Energetic Geometries:
The Dymaxion Map and the Transformation of Buckminster Fuller's Radical Pragmatism

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"Inertia, unchallenged, promotes careless philosophy."
—R. Buckminster Fuller, "Fluid Geography, a Primer for the Airocean World"

R. Buckminster Fuller's appearance on the cover of Time magazine in January, 1964, with a geodesic dome for a head and surrounded by the artifacts of his career, presents us with a complicated figure, for the works displayed fall into an awkward intermediate range between visionary schemes and historical artifacts. Evidence of Fuller's early career, notably the Dymaxion Car and Houses of the 1920s and 1930s, seem quite out of place in the context of the geodesic domes, tensegrity structures, and streaking, futuristic jets filling the rest of the frame. Particularly the car, whose development and spectacular demise bankrupted Fuller entirely in 1936 reminds us of the striking discontinuity between Fuller's pre- and post-war work.

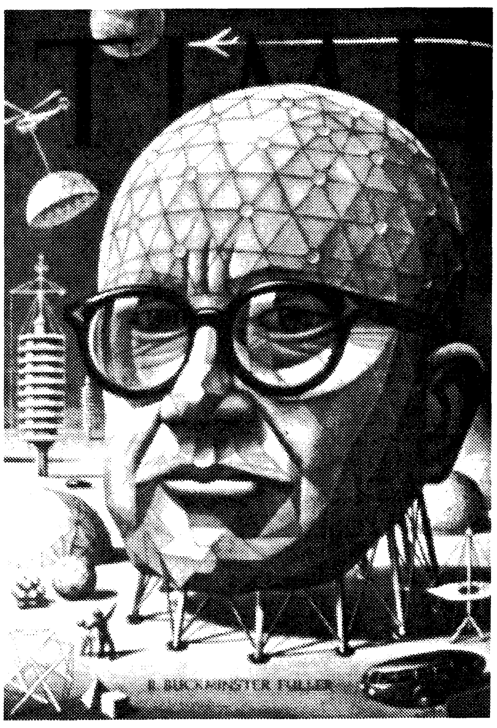

Fig. 1. Time *Magazine, January 10, 1964.*

Such an apparent inconstancy between these two careers—Fuller as the Dymaxion American and as the Geodesic Guru—points toward a fundamental problem in understanding his career and life as a whole. While architectural historians have tended to dismiss his later work as anti-architectural, his disciples have appeared unwilling to critically assess his earlier work, or to meaningfully relate his output to contemporary culture. As I hope to demonstrate, it is precisely the reconciliation of these two modes that presents Fuller in the most sympathetic light. By understanding his work as transitional, that is, placed between the objectivism of the Machine Age and the systematization of the post-war era, one can see Fuller as more deeply rooted in the conception of architecture as a responsive entity to changing technological culture than most designers of his time.

GEODESIC THEMES IN THE DYMAXION PROJECTS

Fuller's career through WWII was almost entirely devoted to the twin precepts of his Dynamic Maximum concept—speed and efficiency. Rooted in his early experience with naval aviation trials, and in the financial failure of the Stockade building system he proposed with his father-in-law, the projects of 1927-46 reflect an almost pathological desire to transform the medieval nature of the construction industry. The early 4-D house, later dubbed the Dymaxion, was Fuller's most complete pairing of naval and aeronautical design with domestic accommodation. "Technology," he would later write, "advances far more rapidly at sea" (1). Fuller's obsession with structural efficiency, here translated into a central mast with guy wires supporting hexagonal floor and ceiling plates, was a neat restatement of nautical and airship engineering principals, in which weight was a primary concern.

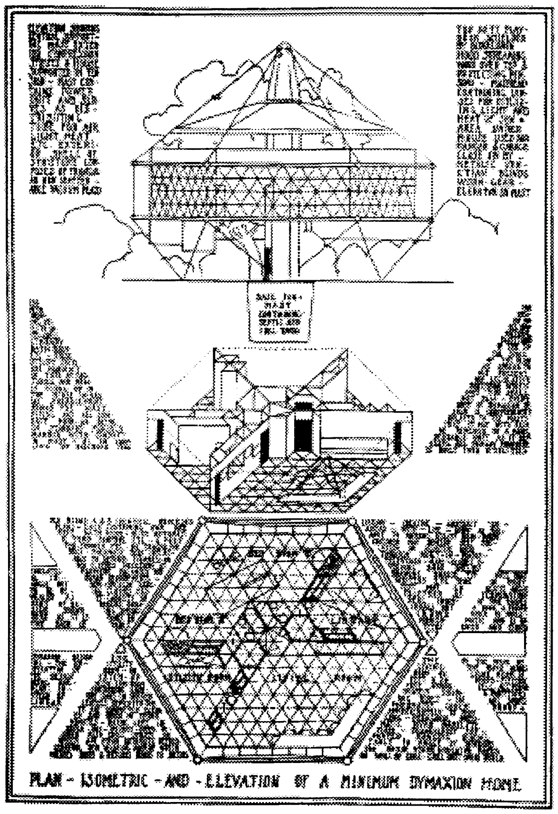

Fig. 2. R. B. Fuller. Minimum Dymaxion Home. 1929.

The equation of the dwelling with air and sea vessels was to have two profound effects on Fuller's development, in addition to a compelling visual influence on his work. First, the notion of a floating structure, buoyant in a fluid air or water ocean, became a major interest. Based in part on his knowledge of airship trials at sea in the 1920s, Fuller began to equate the liquid ocean with the atmosphere—what he would come to refer to as the "Airocean". Early sketches of the Dymaxion vehicle reveal this intent—filled with buoyant gas, the early version of the car would have complemented the mobile delivery of the accompanying Dymaxion House by combining flotation and jet thrust into an "omnimedium" transport.

A second vital ramification of this ship/land/, air/ocean equation was the idea of a transportational network, originally based in Fuller's knowledge of shipping lanes and oceanic geography. The suggested transportation of the early 4-D tower via airship (later replaced by somewhat more feasible aircraft delivery in the Dymaxion House) reveals the first proposal of a global delivery network. No longer constrained by rails or roadways, the omnimedium transports of Fuller's early career were largely informed by the free movements of trans-oceanic shipping and flight. This realization that the world was moving from "wire to wireless" and "track to trackless" was to have a profound influence on his later production, in which the maximization of the economic and social viability of the earth's surface would become paramount (2).

The traditional view of Fuller's career holds that the culmination of this "Dymaxion" period came with the Wichita House of 1944-46. This project, undoubtedly one of his best known and the one that placed him closer to the ideal of the industrialist/architect than any other, does appear to neatly sum up the Dymaxion philosophy and aesthetic, and to essentially clear the slate for Fuller's postwar geodesic investigations. Proposed to the Beechcraft Company, the Wichita House combined Fuller's interest in the efficiency of aeronautical structures and materials with a new found interest in the efficiency of assembly. The resulting package would have been neatly transportable anywhere in the U.S., as evidenced by a "Dymaxion Industrial Strategy Map" derived by Fuller based on distances from production facilities (3). For Fuller, the obvious comparison to his apparently inevitable success was the failure of the industry to accept his earlier "Stockade" building system, and the lightweight construction of the Wichita House can be seen as a powerful challenge to traditional bearing construction (4). In fact, the House was a professional and conceptual dead end for Fuller—panicked on the eve of its mass production, Fuller delayed the project by requiring new studies of the processes involved and the project collapsed. It would instead fall to a radical transformation of the House's stretched skin, combined with the global geometry of Fuller's Airocean concept, to fulfill his hopes of combining transport and lightweight structures into a commercially successful system.

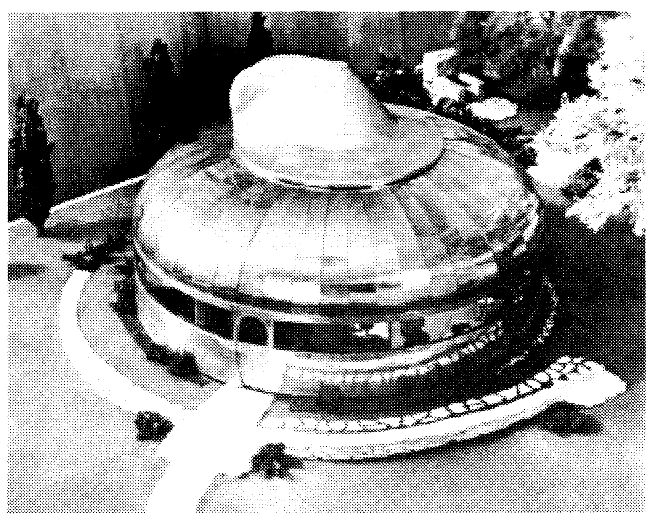

Fig. 3. R. B. Fuller. Wichita House. 1945. Final model.

THE DYMAXION MAP AND THE TRANSITION TO GEODESICS

The seeds of Fuller's later success had in fact, by the time of the Wichita House debacle, already been sown in an often overlooked project for a "Dymaxion Map," published by Life magazine in 1942. It was this exercise in cartography, rather than the more popularized Wichita House, that truly indicated the transition on Fuller's part from the mechanical paradigm of his earlier, "Dymaxion" projects to the network models of Geodesics. Fuller's map involved a comprehensive view of the Earth's surface, free from distortion, that would eliminate the hierarchy of polar-oriented projections. Traditional cartography had projected landmasses onto map planes from a single point, usually the Earth's center, with the result that distances and shapes away from the point of tangency between the mapping surface and the Earth's sphere were necessarily distorted. Additionally, the classic projections such as the Mercator were often laid out to suit political, rather than geographical, hierarchies. For pre-twentieth century travel and navigation, these projections had sufficed. To Fuller, however, they represented outdated technology and an archaic, western-centered view of global economics. "The world's land masses," he wrote, were now "a one-world island at the bottom of the air-ocean" (5). Mariners could traverse the sky-oceans as well as those of the sea, necessitating recognition of the geometrically efficient great-circle routes of air transport. The great circle was to fundamentally alter the economic geography of the planet, placing a novel importance on the Polar Regions as air traffic routes between the hemispheres—thus rendering the Mercator projection and similar cartographic artifacts obsolete. Fuller described the problem using a typically military example:

"People are learning that 'via the North Pole' is the shortest great circle distance from America's midst to the center of population of the world. But when people were told that Tarawa represented the first major gain in the direction of Tokyo, they were not well enough versed in their geography to realize that an announcement that the Marines had taken the North Pole would have put the United States closer to Tokyo's center, and that the Marines were actually further from Tokyo than Chicago is from London" (6).

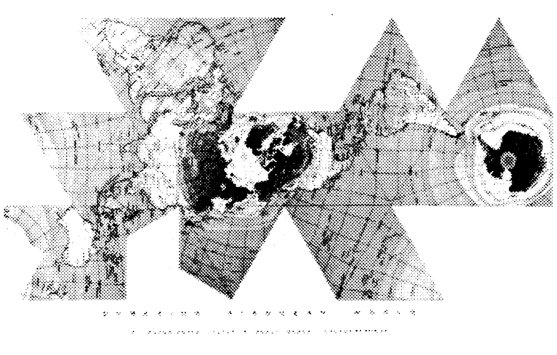

Fig. 4. R. B. Fuller. Dymaxion Airocean World. 1956 version based on icosahedronal geometry.

The original Dymaxion Map consisted of a series of linked squares and triangles, each with sides of 3600 nautical miles. When folded together, these shapes created a rough approximation of a sphere. Within each facet was a locally projected image of the earth's surface, such that a folded map would approximate the appearance of a globe. When unfolded, the map presented in two dimensions a usable representation of the earth's surface without the distortions or cultural focus of traditional cartography. Because each projection was "local", or centered on one facet of the map, no point on the globe would have been more than 2600 miles away from a point with common tangency to both the map and the earth's surface. In the Mercator, the poles—according to Fuller the most important areas in the new Airocean world—were in fact an infinite distance away from the tangent line of the equator, and therefore infinitely distorted. The Map had the additional advantage of suggesting the graphic equivalence of all global regions, opening up the polar areas of the great circle routes to proper geographic understanding.

The Dymaxion Map's importance as a transitional work in Fuller's career lies not only in its cartographic clarity, however, but also in the dual nature of its conception. Derived from his obsessions with naval and aeronautical technology, yet containing within it the seeds of the spherical/faceted geometry of geodesics, the equation of the vehicular, fluid ocean world to the abstract realms of mathematically derived networks marks the fundamental revelation of Fuller's career. Whereas design experiments in fluid motion had previously been confined to the streamlining exercises of Raymond Loewy, Norman Bel Geddes, *et al*, the recognition of the global Airocean network itself as a primary model for architectural production moved Fuller from the visual, stylistic realm into the mathematical. The revelations contained in this project forced Fuller to drop his exercises in comparatively visceral, industrial metaphors, and to pursue what would become his most enduring series of project. No longer based in visual or metaphorical comparisons to fluid vessels, the Geodesic artifacts reveal instead a consuming interest in the abstract, mathematical imperatives such vessels represented on a global level for architecture, urban planning, and design.

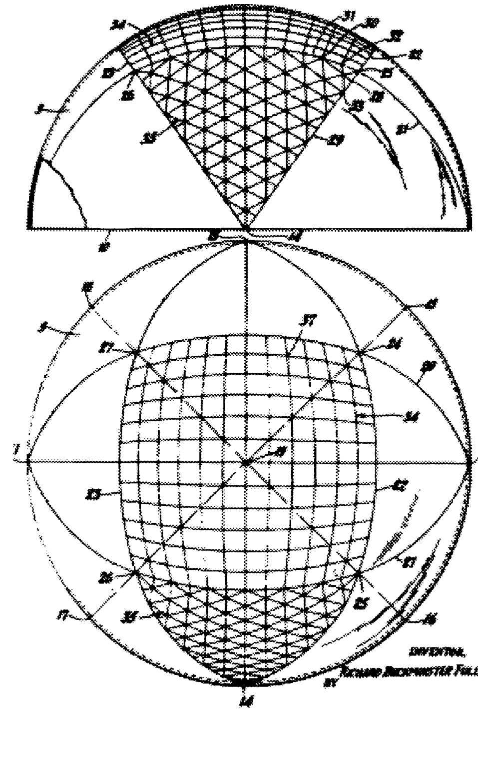

Fig. 5. Dymaxion Map Patent, 1946 showing facets of sphere along great circle routes.

It was during a studio at Black Mountain College in 1948 that Fuller first attempted a "great circle dome", or a structure whose load bearing members took the form of a sphere's arrayed circumferences. By bending flat strips into circles, and attaching them at a series of geometrically determined vertices, Fuller hoped to demonstrate the potential for creating spherical form out of linear members, eliminating the need for complex fabrication of curved components. This idea was an imperfect transformation of the Dymaxion Map into built form, for while it adopted the geographically interesting great circle concept on which the Map was partly based, it failed to match the Map's concept of an efficiently faceted sphere. Instead, the first dome's attempt to use bent linear elements to achieve a spherical form substituted geometrical logic for structural, and the result was a predictable collapse of the entire 45-foot structure upon presentation to the school. The "great circle" members, simple venetian blinds, lacked the structural depth necessary to withstand the gravity and bending forces introduced by the spherical geometry, and when the scaffolding was removed, the sphere simply folded in upon itself (7).

Fuller was to construct or propose a series of transitional domes between 1949 and 1955 that corrected the mistaken structural assumptions of the first great circle dome. The secret lay in Fuller's gradual realization that the great circle geometry, essentially providing statically inefficient *linear* members, could be refined by a system of panelized, triangulated facets that would enable the entire *surface* of a spherical construction to perform structurally. Both gravity and point-live loads would be transferred throughout this system, with tremendous redundancy achieved simply by the number and distribution of panels. The completed dome would therefore act as a monolithically static shape, though with a fraction of the weight, as each panel would substitute a trio of lightweight linear members for a heavier, planar panel. Such a construction would also provide a unique efficiency in that the structure and enclosure could occupy the same space, eliminating the need to allow separate areas for frame and cladding.

Fuller's first series of domes confirmed the parallel development of the geometrical and geographical intents of the Dymaxion Map. Between 1950 and 1955, Fuller led studios at several universities in which the stated program was the construction of a "geoscope", or a sphere onto which the shapes of continents would be projected. When placed such that the locale of the geoscope was aligned vertically under the night sky, an observer could stand within the structure and by looking towards any part of the globe see a portion of the celestial sphere as it would be seen at that site at that moment. Plans for a 200' diameter public geoscope across the East River from the United Nations were drawn up by Fuller, in which military reconnaissance would have played a unique peacetime role, generating precise imagery for display on the map (8). The image of the aircraft in this scenario, caught between mechanical functions of the camera/airframe and electronic location finding methods is a compelling one, as it demonstrated Fuller's growing vacillation regarding contemporary vehicular technology.

GEODESICS AND FULLER'S LATER PHILOSOPHY

The migration of the Geodesic Dome through both industrial and corporate culture in the 1950s and 60s provides a neat overview of Fuller's relationship to the burgeoning military-industrial complex during the era. Initially, his work at MIT drew the interest of the Army, who asked him to carry out a series of experiments involving portable shelters. The easy assembly of the domes in question, and their light weight, made them ideal choices for the purpose, as they could be air-dropped via helicopter and assembled quickly by infantry in a combat situation. These trials led to the dome's ultimate test, in the role of a portable aircraft hangar. Images of these trials, in which helicopters lifted domes out of aircraft carriers, flew them across ocean and surface terrain, deposited them on site, and then landed and taxied into them, were the public's first introduction to the Domes. They were compelling enough on their own to launch Fuller's career as a Geodesic guru, and the realization of the air-delivery method, some thirty years after the 4-D house proposal and only a decade after the Wichita House fiasco remained a powerful illustration for Fuller late into his life.

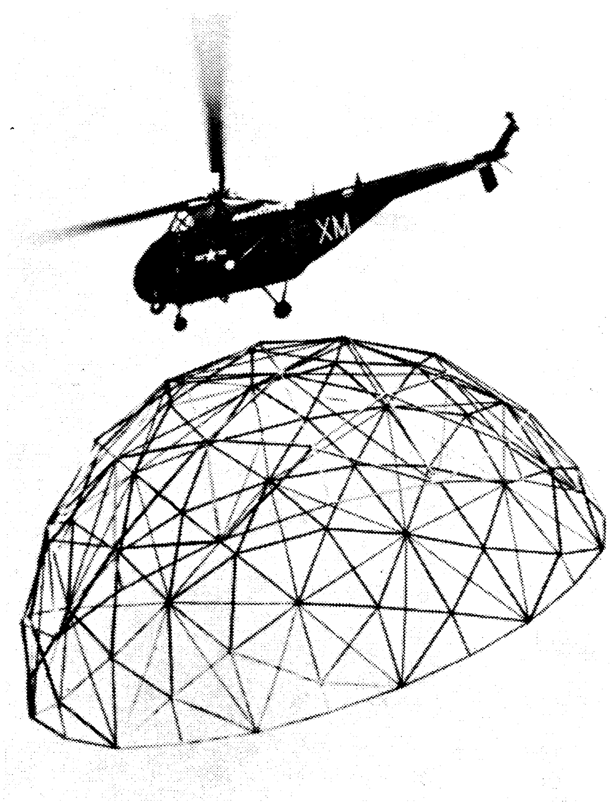

Fig. 6. Military test of Geodesic Dome. ca. 1954.

Geodesic domes were actually installed worldwide as the enclosure of choice along the United States' Distant Early Warning electronic warfare front. The spherical form of the domes provided maximum structural transparency for radar devices scanning the arctic sky for incoming Soviet missiles, and the ability to fly these domes into remote, often-mountainous regions suited the concept perfectly. While the commission of several dozen structures in this project realized Fuller's concepts of global, great circle delivery, structural efficiency, and mass production, the exponentially increasing technology of the ICBM and the parallel development of global radar systems also found a visual ally in the abstract image of these domes seen against stark arctic landscapes. Their role in the popular perception of the Cold War, including a brief appearance in Stanley Kubrick's Dr. Strangelove, portrayed Fuller's greatest achievement as a purely military advance, an association from which he would gradually distance himself.

Fuller found instant success in the civilian milieu as well. Perhaps the greatest single achievement of the Geodesic concept was the construction in 1957 of the Union Tank Car Dome in Baton Rouge, Louisiana. The structural efficiency of the dome was here demonstrated to dramatic effect by a 384-foot clear span, larger than the previous record spans of St. Peter's in Rome and the Pantheon. By this time, a 100-foot travelling version of the dome had made its first expositionary appearance, delivered by a single DC-4 to a trade fair in Afghanistan, and erected in under 48 hours. The function of symbolic enclosure for economic and cultural exhibits was to become the Dome's most enduring legacy, particularly at Expo 67 in and in a largely forgotten proposal for covering the 1964 World's Fair in New York with a mile-wide dome covering nearly 650 acres (9).

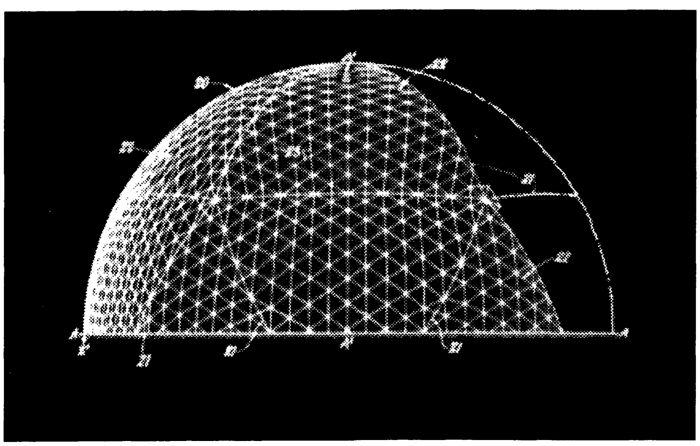

Fig. 7. R. B. Fuller. Geodesic Dome Patent Document. 1954.

One might expect that Fuller, age 65 at the time of his 1959 appointment at Southern Illinois University, would have been content to enjoy the long-overdue success of his industrial vision. Instead, he actually accelerated his theoretical production throughout the 1960s and into the 1970s, during which he proposed his most challenging schemes yet. In 1962, while on a visiting professorship at Harvard Fuller noted that it was a year

> *"...of transition of comprehensive technology from dry land into sea and into sky, from visible to invisible, because more-with-lessing, through transistors, metallurgy, chemistry, electronics, and atomics transfers all basic controls to invisible ranges" (10).*

It is to Fuller's great credit that, having served as self-appointed supervisor of humankind's transition into an industrialized society, he so quickly recognized the massive paradigm shift that occurred in the 1960s. The advent of electronic computing, the exponential advancement of vehicular and infrastructural technologies, and the growing presence of satellite-fed worldwide communications networks all forced Fuller to radically alter his thesis of Dynamic Maximization. Previously concerned primarily with economic and production efficiency, he now embarked on a series of projects which pushed social and ecological factors to the forefront, again seeing his commissioned site as the entire planet, but now understanding that site as far more than the profit-linked vectors of his Dymaxion Strategy and Map. The continuing ephemeralization and global distribution of geodesic structures was matched, on Fuller's part, by a willingness to envision the planet as a collection of dispersed data points—connected to, but not fully represented by, the shipping and transport links of his cartographic projects. Toward this end, it is possible to see his post-1960 work as a vision of a Geodesic world rather than a Dymaxion one, in which the deterministic vectors of infrastructure and capital were to give way to a non-hierarchical, ultimately efficient network of distribution for economic and physical resources. The instantaneity of electronic communication, coupled with rapid advances in air-ocean transport, shrunk the globe of "spaceship earth" even as Fuller's geodesic spheres were expanding their scale and dispersion.

The vision of a resource-engineered "spaceship earth", in which locally dependent communities could rely on the responsible engineering of other sites for their own benefit, was a succinct statement of the "think global, act local" mantra of the burgeoning environmental movement. Intriguingly, the military-industrial complex, once his primary source and client, came to be in Fuller's mind the fundamental evil of American society, the major source of material waste and resource inequality in the world. In response to this inefficiency, Fuller proposed a military-style assault on substandard living conditions throughout the globe, introducing the idea of World-Gaming, or the mathematical modeling of all available inventory and distribution methods, as a counterforce to existing conditions:

> *"A vast overabundance of this...cosmic energy income is now technically impoundable and distributable to humanity by presently known technology. We are not allowed to enjoy this because...government bureaucracies and...big business can't find a way of putting meters between these cosmic energy sources and Earth's passengers, so nothing is done about it." (11)*

Fuller's later philosophy can be usefully broken down into three distinct arguments encompassing the relationship between technology, architecture, and society— the importance of a universally scaled consciousness, the now reconfigured cultural and technical imperatives of ephemerality and velocity, and the demand that all "design" achieve demonstrable socio-objective performance.

The most immediate point of this trinity is that of universality. Based on Fuller's continuing obsession with global geometry, the conception during the 1960s of a planetary architecture was symbolic of the cultural revelation that the entire planet could be considered a site for intervention. Global interdependence would lead, inevitably, to the environmental colony approach inherent in Fuller's so-called "giant projects":

> *"Today the world is my backyard. 'Where do you live?' and 'What are you?' are progressively less sensible questions. I live on earth at present, and I don't know what I am. I know that I am not a category. I am not a thing—a noun. I seem to be a verb, an evolutionary process—an integral function of the universe" (12).*

The idea of the human population as a system of "verbs on earth" is a compelling one, as it implies not only a global call to ecological action, but also an intricate realization of the geodesic network on an infinitely refined, but planetary scale. The dissemination of humanity as agents of positive change, each representing a point of action on a geodesic "Strategy Map" recalls the ultra-efficient mesh of global colonization proposed by the Wichita House. Here, though, such a non-hierarchical organization displays powerfully the sea change in Fuller's politics, as it simultaneously proposed the interdependence and independence of individuals in a global system.

Fuller's post-1945 work also advanced the two Dymaxion notions of ephemeralization and velocity towards new levels of societal engagement. His earlier projects had focused on lightweight architecture as a pure goal of structural performance and on speed as a factor in the economic viability of the Dymaxion delivery systems. However, after 1945 these ideas became linked in the realm of the subatomic, which Fuller adopted as a basis for an entirely new synthesis of his earlier world views with contemporary achievements in physics. While Fuller had, at best, an incomplete understanding of relativity, its metaphors of constant velocity and flux had profound implications for his architecture. Relativity proposed a post-Newtonian world, in which the stuff of matter was to be relentlessly questioned, leading to the dismissal of statics as a useful tool in theoretical physics. In Fuller's 1970 essay, "Architecture as Sub-Ultra Invisible Reality", he proposed what he saw as the ultimate consequences of relativity in the physical world:

> *"Despite the fact that they fool themselves into believing so, humans do not build structures with materials. As now informed by our electro-magnetic spectrum discoveries, we must recognize that man assembles visible module structures with sub-visible module atomic events. Physics has failed to discover solids, or continuous surfaces, or straight lines, or any solid materials. Physics has discovered only kinetic events. There are no things"(13).*

The transition of the physical world from "things" to "kinetic events" implied not only a new conception of matter, but also a translation of the models upon which architecture might be based. In projects such as the Manhattan Dome, for example, Fuller suggested that the elements of such a structure might be reduced in proportion to such a great extent that they would become invisible, more in the realm of energy links than actual structural members.

Fig. 8. R. B. Fuller. Proposal for Midtown Manhattan Dome. 1960.

The ends toward which these advances were to be applied could be none other than the benefit of the world's population as a whole, and the idea of a socio-objective performance standard for architecture is what elevated Fuller's thought above mainstream debates over technology and society in the 1960s. Amidst such prodigals as Peter Cook and the Archigram group, or the "drop out" geodesic dome communities of the era, Fuller's developing theory on the potential for engagement with society by an architecturally produced economic efficiency stood as a powerful challenge. Structural and productional ephemerality were, in his view, necessary to provide the maximum benefit to the population with minimum use of resources—"more with lessing," or the economic use of both 'nouns' and 'verbs'. Resources on a shrinking globe, Fuller reasoned, must also be shrinking, and the continued poverty of third world citizens (even, as he pointed out, in the U.S.) became his guiding cause.

One of the consequences of Fuller's socio-objective concern was his rejection of the military-industrial complex, a complete turn of allegiance from his work through the late 1950s. Much as Corbusier had proposed an "aerial assault" on urban issues throughout the 1920s, Fuller in the 1960s proposed a redirection of military effort, or what he termed "World War Gaming" into the global distribution of income and resources—the concept of "World Gaming." The transition from "weaponry" to "livingry", as Fuller put it, would free up enough resources that "all humanity would have the option of becoming enduringly successful" (14).

It is testament to Fuller's all-encompassing vision of 'Spaceship Earth' that, as his design projects were becoming progressively larger, approaching a global scale, he was simultaneously promoting consciousness on a sub-atomic level. His activist philosophy was a neat analogy to Einstein's equation of physical matter with energy, and this comparison provided an intriguing conclusion to a career that had obsessively pursued questions of matter, velocity, and energy. From his earlier fascination with architecture on a vehicular scale, through his conception of the Dymaxion World as a system of ephemeral networks, to his realization that the material world was actually equivalent to the world of energy, Fuller's thought paired architecture not with artistic movements, but rather with the abstractions of theoretical physics and the absolute realities of the global economy. That these scientific abstractions were to be employed towards social, distinctly anti-political ends reflects the maturity of his thought through the 1960s (15).

Fuller's transition from the "Dymaxion American" to a socially concerned, global sustenance engineer, provides us with a model for architectural production that continues to have validity in contemporary debate. The considered use of technological innovation as a method for distributing or conserving scarce resources is well in line with twenty-first century concerns, and suggests a powerful example for production in today's digital climate. By transforming his production from the hardware-based Dymaxion House, through such resource engineering projects as the Wichita House, and into the realm of globally responsible efforts, Fuller's world view of humankind's relationships to itself and to its received site matured continually. The energetic geometries of the Dymaxion Map provided the key turning point in his career, allowing the mathematical efficiency of his life's work to take into account the global situations of substandard housing, food, etc. The coupling of intellectual production with the recognition of actual global situations should give pause to current practitioners and theoreticians, as it suggests a worldwide responsibility and engagement beyond that which the field currently appears willing to acknowledge.

NOTES

[1]R. Buckminster Fuller. "Fluid Geography, a Primer for the Airocean World." *North Carolina State School of Design Journal* (1954): 42. (Originally printed in *American Neptune*, April, 1944 and included in James Meller, *The Buckminster Fuller Reader*).

[2]"The Dymaxion American," *Time* (January 10, 1964): 47.

[3]Robert Snyder. *Buckminster Fuller. an Autobiographical Monologue/Scenario* (NYC: St. Martin's Press, 1980): 33.

[4]R. Buckminster Fuller. "Designing A New Industry," in Meller, James, ed. *The Buckminster Fuller Reader* (Middlesex: Penguin, 1970): 83.

[5]"The Dymaxion American," *op. cit.* 49.

[6]"Fluid Geography, a Primer for the Airocean World," op. *cit.*_47.

[7]Martin Pawley, *Design Heroes: R. Buckminster Fuller* (London: Harper-Collins, 1990). Fuller characteristically turned this near disaster into a positive outcome, announcing that the studio had, in fact, demonstrated the inherent safety in the concept—the collapse had been slow enough to allow the terrified students within to escape. Pawley fairly relates this incident, as well as the controversy between Fuller and Kenneth Snelson regarding the authorship of the "Tensegrity" concept.

[8]R. B. Fuller and Kiyoshi Kuromiya, *Critical Path*, (London: Hutchinson, 1973). 175.

[9]"The Dymaxion American" *op. cit.* 46.

[10]*Critical Path* 391.

[11]R.B. Fuller, "Guinea Pig B." Introduction to *Inventions: The Patented Works of R. Buckminster Fuller*. (New York: St. Martin's Press, 1983). p. viii.

[12]"The Dymaxion American," *op. cit.* 50.

[13]R. B. Fuller. "Architecture as Sub-Ultra-Invisible Reality," *World Congress of Engineers and Architects 1970*: 15.

[14]*Critical Path*, xxv.

[15]In fact, recent developments in organic chemistry may prove Fuller's vision to be more accurate than he might have even hoped. In the early 1990s, the discovery of new carbon atom formations in the mathematical shapes of geodesic spheres sent excited ripples through the scientific community. The distribution of chemical bond energy along the hyper-efficient geometrical surfaces of these atoms could give them physical properties unlike any other substance known. Christened "fullerenes", the new forms of carbon hold potential as both highly efficient structural materials, and as electric superconductors. Their simultaneous use as physical and energical material would prove Fuller's geodesic concept as precisely as the realization of his "noun-verb" principle, and it would undoubtedly find ecological and social applications at once. "Fullerenes" *Scientific American* (Oct. 1991) 58-59.

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