduced volume of fresh water from Gatun Lake would be necessary to fill these chambers.

Earth’s ocean receives about 77% of all precipitation. Luckily for Australians, an effective Noelian “lily-pad” rainfall collector could be laid out on the oceanic surface south of that continent-nation. The only suitable close-by collection region for North America is in the stormy mid-North Pacific Ocean and a collector placed there could be shared with Japan and, very likely, would have to be installed with Russia’s acquiescence. However, there are several appropriate sites south of the Hawaiian Islands, which could serve the USA alone. Operational Noelian “lily-pads” there would risk an assortment of ultra-hazardous man-made threats: ship collisions, airplane ditchings and the violent crashes of wayward supersonic aircraft and aerospace planes and spacecraft. Since humans have been stoned by meteorites there is a chance—approximately a 1% risk—that Noelian fresh water collectors could be destroyed by an asteroid impact in the Pacific Ocean during the 21st Century. Wherever appropriate, fresh water collected by David Noel’s device may be delivered to consumers using a submarine pipeline that floats below the ocean’s surface, extending from the “lily-pad” to the land’s shoreline.

In 1980, the Massachusetts Institute of Technology’s Energy Laboratory (organized in 1972) convened a committee of experts to review all extractive techniques for obtaining oil from oil shale. The

129 Stephan Gollasch et al., Bridging Divides: Maritime Canals as Invasion Corridors (2006).
Committee’s recommendation involved a solution only slightly more high-tech than the continuous coal-mining machine invented, in 1947, by Harold F. Silver. The group proposed an almost Juggernaut-like 1,000-tonne mechanical mole (with a 10 square meter gnawing face) driving itself through oil shale formations at 60 meters per minute. The device would break the shale rock, remove the oil by in situ rubble heating, and then emplace the unused residue (called “muck”) behind its perpetually roving mole-like body. Shields on modern tunnel boring machines are equipped with movable fins, which help technicians to control the direction of forward movement. In effect, this changes the concept of a tunnel-boring machine from an oversized drill bit in a horizontal mode, to a sub-surface groundcraft. Science has already elaborated data on aerodynamics (from 1866) and hydrodynamics (from 1738). Will 21st Century scientists organize a special study called “lithodynamics”, a lore dealing with controlled maneuvering of lithosphere penetrators functioning with robotic intelligence? Such groundcraft (on the analogy with spacecraft, aerospacecraft, and watercraft) could be guided to their intra-lithosphere goals by geological maps resulting from Project GENIUS.

Such brilliant robotic groundcraft could then be given updated information, not instructions as in computer programming, via collimated neutrino beam telecommunications transmitted from a Ground Control Center. MIT’s proposed solution for an important USA resource-acquisition macro-problem could, thus, become a potential planetary crust miner! MIT’s smart robotic moles were to be tele-controlled, and oil was to be pumped to the surface through trailing hoses at a rate of five million barrels daily. Machines of this kind could well becomes, also, the very first adaptable to the self-repairing mode so much desired by robotics experts. At first, robot manufacturers could create a “breed” of intelligent moles capable of commanded crustal burrowing—even under the ocean—and delivering whatever is extracted or produced to their human masters. Then, later, such robots might be powered by some of the very materials they mine, motivated by solar power (collected and stored for 24-hour-a-day work shifts and delivered downwards in exchange for products sent upwards), or fueled by gases extracted from deep geological strata, where it is thought methane exists naturally. If mole-machines could be powered by heat given off by magma, then the topmost part of our Earth’s mantle, just below the Earth-crust, could become a valuable resource.  

With the approval of archaeologists, independent moles could process urban ores (landfills), global Nature-made ore bodies, and even toxic waste dumps. Such places exist because land-fillers wish to entomb civilization’s castoffs. (Mankind has always made some additions to Earth’s paleontological record; contributions by robots may be nil—that is, their “life-styles” may be entirely waste-free.) If 21st Century Homo sapiens fails to acquire off-planet resources bases on the Moon, Mars, and Venus, then such “desecrations” may become necessary as well as desirable. One of the greatest advantages that will accrue from a future use filed robots in Macro-engineering endeavors is that there is no instant underdevelopment following a macroproject’s completion. In the Third World especially, poverty often succeeds the disappearance of jobs and public services after a particular macroproject’s construction phase terminates. In other words, macroprojects can be placed just about anywhere in the Earth-biosphere—anywhere that they would be appropriate—built without regard for human labor supply centers, human health constraints, sans people costs (insurance, housing, social welfare, recreational needs, crime)! Macroprojects built almost entirely by robots would, therefore, entail no loss (to humans) of democratic freedoms through a regionalized bureaucracy buildup—hence, definitely no “metaphysical pathos” in the ranks of busy local macroengineers!

---

Henry Alexander Murray (1893-1988), co-inventor of the Thematic Apperception Test used in psychiatric diagnosis, thought all humans had a “construction need”, an imperative to organize and to build things. American psychologist William James (1842-1910) recognized an expressed “construction instinct”, an instinct James described “as genuine and irresistible in man as in the bee or the beaver. Whatever things are plastic to his hands, those he must remodel into shapes of his own, and the remodeling, however useless it may be, gives him more pleasure than the original thing.”

Because global Nature is expanded in volume by Homo sapiens the psychological insights of both Murray and James amply justifies a poetic remark to the effect that “Nature imitates Art” made long ago by Oscar Wilde (1854-1900)! Techno-Art and Science—each taken in several senses of meaning—do enlarge mankind’s common reality! Clinton Richard Dawkins, zoologist, seems to think Homo sapiens’ penchant for building small and large things is a genetic effect. Most geoscientists are obsessed with the desire to know, to learn something about planets today that no one knew yesterday; macroengineers are obsessed with the desire to build something, to create new, functioning structures, buildings and devices. More often that not, both professions embrace a macroprojects because it serves their separate needs. Indeed, civil and military macroengineers never encounter a biosphere macro-problem they cannot solve, given enough money or free labor; geoscientists never envision a question about global Nature they cannot at least try to answer, given the sensors and other tools they will need to do so. Psychologists who are proponents of “carbon dioxide therapy” have related that human inhalation of a gas mixture of 30% carbon dioxide and 70% oxygen—Earth atmosphere composition is normally 78% nitrogen, 21% oxygen and 0.03% carbon dioxide—several times a week to a moment of near-unconsciousness alleviates psychotic symptoms in some patients. Is it possible that Earth’s man-augmented Greenhouse Effect—an ecological crisis caused by carbon dioxide gas buildup in the Earth-atmosphere—may elicit Murray’s “construction need” via a carbon dioxide-induced cenotrope? Could Macro-engineering be the means by which this need is manifested? Macroengineers need a comprehensive overview of the problems they face, solve and create through their existence. A person feels good when that person is happy! A person is generally happy when doing a fulfilling task—that is, a project of any size which is challenging enough to leapfrog boredom and yet feasible enough to prevent anxiety. When a person’s self-consciousness is temporarily controlled or mentally disentangled from Earth’s geophysical reality, a personal state or sense of purposefulness and harmony is said to happen. (The vital essence of James G. Ballard’s fictions is that, although Earthly global Nature does produce expectable, if horrific, disasters it is the psychological sickness of Homo sapiens which causes mankind not to mentally be aware of their full impact—in effect, Ballard apprehends our species and Earthly global Nature as involved in a conspiracy—Ballard blames the planet we live on for all the mess!) Electronics and related technologies are very progressive, so much so that, by AD 2050, humanity may be introduced to environments created by tele-macroengineers and automatic terraformers. Wholly changed Solar System planets are not going to be escapist enclaves. Not to be overlooked is Art-as-reclamation (“Earth Art”), as practiced by Robert Smithson (1938-1973) and others, and which could be one expression of robots. Tele-macroengineers and tele-terraformers might be said to practice a unique form of Art, “Arte Povera”!

George Perkins Marsh would have found little that was unfamiliar in Ernst Fischer’s 1915 essay. Marsh, born during 1801 in Vermont, was a voracious reader, although somewhat hampered by a lifetime of chronic eye maladies. Appointed as Minister to Turkey in 1848, legation on behalf of the USA and a special mission to Greece enabled him to travel in Europe and North Africa. On these trips, Marsh collected flora and fauna samples for the Smithsonian Institution in Washington DC. Marsh then returned to the USA in 1854; was appointed by President Abraham Lincoln a representative to

Italy, where he served the USA from 1861 until his death and burial in Rome in 1882. His book, *Man and Nature*, which was first published in 1864, eventually was revised in several bigger editions. With *Man and Nature*, Marsh set out to depict the character and extent of Earth’s anthropogenic changes with an early kind of Environmental Impact Statement. Quite evidently, Marsh was overly impressed—particularly during his Mediterranean Sea Basin excursions—by regional-scale landscape destruction. Geophilosophical bent as well as personal viewing impelled Marsh to emphasize man’s freedom of will to impart motion to matter. Human reaction to a region’s deterioration can be either remedial (reconstruction, restoration, redesign) or removal (emigration), depending upon available noosystem technology and geopolitical conditions. Since Marsh lived more than 75 years before the Space Age’s onset, obviously he dealt with only actual, not potential emigration options and he chiefly sought to foster local reharmonizations of people with global Nature. “The Environment”, a noun that denotes rather a lot (the Universe!\(^{138}\)), and “The Ecology” of the 1970s through the early 2000s would probably have baffled Marsh. Today’s popular “Environmentalists” can be outlandish gurus, tenured university professors, dedicated preachers, lawbreakers, glib politicians and cyberpunks. Today’s reasonable Environmentalists, as individuals, can be members of the same groups! If such persons are the defining counter-culture of our Space Age, then the planning skills of such persons ought to be enlisted by 21st Century Macro-engineering remaking the Solar System.

Marsh stipulated that he was especially concerned about Europeans along with their colonial offshoots, because that far-flung group was technologically ahead of other peoples. It is rather disconcerting that none of the participants at the post-1977 Macro-engineering seminars have drawn their audience’s attention (or their readers) to a still-pertinent Chapter VI, “Great Projects of Physical Change Accomplished or Proposed by Man”, which can be found in the 1974 re-issue of *Man and Nature*. Perhaps this is one of the reasons Macro-engineering is not widely understood by Americans or Indians, even though the term first appeared in the British popular press during 1964 and the American popular press during the 1970s—for an example, see *The New York Times*, Section 4, page 7 of the 19 February 1978 issue. American newspaper and weekly news magazine accounts of declining USA leadership in high technology have influenced legislative decisions to support costly mega-Science and Macro-engineering R&D. (*The New York Times*, a leading newspaper in the USA, in 1978 created its first section devoted to matters centered upon modern Science and Technology, “Science Times”.) Macroengineers have a wonderful and inspiring history! A baseless research and development—R&D is supposed to be the cause of technical progress, product innovation and ecosystem-nation economic growth—cannot be good for commerce or national security.\(^{139}\) A rebuilding of the USA’s and India’s infrastructures might be the means by which the barriers between academic disciplines, between Technology and Science, and between universities, national and regional government, and private-sector industry are dissolved. Certain macroengineers never fail to hype silly ideas in the national public media—like Salter’s Planetran—while ignoring practical macroproject plans—like Knight’s gravity-assisted trains for regional mass transit! In short, some macroengineers sometimes short-circuit their own profession’s expansion. On 1 February 1992, the President of the USA announced that Russia was no longer officially considered an adversary. That termination of the Cold War, and the USA’s rejuvenated relationship with India, reveals the possibility for a much different relationship, perhaps sempiternal, between the USA and all other Earth-biosphere nation-ecosystems biosphere that should be transparent!

Our English language word “Earth” comes from Old Norse and Old German. Put together from many linguistic elements, English used a northern European word for the planet; so, it is called Earth. “A visually striking reminder that art is central to the earth can be shown dramatically by covering the first


and last letters of the word ‘Earth’”. After describing man’s effects on Earth’s biosphere, Marsh then hinted that Homo sapiens may one day transform the Solar System into an Anthropocosmos: “Yet among the mysteries which science is hereafter to reveal, there may be still undiscovered methods of accomplishing even grander wonders than these”. Circa AD 2006, Voyager 1 physically defines the Anthropocosmos (for six and one half billion members of the species Homo sapiens) that has a diameter of 200 Astronomical Units, each AU equals 149,685,270 kilometer. The AU’s value—the average distance between the Sun and Earth’s orbit—was first determined by electrical engineers circa 1961, when Planetary Radar Astronomy was established.

In 1969, stimulated by J.H. Fremlin’s 1964 insights on Earth’s carrying capacity—or holding capacity—Lamont Cook Cole (1916-1978) concluded that in less than 1000 years the mean temperature of the atmosphere would be doubled (from 15°C to 30°C) and Earth’s biosphere would be made effectively uninhabitable. Like Marsh before him, Cole was too subjective and overly impressed by examples of energy mismanagement, rather than creative and successful energy management. Some geoscientists have shown “that the human-induced climatic changes are negligible”. For argument’s sake, let us suppose that Cole’s statement stands, that Earth’s biosphere is uncontrollably heading for a heat death—the exact opposite of Buffon’s anti-Greenhouse Effect and the Nuclear Winterists predictions. Did Cole consciously inflict upon humanity this very warm Hell-like fate because he could not envision diversion of some of that harness energy, used to build domed air-conditioned cities? (If an Earthly super-Greenhouse Effect developed, then it will only be in cooled domes that mankind can reproduce.) Richard Buckminster Fuller, on 8 February 1962 in London, UK, drew the world-public’s attention to his plan to lace a dome over a vast segment of the City of New York, namely Manhattan Island. The Manhattan Dome is the most famous example of a Utopian pneumatic structure in Architecture. If all the known and estimated reserves of fossil fuel were burnt, then the carbon dioxide gas content of Earth’s atmosphere would increase from 0.035% to 0.35%. If all of Earth’s proven and recoverable coal were instantaneously burnt, then this nightmarish event-process (releasing all formerly coal-bound sulfur as sulfur dioxide) would cause a concentration of sulfur dioxide in the air of four parts per million of the air’s total weight. Exposure to such a level of polluted air for only an hour would kill all persons! (A 2005 scientific prediction: “the global averaged surface air temperature and amount of precipitation could increase in less than a decade by 0.8 K and 3%, respectively, if the entire amount of anthropogenic sulfate aerosols were removed from the atmosphere.”) The year—AD 1969—Cole’s unpleasant forecast was printed was also the very year two men first tramped on the Moon’s rugged regolith! Why did not Cole comprehend that there are three other terrestrial-type planets (Mars, Venus, and Mercury) and the Moon, with a total surface area almost exceeding seventy-eight times the USA’s territory, available for future colonization? The area of the Moon is slightly more than the land area of Africa. Richard L.S. Taylor’s Mars Worldhouse macroproject idea for taming Mars is an excellent example of realistic ecological planning. The area of Mars is almost equal to the Earth’s New World plus Australia. To be fair, many living 21st Century scientists bear the torch, not of Liberty, but of L.C. Cole-like “Sustainability”. Taylor’s Worldhouse is designed, like all terraformation macroprojects proposed so far, to modify the existing atmosphere of a planet in order to make climatological conditions suitable for some of the Earth’s life forms. When first completed, the Mars Worldhouse would be slightly more comfortable—assuming a self-contained oxygen supply for each person

144 G.R. Hilst, “What can we do to clear the air?”, Bulletin of the American Meteorological Society, 48, 710-712 (1967).
working there—than Earth’s Antarctica, but with swirling white blizzards replaced by pinkish fine dust storms! In the cited instance above, Cole was a “gloom and doom writer” who seriously misinformed his readers. Such continued misleading negativism could retard all Macro-engineering and Terraforming R&D. As the USA spationaut Russell L. Schweickart, now President of the “B612 Foundation” which seeks to alter the orbit of an asteroid in controlled manner by 2015 AD, has said: “Doomsday is a cliché whose purveyors have spread a gospel of despair based upon acceptance of all problems and rejection of all solutions. This is not only a terribly selective view of life, but one in which there is no room for hope, imagination, creativity, or expanded awareness.”

The publicity successes since 1970 of Environmentalism really imperils Homo sapiens’ future and the stability of our Earth-bioapparatus—it is to be celebrated that Macro-engineering and Terraforming have, somehow, persisted to purvey a counter-acting positivism!

Published Macro-engineering and Terraforming macroproject plans still receive nasty castigation by tenured academics indoctrinated during the late-20th Century. That university-lodged taskforce of socialistic persons seeking stasis in an ever-changing Earth-biosphere is well masked by “scientific” anti-progress opinion-forming media and textbooks. In addition, their continued strong influence is felt via lawmakers and court law-challenges. Sadly, in the USA today, “scientific method” is the focus of legal contention in Court battles but “scientific method” is still a matter of controversy in Science itself!

Since 1945 more than 1500 nuclear explosions were detonated in Earth, and yet there is remarkably little that can be said of blast effects upon the landscape and seascape, mainly because those explosions were mostly underground tests done in accordance with a 1962 international treaty. History’s greatest recorded thermonuclear explosion, the Russian 58 megaton atmospheric test of 30 October 1961 at 8:34 GMT, some 3600 meters above the Arctic island of Novaya Zemlya (at 73° 30 North Latitude by 53° 30 East Longitude) has left little surface evidence of its transient existence. Long-lived chemical products remaining in the atmosphere after that big blast may be misleading climatologists about the minor importance of the Arctic’s “Ozone Hole”; careless safety engineering by Russian testers, however, left the Novaya Zemlya archipelago and the Kara Sea unnaturally radioactive. Some of Russia’s landscape and seascape is a unique former Superpower econightmareland.

During 1957, the USA’s “Plowshare Program” was organized to foster beneficial changes of the Earth’s surface (rather than detrimental wartime changes of man’s townscape) using thermonuclear explosions in peacetime excavation and other macrop projects. The USA’s goals with the Plowshare Program are outlined in Scott Kirsch’s Proving Grounds: Project Plowshare and the Unrealized Dream of Nuclear Earthmoving (2005). Widespread public apprehension as to the wisdom of the Plowshare Program forced its termination by 1973. Russia’s counterpart to the USA’s investigation, the “Program for Use of Commercial Underground Nuclear Explosions”, began in 1965 and was curtailed in 1988. Both the USA and Russia used “dirty” thermonuclear explosives in 115 unsafe experiments for “peaceful purposes” such as mining and canal creation. In Russian and the USA, joint-financed theoretical work does continue on perfecting “clean” thermonuclear explosives. If achieved, such economical geography-changers could transform spacious Russia’s resource-rich regions quickly, making the same technology attractive to foreign investors such as the Japanese, Germans and Chinese. “Clean” thermonuclear explosives might even be used to destroy or deeply bury some previous “dirty” test sites or pulverize threatening Earth-crossing asteroids and comet.

Russian geographers, when describing their huge but needlessly poor and radioactively contaminated

---

country, often regard snow as a semi-permanent soil horizon (atop the ABC soil profile); snow which be plowed or compacted to retard rapid thawing, supplies not only fresh water, but some nutrients and minerals (from natural atmospheric fallout) to the soil’s superstratum. Snow virtually symbolizes Siberia, a part of Russia. During winter, the Arctic Zone provides a depressing environment for humans consisting of low temperatures, strong winds, and weeks-long darkness. In complete darkness, during January to March 2006, Mike Horn and Borge Ousland, starting from Cape Artichesky (Russia) finished the first historically recorded over-ice trek to the North Pole! Surprisingly, the cold Arctic has a per capita economic output that is approximately 10-12 times that of Earth’s Tropic Zone. The distance north or south from the planet’s equator is among the most significant measured environmental variables underlying the differences in per capita by country-ecosystem, but this is probably most easily explained by the overall geographic pattern of human settlement (First, Second and Third Worlds), which tends to influence social institutions. In other words, if humans living in the Arctic (or the Antarctic) were made more comfortable than presently, it is very possible that the economic value per square kilometer of territory situated there would decrease slightly since only very poor persons (nomads) and highly paid persons (industrial technicians and scientists) live fulltime in the Arctic. Because of long-range transport by air, seawater currents and river flows, the Arctic Zone is a place of deposition, a sink, for industrial and agricultural pollutants from the Northern Hemisphere Temperate Zone. Marla Cone’s *Silent Snow* (2005) documents the nature and scope of the problem in the same style as Rachel Carson’s 1962 *Silent Spring*. Increased future ship traffic in the Arctic Ocean will enlarge the “Ozone Hole” over that region. Non-nomadic people work in the Arctic’s cold air and dreary settlements only because there are known mineral, natural gas and petroleum deposits to be extracted and shipped, along with seasonal and non-seasonal hydroelectric facilities to be efficiently operated for the benefit of dependent urban populations dwelling in the Temperate Zone’s warmer climates. There is every reason to assume that valuable Arctic Zone resources remain undiscovered, awaiting future exploration, definition and exploitation by industry. Many persons muse on the possibility of humans someday living in Space Settlements far more capacious than the International Space Station or on a terraformed Mars but few seem to contemplate an increased human use of ~25% of Earth’s surface—the Polar Zones.

It is now scientifically proved that the Arctic Zone is warming and eventually it may reach a seasonally “ice-free” state. Sea ice in the Arctic Ocean, upon which polar bears romp, is less mobile than the sea ice which surrounds a continent in the Antarctic. Floes tend to converge and pile into thick ridges, making the floe ice thicker; the ridged ice lasts into the summertime. Arctic Ocean floe ice extends to the North Pole because it receives less solar energy at the surface since the Sun’s rays strike at a more oblique angle, as compared to the Temperate Zone. Reduced sea ice extent and thickness in the Arctic Ocean would promote regular summertime shipping, and present new opportunities for offshore oil and natural gas production. A Northern Sea Route paralleling the Siberian coastline would be 40% shorter than the current Europe-Asia Route that requires a passage through the Suez Canal; Siberia would have new marketplaces for its products. In addition, new macroprojects—opportunistic hydroelectric power development of diminishing Greenland glaciers and a permanent dam, tunnel or bridge across the Bering Strait—may attract new settlers to the Arctic Zone. As Alexander Alexandrovich Bolonkin and R.B. Cathcart have noted elsewhere: “There is also the possibility…for Arctic [Zone] greenhouses

---

149 J.T. Overpeck et al., “Arctic System on Trajectory to New, Seasonally Ice-Free State”, *EOS: Transactions of the American Geophysical Union*, 34, 309.
under inflated membrane hemispheres producing fresh fruits and vegetables for workers on such macroprojects and to house workers seeking to maintain the present-day natural stock of...sea-ice by construction of artificial ice-floe islands.\footnote{52}

Possibly the first true attempt by experts in Architecture to construct effective artificial life-support systems in climatically harsh Earth-biosphere regions was the construction of greenhouses. Circa 30 AD, to sate his jaded tastes, the Roman Emperor Tiberius had cucumbers grown in his “specularium” and glass-enclosed buildings of the type widely prevalent today in northern Europe were first built during the 1600s. Extensive commercial greenhouses in The Netherlands, even in outer space\footnote{53}, are maintained nearly automatically by heating, cooling, irrigation, nutrition and plant disease management equipment. Humans share commonalities in their biological and medical responses to natural environmental stresses that are stimulated by cold air, snowstorms and strong wind. In the Arctic and Antarctic, life-threatening “whiteout” blizzards inflict the same personal visual discomfort and disorientation as spationauts experience during the hazardous “space walks”—that of being adrift in featureless space! With special clothing and shelters, humans can adapt to the Arctic Zone successfully. Medical researchers have asserted that “…cold-related deaths are far more numerous than heat-related deaths in the United States, Europe, and almost all countries outside of the tropics, and almost all of them are due to common illnesses that are increased by cold.”\footnote{54} Incontrovertibly, living in the Arctic is difficult, even when tempered by strong conventional protective buildings. The intensity of UVB radiation has increased in the Arctic during springtime, caused by severe ozone depletion instigated by man-made chemicals and climate change; UVB radiation stimulates sunburn (erythema) and snow blindness (photokeratitis). People working in the Arctic ought to be shielded from UVB as much as possible.

The first big “Evergreen Dome”-type dwelling hemisphere design “City in the Arctic” was commissioned in 1970 by Farbwerke Hoechst AG in Germany.\footnote{55} “City in the Arctic” was a pneumatically stabilized climate-regulating transparent membrane half-sphere shell with a diameter of 2000 meters, a maximum height of 240 meters and a dome radius of 2200 meters, that was intended to comfortable shelter 15000 to 450000 workers. The approved membrane was to be reinforced and supported by a net of intersecting, braided polyester fiber cables. Even stronger cable-making materials, such as carbon nanotubes, are becoming available today that would improve upon the formidable performance characteristics of “City in the Arctic”. A dynamic air-supported membrane building normally costs only about 30% of a building assembled with ordinary materials. “City in the Arctic” was never built. The Bolonkin-Cathcart macro-engineering concept of inexpensive to construct and operate “Evergreen” inflated domes is supported by computations, making the speculation more than a daydream. Innovations are needed, and wanted, to realize such structures in both Polar Zones, but primarily in the Arctic. James Lovelock’s \textit{The Revenge of Gaia} (2006) actually forecasts that before AD 2100 billions of persons will die because humans have altered the Earth’s biosphere so much that an abrupt “global warming” of the atmosphere is going to occur; Lovelock further suggests that the few breeding human couples that survive after AD 2100 will live in the Arctic Zone where the climate may remain tolerable!

The Bolonkin-Cathcart Evergreen Dome design is presented in Figure 1, which includes the thin

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{Evergreen Dome Design}
\end{figure}

\begin{thebibliography}{99}
\end{thebibliography}
inflated film dome. The Evergreen Dome innovations are listed: (1) the construction is air-inflatable; (2) each Dome is fabricated with very thin, transparent film of a thickness ranging from 0.1 to 0.2 millimeters without rigid supports; (3) the enclosing film is a two-layered element with air sandwiched between layers to provide insulation; (4) the construction form is that of a hemisphere or, in the instance of a roadway/walkway, railway, a half-tube, and part of it has a thin aluminum coating that functions as the collector of incident solar energy. Surplus heat collected may be used to generate electricity or furnish mechanical energy; and (5) the Dome is equipped with sunlight controlling louvers. Sometimes, such louvers are referred to as “jalousie”, meaning a blind or shutter having adjustable slats to regulate the passage of air and sunshine. Real-time control of the sunlight’s entrance into the Dome and nighttime heat’s exit is governed by the shingle-like louvers.

Figure 1.

Figure 1 illustrates the thin transparent Dome envisioned. The hemispherical inflated textile shell embodies the innovations listed. A film as thin as 0.1 to 0.2 millimeters thick has never before been used in a major building. The film has two strong nets, with a mesh of about 0.1 x 0.1 meter and a = 1 x 1 meter, the threads are about 0.3 millimeters for a small mesh and about 1 millimeters for a big mesh. The net prevents the watertight and airtight film covering from being damaged by vibration. The film incorporates a tiny electrically conductive wire net. The wire net serves to inform the Evergreen Dome supervisors concerning the place and size of film tears and rips. The film is twin-layered with a gap between the covering’s layers. This multi-layered covering is the main means for heat insulation and puncture of one of the layers won’t cause a loss of dome shape because the film’s second layer is unaffected by holing. The airspace in the Dome’s covering can be partitioned, either hermetically or not. The Evergreen Dome unit’s #5 shown in Figure 1 is furnished with a heat tube, #6, that can spray warmed anti-freeze liquid onto the Dome’s exterior, thus eliminating snow and ice buildup; Bolonkin and Cathcart only reluctantly suggest the use of deicing spray because of the long-term environmental effects of their use remains unclear. Part of the Dome has a very shiny coating of aluminum to reflect incoming solar radiation. (In Austria, Bartenbach Light Laboratory is mounting large mirrors on nearby hillsides to beam sunlight into the too shaded town of Rattenberg—an instance of “day-lighting” specifically designed to lower the stress in the people of the gloomy town.)

---

As wind blows over and around a fully exposed, nearly completely sealed inflated Evergreen Dome, the weather affecting the external film on the windward side must endure positive air pressures as the wind stagnates. Simultaneously, low air pressure eddies will be present on the leeward side of the Dome. In other words, air pressure gradients caused by air density differences on different parts of the Dome’s envelope is characterized as the “buoyancy effect”. The buoyancy effect will be greatest during the coldest weather when the Dome is heated (from inside) and the temperature difference between the interior air and the exterior air are greatest. In extreme cold climates, such as the Arctic Zone and the Antarctic Zone, the buoyancy effect will tend to dominate Dome pressurization.

An Evergreen Dome in the Arctic Zone covering a land area of 200 by 1000 meters, with irrigated vegetation, homes, open-air swimming pools and playgrounds, could greatly advance dome-building technology over the world’s largest greenhouse, the Eden Project in Cornwall, UK. A city-enclosing Evergreen Dome of 200 by 1000 meters could have a useful area of 250000 square meters, a useful volume of 1780000 cubic meters, an exterior area of 375000 square meters. Comprised of a film only 0.0002 millimeters thick, the Evergreen Dome would mass approximately 145 tonnes. The single

greatest boon to Evergreen Dome construction, whether on Antarctica or in the Arctic Zone, is the protected cultivation of plants inside a pressurized membrane structure that generates energy from the available and technically harnessed sunlight.

The USA’s Geological Survey estimates the Arctic Zone may have 25% of the Earth’s undiscovered petroleum resources; most of the best prospective territory is located in Alaska, Canada, Greenland, Norway and northwest Russia. “For repairs, supplies or moving people in and out…weather windows drive everything”. Exploration costs in the Arctic Zone are comparable to those usually incurred during offshore exploration in the ocean. However, the shipping costs entailed in removing the oil and natural gas from the Arctic Zone are greater than those from completed prospects in the offshore realm. Lacking pipelines, extracted natural gas must be liquefied, then moved in special tankers and oil must be kept warm so that it can flow into tankers for shipment to markets. Alexander A. Bolonkin’s commercial legal entity, Consulting and Research Co. (registered in New York State, USA, in 2001), has devised a unique method for long-distance natural gas transportation—the aerial gas pipeline (AGP). AGP consists of pipe made with impermeable plastic that, when filled with natural gas, is self-supportive in the Earth-atmosphere. It can rise to altitude of 1-4 kilometer and bow between ground-based pumping stations that are separated by a ground distance of 200 kilometers. A.A. Bolonkin is presently finishing the R&D phase and is seeking interested investors. Terrorists are not likely to roam the Arctic Zone wilderness, but should any AGP be disrupted—most easily, we suppose, by destroying a compressor station, thereby “shooting down” a 400 kilometer-long segment of the AGP—it can be repaired/replaced relatively inexpensively (Figure 4.)

At the opposite extreme of the Russian view of snow as “soil” is the Dutch view in The Netherlands of plaggen soils, which are profile-less anthropogenic soils. Somewhere between these two extremes (distilled water and animal feces) fall most of our biosphere’s soils! As the source of foodstuffs, soils are vital in every sense of that word. Many of the macroprojects described hereinafter are planned in

---

the best interests of humanity, to bring more soils under cultivation and to make fertile land wasted by
global Nature." Man’s energy use increased markedly during the 20th Century—from about 1 terawatt
in 1890 to about 14 terawatt by the early 21st Century, according to Vaclav Smil’s *Energy at the
Crossroads: Global Perspectives and Uncertainties* (2003). Of course, that 14 terawatt represents only
a directly measurable part of Earth’s bioapparatus energies that Homo sapiens has so far harnessed by,
of and for Art!

All territory belongs to: (1) Somebody: under private-sector ownership and control; (2) Anybody:
places so isolated that “King of the Mountain” competition prevails (or could take place, as in
Antarctica); (3) Nobody: empty regions (uninhabited by humans); (4) Everybody: public, national,
international control. There are few sane ways in which Earth-biosphere segments have peacefully
changed ownership. Two of the 20th Century’s most rational territorial transfers are that of Hong Kong
(from UK to China’s control) in 1997 and Macao (from Portugal’s to China’s control) in 1999.
Germany’s unification and the self-division of the former Czechoslovakia are also sterling examples of
sensible metamorphosed regional management. Macroengineers see beyond the immediate economic
horizon, since Macro-engineering is being prepared to accommodate our world’s regional trading blocs
(Europe, North America, Asia and Latin America), which may be consolidated in various combinations
in the future.

It was a Swedish professor of government, Johan Rodolf Kjellen (1864-1922), who endowed the study
of planned alterations of the status of Earth-biosphere segments with the name “Geopolitics”, in
*Ymer*. Karel Capek (1890-1938), a playwright who published *R.U.R.* (1920) shortly after Kjellen’s
*Staten som lifs-form* (1918-1919), broadcast the word “robot” by dramatically developing the idea of
the “forced labor” of artificial “men” (composed of organic material) who are persecuted by robots!
Molecular Nanotechnology researchers, now and in the future, seek to obliterate definitions of androids
and robots in use today, trading such outmoded definitions for a still-unwritten definition of artificial
life. How very appropriate that Kjellen published his concept of international politics in *Ymer*, since
that journal’s title refers to a Norse mythology giant from whose body the gods created Earth!

Strategic evaluation of Earth’s biosphere regions was promoted by Karl Haushofer (1869-1946) at his
Munich, Germany, Institut fur Geopolitik. He did much to advance this system of geographical study
to be inclusive of factors such as finance, social customs, and political personalities. After 1930, his
documentation became outlandish, but he was correct in adopting the concept that proper evaluation of
strategies should be unlimited. After his 1919 retirement (as a modern Major General) from the
Bavarian contingent of the German Army, Haushofer shaped the idea of geopolitical multivariate
analysis. Modern Geopolitics must include the operation called “Verstehen”, since “Verstehen” would
still be operational when Earth’s robosphere contains bionic humans, androids and artificial life. Haushofer, Erich Obst, Hermann Lautensach, and Otto Maull defined the subject thus in 1928:
“Geopolitics is the science of the Earth relationship to political developments. It is based on the broad
definition of Geography, especially Political Geography, which is the science of political organisms in

(May 1990).
162 See: Volume 19, pages 283-331 (1899-1900).
164 Theodore Able, “The Operation called ‘Verstehen’”, *American Journal of Sociology*, 54, 211-218 (1948). See also:
1953).
space and their structure…. It guides practical politics to that point where it must take the step into the unknown. Only if inspired by geopolitical knowledge, can this be successful. Geopolitics will and must become the geographical conscience of the State.”

A formal content analysis of all issues of the Zeitschrift fur Geopolitik, from 1924 until 1965, showed that “the most thought-provoking contribution of the geopoliticians centers on their belief that, in spite of its European origin, the transcending long-range interests of the United States [of America] lie in the Pacific [Ocean] rather than in the Atlantic [Ocean] world.”

A Space Elevator located in the Central Pacific Ocean, perhaps near Jarvis Island, would focus most of the USA’s geopolitical efforts on that vast region!

Next, it behooves us to closely examine some macroprojects that are currently being considered by corporations, countries, communities, and certain industrial “Big Thinkers”! Since about 1978, some of these planned macroprojects have been glossed over in mainstream magazines in the form of too-sweet intellectual candy, although some of these same macroprojects have been seriously outlined in laborious scholarly siftings and compilations. Somewhat strangely, in books published before 2006 that are filled with fascinating chapters by Macro-engineering’s living devotees, nothing can be found which even approaches a systematic discussion of the geopolitical factors finding their center in particular macroprojects (present-day, proposed and those being built)! Our negative criticism is hardly supercritical. Insufficient interrelating of built and proposed macroprojects evades the topic of synergism, the linkages between environment and economic development. Not a discipline in its infancy, relevant geopolitical factors in noosphere Macro-engineering cannot be ignored! For macroengineers (as for Haushofer for a short period after World War I) the prescriptive role for Geopolitics is its prime purpose. Frank P. Davidson, a USA leader in Macro-engineering asserted (in his 1986 MACRO: Big is Beautiful) “the time is now approaching for a further institutional invention: a School of Engineering and Diplomacy”. Davidson’s sub-title played on Small is Beautiful (1973), by Ernst Friedrich Schumacher (1911-1977). His insight is not his alone, but merely a published reincarnation of a reasonable perception.

It is a historical fact that some time between 1965 and 1968, the domestic behavior of the USA’s economy changed, having become dependent upon economic activity outside of North America to an unprecedented degree. First, in 1965, Japan became an economic competitor; next China became an economic rival. For a while, the Cold War was amplified by a developing “North-South” confrontation, a hemispherical debate first recognized as such, during 1955-1959, by Sir Oliver Shewell Franks (1905-1992). The North is and has been colonized by people arriving from the South, a reversal of World War II political geography. Since the Northern Hemisphere consists of 40% of all land and is owned by 80% of all humans while the Southern Hemisphere has 60% of the planet’s land and is occupied by only 20% of all humans, we wonder why any hostile dialogue is uttered! By AD 2050, according to the UNO, Earth may have a population of over nine billion persons. If Third World peoples continue to reproduce too quickly (relative to their life-supports development), then they will lay waste to their “Spaceship Earth” compartment. Commonly, it is asserted, humans must adopt a widespread recognition that human population increase is a function of increases in food availability, that understanding this fact is needed to bring about shifts in social, political, educational and religious mind-sets; we wonder if affordable and useful robot “babies”, constructed in the millions of units, might not be an effective method to slow human population growth. How many persons realize how aptly designed the “Ecology” symbol is to express the North-South split. The symbol, placed in the

165 K. Haushofer et al., Bausteine zur Geopolitik (1928), page 27.
public domain by cartoonist Ron Cobb, seems to illustrate an abstractly divided Earth-lithosphere, surrounded by a shared atmosphere or biosphere. In common with previous symbols such as the mandala and the Mobius loop, Cobb intended his symbolic invention to represent the idea of Earthly unity. But it does not accomplish that at all! New United Nations Organization geopolitical approaches to regional and global conflict resolution are needed. Human noosystems could view Earth as the Solar System’s first sub-divided tax assessment district for an augmented Rodoman-ALPS! In a time when most humans are fully aware that debris from outer space can devastate the planet, it is time humans commence thinking of solutions for this newly perceived threat to human life, infrastructures and planetary biosphere.167

That isolated Tibet has for many generations been considered—especially by North Americans and Europeans—as a kind of bastion of spirituality in an Earth-noosphere increasingly riddled with crass materialism, was disclosed by Peter Bishop’s The Myth of Shangri-La: Tibet, Travel Writing and the Western Creation of Sacred Landscape (1989). Novelist James Hilton (1900-1954), chose to site his Lost Horizon (1933) somewhere on the Himalayas’ north slope; he invented “Shangri-La”, a hidden valley-city in Tibet, to deal with the idea of human immortality and existing to protect and preserve all great portable works of man (books, art, music, but not macroprojects) from an inevitable future global holocaust. (Bizarrely, mankind’s first nuclear bombs were fabricated at a site code-name “Shangri-La”, the Los Alamos Scientific Laboratory established in 1942!) Of course, a non-fiction Shangri-La would not go untouched by a Herman Kahn (1922-1983) “Doomsday Machine”, a fanciful weapon which would destroy the Earth’s biosphere as a penalty for aggression, mushroomed in the popular media in such a way as to somewhat cripple all his subsequent future-forecasting efforts. Future robots and artificial life could not be excluded either! Tibet, situated between Earth’s two most populous ecosystem-nations—China and India—is remote and little known, even today. Tibet’s future economic and military importance is symbolized in the 1 July 2006 dedication of the USA$4.2 billion Qinghai-Tibet Railway carrying passengers and freight 2520 kilometers to Lhasa from Beijing.168 Its dedication by a former governor (during the 1980s) and current President of China, Hu Jintao, coincided with the 85th Anniversary of the Communist Party.

On 6 October 1950, China invaded Tibet, integrating it into China. On 20 October 1962, China invaded India at two places: east of Bhutan and north of Jammu and Kashmir. These regions remain disputed land. Many geopoliticians assume China’s goal in 1962 was to obtain control of the Aksai Chin region, which it did, and that the march on Arunachal Pradesh was a diversionary military thrust. Domination of the Aksai Chin’s trade routes linking Sinkiang Province with Tibet was only one sound reason for these internationally condemned armed attacks. Another important reason was that China wanted to secure all land and air approaches to the Tarim Basin, where China’s military authorities later conducted their first nuclear weapon test, on 16 October 1964, at Lop Nor. The largest part of India’s territory that was occupied/lost to China was located in Arunachal Pradesh, where China’s attacks were first initiated. Some of India’s territory, however, was never relinquished by China. Even twenty-six years after the clash, Indian geopoliticians adhered to the broadcast idea that the “purpose of the Chinese attack on 20 October 1962 is still shrouded in mystery”!169 But, just perhaps, the statement was timed to support the December 1988 visit to China by India’s Prime Minister. There is an interesting new facet to this story, uncovered by “Google Earth” bloggers. Satellite imagery

clearly shows that China’s government has built a 700-meter by 900-meter three-dimensional outdoor physical model representing a 350-kilometer by 450-kilometer section of the Aksai Chin. (Figure 5) Curious bloggers are unsure for what reason so much time, energy and money was spent to create what may be a military tactics-training site. Our question: Is there a roofed physical model of Arunachal Pradesh somewhere? Certainly, macroengineers would also benefit in the planning phase of a dam project to be able to use a hydraulic physical model.

Generally speaking, India is a socialistic country because Socialism is mandated by its Constitution, while China is less vigorously under the sway of communism than before 1989. These states could share a unity of purpose shortly. We think that India and China seek to pool their efforts to detain their peoples in separate well-managed agrarian/industrial noosystems. Co-operatively run by both societies, a Tibet-based hydroelectric power generation center would entangle both groups in a self-reinforcing web of fresh water and electricity management organizations reminiscent of the “hydraulic societies” described by Karl August Wittfogel (1896-1988) in his *Oriental Despotism: A Comparative Study of Total Power* (1957).

China’s theoretical potential from all tabulated hydrological resources is nearly 600000 megawatt. Some 17000 to 38000 megawatt could be generated at a single site on the Yarlung Zangbo, a river that eventually becomes the historic Brahmaputra River upon reaching India. Running from West to East in Tibet, the Yarlung Zangbo’s huge power drop site for a proposed Chinese hydroelectric plant is very close geographically to the region “reconnoitered” by China during late-1962. Techniques needed to

---

build very large dams are not well understood by China’s educated leadership, because older members of that group of macroengineers predate China’s “Great Leap Forward” (1958-1960) as well as the “Great Proletarian Cultural Revolution” (1960-1968) periods when macroprojects were not built in China. Younger Chinese macroengineers postdate those lost years and, therefore, are inexperienced to some degree, even considering the Three Gorges Dam project and others like it that are physically smaller in size. China’s national government gives very high priority to the exploitation of hydrologic resources, and mini-, medi-, and macroprojects are being pursued in all parts of China with flowing rivers and canals. It is, obviously, a national security risk for China to concentrate so much of its electrical energy plant in so few places (Gezhouba Hydroelectric Dam, Three Gorges Dam, and a possible Tibet Hydroelectric Dam).

China exercises full control over Tibet, considering it an integral part of China and no existing USA foreign policy is based on the premise that Tibet is not a part of China. During 2003, India officially accepted China’s definition of “Tibet”.

The 1800 kilometer-long Yarlung Zangbo is the main drainer of Tibet’s runoff. For much of its course, the river follows a detrital-filled graben marking the crustal boundary between two tectonic plates. The large volume river is normally frozen from October-November well into March-April; Himalayan snowmelt causes high water flows and flooding in April, May, and June. Later, summer showers also may cause some local flashfloods. The Yarlung Zangbo’s average discharge is more than 4000 cubic meters per second. At its most easterly point of flow—a place (at 29° 50 North Latitude by 95° 10 East Longitude) first explored by the British in 1913—the river makes a sharp course change, looping around the 7756 meter-high Namcha Barwa peak and falling in elevation by almost 2200 meters! 171

Peter Heller’s Hell or High Water: Surviving Tibet’s Tsangpo River (2004) describes a harrowing January 2002 kayaking team expedition on the river. If a major dam or barrage were emplaced upstream from Namcha Barwa near the town of Pe, some of the seasonal runoff could be stored. By boring a 40 kilometer-long tunnel under Doshong La, a mountain pass south of Pe, enough of the Yarlung Zangbo could be harnessed to produce immense amounts of hydroelectricity needed by an industrializing Tibet, northern India and eastern China. 172 All Himalayan dams must be built to endure greater runoffs and increased glacier melting since, under most global albedo change scenarios, the summertime monsoon system will have a different impact on the region in the future than it does currently.

Chapter 5

RE-MACROENGINEERING REGIONS

During the past 300000 years, about fifty billion people have lived in Earth’s biosphere; more than six and a half billion persons inhabit our planetary bioapparatus at the present time. Nearly forty years ago, in 1968, towards the end of the movie *2001: A Space Odyssey*, when the lonely spacecraft’s onboard Heuristically programmed Algorithmic computer goes haywire and has to be rewired and unplugged, in its last moments of “life” HAL 9000 reveals its birthday: 12 January 1992. So far, neither the computer building industry nor the molecular Nanotechnology industry has presented humanity with a HAL 9000. However, judging the currently observed trend in computer design is not a dead-end, “the close of the 21st Century should bring the end of human dominance on Earth”.

Technological determinist Marvin Minsky says without any trepidation whatever: “Will robots inherit the Earth? Yes, but they will be our children. We owe our minds to the deaths and lives of all the creatures that were ever engaged in the struggle called evolution. Our job is to see that all this work shall not end up in meaningless waste.” Speaking on the level of 1967’s popular culture, even the overpopulated Village’s minders, which does its work entirely underground—that is, as if the Village were Ballardia’s equivalent—and is totally reliant for its daily mega-system business operations on the hushed elegance of a “super-computer” named “the General”, in the Surrealistic television serial *The Prisoner*, could not control the local tidal flux of North Wales’ Tremadoc Bay lying adjacent to a strange-looking rural node named Portmeirion, built during 1925-1972 by Sir Clough Williams-Ellis (1883-1978). *The Prisoner*’s imaginative teleplay writers always treated its “technology” as an abstract noun for an evil category of Art. Whatever their size, when robots are added to our planet’s biosphere professional macroengineers will have to then speak of a cyber-ecology of Earth, at the very least.

In 1981, Julian Lincoln Simon (1932-1998) published *The Ultimate Resource*. That supreme wealth is, thankfully, Homo sapiens—an animal with a mind and tools to express its desires. Simon’s voice and publications made it abundantly clear that prejudices and material interests basically underlie the greater part of those special-interest groups’ idealistic-sounding rhetoric demanding “preservation”, “birth control”, and “self-denial”. These assemblages of scornful, politically motivated individuals have had no extra-ordinary effect on Third World peoples—so far; these numerous and far-from-publicity-shy political action groups do tend to confuse and misdirect First and Second World peoples. Such noisy, but comparatively small aggregations, have little understanding of a scientific Ecology in which Homo sapiens exists! Green environmental extremism is the most dangerous and obscene form of misanthropy yet developed in the First World! A 21st Century new Macro-engineering elite will have to reflect seriously on and completely reorient themselves towards a new and galvanizing operational images of our Earth-biosphere’s future. The new task of Macro-engineering is to turn Art into Science and Science into Art with Technology the vital linkage in both instances! J. Andrew Ross’s “Globall Hyperatlas”, a spherical television display device that was introduced in Chapter 2, has

---

the same profile as a line drawing used to illustrate a concept of the observable Universe inside a Black Hole.\textsuperscript{178} We find this interesting because some astrophysicists, such as Freeman John Dyson, seeks technology for mankind, not mindkind, to burst out of the postulated confining configuration of matter, energy and time in the far-future! But, let us here attend to first things first. Geography and Macro-engineering must fully educate all humans to appreciate their wondrous planet.

Translated into English from Russian in 1990 by Elisabeth Koutaissoff, \textit{What Was Man Created For? The Philosophy of the Common Task} by Nikolai Fedorovich Fedorov (1828-1903) plumps for a form of Technology so high in its concept of “conquering” Earth’s global Nature that even the lowest of our species, the deceased, would be resurrected in the ultimate act of human altruism! Over fifty billion humans added overnight to only the Earth’s incapacious biosphere? What a nightmare—almost a kind of nihilistic medical delusion like the Capgraz Syndrome, where “doubles” replace persons whom one knows! Fedorov carries his unusual metaphysical ideas of mankind’s totipotency too far. He would have pushed Science to a level where its operational technology of restructuring of all materials via molecular Nanotechnology (even the \textit{Holy Bible} Genesis 3: “Dust thou art, and unto dust thou return”) is solely devoted to a function of resisting death. Surely, if Earth is but one our God’s global Nature-creation projects in His physical Universe, then devoting ourselves strictly to this planet’s care and redemption might be a conflictual duplication of ongoing Divine effort.\textsuperscript{179} Fedorov seemed to regard Homo sapiens as approximately one half of a mysterious Earth duplex system: mankind and its materializable supra-noosphere! His viewpoint really pits Cornucopian technologists against Pandoran technologists!

Thorstein Veblen (1857-1929): “The question of natural resources is, after all, a question of technical insight”.\textsuperscript{180} Like Erich Zimmerman (1888-1961), in \textit{World Resources and Industries} (1933), Julian L. Simon treated technology as constantly improving—as technology progresses, more resources become accessible; many resources can be recycled, while others can be dispensed with as substitutes are found by science. As our physical sciences resolve our planetary homeland (and the known Universe) into macro-objects and micro-objects composed of mass and energy, our investigative social sciences have demonstrated that persons experience the locus of policy processes, hence “Verstehen”. Some psychologists define the human personality as that which permits a prediction of what a person will do in a given situation. Raymond Bernard Cattell (1905-1998), in Psychology’s arcane lingo, claimed every person had a “personality sphere” clearly indicated by thirty-five “surface traits” which measure the entire range of a human’s personality. We think it likely that every individual artificially intelligent machine—a representative of 21\textsuperscript{st} Century mindkind—will also have a “personality sphere”, making each a measurably definable secular person.

Reliable predictivity is the ultimate hallmark of science and the essential determinate of science’s success. Science has also introduced objectivity as the decisive measure of enlightened discourse in the everyday affairs of most of humanity. Scientific objectivity distinguishes Science from the Humanities and other disciplines where understanding rests on debatable dogmas and subjective interpretations. Some view “Spaceship Earth” as an apt expression of the notion of unified planetary fate, as if the whole thing were on some unalterable geophysical trajectory, quite literally a universal flight-path, to inevitable tragedy! Maybe future Mars and Venus terraforming should rightly be considered as “restitution” for mankind’s so-called crime of long-term Earth-biosphere “mauling”.

\textsuperscript{178} W.M. Stuckey, “The observable universe inside a black hole”, \textit{American Journal of Physics}, 62, 788-795 (September 1994).


\textsuperscript{180} T.B. Veblen, \textit{Absentee Ownership and Business Enterprise in Recent Times} (1923), page 272.
Mankind’s perceptions of physical reality have changed under the influence of Science to encompass terms with special Latin and Greek prefixes describing the size of things: words beginning with micro-, macro-, and nano-. George Bugliarello defines civil engineering as the modification of global Nature to make human habitats possible; his definition focuses Macro-engineering on manipulation of all the elements that become “human habitat”. Geoengineering and Terraforming are included in Bugliarello’s sensible definition. 181 Art is not to be overlooked, as Leonard Shlain points out at pages 427 to 430 in Art & Physics: Parallel Visions in Space, Time and Light (1991): “…revolutionary art anticipates visionary physics…. When the vision of the revolutionary artist, rooted in the Dionysian right [human brain] hemisphere, combines with precognition, art will prophesy the future conception of reality…. I propose that [Albert Einstein’s post-AD 1905] space-time [continuum] generates universal mind…. Universal mind would be the moving force behind our [current Earth-noosphere’s] zeitgeist, speaking through the works of revolutionary, right-brained, visionary artists first, and later through [Apollonian] left-brained, visionary, rational physicists.” While the UK science fiction novelist James G. Ballard postulated the ultimate in geohazard-less planets, the economist Julian Simon did not foresee robots ultimately viewing Homo sapiens as an intellectual resource! Future molecular Nanotechnology, when it separates Homo sapiens from the Earth’s global Nature—or that of any future human-inhabited planet—should bring about a marked hastening of the ongoing spiritualization of human lives.

Only in our Solar System is the Sun our ultimate source of energy, beyond energy emanating from Earth’s core and mantle. This Solar System is massive: the Sun (1.99 x 10^30 kilograms) plus the traditional planets (2.7 x 10^27 kilograms) equals a lot of substance. Earth has a volume of 1.0832 x 10^21 cubic meters—a fact that gives Homo sapiens no cause for concern about Earth-biosphere living space, industrial and residential energy, or remaining Geological Time. In terms of conventional energy-consuming technologies, humans will continue to find economical fuels for some time to come. If nuclear fusion reactors are perfected, humans will then have fuel, derived from the ocean, for centuries. Bogus radical Green “environmentalists” would have humanity believe that such unlimited power supply could create a naïve public belief in technology, but have no important effect on geopolitics because our noosphere’s problems are unrelated to energy worries, or might even cause a species “population explosion”! 1975’s The Population Bomb brought forth 1990’s cant metaphor, The Population Explosion. Such gloom-and-doom social movement books really convince the world-public that it is far too late to halt Earth’s destruction! (For sure, where there is no affirmative Macro-engineering vision of the future, people will perish.) Further, some negative social and physical planners theorize global or local Nuclear Winters as a potentially useful event-process demonstrating their veridical insights. True, thermonuclear weapons are anti-biotic, the most effective ever invented. Even romantic Gaiaists have had to swallow that bitter pill of truth. There remains, for cause of global or local war, always the act of a criminal, a pirate, a prankster, or a religious or ideological dissenter, or a biological and/or machine entity with motives arising from artificial intelligence or Alien technology and culture. A common serotonin-induced psychological depression can make some human males and females overly aggressive and destructive. 182 The carrying capacity of Earth is, depending on the reader’s point of view, set by Terran or Alien science! A developing molecular Nanotechnology—the instrument through which humans are going to transform Earth’s global Nature totally—will soon, more and more, be regarded as a crucial technology affecting geopolitical conflicts and confrontations.

Although molecular Nanotechnology’s future projected role in stimulating Homo sapiens’ final technological revolution was not then widely anticipated or known, Julian Simon’s most telling

argument in *The Ultimate Resource* is not merely an economic one, but “that the sheer number of people alive, enjoying life, may also be relevant”. Simon’s books, and Bjorn Lomberg’s *Global Crises, Global Solutions* (2004) are, indeed, cheering realistic thinking! (Simon slips a bit when, in *Scarcity or Abundance? A Debate on the Environment* (1994), he states: “We now have in our hands… the technology to feed, clothe and supply energy to an every-growing population for the next 7 billion years”. Our Earth won exist in seven billion years because the Sun is aging!) Before World War II, Lewis Mumford (1895-1990) advised advocacy environmental associations with these words: “The task of regional planning…is to make the region ready to sustain the richest types of human culture and the fullest span of human life, offering a home to every type of character and disposition and human mood; creating and preserving objective fields of response to man’s deeper subjective needs”.183 World War I taught Europeans and Americans that a global geopolitical disaster was possible, while pre-World War II peoples looked for imminent, worldly salvation when World War I and a following global economic Depression ravaged the world order as they and their European ancestors has know it from the AD 1648 Peace of Westphalia. In other words, Mumford and others quested after Utopia, stimulated by a millenarian-prone social environment. Mature moderns, instructed by World War II—when global Nature geophysical disaster became possible also because of the advent of thermonuclear weaponry—desire alternatives sometimes offered by Macro-engineering. Terraforming and Geoengineering professionals ought to imbue some of their writings with some of Mumford’s ideals. Virtual realities proponents only offer a temporary, terminable escape, not a “cure”.

Macro-engineering professors suggest material gain—the amplification of our powers as person in our Earth-biosphere. Too many First World idiot-Gaiaists have virtually called for the dematerialization of humanity! Macroengineers do respect the Earth. During September 1949, just as the Cold War had begun, a meeting called under the title of “Biology and Civil Engineering” was convened in London, England. Participants examined some documented facets of man’s materials impact on the planet. The major concern and conclusion of those gathered builders and biologists was that humans have outpaced supra-mantle global Nature in promoting changes, that civil and military engineers should endeavor to better match their activities to Earth’s biogeochemical cycles, lest Homo sapiens-instigated event-processes overwhelm the biosphere. Molecular Nanotechnology’s post-20th Century perfection, which seems impending, will certainly blur existing differences between structures and materials for all Geological Time, and possibly for all Astrological Time if, in addition, nuclear transmutation is economically accomplished. Alteration of the opened Universe—a la Freeman J. Dyson’s technique—holds the possibility of making a single huge nano-structure subject to the zoned planning actions of macroengineers, interior decorators an industrial redevelopment specialists, with Homo sapiens’ descendant or robot offspring basking it its humoresque artificial afterglow! Others, however, merely plan to build a second Universe.184

During 1948, Geoffrey Gorer recognized a typical American characteristic involving industrial “Big Thinking” and industrial “Big Building: “To any protest of the break with tradition, of the impracticality of a new proposal, the response has always been: ‘Why not?’”.185 The USA has long been a noosystem that strongly nurtured human creative capacity. Quite soon, however, it may no longer be such a noosystem, according to L.E. Harrison’s *Who Prospers: How Cultural Values Shape Economic and Political Success* (1992). Thomas Parke Hughes, aping a late-1980s fashion for “Endism”, asserted that the USA’s enthusiasm for technology and science extended from 1870 until 1970, surviving only amongst “engineers, managers, system builders, and others with vested interests

in technological systems”. Geoffrey Gorer’s characterization of Americans was not a pre-World War II Englishman’s admiration carried forward in time to an almost pre-World War III moment. With remarkably few reservations, Americans today invite Macro-engineering, Biotechnology and molecular Nanotechnology to devise controls for the things of this world! Indeed, that task garners much public praise and financing and few curses from the USA citizens. We note with some feeling of relief that Macro-engineering is being fostered by the positive attitudes of India’s professionals. One of their outstanding macro-problems is patently obvious—the prevention and effective countering of foreign radical Green propaganda that could cripple efforts to take India from a Second World status to a First World status. Truly, the Northern Hemisphere is humanity’s primary homeland geostrategic region. Failure of the Tripartite Pact after 1940 as well as the end of the Cold War by 1990 prevented totalitarian conversion of large parts of this prime Earth-biosphere region.

Older geopoliticians habitually divide Earth into halves, in such a manner that most of the land is in a single hemisphere. The center of our planet’s “Land Hemisphere” is near Nantes, France, the once rustic birthplace of that redoubtable author, Jules Verne, while the “Water Hemisphere” center is located near New Zealand. Technological advances in submarine industry should reduce the significance of this vintage planetary divisional scheme. Hugh Robert Mill (1861-1950) compiled a dictionary of geographical terminology circa 1900-1910. In that lexicon, he defined “aneumene”—meaning, not “ecumene”—using the English Channel as a paradigm: “The English Channel, with its population of passengers and crews of boats, is a type of aneokumene.” Halford John Mackinder stated that the unity of Geography in terms of “natural regions” should be based on our Earth’s hydrosphere, not its lithosphere. Most of Earth’s biomass is in the ocean. Innumerable submersibles have already been launched and are in use globally. Some unmanned vehicles are guided by brilliant computer programs and mission management systems. The carrying capacity of the Earth-surface could be greatly increased by sound application of always improving underwater technologies.

Geopoliticians in India and the USA are now forced by circumstances of technology’s impingement to ponder a Geopolitics that includes the surface and sub-surface of the land and the ocean. The USA’s national income accounts have been reorganized to estimate the contribution to the gross domestic product of the ocean sector from the year 1972 to the present-day, providing geopoliticians with a consistent database to measure, and choose among, alternative ocean exploitation schemes. A full-fledged Macro-engineering includes anthropological political geography, as indicated by a word coinage in 1959 by Stephen B. Jones (1903-1984), “Geoanthropolitics” and, in addition, the future geopolitics of terraformed planets when Homo sapiens has a thriving poly-global civilization. For the time being Antarctica and the ocean cannot be colonized by any people, except on a temporary basis. Derwent Whittlesey (1890-1956) recognized in 1945 at the close of World War II the “wide range of outlook existing among contemporar4y societies...is a powerful geographic deterrent to establishing a single worldwide political community”. Despite the spread of literacy and higher education, many persons lack knowledge about the chronology and relationships of historical facts. The 18th Century’s Industrial Revolution irreversibly altered Earth-biosphere conditions, to the point where it is difficult for persons living now to project themselves back beyond the recorded and derived economic statistics on life-styles to imagine Earth-biosphere conditions that are already alien and almost incomprehensible. It is a measure of the First World’s isolation from the human past that significant

---

numbers of USA’s best-educated youth perceive only the evils of technology and none of its wonderful benefits. For people in India and the USA, the only kind of Geopolitics we can know is the one that has to work amidst a credulous Homo sapiens, poorly educated, ruled by jumbled and non-concurrent moralities, and bent upon other activities than the search for universal truth via Science. Few persons making and earning a living in today’s Third World seem to acknowledge that the First World’s direct ancestors suffered ugly, killing labor in unsafe mines, weather buffeted farms, and in industrial fabrication. Barry Commoner slanders the First World with this incorrect thought: “Colonialism has determined the distribution of both the world’s wealth and its human population, accumulating most of the wealth north of the equator and most of the people below it”\(^{191}\). False! The boundary dividing the South from the North is not Earth’s Equator! And, just what is “wealth” since it can be counted in so many different ways?

According to mass communications practitioners, about 75% of Americans get “environmental news” from television. Since “live” and “video taped” television images can be digitally retouched, that means that “television diplomacy”—the use of television-generated pictures to affect public opinion, usually measured by polling, on international relations is a present-day danger the undereducated need to be prepared to discern and respect lest they pay a fearful price through conscription and taxation. As the Tudor playwright William Shakespeare (1564-1616) said, “All the world’s a stage…”\(^{192}\) And, would not an Earth-surrounding augmented Rodoman-ALPS, a possible 21st Century comprehensively potent entity caring for Homo sapiens and its Earth-biosphere (or Earth robosphere) really confirm this future fact?

Arthur Charles Clarke, the world famous science fiction/science fact writer, lives in Sri Lanka. That lushly vegetated island-nation was to have marked the border between the German-Italian and Japanese spheres of influence-coercion, as aggressively proposed by expansionists of those countries prior to World War II. For example, Giichi Tanaka (1863-1929), Prime Minister of Japan and Minister of Foreign Affairs from 1927, formed his infamous “Tanaka Memorial” in 1927.\(^{193}\) In 1944, Mitsubishi Aircraft Co. engineers “were working on plans for a Japanese aircraft able to bomb the Panama Canal and the American West Coast from the Kurile Islands.”\(^{194}\) Three years earlier, in 1941, Nazi Germany’s Eugen Sanger (1905-1963) was drawing up final blueprints for the “America Bomber Project”, the Me264, an atmospheric skipper capable of being our species first manned spacecraft!\(^{195}\) Nazi geopoliticians made tentative policies to occupy North America as far west as the Rocky Mountains, while Imperial Japan’s schemers composed designs to capture and administer the western coasts of Canada and the USA, thereby dominating the North Pacific Ocean. Their September 1940 alliance linked finally the Asian and European theaters of war, turning the 1939-1945 conflict into a struggle between different conceptions of World Order. Japan and Germany, independent foci of geomilitaristic expansionism, had each done preliminary work on nuclear fission explosives. The Nazis, however, had an edge over the Japanese in delivery systems work, by R&D on long-range ballistic missiles. “Had the war continued into 1946, the Germans might well have made good their plans to bomb New York City.”\(^{196}\)

Continued trans-Pacific Ocean economic and political integration seems to be a real prospect. The term “Pacific Rim” is a 1980s word coinage meaning the coastal countries bordering the North and

---

192 *As You Like It*, II. VII, 11, 139.
South Pacific oceans—nations like Canada, Korea, Japan, Australia, Indonesia and some Latin America nations. The first Pacific Rim Conference was held in Perth, Australia during November 1986. Perth faces onto the Indian Ocean. A line drawn on a map that connects Perth, Australia and Seattle in the USA clearly indicates a modicum of the potential global importance of the Central Pacific Ocean. However, at the present time, the business focus of the Pacific Rim is located in the Northern Hemisphere, and it may have a transportation infrastructure reinforcing today’s focus: (1) Russia’s Baikal-Amur Mainline railroad, a containerized cargo railway operational since 1989; (2) ocean container ships taking advantage of a newly ice-free Arctic Ocean and (3) the Jarvis Island Space Elevator. With Siberia, Russian will continue to be the largest, and potentially the richest, nation in the Earth-biosphere; the implicit converse is radical: without Siberia, Russia could cease to be a world power and, indeed, fade forever from the ranks of Superpowers!

As related to the Third World, the concept of technological development is relative, referring to how that collection of countries compares to the First and Second Worlds, which had been stimulated to economic growth by the Industrial Revolution. The term “undeveloped”, later transmuted to “underdeveloped”, gained its current connotations from the writings and speeches of Paul N. Rosenstein-Rogan (1902-1985), who worked at the International Bank for Reconstruction and Development from 1947 until 1953. The Third World, as a transnational regional group, first lamented its economic inequality in a broad way at their 1964 Cairo, Egypt, conference of the Non-Aligned Summit, where twenty-nine African countries and others attended that October grandstanding of newly emerged leaders. The Non-Aligned Movement held its 10th meeting, on 1-6 September 1992, in Indonesia.

The Third World’s governments have not completed their business and government shifts towards large-scale market economies, so the unsolicited advice quoted above is mostly accepted by First and Second World leaders—so far. The “power gap” between the North and South could be closed rather quickly. The greatest danger now facing Homo sapiens lies in the subordination of weapons technologies to the values of earlier Historical Time periods and their exploitation by those who do not understand their implications and consequences but seek only their own selfish personal or lodge purposes. Nuclear War, as well as other kinds of aggressions using “smart” and “brilliant” weapons, could be considered by some countries and some terrorist groups as a type of foreign economic policy if it had important side-effects on foreign economic policy. Terrorism has a powerful allure for some persons since 11 September 2001 (when New York City’s World Trade Center was demolished by Muslim fanatics from the traditional Middle East). The Earth-noosphere fittingly reflects and inflects a single technical civilization, a world of unified Science-based technique but very discordant multiple social values. Unflinchingly, we suggest that the only suitable “Global Village” is an Earth-biosphere geopolitical World Order that is a new model of co-existence lodged within a single interconnected civilization. Perhaps formation of a “Pacific Rim” focused on Jarvis Island, as suggested in Chapter 6, and/or “21st Century Atlantropa”, as offered in Chapter 7, could prove to be useful shaping molds for a future geopolitical vision? “Ecopolitics” has emerged as a force operating to transform international geopolitics. Needless to say, Ecopolitics bears no close resemblance to Macro-engineering!

Technology’s progress is challenging the present-day concept of Earth’s ocean being non-developable. Some writers, endeavoring to convince Earth’s skeptical publics that ocean segments are capable of being developed, have coined glamour words (like “hydrospace”) to stimulate recognition of the ocean’s potential basis for Homo sapiens’ future prosperity. Representatives of humankind have had the capability to reach any place on the submerged seascape at any time, even for purposes of drilling

Humanity operates machinery using more power than is generated by the metabolisms of all living natural persons. As almost hallucinatory as that generalization might seem, the present-day flow of energy through our functioning technology does not compete meaningfully with the flow of energy through Earth’s global Nature. Certain anthropogenic alterations of the land and ocean involve horizontal transfers of matter and energy. Flowages of matter (carried by rail cars, trucks, automobiles, ships, liquid-gas-slurry pipelines, electric grid networks), usually as concentrates, have no Earth-biosphere counterpart. These concentrates converge on (and are processed in) our Earth-noosphere’s urban regions—cities are actually “mass savings accounts”, which can be widely distributed in a rapid manner by detonated thermonuclear explosives, one kind of those hideous “weapons of mass destruction”. Cities have their own biogeochemical cycles involving re-use, waste and pollution that are analogous to our biosphere’s “reservoirs” and “plumbing”, a view examined in depth in *Earth Science in the City* (2003) by Grant Heiken and other editors. John Stuart Mill (1806-1873), covered most of the elements when he stated, in *Principles of Political Economy* (1848, Volume 1, page 32) that moving macro-objects and mass converted to controlled energy are all that Homo sapiens can do with any global Nature.

The future Earth noosphere, transformed physically by molecular Nanotechnology’s earlier perfection, will amplify the usefulness of Allen K. Philbrick’s theoretical invention, “the particulate region”. In other words, macroengineers should already be prepared for molecular Nanotechnology’s future creations! The ultimate uncontrolled particulate region, obviously, would be an Earth-biosphere pulverized into radioactive powder via a macro war fought with thermonuclear explosives. Any viable 21st Century geographical prediction of the location of phenomena in Earth must be a description of the movements of objects and energy in a nano-structure. For example, emplacements or displacements of objects surely would be many and varied (interactions, diffusions, circulations, flows, orbits and even planetary escapes of nano-objects) in an Earth-biosphere dominated by molecular Nanotechnology’s tiny machines. Whatever energies and matter the Universe inserts into our Solar System—in transit now and moved in the future—will simply be imbricates upon humanity’s enormous materialized deeds. A rapid increase in the volume of the Anthropocosmos will promote open-mindedness amongst humans! Still in AD 2006 without a regularly published journal devoted to the topic, the First International Conference of the International Association of Macro-Engineering Societies met in Barcelona, Spain during November 1989.

It is known the Earth’s Tropic Zone is expanding as the Polar Zones shrink in area. While geoscientists cannot yet state specifically which Polar Zone glacial ice-sheets will soon melt, some speculate in an informed way about using liquid fresh water produced by Greenland’s glaciers, which comprise 10% of Earth’s ice. A floe-ice free Arctic Ocean, with heavier ship traffic, will cause the deposition of soot that causes ice melting. The International Institute for Applied Systems Analysis (organized 1972) and the UN Organization’s Institute for Training and Research (established 1966)

---


have studied the possibilities of harnessing this natural and man-caused source of electricity-generating runoff. Their macroproject concept involves construction of a network of surface fresh water gutters, flumes, and aqueducts directing the cold flowing melt-water to natural and excavated reservoirs. From such places, the liquid would be dropped into Francis or Pelton turbines to manufacture 200000 megawatt. Greenland could become a party to an “Arctic Free-Trade Zone” comprised of Russia, USA, Canada, Greenland, Iceland, Norway, and Sweden. How to transport the electricity made and exported by Greenland to distant markets? Convert the power to microwaves and then transmit it to Earth-orbiting reflector satellites for rapid relay to electric power-hungry industrial regions of Europe and North America.

The disfigured and industrially polluted landscape of all Europe could be cleansed through liberal use of electrical power not generated in the region. Soil contaminants can be removed with induced electrical fields. Power generated in Greenland may also be exported via a High Voltage Direct Current undersea cable to Iceland, and from Iceland to the UK and mainland Europe.

Farming and ranching in Greenland have benefited from deglacialization. If Greenlanders decide to further capitalize on the geophysical results of glacial ice-sheet melting on Greenland, then electric power generated in Greenland could also be used in another local macroproject with global ramifications. Chlorofluorocarbons (CFCs) ejected by technology’s handiworks are still catalyzing the thinning of the Earth’s stratospheric ozone layer. Huge amounts of electricity generated in Greenland by falling water could power laser installations in the Northern Hemisphere, which then process, over a decade-long period all of Earth’s atmosphere, disrupting the CFCs causing some of the man-augmented Greenhouse Effect. The CFC clearance macroproject, first proposed by Thomas Howard Stix (1924-2001) in 1989, got a fuller mathematical exposition in *Plasma Science and the Environment* (1997) by Wallace Manheimer, Linda E. Sugiyama and Thomas F. Stix.

Before World War I, prior to the enhanced Greenhouse Effect’s widespread recognition, macroengineers conceptualized plans to divert the Gulf Stream by blocking the southward flow of the Labrador Current, which carries the mixed seawater and freshwater from the Hudson Strait to the Tail of the Grand Banks, with a causeway in order to change the Arctic Ocean and the Polar Zone climate. A 1912 proposal by Carroll Livingston Riker (1854-1931) to the USA’s President and Congress, *Conspicuum of Power and Control of the Gulf Stream*, envisioned a 320 kilometer-long causeway extending eastwards from Cape Race, Newfoundland. We think Riker may have been greatly stimulated by a railroad bridge (built 1904-1912) connecting the Florida Key in the USA. Henry Morrison Flagler (1830-1913) undertook the macroproject to open the State of Florida for resort development. Completion in 1914 of the Panama Canal probably represented the last physical manifestation of the USA’s interest in “Manifest Destiny”—hence, Riker’s address to Americans rather than Canadians. Canada owns the seascape encompassed by Riker’s quixotic macroproject plan. Oceanographic and climatologic research during the 20th Century and early 21st Century shredded Riker’s oceanographic assumptions: the Gulf Stream, mapped first in the 16th Century, and despite popular belief, is not the cause of western Europe’s mild climate. Simply put, there is no real need

---

for Riker’s seascape macroproject, although it might have been introduced as a causative factor in the 2004 Hollywood epic *The Day After Tomorrow*. Other direct applications of macro-engineering skills on vast geographical scales have been mulled over the years since the “RMS Titanic” sank on 14-15 April 1912, mostly by Russian industrial “Big Thinkers”. One of these, Pyotr Mikhail Borisov, thought demi-globally! Borisov’s controversial propaganda, which started circa 1961 and peaked during 1973, favored a causeway spanning the Bering Strait that separates the USA from Russia. According to his booklet *Can Man Change the Climate?* (1973) he planned to pump cold seawater from the Arctic Ocean into the North Pacific Ocean for the purpose of letting more warmer North Atlantic Ocean seawater flow into the Arctic Ocean. His causeway pumping station would have consumed huge amounts of electricity, the source about which Borisov was quite vague, but as noted above could well be provided by a Greenland-based utility. Borisov’s facility would be the most costly “solution” for quickly melting Arctic Ocean floe ice and the Arctic’s glacial ice and permafrost land. He had hoped nuclear fission reactors would be a source of economical electricity by 1980. But, since the 26 April 1986 nuclear fission reactor catastrophe at Chernobyl we now know that such old-fashion machines are expensive no matter how modern the designs and technology may be. (The USA’s design for truly 21st Century Generation IV high-temperature, gas-cooled nuclear reactors will be beneficial to humanity and failsafe.) The Borisov causeway pumping plant’s roof was intended to provide room for an inter-continental highway and railway. If built, it ought to have ship locks too. (James G. Ballard’s *Hello America* (1981) raised the biosphere/technology collapse novel to new whimsical heights. In that yarn, intrepid explorers—circa AD 2114-2126—describe North America a century after a Bering Strait Dam had caused widespread arid climate regimes, leaving New York City awash in sand dunes while California is a rainforest!) Borisov’s pumping plant could hasten the North Atlantic Ocean’s recovery from a large input of freshwater caused by Greenland ice-sheet melting, promoting the thermohaline circulation that moderates Europe’s western climate regime. Joseph B. Strauss (1870-1938), who oversaw the construction of San Francisco’s Golden Gate Bridge in California, originated the idea of bridging the Bering Strait for railroad traffic in 1892. In 1976, H.H. Anderson in the UK suggested a tidal flap regulating seawater flow in the Bering Strait and at a sea level Panama Canal for the purpose of moving warm seawater from the Central Pacific Ocean, through the action of natural ocean tides, to the Arctic Ocean, thereby warming the Arctic Ocean. Anderson’s “LUNAHEAT” concept is currently under scrutiny at the Candida Oancea Institute in Bucharest, Romania. Part of the philosophy of the Institute’s workers is that macroprojects today are outgrowths of macroprojects of our ancestors. As Charles C. Mann points out in *1491* (2005), the “New World”—before Columbus found it in AD 1492—had already been irrevocably shaped by long-term human inhabitation. The “Old World” has been even more altered by humanity since all people in the “New World” originally came from the “Old World”.

The James Bay Hydroelectric Project is a partly capitalized facility intended to ensure the flow of power overland by almost outmoded HVDC cables to North America’s industrial heartland. However, severe weather conditions and electromagnetic storms, which interfere with ground-level cable transmission from extremely remote locations, have caused several system-wide outages in Quebec and beyond. As far as the USA is concerned, it would be beneficial to expand a mostly installed 1921

---


“superpower system” for the region between Boston and Washington DC, as first set forth in _US Geological Survey Professional Paper 123_ by W.S. Murray and his colleagues. Quebec could produce exportable hydroelectricity for North America, even if it were ever to become independent of Canada. Prime Minister Robert Bourassa (1933-1996) documented the exciting Big Business approach to future Quebec water and electricity exportation facilities and polices in _Power from the North_ (1985). When the James Bay Hydroelectric Project commenced its Phase 1 construction in 1971, Bourassa called it “the project of the century”. Phase 2 began during 1989 and is still incomplete. If it is finished, the James Bay Hydroelectric Project will generate 27000 megawatt. Even since the publication of _Social and Environmental Impacts of the James Bay Hydroelectric Project_ (1999), edited by James F. Hornig, more specific environmental change facts have become available that shed new light on the efficacy of this gigantic macroproject in Canada. Even if all rivers emptying into James Bay were dammed, the cutoff of freshwater runoff would not affect the North Atlantic Ocean’s dynamics. Better climate change scenarios, too, provide computer simulation outcomes that offer good cause to re-open the public debate in Canada about the James Bay Hydroelectric Project.

Closely identified with the James Bay Hydroelectric Project is the Great Replenishment and Northern Development (GRAND) Canal submitted by Thomas W. Kierans during 1959. With foresighted political savvy, Kierans defined the GRAND Canal as a freshwater “recycling” macroproject, not a water “diversion” macroproject since he did not plan to intercept river runoff before it entered James Bay, but simply wished to pump it from a James Bay converted into a freshwater lake from a shallow seawater arm of Hudson Bay. Currently, the Hudson and James bays combine to form the Earth’s largest inland sea. (The GRAND Canal has been referred to as the eastern version of the North American Water and Power Alliance, NAWAPA.) Kierans proposed to dam the mouth of James Bay with a barrage equipped with sluice gates that open at low tide, allowing seawater to flow northwards into Hudson Bay while retaining the freshwater from contributory rivers. Within a few years, James Bay would become a freshwater lake from which 20% annually could be pumped southwards to the Great Lakes. A yearly water export of 347 cubic kilometers was planned at a construction cost of USA2005$130000000000. The only geophysical factor disregarded by Kierans is the high probability that earthquakes will increase in frequency in the region owing to post-Ice Age rebound of the crust that supports Hudson and James bays.

Much has been published about the North American Water and Power Alliance (NAWAPA), a series of macroprojects contrived in 1050-1959 by Donald McCord Baker in the USA. NAWAPA was designed to move 310 cubic kilometers yearly of freshwater from Alaska to Canada and, thence, to the USA and Mexico at an estimated 2005 cost of USA$600000000000. An extant NAWAPA would be a geopolitical tool useful to Canada and the USA in any future dispute with Latin America’s Mexico. The USA-Mexico frontier is the only international border where the First World and Third World confront one another and Mexico is the only Third World state broadcasting television directly to a

---

First World country to please its citizens living and working in the USA. The NAWAPA has not yet captured the public’s attention, remaining but a mere shadow far from concrete realization. There is always the prospect that future climate change and Mexico’s overpopulation will stir the public to ponder its 21st Century establishment. The NAWAPA is most favorably described in The Ralph M. Parson Company Brochure 606-2934-19, “NAWAPA: North American Water and Power Alliance”, issued October 1964. Ralph M. Parson (1896-1974) founded his company during 1944 in Los Angeles, California. Its current California headquarters in Pasadena is not many kilometers from Southern California’s infamous Salton Sea, an artificial inland saltwater lake that is technically out of control. The Salton Sea is the single most remarkable physical environment contradiction of a basic tenet of life in the USA: “The Salton Sea confounds the region’s and the nation’s traditional confidence that physical problems must inevitably yield to engineered solutions”.223 There is no means existing for anticipating the full environmental impact of NAWAPA construction or to accurately predict California’s geological future.224 However, both GRAND Canal and the NAWAPA offer the prospect of a physical connection—electricity and freshwater flows—between the proposed “Arctic Free-Trade Zone” and North America. And, inter-basin freshwater transfers at NAWAPA and GRAND Canal geographical scales could help with the achievement of awesome synergism, even becoming a geopolitical tool to stabilize North America’s relationship with Latin America. Then, there is the follow-up technology, the “Continental SuperGrid” concept of pipes filled with liquid hydrogen, each holding a super-conductive wire that would act as a repository and conduit of energy (electricity and fuel) to make possible the mid-21st Century’s Hydrogen Economy in North America and elsewhere.225

Connecting the Great Lakes, a product of massive glacial scour during the most recent Ice Age, with the Mississippi River is the Chicago Diversion.226 Since 2 January 1900, thanks to the imposition of an artificial waterway, the canal has connected Lake Michigan with the watershed of the Mississippi River. Uncontrolled water exports from Lake Michigan can drastically affect shipping and urban water supply systems. Future climate change is also a factor to be considered.227

Russia is both famous and infamous for a Communist period macroproject by which it was planned to shift the flows of major rivers draining into the Arctic Ocean.228 The last time active planning for the macroproject was publicly announced was in June 1985, before the breakup of the USSR. A vast tract of Russia—especially Siberia—is drained by north-flowing rivers that finally melding with the Arctic Ocean. For decades during the 20th Century, the former USSR’s Communist elite, primarily Russians, toyed with ideas for exploiting this wasted fresh water resource by diverting it to the southern USSR’s arid regions. A pre-1985 climate impact model indicated that a built freshwater transfer system annually shipping 200 cubic kilometers of fresh water southward would evoke nil Arctic Zone climatic change.229 Decades of macroproject planning effort were trashed during March 1986, without detailed explanation to citizens or others, until the 16 August 1986 issue of Pravda was posted.230

223 William deBuys and Joan Myers, Salt Dreams: Land and Water in Low-Down California (1999), page 246.
ago entered a post-colonial period, while Russia may have done so only by 1991. As in Canada, better data and modeling of 21st Century Russia’s environment may spur a revival of the North-South freshwater rerouting macroproject plan. Many source regions of exportable freshwater. A “direct carbon dioxide [gas buildup Earth atmospheric] effect in continental river runoff records” has been detected.231 Northward flowing freshwater runoff in Russia has increased by, at least, 4 to 15%. Freshwater reservoirs are leading indicators of the extent to which the boundaries between Earth’s global Nature and the anthropogenic world are vaguely defined since both realms contain some components of the other since freshwater reservoirs are constructed ecosystems. Russia’s north-flowing river runoff is now a wasted resource because there is insufficient freshwater retention reservoirs available and because there is no practical market for the freshwater yet.232

Thirty years ago, in 1976, the USA Congress authorized and funded an examination of large-scale freshwater diversions, in part, to replenish the depleting groundwater of the Ogallala Aquifer, which lies beneath thousands of farms and ranches southwest of the Great Lakes Region. Without a deposit of freshwater in the Ogallala Aquifer, which was discovered in 1899, all irrigated agricultural endeavors would eventually be terminated for lack of freshwater. Wells are being bored deeper and deeper to tap this sub-surface supply, but sometime during the 21st Century the entire geological formation will have been sucked dry. Frank Zyback’s 1948 introduction of the water pivot, combined with D.L. McDonald’s 1909 instigation of wellhead pumps, has prompted a massive diminishment of a natural freshwater deposit.233 During June, 1983, at the 36th Conference of the Canadian Water Resources Association, J.W. Bulkley presented a diversion plan removing freshwater from Lake Superior, sending it to the Basin of the Missouri River by overcoming a watershed existing since the most recent Ice Age ended. Bulkley’s facility could provide a means to recharge the Ogallala Aquifer in the High Plains Region.

Surface freshwater withdrawals from the Missouri River, which eventually joins the Mississippi River, would surely lessen the risks of structural failure at the Old River Control Structure in Louisiana. The function of the Old River Control Structure is to draw off floodwaters, which would otherwise pass Baton Rouge and New Orleans 240 downstream, into the Atchafalaya River, where it subsequently enters the Gulf of Mexico. It was installed to postpone the Atchafalaya River’s natural capture of the Mississippi River; the USA Congress authorized its construction in 1954, it was completed by 1959 and tested under flood conditions in 1993. Martin Reuss’s Design the Bayous: The Control of Water in the Atchafalaya Basin, 1800-1995 (2004) portrays the history of this infrastructure item. Were it absent, the Mississippi River flowed to Morgan City instead of New Orleans, there would be a deep saltwater estuary reaching northwards as far as Baton Rouge, Louisiana. Since Hurricane Katrina of September 2006, New Orleans has become a swamp phoenix of a sort. But macroengineers have not yet devised a comprehensive plan to keep the city, which rest on the Mississippi River’s delta, from subsiding and eventually becoming inundated by a local sea level rise. One potential Old River Control Structure failure mode not fully addressed is the high probability of seismic disturbance. The most powerful earthquakes ever recorded by North America’s history were those at New Madrid, Missouri, during AD 1811-1812. While such great tremors may not recur until AD 2312, they are nevertheless worrisome to Macro-engineering professionals.234

---

originating at New Madrid in the central Mississippi Valley began on 16 December 1811, and lasting more than a year, these earthquakes have not been equaled for number, continuance of disturbance, area affected, and severity. A pseudo-scientific, incorrect and unofficial earthquake prediction issued by Iben Browning in 1990 needlessly alarmed many persons in the Midwest and turned New Madrid into a news media circus. Essentially, this facility must be capable of withstanding any Earth-normal hydraulic and seismic loading or risk the prospect of a reorganization of the USA’s export/import economy on the Gulf of Mexico coast. Mitigating such a disastrous disruption economic scenario would be the unaffected operations of the Tennessee-Tombigbee Waterway opened in 1985. According to Jeffrey K. Stine’s Mixing the Waters: Environment, Politics, and the Building of the Tennessee-Tombigbee Waterway (1993), this 375 kilometer-long canal connecting Mobile, Alabama, with the Tennessee River shortened the barge route from the North to the Gulf of Mexico by almost 1400 kilometers. Because it is not a river but, rather, a current-less canal, it offers lower fuel costs for towboats pushing or pulling long strings of barges. Another future mitigation might be its function as a substitute, not mere supplement, barge route for the Mississippi River if that becomes blocked, either by earthquake activity or by some anthropogenic calamity (terrorism, accident).

From September 1961 until September 1966, all or part of fourteen USA states in the Northeast, about 7% of the conterminous USA with (then) almost 28% of America’s population, suffered a freshwater supply crisis induced by drought. The capacity of all developed urban-supply storage basins was strained by low natural input and high usage output. By 1966, even Washington DC’s reservoirs were nearly bone dry. A.J. Pansini and R.B. Gerard, each separately, proposed to convert Long Island Sound into the USA’s largest man-made freshwater reservoir with the construction of dikes at both ends of a post-Ice Age expression of the North Atlantic Ocean. Many glacial features are evident on the seafloor of Long Island Sound. Sources of freshwater to fill their 64 x 10^9 cubic meter item of urban infrastructure was to be the Connecticut and Housatonic river runoffs, together with other local streams. “United States v. Maine et al. (Rhode Island and New York Boundary Case)”, a case decided by the US Supreme Court in 1985, and reported in US Law Week 53 LW 4151 of February 1989, affirmed that the State’s own Long Island Sound. Long Island Sound is closed by the borderline extending from Montauk Point to Watch Hill Point. (Plum Island’s presence nearby may pose some danger for this enormous domestic water supply facility and the fact that a Category-3 storm, Hurricane Bob, passed directly over Long Island Sound on 18 August 1991 gives further reason to be concerned about water supply purity.) Gerard did not consider a possible diversion of Hudson River runoff into a Long Island Sound Reservoir. Nowadays, water flowing in the Hudson River’s estuary below Troy, New York, is fresh south of Poughkeepsie and saline south of Peekskill. At its western end, Long Island Sound is connected with New York Harbor through a tidal strait, the East River.

ships (petroleum and natural gas tankers and container ships\textsuperscript{239}) and exports via ocean-going ships carrying coal and fabricated products of all kinds. Similar concepts have been aired in Europe for artificial island off the coast of Belgium.\textsuperscript{240} The bottom of Lake Erie is at a higher elevation than the surface of Lake Ontario—there is a 30 meter-thick layer that can be utilized. That layer could be constantly replenished by freshwater inflows via the GRAND Canal and/or NAWAPA. The USA alone owns 28\% of Earth’s currently recoverable coal reserves, and could be a large coal exporter well into the 21\textsuperscript{st} Century. If a large percentage of the USA’s yearly exported coal were to exit via Chattey’s ICONN situated near New York City, then much freshwater used to operate the New York State Barge Canal would flow down the Hudson River—at first flushing riverbed sediments—to the vicinity of Manhattan Island. Surely, some of the Great Lakes Region-James Bay freshwater could be further used to quickly fill the Pansini-Gerard Long Island Sound Reservoir? Especially as local water supplies are increasingly contaminated with road salt!\textsuperscript{241} The Pansini-Gerard Long Island Sound Reservoir could rightly be termed a restoration scheme because, during the most recent Ice Age, even Block Island Sound to the east of Long Island was a giant freshwater lake. Long Island Sound was a freshwater lake for thousands of years before the North Atlantic Ocean breached a recessional moraine at The Race, separating Fisher’s Island-Watch Hill from Plum Island-Long Island. Japan provided macroengineers with a small-scale physical example-model\textsuperscript{242}—their Sea of Nakaumi-Lake Shinji macroproject\textsuperscript{243}—to study in advance of beginning positive planning work on the Pansini-Gerard Long Island Sound Reservoir concept. By no stretch of the imagination could this potential New York State facility be considered a limit design—that is, a design that pushes the planning and construction skills that are the pride of Macro-engineering! It is worth noting the Hong Kong reclaimed a nearby bay to serve as a freshwater reservoir.\textsuperscript{244}

\textsuperscript{244} H.J. Walker, “Reservoirs from the Sea: Hong Kong’s Answer to its Water Supply Demand”, \textit{Scientific Bulletin}, 5, 19-25 (1980).
Chapter 6

GEO-ECONOMICS AND MACROPROJECTS

Somber predictions about routine endeavors involving earth material movements have varied from good, under exceptionally favorable circumstances, to bad, in some occurrences where geographical data seemed reliable. At what depth does the Earth-crust become environmentally irrelevant? The lower boundary of the humanly important part of the lithosphere clearly depends on the nature of the geotechnical macro-problem in question and of the structures and/or event-processes involved. Geographical predictions are founded on baseline data that provide an historic record of regional and/or global Nature conditions for comparison with impact levels, a qualitative or quantitative evaluation of an impact parameter. If local or global Nature baseline data are sparse, inaccurate, or exaggerated, then predictions based upon them are bound to be useless, misleading, or even dangerous. So how credible are geographical predictions focused on extra-routine macroprojects? Science’s collection of theories always results in a real-world planet of human-made “datascapes/guess-scapes”, Art’s theories often result in many displayed “dreamscapes” of some type. Macroproject budgets and government finances are governed by outgoing bank cheques and the fluctuating bank balance as well as elaborate internal or external structural political/geopolitical checks and balances! Mankind’s current so-called economic “globalization” is nothing more than a temporary trompe-l’oeil, purveyed by the elitist and wealth First World upper-crust group to engage our Earth-noosphere’s working class in its most recent self-serving Machiavellian psychodrama! The deductive qualitivity of Geopolitics’ approach (interpretation) should be recognized by all macroengineers as important as Anthropogeomorphology’s inductive quantification, since all existing event-processes of Earth-biosphere change and event-processes of the planet’s past Geological Time assume vital meaning when they are found to have set our Earth-biosphere’s “stage” for a loss of life and property!

Peruvian Amazon River Basin primitives, as movingly portrayed in macroengineer Frank P. Davidson’s favorite “professional” commercial film, *Fitzcarraldo* (1982), see their marginal Tropic Zone region as a “world”, or “dreamscape”, made geophysical. The movie was directed by Werner Herzog and starred the late Klaus Kinski. It was the story of an Irish soldier-of-luck who tries to haul a steamboat over a mountain in search of new river routes in the Amazon River Basin. Since Herzog himself actually did what the film’s main character did, this cinema is a fascinating record of this “heroic”, if crazy, effort! In a very real sense, peoples living in the urbanized world share that dreamy viewpoint since our geophysical surroundings may be but a kind of “datascapes shadow” of the real four-dimensional space-time continuum local global Nature world, or noosphere. Davidson might reconsider an earlier commercial film amusement, *The President’s Analyst* (1967). Rodoman-ALPS, where on-screen television images based on a “datascapes” would almost be the equivalent of being-on-the-scene, is s direct result of a unique blending of illusion and reality, like *Fitzcarraldo*, but with a desire to reverse as well as enlarge the 1 January 1984 breakup of a very large USA telecommunications system (American Telephone & Telegraphy Co.) existing since 1885. Global telecommunications, as it exists in 2006, is frighteningly comprehensive. If Frank P. Davidson’s Third World natives really desire to encounter a wild dream world, then the UN Organization ought to donate portable telephones and give the Amazon River Basin natives unlimited free long-distance call service to randomly-dialed First and Second World numbers! Maybe a freely translated conversation with people so different from themselves would induce stranger dreams than those the presently endure.

---


Macro-engineering proposals for additions to Earth’s future contents, contours and climates ought to always be considered “iffy” propositions. A naked Third World person’s abilities for committing mayhem are decidedly limited. Mankind—the first half of “Anthropogeomorphology”, according to Sigmund Freud (1856-1939), is an unpredictable prosthetic near-deity: “Man has become a god by means of artificial limbs, so to speak, quite magnificent when equipped with all his accessory organs; but they do no grown on him and they still give him trouble at times…. Future ages will produce further great advances…and will increase man’s likeness to a god still more…. All the same, …the human being of today is not happy with all his likeness to a god.”

It is possible future prosthetic attachments and robots may make it disadvantageous to remain human or to evolve further as Homo sapiens. A somewhat joyless Freud saw an inbred natural human aggressiveness as the greatest impediment to the formation and continuance of human civilization. The question remains open, however, if a spatially boundless cyborg and/or robot civilization would be one of joy (in German, Freude)!

Perhaps it would be best to say, at least until the Age of Molecular Nanotechnology is unmistakably underway and commonly apparent, that Homo sapiens is a non-omnipotent “deity”, a fallible group of organisms with “free will” subject to God’s creation, a Universe governed by discovered and discoverable laws which came into existence, along with Astronomical Time, when the Universe began. Human noosystem formation is the historical social event-process of Homo sapiens’ self-definition and self-organization against universal, not merely Earth-biosphere, chaos. As Earth expresses God’s laws—that is, localized “Laws of Global Nature” as such are currently understood by Science—emboldened geoscientists and technologists must think that all is risk and reward. The motion of the planets in our Solar System is chaotic. An errant asteroid jerked from some a stable Earth-crossing orbit could subject our world to a terrible onslaught, perhaps vaporizing many persons during its impact, when land and sea-bottom elevations would then be markedly altered in mere minutes and massive quantities of magma would become lava, even at the antipodes of the impact. Hollywood’s cinematographers have capitalized on this scenario with such epics as Meteor (1979), Deep Impact (1998) and Armageddon (1998). Without boarding any particular geo-ideological bandwagon, Macro-engineering practitioners must read a wide spectrum of scientific, technical and geopolitical literature in order to have a sharp-sighted grasp of all germane facts. Sigmund Freud was not speaking of cyborgs, which are a kind of centaur, but we must think of our worlds as truly self-reproducing factories embedded in a multi-global Solar System-based Homo sapiens civilization—as if they were James Graham Ballard’s geopolis (Earth, Mars, Venus, the Moon) or, perhaps, a copycat macroproject like Richard L.S. Taylor’s Worldhouse on Mars!

Apprehending and considering Earth’s current volatile and vituperative social atmospherics, events in our processing minds during current global economic conditions are the least surefire factor affecting our Earth-world’s future state or existence. A sociologist, Gustave Le Bon (1841-1931), in La Psychologies des foules (1895) said: “The age we are about to enter will in truth be the era of crowds.” Adolf Hitler in Nazi Germany was the first national leader to prove Le Bon’s statement a fact; today’s globalized “Television Generation” could become the next victims and perpetrators! If humankind does not learn to control his worst behavior, the Geopolitics should focus on generational estate planning. Without the slightest aberration, however, we think and believe that modern Geopolitics and Macro-engineering professionals should look ahead with optimism (laced with steely

249 G. Le Bon, The Crowd (1913), page 15.
realism) to AD 2057, the 100th anniversary of Sputnik I and the International Geophysical Year.

During 1984, the Stockholm International Peace Research Institute (SIPRI, founded 1966) published *Environmental Warfare: A Technical, Legal, and Policy Appraisal*. SIPRI’s monographists decry the macro-problems that would follow a hostile disruption of the Old River Control Structure on the Mississippi River in Louisiana, USA. America suffered its first Guernica or Rotterdam on 11 September 2001. It is entirely possible that other ecosystem-nations will also be attacked in a devastating manner. SIPRI’s slim book offered an emendation to the 1977 Convention prohibiting “Geophysical Warfare”, which would permit organization of Boris B. Rodoman’s “Biosphere Command Centers”. An intensive check-over of that Convention seems to lead to a non-stretched interpretation of Article 56:5-6 as an opportunity for Macro-engineering’s adherents to establish an Earth-girdling macroproject management facility, while helping to propel “World Peace” to a quiet conclusion. Article 56’s clause 6 suggests that further agreements among the Convention’s signers could provide additional protection for macro-objects containing dangerous forces or materials. Since ecosystem-nations are to be considered as technical systems (micro- and macro-objects) and their destruction through conflict (conventional or unconventional warfare) endangers our Earth’s biosphere, why not form an agency to build on that 1977 Convention? Specifically, Indians and Americans should wholeheartedly promote the agreeability of strategic anti-ballistic missile defenses, a melding of machinery benefiting the world’s biota.

As currently constituted, the United Nations Organization reflects the post-World War II Superpower’s desire to preserve the integrity of the interstate system of legal relations. An amalgamation various military doctrines, embodied in an augmented Rodoman-ALPS, could help to professionalized Macro-engineering-Geopolitics in something other than an “arena” where Third World terrorist gladiators green with technological envy of the First and Second World train to attack others. Arms, even super-weapons of mass destruction capabilities, are available today to terrorist lodges worldwide and, in future years of the 21st Century, the Earth-biosphere may well be radically transformed by charismatic clan leaders who can link terrorist bands into a chain of primordial power. European nations, the USA and India have all been victims of terrorism. It seems utterly impossible to devise a deterrent policy that might be universally applicable. Biosphere damage is bound to happen before Earth’s First and Second Worlds could bring all Third World states up to topmost human Standard of Living via perfected molecular Nanotechnology. Rodoman-ALPS, pronounced “OUR ALPS”, should be constructed to militate against the globalization of mini- and meso-wars. Robots made “alive” by our technology, could perform as tireless Environmentalists, taking on tasks of planetary cleaning, which Antoine de Saint-Exupery (1900-1944) had to delegate to his adorable Little Prince!250

Frank Paul Davidson wished that Macro-engineering curricula trained its “offspring” in the styles of Diplomacy and Engineering, while one of the early USA proponents of anti-ballistic missile defenses, Daniel Orrin Graham, on 17 November 1985, lamented that professional diplomats were less competent to preserve the USA than its engineers! Davidson developed privately an answer, “Engineering Diplomacy”, to Graham’s public complaint, which time’s passage will probably uphold.251 Davidon, the USA’s premier popularizer of “Macro-engineering”, editor of six basic textbooks, trained in International Law, could be the individual most able to do for the just-emerging Macro-engineering profession what Charles Lyell (1797-1875), an attorney, did to popularize the overly abstract basic insights on Geology provided by James Hutton (1726-1797)—but only with remarkably better advice on matters of Geopolitics and Science germane to Macro-engineering!

Indoctrinated Green journalists, often read, heard or seen by millions of persons, are able to easily name some biosphere risks impacting Earthlubbers and often seek to stymie technology’s R&D programs in the vain hope of keeping Earth as an Anti-Object Artwork! Considering the public in India and the USA receive little information on Terraforming, it is only natural that such a far-term future oriented profession should suffer slow growth. The profession of Macro-engineering must not endure that same kind of non-reporting or negative news media criticism, since it would be unhealthy for planet Earth. Molecular Nanotechnologists are the key innovators supporting all further industrial “Big Thinking” in Macro-engineering and Terraforming. Planning started with Homo sapiens’ farming 10000 years ago. Planning would possibly terminate with molecular Nanotechnology’s perfection.

Mankind’s influence, such as it is, on the Earth-atmosphere’s energy budget has arisen from several sources. Although the ocean’s surface is virtually unaltered—except that all the ships used by people, which displace 1767000000 cubic meters of seawater, keeps the ocean approximately five micrometers higher than it would otherwise be—we have markedly changed the land’s reflectivity or absorbtivity. Irrigation and agriculture-induced net heating of the troposphere is caused evaporation. Injection of particulate material such as forms of smog has caused a net cooling of the air by reflecting solar radiation. The Asian Brown Cloud, composed of dust from Rajasthan and dark aerosols from India’s factories and low-grade coal burning, shades the region over which it is generated, and “Global Dimming”, the measured worldwide decreasing transmission of sunlight through the Earth’s polluted atmosphere is adjudged by reputable climatologists to be a macro-problem in need of a cure. Everywhere, it is a macro-problem caused by industry and people. “Specifically, the globally average surface air temperature and amount of precipitation could increase in less than a decade by 0.8 K and 3%, respectively, if the entire amount of anthropogenic sulfate aerosols were removed from the atmosphere.” Carbon dioxide gas emissions (from burning fossil fuels) causes a net heating of the air, and is another source of change.

The primary “greenhouse gas” present in the Earth’s atmosphere is water (in the form of gas, not vapor), which causes 80% of the warming as compared to carbon dioxide gas’s 20%. If gaseous carbon dioxide were subtracted all at once from the Earth-atmosphere—by molecular Nanotechnology or a Miracle—then the immediately subsequent 3% decrease in today’s Greenhouse Effect would inevitably result in a 1°C decrease in Earth-normal global average air temperature. If 100% of the air’s carbon dioxide gas were converted technically to carbonate rock, its distribution globally might produce a vast (5.1 x 10^{14} square meter) and undifferentiated superficial stratum 2.5 millimeters thick; this 12.75 x 10^{11} cubic meter globalized rock formation will be an “Anthropic Rock”. A single-site warehouse, or the world’s largest point-sink, would bulk 128 cubic kilometers of Anthropic Rock! The World Meteorological Organization, on 14 March 2006 issued its first WMO Greenhouse Gas Bulletin. Bulletin No. 1 reports that since the beginning of the Industrial Age circa AD 1750 “atmospheric CO_2 has increased by 35%, primarily because of emissions from combustion of fossil fuels…and, to a lesser extent, deforestation…”. Over a period of almost 360 years carbon dioxide gas has risen from about 280 parts per million to 377 parts per million by AD 2004. The WMO claims that carbon dioxide gas is “the single most important infrared absorbing, anthropogenic gas” in our Earth-atmosphere and “is

---

responsible for 62% of the total radiative forcing of the Earth by long-lived greenhouse gases.” The odd placement of the comma between “absorbing” and “anthropogenic” surely gives a false impression of mitigative urgency to the uninformed John Q. Public’s of the world.

Human familiarity with the Moon’s phases had considerable practical consequences in pre-Industrial Revolution societies reliant on the reflective Moon for all nighttime outdoor illumination. The full Moon is 0.0000067 as bright as the overhead Sun. Outdoor artificial lighting plays a really significant role in the world-public’s acceptance of 21st Century architecture. Despite the low Bond (0.11) and visual geometric (0.12) albedos, the Moon is so near to the Earth and reflects so much sunlight, as moonlight, that it qualifies as the second brightest light source in Earth’s sky, after the Sun. Each spherical body receives a solar irradiance of 1367.6 watt per square meter and each has its unique absolute spectral reflectance. In modern societies, romance-inspiring moonlight is not yet a matter of everyday practical importance; that may change as a globalized civilization becomes increasingly industrialized, ever more technically reliant upon controlled energy. Humanity’s present-day needs now exceed 14 terawatt. A society separately situated on the Moon, which has but 7% of Earth’s area, could periodically measure and monitor Earth’s Bond (0.306) and visual geometric (0.367) albedos.

The best commercially available white light-emitting diodes produce 25 lumen per watt, while the best incandescent white light emitters can produce 17 lumen per watt. Approximately 13000 terawatt of solar energy strikes the Moon, and except for three hours during a full lunar eclipse, the Moon is exposed to steady sunlight; during AD 2001 to 2200, future Moon colonists and visiting Earthlings will experience 155 total eclipses. Settlement of the Moon is expected to occur during the 21st Century. Human groups thereon are legally obligated to conform to the UN Organization’s “Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement)”, which entered force on 11 July 1984. The Moon’s rocky surface reflects about 7-11% of the sunlight it intercepts. Every square meter of the Sun-facing Moon surface is equivalent to a single 275-watt light bulb. The Moon is 31% brighter at perigee than at apogee: during the 21st Century its closest perigee (of 356421 kilometers) will happen on 6 December 2052; during the 22nd Century, it most distant apogee (406720 kilometers) will occur on 3 February 2125. Envision a “Disco Ball” Moon emitting continuously 225000 x 10^{12} lumen, its grayish natural landscape totally obscured by anthropic machines and mirrors!

The physics, chemistry, and dynamics of the Earth-atmosphere’s recognized event-processes is intensively studied so that humans may be enabled to understand, predict, and control abrupt, as well as steady, planetary event-processes affecting the weather, climate regimes, and air pollution. During the 20th Century, harnessed energy released from mined non-renewable energy resources was added to a recently assessed variable and interrupted geothermal heat flow as a known net heat source tending to warm the Earth-atmosphere.\(^{255}\) (If J. Marvin Herndon’s “georeactor” is in the Earth’s core, then Earth’s fluctuating geothermal flow will diminish, in a punctuated manner, through future Geological Time, and may stop emitting any energy. Cessation of the Earth’s “georeactor” will not precipitate any of the civilization-stressing geophysical disasters so vividly dramatized in the 2003 Hollywood epic The Core, which was condemned to a special place in the annals of bad Physics in Sidney Perkowitz’s Hollywood Science (2007). Herndon theorizes the “georeactor” powers Earth’s geomagnetic field. The future absence of a geomagnetic field may, therefore, reduce the energy available to life forms in the Earth-biosphere.\(^{256}\) Excavated nonrenewable resources are quantitatively finite since humans


\(^{256}\) Viktor A. Gusev and Dirk Schulze-Makuch, “Low frequency electromagnetic waves as a supplemental energy source to sustain microbial growth?”, Naturwissenschaften, 92, 115-120 (2005).
cannot remove the supportive ground beneath their species’ life-maintenance activities! Abrupt geophysical catastrophes, both natural and artificial, do impend and the Earth-confined civilization, generally conversant with the likeliness of certain specified event-processes, may eventually decide to exploit another celestial body’s crust—the Moon’s—for its renewable energy sources derived from, and imparted by, the Sun (photovoltaic generated electricity based on current solar irradiance and $^3$He isotope fusion fuel energy founded upon solar wind-deposited elements). Continuous monitoring of the Sun commenced during February 1996 when the Solar and Heliospheric Observatory became operational.

Earth’s global mean total insolation—the solar radiation actually absorbed by the planet’s surfaces, heating all impinged rocks, soils, ice, freshwater and seawater, and living creatures—is 168 watt per square meter. The atmosphere-less Moon receives 1367.6 watt per square meter, some of which is reflected, causing some of Earth’s air situated in a region below a time of full Moon to be warmer by 0.02°C compared to the time of the new Moon. (A total eclipse of the Sun on 11 August 1999 caused winds that moved across the Earth’s surface in time with the Moon’s moving eclipse shadow.) Selenography, the equivalent of Geography, has few landmarks on the Moon to serve as easily recognizable region-organizing framework. Even as Neil A. Armstrong first stepped onto the pitted and cratered Moon on 20 July 1969, macroengineers were still uncertain about the place’s human-scale geomorphology. Whether laboriously walking in the encumbering spacesuits, or riding each of the three Moon Buggies (Lunar Roving Vehicles) abandoned on the Moon in an operable condition by Apollo Missions 15, 16, and 17 since 30 July 1971, for past Moon explorers as well as future explorers, the lunar bulge, horizon, along a six kilometer chord is 1.5 meters. Exploration of the Moon has caused a measurable degradation of the lunar vacuum because of gas leaks from spacesuits and spacecraft as well as ascent rocket engines. Accurate topographic mapping of the Moon only became possible and available after the 1994 Clementine Mission, which resulted in the first global altimetric data set for the Moon. NASA and the European Space Agency are planning for new lunar mapping space probes to be launched during the early 2010s.

Earthly “Global Warming” is a commonplace, first widely touted during the late 20th Century. Indeed, it is the keystone of accumulating geophysical evidence utilized by those who have theorized about, and declared a name for, a dawning Earth-alone Geological Time period, the “Anthropocene”. Anthropic activity, which tends to enforce schedules on macro-objects and energy/material flows included in all planetary event-processes, is an operating integral component of all Earth-Moon system changes, especially since the Space Age’s 1957 inauguration. Nevertheless, the unexpected and the accurately forecasted future geophysical catastrophe can impact the Earth-Moon system, causing a profound, and comprehensive, macro-planned post-event-process readjustment of human civilization’s behavior.

Puzzlingly, an evidently important atmosphere mystery, Global Dimming, has not yet garnered the scientific or world-public attention it really ought to receive. Each year, less sunlight reaches the Earth-surface to heat rocks, plants and animals and other things. Global Dimming, in brief, is an accurately, if preliminarily, measured ongoing geophysical event-process affecting humanity’s only planetary residence in this Solar System. The most obvious suspected causes of Global Dimming may be: (1) a less intense solar constant; (2) anthropogenic dust in the atmosphere, especially over and downwind of cities; (3) unexamined aspects of atmosphere gas interactions and (4) a combination of...

causal factors. Even though its cause may be uncertain, a cure can be suggested: more sunlight to overcome the gloom! A 3% per decade reduction of the total sunlight reaching the Earth-surface would result, mathematically, in a potential for total darkness after 330 years. Of course, that won’t happen because Global Dimming must have some real physical limit. Certainly, humans would become diseased or deceased if the air got too thick with dust and other intolerable pollutants!

Global Dimming means a higher proportion of diffuse light will be incident at the Earth’s surface, perhaps enhancing photosynthesis in green plants. If we assume that Nuclear Winter is unlikely, then Global Dimming may become, of necessity, the major survival problem impacting our species. Offsetting Earth’s Global Dimming will be a broadly vital challenge to the abilities and capabilities of the most masterful extant proponents of Space Age Macro-engineering. After all, the rapid onset of the Mount Pinatubo 1991 volcanic eruption resulted in a calculated reduction of $5.64 \times 10^{22}$ Joules of heating within the biosphere; atmosphere dust loading by Mount Pinatubo caused a measurable increase in global diffuse radiation that, subsequently, caused a notable reduction of atmospheric carbon dioxide gas, thereby promoting Global Cooling.

Complete industrialization of 59% of the Moon’s $3.796 \times 10^{6}$ square kilometer surface is usually touted as humanity’s goal-quest for additional energy, ores and other resources. All realistic Macro-engineering developmental projections foresee the high cost of ensconcing Earthlings comfortably on the Moon’s nearside. The Sun and the Moon—each covering about 0.2 square degrees—appear nearly the same size when viewed from Earth. How would the Moon appear to Earthlings if it were covered with reflective macro-objects such as shiny mirrors? Like a glittering 1970s dancehall Disco Ball? Christian Marchal solved the physics of placing Earth-facing mirrors on the Moon in 1982. Alexander Alexandrovich Bolonkin has invented the best kind of mirror to emplace on the surface of the Moon (Figure 1).

![Guided mirror on the Moon](image)

Figure 1.

Guided mirror on the Moon

Notations: 1-2, Double-thin film mirror; 3-toroid ring to support the mirror tension surface; 4-

---


inflatable columns for controlling the mirror angle; 5- solar beam; 6- reflected sunlight beam; 7- Earth; 8- Arctic Zone Evergreen Dome town; 9- thin transparent film protecting the town from cold air; 10- satellite; and 11- mirror.

Non-Rocket Space Launch and Flight (2006), by the dauntless Alexander Alexandrovich Bolonkin is a treasure-trove of new, often very revolutionary, inventions to foster low-cost human travel in outer space and human settlement of other planets and the Moon. His macroproject concept of a Cable Space Transport System, sited at one or both of the Earth’s Poles, could efficiently convey cargos and people to the Moon. (At the South Pole, on 16 January 2004, a total solar eclipse will be visible; the North Pole has a total solar eclipse on 6 July 1815.) In other words, an array of A.A. Bolonkin’s inflated sunlight reflectors could be erected on the Moon to overcome Global Dimming by diverting more sunlight Earth’s way! Alexander Alexandrovich Bolonkin was born in the former USSR in 1933. He worked in the USSR’s aviation, rocket and satellite industries until 1972, when he was arrested by the infamous KGB, sent to prison for fifteen years, then exiled. Since coming to the USA in 1987, he has worked for the NASA, in the world-renowned scientific research laboratories of the US Air Force, and completed projects for the National Research Council.

The global sea level rise could make less attractive a spin-off from Robert Panero’s Macro-engineering plan for damming the Amazon River in several places, forming a “South America Great Lakes System”. Panero’s “South American Great Lakes System” would eclipse what was probably the most audacious hydraulic macroproject ever undertaken in the ancient New World: the remarkable La Cumbre Canal located in Peru, which was constructed over a 200 year period and represents a labor investment perhaps ten times that devoted to Egypt’s Great Pyramid of Cheops.

Born ten years after Frank Paul Davidson, in 1928, Robert Panero was tutored in a family-owned civil engineering firm started by his father, Guy B. Panero Engineers (incorporated 1947 and merged with another company in 1970). Robert Panero served in the Korean War from 1951 until 1952. From 1956 until 1960, he was involved with the RAND Corp. and the MITRE Corp. through the Special Projects Group of Guy B. Panero Engineers. During the period 1960-1964, Robert Panero then directed his firm’s overseas operations from Rome, Italy. In 1964, the year “Macro-engineering” made its first appearance in the UK’s popular New Scientist weekly magazine he joined the Hudson Institute, eventually becoming Director of Economic Development Studies until his departure in 1974. Circa 1956-1957, Robert Panero had coined the term “Super Projects”, which are exactly like Frank P. Davidson’s “Macroprojects”. In 1974, Robert Panero Associates was established in New York City to R&D Third World resources, especially those in Latin America, via geographically gigantic and sometimes costly constructions.

Davidson and his colleagues define “Macro-engineering” as a “process of marshalling money, materials, personnel, technology, logistics and opinion on a huge scale to carry out complex projects, often international (or ‘multi-national’) in nature, that last over a long period of time. A macro-engineering project requires massive funding, significant manpower, large-scale equipment and tons of material. Macro-engineering projects extend the state of the art of technology, may take place in difficult and sometimes hostile environments, and require sophisticated project management.

On the other hand, Robert Panero, best known for his 1969 Amazon Dam proposal, thinks “A Super Project is one that represents, symbolizes and causes a fundamental change in mentality. Everyone understands it because it changer their own view of the future”. Panero’s “Gestaltist” viewpoint is profound. Systems thinking in Geography may have stemmed, in part, from Gestalt psychology, as developed by Kurt Koffka (1886-1941) and Wolfgang Kohler (1887-1967). The Gestaltist view is that a “whole” was often different than the sum of its parts. It seems to build upon the thinking of many living philosophers and certainly is in accordance with the published 12 March 1964 New Scientist comment: “The real cause of our attachment to macro-engineering is at once more subtle and more profound”. Whether they are spoken of as “Super Projects” or as “Macroprojects”, such constructive endeavors—along with future terraformation of other planets and Moon remodeling—are futuristic. The “future” is, itself, a “project”, a work of collective imagination and aspiration. Panero and Davidson would be unlikely to disagree with that statement. We suppose that terrorist lodges that have attacked infrastructure in the USA (11 September 2001, the “911 event”), UK, Spain, Indonesia and many other places (India on 11 July 2006, the “711 event”) could be publicly identified as destructive macrominders; new technology, or existing high technology, has applications inspired and used by global and local terrorist lodges.

So far, all large-scale economic developments attempted in the Amazon River Basin have failed to become profitable, with the exception of forestry and petroleum and other kinds of mining. Commercial agriculture in the Basin is non-competitive because the soils there are so poor in plant nutrients. Although permanent natural lakes in the Basin have only recently been discovered, rainforests in South America certainly should be spared from any widespread freshwater immersion. During the 1960s, Robert Panero proposed several large hydroelectric macroprojects; since then, he has devised a macroproject aimed at providing controlled freshwater and new arable land for the Basin’s farmers, macroprojects using what many Brazilians view as ecologically harmless mini-dams. Panero, an energetic eager beaver, advanced his idea for many low-head dams on many of the Amazon River’s tributaries. He called for a series of small dams to be placed alternately along a single river that would flood upstream regions and drain downstream regions. The upstream regions would gradually fill with sediment, with the fertile downstream regions gradually losing fertility from over-farming. Every 50 years approximately, the low-head dams would be deliberately demolished to be duplicated elsewhere as new cheaply constructed earthen dams, in order to irrigate low-fertility lands (draining the silted, waterlogged regions) for replacement agricultural enterprises. (Robert Panero’s technique for Latin America farmland refreshment is worthy of North American beavers!) However, Robert Panero’s “South American Small Lakes System” macroproject plan will probably never be realized for geopolitical and other reasons even though the continent’s Physiography seems to favor it. It is more than interesting to note the absolute geographic location of Brazil’s seat of national government. Brasilia was established in 1960 close the Amazon River Basin.
All maps reflect the interest of their makers. Geographers and macroengineers do not find Arno Peters’
cartographic work, the so-called Peters Map Projection, supportive of their purposes.271 Peters’ map
projection looks like something inspired by the paintings of Amedeo Modigliani (1884-1920)! All
First World geopoliticians mourn Peters’ lack of interest in Earth’s ocean—70% of our world. Peters
(1916-2002) was a historian whose doctoral dissertation subject was film as propaganda. Peters
seemed to fancy himself as Cartography’s version of History’s Werner Stein (1913-1993), the man who
constructed the delightfully useful cultural-historical reference, Kulturfahrplan (1946). The result of
work mainly done from 1967 until 1973, The Peters Atlas of the World (1989) is beautiful, but also
harmful to North-South interests. Peters’ almost cartoonist portrayal, and sly betrayal, of the Third
World is breathtaking in its effectiveness.

Argentina’s recent leaders appear to have determined that opening up the southernmost parts of their
nation is vital for its national economic development. Obviously, they also intend to reap what they
can from Antarctica. Earth’s first native Antarctic (date of the anonymous boy’s natality was 7
January 1978) is also an Argentine! The conflict over control of Antarctica is potentially the most
complex, wide-ranging, and dangerous of all the conflicts involving the South American ecosystem-
nations. In 1950, the populations of North America and Latin America—“Latin America” includes
Central America—were about equal at 166000000 each. By AD 2020, Latin America’s population
could be over 700 million while North America’s might be 330 million. In other words, the impending
geopolitics of the New World will be characterized by disturbances (resource denials, trade restrictions,
environmental damage, legal and illegal mass migrations, narcotic trafficking and, possibly, fanatic
terrorism). Central America, like the Middle East in the Old World, poses unique geopolitical threats
to all mankind. Those regions are where maritime shipping lanes converge (on the Suez and Panama
canals) and where undetected cruise missiles could emerge from, traveling to their European and North
American targets entirely over land. Briefly, a cruise missile attack (in the absence of a functioning
Rodoman-ALPS configured to track and destroy aerodynamic missiles as well as ballistic missiles)
could be a matter of uninformed speculation, failing to justify a victim’s counter-attack. The French
Revolution installed Earthly global Nature as a quasi-divine Authority; the concept of “Latin America”
was created in France under Napoleon III. 272 The model for political activity in Latin America is
France. When he embarked upon his presidency, Dwight David Eisenhower (1890-1974) sought to
remind the USA’s public that global war could originate in Latin America.273

Paul Bracken, nowadays a professor at Yale University’s School of Management, lodged an opinion in
1982 that South America will be Earth’s first region “subjected to a super-industrial scale of
development….”274 As Bracken opined, “super-industrial refers to the degree to which projects are
undertaken on such a massive scale that unintended side effects…are of greater consequences than the
intended effects.” How can a single term (that is, “super-industrial”) meaningfully encompass all
those references (high-rate, degree, counter-productiveness)? Only an unwanted and/or unplanned
World War III could possibly qualify as a macroproject with the characteristics Bracken has implied!
Future cybernation could ensure a pollution-free environment for social health! Robert Panero’s
“South American Great Lakes System” does have considerable negative externalities, but nothing on
the geographical scale Bracken invokes. At that time, apparently, Paul Bracken was simply blind to the
“Big Picture” approach to Diplomacy, Macro-engineering, and Geopolitics. Bracken has warned that
India, China, Iran an other countries were adopting “sidewise technologies”—mature technologies
applied to new macro-problems—that pose a competitive challenge, in some cases a threat, to the USA

and Europe. In a publication edited by Bracken, organized intellectual frameworks are offered that help readers recognize and understand sidewise technologies; mature competitive technologies can be overlooked by First World states publics that are currently in thrall with Information Technology, Biotechnology, and developing molecular Nanotechnology.\footnote{Paul Bracken, “Sidewise Technologies: National Security and Power Implications” (15 July 2004). \textit{Yale School of Management Working Paper No. ES-35}.} Bracken’s \textit{Managing Strategic Surprises} (2007) discusses global technology related to basic strategy and investment.

Riverside and coastal shipping in Brazil is probably a very good capital investment—better than railroads and rainforest-destroying superhighway. Such a coordinated water transportation system could be useful, if Robert Panero’s “South American Great Lakes System” were realized. \textit{Audubon}, a popular magazine noted for its punctilious panegyrics about Earthly global Nature, in its March 1979 issue, outlined and maligned Robert Panero’s macroproject plan to utterly transform the huge watershed of a New World Tropic Zone river. In 1990, that limpid article was reprinted in John G. Mitchell’s \textit{The Man Who Would Dam the Amazon & Other Accounts from Afield}. Today’s Amazon River has an elevation west of Iquitos, Peru (3750 kilometers upriver from the mouths of the Amazon River) only 114 meters above present-day sea-level; it descends eastward to an elevation of but 10.5 meters, about 3200 kilometers from its termination in the South Atlantic Ocean, and ocean tidal effects have been measured and recorded many kilometers inland from the ocean. The greatest inland penetration of a tidal bore anywhere is in the Amazon River Basin, where noisy bores on the Capim, Guajara, and Moju rivers—tributaries of the Amazon River—occur more than 150 kilometers inland. The “pororoca”—in the language of the Tupi-Guarani Indians, the name means “great din”—is the most famous on the Amazon River. Great floods have raised the Amazon River 10 meters above its normal flowing height, while the river discharges almost 16\% of all the world’s runoff yearly.\footnote{Eltahir A.B. Eltahir et al., “A see-saw oscillation between the Amazon and Congo basins”, \textit{Geophysical Research Letters}, \textbf{31}, L23201 (December 2004).} Anthropogeomorphology’s experts are aware that a future global sea level rise, possibly as much as 8 meters if the Polar Zone ice-sheets sublimate or shed a lot of ice late in the 21\textsuperscript{st} Century, would have the effect of allowing 10000 tonne ships to voyage upstream west of Manaus, Brazil. A one-meter sea level rise would also make Robert Panero’s low-head, mini-dam hydroelectric powerhouses inoperable in that extremely flat terrain which comprises most of the Amazon River’s watershed! Indeed, estuarial ecosystems would be enlarging geographically everywhere in our biosphere. There is not need, however, to view such oceanic inundation as something uniquely destructive. Anthropology’s version of a newly organized “Environmental Forensics” proved that the Amazon River Basin was densely populated prior to the New World’s exploration by peoples from the Old World. The Amazon River Basin was not a pristine landscape but, instead, was dotted with settlements connected by a network of roads. Prior to the arrival of the Europeans, the Amazon River Basin had already been geomorphically transformed (by numerous persons wielding complex earthmoving, engineering and manpower organizing skills).\footnote{Michael J. Heckenberger et al., “Amazonia 1492: Pristine Forest or Cultural Parkland?”, \textit{Science}, \textbf{301}, 1710-1714 (19 September 2003).} A very large dam, such as Robert Panero’s 1960s Santarem barrier on the Amazon River, could save the Basin’s rainforest from ruinous inundation by the South Atlantic Ocean. A large freshwater lake impounded by the Santarem Dam would not affect Earth’s rotation but would affect local and global climate regimes through as yet unknown changes of the troposphere’s heat and water budget, thereby affecting other operating or planned macroprojects in the region as well as, possibly, similar infrastructures located in the Congo River Basin.

Marq de Villiers, in \textit{WATER: The Fate of Our Most Precious Resource} (2000, pages 3839): “Even if we could, we wouldn’t shift Brazil’s 20 percent [of Earth’s river water] to, say, the Sahara. Doing so
would put an end to the greatest reservoir of biomass on earth, and the planet’s greatest rain forest… that we have come to understand is its respiratory system. To do so would be like placing a giant vise around the earth’s lungs.” This is journalistic exaggeration of the first water! Why would anyone create a desert in South America to water a desert in Africa? Why does anyone still believe South America’s rainforest is one of the Earth’s “lungs”? There is no good reason why freshwater cannot be captured for use just as it flows into the South Atlantic Ocean! An Austrian metallurgical specialist and macroengineer, Heinrich Hemmer (1924-????) designed a means for the partial irrigation of the Sahara and the Sahel via freshwater imports from South America’s Amazon River. A detailed account of Hemmer’s plan for undersea arteries is presented in the defunct science periodical *Speculations in Science and Technology*. Hemmer (1) calculated the sizing of the fluid pipeline to suit the flow characteristics of freshwater and the pressures at each end of the pipeline; (2) calculated the strength of the pipe, considering the internal, external and oceanic loads the pipe must tolerate; (3) suggested a pipe coating—pipe, whether steel or aluminum require corrosion protection (including specific cathodic protection system for additional external protection); (4) selected a feasible pipeline route; (5) determined that a surface tow and/or a mid-depth tow is efficient; (6) investigated what marine engineering codes and government regulatory requirements must be met. Hemmer’s pipeline would face examination by all signatories of the Treaty of Amazonian Cooperation (1980). Modern computer simulations would, of course, enhance Hemmer’s pioneer work. (Submerged floating tubes to carry car and truck traffic across fiords are being investigated in Norway.) Via a 4300 kilometer-long lozenge-shaped pipeline, Hemmer hoped to deliver freshwater to the parched throats of North Africa’s suffering peoples. His preliminary calculations are impressive: a super-long 80 meter-diameter plastic-coated metallic floating pipe from the Amazon River to Africa’s Mauritanias carrying 10000 cubic meters per second. His macroproject plan foresaw the export of about 10% of the Amazon River’s runoff, which would be pushed and drawn along by land-based (or, possibly sea-based) fission or fusion nuclear reactor-powered electric water pumps. Figuring a demand in North Africa for 10000 cubic meters of freshwater per hectare per year, Hemmer concluded that 315000 square kilometers of dry land could be fully watered. (Hemmer’s delivered freshwater could then be pumped overland via a pipeline extending from Nouakchott, Mauritanias, to the Bay of Saloum in Libya.) Hemmer’s freshwater would supplement the extant supply wrought from the “Great Man-Made River Project” since 1990. Hemmer’s pipeline would also have the effect of continuously drawing down a large Amazon River Reservoir, keeping that Basin’s rainforests from becoming dead wood at the bottom of a large, putrid lake. If very cheap electricity could be made available, then a good deal more of the Amazon River’s 100000 cubic meters per second flow might be siphoned off to South America’s arid or water-short regions. Prevention of a gigantic freshwater collection at one place on Earth’s crust near the equator would also reduce the rate of slowing of our planet’s rotation.

A UK hydraulic engineer, publishing before World War I, calculated a complex canal pumping network to enable the tapping and storage of the summertime Martian polar ice-cap runoffs. As a matter of geography, Mars is not a place of idyllic beauty. In a succinct technical-level text devoid of techno-babble, *The Riddle of Mars* (1914), Charles Edward Housden (1855-1921) worked up a

humanization watering system macroproject that could transform Mars, terraforming it into a Xanadu-like planet! Like Heinrich Hemmer’s plan to water the Sahara, Housden planned the exact number of pipelines and canals he thought absolutely necessary to harvest the hemisphere-alternating annual runoff from the Polar Zones, and also the energy required to pump freshwater from Mars’ North and South Poles to irrigate farms and fill city reservoirs established within a belt-shaped equatorial region.

Housden was born 19 July 1855 and was educated at the Indian Civil Engineering Colleges in then British-ruled India. By October 1876, he was appointed to the Public Works Department of the Government of India, having passed a vernacular examination at the departmental standard as well as a colloquial examination in Burmese. Circa June 1903, he was serving as a sanitary engineer to the Government of the City of Rangoon; 1908 saw him engaged as Superintending Engineer and Sanitary Engineer, East Bengal and Assam, stationed at Shillong. A rule then governing civil servants in India imposed mandatory retirement at age 55 years, so Housden left the service in July 1910. On 27 November, Housden became a member of the British Astronomical Association, while then living in London, England. On 13 March 1913, the British Astronomical Association Journal (Vol. 23, pages 278 to 290) carried his landmark article “Mars and Its Markings”. Between 1907 and 1914, he published at least three major books on topics relevant to water management macroprojects. Housden died sometime during 1921, while residing in Hove, Sussex, England.

Robert Lionel Sherlock (1875-1948), at page 347 in a famous 1922 monograph, Man As a Geological Agent: An Account of His Action on Inanimate Nature wondered about Aliens and Homo sapiens: “Can we foresee the final results when all possible engineering works shall have been carried out? Is it possible that in the yet far distant end Earth will come to the state said to exist on Mars, and be covered by enormous canals from pole to equator? The canals of Mars, if they really exist, a question still under discussion, are far greater than any our engineers imagined. The battle of the Martians with Nature has been on a much more gigantic scale than Man’s conflict, and yet we hear that the Martian is on the point of extinction, and Mars of becoming totally lifeless. Even on Mars the mighty engineering works seem merely to scratch the skin of the planet, and the final result of Martian activity in the solar system seems likely to be infinitesimal.” Sherlock valued C.E Housden’s hydrological expertise and his findings about the planet Mars; Sherlock’s book was one of the few attempts made before 1966 to gain an omniscient view of the transformative powers of mankind’s science and technology over Earth’s biosphere. Soil mechanics is the meeting ground for future Spacefaring macroengineers; only on a liquid-less planet—Mars has water and other flowing fluids—would there be no need for “soils engineers”! Housden’s pipe-laying macroproject must necessarily be re-routed if, using Richard Taylor’s Worldhouse plan, a freshwater lake is formed in the Valles Marinaris of Mars. Perhaps a series of cascading lakes—somewhat akin to aquaria—may be established to fulfill many industrial functions (mineral processing, fish farming, and hydroponics). Since the early 1960s, Homo sapiens has had certain evidence that Sherlock’s Martians do not now thrive and that Martian canals are not visible on Mars’ crust. Today’s Mars atmosphere is so very thin no non-encapsulated human could there survive.284 Like the Tower of Babel, these proposed future artworks represent both the ambition and the chaos of mankind’s civilization embarking on a unified future, a future many persons hope and pray will be interminable. (We ignore the probable future presence of mindkind—the invented species Machina sapiens.)

MACRO: A Clear Vision of How Science and Technology Will Shape Our Future, Frank P. Davidson’s 1983 summary of Macro-engineering’s professional and popular status at the time of its publication, is oddly anachronistic. On a geopolitical level, life in Davidson’s generalized Earth-biosphere future is


A “Trans-North Atlantic Ocean Tube-Tunnel” is make-believe reaching its apogee. Its 21st Century incarnation is a neutrally buoyant tube, anchored at a depth of 45 to 100 meters beneath the North Atlantic Ocean, from which air has been extracted to create a working vacuum in which supersonic magnetically levitated trains will move at speeds of 6400 kilometers per hour. At a cost of 2006 USA$90 to 180 billion, it would be, if built, a fantastically lucrative terrorist target! Disregarding possible natural shifts in the Gulf Stream’s route in the eastern North Atlantic Ocean or the shift that might occur were C.L. Riker’s causeway constructed, the seafloor geology along the route selected by Davidson, Harrington (and, nowadays, Ernst G. Frankel) in Davis Strait is becoming better known. Late in the 20th Century, big gold deposits were found in Greenland, a place that is currently covered by moving glaciers that are undergoing drastic geographical changes. Sub-surface warmth, caused by intensive volcanism, would be a real macro-problem in Iceland, where crops of bananas are grown in hothouses using volcanically heated groundwater! Though it had not remarkable widespread effect on the North Atlantic Ocean’s state, Iceland’s Surtsey volcano, which formed in AD 1963-1965 by massive seafloor lava accumulation, could easily menace the submarine subway macroproject. Iceland “is the only spot on Earth above sea level where fissures, formed by spreading at mid-ocean ridges, are likely to erupt on a titanic scale.” The haze of sulfuric particles belched by a new eruption—the most recent was in 1783—could shutdown all air traffic in the Northern Hemisphere, perhaps making the submarine tunnel even more valuable. Harrington-Davidson-Frankel’s 4100 kilometers-long tube passing aircraft-like fuselages would cost the Earth—a real pipedream! Macro-engineering professionals must strongly resist such fixed link fixations and other such juvenilia. Deep draft icebergs traversing Davis Strait in the hundreds annually pose too great a threat to be ignored so flagrantly.

While Virtual Reality machines could “send” riders—not aboard a high-speed magnetically levitated train—to London, Venice or Venus, Rodoman-ALPS wont have the technical capability to really guard any submarine facility unless it were tied via Earth-orbiting satellite into tele-robotic underwater guards via “blue-green” laser beams, which because of their wavelength are able to penetrate many meters of seawater. A global, computerized, interconnected network of intelligence, both human and artificial, could lead to a thorough exploration and exploitation of the Earth’s ocean. On the ocean surface, today’s 100000+ tonne cruise liners may end at the breaker’s yard in Alang, India or on the mudflats of Bangladesh where they are torn apart by impoverished Third World persons, since Virtual Reality could make sightseeing through high-resolution television monitors both inexpensive and comfortable.

—no lines, no customs searches, no pickpockets, no confiscatory money exchange rate or lost luggage! Some person will always seek physical and psychological pleasures derived from traveling. A more peaceful world might result if Virtual Reality “passengers” never physical visited sociologically volatile Third World seaports. Future television and computer linkages in Virtual Reality could make adventures possible for the handicapped as well as healthy persons.

Jarvis Island, located in the South Pacific Ocean (as one of the Line Island), uninhabited since 1942, should be designated as a prospective site for a Space Elevator. Jarvis Island is about 41 kilometers south of the equator. Although not perfectly located for a heavenly funicular, Jarvis Island consists of only 65 hectares. It is a low, basin-shaped coral island with a maximum height above sea level of on seven meters—meaning that it could be badly eroded by a higher global sea level expected by AD 2050 to 2100. A seven kilometer-long seawall could fend off most of the direct wave action. Jarvis Island has a 323100 square kilometer Exclusive Economic Zone (EEZ) under the 1982 UN Organization Law of the Sea Treaty. The atoll has been a USA Possession since 13 May 1936, and it is now a part of the National Wildlife Refuge System (administered by the Department of the Interior’s US Fish and Wildlife Service). Jarvis Island’s present-day EEZ extends into the Northern Hemisphere. No major natural hazards are likely to affect the island. Hypersonic aerospace planes might land on Jarvis Island, something the pre-World War II “China Clippers” (M-130’s put together by the Glenn L. Martin Company) never did.286 Recently, environmental investigators have note that island trails caused by Nauru Island—far to the East of Jarvis Island—correlates with the differences between El Nino and La Nina climate regimes; in effect, they may have established a prediction system!287

David Noel’s maritime “lily-pads” to collect over-the-ocean rainfall should be fabricated of a gas permeable, non-opaque plastic membrane so as not to shade the Central Pacific Ocean’s topmost seawater layer. Indeed, the euphotic zone—the top 100 to 200 meters of the ocean surface—could be enlarged in volume by dangling fiber-optic cables below the floating Noelian membranes, which would convey natural sunlight (some of which might be focused on these “lily-pads” by Earth-orbiting sunlight reflector satellites) to deeper layers of the covered ocean. Noelian collectors could even become sea farms (mariculture enterprises) illuminated 24-hours-a-day. Ocean productivity would escalate enormously, in part because the volume of the world-ocean exceeds ten times the volume of land above sea level. In the ocean’s equatorial zone, seawater could be enriched by the periodic addition of processed urban sewage, towed to pad sites and other appropriate places in blimp-like floating dracones with minimal capacities of 250000 cubic meters (based on the dimensions: 350 meter length, 72 meter width and thickness of 14 meters). Dracone barges are flexible fabric tubes manufactured to carry petroleum, freshwater and other liquids less dense than the seawater in which they float. The density of seawater is 3% more than freshwater. At this time, they are chiefly used to supply freshwater to many Greek islands. A Noelian “lily-pad” industrial complex can be supplemented by floating Self-contained Oceanic Resource Bases (SORB) that were first detailed during 1970. SORBs absorb—actually, extract—energy from major ocean currents.288 SORBs can dangle fiber-optic cables that carry sunlight to the dark depths of the ocean, attracting fish and the prey they feed on.289

Evaporation from the ocean’s surface can be speeded by the application of effective technologies.

During 1972, the physicist Howard A. Wilcox addressed a conference, “The Ocean, Nuclear Energy and Man”, convened by the Marine Technology Society, founded in 1963 “to make real contributions in fostering progress in the marine sciences for the benefit of mankind”. Wilcox forecast dire results should Homo sapiens continue to burn exhumed fossil fuels at the same pace then prevalent. Wilcox spoke in a remarkably theatrical tone, threatening that by AD 2170 the activities of humans would be generating heat at a rate almost equal to 10% of the Sun’s input to the Earth’s atmosphere and that, by 2230, the ocean would be close to its boiling temperature (around 100°C). Nothing of this approximate magnitude has been prognosticated or alleged as an Earth-biosphere threat by the most radical Green advocates of extreme Global Warming—yet! Vapor, vapor, all is vapor (or gas)! Nearly 10% of the ocean has been absorbed deep into the Earth since our planet’s formation billions of years ago and, with the elapse of one billion years, the ocean will lose about 27% of its extant volume to further geological subduction. The ocean will disappear forever, converted to plasma, when the maturing Sun expands to its Red Giant Stage four or five billion years hence. Meanwhile, there is much man can do with the existing ocean! H.A. Wilcox’s Hot-House Earth (1975) offers scare Science. His book was counter-weighted in 1976 by Lowell Ponte’s The Cooling: Has the Next Ice Age Already Begun? Can We Survive It? Ponte postulated the end of the North as a geopolitical entity while Wilcox established a care for the over-populated South’s reduction in numbers not requiring either embryo abortion by overheated mothers or adult sexual abstinence!

The meteorologist who, during the 1930s, proposed the primary mechanism for precipitation’s formation in clouds, Tor Bergeron (1891-1977), also proposed—circa 1960—that industrialized humans should deliberately heat a certain ocean region in order to energize a regionalized hydrological cycle for “naturally” watering North Africa’s desert and savanna landscapes. Hubert Horace Lamb (1913-1997) incompletely described Bergeron’s 1960 macroproject to moisten the Sahel and Sahara, mentioning only that Bergeron wished to inject water vapor into air masses formed over the North and South Atlantic Ocean, which normally move inland over Africa and which increase normal rainfall, or break drought spells in that arid dem-continental region. Clouds are a non-polluting way to transport freshwater—in a manner of speaking, they are global Nature’s dracones—and cheaply too. Lamb concluded about Bergeron’s macro-engineering concept that it was sound and could “make a very significant contribution to food production.” Bergeron’s water vapor would be created at a region south of Ghana’s Three Points Cape, where zero latitude intersects zero longitude (at zero altitude) in the Gulf of Guinea. During 1965, Tor Bergeron had identified two energy sources to heat (or even boil) that ocean region’s surface seawater layer: (1) thermal energy released by “clean” nuclear or thermonuclear explosives or (2) thermal energy releases from floating fission or fusion nuclear reactors on or in the surface seawater layer. No discussion of the disposition of the boiled seafood likely to pop up was ever mentioned; cooked, or at least killed sea creatures (plant and animal) might be harvested as a rich fertilizer to be applied to nutrient-depleted soils farmed by North Africans! Today’s aquaculture experts might devise means to fence a region of artificially heated open ocean seawater with sonics and other high technologies. It is known that sea mammals are adversely affected by shipping noise so that sonic beam-forming devices will require expert adjustment to specific marine locales and specific marine creature sound tolerances.

Technology R&D will force changes upon the world’s noosystems. Noosystem traditions (cultural mind-sets) will alter with the passing of Historical Time during which technical progress takes place. The international importance of every noosystem will change as well. Our Earth-world is a macro-problem. Every nation should have an interest in organizing and funding an augmented Rodoman-ALPS, especially if it was built as a facility funded by a planet-wide geohazard abatement tax district. Such facility would provide a global state of consciousness and permanent visibility that assures the automatic functioning of all subscribing noosystems. Nicholas John Spykman (1893-1943) thought such purchase plans to be one of the “great variety of techniques designed to win friends and influence people.”

The first fairly complete global ethnographic atlas was compiled by AD 1826. Carl Stratz de Haag (1858-1924) suggested the possibility of Homo sapiens divided into a “Progressive” and a “Static” group. Humanity now knows the impossibility of existence of de Haag’s groupings. And, very probably by AD 2050, artificial life will have to be included in any future ethnographic atlas compiled to illustrate the distributions of intelligent persons! Harold Sprout (1901-1980) argued that population size will be the eventual determinant of geopolitical status on the grounds that technological skills are the primary requirement for economic and military strength and that the capacity to acquire those civilian and military skills is evenly distributed in the world’s population. The ecosystem-nation with the greatest population, it logically follows, will be the most influential. However, logic is not reality just at the map is not the world.

Saudi Arabia—the toponym conjures a vision of a desert landscape studded with oil derricks tended by a few people carried to their jobs and gambling pleasure palaces by Rolls Royce automobiles. Saudi Arabia is, in fact, under-populated for the infrastructure is must maintain; workers from other countries fill the employment gaps. Saudi Arabia’s government should consider the rapid development and deployment of self-replicating machines, which could be field-tested in that arid and sparsely employed territory. Such automatons could be seen (in geopolitical terms) as “force multipliers”. Visualize an extensive deployment of various size machines systematically rearranging the countryside’s materials by tenting Saudi Arabia’s huge Empty Quarter! The result of such effort would, most reasonably, be best protected by an augmented Rodoman-ALPS since the Wabar Meteorite site clearly shows the effect on the landscape of a powerful space debris impact. The first architectural “duty” of the tenting must be to suppress sand storms that obscure the vision of ship navigators plying the Strait of Hormuz. The Empty Quarter, know to the Saudis as the Rub’ al Khali, is situated strategically, lying between the Persian Gulf and the Red Sea. The narrow entrance-exits of the two gulfs can be dammed to produce hydroelectricity. From Primer For Those Who Would Govern (1987) by Hermann Oberth: “Even Saudi Arabia and Iran could be irrigated, if the Persian Gulf were sealed off at the Strait of Hormuz and the water of the Shatt el Arab used. Of course, sea water from the Persian Gulf would also have to be drawn out and desalted.” The nearby Arabian Sea’s biological productivity is increasing markedly as the landmass of Europe and Asia warms during the 21st Century. Macro-engineers working in Europe and the USA have designed a Hormuz Strait Dam and a Red Sea Dam. Myriad automated devices—devoid of Freud’s Id and Super-Ego—operating in the remote place may have the effect of profoundly altering the traditional Middle East’s arena of power struggles. Under USA law, a human is

295 N.J. Spykman, America’s Strategy in World Politics (1942), page 12.
a natural person, but a corporation licensed by statute is an artificial person. Perhaps the Rub’ al Khali installation comprised of robots a “satrap”, with the domain of their real-world operations to be known as a “satrapy”? Many of Earth’s largest economic units are corporations, not countries. The biggest corporations are high tech, multi-national, with access to (and development rights in) subsidiaries dealing with the newest forms of industrialization. Often, they are staffed with an inter-metropolitan elite, using networked computers and televised board and R&D meetings. Such groups may not have a strong allegiance to any single ecosystem-nation. A rather feasible tenting of the Sahara has already been outlined by macroengineers affiliated with the Candid Oancea Institute in Bucharest, Romania’s capital. It is not a stretch of the imagination to apprehend a Rub’ al Khali Tenting Macroproject as a spin-off from a 1960 Japan-originated school of architectural thought, Metabolism. Ideally, Japan’s Metabolists desired to plan and construct a city so flexible in its connections that its parts could grow, transform themselves and die while the whole continued to function (live). A large airy tent would never suffer the problems of sick human inherent with many modern buildings—that is, the “tight building” or “sick building syndrome”. Looking ahead to the 22nd Century might not Muslims from a tented Saudi Arabia enjoy living in a newly terraformed Mars or Venus, where naturally arid landscapes have been recently replaced by a more pleasant “Second Nature” instigated by Homo sapiens? Considering its huge oil and natural gas deposits, Saudi Arabia alone would be able to fund all molecular Nanotechnology R&D necessary to undertake such the Rub’ al Khali Macroproject. Our forecast: Saudi Arabians can look forward to urban sprawl.

“Geography” is one of the most ancient disciplines (if not the oldest) with continuity of name, its subjective content having changed during recorded human history. Twenty-first Century Geography can be seen existing as a unified, theoretical and predictive Science-Art, surpassing older organizations of the content. India and the USA’s geographers find their central intellectual macro-problem in options of where macroprojects should be properly located in Earth’s biosphere—called “Geopolitics”—and in other planets, which ought to termed “Geoscience”, until geographers arrive there in person and/or via mobile robots. Anthropogeomorphologists, specifically, are and must be lateral thinkers, dealing with long-term biosphere scenarios and must be concerned with the future of Earth’s human ecumene. An example of this solution-seeking endeavor is that urban planning work, Ecumenopolis: The Inevitable City of the Future by the late C.A. Doxiadis. Could his 1974 book be the first global vision to initiate large-scale global Nature planning for energy production and human settlement? Doxiadis’ vision can be compared with that of Herman Sorgel, a German architect, who loathed technical quick-fire deliver, but admired macro-projective thinking and building! During the first half of the 20th Century, he, along with some of the most famous architects of the 1920s and 1930s—persons such as Peter Behrens (1868-1940) and Erich Mendelsohn (1887-1953)—designed a reclamation macroproject called “Atlantropa”, which encompassed the Mediterranean Sea Basin and the Sahara!

Sorgel devised his macroproject during the late-1920s for climatic regime ameliorations over the Sahara and the Mediterranean Sea Basin. Since the years Sorgel published his macroproject plan for Atlantropa’s creation, amazing distortions of the anthropo-geomorphological concept have come into existence, with even famous scientists having subsequently made some rather stupid mistakes with reference to Atlantropa. For example, in 1971, Glenn Theodore Seaborg (1912-1999), recipient of one-half of the Nobel Prize for Chemistry in 1951, and his co-author William R. Corliss, wrote perhaps the

302 Michelle Murphy, Sick Building Syndrome and the Problem of Uncertainty (2006).
last full-length USA book on the now defunct “Plowshare Program” (1958-1975)—the civilian use of
plutonium-based nuclear explosives for peacetime landscape and seascape transformations. Seaborg
and Corliss’ book, *Man and Atom*, an otherwise fine exposition, contains a fundamental oceanographic
error when describing Sorgel’s Atlantropa plan: “nuclear blasts could help fill in the Strait of Gibraltar,
a feat which, according to its proponents, would cause the Mediterranean Sea to rise a bit and freshen
to the point where the Sahara could be irrigated. Of course, the advantages of a verdant Sahara would
have to be weighed against the loss of Venice and other sea-level cities. We repeat these proposals
primarily to stimulate thinking about the pros and cons of planetary engineering.” They must have
meant “thinking” stimulated by reverse psychology! Finding accurate geo-historical data is difficult
enough without having still more confusion generated by paradoxical psychology. The Seaborg-
Corliss mistake was repeated when David D. Caron began his article in a professional ecology journal
with a reprise of it, citing R. Sylves’ *The Nuclear Oracles* (1987, page 193). Nevertheless, their point
that it was technically possible to replace macro-geomorphic event-processes with macroprojects such
as Sorgel’s mapped nucleus for “World Peace” we find exciting.

---

Chapter 7

21st Century ATLANTROPA

Fortunately, the USA-manufactured thermonuclear weapons lost from 17 January until 7 April 1966, in the Mediterranean Sea near Palomares, Spain, were failsafe gravity bombs. Only one of the bombs remained for long in the seawater, about 15 kilometers east of the Palomares Fault. In 1972, Arthur R. Miller, Co-chairman of the USA’s Delegation to the International Commission for Scientific Exploration of the Mediterranean Sea, exaggeratedly suggested: “If the sill at Gibraltar were removed, the heat budget of the Mediterranean Sea could be changed, tidal fluctuations might inundate coastal towns, and coasts would be eroded or shifted. The ecology of the water itself would be different and the balance of rainfall and river flow would be affected. One might even speculate that had the nuclear bomb lost off Palomares exploded and opened the sill of Gibraltar, the ecology of the entire Mediterranean area including the Black Sea would have been affected by a changed regime.”

Miller’s suggestion is unadulterated radical Green rubbish! About 400 kilometers separated the less than ten megatonne explosive yield bomb’s temporary seafloor resting place in the Alboran Sea from the crustal saddle, which is located at a depth of 320 meters, forming the boundary between the Mediterranean Sea and the North Atlantic Ocean’s Gulf of Cadiz, which is situated west of the Rock of Gibraltar. However, most of Miller’s absurd suggestion could take place, to some degree or other, when global sea level rises by about one-meter during the 21st Century.

Immediate fixation of macroengineers on the Strait of Gibraltar is centered on proposals to span it with a bridge or a bored tunnel. Completed hydroelectric dam macroproject proposals focused on the Persian Gulf at the Strait of Hormuz and on the Red Sea at Bab-el-Mandeb, raises the chances—but only very slightly—that a Depression era macroproject could promote a 21st Century emplacement of a hydraulic barrier throttling all seawater flow in the Strait of Gibraltar. By the turn of the century, AD 2001, the public’s interest in the pre-World War II scope of Macro-engineering as directly related to the Mediterranean Sea Basin as a developable unitary region was renewed. An expected future rise in global sea level, which will inevitably influence the Mediterranean Sea Basin’s natural 13000 kilometer-long shoreline, has instilled reasonable trepidation in Italy’s public that is evidenced by the public debate since May 2004 about the macro-engineering appropriateness or inappropriateness of shielding Venice against seasonal high-tide and storm surge flooding with an expensive lift-gated permanent dam, fully described in Flooding and Environmental Challenges for Venice and its Lagoon (2004) by C.A. Fletch and T. Spencer (Eds.). Worldwide, approximately ten million persons live below present-day sea level, and as global sea level rises, more may be fated to do so also as, for example, in the Mediterranean Sea Basin.

Technology historians recently reviewed the old macroproject proposal known finally as the “Atlantropa Project”, but with no goal to revive it, merely to note its proper place in the century-long

unfulfilled experience of Europe’s economic and social integration. These historians had available two superb late-20th Century histories of the “Atlantropa Project”: (1) A. Gall’s *Das Atlantropa-Projekt* (1998) and W. Voigt’s *Atlantropa* (1998). The ongoing shift in the Mediterranean Sea Basin’s human population demography may foster a new, favoring regional public attitude on the increasing practicality and imperative necessity of a revamped “Atlantropa Project”. During April-September 2003, the Deutsches Museum in Munich, Germany, exhibited “Klima: das Experiment mit dem Planeten Erde”. An hour-long television documentary, laden with colorful three-dimensional special effects “recreations” of Atlantropa appeared in Germany during November 2005. By displaying the inspiring architectural drawings of the envisioned facilities planned for the Gibraltar Strait Dam and the empoldered Mediterranean Sea Basin’s new harbors, the world-public was informed of a possibility of Macro-engineering. Macroengineers are fearless synthesizers with a strong distaste for the piecemeal approach to geophysical and social reality.

During 1929, in Berlin, the World Power Conference promoted the founding of the International Commission on Large Dams to foster progress in the design and operation of big dams. The German dirigible “Graf Zeppelin” (LZ-127) completed a circumnavigation of the world in August 1929 causing public excitement just like Space Shuttle flights sixty years later. It was an achievement of great consequence because it solidified some European’s physical connections with overseas colonies. Herman Sorgel (1885-1952), in 1929, first detailed a concrete arched-in-plan gravity dam to adjustably control all seawater entering the Mediterranean Sea from the North Atlantic Ocean. With powerhouses generating 50000 megawatt, the Strait of Gibraltar Dam was the main infrastructure facility intended to unleash chiefly European farm and city construction during the reclamation of the exposed continental shelf that would soon appear because a closure of the Mediterranean Sea Basin can cause a natural evaporative reduction of the sea. Sorgel’s plan required a dam to separate the Mediterranean Sea from the Black Sea and sea-locks at the Suez Canal to separate the Mediterranean Sea from the Red Sea. The impresario Herman Sorgel imagined and proselytized for the rapid creation of additional European colonies in Africa; Greater Europe was to extend from the North Pole to southern Africa, fronting on the Indian Ocean. Others later announced similar techno-visions. For example, Henry John Leir (1900-1998), in his *La Grande Compagnie de Colonisation: Documents of a New Plan* (1937) presented a fictional macroproject plan for a culturally united Europe geographically astride a reduce Mediterranean Sea and situated in a world wherein enlightened industrialist consistently help humanity achieve lasting world peace. Until the late 1950s, Europeans continually pursued a geopolitical and geo-economic union with northern Africa.

In 1950, the population of the Mediterranean Sea Basin was 170 million Europeans (73%) and 63 million North Africans (27%); by AD 2025, there could be 305 million Europeans (44%) and 381 million North Africans (56%). Especially during the period 1964-1973, in a time of acute labor shortage, Europe became a region of legal immigration. World War II casualties in Europe, Muslim immigrants to France from Algeria and Germany’s 1950s guest worker program, together with high birthrates amongst European Muslims and low birthrate amongst traditional Europeans are the chief causes of the remarkable demographic shift. According to the *European Demographic Data Sheet 2006*, by Wolfgang Lutz, nearly 25% of the people in the European Union in AD 2030 will be older

---

than 65 years of age. The African Union was proclaimed on 1 March 2001 and on 29 October 2004 Europe’s leaders signed a European Union Constitution. A demographic shift in Europe seems to presage an epoch—occurring, perhaps, sometime circa 2010-2050—that will alter Europe’s still distinctive culture: post-World War II Europe has been colonized by Muslims mostly from North Africa. By 2010-2050, Muslims in southern Europe (Spain, France, Italy) may form 25% of the population and working Muslim adults may comprise 40% of the available labor force. This means that an almost forgotten macroproject such as the Gibraltar Strait Dam and its associated Basin infrastructure may find future acceptance with voting citizens of southern Europe and northern Africa. Forecast future climate regimes in the Mediterranean Sea Basin are likely to be the initial stimulation for a re-thinking of the old macroproject proposal. After AD 2050, North Africa’s population may exceed southern Europe’s by nearly one hundred million persons!

The Netherlands owns infrastructure valued at approximately 2006USA$2.5 trillion—equivalent to the annual USA-European Union commercial relationship—that has been set into place to protect the people of that ecosystem-nation from unwanted seawater incursion. There appears to be a 1% chance that a one-meter rise of global sea level will come to pass during the 21st Century. (A 2-meter rise is the threshold defining “dangerous anthropogenic” alteration of the ocean’s level.) Assuming a cost of 2006USA$1 million per linear kilometer, a total seawall protection for the Mediterranean Sea Basin’s shore from an incursive future permanent inundation might cost almost 2006USA$13 trillion.

Kenneth Jingham Hsu’s *The Mediterranean Was A Desert* (1983) popularized the 1972 geological theory that the desiccation of a closed off Mediterranean Sea—during the Messinian when the Strait of Gibraltar did not exist—may have occurred for a period of several hundred thousand years more than 5.3 million years ago when virtually all seawater evaporated to form an arid saltpan several kilometers deep. The validity of Hsu’s concept remains in question. Eventually, the Mediterranean Basin was refilled with seawater mostly flowing in from the North Atlantic Ocean.

Today’s Strait of Gibraltar is a shallow (320 meter deep) and narrow channel (13 kilometer wide) and it is the Mediterranean Sea’s only natural connection with the North Atlantic Ocean. The Mediterranean Sea’s area (about 2.5 x 10^12 square meters) amounts to less than 0.7% of the surface of the Earth’s ocean surface and less than 0.3% of its volume. A region ranging from zero elevation to 200 meters below sea level—the continental shelf—accounts of 30% of the seafloor area. Supposing the Strait of Gibraltar to be closed, the present-day rate of sea level reduction due to natural evaporation could be about 0.5 meter annually. Uncovering the continental shelf of the Basin would take about four centuries. A one-meter rise of sea level within the Basin, however, will directly affect all container transshipment gateway seaports—commercial shipping harbors with supporting hinterlands that are rich in industrial and agricultural production and consumption—such as Port Said, Damietta, Marsaxlokk, Gioia Tauro and Algeciras. A sea level rise will deepen all harbors but damage existing harbor infrastructure. Trade within the Mediterranean Sea Basin, served by more than 305 seaports including Barcelona, Marseilles, Genoa, Piraeus and Izmir will also be greatly affected by future changes of harbor navigation depths.

---

First advanced as a macroproject plan to control the flow of the North Atlantic’s surface layer into the Mediterranean Sea for the purpose of hydroelectric generation and grand-scale continental shelf reclamation for human settlement, after World War II the Atlantropa Project was publicly touted by two technology historians, separated by a demographic generation, as a “macroproject of the future”. Walter H.G. Armytage, in 1961, and Ervan Garrison, in 1991, voiced their professional convictions in popular books that a Strait of Gibraltar Dam generating electricity was a desirable, potentially a key piece of world civilization’s sustaining infrastructure. Without endorsement, Henry Petroski recounted Atlantropa’s intellectual history and its obvious geographical impacts in *Pushing the Limits: New Adventures in Engineering* (2004). 

“The Convention for the Protection of the Mediterranean Sea Against Pollution”—commonly referred to as the “Barcelona Convention”—was adopted on 16 February 1976. It is interesting to realize that international marine shipping steel containers lost overboard from ships traversing the Mediterranean Sea are equivalent to the clay amphorae of Greek and Roman times. Some of our ancestors were just as polluting of the environment as some of our peoples are today.

In marked contrast to Armytage and Garrison, Stephen Henry Schneider has condemned Herman Sorgel’s Mediterranean Sea Basin reclamation macroproject. Schneider misunderstood and inaccurately described the Atlantropa Project—he badly jumbled all the germane geographical facts. A Herman Sorgel planned Gibraltar Strait Dam would never cause the Mediterranean Sea’s level to rise, raising the ridiculous possibility of enlarging northern Africa’s Lake Chad via a “Second Nile River” dug to carry salt water overflow away from the Mediterranean Sea! Schneider also claimed that Sorgel’s dam could degrade northern Europe’s climate because of the stoppage of the high-salinity seawater outflow into the North Atlantic Ocean.

Herman Sorgel’s 1930s economic Depression era plan for the actual physical depression of the Mediterranean Sea’s level encompassed the creation of the world’s largest man-made freshwater lake in the Sahara. If the Congo River, which carries 1320 to 1775 cubic kilometers yearly, were dammed at Stanley Canyon, it would impound a very large lake that Sorgel dubbed the “Congo Sea”. A tributary of the Congo River, the Ubangi River, could then flow northwest, joining the Chari River. The diverted freshwater would then finally be deposited in Lake Chad by the Chari River. Lake Chad could be enlarged, forming the “Chad Sea”. Sorgel’s Congo Sea and the Chad Sea might cover as much as 10% of Africa. A “Second Nile River” freshwater artery, Herman Sorgel asserted, could be induced to flow north, across the uninhabited central Sahara, creating an irrigated region resembling the human-occupied narrow Nile River Valley in Egypt. Very likely the Second Nile River would become a Mediterranean Sea nutrient enrichment source, just like the first Nile River, especially after vast adjacent swaths are systematically permanently settled. Without creating Sorgel’s Congo Sea, a run-of-river dam costing 2006US$50 billion on the Congo River at the Inga Rapids could generate 40000 megawatt; that power could industrialize Central and southern Africa.

Late in the 20th Century, Robert Glenn Johnson, suspecting that the increasing salinity of the seawater exiting the Mediterranean Sea at the Strait of Gibraltar might be the future cause of a new Earth Ice Age commencing in the early 21st Century, proffered a controversial proposal to study the Macro-engineering concept of a porous barrier, a permeable rubble-mound dam, emplaced in the fluid

---

connection between the North Atlantic Ocean and the Mediterranean Sea.\textsuperscript{324} Johnson’s artificial reef-like rubble pile would throttle the seawater flow, but it was intended to slow only the outflow of high-salinity seawater from the Mediterranean Sea, in order to prevent ice-sheet formation in northeastern Canada. His anti-Ice Age macroproject rests entirely on the proposition that Egypt’s Aswan High Dam (closed 1965) has caused the measured increased salinification of seawater leaving the Mediterranean Sea\textsuperscript{325}; Johnson’s anthropogenic submarine ridge becomes an expensive and worthless techno-fix if the Aswan High Dam were breached! If the dam were suddenly broken, as in Michael Heim’s terrifying 1972 novel \textit{Aswan!}, the release of the reservoir’s entire contents would elevate temporarily the Mediterranean Sea’s level by about 6.6 centimeters. Johnson’s theory of the Neo-Ice Age is carefully sketched in \textit{Secrets of the Ice Ages: The Role of the Mediterranean Sea in Climate Change} (2002). The public controversy initiated by Robert G. Johnson remains, as of 2006, scientifically unresolved\textsuperscript{326}. Both Johnson’s and Sorgel’s barriers would alter (de-tune) the Mediterranean Sea’s tides, in some instances (such as the Aegean Sea) possibly doubling the amplitudes of its semidiurnal tides. Furthermore, changes of the Mediterranean Sea’s wave climate will also occur, forcing prudent revision of existing ship weather-routing procedures.\textsuperscript{327} In addition, both barriers would probably terminate the anthropogenic atmosphere carbon dioxide gas drawdown currently performed the Mediterranean Sea.\textsuperscript{328} It is doubtful that the Gibraltar Strait Dam, planted in the ocean, could imitate China’s Great Wall on land as a notable impediment to gene flow.\textsuperscript{329} 

Commercial hydroelectric dams first began operating in the UK and the USA from 1880-1882. Germany became an early leader in the construction of big dams and reclamation of vast tracts of wasteland, according to David Blackbourn’s masterful encyclopedic history, \textit{The Conquest of Nature: Water, Landscape, and the Making of Modern Germany} (2006). Commencing circa 1929, and ceasing by circa 1952, the German architect Herman Sorgel proposed construction of the world’s most powerful hydroelectric dam, which he estimated capable of generating 50000 megawatt at the Strait of Gibraltar, when the Mediterranean Sea had been reduced by 200 meters. His 45 kilometer-long concrete gravity dam would weigh almost 104 billion tonnes, or about equal to 19000 Great Pyramids of Cheops. (That weight is approximately five times humankind’s annual global redistribution of Earth materials—meaning, if all materials worked yearly were directed to accumulated in the Strait of Gibraltar, then it would take a little more than five years of effort to emplace Sorgel’s edifice!) Nowadays, perhaps, the widespread use of robots would reduce the need for recruitment of trained and acclimatized human labor. In terms of material volume, Sorgel’s edifice would equal the emplaced bulk of 960 Dutch Afsluitdijks or 450 Three Gorges Dams or equal the volume of materials removed to create either 600 Suez Canals or 120 Panama Canals! Members of the Candida Oancea Institute in Bucharest, Romania, estimate the cost of building Sorgel’s monumental installation would be approximately an investment of 2006USA$100 billion, about the early 21st Century property tax valuation of New York City’s Manhattan Borough. Offsetting this cost is the average annual avoided oil equivalent saving that will amount, annualized, to tens of billions of USA dollars.

\textsuperscript{324} R.G. Johnson, “Climate Control Requires a Dam at the Strait of Gibraltar”, \textit{EOS: Transactions of the American Geophysical Union}, \textbf{78}, 277-281 (1997).


“Atlantropa” means a macroproject that suggests a “turning towards the North Atlantic Ocean” for hydroelectricity. Nowadays, all electricity manufactured at Sorgel’s enormous Gibraltar Strait Dam could be efficiently transmitted to consumers within the Mediterranean Transmission Super Grid by super-conducting cables. A new transmission technology, the one-meter diameter SuperCable, can simultaneously transmit 5000 megawatt of DC electricity and 10000 megawatt of thermal energy in the form of hydrogen, making it possible to have a continent-serving facility. The peak electricity load of the current Mediterranean Power Pool is expected to be 278 Gigawatts by AD 2010. Power can be transferred over a region consisting of three time zones.

Last century, Cathcart opted for an adapted Sorgel-like Gibraltar Strait Dam, constructed with a very strong shear key, that might operate successfully—in an economic sense—with only a 50 meter reduction of the Mediterranean Sea’s level, uncovering a new area of land amounting to about 8% of the Mediterranean Sea’s present-day surface. However, neither Cathcart, nor Sorgel evidently, thought or made the useful effort to derive a calculated optimal efficiency sea level. Unlike dams blocking river valleys, Sorgel’s dam would never suffer sapped hydroelectric power production caused by drought since the dam’s head-pool is the Earth-ocean!

About 10000 years ago, the Mediterranean Sea was 50 meters lower than today, without 125 x 10^6 cubic kilometers of seawater that is present now; only 0.0168% (21 x 10^3 cubic kilometers) might be offset by deliberate channeling of seawater from the Earth-ocean to below-sea level regions on land such as the Dead Sea, Lake Assal, Lake Eyre, Caspian Sea Basin, Salton Sea. All other factors remaining the same, if the seawater surface was under a Mediterranean Sea air column that was 50 meters thicker by AD 2050 than it is today, then it is probable that the air’s temperature at the air-sea boundary would be about 0.3° C warmer. Adding the likely temperature increase due to predicted global warming—ranging from, say, 2.1 to 4.4° C—by AD 2080 plus the “atmosphere thickening factor” of 0.3° C means that seawater evaporation may be significantly enhanced. In other words, a 50-meter reduction might be accomplished in less than a century. To put that estimate into proper perspective, Earth’s Polar Zones are approximately 0.5° C warmer during a full Moon than during a new Moon because the tidal pull alters wind flows sufficiently to transfer heat to the Polar Zones and to measurably affect average temperatures in those frigid regions. There might be, incidentally, an increase in the number and severity of Mediterranean Sea Basin hurricanes resulting from seawater warming. The 6.3 kilometer-long Corinth Canal, completed in 1893, and only 8 meter deep, will in about sixteen years fall dry, becoming like the “Diolkos” ship slipway of 700 BC! Century commercial RO/RO shippers might prefer to use it as a 21 meter-wide portage ship railway or hovercraft guideway. The UK inventor Christopher Cockerell (1911-1999) tested the first practical hovercraft in 1959.

---

Many physical and biological changes would occur upon completion of a Sorgelian Gibraltar Strait Dam. For example, freshwater artesian springs that are undersea springs nowadays may become valuable in the future as sources of freshwater for new coastal settlements and farmland. Fernando Gomez has examined some of the seawater chemistry consequences of a closure.\textsuperscript{338} The Mediterranean Sea will warm and become saltier, causing many extant species of its rather sparse life component to decline in mass or become extinct. In brief, Atlantropa’s builders will cause an anthropogenic marine salinization. Any future climate changes will affect the storm tracks and storm characteristics that govern the hydrological cycle in the Basin\textsuperscript{339} and that event-process may affect the North Atlantic Ocean’s thermohaline circulation were either R.G. Johnson’s underwater ridge made of pile rubble or Herman Sorgel’s concrete dam built.

Once the Gibraltar Strait Dam is emplaced, the Mediterranean Sea will then have the character of an “aquarium”. Aquatic biological invasion of the Mediterranean Sea is a fact of life and preliminary open-ocean fertilization experiments have been done to stimulate a part of the surface seawater layer.\textsuperscript{340} To remedy local pollution problems, some new species of seaweed may be introduced.\textsuperscript{341} Isostatic rebound-related earthquake activity and reduced hydrostatic pressure caused by regional isostatic rebound of the Earth’s crust might destabilize gas hydrates present in the seabed. Some extant coastal infrastructures will, undoubtedly, benefit greatly from a 50-meter reduction of the Mediterranean Sea. For future Atlantropans, not only will Macro-engineering be experimental—colossal barrier building, harbor and city construction—but the macro-management of the various Basin-wide megaprojects will also be profoundly experimental! Atlantropa embodies an idea of a combination of a civilian and military geopolitical “regime”. Regimes are most wanted and/or needed in geopolitical situations where great interdependence prevails or will prevail.\textsuperscript{342} An operating Mediterranean Sea Basin Authority should seek to use the Sea as a source of international revenue, and such monies should be expended to ameliorate any hardship environments imposed by harsh climatic changes on Atlantropa’s politically demarcated ecosystems. Linked concepts provide a neutral basis for international monetary transfers, and geophysical justification for special developmental work by macroengineers attending projects in those least-developed nation-ecosystems sharing the Mediterranean Sea’s newest shoreline.

Collapse of the Sorgelian Gibraltar Strait Dam, from any cause, would foster catastrophic dam-break wave propagation with tsunami-like characteristics\textsuperscript{343} and terribly deleterious effects upon the new and old shorelines. A dam-break disaster of such imagined magnitude has never before been physically or computationally modeled, but a start has been made in another oceanographic investigation context.\textsuperscript{344} The leading wave might reach a velocity of 150 kilometers per hour. Sensitive DamFlow computer modeling applied to the particular macro-problem at the Strait of Gibraltar ought to be helpful simulations for persons trying to assess the nature and totality of the hydraulic situation.\textsuperscript{345} (Operating since April 2005, Europe’s fastest computer, 42 teraflops, “MareNostrum” at the Barcelona


Supercomputing Center (GOTO: www.BSC.es) in Spain—awaits funded programming aimed at complete solutions of Mediterranean Sea Basin air/seawater circulations! Such an infrastructure fracture would be a gigantic emergency and restoration macro-management headache; in terms of public relations, it could be a long-term Earth System Science and Macro-engineering setback! Since the induced reduction of the Mediterranean Sea will raise the ocean’s level by around 33 centimeters, the quick return of a long-time aerial water vapor export as a single inrushing flow would adversely affect the navigational level of all world seaports!

The world’s ocean is the surface temperature boundary for the Earth-atmosphere over 71% of the planet’s surface; a segment of the ocean, the Mediterranean Sea, is considered the “Mare Nostrum” of Earth System Science during the Anthropocene. A modern historiographer, Allan Megill, instructs the answer historians seek to the question of “what was actually the case?” in the recorded past is “recounting”. Historical explanation, he wisely opined, is dependent on a professional “recounting”, which he likened to an event-process “like the winning of [2300 square kilometers of] land from…[The Netherlands’] Zuider Zee.” A reduced Mediterranean Sea would be a maritime archaeological treasury. An in-depth recounting of the Atlantropa Project, promoted from 1929 until 1952 in Germany by Herman Sorgel, deserves a thorough reassessment in the event that impending global change challenges Space Age humans everywhere—including even those possibly visiting and/or contemplating Mars’ future terraformation—to macroengineer our Earth.

“Technology” is employed loosely to denote the development and use of tools in human pursuits, yet we are more than mindful that any definition is problematic because the word’s meaning changes at a rate as rapid as that at which what it signifies alters our noosphere, commerce, weltanschauung, ecosystem-states and Solar System planets and moons. In humans, technology creates a sense of wonder, helping to solve the problem of boredom, absence of meaning, and loss of motivation. It can serve as a casting formwork for future actions. Likewise, rigorous definition of technological “expertise” is also elusive, but we herein employ the term to denote the idea of specialized knowledge with a capacity to influence noosystems decision-making and, thereby, to alter humanity’s present-day world and, eventually, other visited planets—in this Solar System, at least. Our present-day knowledge of Science, Art and progressing technology points to an unbounded period of human development at least in the Earth-biosphere; the real danger to humans is man himself. Homo sapiens’ civilization cannot macro-engineer Earth without “designing” humanity. “Technical Fix”—really, “Techno-Art”—is the full story of all extinct and extant human societies! Planetary stylization rather resembles what painters do to a blank canvas: elite techno-artists apply a crust of technology (instead of paint) to a possibly currently unused surface.

It seems obvious to all concerned with the urgent macro-problem of humanity’s long-term survival and prosperity that Macro-engineering’s elite must properly maintain the Earth-biosphere, or any applied Terraforming elsewhere in our Solar System will lack its planet-stylization model. Informed geoscientists know Homo sapiens is the only species that is equipped with large-scale Earth feature changing Techno-Art, which is certainly selectively pressuring all other living, biosphere-confined organisms. Vegetation and animal life on the land and even the creatures living in the deepest places of

the ocean—especially after 23 January 1960 when the bathyscaphe “Trieste” descended one of the deepest places of the Pacific Ocean—are subject to our discretion. All life—even that within our guts and bloodstreamsis potential artifact. Because of the Space Shuttle and the International Space Station humans are adapting, via gravitational physiology, to variances of gravity during short aerospace plane flight, extended journeys in outer space, and the gravitational field of the Moon. As the technically progressing pilots of Fuller’s “Spaceship Earth”, increasingly capable of voluntarily exiting the presumed vehicle via smaller aero- and space craft, Homo sapiens must teach itself and its future teammates, mindkind (Machina sapiens?), to properly operate this Space Age planet before people can ever hope to successfully occupy and operate for an extended period of Historical Time a “Spaceship Mars” or “Spaceship Venus” residence-factory.

There is a chance—approximately 1%–that Earth’s ocean will increase in volume, becoming higher by about one meter circa AD 2100. Many of our world’s coastal metropolises will be affected adversely. For example, a one-meter rise would flood most of New York City, including the subways and its three major airports. The Netherlands’ population would likely see Schiphol Airport near Amsterdam submerged. Imagine the changes wrought on the global air transportation network—all those straight lines on maps of air routes—when major ports of entry and departure are closed down permanently! Sea level might rise even further if unbridled injections of carbon dioxide gas results in a doubling of the Earth-atmosphere’s carbon dioxide gas content. The Mediterranean Sea Basin-Black Sea Basin is the region where much can be done since it is adjacent to First World states and the common availability of high-technology R&D. “More importantly” and “most importantly”—these adverbs of degree cannot be made to fall trippingly from the English-speaker’s tongue and they smack of unseemly conceit. If degrees of importance must be compared an answer lies in “of greater importance” or “of paramount importance”. In a regime of choice, where unfettered use or use with some permanent physical limitations of the high-seas in the Mediterranean Sea Basin-Black Sea Basin is weighed, we think it of paramount importance that the second option be adopted in order to abruptly counteract a doubling of the air’s carbon dioxide gas content. How might it be possible, using Macro-engineering techniques, to cool the planet’s air economically and quickly?

A “checker-board” Mediterranean Sea and Black Sea surface would tend to promote convection if the albedo of that fluid surface was diminished in some sub-regions (so that less solar energy were reflected back to the sky above), then the conversion of the energy at the surface would raise the temperature at its surface (and, thus, increase the radiation and evaporation) from the darkened regions, as well as heating the adjacent air by conduction and convection. By changing the thermal conductivity or heat capacity of the topmost seawater layer of the Mediterranean Sea and Black Sea, or both, or its seawater content available for evaporation, the surface layer would be affected, and thus, the outgoing radiation. A self-replicating plate-like robot mono-layered Mediterranean Sea-Black Sea—approximately 0.008% of the Earth’s ocean—could be harnessed to roughly “fine tune” that closed-off segment’s sea level and its internal oceanic hydro-climates while functioning as a blanked beneath a modified Mediterranean Climate type! To offset global warming stimulated by a doubling of the carbon dioxide in the air, about 10% of the world’s ocean, primarily in the Tropic Zone and Temperate Zones, must be colored white. The strategic importance of the Mediterranean Sea-Black Sea is that the region is an enclosed body of seawater close to large human population centers of Europe and the traditional Middle East where air-cooling could be most needed quickly. Obviously,

---

this makes any reduction of the Mediterranean Sea via Herman Sorgel’s method very, very counterproductive if the climate geoengineering scheme outlined next were needed in a hurry!

A large patch of solar-powered white-colored bobbing dumb robots having an anti-beaching capability will be effect for the job required. Just like Heinrich Hemmer’s South American-North Africa submarine freshwater pipeline in the ocean, each operating pollution-free machine must be coated to prevent corrosion and to prevent reflectivity-degrading organisms preferentially attaching themselves to the robot’s hull. 353 (Teflon has been marketed only since 1960) J.B.S. Haldane (1892-1964), in Daedalus, or Science and the Future (1923), foresaw Earth’s ocean turned the color purple after a cultivated alga fertilized by artificial substances was introduced to increase Homo sapiens-harvested fish stocks! (Was Joseph Ward Moore, 1903-1978, impressed enough by Haldane’s remark to stimulate Moore to publish his science fiction novel Greener Than You Think in 1947?) Floating artificial plants, as proposed by Edward Forrest Moore (1935-????), could detoxify polluted seawater in harbors. Only 3% of the sunlight striking a green plant is actually stored as chemical fuel within the organism; by contrast, some minuscule non-living devices that convert sunlight into usable energy have theoretical maximum efficiencies greater than 30%. Maintenance workers—Homo sapiens (mankind) and/or Machina sapiens (mindkind) can be housed and headquartered safely on floating bases. 354

Actually, the reflective multi-robot sea covering mimic’s the effect of the Sahara Tent Greenbelt, but in a smaller geographical context. Qualitatively, examining images of the Earth’s surface made from orbiting or fly-by spacecraft, anthropic activities are turning the planet into a more absorptive macro-object and, as a direct result, darker in the infrared and brighter in the visible wavelengths. At the same time, the greatest and largest source on land of Global Dimming dust, the Sahara in North Africa, remains virtually unaltered by humankind. 355 About 50% of the Earth-atmosphere’s dust content emanates from northern Africa, especially the all but lifeless hot landscape of the Chad’s Bodele Depression in the Sahara. 356 These long-standing geographical facts can be altered radically, according to calculations done at the Candida Oancea Institute, principally by Viorel Badescu, during 2003-2004. 357 Badescu and Cathcart proposed a geographically gigantic encrustation macroproject, the pneumatic tenting of 3.5 million square kilometers of desert—about 50% of the Sahara! That may seem wildly optimistic, yet a plan was offered in the early 20th Century to construct a series of cloth reflectors at least 5200 square kilometers in area to signal Martians of our presence on Earth! 358 Their report carefully and fully outlines the possible climate regime-altering capabilities of their proposed Sahara Tent Greenbelt, which they anticipate will be an aggregation of 700000 almost-identical big white-colored inflated buildings. (Note: mankind’s first potentially inflatable home in outer space, the Genesis I satellite tested from July 2006 by Bigelow Aerospace, is made of Kevlar, a fabric which has physical properties quite different from the rigid standard aluminium paneling of the International Space Station.) Their desire is to quickly change the Sahara’s albedo and to afford agriculturalists, even some nomads, with potential greenhouses made to grow crops by harnessing freshwater pumped from known underlying freshwater aquifers. It is foreseen that the entire facility will be managed via the Internet and all ecosystem-nations will maintain their current territories. Electrical power, in

addition to solar power naturally, can be furnished to residents of the Sahara Tent Greenbelt by utilizing a unique hydrologic opportunity afforded by the Qattara Depression, where seawater from the Mediterranean Sea may be directed to pass through turbines before evaporating in the Qattara Depression. According to calculations, only about 20% of the hydroelectricity to be generated by Qattara Depression powerhouses will be needed to power the whole installation. One of their most interesting findings is that dust blown from the Sahara will cease to adversely impact the flora, fauna and human health in the Caribbean Sea. Shortly after completion of the Sahara Tent Greenbelt, the Earth-atmosphere will become 50% cleaner so that regions surrounding North Africa will benefit from the macroproject! Computer simulation of the effect of the desert’s subsequent albedo that is unequivocally attributable to the Sahara Tent Greenbelt will be effective in countering Global Warming’s regional effects by lowering local temperatures. The compartmentalized building constructed, in part, of fireproof fabric and air ought to be conceived as an enclosed botanical and eco-industrial park. Someday, perhaps, the poisoned ground instigated by France’s 17 nuclear weapon tests—four were atmospheric and 13 were triggered in specially mined tunnels—near Reggan, Algeria, and in the southern Sahara from 13 February 1960 can become museums? The Sahara’s present-day arid condition began about 4000 BC; it is now possible to reverse this condition technologically.

There is a safer and significantly less costly means for a truly 21st Century Atlantropa to come into concrete reality: terracing the Mediterranean Sea-Black Sea Region with a one or two-meter tall Gibraltar Strait Dam fabricated with inexpensive textiles that excludes the effect of a global one-meter sea level rise!

Space Techno-Art’s proponents favor the construction of various symbolic artifacts in Low and High Earth Orbit space. With plastic sheeting and textile envelopes, Air Techno-Art’s advocates opt to exploit all the potentialities of compressed air or naturally generated wind. Land Techno-Art’s fans reshape the Earth’s rocks and soils into unique sub-aerial landscapes of some artistic merit appreciated by its aficionados. Christo installed eleven Flamingo-pink floating plastic mats covering approximately 600000 square meters of a coastal lagoon in Biscayne Bay near Miami, Florida, for his temporary “Surrounded Islands Project” work of art during 1983. During 1969, Peter Hutchinson and Dennis Oppenheim installed artworks beneath the ocean’s surface off Tobago, West Indies. Their installation is misidentified as “Oceanographic Art” since it is essentially decorative. However, Ocean Techno-Art is a form of seawater sculpting by aquatic terracing focused on the 71% of Earth’s surface that is ocean; the modern-day originator of spatially large-scale intentional Ocean Techno-Art is the German architect Frei Otto, who first contemplated the concept in 1953. Ocean Techno-Art has a commercially viable aspect to it that Oceanographic Art lacks and must, as a macroproject technology application, be of great interest to 21st Century macroengineers.

About 3000 BC, the Earth’s atmosphere’s methane gas content began to increase. Methane’s generation source was human cultivation of rice in flatland fields. About 2000 years ago, humans had begun to grow rice in watery paddies carved from hillsides, like picturesque those stair-like terraces to be found today in central Bali, Indonesia and at Ifugao in the Philippines. (Sadly, 21st Century technology and neglect brought about by social change has made such spectacular terraces uneconomic to maintain except as native cultural museum exhibits.) Methane is a greenhouse gas and the

---

361 Lynne Cooke et al. (Eds.), Robert Smithson Spiral Jetty: True Fictions, False Realities (2005).
anthropogenic contribution to the air causes some global warming, possibly also influencing the Earth’s global sea level rise.\textsuperscript{363}

Perhaps one-half of all humans alive today eat rice as a main staple. Microorganisms living in anoxic rice field soils contribute between 10 and 25\% of the yearly global methane emissions; by AD 2030, there may be five billion consumers of rice. Artificial wetlands introduced to shaped hillsides have in the past, and continue during the present time, to contribute to the global ocean’s sea level instability. Huge methane releases from hydrate dissociation triggered by depressurization following submarine slumping of seafloor sediments have taken place in the Mediterranean Sea.\textsuperscript{364} An anthropogenically induced one-meter reduction of the Mediterranean Sea’s level—to stabilize that arm of the world-ocean at its present-day level at the same time the Earth’s ocean is generally rising everywhere—is unlikely to prompt unnatural methane releases during the 21\textsuperscript{st} Century.

Thousands of freshwater reservoirs on land, storing 6500 cubic kilometers of freshwater, have had the effect of retarding the ocean’s natural and/or unnatural tendency to measurably rise worldwide.\textsuperscript{365} The Netherlands’ famous Ijsselmeer did not directly terrace the ocean, but simply replaced a segment of seawater with an equal volume of freshwater, according to Robert J. Hoeksema’s \textit{Designed for Dry Feet: Flood Protection and Land Reclamation in the Netherlands} (2006) and France’s La Rance Tidal Barrage merely harnesses the daily tides. Absent all reservoirs on land, the ocean would be higher than it nowadays is. Evidently, and prospectively, it is Homo sapiens’ intention to occupy the land and the ocean with various kinds of infrastructures; per contra, humans can still only use the Earth’s air.

By AD 2100, the world’s ocean could rise by 0.5-1.0 meter relative to its present-day level. Earth’s coasts will be impacted directly. Human activity to make and earn a living will “globalize” the Mediterranean Sea—its seawater, organic and inorganic contents, shores, according to all the speakers in Istanbul, Turkey at the 9-13 April 2007 meeting of CIESM: The Mediterranean Science Commission. All ecosystem-nations that are not landlocked should now be planning for a future 0.5-1.0 meter rise of the ocean that will affect their coasts directly. States within the Mediterranean Sea-Black Sea basins have several old and potentially expensive macroproject plans to accommodate to a global sea level elevation. However, recent R&D and new products derived from advanced materials technologies—particularly, technical textiles exhibiting high-performance, purely functional, and precisely woven or non-woven fabrics—offer the prospect of cheap regional sea level rise control macroprojects.\textsuperscript{366} We are often astonished when we contemplate what human-developed technologies can do to rearrange the world. John H. Lienhard’s attempt to reconcile large-scale technologies with the chain-linked inventors, \textit{How Invention Begins: Echoes of Old Voices in the Rise of New Machines} (2006), starts Chapter 1 with the sad imagined story of a male human hunter, “Otzi”, who died in the freezing-cold snowdrifts of the Otztaler Alps circa 3300 BC; owing to Global Warming which is, in part, caused by the effects of anthropic technologies, if a 5\degree C air temperature increase occurs during the 21\textsuperscript{st} Century, “the Alps would become almost completely ice-free”.\textsuperscript{367} More deceased people, additional “Otzi” persons, may then be revealed, but few new ones will ever again become ice-entombed in that region of the world.

Commercial shipping interests and tour group organizers and related industries are the most obvious pro-amelioration macroproject constituencies examining the environmental impact of future sea level rise in the Basin in addition to the ecologically sustainable fisheries, recreational boating/yachting, harbor maintenance and the military communities. The Mediterranean Sea Basin, renowned for its beautiful beaches and healthful climate, suffers extensive boundary layer air pollution originating mostly from other regions of the world because the Basin lies at the “crossroads” of global wind currents and receives an inordinate amount of industrial pollutants. Ship stack emissions contribute substantially to air pollution over the summertime Basin, which also modifies the region’s cloud properties affecting the region’s climate radiation budget through sulfate aerosol forcing. Ancient Roman harbors have been submerged by prehistoric sea level rise, and even those were often dredged to maintain their viability as entrepot ports. Nowadays, seawater in the Mediterranean Sea has visibly and measurable different properties than in the recorded past. Remarkable shifts in the thermohaline circulation and water mass characteristics have occurred because mankind’s activities on land, including large freshwater reservoir construction and the widespread regulation of river sediment deposition.

Peak evaporation of the Mediterranean Sea, driven by energy release from seawater, takes place during the wintertime. The Mediterranean Sea measurably warmed during the 20th Century and the potential effects on the pelagic food webs, as well as the Basin’s future climate regimes, is unknown. Future volcanic eruptions on land may cloud the Basin catastrophically; future seafloor volcanic eruptions could create more land—such as the eroded-from-sight Graham Island of 1831—possibly at the Marsili seamount north of Sicily; geothermal heating of the seawater can affect Mediterranean Sea overturning circulation. Because a warmer surface seawater layer is present, during the 21st Century, the Mediterranean Sea Basin hurricanes possibly may become slight more intense storms, with higher boundary layer wind speeds and increased vertical mixing of seawater masses. A Basin-wide sea level, higher than today’s by one-meter, may also lead to higher wintertime storm surges affecting the Basin’s coast and its costly-to-repair-or-replace infrastructure; in the northern Adriatic Sea, at Trieste and near Venice, weak and moderate positive storm surges do not exhibit any definite trend from 1939 unto 2001, while strong positive storm surges clearly became less frequent over that same time period, even with a simultaneous small rise in sea level.

The Mediterranean Sea-Black Sea basins connect with the North Atlantic Ocean through the Strait of Gibraltar. Long-span bridges are becoming lengthier because macroengineers have the assistance of computers capable of fully calculating the forces impinging such structures and because new ways of isolating suspension bridge tower bases from earthquakes have been developed. (For example, these new methods are especially on display in the tentative 21st Century plans to span the Taiwan Strait with a tunnel or a bridge.) Macroengineers must meet managerial macro-problems such as financing and resource accumulation. Technical challenges remain, of course, but new materials like carbon fibers embedded in composites are being researched and developed as practical solutions to most anticipated problems.
macro-problems.

Three-dimensional, computer-generated bathymetric charts and high-resolution geologic sections are already available that generally reveal the Strait of Gibraltar’s geologic framework. International studies of the Punta Malabata, Morocco to Punta Paloma, Spain, Gibraltar Strait Tunnel, with construction slated for commencement in AD 2008, has stimulated most site investigation efforts—so far. Additional pre-planning site studies may be required if the Bolonkin-Cathcart Gibraltar Strait Textile Barrage (GSTB) macroproject plan is adopted for implementation by a “Confederation of Mediterranean Sea Basin-Black Sea Basin States”. With a land:ocean area ratio of 4.4, the Mediterranean Sea Basin-Black Sea Basin is the most land-dominated of all oceans; the land area connected to the region by hydrology is dominated by Africa (65%), Europe (28%) and Asia (7%). The Confederation might be named “Atlantropa”. The Confederation will be an institutional organization in which the policies of every member country are, at least in part, influenced by the preferences of voters/taxpayers from other member nations. For convenience, the Confederation could be generally known as “Atlantropa”. The Confederation will govern the GSTB and its associated electric power/hydrogen distribution network—the Confederation’s version of the future “SuperGrid” in North America.375

The Bolonkin-Cathcart GSTB will be draped on a general alignment between Tarifa (36° 01 North latitude by 5° 36 West longitude) on Spain’s coast and Ksar e’ Sghir (35° 50 North latitude by 5° 32 West longitude) on Morocco’s shore. A.A. Bolonkin and Cathcart do not assume their GSTB is a definitive solution—“State-of-the-Techno-Art” is always provisional—but they do think it is probably the best macroproject plan that can be devised considering all of the technologies currently available. The GSTB, if built as intended by Bolonkin-Cathcart, will be a submarine artwork imitative of Christo’s aerial work of Techno-Art, engineered by Ernest C. Harris (1915-1998), “Valley Curtain, Rifle, Colorado, 1970-1972”. Deployed properly, and configured appropriately, because of seawater currents, the GSTB will bow eastwards like a ship’s sail from the selected 20 kilometer-long alignment site. Billowing will also be caused by a difference in sea level on a two-sided bottom-anchored membrane and seasonal wind pressure acting directly on the GSTB. Planners of the GSTB macroproject will draw on the installation experience with heavy wire nets, floatation systems and their moorings derived from World War II anti-submarine installations in strategic harbors and that documented experience offered by the 100 kilometer-long World War I anti-submarine Otranto Strait Barrage of 1915-1919. One of the main factors governing the GSTB’s monetary cost will be the seafloor cut-off wall—made to minimize seawater seepage. A submarine cut-off trench need not be dug across the Strait of Gibraltar, nor an uninterrupted underwater grout curtain installed, to ensure proper functioning of the completed Gibraltar Strait Textile Barrage.

From its western sea approach, the GSTB will have the characteristic of an architectural deception resembling an English Garden or zoo landscape architect’s ha-ha (also known as “sunken fence”) in that—absent warning light-buoys and radar reflectors—ship navigators will visually misapprehend the true nature of the sea route ahead. Those mariners, such as private-sector fishermen and yachtsmen, piloting their boats without benefit of up-to-date navigational charts that indicate the GSTB’s presence in the seascape will have no inkling via normal optical clues whatsoever that a one-meter drop in sea level obstructs the entrance to the Mediterranean Sea! Mariners without radar readouts using the eastern sea approach will visually spy a one-meter high tensioned fabric wall, which if made of

aquamarine-colored textile might be almost invisible until closely sighted!

Approximately 50000 vessels of all types currently pass through the Strait of Gibraltar annually and the two ship traffic lanes are considered to be military chokepoints; at least one, and possibly two, Frei Otto-style tensioned fabric ship-locks will be required to accommodate post-construction GSTB transiting ship traffic. A ship-lock failure, once in a great while is possible. However, even structural failure of a blocking one-meter high GSTB, extended 20 kilometers across the Strait of Gibraltar, won’t necessarily be a disaster for the Confederation; more or less, it will be similar to a strong storm surge event with a constant 106000 cubic meter per second incoming “surge” rippling rapidly eastwards towards Greece and Turkey to eventually inundate (by one meter) 2500000 square kilometers of sea surface as well as some of the Basin’s strand. Certainly, coastal infrastructures on land will be impacted most directly and, subsequently, in need of repair and some replacement; submarine infrastructures—such as the underwater acoustic detector of high-energy neutrinos, ANTARES[^377], in the Mediterranean Sea off the coast of Toulon, France—should be immune to damage of any kind.

Other than collisions caused by errant ships and the cycling pressure changes of small intra-Basin tides, the most significant prospective structural integrity maintenance threat facing a Gibraltar Strait Textile Barrage are tsunami generated within the Mediterranean Sea Basin or in the North Atlantic Ocean. (The small tsunami from a Black Sea small asteroid splashdown won’t pose much of a threat, but the social chaos caused in the region immediately surrounding the afflicted Black Sea could undermine the Confederation’s geopolitical stability[^378].) The tsunami caused by the 1 November 1755 Lisbon, Portugal, seismic episode caused a maximum 11 meter wave run-up at Tarifa and 10 meter at Tangier in Morocco; the Rock of Gibraltar’s seaport was hit with a maximum wave run-up of 2 meter. The Minor Planet Center in Cambridge, Massachusetts, USA, currently lists over 783 “Potentially Hazardous Asteroids” (PHA) that pose future impact threats to Earth. One PHA, the 300 meter-diameter asteroid 99942 “Apophis”, will pass within 32000 kilometers of Earth on 13 April 2029. The impact of “Apophis” with the Mediterranean Sea or the North Atlantic Ocean just west of the Strait of Gibraltar could be truly catastrophic[^379].

A one-meter high tsunami impacting the one-meter high air-exposed eastern face—really behaving as a kind of flexible hydrostatic seawall—of the GSTB will likely exert a momentary pressure of 10000 kilograms per square meter, or about 200000000 kilogram overall. Tsunami momentum effect must be very carefully considered in great detail. When a tsunami meets a semi-slack barrier, the barrier takes some momentum from the tsunami and transfers it to the GSTB if it can move, making it extremely taut; after the snap loading, some of the momentum is bounced back to the ocean in various directions. If a single GSTB is deemed insufficient to withstand the forces applied, then another paralleling GSTB can be installed since each is not as costly monetarily as a single Gibraltar Strait Bridge[^380]. Elongation of the GSTB’s super-ropes under dynamic loading will dissipate some tsunami-deposited energy.

In the particular case of the GSTB, there is a quite interesting newly apprehended hydraulic effect observed in India by B.R. Rao[^381]. Pending further computations, Rao’s observation is only partially comprehended by Bolonkin and Catheart, the originators and chief proponents of the GSTB.

macroproject. Any North Atlantic Ocean tsunami overtopping the Gibraltar Strait Textile Barrage will encounter a sudden one-meter hydraulic descent immediately after passing over the GSTB. Is it possible a sudden descent of flowing seawater at the GSTB impedance in a one-meter waterfall will effectively attenuate a potentially devastating tsunami’s subsequent run-up on 13000 kilometer of Mediterranean Sea Basin coast? The acute observation by B.R. Rao of the remarkable effect a precipitous topographical drop on tsunami propagation hydrodynamics may be as instigative subsequently as the contemplations of Benjamin Franklin (1706-1790) on oil’s spread on seawater.  

When a tsunami slams the GSTB, part of the wave’s energy is transmitted through the GSTB, part is reflected from the GSTB and another part is absorbed in the various materials of which the GSTB is constructed. Tsunami overtopping of the impermeable tensioned fabric dam with zero freeboard will cause a North Atlantic Ocean seawater hydraulic flow (from super-critical to sub-critical) that induces vibrations in the GSTB (near-critical flow induced vibrations, vortex shedding and suction on the air-exposed “downstream” face of the dam-artwork). In effect, the Mediterranean Sea close to the intact quivering/resonating GSTB will become a stilling basin that will dissipate the kinetic energy of the overtopping seawater flow. A one-meter overtopping results in a temporary 106000 cubic meter per second flow and a two-meter overtopping results in a 300000 cubic meter per second waterfall. The optimum value of the drop height at the GSTB must still be determined by elaborate mathematical exercise and by physical model testing since macroengineers will wish to stabilize the GSTB’s geographical position and not cause any dangerous structural damage to the GSTB. Unfortunately, R&D reports on tensioned membranes vertically spanning water depths of limited extent are rare in the appropriate scientific literature. The total area of the water-retaining fabric drape that is planned to comprise the GSTB is about 200 square kilometers but only approximately 20000 square meters of it will actually be fully exposed to the air and material-degrading sunshine on it eastern face while under continuous imposed one-meter seawater head (hydraulic pressure) on its submerged western face.

Cables and membranes are the essential components of Frei Otto’s architecture proposals. Application of advanced technical textiles and super-ropes composed mainly of Kevlar—or eventually, carbon nanotubes—could permit safe emplacement and use of a pontoon bridge spanning the Strait of Gibraltar. In fact, a vehicle-carrying floating bridge macroproject, connecting Tarifa, Spain and Point Cires, Morocco, imitating the span used by Xeroxes in 480 BC to support his marching troops and their baggage train as they crossed the Hellespont, was proposed by a USA architect, Eugene Tsui. GOTO: [http://www.tdrinc.com/gibraltar.htm](http://www.tdrinc.com/gibraltar.htm) . Braided or stranded super-ropes could stabilize a pontoon bridge in a fixed geographical alignment for a long period, especially in a one-meter per second eastward flowing seawater surface current refilling the evaporating Mediterranean Sea, which has a yearly seawater deficit of about 0.5 meters.

The ultimate hydrostatic head supported by a textile (woven or non-woven) is the measure of the resistance to the passage of seawater through the material; the standard applicable for determining the resistance to seawater penetration is the hydrostatic pressure test. Several international material standards regulatory organizations, as well as may national standard-setting agencies, generally accept the height of a seawater column, expressed in metric units of distance, as the applicable validation of a test method primarily intended for dense fabrics and films. “Waterproof” and “watertight” are synonyms in this instance. In the past, the resistance to seawater penetration (in ship sails, ship cargo hatch-covers) has been technically achieved by coating woven textiles with various waterproofing materials; watertight textiles can now be achieved by dense weaving of strong fibers. Multi-axial,

---

multi-ply textiles are bonded by a loop system, consisting of one or more yarn layers stretched in parallel; yarn layers can have different spatial orientations and different yarn densities. The combination of multi-directional fiber layers is known to capable of distributing extraordinary high strain forces; multi-axial, multi-ply textile structures are dimensionally stable in any direction and exhibit isotropic distribution of stress forces with uniform strain behavior. Kevlar (29, 49, 149)—since 1971 a Dupont, USA, trade name for aromatic polyamides—with a tensile strength of more than 3 Gigapascals, a failure strain of 3% and a material density of 1.4 grams per cubic centimeter is a good example. All extremely strong materials able to perform as unitary form-active structures ought to be investigated for use in the proposed Gibraltar Strait Textile Barrage.

The characteristic strength of a structural or film material must have to low probability (5%) of not being reached during the time of the material’s use in the GSTB and the characteristic load must not have more than a 5% probability of being exceeded during the GSTB’s design lifetime. Potentially, embedded fiber-optic electronics—detectors, reporters and automated alarm actuators—ought to be incorporated to monitor in real-time the super-ropes as well as the draped barrage, which must fit tightly to the Gibraltar Strait’s sea bottom and sidewalls to successfully fulfill its macroproject functions, giving instant alerts to immediately responsible shore-based supervisors of all developing GSTB structural issues related to the GSTB’s safe and efficient performance. Should the GSTB become separated from its two sidewalls and sea bottom anchorage, swept away by an overwhelming tsunami after full loss of structural integrity, then possibly it might be partly retrievable/salvageable and, if so, its quick post-failure replacement would “re-initiate” the artificial Mediterranean Sea reduction (by natural evaporation) in a manner timely. Again, the aim of macroengineers will be to keep the present-day level of the Mediterranean Sea at less than the rest of the ocean will be once global sea level has made the difference important. A clever collapse design could even optimize recovery of a broken GSTB’s components—in other words, the GSTB might be constructed with a design philosophy including the possibility of semi-controlled collapsibility, even pre-planned folding!

The width of the Strait of Gibraltar at the place designated previously is 20000 meters and the charted maximum depth is 900 meters, with an average depth of 450 meters. The GSTB will have a seawater surface difference of one meter. If the top of the barrage is partially supported by pontoons floating on the North Atlantic Ocean, the installation may be utilized as a vehicular highway between Spain and Morocco. Sea-going ships arriving and departing the Mediterranean Sea Basin will bypass the GSTB by using sturdy fabric ship-locks built at each terminus of the bridge-barrage. A simple sketch of the Gibraltar Strait Textile Barrage is provided in Figure 1, below.
Kevlar or other suitable film-like flexible material forming the seawater barrage and the installation’s associated hydropower station. (a) side-view, (b) front-view, (c) pontoon highway bridge between Africa and Europe. Notations: 1-flexible non-woven or woven textile dam, 2-support cable, 3-pontoon, 4-hydroelectric turbine, 5-North Atlantic Ocean, 6-Mediterranean Sea, 7-anchor, super-rope spool, motor of support cable, 8-stabilizer, 9-stones, 10-angle \(a = 30^\circ\).

Let us consider the GSTB emplaced between Spain and Morocco in the Strait of Gibraltar by giving some statistics. If the topmost part of the GSTB, on the North Atlantic Ocean side, is partially supported by pontoon, the installation may be used as a fixed link super-highway, possibly even as a railroad route. In other words, very much the same function as Eugene Tsui proposes for his macroproject; Tsui opted for a very wide structure carrying 24 lanes for motor vehicle traffic (16 lanes for automobiles, 4 lanes dedicated for trucks and buses, and 4 standard train tracks and 2 high-speed trains). Transiting ships can use fabric-gated sea-locks to pass through the GSTB. The Bolonkin-Cathcart GSTB will be cheap to construct—about the same as Tsui’s structure, USA2005$10000000000, yet have even more useful features and functions—especially when compared with a conventional concrete gravity dam as first proposed during 1929 by Herman Sorgel! (Sorgel’s macroproject even rated a news story, “Huge Dikes are Now Proposed to Dry Up the Mediterranean”, on 29 December 1929, Section IX, page 7, in *The New York Times*. Then, Sorgel’s pre-Atlantropa Panropa Project was estimated to cost USA1929$8000000000, which is equivalent to about USA2005$86440000000.)

The Bolonkin-Cathcart Gibraltar Strait Textile Barrage could generate a total power of 800 Megawatt. Constructed of a film with a thickness of 0.05 millimeter, the total weight of the dam’s impermeable textile barrier would be 810 tonnes. Adding the 36 millimeter thick support super-ropes, each separated from the other by a distance of 10 meters, results in a total cable weight of 3240 tonnes plus 32 tonnes of connecting super-ropes. The total weight of the GSTB installation—with any floating pontoons—ought to total 4182 tonnes. Pontoons can also be constructed of non-woven film and additional weight will be small. Bolonkin and Cathcart used conventional film and cables made of the cheapest suitable plastic. They found that, if they used the artificial fiber with a safety stress of 100 kilograms per square millimeter, the total weight of the installation decreased by 10 times (up to 418 tonnes). That is millions of times less—and much, much cheaper—than a conventional reinforced concrete gravity dam.
But, there is a different GSTB hydropower generation opportunity worth exploring—Siphonic Hydropower. Adjacent to the super-rope sidewall seals and seafloor anchorages of the proposed GSTB, the landscapes of Spain and Morocco offer nearly ideal conditions for the emplacement of Siphonic Hydropower facilities. Low-head hydroelectric power plants of a recently perfected type can manufacture electricity using gearless air-turbines basically moved by seawater falling one-meter from the North Atlantic Ocean to the reduced/stabilized Mediterranean Sea. There can be an efficient recovery of economic energy in the form of electricity from a low-head seawater drop. The monetary construction costs of two power plants—one in Spain the other in Morocco—will be reasonable, even less than that of the GSTB. All machinery housed in these power plants ought to be made secure from damaging environmental elements—possibly even small tsunami—and be readily inspected and repaired by Confederation crews working on solid ground! Research in the UK by M.J. French since 1989, Siphonic Hydropower has evidently reached a near-perfection status and early marketing stage in its rigorous macro-engineering R&D. The GSTB will present Siphonic Hydropower developers with all the basic elements required for a potential hydroelectric development—a “limitless” world-ocean stream and an anthropogenic “power drop” through which the North Atlantic Ocean’s seawater can be utilized to convert the potential hydraulic energy into electrical energy. Where the available seawater head for the GSTB is only one-meter, he losses in the Siphonic system (owing to aeration, due to pipe friction and due to upward air bubble drift) would waste probably 0.4 meter of the available head. Thus, the efficiency of the Siphonic system would be about 60%, without considering losses in the air-turbines and in conventional—that is, non-SuperGrid wire—electricity transmission line loss caused by resistance and heating (7%). A Siphonic system of the size envisioned for the GSTB would justify the use of very efficient—that is, costly and precisely manufactured—air-turbines, say at least 80%, so that overall efficiency could be approximately 50%. Thus, the electricity output could be 500 megawatt. While not remarkable large, the power would be generated 24 hours per day, every day of the year regardless of weather conditions, forming a Mediterranean Sea Basin electrical generation and distribution system’s reliable base-load. (One megawatt is enough to power 1000 European-style homes.) Compress air turbines energized by falling seawater will not affect the Gibraltar Strait’s migratory birds, which is an advantage over wind farms, such as the 150 windmills Eugene Tsui proposed for his facility, where windmills are clustered at a site with persistent favorable winds.

Summarizing, Bolonkin-Cathcart propose a unique Ocean Techno-Art macroproject—the combination of the Gibraltar Strait Textile Barrage and Siphonic Hydropower—as an inexpensive total solution for the major known and forecast multiple environmental macro-problems affecting the Mediterranean Sea Basin-Black Sea Basin. Proof and practical adaptation of this technology at the GSTB might foster its adoption elsewhere. They have also offered a new kind of textile-based hydrostatic seawall capable of successfully resisting unpredictable incident one-meter high tsunami. Joseph-Marie Jacquard (1752-1834) invented the automatic loom and his work with calculating machines eventuated in today’s computers, according to James Essinger’s *Jacquard’s Web* (2004). How fitting, then, that commercially available woven textiles/braided or stranded super-ropes and super-fast computers are precisely the two industrial tools most needed to successfully resolve the Bolonkin-Cathcart gedanken experiment!

---


A few tabular icebergs and bergy bits pose navigational hazards in the southernmost part of the Indian Ocean. Since a decision by the International Hydrographic Organization, during Spring 2000, the southernmost boundary of the Indian Ocean is 60° South Latitude. (South of that imaginary line is the Southern Ocean that encircles Antarctica.) However, many Indian Ocean navigational hazards appeared when the December 2004 tsunami rearranged the geographic features violently. Islands disappeared from wave action. Beaches were eroded and many coastal cities destroyed. Seaports were restructured, often littered with new wrecks. For a while, vital shipping lanes became less certain as safe routes of travel and transportation, especially with navigational buoys and other shore-fixed aids damaged or lost. To set all things right, who was needed? In the USA Superman would do, but in India only Krrish could perform the rescue and clean-up tasks of a superhero. Unlike Superman who, after all, is an Alien from far-distant regions of outer space, Krrish is human. Disguised by a mask and a black leather coat, Krrish saves people because he is a truly decent person served by masterful intelligence.

Although outsourcing of jobs to India has been a major business news story for several years in the USA, the National Geographic-Roper Public Affairs 2006 Geographic Literacy Study found that 47% of Americans polled were unable to find India on a simple map of Asia. (GOTO: www.nationalgeographic.com/roper2006) Though not tested specifically for particular knowledge, it is unlikely ignorant Americans have the slightest glimmer of where the Indian Ocean’s great seaports are located—places like Chennai, Mumbai, Kolkata in India, Colombo in Sri Lanka, Jakarta in Indonesia, Richards Bay in South Africa or Melbourne in Australia. And, if Americans cannot point to India, it is doubtful they realize the strategic value of major shipping chokepoints (Bab el-Mandeb, Strait of Hormuz, Strait of Malacca and the Lombok Strait).

Computer simulation of the sensitivity of the Indian monsoon to changes in albedo and Earth-atmosphere carbon dioxide gas buildup revealed saddle-node bifurcations in the response. If the albedo increases from the present-day value of 0.47 up to 0.5 there will be a decrease of total rainfall from about 8 millimeters per day to 5 millimeters per day. But if the albedo exceeds 0.5 then there is an abrupt bi-stable snap downwards to less than 1 millimeter per day, which would not reverse until albedo dropped to 0.48. The real-world geophysical consequences of such a drastic change are almost indescribable: the abrupt transition of the Indian summer monsoon “would possibly transcend the adaptive capabilities of the people living in the rural areas of India”. Macroengineers can play a strategic role to insure that Indians do not suffer nor endure lives of physical drudgery in a world of stunted personal futures. We anticipate an “Indian Ocean Rim Century”—how will we know it when it begins? With its July-August 2006 issue, Foreign Affairs broadcast to the non-average American, the elite reader international policy discussions, the newly prominent role India plays in the unfurling regional geopolitics of the Indian Ocean’s rim. Perhaps the truest indication of the “Indian Ocean Rim Century” will be obvious when crowded and farmed India, an ecosystem-state where practically-

---

speaking only the sky is still semi-natural, first attempts to geoengineer the monsoon climate regime of the Indian Ocean. Macro-engineering the Hindi “Megha” linked with a 21\textsuperscript{st} Century story sequel to \textit{The Meghaduta} may be necessary.\textsuperscript{389}

The Indian Ocean has facilitated the complex webs of capital and commodity exchange. The Strait of Malacca, linking the Indian Ocean and the Pacific Ocean, is the shortest sea route between three of the world’s most populous countries—India, China and Indonesia. (Figure 1.)

![Proportional World Population, AD 2050.](image)

The importance of Singapore dates only from the early 19\textsuperscript{th} Century. Before the arrival of the Europeans in the 16\textsuperscript{th} Century and also later, when local shipping followed sea routes close to the shore, the sea route from the Indian Ocean to the South China Sea led through the Malacca Strait. When the Dutch traders came and ventured from Africa’s Cape of Good Hope directly across the Indian Ocean to the Sunda Strait, Batavia flourished. Singapore’s preeminence developed only after the Suez (1869) and Panama (1914) canals became operational because the canals obviated the necessity of circumnavigating South America and Africa. The Strait of Malacca is a shipping chokepoint, a bottleneck with the potential for ship collisions, ship groundings or massive liquid cargo spills and even piracy! (Figure 2.)

If the Strait of Malacca were closed, nearly 50% of the world’s commercial fleet would be required to sail further. China and India are almost “island” ecosystem-nations when international trade is the measure: by volume, more than 95% of India’s and 90% of China’s foreign trade is by ship. Realizing that many of its citizens reside on, and much of its industrial base is co-located at the coast, India has instituted a naval expansion, including the establishment of new Indian Ocean bases.

The Isthmus of Kra, Thailand, is a potential macroproject site for an interoceanic canal comparable to Germany’s Kiel Canal (built 1887-1895) through the Jutland Peninsula. Since 26 December 2004, Thailand’s proposed shipping canal, the Kra Canal Project to supplement the maritime Strait of Malacca chokepoint, must be built and operated with the expectation that future Sumatra-Andaman earthquakes will occur. 21st Century shipping through the island-strewn region marking the Indian Ocean’s eastern edge extending from Australia to Thailand will be directly and indirectly affected by unsettling geophysical event-processes. For example, the shallow Sunda Strait is likely to again experience a colossal volcanic eruption and consequent tsunami at Krakatoa. Farther afield, China and Japan are expected to finance the Kra Canal’s construction because China and Japan are the two main destinations of Middle East-loaded crude oil tankers and LNG carriers. But, Japan is predicted to endure an economically crippling Tokyo earthquake that could impair its financial capacity greatly.


The Isthmus of Kra may become the site for a new sea level interoceanic canal macroproject that makes the circumnavigation of a narrow peninsula unnecessary, saving shipping time for tanker vessels bound for China and Japan from the Middle East’s oil and natural gas fields. A 102 kilometer-long route through flat land with a high water table connecting Satun on the Indian Ocean with the Gulf of Thailand at Songkhla seems the most likely to be excavated. Cathcart\(^{392}\) opted for two 350 meter-wide channels, each with 200 meter-wide bottom prisms and maximum navigational depths of 25 meters because such a channel could accommodate crude oil tankers, LNG carriers, car carriers, chemical tankers, container ships, dry cargo vessels, heavy-lift ships, tugboats and RO-RO vessels. A twin-channel Kra Canal has advantages: head-on ship collisions cannot happen and problems with one channel would not stop all movement through the Kra Canal. The capacity of a two-channel Kra Canal should be about 200 ships daily. The Canal will have twice a day tidal fluctuations, with current speeds of 1.0-1.75 meter per second going eastwards half a day, then westwards for half a day. Considering the large size of the ships using the Canal, and the types of cargo being carried by them, a tidal fluctuation means that any spillage into the Kra Canal has the potential to affect both ends of the Canal.

To dig the Kra Canal’s twin 350 meter-wide navigation channels, a minimum of 200000000 cubic meters of solid material must be removed and placed somewhere else. Based primarily on research reading of the American Society of Civil Engineers’ *Ship Channel Design and Operation* (2005) and Mort J. Richardson’s *The Dynamics of Dredging* (2002), Cathcart supposed the advent of sea-going floating nuclear-powered cutting-head suction dredges, working all day and all night for approximately five years could remove the materials from the immediate macroproject work site. At the 1970 World Dredging Conference of the World Dredging Association (organized 1967), William R. Murden (1915-1997) and Robert E. Donovan (1942-1996) presented plans and specifications for the world’s first floating nuclear-powered cutter-head suction dredge. Murden and Donovan designed a beautifully sleek sea-going self-propelled prototype vessel—somewhat resembling the nuclear-powered cargo-passenger ship “NS Savannah” (launched 1962-decommissioned 1972). The “NS Savannah” was rated at 74 megawatt. A small, sealed, tamper-resistant, portable, autonomous USA-proven nuclear fission reactor producing up to 100-megawatt may become available before AD 2020. The SSTAR, in its 100-megawatt configuration will weigh 500 tonnes and have a volume of 440 cubic meters. The SSTAR could put out 50000 Shaft Horse Power (37-megawatt) allowing the remaining 63-megawatt to be used to power all other equipment. It will be a thoroughly tested prototype by AD 2015.\(^{393}\) The nuclear dredges required for the Kra Canal Project may cost about 2005USA$100000000 each. At least two will be needed. The target cost of the Kra Canal Project is approximately 2005USA$2500000000, so the cost of four globally mobile sea-going nuclear-powered dredges will be about 0.4% of the estimated final cost of the macroproject.

The preferred dredger design concept is based on Murden and Donovan’s ship capable of sailing under its own power to Thailand from the USA. Its biggest advantage over all existing barge-like, tugboat-moved dredges is the absence of on-board oil bunkers and freshwater tanks. (One of the world’s largest dredges, “Super Scoop”, though without means of self-propulsion—it uses its anchors and tugboats to move short distances—was, on 22 February 2005, in an 8 to 0 US Supreme Court decision in *Stewart v. Dutra Construction Co. 125 S. CT. 1118*, provides the dispositive USA definition of a “vessel” for the purposes of determining whether a watercraft is a “vessel” within the purview of the Jones Act and the Longshore Harbor Workers’ Compensation Act.) Its nuclear fuel can be refreshed after five years of work, permitting the dredger to proceed to other places for work. One possible


application would be to dredge and maintain a deep Kra Canal approach channel in the Gulf of Thailand. Continuous excavation at the Strait of Malacca and in Sunda Strait may also prove to be lucrative future business options.

Bernard Graf’s *Bridges That Changed the World* (2002) recounts the world-famous spans that are familiar to most macroengineers. Bridging and tunneling schemes now under serious consideration by the Government of Indonesia are sure to make the macroproject record books in the future.

The concept of constructing a fixed link between Java and Sumatra was first brought to public attention circa 1958. By 1968, the seismic risks for a fixed link (bridge or tunnel) had been comprehensively evaluated by Wiratman Wangsadinata, working at the Bandung Institute of Technology (organized 1920). Wangsadinata opted for a suspension span of greater than 3000 meter, equipped with a multi-box deck that could be undertaken by AD 2010. With a total length, including approaches, of 27.5 kilometers, the estimated total cost is 2005USA$9000000000. The alignment of the Sunda Strait passes through the islands of P. Ular, P. Sangiang and P. Panjurit. A competing macroproject proposal, the Sunda Strait Tunnel, has been fully outlined by Sindur P. Mangkoesoebroto. The 33 kilometer-long Nusantara Tunnel bored through the seabed’s materials at least 50 meters below the seafloor passing north of Merak Island near Java and north of Rimaubalak Island situated near Sumatra. The plan is to excavate a twin-bore tunnel between Banteng and Lampung, through which electric shuttle trains would carry vehicles. It is hoped to complete the Nusantara Tunnel by AD 2010 at a cost of about 2005USA$5000000000. In other words, the tunnel route is approximately 10-15 kilometers north of the suspension bridge route and, therefore, closer to the infamous volcano Krakatau; both macroprojects are to be located in some of the most seismically active strata in the world. Some 13-20 million persons cross the Sunda Strait annually, and this number is forecast to increase to 40 million persons by AD 2020.

In 2006, a third option for “bridging” the Sunda Strait has been offered by Alexander Alexandrovich Bolonkin and R.B. Cathcart: the Java-Sumatra Aerial Mega-Tramway.

Sumatra is geographically defined by a 3 kilometer-wide Malacca Strait and a 30 kilometer-wide Sunda Strait; across the Sunda Strait is Java. (Lombok Strait, 18 kilometers wide, separates Java from a chain of islands further south.) Approximately 245 million people are citizens of the Republic of Indonesia; the nation’s capital, Jakarta, situated on Java, may have a 21 million residents by AD 2015. Among the natural hazards affecting people on Sumatra and Java, tsunamis, earthquakes, volcanoes and annual forest fires are most remarkable. The 27th August 1883 Krakatau hydro-volcanic explosion and tsunami in the Sunda Strait are famous as is the haze caused by forest fires on Sumatra. In 2002, six of the ten members of the Association of Southeast Asian Nations (organized 1967) vowed to fight fire pollution (smoke) in the region. Further development of comprehensive hazard mitigation is vitally necessary to reduce as much as possible the impact of natural and human-caused hazards. The region surrounding the Sunda Strait has a high potential to endure possibly predictable volcanic eruption and Anak Krakatoa—volcanic ash cloud, air shockwaves, tsunami—and ground motion caused by very strong earthquakes. In future, the Sunda Strait also may endure industrial hazards emanating from the Merak-Cilegon region and agricultural hazards in the Lampung and Ujung Kulon regions, where fallow land cleared for an anticipated season of crop planting, as well as natural forest felled and burned to create plantations, is subject to seasonal wildfires.

---


For these reasons, Bolonkin and Cathcart concur that a Nusantara Tunnel bored beneath the Sunda Strait is an inappropriate macroproject for the Republic of Indonesia to undertake at this time. A suspension bridge may be only marginally less threatened by likely event-processes than a tunnel. As a viable alternative, Bolonkin and Cathcart suggest the Java-Sumatra Aerial Mega-Tramway (JSAMT) based, in part, on the USA Patent 6494143 awarded to Alexander A. Bolonkin on 17 December 2002. If built, the JSAMT will be a truly remarkable 21st Century technology extension. The JSAMT will act like the famous 260 meter-long Transporter Bridge spanning the River Tyne since 1911 at Middlesbrough, England, but be entirely unique by employing containers that are gliders. Imagine, a glider-container soaring into the sky, volplaned across the Sunda Strait. The islands of Indonesia are connected by a network of hundreds of airports but the national highway and railway network remains fragmented and, as a consequence, uneconomical. Even common inter-modal standard shipping containers—like those stacked by the hundreds at Malaysia’s seaports of Tanjung Pelepas and Port Klang—cannot yet be shifted throughout Indonesia with dispatch or low-cost. Briefly, the Republic of Indonesia’s future industrialization requires a national policy encouraging the timely initial organization of an aerial linkage capable of moving containerized cargoes and people over the Sunda Strait! The Java-Sumatra Aerial Mega-Tramway is a logical, and affordable, technology to accomplish that task within a reasonable period of time.

The Berlin Airlift (27 June 1948 to 12 May 1949) was an extraordinary first use of a new tool of policy, a system for transporting supplies by air when ground routes (highways, railways and canals) were blockaded. Ultimately, about 2.1 million tonnes of supplies of every kind were ferried in powered airplanes from western Germany to besieged Berlin in nearly 139000 flights. The militarily circumscribed inbound routes ranged in distance from 240 to 450 kilometers in length. Weather forecasting for the two inbound routes and the single outbound air corridor was organized more thoroughly than any air operation previously undertaken. What if an aerial mega-tramway connecting Berlin with a single launch/recover site in western Germany had existed during 1948-1949? Bolonkin and Cathcart think they have an answer for the alternative history postulation: 2.1 million tonnes of material could have been delivered to Berlin in standard shipping containers using to acceleration installations (Berlin and western Germany), ten gliders of 240 tonnes each with average capacity of 160 tonnes over a period of just 55 days instead of almost 320 days! (A freighter version of Europe’s Airbus, the A380F, will carry 150 tonnes.) The Berlin Airlift advanced the logistics of airpower. Bolonkin and Cathcart think their Java-Sumatra Aerial Mega-Tramway has the potential to truly revolutionize the Republic of Indonesia’s industrial and commercial logistics for the suggested cargo and passenger transfer system, which would used universalized connection-disconnection devices atop the standard shipping containers396; JSAMT will consist of a 40-200 meter-long closed-loop cable path with ground-based engines that propel standardized winged shipping containers a total distance of 35 kilometers, across the 30 kilometer wide Sunda Strait.

An aerial tramway is a type of aerial lift that utilizes comfortable cabins carrying passengers and package cargoes; it constitutes almost the exact opposite of a water-traversing cable ferry that uses barges to haul people and things across bodies of water even when water currents impose strong transverse flow forces. Naturally, suspended aerial tramway cabins can be violently jiggled by buffeting winds. Basically, the JSAMT will consist of kinetic aircraft that can be used to accelerate a standard weather-tight winged shipping container to a sub-sonic speed of 270 to 300 meter per second until its speed decays to a safe landing speed of 50-60 meter per second on a paved runway on the other side of the Sunda Strait. An acceleration of three times gravity (3 g’s) will not discomfort passengers

with normal health and the paved airfield runway length actually necessary to bring the winged container to a halt is only about 1.5 kilometer. The flight path over the Sunda Strait will be subject to the vagaries of the weather as well as other naturally hazardous flight conditions (Figure 3a and 3b). Bolonkin and Cathcart anticipate a need for the internationally approved shipping containers—some of which will be adapted to convey passengers in comfort—to go no higher than 300 to 500 meter altitude above the Sunda Strait. This system for the air-bridge includes a closed-loop cable and drive station located on land. The cable, supported by columns with rollers at the top, and the drive station has ground-based engines, which can be fueled by virtually any cheap available energy.

The subsonic loaded glider—winged container aircraft—starts from a small conventional area (40 to 200 meter long) and is accelerated (with 0.7-3 g) in the air after lift-off to a speed of 270-300 meter per second (Mach number 0.9) by the drive station over a distance of 1-6 kilometer. The glider then flies for a distance of 30-70 kilometer (Figure 6), gradually shedding speed and increasing the attack angle of the wing. When the speed has decreased so it is close to the proper landing speed, the glider lands smoothly. Instead of an airfield, for take-off, a short (40-200 meter) railway can be employed (Figure 6). The glider container carrier can be moved on a special bogie up to speed 50 meter per second, take-off and then it is accelerated in the air up to a speed of 270-300 meter per second by the cable. After acceleration the cable is disconnected from the vehicle and the vehicle then free flights across the Sunda Strait.

![Figure 3. JSAMT: (a) Terminal. Drive system for acceleration of kinetic glider (acceleration station); (b) Aerial Tramway path over Sunda Strait. Notation: 1- closed-loop cable; 2- land; 3-support column with roller; 4-flight vehicle (winged container, manned or unmanned); 5-flight vehicle’s normal trajectory; 6- ground-based cable drive station.](image)

The flight data are significantly improved if the kinetic vehicle has variable wing area or variable swept wings (Figure 4 and 6). The flight altitude does not influence the JSAMT’s range because the energy spent in climbing will be returned in gliding. The advantages the Java-Sumatra Aerial Mega-Tramway offers are: (1) the load capability of kinetic aircraft—winged standard shipping containers—increases as a factor of two since the winged container has no fuel or engine; (2) the kinetic aircraft, the attachable/detachable wings, is significantly less expensive than conventional aircraft such as the Airbus A380 with pressurized cabins, engines and on-board navigation devices; (3) the ground-based propulsion engine can operate on the cheapest available fuel; (4) the maximum flight period is only a few minutes, at most.

1. The maximum range, \( R \), of kinetic air vehicles is obtained from the kinetic energy of theoretical mechanics. It equals
\[
d \left( \frac{mV^2}{2} \right) = \frac{mg}{K} dR, \quad R = \frac{K}{2g} \left( V_1^2 - V_0^2 \right),
\]

(1)

Where \( R \) is range [m]; \( K \) is the average aerodynamic efficiency (\( K = 10-20 \) for sub-sonic aircraft and \( K = 5-8 \) for super-sonic aircraft\(^{397} \)); \( g = 9.81 \text{ m/s}^2 \) is Earth’s gravity; \( V_1 \) is initial (post-acceleration) speed [m/s]; \( V_0 \) is final (near-landing) speed [m/s] (\( V_0 = 50-60 \text{ m/s} \)); \( V \) is variable speed, \( V_0 < V < V_1 \) [m/s], \( mg/K = D \) is drag caused by air [N]; \( m \) is vehicle mass [kg]. The last equation in (1) is obtained from the first equation using integration. The result of computation for both sub-sonic (\( V < 300 \text{ m/s}, M < 0.9 \) Mach number) super-sonic vehicles is graphed in Figures 4 and 5, below. The range of a sub-sonic vehicle is 45-90 kilometer for \( V_1 = 300 \text{ m/s} \); the range for a super-sonic vehicle can reach up to 400 kilometer for \( V_1 = 1000 \text{ m/s} \).

![Range of sub-sonic kinetic glider versus initial speed for different aerodynamic efficiencies. \( K =10, 12, 14, 16, 18, \) and 20.](image)

Figure 4.

Range of sub-sonic kinetic glider versus initial speed for different aerodynamic efficiencies. \( K =10, 12, 14, 16, 18, \) and 20.

Results of computation for sub-sonic (\( V <300 \text{ m/s}, \text{ Mach number} < 0.9 \)) and super-sonic (\( M = 1-3 \)) vehicles are graphed in Figures 4 and 5, below. The range of a sub-sonic flight-worth vehicle is 45-90 kilometer for \( V_1 = 300 \text{ m/s} \); a super-sonic vehicle can reach a maximum range of up to 400 kilometer for \( V_1 = 1000 \text{ m/s} \).

\(^{397}\) For example, the sub-sonic Boeing-747 has a maximum \( K = 16 \), the super-sonic retire Concorde had a maximum \( K = 7.5 \). The Boeing 2707-300 has a \( K = 7.8 \).
2. Maximum acceleration distance can be calculated using the equation

$$S = \frac{V_1^2}{2gn}$$

where $n$ is overload, $g$. Results of computations for subsonic and supersonic aircraft is presented in Fig. 6.

Fig. 6. Aerodrome (railway) acceleration distance via a take-off acceleration of glider.
Acceleration (3g) distance is 1500 m for a speed of 300 m/s for the subsonic vehicle and 17 km \((n = 3)\) for a speed of 1 km/s for the supersonic vehicle (Figs. 7, 8). That is not aerodrome length, it is acceleration in the air.

**Fig. 7.** Full acceleration distance (air acceleration included) of sub-sonic kinetic glider versus an initial speed and different horizontal overloads.

**Fig. 8.** Full acceleration distance (air acceleration included) of super-sonic kinetic glider versus an initial speed and different horizontal overloads.

3. **Average speed** and flight time are
4. The trajectory of horizontal turn can be found from the following differential equations
\[
\dot{V} = -\frac{gn}{K}, \quad \phi = \frac{L_1}{mV} = \frac{g\sqrt{n^2-1}}{V}, \quad \dot{x} = V\cos\phi, \quad \dot{y} = V\sin\phi, \quad \text{or}
\]
\[
V = V_1 - \frac{gn}{K}t + V_0, \quad \phi = -\frac{K\sqrt{n^2-1}}{n}\ln\left(1-\frac{gn}{K}t\right), \quad \dot{x} = V\cos\phi, \quad \dot{y} = V\sin\phi,
\]
where \(L_1\) is the projection of the vehicle lift force to a horizontal plane (vertical overload is 1); \(t\) is time [seconds]; \(\phi\) is turn angle [rad].

Results of computations for different overloads are presented in Fig. 9. They show that the vehicle can turn back and return to its original aerodrome.

**Fig. 9.** Horizontal deviation versus range of the subsonic kinetic vehicle for initial speed \(V = 200\ 220\ 240\ 260\ 280\ 300\ \text{m/s}\), horizontal overload \(n = 3g\), aerodynamic efficiency \(K = 14\).
The energy required for acceleration of the aircraft and the cable is \( E = mV^2/2 \). This is about \( E = 47 \) mega joules if \( V = 250 \) m/s. The drag of the aircraft and cable is about \( D = 3 \times 10^4 \times 1000 = 39 \) mega joules. If the vehicle launches occur every 0.1 hours the ground-based engines must have a total power of about \( P = E/t = 30 \times 10^6 \) 6/60 = 93 kilowatt. If the engine efficiency is \( \epsilon = 0.3 \) the fuel consumption will be \( F = E/\epsilon/\eta = 39 \times 10^6/\epsilon/0.3 = 3.1 \) kg per flight. Here \( \epsilon = 42 \times 10^6 \) [J/kg] is the energy capability of common diesel fuel. This means that 0.031 kilogram of fuel is consumed for each passenger carried.

If the tensile strength is \( \sigma = 180 \) kg/mm\(^2\) = 1.8 \times 10^9 N/m\(^2\), \( \gamma = 1800 \) kg/m\(^3\), then the total weight of the flywheels storing energy will be about \( M_w = 2E\gamma/\sigma = 2 \times 10^6 \times 1800/1.8 \times 10^9 = 94 \) kilogram.

Assume a cost of 2005USA$20000000 for the installation, a design lifetime of two decades, and a per annum maintenance cost of 2005USA$1000000. If 100 passengers are launched on every trans-Sunda Strait flight, there are 10 flights every hour for 350 days per year and that load co-efficient is 0.75, then \( N = 2 \times 100 \times 10 \times 24 \times 350 \times 0.75 = 12600000 \) passengers will be sent across the Sunda Strait via the Java-Sumatra Aerial Mega-Tramway! And, the cost per passenger is 2005USA$2000000/12600000 = $0.16 plus fuel cost. If 0.031 kilogram of fuel is used per passenger and the on-site liquid fuel price is 2005USA$0.5 per kilogram, then the cost is 2005USA$0.016/persons for liquid fuel. The total cost will, therefore, be about 2005USA$0.18 per passenger. If a one-way fare ticket costs 2005USA$1, then the profit will be about 2005USA$10.3 million yearly. The efficiency will be improved when the glider can take 200 or more passengers. For a trip distance of 35 kilometers—rather short—five vehicles will be needed to properly serve the public in Indonesia (four working + one on stand-by). Fuel prices change with time—at the time of writing—they are escalating to never-before-seen levels, but in any case the cost of delivery will be sometimes less than delivery by conventional aircraft.

The public image of the Java-Sumatra Aerial Mega-Tramway is at least as important as the macroproject’s management during its physical creation.\(^3\) Considering that the JSAMT is a novel freight and passenger moving patented invention, some serious research must yet be undertaken to artfully craft a favorable public image in the Republic of Indonesia of the JSAMT that will enlighten and attract supporters. For example, many Indonesians who are accustomed to a slow pace of life will find computer simulations of a trip across the Sunda Strait aboard the winged containers too much “zoomscape”\(^4\), perhaps even frightening. JSAMT will be a pioneering new technology that must be presented locally both as a patented invention familiar enough not to alarm people and innovative enough so as not to see too familiar! One of the world’s tallest office buildings, the Petronas Towers in Kuala Lumpur has excited the public of Malaysia since 1996. So, image managers will need to tune their regional and world-public presentations to investors, government authorities and future JSAMT riders carefully, taking into account all likely negative reactions.

The development of spacious well-lit and secure container storage yard at both ends of the JSAMT will require seamless cooperation at many levels of government. There will be no need for transit sheds on Java or Sumatra since the standard shipping container is weather-tight and functions as a mobile


\(^4\) M. Schwarzer, Zoomscape: Architecture in Motion and Media (2004).
Refrigerated containers will require a reliable source of electricity. We view JSAMT as a unified/unitary transportation system, cooperating with railroad operators and truckers, with the potential to provide fixed linkages amongst, at least, the main islands of the Republic of Indonesia. JSAMT could reduce ship traffic in congested sea-lanes (Malacca Strait, Lombok Strait and Sunda Strait) and assist shippers to avoid pirates plaguing slow-moving high-value cargo vessels plying the Republic of Indonesia’s territory waters. Once the JSAMT has been perfected, it may become adaptable to other suitable sites in the region, such as spanning the Lombok Strait, connecting Java with Malaysia. If macroengineers spanned Palk Strait with an Aerial Mega-Tramway, then the home of “serendipity”, Sri Lanka, would become connected with India!

World Ocean Circulation Experiment initiator Carl I. Wunsch, at the 21 October 2001 Opening Ceremony of the International Association for the Physical Sciences of the Oceans (IAPSO, named 1991) expressed this opinion: “I will speculate that in 50 years…the physical oceanography of the general circulation will have become, under the impact of growing computing power, matured understanding of fluid flows generally, and ever more powerful observation technologies, a largely ‘solved’ problem. There will be routine estimates of the three-dimensional state, at very high resolution…. Will we have biologically-based instrumentation? Quantum computation? Will the main activities of physical oceanographers be directed at the ‘engineering’ applications of biological productivity, weather and short-term climate forecasting, pollutant movement? Is this the definition of success?” We label this coming professional status that Wunsch tantalizingly alludes to “The Aquarium Theory” on the analogy of fish-tank maintenance by aquarists; if the world’s ocean were pumped into an aquarium, that cube would have side measuring 1350 kilometers. An aquarium is a form of building and a building is a specialized instrument, according to Bernd Brunner’s The Ocean at Home: An Illustrated History of the Aquarium (2005).

It is ironic that Oceanography has proven that Homo sapiens, even acting collectively, is a minor group of actors—initiators of event-processes—in a major part of global Nature. The ratio of the ocean’s volume to land is about 11.) Nevertheless, human actions seem to lead in the opposite direction, if we are to accept the findings of Mankind and the Oceans (2005), edited by Nobuyuki Miyazaki, Zafar Adeel and Kouichi Ohwada. Certainly, a new geopolitical regimes has developed to name deep-sea topographic seafloor features that were once unknown; maps generated by Oceanography’s numerical geo-modeling are, in practical effect, potential juridical territory, defined rationalizations (regions) that facilitate surveillance and ultimately political control.

Arran Gare, in Nihilism Incorporated: European Civilization and Environmental Destruction (2003), suggested human advancement in science and technology has resulted in an “extreme” detachment—that is, a special world known only by Homo sapiens—from the Earth’s biosphere and an increasingly complete instrumentalization of global Nature and human individuals caused by the onset of the World Wide Sensor Web. For Oceanography, determining prudent ocean policy for our ever-more plenary planet often requires the use of all kinds of technology to prescribe what ought or ought not be done; to

---

preclude or mitigate pollutants by the “best available technology”; to measure and continuously monitor the world-ocean, as well as levels of industrial pollution and to develop techniques and technologies to cleanse oceanic pollution. (A new monitoring ship that might find use in the Indian Ocean is the “Sea Orbiter” designed by MARINTEK in Norway.\footnote{GOTO: “A la Jules Verne”, \url{http://www.ntnu.no/gemini/2006-01e/julesverne.htm}.} Figure 10a and 10b.
Figure 10a.

“Sea Orbiter”: above the Indian Ocean’s surface, the drifting vehicle can function as a climate research station, below the Indian Ocean’s surface scientists can, in comfort, document the passing parade of life as well as make other useful oceanographic observations.
“Sea Orbiter” (interior cutaway view): sixteen persons can inhabit the vehicle at one time. It will be a stable sea platform allowing even those not used to the sea travel to remain well, without problems of seasickness, for example!
“Synthetic Seas” are impossible of laboratory creation, thereby focusing all available and developing expertise and extant and future manipulatory techniques on the fullest proper use of humankind’s common property, the physically and robotically explored ocean.

Computational Oceanography, based on technology-mediated observations, which someday may include robotized sea animals just as Carl I Wunsch predicted, adopts Ian Hacking’s “instrumental realism” philosophical perspective that theoretical entities are real if they are subject to experimental manipulability: “Experimental work provides the strongest evidence for scientific realism. This is not because we test hypotheses about entities. It is because entities that in principle cannot be ‘observed’ are manipulated to produce a new phenomenon and to investigate other aspects of nature.” (Molecular Nanotechnology, when it is finally used widely, will surely substantiate Hacking’s assertion.) Etymologically, the English-language verb “detect” means to take the roof off that covers something, to uncover it; aquariums often have horizontal protective lids as well as vertical in-tank subdivisions.

Techno-Artists have long evidenced an obsession with the ocean; Christo devised impressive geographically large-scale macroprojects dealing with seawater and currents therein. Christo’s Running Fence, built during March 1976 in northern California’s Sonoma and Marin Counties, was an “iceberg” white-colored textile fence that entered, or exited, the North Pacific Ocean. Its construction, which involved many persons and groups and diverse sources of financing, required the first USA Environmental Impact Report for an artwork! Christo’s works of art inspired us to muse on new technical means of sub-dividing the Indian Ocean, both horizontally and vertically, using textiles.

Subsequent to a detailed survey of the known pertinent literature, we have become very favorably disposed to an innovative technology’s deployment in the Indian Ocean and adjacent regions as a very reasonable cost means of directing major marine currents. The use of water mass movement control by flexible and sometime porous “fabric” vertical curtains was first tested in freshwater reservoirs prior to 1990, and the results of those tests, as well as later tests, were elaborated upon by Tracy B. Veermeyen’s “Use of Temperature Control Curtains to Modify Reservoir Release Temperatures” in the Proceedings, ASCE’s First International Conference on Water Resources Engineering, San Antonio, Texas, August 14-18, 1995. As long ago as 1996, vertical drapes were tested as a technique for controlling algal blooms in freshwater reservoirs. What has been notably absent—until now—is s study of the commercial applications of these kinds of textile curtains to ocean regions, and to aquaculture’s and Macro-engineering’s various private-sector business pursuits.

The first transatlantic metallic-core telegraph cable laying attempt in August 1857—only a century before the advent of humanity’s Space Age—failed and a second attempt, successful, was completed in July 1866. The first fiber-optic cable came into operation in 1988. Approximately 70-80% of all undersea cable networks are in use—cables fabricated and inserted into the ocean before the 1980s are becoming obsolete stock for the commercial telecommunications industry. An abandoned metallic

---

submarine cable is used (via continuous voltage recordings) to monitor the real-time seawater transport of the Florida Current. Many more such retired cables are destined for discard because the global telecommunications industry is expending monies on more efficient submarine fiber-optic cables, which compete very well with Earth-orbiting satellites subject to solar storms (bad space weather). Metallic core undersea cables are sturdy, easily able to withstand high water pressures and cold saltwater temperature, sometimes even to tolerate deep-sea fishing equipment disturbance by snagging. Can these characteristics be of advantage to Macro-engineering in the Indian Ocean?

Imagine a futuristic development scenario: some persons speculate that global Nature’s closing of the gaps between islands in the Indonesian Archipelago circa 5000000 years ago may have caused the onset of Earth’s most recent Ice Age approximately 2700000 years ago, as well as the aridification of eastern Africa. Today, the Central Pacific Ocean-to-Indian Ocean seawater transfer within the Indonesian seas—the Earth’s only exchange of Tropic Zone water between two nearly separated oceans—is an important factor governing heat flows between the Indian Ocean and the Central Pacific Ocean. This present-day cold seawater Indonesian Through-Flow (ITF), moving a depth of about 300 meters and below, is almost proved to be the “pacemaker” for the Asian Monsoon and El Nino. World Wide Sensor Web monitoring of the ITF may result in accurate forecasts of the intensities of the Asian Monsoon and El Nino a year in advance. What if the Makassar Strait through which 90% of the ITF passes was blocked by a filmic drape suspended underwater (several hundred meters) by carbon nanotube super-ropes? If the ITF were halted, the meridional seawater circulation, vertical stratification, sea-surface temperature and sea level of the Indian Ocean and Central Pacific Ocean would be suddenly and drastically altered technogenically. What could such Architectural Ecology accomplish? Would it result in a favorable or unfavorable effect on the various regional climate regimes? Only computational geo-models might hold a tentative answer to these questions!

Interruption of the ITF at Makassar Strait to separate regions of the world’s ocean would be a macroproject less difficult of emplacement than the infamous boscage revealed in a delightful history, The Great Hedge of India (2001) by Roy Moxham! A massive invisible drape at Makassar Strait would create, in its collective effect, the North-South marine ecosystem equivalent to the East-West imaginary line—a mapped boundary line running through Lombok Strait between Bali and the islands of Lombok and Sulawesi that biologist Alfred Russell Wallace (1823-1923) drew as the division of the South Asian and Australian biogeographical regions. The true “beauty” of using textiles and carbon nanotube super-ropes to alter geographical reality is that they can be removed or moved, enlarged or diminished in area to affect a place almost instantaneously; if any kind of correctable macro-problem is obviously developing subsequent to any installation of such devices, then necessary remediation can be rapidly and inexpensively instituted.

An additional alteration of the Indian Ocean major marine currents if foreseeable: the focusing of

---

seawater waves to benefit wave-energy extraction macroprojects and/or to “channel” a tsunami as it approaches coasts, guiding them to places where damage to infrastructure will be minimal and loss of human life will be capped because of the now functioning Indian Ocean Tsunami Warning System.\textsuperscript{413} A future emplacement of the World Wide Sensor Web in the Indian Ocean region would permit the development in time of a state-of-the-art data-surveillance system, as proposed by Thomas Y. Levin, Ursula Frohne and Peter Weibel in \textit{CTRL [SPACE], Rhetorics of Surveillance From Bentham to Big Brother} (2003). Interestingly, it has been found that regularly spaced arrays of 1.6 meter-deep holes drilled vertically into the ground attenuate the passage of certain vibration frequencies by 90%.\textsuperscript{414} We speculate that an array could protect some land-based infrastructure during earthquakes.

In 1927, Viktor Petrovich Kalmykov (1908-1981) suggested the architecture of his “Saturnii” [English: “Saturn”]. Saturnii was to be a city, located at the Earth’s equator that eventually, in its hover mode, would be elevated above the land and ocean surface by nuclear rockets. Finally, it was imagined to be capable of being orbited. (A ring of controlled satellites with reflectors can form a parasol to cooling the air planet-wide.\textsuperscript{415}) Quite aside for the absence of powerful rockets capable of raising such a heavy and unstable macro-object until it orbits Earth, we find it interesting to assess the value of an floating, uninhabited, flat textile with a sky-facing mirror surface situated at the Earth’s equator in the Indian Ocean. Its main purpose would be to act as an amplifier of terrestrial albedo to control the air’s global-mean temperature.\textsuperscript{416} Comparatively, Saturnii would be like a linked set of Mega-Float barges. The world’s largest artificial floating island, the Mega-Float Island—one kilometer long, 121 meter wide, with a draft of three meter—at Yokosuka Port, Tokyo Bay, Japan was fully installed by 10 August 2000.\textsuperscript{417} A strictly sea-going Saturnii would be a megastructure 1200 kilometers long by 100 kilometers wide anchored to the seabed of the Indian Ocean at the Equator. It would not need to be rated for seaworthiness (by naval safety authorities or insurance industry inspectors) and since it is immobile after emplacement, it might not even qualify as a vessel, although this is not a firm assertion yet.\textsuperscript{418} Its 120000 square kilometers of mirrored upper surface must reflect enough sunlight back to outer space so that Earth’s global warming is terminated!

Those who service and maintain the reflective floating membrane Saturnii might also tend to the maintenance of Alexander A. Bolonkin’s gas-rocket launcher stationed in the Indian Ocean. In the July 2006 issue of \textit{Climatic Change}, Paul Crutzen proposed to load the stratosphere with sulfates—derived from burnt sulfur—to reflect sunshine heating the atmosphere, causing an anthropogenic “global dimming”; he proposed to loft his global warming chemical counter-measure to the stratosphere with balloons or “artillery guns”. As it happens, Bolonkin proposed a “long tube (up to 0.4-0.8 km)… located in the sea and provides mobility and serves as an aiming device…. The research shows that the launcher can give a projectile a speed up to 5-8 km/sec. The proposed launcher can deliver up to

\begin{itemize}
\end{itemize}
85,000 tonnes of payload to space annually at a cost of one to two dollars per pound of payload.”

Natural gas flaring is being phased out in the petroleum-rich Persian Gulf countries; stockpiling of huge quantities of sulfur, from the desulphurization of gases containing H$_2$S, is therefore to be expected. From such a stockpile, Bolonkin’s launcher can seed the stratosphere with the particles necessary according to Paul Crutzen.

We suggest that Science and Techno-Art educated persons in India and the USA think a bit on these concepts—we all wish to keep and expand the true “Fabric of Life”, don’t we?

---

Chapter 9

WHAT IS EARTH’S WORTH?

Homo sapiens is a self-described discerner and planner of geophysical finality, at least within our as yet monetarily unvalued Solar System. The machines and systems of machines people use in planet-wide infrastructures allowing synchronicity of utilization and aerospace vehicles permitting limitless movement in outer space look as they do from our species’ deliberate choice. The shape of useful and beautiful things to come, as are those of the present-day and the historic or salvaged prehistoric human past, always result from calculation, whether hastily or leisurely done. Unaided humans can sense 0.1 millimeters to a few kilometers geographically and remember from 70 milliseconds to eight or more decades of otherwise unrecorded event-processes. Beyond the constraints of extant early-21st Century knowledge-making technology, beyond obviously verifiable science, are the sub-microscopic—smaller than one Fermi (10\(^{13}\) centimeter)—and the super-macroscopic (the Universe, and anything bigger than the known physical Cosmos) realms of our ultimate environment into which living persons are admitted only by means of ultra-sensorial faculties of intuition, inspiration or revelation.

When James Hutton stated in 1788 there was “no prospect of an end” for the Earth, he meant there were then no measured indications of our planet’s eventual absence, not that it was an eternal macro-object. Astronomical calculations show that Earth, if it stays at one astronomical unit (AU) from the ageing-towards-Red Giant Stage Sun for five billion years, will reach a peak temperature of 2300 K before it eventually is engulfed by the Sun and finally vaporizes at a temperature of 300000 K into an impalpable boiled-off smoke-like pall; an Earth vaporized terminates the residence time of all of its planetary materials and propels them into interstellar space where they are most likely to be classed as “waste” if they are noted at all by Aliens, people, or outer space-cruising robots.

Founded in 1807, the Geological Society of London in the UK is the world’s oldest geology-focused social group. On 19 February 1830, in a lecture to the group’s illustrious membership, Adam Sedgwick (1785-1873) admonished geoscientists to foreshew environmental futurism and not “to speculate about the physical revolutions of the ages which are not yet come”.\(^{421}\) Even so, as planetary passengers we have been forced to seek foreknowledge because, unlike the Earth at Oklo, Gabon, in Africa, our species has assumed the task of safe disposal of our most long-lasting industrial wastes.\(^{422}\) (Earth is enshrouded by radioactive particles caused, in part, by the highest known nuclear bomb test, “Starfish Prime”, on 9 July 1962 at an altitude of 400 kilometers over the Central Pacific Ocean.) More importantly, geoscientists realize that the long-espoused Law of Superposition has revelatory historical implications for the topmost Anthropocene stratum upon which our ambulatory species currently treads: its long-term preservation potential is much smaller than that of older deposits, such as pre-Pleistocene strata, because, owing to its unprotected surface position and exposure to weather, water flows and space debris impacts, its vulnerability to common and extraordinary human instrumentalities of material mobilization is very great. Late in the 20th Century, the USA’s National Research Council (organized 1916) assigned Environmental Geology a big task which entails a very challenging ultimate goal: “to understand the past, present, and future behavior of the whole Earth”.\(^{423}\)

Unquestionably, Homo sapiens’ most important task, and many of its machine creations as well, is mind-endowed life’s preservation. That “life” can include Homo sapiens (mankind) and Machina

---


sapiens (mindkind). Like Carl Bernhard von Cotta (1808-1879) who, in 1852, announced his thought-belief that our species “must accept a more gifted successor as ruler of this Earth”\textsuperscript{424}, Hans Peter Moravec foresees intelligent robots with artificial emotions—so that these legal persons may understand their human contemporaries and absent predecessors better and to achieve self-pyschoanalysis and self-improvement—that could, by AD 2050, operate our world-civilization increasingly well without our species’ active participation; eventually, “their activities may become incompatible with …Earth’s continued existence.”\textsuperscript{425} Peter Menzel and Faith D’Aluisio’s Robo sapiens: Evolution of a New Species (2000) embraces a hybrid species of life (the product of human-machine hybridization) endowed with intelligence so demonstrably superior to that of a purely biological mankind that the new species achieves global physical prominence (out-masses mankind) as well as intellectual dominance (controls mankind) late in the 21\textsuperscript{st} Century.

Summarizing, these referenced robotics experts, and others of their ilk, promote a scathingly non-censured viewpoint on the Universe that indicates humans lack the ability to rule the Earth and, possibly, even the right to do so—that is, this millennium will bless or curse Homo sapiens. All human populations are Earth-biosphere immigrants—this a theory espoused by Biblicists and professional anthropologists—and, logically, that means it is almost foolish for humans to claim unique possession of any particular landscape; An ever-broadening Panspermia Theory propounded by Astrobiology also undercuts the uniqueness of Homo sapiens as an original tenant. To compound the fact of settlement, with the aspect of terrain, into an abstract of eternal and immutable ownership is an obvious cultural trait, which is exhibited by all people. Will post-Homo sapiens robots (mindkind)\textsuperscript{426} exhibit the same trait?\textsuperscript{427}

At the same time radical Green alarmists, especially the virulent propagandists of the Gaia persuasion, nowadays tout the “sacredness” of the Earth as a whole unit, they also strongly assert that only human values and ethics (that is, societies) determine the dividing line between legal persons and non-persons. Such posturing encourages our purely logical speculation about a massive post-Homo sapiens “robotic society”, and its logical effect upon Earth’s future existence or absence. Railing against simplified Earth-wide ecosystems during 1970, an American radical Green celebrity demanded humanity burden itself forever with an international treaty-enforced global biological diversity accomplished by a single species—Homo sapiens—with a single goal which he desires: “a vision of the kind of Spaceship Earth that ought to be and the kind of crew that should man her.”\textsuperscript{428} Such extreme geopolitical sentiment trivializes any veritable global Nature and makes human-conceived and visited Techno-Art, whether fantastic or purely practical, a travesty. A year later, in 1971, Paul Ralph Ehrlich also condemned Homo sapiens as the “negative animal” because he supposed humans as essentially destructive, whose activities are misguided and tend to cause a suicidal genocide. A pro-exploration and exploitation of outer space declaration, “off the Earth”, has another meaning in American slang: for all Green advocates such as Ehrlich, “off the Earth” means Gaia’s torturous murder by a merciless mankind. Current Green fixation on Global Warming, while at the same time Greens voice almost no complaint about Global Terrorism, is “displacement” as Sigmund Freud defined it. Still, Ehrlich did offer some sound philosophical advice via a quotation attributable to Aldo Leopold (1886-1948): “The first rule of intelligent tinkering is to save all the parts”.\textsuperscript{429} The Solar System, which has a gravitational influence

\textsuperscript{424} B. von Cotta, Geologische Bilder (1852), page 242.
\textsuperscript{425} H.P. Moravec, Robot: Mere Machines to Transcendent Mind (1999), page 11.
\textsuperscript{426} Giorgio Buttazzo, “Artificial Consciousness: Utopia or Real Possibility?”, Computer, 34, 24-30 (July 2001).
\textsuperscript{427} Arnold Brown, “The Robotic Economy: Brave New World or a Return to Slavery?”, The Futurist, 40, 50-55 (July-August 2006).
almost one-half the distance to the closest star, is comprised of many uncounted atoms.\textsuperscript{430}

So far, space exploration is the most fundamental change in Macro-engineering’s history because it opens an almost infinite number of new places (geographies) and space between places (spatiographies) for humans and robots to map and exploit.\textsuperscript{431} Today’s hyper-modern Macro-engineering instructs interested persons on how spacecraft, space settlements and extra-terrestrial planetary/moon/asteroid colonies without atmospheric pressurization and barely-encapsulated space-based robot staff can undertake, and successfully complete, very big macro-object manipulation tasks.

A rhetorical question, by definition, is a query asked merely for effect with no answer expected; for example, “What’s our world coming to?” Once human spationauts observed Earth from the Moon’s surface, simultaneously televising their perspective to all mankind, it then became possible for our species to envision Earth, at the very least its biosphere, as a “living organism capable of death”.\textsuperscript{432} Joshua Lederberg likened Earth’s microbial mass as the equivalent of the World Wide Web.\textsuperscript{433} Since 20 July 1969, geo-conservation, a globally organized program for the preservation of our Earthly geological heritage, is promoted by the International Union of Geological Societies. Geo-conservationists may wish to preserve a few places on the Moon—Neil Armstrong’s spacesuit bootprints, for instance. However, a natural geomorphic event-process, the lunar gardening effect fostered by the diurnal thermal pulse, will gradually erase his historic imprints in about a century (circa AD 2069). Nevertheless, robotics experts compel all geoscientists and macroengineers to ask: “What is coming to our Earth-biosphere?” and, subsequently, “What will inspired intelligent robots do with planet Earth?”

The irrefutably direct precursor of all global contamination and pollution, solid litter from stone-flaking industry, is an indicator/symptom of Homo sapiens’ Paleolithic Period. Deposits of anthropurgic debris, however, failed to impress Charles Lyell, one of Geoscience’s most effective proselytizers. He exhibited a remarkable narrow-mindedness with his contemptuous published interpretation of the discovered artifacts of Europe’s prehistoric peoples; Lyell presumed his own ancestors were a lot less intelligent than his contemporaries. Early stone implements were not strictly utilitarian since some Paleolithic tools are made with better workmanship than was needed to make them useful—their design, therefore, was beyond mere technology, grading into artworks. His sternly dismissive assessment of Paleolithic people—those humans alive, making a living, prior to 6000 BC—resulted in a nasty mockery. If these “savages” had been as intelligent as the UK’s 19th Century Victorians, he announced, then Archaeology ought to have found “lines of buried railways or electric telegraphs, from which the best engineers of our day might gain invaluable hints; astronomical instruments and microscopes of more advanced construction than any known in Europe, and other indications of perfection in the arts and sciences, such as the nineteenth century has not yet witnessed…. Vainly should we be straining our imaginations to guess the possible uses and meaning of such relics, -machines, perhaps, for navigating the air or exploring the depths of the ocean, or for calculating arithmetical problems, beyond the wants or even the conception of living mathematicians.”\textsuperscript{434} We think this haughty attitude is still, unfortunately, prevalent during the 21st Century. Regrettably, it can be found in the Green public lament that all humans are genetically unprepared to macroengineer the Earth-biosphere, their incessant “Stone Age minds in Stone Age bodies” complaint. These same busybodies virtually disallow any public consideration of human genetic improvement—such as,

\textsuperscript{432} J. Millar, “Ground Control”, \textit{Tate: The Art Magazine, Issue No. 18}, (Summer 1999), page 29-33.
\textsuperscript{434} C. Lyell, \textit{The Geological Evidence of the Antiquity of Man} (1863), page 379.
markedly increasing the average human IQ—even after the Human Genome Project’s completion! The Antikythera mechanical computer, a complex analog device made to calculate time’s passage and astronomical cycles, dredged from the Aegean Sea in 1901—the final year of the UK’s Victorian period—clearly indicates that some ancients were demonstrably our equals intellectually.

We think it is possible that Homo sapiens may become “obsolete” within the purview of intelligent robots. If intelligent robot mechanical adaptation could respond sufficiently rapidly to Solar System changes, this would eliminate any need for the Earth to be artificially regulated because all possible states of the machines’ environment would be equally tolerable. However, the thermodynamics, chemistry and physical structure of robots will set bounds on the range of environmental conditions that can be adapted to; as these yet-to-be-discovered limits are approached, environmental conditions would then restrain growth rate, and adaptations necessary for social group survival can also cost energy. (Half in jest, of course, we sometimes privately refer to this possible future robotic society as “Dozy World” since it is an extraordinary one of its kind and is Sun-centered.)

The English-language phrase “Geological Time” was first used circa AD 1837. Realization of perfected robotic technology could abruptly and forever terminate Geological Time for Earth-size planets with Geologic Rock Cycles in this Solar System; were this ever to happen, then Geological Time would be rendered useless as a professional term, at least locally, in the Milky Way Galaxy. It is probable that a team of human-robot persons—“Terra-creatures” because they initially inhabit and, maybe, originate with the Earth-biosphere—will command a big machine to appropriate celestial macro-objects and the, on a timetable, crumble those acquired bodies into harvestable artificial asteroids. “Terra-creatures”, we suppose, are to be functionally confined to the accessible universal space-time continuum, and to be unbothered by any “life expectancy” limitations, although they may come to consider a vanished Earth as their lost “Garden of Eden”. The robots of such a social group, who may not have adopted the living organism as its role model, will be solar powered and, therefore, will have a metabolism quite different from Homo sapiens. (Some robots will be almost ant-size; Earth’s ants currently our-mass Homo sapiens by a 4:1 ratio.\(^{435}\) The main characteristic that will truly separate “them” from “us” is that “Terra-creatures” will not be restricted by mental inhibitions. Non-socialized “Terra-creatures” will be totally unfettered by social limits on the acquisition of knowledge/data/information. Since their macroprojects won’t have big monetary costs, “Terra-creatures” are unlikely to forego the idolatry of Gigantism, which was needed by their Homo sapiens predecessors. Technological fantasy serves two good purposes for present-day humanity: (1) as a manifestation of techno-enthusiasm and (2) as comprehensive guidance toward future geophysical-cultural realities. If all post-human “life” is technological then the concept of technology becomes vacuous.

Our world’s end has been imagined resulting from general nuclear war\(^{436}\) or some other (equally devastating) natural or unnatural—perhaps the future precipitation of highly competitive, even aggressive, microbes\(^{437}\)—event-process. The closest known star that seems to be a twin of our Sun is 18 Scorpii, about 46 light-years distant. (Another star most like our Sun is HD 98618.) The most recent known supernova, an exploded star about 20000 light-years from Earth, is Kepler’s Star. It was first observed in AD 1604. The only observably unstable star predicted to become a Milky Way

---


Galaxy supernova is HR 8210, about 150 light-years from our homeland. Supernova radiation can, in seconds, rapidly heat the dense Earth-atmosphere and cause a drastic reduction of the planet’s ozone layer, with the effect of killing outright, or causing genetic mutations in, all exposed biota. Most of these Doomsday scenarios dealt with the demise of Earth’s biosphere, not with the planet’s actual disappearance from the universal space-time continuum, as will occur if the Universe changes over time as predicted. By mid-1999, however, it seemed to the uninformed as if Earth might be de-materialized, and Homo sapiens made extinct, by a piece of laboratory science equipment, the Relativistic Heavy Ion Collider (RHIC) at the USA’s Brookhaven National Laboratory. Some physicists suspected RHIC might create a deadly Black Hole from quark-gluon plasma. To allay, if not dispel, the world-public’s groundless concern, a 10 October 1999 Environmental Impact Statement was issued. The RHIC’s normal and safe operation from 10-12 June 2000 to the present-day proves the equipment’s benign behavior. (If a Black Hole became lodged at the Earth’s center of mass it would reduce the Earth’s radius to just 0.887 centimeters!)

World-civilization commenced when people gathered in cities, and modern-day cities cannot exist without macro-engineering—indeed, the most theoretical of macroengineers are called “Geoengineers” and “Terraformers”, persons now training themselves to build and maintain humanity’s global urban infrastructures in the face of natural and extraordinary changes or to make other planets comfortably inhabitable by Homo sapiens. Both branches of Macro-engineering reign Earth’s inherent materials and intrinsic energy to the best use of mankind’s viewpoint. Quite remarkably, neither social group of theoreticians seems to have pondered two questions: (1) “What if only Terra-creatures dominate the future Earth-biosphere?” and (2) “What does that event-process portend for the whole Earth?”. In 1966, Freeman John Dyson proposed a colossal space-based robot planet-fragmenting machine for the good, pro-life in some form or other purpose of creating the ultimate city, a Dyson Sphere partially surrounding the Sun; in fairness, we understand that F.J. Dyson is not an impresario advocating Earth’s future obliteration.

A discontinuous shell of 100000 totally automated machines, appropriately modified “O’Neil Model 4 Space Colonies”, about most of the Sun can carry Terra-creatures to other places in the Universe, extending mind-endowed life’s survival options from local globetrotting to a prolonged, intensive and extensive exploration of the Universe. (Inside a uniform density spherical shell the net gravitational attraction is exactly zero no matter the related mass’s position inside the shell.)

Planets are dynamic systems resulting from severe chemical fractionation caused by gravitational settling that do not lend themselves to preservation as artworks do; were operational automated machines set free, the Terra-creatures most likely would know how to preserve planets “forever”. Title to the Sun during that future period of Cosmic Time—Geological Time would have ceased to be a

---

locally useful measurement—becomes indisputable, unless Alien claimants, whether kindred spirits or otherwise, make themselves evident or known.\footnote{Gregory L. Matloff, “A Proposed Infrared Search for Artificial Kuiper Belt Objects”, \textit{Journal of the British Interplanetary Society}, \textbf{57}, 283-287 (July-August 2004)}. Perhaps, that social group might be convinced that a planet-leasing agreement is mutually profitable. Ultimately, nearly all the planets of the Solar System are going to be violently impacted by the Sun as it ages, swelling its size to vaporize some planets (Mercury, Venus, maybe Earth) and shift the orbits of others.

Is there any chance for Homo sapiens or Terra-creatures to survive the Sun’s aging to a stage where it is a dangerous Red Giant? One attempt to answer this interesting question was made by Leonid Mikhailovich Shkadov at the 38\textsuperscript{th} Congress of the International Astronomical Federation meeting in Brighton, UK, during 10-17 October 1987. There, he reported on the possibility of controlling the intact Solar System’s future motion within the Milky Way Galaxy, allowing mankind or mindkind to migrate to another star without leaving Spaceship Earth or, indeed, the Solar System. Briefly, he proposed a technical means to render the terminology “interstellar travel” utterly meaningless since the Sun and its cortege of nine or more planets, moons and uncounted asteroids could be directed towards another Sun-type star located in another part of the galaxy far, far away!

Shkadov’s thruster consisted of a mirror placed in interplanetary space some distance from the Sun. His solar sail-like mirror would cause the central symmetry of the solar radiation in the mirror-Sun system to be violated and, as a consequence mass density, where the mirror-Sun distance remains constant, a balance exists between the gravitational force and the force due to solar radiation pressure. Shkadov proved that in the case of a well-designed system, the thrust force could permit a significant deviation of the Solar System’s normal expected trajectory in the Milky Way Galaxy.

The energy radiated by a Sun-type star is due to the nuclear fusion reactions occurring in its nucleus; a steady-state star is characterized by a permanent balance between the energy flux that is generated by its interior nuclear reactions and the energy flux emitted at its surface. The star’s energy flux is emitted almost isotropically. In the instance of Shkadov’s thruster, the star is prevented from losing energy on the solid angle opturated by the mirror, as the energy emitted in that direction is returned to the Sun’s surface together with the reflected radiation. If exactly backscattered toward the Sun, for example, only radial momentum is gained by the scattering unit; however, if deflected an any angle less than Pi (3.14)\footnote{A.S. Posamentier and I. Lehmann, \textit{Pi: A Biography of the World’s Most Mysterious Number} (2004).}, then it will also impart angular momentum to the scatterer: the Poynting-Robertson Effect. \footnote{Viorel Badescu and R.B. Cathcart, “Stellar engines for Kardashev’s Type II Civilizations”, \textit{Journal of the British Interplanetary Society}, \textbf{53}, 297-306 (September-October 2000).}

It was proved that for the mirror ram angle of 30° first considered in 1987, both the Sun’s photosphere temperature and the absolute bolometric magnitude remain quite close to the present-day measured values. Also, detailed calculations disclosed in Badescu and Cathcart’s report in 2000 led to the important and helpful conclusion that the lateral deviation during one orbital period of the Sun,
estimated by Shkadov to be about 4.4 parsec, is probably an overly cautious underestimate. (A parsec is equal to 206000 astronomical units. That is, 206000 multiplied by the radar measured distance in kilometers between the Sun and Spaceship Earth.)

But, the example above is not the only possible stellar engine! In their *Journal of the British Interplanetary Society* report of 2000, Badescu and Cathcart defined a stellar engine as a device that uses a significant part of a star’s resources to produce energy. A “Class A” stellar engine—for example, L.M. Shkadov’s 1987 engine—uses impulse of the radiation emitted by any appropriate star to produce vectored thrust force; when acting at a distance this thrust force generates work. A “Class B” stellar engine uses the energy emitted by a star to generate mechanical power. The “Class B” stellar engine proposed by Viorel Badescu in 1995\(^{448}\) consists of two concentrically spherical surfaces enclosing a star. The inner (or Dyson) shell surface acts as a solar energy collector. Its outer shell surface is a thermal radiator. The result is that the two shells have different but uniform temperatures; the existing difference of temperature determines a heat flux from the inner towards the outer shell and this flux can enter an ordinary thermal engine used for power generation purposes. So, one can see that small radii increase the feasibility of a “Class B” stellar engine as the amount of component material required is proportional to the radius.

A totally new type of stellar engine was first proposed the AD 2000 UK-published report. It is a blend of “Class A” and “Class B” stellar engines. Viorel Badescu named it a “Class C” type stellar engine. The “Class C” stellar engine uses the impulse and the energy of a star’s radiation to provide both thrust force and mechanical power. This sort of physical configuration could provide mankind, mindkind or a Terra-creature group consisting of both types of intelligent life form with both power and the possibility of interstellar travel. The efficiency of a “Class C” stellar engine increases by lengthening its radius and decreasing the mirror ram angle. And, there is a rigorously calculable minimum radius for such an engine to provide useful power. The vital fact, however, is that there is an optimum stellar engine radius in terms of the provided power density. For values adopted after 1987—that is, by AD 2000—this optimum radius is around 450 million kilometers or, approximately, three Astronomical Units.

In summary, interstellar travel seems entirely possible for those able to build stellar engines, either by staying aboard Spaceship Earth and future terraformed planets such as Mars and Venus or following the construction of a “Class C” stellar engine. Should future unfavorable local changes in the Milky Way Galaxy provoke a desire to move the Solar System, whatever its physical form—that is, whether it is an intact Solar System or as a Dyson Sphere—as a system of various kinds of macro-objects, this can be done quite effectively utilizing stellar engines! Since it is postulated by some Astrobiology experts that some Aliens may have become self-absorbed after enshrouding themselves within an isolating Dyson Sphere, the Badescu and Cathcart macroproject proposal means that it ought to be improbable that mankind will become so inwardly fixated. Terra-creatures from this Solar System are most likely to move towards another Sun-class star for the purpose of solar exchange—the abandonment of our present-day Sun and the replacement of it with another, younger, star for the single-minded purpose of continuing a star-centered civilization. Humans can transmute light into matter\(^{449}\) and, within a span of possibly two centuries or less, mankind and/or mindkind could achieve real-time computation at the ultimate physical limits.\(^{450}\)

---


In 1952, ten years after the tentative start of Homo sapiens’ Space Age in wartime Germany, geoscientists recognized the present rate of biosphere carbon cycling, if integrated over Geological Time the accumulated total mass of living cells would equal the present-day mass of the Earth. The import of that rather amazing fact is great: the planet has been well utilized, possibly over-used, for nearly five billion years by organisms that may, or may not, have actually originated below the sheltering Earth-atmosphere. The Extended Organism: The Physiology of Animal-Built Structures (2000), by Jeffrey Scott Tuner, exposes the fact that animals have always constructed and used structures and building to control their ecological environments; animal-built facilities function as external organs of physiology of their builders. Geoscientists have proved, beyond cavil, that industrious ancient peoples reshaped Earth’s landmass and this new Anthropogeomorphologic fact simply means that modern humans live within an already unnatural Earth-biosphere setting. Living when the Earth-biosphere’s stable climate regimes were different from those currently existing over the same regions, prehistoric peoples did grand-scale Earth-crust alterations by piling soil and rock or digging into it. Robert Sherlock, mentioned earlier in this text, wrote the first modern history of technogenic excavation. In many instances, people have reactivated natural earth-surface event-processes such as landslides, thereby causing enormous units of crust material to change location quickly.

The world’s first anthropic metasomatizer, Roelof Dirk Schuiling in The Netherlands, has planned to elevate parts of the Earth’s uppermost crust a tiny distance in selected valuable regions—the Netherlands, mainly—by harnessing the effect of a common chemical reaction. The gradual application of sulfuric acid injected into limestone changes it to bulkier gypsum (by up to 53%). Inducement of sulfuric acid to a horizontal subterranean limestone stratum can gently lift the Earth-surface layer above. Schuiling’s insight inaugurates “Geochemical Macro-engineering”, and is opposite in result than an intentional underground mining caused subsidence in the northwest part of the inland barge-port at Duisberg, Germany, recounted in Cities and Geology (1973, page 390) by Robert Ferguson Legget (1904-1994). And, Schuiling’s chemistry for land elevation might best be categorized as “Anthropic Metasomatism” since the term metasomatism (or Metasomatosis) is an event-process by which the chemical composition of a rock is changed by interaction with fluids; replacement of one mineral by another mineral without melting. The results of any macroproject application of R.D. Schuiling’s patented process could be named, and referred to in Macro-engineering, Geoscience and Techno-Art’s professional literature, as “Schuiling Landscape Sculpture”. R.D. Schuiling has also innovated another geochemical—nay, alchemical—process to enhance soil weathering that sequesters carbon dioxide gas, which could help to negate further buildup of that

greenhouse gas in Earth’s air. Mineralogy, which is a geoscience capstone, continues to adapt to our Space Age’s advent during the previous century.

James Ross Underwood, Jr. was the first to chart a new classification of Earth’s rocks by adding a fourth standard basic class of such materials, Anthropic Rocks, thereby adding much to the complete technical understanding of Earth’s peculiar Geologic Rock Cycle. Underwood’s most thorough discussion of this new rock category—that is, supplementing the outmoded Igneous Rocks, Sedimentary Rocks, Metamorphic Rocks only scheme—has appeared in several professional publications. Yet, the profession has been slow to adapt or to adopt Underwood’s genuine innovation if categorization. Some professionals move so slowly in response to change, one might suppose they have been gorgonized by geoscience’s doctrines; “calculus” is the Latin word for “pebble”, and the first calculations done by humans were made by rearranging pebbles.

For millennia humans dug and piled only natural rocks fragments. Archaeologists, during 1998, reported that artificial rock was made in ancient Mesopotamia. UK Victorians were very familiar with the durable rock surface formations constructed of Pulhamite and Coade Stone decoratively used in public parks. The constancy of rocks featured in the many attempts undertaken to immobilize radioactive wastes; the Australian researcher, A.E. Ringwood (1930-1993), developed a titanate ceramic called SYNROC, his acronym for “synthetic rock”. D.J. Sheppard proposed Sun-orbiting space colonies, interplanetary and interstellar spaceships ought to be fashioned of reliable concrete. Still others have proposed deep-diving nuclear-powered submarines be manufactured from concrete tubes. Far-out ideas have promoted the development of a multi-disciplinary field of Earth and planetary material studies, according to R.J. Hemley.

Anthropogeneous lithogenesis is a historically new event-process within the Earth. In The Holy Bible, Isaiah 26:4: “Trust in the Lord forever, for in the Lord God you have an everlasting rock”. Nothing humans today make will last forever. But, manufactured rocks, such as concrete, can endure for a long period of Earth’s future Geological Time. In the USA, oddly, civil engineers—potential macroengineers—generally graduate from university knowing little about the properties of one of their primary constructional materials; Middle Tennessee State University (in Murfreesboro), during 1996, was the first American college to establish a Bachelor of Arts program fostering degrees in concrete’s properties and use! Concrete, unlike any other structural building material, allows architects and engineers to choose not only its mode of production, but its material properties as well. (Only when molecular Nanotechnology is perfected will such be the case for other building materials.) Techno-Art plays may, someday, play a role in the making of artificial rocks: EARTHSTAR is a ceramic artwork created in aerospace that utilizes the transforming event-process of heat generated during atmospheric re-entry. EARTHSTAR was conceived in 1996 by Richard Clar; His “space art eutectic” seems to

---

466 D.J. Sheppard, “Concrete Space Colonies”, Spaceflight, 21, 3-8 (January 1979).
extend the tests of ‘artificial meteoroids” done by NASA and the European Space Agency. Earth’s atmosphere, since 21 April 1997, has been employed as a secondary crematorium for de-orbited human ash containers. (Is Earth “Green pristine” still? It is not for ethical reasons alone that terraformers wish for a frontier that has always been lifeless.)

James Ross Underwood’s practical proposal for an “Anthropic Rock” category recognizes at last the pervasive spread of humankind and its industrial products. Underwood’s theoretical innovation is a logical extension of the near-constant redefinition event-process that terms such as Igneous, Metamorphic and Sedimentary have already undergone because of scientific progress. Logically, anthropic soils will result from the natural or unnatural breakdown of Anthropic Rock parent materials. In other words, the International Committee on Anthropogenic Soils has its work cut out for it and urban geoscientists now have to sort through the artificial strata underlying cities everywhere.

“Dyson Spheres are impractical”, says a popular Space Science proponent. Too exuberant, his overstated opinion is an easily misunderstood quip. Since astronomers and Search for Extraterrestrial Intelligence (SETI) experts constantly look for Alien-built Dyson Spheres, the opinionated quoted person must surely have meant to assert this Solar System offers too-little solid mass to provide enough rocky material (in the form of natural or artificially created asteroids) for a successful Homo sapiens Dyson Sphere building macroproject. But, what if the mind-endowed social group attempting such a feat in this Solar System were not humans but, instead, exclusively a population of Terra-creatures? Frail humans may seek to become Terra-creatures, since that could be deemed a wise strategy to avoid the unpleasantness and stressful rigors of Earth-world overcrowding (strictly imposed rationing, mandatory rationalized recycling, and costly interminable worldwide reconstruction). Probably, Terra-creatures would construct a Dyson Sphere simply because they are power hungry and also because a lack of gravity and air in their Sun-orbiting space settlements should be no hardship; machines without organic parts can work in a gravity field/acceleration around 25000 times greater than any human and can tolerate killing radiation and zero air pressure. Machines must have power. Still, such an undertaking is a last resort Macro-engineering, at a sub-galactic level of social group organization in a single industrialized Solar System, the Sun’s: briefly, extremist materials processing.

Since the Earth is immersed in a complex, dynamic plasma system (the Sun, solar wind, magnetosphere and ionosphere), Kardashev Type II Civilizations must be actively responsive, not merely sensitive, to changes in their central star’s behavior during a long period of Cosmological Time. David Criswell has helpfully suggested what a proper practical response might be: a pre-Red Giant Stage Sun life span-prolonging tele-quarrying macroproject. Before Criswell, in *Patience dans l’azur: L’évolution cosmique* (1981), the astrophysicist Hubert Reeves had devised a hypothetical Sun revival technique.

---

using powerful, tunable, penetrative shaped laser-beams to “stir” the Sun’s unused hydrogen mass shell, located between its fusion-dominated core and the solar “surface”, with a photonic “swizzle-stick”. Stirring is supposed to make possible the further transformation of hydrogen into helium, extending the Sun’s lifetime by a factor of ten!

The Sun’s formation, composition, and sources of energy are of profound relevance to science’s truthful documentation of the Universe. The Sun’s ever-changing flux of photons, particles and plasma defines the dynamic environment to which Earth responds and adjusts.\textsuperscript{478} Foreseeing the Sun’s future as a macro-object has also become a scientific quest-goal. The Sun encompasses about 99.8% of our Solar System’s mass and it serves science as a model of “normalcy” relative to all other Main Sequence Stars in the known Universe. Calculations by some experts boldly anticipate the Sun’s shifting from its current spectral class, G2V, to a Mira star-like Red Giant Stage.\textsuperscript{479} Considerable scientific uncertainty remains yet about this solar change theory, especially the phase that deals with Earth’s survival/non-survival as an intact, but uninhabited, celestial macro-object, a cinder. Evidently, all of the terrestrial-type planets of this Solar System will undergo either vaporization or extreme whole planet heating in the future. Space Age science has directly measured the solar wind and is now developing a comprehensive theory of space weather as, for example, in V. Bothmer and I Daglis’s \textit{Space Weather — Physics and Effects} (2006) and in John M. Goodman’s \textit{Space Weather and Telecommunications} (2005). The impacts on the Earth of the Sun’s energy output variations have implications for policy making by geopoliticians dealing with global change, the economics of outer space-based technologies and macroprojects, and ecosystem-nation defense.

The vacuum of interplanetary space is the ideal environment for propagating electromagnetic radiation since virtually all frequencies propagate with essentially the same low attenuation. The laser (light amplification by stimulated emission of radiation) is a device that converts mixed frequency radiation into a discrete frequency of highly enhanced and coherent visible radiation; thus, a recoilless laser device is a source of optical radiation—stimulated emission of light that is nearly monochromatic—that has exploitable characteristics.\textsuperscript{480} The coherence of the light beam permits the beam to propagate long distances with little dispersion and to be focused on a small region. The projected light beam travels at the speed of light and can be either continuous or pulsed. It can be directed and its energy adjusted to the needs of its wielder. Although a laser beam has zero mass, when it impinges on the solid or gaseous target the intruding laser beam must be absorbed to cause an observable effect. The Sun is a gaseous macro-object containing $12 \times 10^{56}$ atoms. Currently, the greatest power density of a pulsed laser on a spot target achieved is $0.85 \times 10^{22}$ watt per square centimeter; the light pressure of the beam exceeds 30 petapascals or around 300 million times greater than Earth’s sea level air pressure! Laser-induced nuclear physics experiments may soon replicate in the laboratory the conditions inside the Sun.\textsuperscript{481} Shot from the vicinity of Earth any laser beam moving towards the Sun will become significantly affected by that massive object’s gravity (light bending) as well as by its natural solar energy and material output (solar wind, flares, coronal mass ejections).

Asteroid 12343, “martinbeech”, and Asteroid 9631, “hubertreeves”, honor two astronomical scientists whose ongoing research is most relevant to prolonging the Sun’s lifetime. In Chapter Eleven of \textit{Atoms of Silence: An Exploration of Cosmic Evolution} (1984, pages 122-124), Hubert Reeves speculated on two macroprojects intended to revive a dying Sun. “Recall that the Sun obtains its energy by burning

hydrogen into helium. The nuclear reactions responsible for this fusion take place where temperature is highest, at the center of the Sun. About 50 percent of this central hydrogen has already been transformed in this hot region. Yet there will remain vast masses of unburned hydrogen between the core and the solar surface. This is, in a sense, a malfunction in the machinery of the Sun. A ‘pump’ is needed to circulate the fuel and to help rid the central furnace of the ashes of the fusion process. We could in this way prolong the life of the Sun from 10 billion years to about 100 billions years! For this project we must ‘stir’ the material of the Sun periodically, much as one stirs a cup of coffee to mix the sugar and the liquid, or, even better, as one revives a campfire by pushing wood from the periphery into the hot coals at the center. To do this we must create a hot spot between the center and the surface, a little outside the fusion zone. I can see two possibilities. The first is to detonate super hydrogen bombs. With today’s bombs we have already created temperatures much higher than those in the Sun’s heart. The problem is to get the bombs to their intended destination without vaporizing along the way. Here I am fresh out of ideas. But, after all, we have plenty of time to think about it. The second possibility is to aim a powerful, extremely concentrated laser beam at the solar surface. Here again, though, we must face the problem of assuring that the energy is not dissipated too soon.”

Hubert Reeves’ Macroproject #1 we label “Plummet Stirrer” and Macroproject #2 is dubbed “Swizzle-stick Stoker”. Since the Sun rotates, both macroprojects offers schedulable direct mixing of materials exterior to the Sun’s core and within the Sun’s photosphere. So far, astronomer Martin Beech is the only properly trained person who has examined Reeves’ suggested true Astro-engineering macroprojects at length in an appropriate scientific journal. Both astronomers hope to make intelligent life forms immune, for a great period of Astronomical Time, to normal stellar object aging via an Astro-engineering event-process of super-core star homogenization! (Some observable Blue Stragglers are stars technically rejuvenated by Aliens, according to Beech.)

Solar System asteroids naturally plummet into the Sun. It has been proposed that surplus weapons plutonium and other highly concentrated wastes might be packaged and accelerated to 30 kilometers per second in a direction opposite to Earth’s orbital motion, ultimately, being transmuted by the Sun. To test the efficacy of either or both Macro-engineering concepts, we need not obtain an asteroid from the Solar System’s Asteroid Belt because and industrially useful 20 meter-diameter Asteroid 2003 (YN107), “the first object known to currently be a quasi-satellite of the Earth”, is conveniently nearby and can be harvested. Helioseismic measurements during and after asteroid splashdown will help to constrain science’s Sun reaction theory since it gives alert astronomers the opportunity to image the interior of the Sun. Circa AD 2300, hard science fiction novelist Glen David Brin has Earthlings undertake “Expedition Sundiver”, a manned “Sunship” trip into the Sun’s chromosphere. Nowadays, astronomers hope a future NASA “Solar Probe” spacecraft will be launched to explore the region of Solar System space within about 0.014 Astronomical Units of the Sun. As presently configured, NASA’s Solar Probe spacecraft would be conically-shaped—rather like an ablative nuclear warhead nosecone from an ICBM that protectively enshrouds delicate electronics and chemical explosives—to shade the reporting robotic projectile’s internal electronics and, also, to create a wake-shield behind the Solar Probe that is relatively free of damaging high-energy particles. As the Solar Probe enters the Sun’s photosphere it must be capable of withstanding the sustained temperature of several thousand degrees Kelvin, rapid alterations in the ambient magnetic field, induced electrical currents, and secondary electron showers generated by charged particles striking the machine’s electronic components! Approximately 99.5% of the Sun’s light emerges from the top of its photosphere where the temperature is 4500 K. The fusion process within the Sun commences between 0.29% and 0.46%
of the star’s radius.

How special is our Solar System? That is an important question not yet fully answered by science. Astronomy and Macro-engineering have traditionally been pursued in conventional observatories and laboratories and on theorists’ computers. Intense, focused lasers can be utilized to study thermodynamic properties of star-replicating artificial plasmas. There are awesome gravitational, magnetic and material/energy flows emanating from the Sun that could readily distort a laser beam aimed at it from the vicinity of the Earth. In terms of Astro-engineering, what has been missing until recently is any ability of astronomers and macroengineers to regularly test thermodynamic theories and actual prospective spacecraft equipment (such as the anticipated Solar Probe with its operational payload) in an experimental setting where the initial and final states are characterized fully and completely documented in useful detail.

Healthy body temperature of a human is 310.15 K. Startech Environmental Corp (founded 1993) in Wilton, Connecticut, USA, manufactures a capacious “Plasma Converter System” capable of reaching sustained temperatures of 16922 K. For comparison, the estimated maximum basal temperature of the Sun’s 400 kilometer-thick photosphere is 7610 K. Startech’s furnace, nicknamed “The Destroyatron”\textsuperscript{485} can dissociate anything put into its electrically-heated central cavity wherein, on command, it instigates Sun photosphere-like conditions safely contained within its well-insulated stable structure housed in an ordinary industrial building. Startech’s “Destroyatron” may be the ideal plasma immersion test apparatus located on Earth for future rigorous factory checkout of the Solar Probe’s heat shield, its broadcasting contents, as well as the real-world plasma penetration characteristics of laser beams of various frequencies. If all equipment feasibility and operability testing is satisfactorily concluded on Earth, then we expect that all further efforts for these Sun-stoking macroprojects will be moved to the Moon where a Headquarters can be simultaneously established for “Macroproject Plummet Stirrer” and “Macroproject Swizzle-stick” that will eventuate in a stirring of the Sun.

Deliberate planet obliteration (via crust-stripping) would substantially affirm, if not completely substantiate, the epoch of a “Dosmozoicum”, an “Age of Life in Space”. In a word, planets are simply macro-objects for pity and consumption by those (possibly soulless) post-Homo sapiens Terra-creatures endowed with minds and physically manipulative appendages. In 1964, Nikolai Semenovich Kardashev unambiguously implied the projected onset of a Solar System-wide period of planet disassemblies done by people circa AD 5200. Cosmology classifies our Sun as a fourth generation star while macroengineers find it desirable to define the profession’s research horizon as delimiting the intellectual sense of universal space-time continuum current at the most advanced frontier of thought amongst spacefarers, whether still human or otherwise. Hubertus Strughold (1898-1986) helped to forge a bond between professions when he neologized “Dosmozoicum” shortly after 1945.\textsuperscript{486} Wisely, he divided the extant Solar System into two spatial-material categories: (1) “Spatiography”—the word first became officially recognized, and made it first appearance, at page 311 of Volume 1 in the \textit{Oxford English Dictionary Additions Series} (1993)—focuses on revealing the nature of universal space-time whilst (2) “Planetography” gives geoscientists data and winning scientific theories about all macro-objects discovered in outer space. Space actually is not empty, yet somehow Strughold’s “Spatiography” must usefully focus on matter under all cosmic conditions.\textsuperscript{487} Both Macro-engineering and Geoscience ought to pursue their Space Age tasks within Strughold’s schema.

\textsuperscript{485} S.F. Brown, “Test-Driving the Destroyatron”, \textit{Fortune}, 149, 62-63 (3 May 2004).
Geoscientists evaluate our species’ extant world-maintaining capacity as a 0.3-0.7 Type Kardashev Civilization (that is, less than a Type I or, better stated, 30-70% of a Type I) with a capability to become a Type II Kardashev Civilization provided humanity develops the means to multiply its power usage by 2.21 million. For certain purposes, it is expedient to separate living organisms into two distinctive active groups: (1) “autogenic engineers” which change ecosystems by their own growth all the while remaining integral to the altered ecosystem and (2) “allogenic engineers” which alter the ecosystem and then leave non-living physical structures behind. Humans are tinkering allogenic macroengineers par excellence, and also mimic the behavior of autogenic macroengineers by constructing glasshouses. Worldwide, most ground is brown in color because decomposers (bacteria, fungi and some invertebrates) cannot breakdown all soil-stored carbon and because some ground is not conducive to breakdown at all—for example, waterlogged bogs and peat lands with anoxic conditions. And, some ground—so-called “Brownfields”—are just too contaminated with anthropic inputs of biota-poisoning heavy metals. Mine pits and rubbish piles best typify mankind’s long-term anthropo-geomorphological activities in the Earth’s biosphere. But do not all organisms use the Earth as a waste receptacle? And, is not the Earth but a burial-ground for all life? Techno-artists have even harnessed geothermal energy. The autogenic/allogenic working classification, magnified by the fact the human brain seems to have a dedicated region that is used for macro- and micro-engineering thoughts exclusively, allows us the cautious surmise that it fits well with Strughold’s categorization and, moreover, ought to meld usefully even if only Terra-creatures exist! Appropriately modified—less complicated, actually—“O’Neill Model 4 Space Colonies” may become 100000 Terra-creature “nursery” environments after Terra-creatures destroy their outmoded Earth-biosphere niche-homeland. Clustered Terra-creatures, gathered in these nurseries, will naturally exhibit both positive phototaxis and positive gravitaxis. The intellectual potential powers of future autogenic Terra-creatures are not even guessable. However, there appears to be a limit the nature of Terra-creature technology because there are universal limits on computation. In 2004, Lawrence M. Krauss and Glenn D. Starkman envisioned an expanding spherical shell of self-replicating devices, moving at the speed of light, that devour all material and absorb all energy they encounter and harness the information collected by beaming it back to their origin place. The total number of computer bits that could be acquired would be less than $1.35 \times 10^{120}$, according to their mathematics.

Differences in the manner in which human males and females perform verbal and visuospatial tasks have long been documented in the scientific literature but, recently, it has been proven that men and women use different parts of their brains when processing both language and visuospatial information.

---

490 F.X Han et al., “Industrial age anthropogenic inputs of heavy metals into the pedosphere”, *Naturwissenschaften*, 89, 497-504 (November 2002).
identifies Asteroid 2511), alleged that separate regions of the human brain are used for "scientific versus engineering modes of thinking". As macroengineers we cannot speak to that purely biological-psychological-theological question, surely more than an issue of mere tissue, but we do note the coincidence that major propagandists for post-Homo sapiens inspired artificially intelligent robots (Hans Moravec and Raymond Kurzweil) were both born during 1948, the sea-change year when humans diverged into two major geopolitical camps (East and West) during a Cold War period and scientists were absolutely perplexed by measurements which seemed to indicate Earth was older than the Universe! Because we deal on a daily basis with the Earth-biosphere’s geophysical reality, macroengineers are blessed with a lot of commonsense. Still, we do relish a delightful fantasy now and then—for example, the Banach-Tarski Theorem, described and detailed deliciously by Leonard M. Wapner, who was also born in 1948, in *The Pea and the Sun: A Mathematical Paradox* (2005). The Banach-Tarski Theorem allows mathematicians to rearrange a solid Earth into two solid Earths of the same radius using as few as five pieces! Albert L. Stasenko penned an amusing mining macro-plan increasing the Earth’s surface area by planet hollowing. Freeman J. Dyson’s motor will be to our descendent, perhaps transcendent, Terra-creatures’ “Dosmozoicum” what Thomas Newcomen’s steam engine was to Homo sapiens’ Industrial Revolution. Earth is the universal space-time test site for the invention and study of the new relationship between Terra-creatures and all else created by applied Macro-engineering; their first planetary test site will prove or disprove remotely sensed data as to the planet’s constitution via rapid, rough dissection.

After proposing Dyson Spheres are Alien abodes in 1860, F.J. Dyson made his first approximation for his asteroid-making machine, which in its operational mode is quite like the Alfven Propulsion Engine. Using his postulated device, and making the Earth a gigantic armature of a Sun-powered electric motor with elements placed in Low Earth Orbit, High Earth Orbit, and Very High Earth Orbit, Earth would be caused to spin faster and faster on its rotation axis until its crust structurally failed after centrifugal effects caused gravity to fall to zero at the planet’s Equator. (A UK Space Science researcher, Paul Birch, feels the electric motor, as described by Dyson, “seems unnecessarily complex” and offers a different machine to spin-up a planet.) Operationally, Dyson’s motor—hereinafter dubbed “Archimedes”—was to place the Tropic Zone’s underlying crust under great tension, a 40076 kilometer-long potential Earth-crust rupture zone equidistant between the North and South Poles. Archimedes sole purpose is to shatter and quickly scatter Earth’s materials. Archimedes (Figure 1), kindly sketched by Martyn John Fogg, is an adaptation of an illustration from his *Terraforming: Engineering Planetary Environments* (1995).

---

Achievement of high-temperature superconductivity would revolutionize the adapted Alfvénian engine used for tectonic plate removal, a post-Paleolithic “stone control” writ large. For Archimedes to work efficiently, the space it will occupy must be clean. The electrical cable windings (snugly draped upon,
and held firmly to, Earth’s surface) used will then be vulnerable to the effects induced by any G5 (Extreme) Space Storms engendered by the Sun. A Satellite Power System (SPS) serving humans was first proposed by Peter Glaser in 1968. The SPS hardware components would consist of an array of photovoltaic cells mounted on a platform located in geosynchronous orbit of the Earth. The solar cells convert sunlight into electrical energy 24 hours a day, and the electrical energy is converted to microwaves that are transmitted to receivers at the planet’s surface. If an SPS constellation is ever launched, and if it is ultimately unified with a worldwide electrical energy transmission-distribution system promoted by Global Energy Network Institute, then such tied-circuit systems ought to be appraised properly as the elementary technological mockup for a Dyson-Alfven Motor.

Subsequent to space clearance, a very large-scale tele-quarrying effort will then begin—a planet’s crust is just so much (valuable) overburden—so that no Earth materials are ever classified as “waste” (that is, only educts, no products) for lack of a fully robotized and truly total rock cycling program. At one Astronomical Unit, the escape velocity from the Sun is less than 425000 meters per second; thus, if this rapidly quarried material move at less than 42500 meters per second, but more than 112000 meters per second, it will remain “forever” available to Terra-creature macroengineers at one Astronomical Unit. Each Archimedes—they would be applied, in succession, to Mercury, Venus, Earth, Mars—ought to be customized for the job; a Dyson-Alfven Motor is a life-of-planet asset, meaning it is built for a specific planet’s demolition and operates until all materials are harvested, but before they are sorted. If planets are serially demolished, then some off-planet mechanical parts (chiefly the satellites) from the initial Dyson-Alfven Motor might be reused; a macro-problem arises from the fact that these parts, unless they are self-propelled robots, will be mixed with the destroyed planet’s wildly rambunctious debris field. (A shattered planet’s debris field must occupy a very large volume of space otherwise the material would naturally aggregate into a new planet!) However, using rockets, such recyclable parts might escape damage or destruction by leaving the Low Earth Orbit, High Earth Orbit and Very High Earth Orbit interplanetary space region immediately upon sensing and reacting to, or being instructed by distant macroproject technicians, to avoid encountering uncontrolled debris erupting from a distorted gravity field below! Mercury and Venus are separated from Earth and Mars by a significant distance, perhaps self-replicating seed elements of the very first local Archimedes ought to be ordered to move in opposite directions: 66% towards the Sun and 33% away from it? Mercury and Venus should be used quickly lest the Sun’s natural changes, some of which are unpredictable, make them worthless (processing monetarily too costly for humans or energetically too costly for Terra-creatures or the subject macro-objects are already engulfed by the Sun). To overcome Earth’s gravitational binding energy (approximately $2.18 \times 10^{32}$ watt)—the total output of the Sun for less than a single Earth-normal month—should suffice to do the task.

It is the “wildness” of F.J. Dyson’s artificial asteroids that really dictates Terra-creatures must crumble Earth first. Earth normally becomes about 10000 tonnes more massive per annum owing to the in-fall of natural space debris—that is the single most vital reason for the Torino Impact Hazard Scale. If Mercury, Venus and Mars were broken first, then soon thereafter Earth would be bombarded much more intensively; if Earth were broken first, Venus and Mercury would be most heavily bombarded. Life’s tolerable temperature is approximately $20^\circ$ C, plus or minus around $15^\circ$ C. Approximately 0.5% of space rocks leaving the Asteroid Belt, situated between Mars and Jupiter, normally strike Earth, mostly because the Yarkovsky Effect constantly nudges these macro-objects sunward. Hypothesizing, were the Earth-atmosphere subjected to an hour-long shower of rocky asteroid

---

fragments (10 kilogram per square meter), the absorbed energy suddenly could raise the troposphere’s average temperature by 10-30°C. Probably only life’s underground and submarine species could safely weather such recurrent flash-type waves of heating without experiencing great metabolic stresses and suffering unusual deaths. Although lower atmosphere-upper crust warming may eventually lure deep-biosphere lithoautotrophic microbes towards the Earth-surface, it won’t badly affect Terra-creatures. But, the impacts of non-intercepted large meteorites poses, at least hypothetically, a somewhat distractive, perhaps destructive threat since the odds of many Terra-creatures being “killed” rises over the norm prevailing today.507

During the Cold War, Russian geoscientists conducted expensive fieldwork and intellectually abstract study to learn if it was technically possible to effectively use Earth’s tectonic plates to focus energy on an adversary’s homeland.508 On 24 December 1963, the USA granted Patent No. 3115194 on a “Nuclear Reactor Apparatus for Earth Penetration” to William Mansfield Adams.509 His two-section device was designed to reach the Mohorovicic’s Discontinuity and for half of the device to be recoverable after its ascent to the Earth-surface. Assuming the molten rock has a viscosity similar to lava, Adams’ tool, with a bulk density of approximately 7.5 grams per cubic centimeter, would fall gravitationally at a rate of 7.8 kilometers per year and would, therefore, take 6 years to reach the boundary separating Earth’s crust from the mantle/core. Interestingly, Adams’ gadget was written up in Time (Vol. 83, No. 2, 10 January 1964)—the same issue featuring a cover story on Richard Buckminster Fuller, “The Dymaxion American”. Time editors and science writers never made any link of W.M. Adams and children book market novelist Victor Appleton II’s Tom Swift and his Atomic Earth Blaster (1954)! Neutrino Tomography will soon unveil Earth’s density profile three-dimensionally—density variations of materials drive some geological event-processes and (most vitally for this exercise) reveal exactly the motivation for Earth’s plate tectonics. A detected swarm of neutrinos vertically traversing an Earth diameter encounters 10^{10} grams per square centimeter; the total characterization of several paths should reveal Earth’s true gross and fine-scale structure; the world’s first transuranic chemical analysis will be achievable. Such mappings and data, eventually thoroughly done on other planets also, will prove invaluable to Terra-creatures intent on asteroid-creation jobs.

Almost every solid macro-object in known space-time rotates as a result of the way it formed, or because of collisions with other objects; gravity and magnetism can slow the rotation of objects but there is little in our Universe that can completely stop object rotation.510 To a first approximation, the shape of the Earth, which is “fluid” over the scale of Astronomical Time, is an oblate spheroid exhibiting a flattening of 1/298.257. About three centuries ago, William Stukeley (1687-1765) and other geoscientists thought easterly dipping coal-bearing strata indicated unmistakable sedimentation influence by Earth’s rotation.511 In the early 21st Century, some radical Green anti-technologists publicly claim to believe that to deform or destroy—as by induced spin-up—any planet is to present God to humanity as the ineffectual governor of something not really the Creator’s own; Terra-creature-directed fragmentation of God’s planets does not have this result when something glorious and good-for-all-life is constructed subsequently. Artificial Intelligence developer and philosopher Marvin

Minsky affirmed the consensus group forecast that robots will “inherit the Earth” from Homo sapiens. During 1983, Cathcart had briefly described the accomplishment of a Societies-and-Sun “Project Future HOME”—HOME is the acronym for Habitat of Mankind’s Economies—as the singular spatiographical human experience circa AD 12000. HOME was a hyper-modern environmental geology structure, a Dyson Sphere, that was not self-referential or a parodying of human Architecture’s old forms.

Descriptively, what sort of rearranging geological event-processes shall Terra-creatures expect when Archimedes—the Dyson-Alfven Motor—spins up an all but vacated Earth? To determine this somewhat didactic literary answer, we assumed for practical purposes that Earth’s crust (that is, all of its component sixteen or so tectonic plates) is a single macroproject-geological structure, after the technolitho-system hierarchy devised by V.T. Trofimov and his like-minded colleagues. Tectonic plate removals via rapid excavation might be assessed as a negative geological event-process (deductive Macro-engineering) occurring as the straightforward result of the mechanical influence of a powerful technogenic factor, the first Dyson-Alfven Motor, opposing planetary self-gravitation and chemical fractionation! Such a removal also amounts to an abstraction of an entire Hans Carol “geomer” (Figure 2). (Hans Carol, 1915-1971, was a Canadian geographer who introduced the “geomer” to designate any part of the Earth’s geosphere.)

![Figure 2](image)

**Figure 2.**

Mile = kilometer

5 = 8

---

All earthquakes are ultimately caused because Earth’s materials have been deformed by gravity and planetary rotation, which long ago caused the formation of constantly moving tectonic plates. Some 85% of Earth’s crust consists of rigid tectonic plates and about 15% is composed of deforming crust and other materials in tectonic plate boundary zones. Varying density layered and colliding tectonic plates have dynamically unstable cracks, which sporadically exhibit colossal shearing failures. Decreasing Earth’s period of rotation means the Eotvos force will become greater owing to Earth’s induced angular velocity and topographic flattening.\(^5\) The Earth has been altered by its rotation into an equilibrium oblate spheroid shape such that particles at rest on the planet’s surface can remain at rest and not be swung out to the Equator, in the absence of any additional force; an additional horizontal force, induced by a Dyson-Alfven Motor, will cause material to be flung into interplanetary space.

A Terra-creature instigated shortening of a day’s length of time must increase the Earth-crust’s stress and, very probably, reinvigorate planetary geodynamics. This strengthening effect will be observed by real-time monitoring; through the use of ground-level latitudinal cable windings necessary for the Dyson-Alfven Motor, vital whole body measurements can be safely obtained remotely. Neo-tectonic deformations, caused by the sporadic shallow magma body bulges and collapses, are monitored by a variant of this proposed Terra-creature technique.\(^5\) Earth’s dipole moment could naturally cease circa AD 4000, according to some experts. Its absence, during a dipole switchover a period of Geological Time of not less than thousands of years, will then affect all Earth-biosphere biota and the highly integrated electronics—at least of the kind used today—of any extant Earth-confined Terra-creatures when it falls to zero from it average. In other words, pre-Dosmozoicum Terra-creatures may reschedule this natural event-process according to their robosephre-dictated requirements. Re-energizing the Earth-mantle by mass redistribution due to centrifugal force caused by induced spin-up increases the future possibility of a historically recorded true polar wander (drift of the planet’s spin axis relative to the mantle).

A pulsed secular change in Earth’s curvature—expansion with continuing tectonic plate subduction—will cause the surface curvature to gradually decrease resulting in “flattening” of the semi-rigid crust. Flattening results in lower-crust extension that inverts and folds the already laid-down upper-crust sediments. Sidney Paige (1880-???), in 1955, disclosed a controversial geologic theory that the Sun was the source of energy expended in Earthly orogenesis and epeirogenesis. His mountain-building theory remains unverified, but sometime in the Earth’s future Geological Time may undergo a full-scale test.\(^5\) The straight-line distance through Earth’s lithosphere between the North Pole and South Pole, which are antipodal places, will be shortened by 500-800 kilometers when the Dyson-Alfven Motor has its maximum effect, just before the planet crumbles. The Tropic Zone, a latitude-demarcated climatic regime zone, is the most noteworthy geographical region of Earth expansion. The most disturbed part of any future spun-up Earth, the Tropic Zone will be geographically tumultuous with hot terrain—so chaotic that only continuously operative computer real-time models, not stale two-


dimensional maps, could be used to keep track of the region’s structural changes.\textsuperscript{520}

The Equator-to-Poles surface air temperature difference generally increases with the increase in planetary rotation rate.\textsuperscript{521} The Coriolis force requires winds and ocean currents to move nearly perpendicular to thermal gradients. When an elegant computer-simulated Earth rotates in 180 minutes, the climatic zone dominated by the Hadley cell’s circulation extends between 15° North and South latitudes, as compared to Earth-normal of 5-35°. The boundary layer air temperature in the steamy Equator-straddling region would be 310 K whilst at the Poles 230 K is likely to prevail. Ice will accumulated at the Poles and this ought to change the gravitational torques acting on the Earth from the Sun and the Moon, forcing a marked change in Earth’s axial tilt; some torques acting on the Earth at a distance include frictional torques (such as wind stress over land and ocean, seafloor drag, and viscous stress at the core-mantle interface) pressure (acting across the troposphere and surface topography interface), gravitational and magnetic generated by Earth’s geodynamo.

Increasing planetary temperature equability would be more important to the terrestrial biota than to the marine life forms because seawater’s ameliorating effect as a medium. (Some flora and fauna could never be removed from Earth because Terra-creatures could find it unnecessary or undesirable to conserve some species—post-Homo sapiens ecologically insignificant units—and also because not all individuals of any species can be found and caught! (Humanity still has not completed a full inventory of Earth’s species of life.) Related climatic event-processes include changes in precipitation and air circulation patterns at every geographical scale of examination. A much lower sea level would likely stimulate numerous submarine and sub-aerial volcanic eruptions, causing climates to change radically and unpredictably through massive dust ejections and greenhouse gas buildups. A planet-enshrouding cloudy sky—the ultimate in “Global Dimming”—surely must cause a global reduction of precipitation owing to the cessation of the Hydrologic Cycle.\textsuperscript{522} With a single pervasive cloud deck of 100%, Earth’s albedo will be twice what it is today. Wildfires will consume vast amounts of tinder-dry biomass affected by a planetary hyper-drought condition—not as bad as the “drought” on an unterraformed Venus, of course—making nearly all land not only arid but with significantly altered, even charred, ABC soil-horizons. Eventually, all abandoned animals will become malnourished, soon sickening or starving to death; meantime, freshwater aquatic life forms will become extremely rare or extinct. Water losses to outer space due to dissociation of molecules in the upper atmosphere and the loss of hydrogen will continue unchecked. If all plant photosynthesis terminated because of induced daytime darkness, then atmospheric oxygen content would decrease 1% over a period of 20 years, carbon dioxide gas would increase slightly for a century thereafter, then remain constant.\textsuperscript{523} Creatures in the deep-biosphere may continue to survive, virtually unchanged, perhaps until the planet is entirely broken; they may even migrate upwards as the planet shatters, finally to be flung into outer space to endure a death by desiccation.

In a surface of Venus-like low-sunlight period, the cold and murky ocean would stand low but would still circulate and be aerated and replete with nutrients. Secular cooling would compel the mass migration of marine thermopile macro-organisms towards the Tropic Zone. This simplistic Earth-normal (“as is” planet) computer-model scenario is complicated by other geophysical factors:


widespread seawater turbidity, powerful new ocean currents and rapid neo-tectonic changes in the ocean basin’s shape (a significantly shallower equatorial region?), makes predictions about global sea level astonishingly difficult. The ocean may then account for less than 70% of Earth’s surface area. More than likely, the Tropic Zone seawater will largely be heated by globe-girdling submarine volcanism, inducing symmetrical northward and southward moving seawater currents—one chronic high-temperature hydrothermal mega-plume extending from seafloor to the interface with the air! The clash between cold and warm currents in the ocean will give birth to violent weather, clashes of contrary air masses that will rival, or exceed in power, today’s devastating super-typhoons. And, of course, the equatorial seawater mega-plume would force the diffusion of various gases (methane, hydrogen, helium, carbon dioxide) spewed into the air, changing the volume, relative constituents and other characteristics of the atmosphere.

When Archimedes increases Earth’s rotation to 100 minutes, the geographic region (bordered by 5° North and South latitudes) bisected by the Equator would be on the cusp of escaping. Earth-normal rotates, from West to East, at 1669.8 kilometers per hour. Close to the moment of breakup the Earth-abnormal will spin at 24100 kilometers per hour. Just prior to its crust shattering, Earth’s ellipticity will be 0.24 (Earth-normal = 0.0033)—our former homeland will be a maximally oblate spheroid—instead of a ball, it would be an oval-shape.

Off-planet Terra-creature observers could countdown to the moment of crust lift-off by reading a digital tachometer display gauge. When Earth finally rotates at 24120 kilometers per hour, crust rupture and upper-mantle explosion cannot be stabilized, halted or reversed; simultaneously, a technogenic gravitation sorting commences within the remaining lower-mantle and whole core, which also cannot be stabilized, stopped or reversed by any known or speculated means. Remote radar or laser probing during the 100-minute sidereal day implies that outer-spaced based HOME-makers’ remote-controlled monitors will have a line-of-sight observation station; monitoring of a single significant human structure (a Herman Sorgel Gibraltar Strait Dam perhaps?) or other obvious surveyed monument or landmark for about 50 minutes. Day/night temperature changes would be fast-paced, extreme, and only the hardiest biota could cling to the constantly shaking landscape in ultra-gale force winds stronger than Force 12—winds never endured or thought possible by Francis Beaufort (1774-1657).

A polar displacement of less than one degree will cause very extensive seawater inundation of the landmasses, destroying a lot of humanity’s and Terra-creature’s deserted infrastructures. Near sea-level infrastructure would very quickly become ruined by many mega-tsunamis, in addition to abnormally rapid weathering subsequent to abandonment. In many places, mega-tsunamis relentlessly sweeping broken infrastructure inland will mark their maximum seawater wave run-ups with an anti-gravitational gradation, an erosion and deposition operating mainly from a lower to a higher elevation. Heaped man- and Terra-creature manufactured materials will, therefore, form a continuous trace paralleling the former shoreline, visibly demarcating the distance the strongest mega-tsunami wave moved inland from the violently sloshing ocean.

All excavated crust-material will be torn into many pieces by core-mantle gravity when the crust’s fracture criticality is exceeded and a breakdown in shear strength occurs at some level of anisotropy greater than 10%, creating a debris field in interplanetary space consisting of earth, gases, dead organisms as well as previously unseen pulverized stuff. We suppose the intentional jetting of Earth-material into interplanetary space as a kind of one-time-only artificial volcanic eruption, a sustained, global Plinian column virtually without fallout, in fact the Earth is a single volcano! Ejected rubble mass will constitute a free-floating “conglomerate” having no significant structural strength other than
its self-gravity, which will have a gravitational sphere of dominance extending 10000000 kilometers. Possibly, less than 1% of the material will collide with the Sun, Venus and Mercury. Crumbling the Earth means that all underground biota—all the microbial creatures residing in and defining the present-day Earth’s deep-biosphere core-enveloping boundary—whether dead or alive, would undergo exhumation. Naked living organisms flung into airless space would burst, becoming blob-like desiccated remnants identifiable only after forensic laboratory study, if collected by curious Terra-creatures. Killed by space conditions, space causes a precautionary partial sterilization of the materials that, later, will be gathered to construct the needed Terra-creatures’ Dyson Sphere (or, mankind’s HOME?). The deep-biosphere’s lithoautotrophic microbes were Earth’s first globally dominant organisms; outer space-using Terra-creatures will eliminate the globe containing their shell-shaped rocky homeland but will imitate their activities on a much grander spatial scale. Archimedes ultimately allows, at least, the prospect of directly sampling any planetary mantle.

With parity of other conditions, when total crust tension at Earth’s Equator increases beyond a certain value, Terra-creatures can expect the crust there to shatter in different but already defined places—most likely at tectonic plate boundaries paralleling lines of latitude. Lift-off would be descriptively complicated because 78% of Earth’s crustal material is concentrated in land, and because the undersea and sub-glacial crust exactly at the axial poles does not rotate hardly at all. The above sea level part of the continental crust amounts to about 2.5% of the crust’s bulk down to the Mohorovicic discontinuity, about 2% of their weight. Thin sub-ocean tectonic plates (Pacific, Cocos, Nazca) could structurally fail somewhere at the Equator in advance of the final, global uplift tectonism of thicker sub-aerial tectonic plates (South American, African), which are also denser than sub-ocean plates. Intact tectonic plate rock properties and the discontinuity of a plate’s rock mass (that is, its boundary zone) are among the most important geophysical variables affecting Earth’s loss of integrity.

Immediately following a fast crust-material removal, the upper mantle material would self-excavate by turning molten “instantaneously”; the magma induced to become lava contains great quantities of water and gasses which, absent about 0.48% of Earth’s formerly overlying mass, would cause lava to exsolve volatiles explosively. Certainly the lower mantle material and possibly core material—actually, all materials lying deeper than the Mohorovicic discontinuity—previously very compressed and very hot will react to their introduction to outer space’s vacuum. It is possible that as much as 99% of Earth’s mass will vaporize, becoming “smoke” as it were.

As a result of their varying initial velocities during ejection, most of the cooled crust-mantle fragments will spread out into a toroidal cloud that, eventually, expands in volume until it is bounded only by the limits of their aggregated maximum inclinations and distances; the faster the initial velocity, the speedier the debris cloud will lock into a Keplerian orbit of the planet’s intact core. (The intact core may be, or may not, be J. Marvin Herndon’s“georeactor”. If that core-material “New Earth” is a large radioactive metallic nugget without cracks in the debris field, which as it cools and contracts will increase its rotational speed, then the derelict “New Earth”—that is, a place spoiled by the extraction of minerals—eventually may have to be broken by some other technique (vaporization via directed solar mirror heating to 3800 K over a long time or explosively via a thermonuclear charge planted at the center of mass. In 1903, Ernest Rutherford (1871-1937) surmised that if a “proper detonator be found, it was just conceivable that a wave of atomic disintegration might be started through matter, which would indeed make this old world vanish in smoke.” Still, in 1930, Robert A. Millikan (1868-1953)
opined that there was no risk whatsoever that Homo sapiens could do real harm to any solid macro-object as large as a planet with the mass of Earth.\textsuperscript{527} Even for Terra-creatures, “smoke” will be difficult to collect and contain.

Aristotle (384-322 BC) held our world constituted an unstable combination of the four basic elements (earth, air, fire and water). Fritz Zwicky (1889-1974), in his 12 May 1948 Halley Lecture at Oxford University in the UK, suggested that one of our Solar System’s uninhabited small bodies might be explosively shattered to demonstrate to all humans that Earth’s geophysical instability as well as the disruptive effectiveness of nuclear explosives—1948 was the year the Cold War began. Zwicky felt there were two “obvious goals” for Solar System remodeling: “to gain both more living space and to separate the representatives of those political and moral ideologies which on the Earth seem incompatible.” Furthermore, he announced, the possibility of accelerating our Sun to higher speeds in the direction of another star we might find to our liking. The solar apex—the point on the celestial sphere towards which our Solar System is currently moving—is located in the constellation Hercules. Freeman J. Dyson and L.M. Shkadov owe a great intellectual debt to Fritz Zwicky’s experimental macro-engineering concept. (Zwicky’s Halley Lecture was printed in the 1948 volume of \textit{The Observatory}, Volume 68, pages 121-143.)

Planet demolitions plus other rounded-up Solar System macro-objects should provide Terra-creatures with malleable rubble. The stuff, all $0.278852 \times 10^{30}$ kilograms, or 0.14\% of the Solar System’s known mass, of robot dreams. The material will likely be shaped into Space Nurseries for Terra-creatures. A choreographed swarm of managed technogenic macro-objects would then be forced to move unidirectionally together around the Sun. Material pulverization in space, solar furnace melting, and subsequent hot shaping and molding will, more or less, sterilize all construction materials used. Never will there be salvage. The industrial processing of all objects gravitationally bound to the Sun will erase all fossils and unsaved cultural records—Terra-creatures may not make any effort to save the USA’s Plymouth Rock, the Kaaba’s Black Stone and Scotland’s Scone Stone because these objects have no symbolic meaning for them—and, thereby, removing from existence forever all planetary pollution. Form just about nine “Little Bangs” to the “Big Cleanup”!

Some kind of clock—perhaps a cooled mercury clock accurate, theoretically, to one second in 400000000 years—will set the pace of Terra-creature space industrialization.\textsuperscript{528} A spatially enormous control system will be needed to oversee all macro-object movements, a kind of integrated immortal consciousness of daisy-chained Terra-creatures. This control system would be a never lackadaisical heliotrophic robot orrery-oracle, a deus ex machina sapiens. Acquainted with all of this Universe’s influences, and aware of the positions at any given instant of all of the macro-objects in the Terra-creature social group’s technogenic “Solar System”, this controller ought to include in one and the same formula the motions of the largest objects and those of the smallest important objects. Any changes to the fabricated (incomplete and expanding) “Sphere” would have to be imposed by the robot’s programming as a form of “process control” write large.

At one Astronomical Unit, the Terra-creature Kardashev Type II Civilization’s exterior surface will be $3 \times 10^{17}$ square kilometers. Viewed from space exterior to the Dyson Sphere—literally, “outer space”—the Dyson Sphere will be detectable by infrared equipment. Terra-creatures invested with spirit will be true “environmentalists”: “environs” means the terrain surrounding a place (the Sun); they become Sun-worshipers not attached to any particular object but simply to any usefully luminous star.

\textsuperscript{527} E. Hobsbawm, \textit{The Age of Extremes} (1994), page 534.

“Inner space”, the volume of this Universe between the Sun’s photosphere and the interior surface of the Terra-creature’s Dyson Sphere, maybe a high-traffic shell-shaped zone of space, filled with vehicles constituting a circulation pattern; in a way, such a zone would be reminiscent of, or actually resemble, vanished unitary planetary materials stratification (geological strata) and materials circulation (Hydrologic Cycle and Geologic Rock Cycle)—in both aspect and prospect, it will be a gigantic version of world trade with which globalized 21st Century humans are quite familiar. Nearly all of the former Earth’s $10^{49}$ atoms may find a new use, recycled into robots expanding spherically into the exploitable Universe from a single point, the aging Sun.

Terra-creature construction of a Dyson Sphere doubtless will be the greatest technological feat that could be conceived on the scale of a single Solar System. Proof of the Lense-Thirrning Effect means that when the spinning Earth is nonexistent it can no longer drag the local space-time reference frame; deliberate movement of a spinning Sun—via either of three possible Badescu-Cathcart stellar engines (A, B and C)—will change the geometry of this Universe by generating an invented space-time curvature. In effect, induced macro-object movement permits a continuously re-contextualized existence for loose and/or controlled macro-objects, by every means of measurement known today.

---
