Phase II, (1967) Document 5

COMPREHENSIVE DESIGN STRATEGY

by: R. Buckminster Fuller

World Resources Inventory
Southern Illinois University
Carbondale, Illinois
U. S. A.

ACKNOWLEDGEMENTS

Permission to reprint various writings is gratefully acknowledged to the following publishers:

Man with a Chronofile:

Saturday Review
April 1, 1967.

Vision 65 Summary Address:

American Scholar
Phi Beta Kappa Quarterly
Spring, 1966.

Document layout and indexing by Dale D. Klaus, Research Assistant to R. Buckminster Fuller.

Other volumes in this series are:

Phase I, (1963) Document 1: Inventory of World Resources,
Human Trends and Needs
by R. Buckminster Fuller and John McHale

Phase I, (1964) Document 2: The Design Initiative
by R. Buckminster Fuller

Phase I, (1965) Document 3: Comprehensive Thinking
by R. Buckminster Fuller

Phase I, (1965) Document 4: The Ten Year Program
by John McHale

World Resources Inventory
Southern Illinois University
Carbondale, Illinois
U.S.A.

PHASE II, (1967) Document 5

CONTENTS

APPENDICES

MAN WITH A CHRONOFILE

By Buckminster Fuller

I was born cross-eyed. Not until I was four years old was it discovered that this was caused by my being abnormally farsighted. My vision was thereafter fully corrected with lenses. Until four I could see only large patterns, houses, trees, outlines of people with blurred coloring. While I saw two dark areas on human faces, I did not see a human eye or a teardrop or a human hair until I was four. Despite my new ability to apprehend details, my childhood's spontaneous dependence only upon big pattern clues has persisted.

Most children like to collect things. At four I started to collect documents of my own development as correlated with world patterns of developing technology. Beginning in 1917, I determined to employ my already rich case history, as objectively as possible, in documenting the life of a suburban New Englander, born in the Gay Nineties (1895)-the year automobiles were introduced, the wireless telegraph and the automatic screw machine were invented and X-rays were discovered; having his boyhood in the Turn of the Century; and maturing during humanity's epochal graduation from the inert, materialistic nineteenth into the dynamic, abstract twentieth century. I named my documentation the Chronofile.

As the era of this case history loomed into greater perspective for me, as readable in the Chronofile, it became more accurately identifiable as that which, on the one hand, terminated Sir Isaac Newton's normally "at rest" world of myriadly and remotely isolated, hybrid cultures, to which change was anathema; and, on the other, opened Einstein's normally "dynamic", omni-integrating world culture to which change has come to seem evolutionarily inevitable. By 1917 I was convinced that, unannounced by any authority, a much greater environmental transformation was beginning to take place in our generation's unfolding experience than had occurred, for instance, between my father's, grandfather's, great-grandfather's, and great-great-grandfather's successive generations. Their writings contain glimpses of their lives in their successive undergraduate days in the classes of 1760, 1801, 1840, and 1883 at Harvard. They tell of day-long trips walking or driving from Cambridge to Boston via Watertown Bridge.

As in 1913, in Fair Harvard's "Age that is past/surrendered her o'er (once more)/ to the age that" was "waiting before," I felt intuitively in our freshman year that the subway, which then opened to connect Cambridge and Boston by a seven-minute ride, was harbinger of an entirely new distance-time relationship of humanity and its transforming environment. It seemed to me that the science-quaking fact of our boyhood was that light has a speed. Though fantastically fast, its 700 million miles per hour is not as absolutely fast as Newton's "instant universe." Newton's foundation was experimentally unrealistic. Light was real-but 99 per cent of reality's electro-magnetic spectrum was invisible. We could no longer pilot with our physical senses. We had henceforth to rely upon intellect and its power to in-vent and navigate with the instruments which could tune and scan the vast ranges of nonsensorially tunable reality. This called for intellectual confidence in the fundamental but non-obvious trends, and disregard for the only momentarily spectacular news.

Average life-span expectancy for our classmates born circa 1895, as then calculated by the life insurance actuaries, was forty-two years. During our lifetime, the average life expectancy in the United States has increased to seventy years. Up to the time we were born, the average total distance covered by a member of humanity in his all-time, average life span of twenty-seven years, was 30,000 miles. My total travel to date, by land, sea, and air, is a hundred-fold that distance. It aggregates more than 3,000,000 miles and now, at

---

First published in "Saturday Review", April 1, 1967.

seventy-two years, I find my work often taking me annually several times around the world with many lesser to-and-froings. This is in no wise a unique record. It is average for ever increasing millions of humans who have responsibilities in the vast frontiers of technology, business, and statecraft of a swiftly emerging spherical world city. Today's air hostesses far out-travel me, and Gemini astronauts outdistanced my 3,000,000 miles in one week's orbiting. Quite clearly, a complete transformation of human ecology in universe is occurring. It is not surprising that man, burdened with obsolete "knowledge"-his spontaneous reflexing conditioned only by past experience, and as yet unable to realize himself as being already a world man-fails to comprehend and cope logically with the birth of Universe Man.

By 1927 I felt that three big questions were posed by what the Chronofile as then made visible by the foregoing type of information.

First what could society, backing up into its future, with eyes fixed only on the ever receding and less adequate securities of yesterday, do to make this evolutionary process a gratifying rather than a painful experience?

Second, what could the average intelligent and healthy, moneyless individual best contribute, singlehandedly, toward bringing the earliest and happiest realization of advantage for society in general through taking and maintaining the comprehensive, anticipatory design-science initiative-in the face of the formidable axiomatic errors and inertias of academic authority as well as the formidable economic advantage of the massive corporations and their governments and mutually shortsighted foci of resource and capabilities exploitation?

Third assuming that by competently reforming only the environment instead of trying to reform man, a favorably designed environment can be realized which will both permit and induce man to accomplish the same logical degree of physical success in universe as is manifest, for instance, by the hydrogen atom, how then can the economic and technological capability of all humanity to enjoy freely all of its world be accomplished exclusively by design science, without any individual interfering with another and without any individual being advantaged at the expense of another, with a design that will also induce its spontaneous adoption by world industrialization’s managers?

In 1917, in the U.S. Navy, as I studied these questions the Chroaef4&-4iscl-osed a technological-environment-regenerated acceleration of technical evolution. This concept of accelerating acceleration, which had been-discovered by Galileo and was later identified with gravity by Newton, had not been conceived of as accelerating social evolution. During 1922-1927 the Chronofile also disclosed a trend of comprehensive ephemeralization -i.e., the doing of ever more with ever less, per given resource units of pounds, time, and energy. Ephemeralization was vastly augmenting: the standards of living of ever increasing numbers, but only inadvertently, as fallout from the defense-subsidized preoccupation of science with a weaponry supporting industrialization.

Ephemeralization was also accelerated by ever increasing quantities of invisible energy events of universe, detoured by human intellect from their previously only cosmically flowing patterns to flow through engineered channels and impinge upon intellect-invented levers and thereby to vastly augment the work accomplishable by mankind’s muscles in re-arranging the energetic environment events to more effectively sustain the metabolic regeneration of human life.

Ephemeralization, which constantly does more with visibly less-as does, for instance, the one-quarter-ton communications satellite outperform 150, 000 tons of transoceanic cables-

has not as yet been formally isolated, recognized, and discussed in print as such by any economists. Until economists recognize it, ephemeralization cannot be popularly comprehended and be adopted in public policy formulations.

However, as the years have gone by the combined effects of accelerating-acceleration and ephemeralization account primarily for the technical and economic augmentations which are now overwhelming man-trying to make him a success in universe despite his age-old Malthus-supported conviction that humanity, regardless of its composite significance and fate, is, with but a few exceptions, destined to demonstrate personal economic failure and premature death. Public policy the world around as yet assumes that Malthus was right-ergo, the vital necessity of Defense in view of the inexorability of the next Great War.

My Chronofile gradually disclosed the invalidity of that great superstition. It showed, for instance, that the metals in 80 per cent of all of yesterday's obsolete mechanics and structures, contrary to popular conception of their ”exhaustion, ” have been recovered, re-fined as "pure metals, ” and put to work again. Eventually, 99 per cent of the all-time mined metals will be recovered and put into the recirculating-metals bloodstream of world industrialization as we go competently into the sea to recover all of yesterday’s lost ships and cargoes-in particular, the war-sunken munitions vessels. But the rate of discovery of additional metal ores is slower than human population increase.

Throughout the twentieth century, therefore, the metals mined or unmined and materials in general have continually decreased in ratio to each individual. At this moment the cumulative total of metals-mined and refined by man throughout history-is wholly employed in machines or structures which, operating at full design-limit capacity, can successfully support only 44 per cent of living humanity. Therefore, no exclusively political act of any political system can make the world's resources take care of more than 44 per cent of humanity. But the over-all mechanical efficiency of the extant machinery and structures is only 4 per cent. An over-all efficiency of 20 per cent is engineeringly feasible at present. It could go to 80 per cent someday. A design-science revolution could solve the problem.

Despite the constant increase in human population and constant decrease of materials per person, between 1SOO and 1965 the number of people attaining economic and physical success-by full participation in the highest standard of living progressively developed by world industrialization-rose steadily from less than 1 per cent to 40 per cent of all living humanity. This is a personal standard of living and health superior to that ever enjoyed by a pre-twentieth-century monarch. The 40 per cent of humanity thus surprisingly grown successful, despite constantly diminishing material resources per capita, can be explained only by accelerating ephemeralization.

Paradoxically, the self-accelerating doing-more-with-less invention revolution has been generated thus far almost exclusively by the technology of the world’s weaponry race, whose ultimate objective has always been to deliver the greatest blows the farthest, most accurately, and most swiftly with the least effort. Evolution seems intent upon making man a success despite his negative fixations. The doing-more-with-less economic success of 40 per cent of humanity, accomplished in only half a century, cannot be attributed to any political doctrine. Technology has flourished equally under exactly opposed ideologies.

Take away the energy distributing networks and the industrial machinery from America, Russia, and all the world's industrialized countries, and within six months more than two billion swiftly and painfully deteriorating people will starve to death. Take away all the world's politicians, all the ideologies and their professional protagonists from those same

countries, and send them off on a rocket trip around the sun and leave all the countries their present energy networks, industrial machinery, routine production and distribution personnel, and no more humans will starve nor be afflicted in health than at present.

Fortunately, the do-more-with-less invention initiative does not derive from political debate, bureaucratic licensing, or private economic patronage. The license comes only from the blue sky of the inventor's intellect. No one licensed the inventors of the airplane, telephone, electric light, and radio to go to work. It took only the personally dedicated initiative of five men to invent those world-transforming and world-shrinking developments. Herein lies the unexpectedly swift effectiveness of the invisibly generated and inexorable design-science revolution. Politics is, inherently, only an accessory after the fact of the design-science revolution. Despite this historically demonstrable fact, world society as yet persists in looking exclusively to its politicians and their ideologies for world problem-solving.

Within all the foregoing concepts and in view of the low technical advance in every-day dwelling facilities as compared to transport and communication developments, my 1927 Dymaxion House was invented to function in due course as a prime instrument in an air-deliverable, mass producible, world around, new human life-protecting and nurturing, scientific dwelling service industry as the preferred means of transferring the scientific do-more-with-less capability from a weaponry to a livingry focus. I saw that a technology which produced total economic success for humanity could eliminate the fundamental causes of war, i.e., "you or me to the death-on behalf of yours or mine-for there is not enough to sustain us both". the seemingly scientific fact established by Thomas Malthus and later fortified by Darwin’s survival-only-of-the-fittest. All else that I have done since then has related to these design-science considerations.

Thus in 1927 I embarked on a lifelong undertaking whose earliest possible realization lay a quarter of a century ahead, i.e., in 1952 (the year the Ford Motor Company acquired my first large Geodesic Dome) with full-scale, world-around industrialization of the livingry service industry to be realized only half a century ahead in 1977. I predicated the economics of my grand strategy upon my own superstition-free concept of wealth as consisting exclusively of integrated intellect and energy. Since science's Law of Conservation of Energy states that energy may neither be created nor lost and experience shows that every time intellect experiments with energy it learns more, wealth can only increase.

Despite their negatively accounted cost and theoretically incurred debt and wastage of more than a trillion dollars, World Wars I and II and subsequent cold warring have rendered the United States ever more vastly wealthy, despite the additional hundreds of billions of dollars lend-leased- or given away. Why? Because those wars required ever more automated tool-up to harness more universe energy to do ever more continuous work on an earth whose total industrialization’s percentage of strictly killing tools has become a progressively negligible minor fraction. The harnessed energy, production, distribution, communication tools, and techno-scientific literacy thus inadvertently established-all of which can produce peace-supporting prosperity-is the wealth.

There are two prime sources of energy to be harnessed and expended to do work. One is the capital energy-saving and storage account; the other is the energy-income account. The fossil fuels took multi-millions of years of complex reduction and conservation, progressing from vegetational impoundment of sun radiation by photosynthesis to deep-well storage of the energy concentrated below the earth's surface. There is vast overabundance of income energy at more places around the world, at more times to produce billions-fold the energy now employed by man, if he only knew how to store it when it is available, for use when it

was not available. There are gargantuan energy-income sources available which do not stay the processes of nature's own conservation of energy within the earth crust "against a rainy day." These are in water, tidal, wind, and desert-impinging sun radiation power. The exploiters of the fossil fuels, coal and oil, say it costs less to produce and burn the savings account. This is analogous to saying it takes less effort to rob a bank than to do the work which the money deposited in the bank represents. The question is cost to whom? To our great-great-grandchildren, who will have no fossil fuels to turn the machines? I find that the ignorant acceptance by world society's presently deputized leaders of the momentarily expedient and the lack of constructive, long-distance thinking – let alone comprehensive thinking – would render dubious the case for humanity's earthian future could we not recognize plausible overriding trends.

The only visible means of converting the momentum of negative employment of the physical principles operative in universe into making man a lasting success is in the design-science invention revolution, which fortunately may be joined by individual initiative founded on comprehensive intellectual integrity.

Whether all of my assessment of our historical position is correct and whether my grand strategy may be winning or not may possibly be readable in statistics that reflect the sudden surge of attention to and application of my ideas in the past five years. Though for more than half a century I have been purposefully disregarding the "earning of a living" or "money-making" in my occupational deliberations, my efforts sustaining but only incidentally accruing income, the income--low and slow at first--has steadily increased to ever more effective magnitude.

What, if any, is the significance of this upsurge? It seems to say that the generalized principles governing world industrialization which I seemed to discern, and the evolutionary events which they seemed to make predictable, are now tending to be con-firmed by unfolding events. My activities upsurge also probably reflects the fact that my world-around buildings are enclosing thirty-fold the clear-span interior space per pounds of material of any known alternative clear-span engineering systems designed to withstand the same hurricanes, snow loads, and earthquakes. It also reflects the recent years' experimental confirmation in various regions of science of nature's use of the mathematical coordinate system which I long ago discovered and developed.

The upsurge probably further reflects the growing realization by world youth that its desire for success for all humanity can never be accomplished by politics, which is inherently divisive and biased and, to be effective, must eventually have recourse to its ultimate tools of war-making; and that fundamental world peace probably can be accomplished only by a design-science revolution which can and may realize the feasible potential by upgrading the performance per units of resources to provide 100 per cent of humanity with an ever higher standard of living.

The upsurge probably reflects as well the realization of increasing numbers of the world's youth that world peace probably can be accomplished twenty years faster by a deliberate design-science revolution than by waiting for the inadvertent twenty-years-later-fallout into the standard-of-living-advancing-commerce of the accelerating ephemeralization, as originally promulgated by only a wide variety of basic fear motivations, all of which result in the self-protective world-munitions racing. The world youth intuit that the twenty-year difference could be the difference between humanity's success or extinction.

The upsurge also probably reflects the support I am receiving from industry and

the National Aeronautical and Space Administration in my answer to those who say, ”Why don't we stop spending billions for going to the moon and spend the money solving the world’s housing problems!" My answer is that we will not have developed the high level of technology with which to successfully sustain all of the games-preoccupied human passengers on the promenade deck of the Good Ship Earth until we give total chemical, physical, and medical science and technology the task of understanding and successfully supporting humans as regenerative metabolic processes anywhere in universe for protracted periods, remote from the complex, regenerative, life-sustaining conditions unique to the biosphere surrounding earth, with the total scientific information translated into the mechanisms and content of a little black box weighing about 500 pounds and requiring replenishment only yearly. Only by the stark, resourceless conditions thus imposed upon experimental science will humanity be forced to transcend its erroneously conditioned earthian reflexes which would otherwise continue to frustrate it with worthless opinions, politics, and war after war.

The upsurge in the accrediting of my functioning is also probably related to my forty years' earlier forecast of the last decades' admission by world-around science that Malthus is wrong and, granted removal of all political boundary restrictions, that the physical resources of earth can support all of a multiplying humanity at higher standards of living than anyone has ever experienced or dreamed.

The upsurge further reflects the recent enthusiasm of scholars and natural scientists for my definition of universe as the cumulative aggregate of all humanity's nonsimultaneous experiences, all of which are finite and include both the ponderable physical and the imponderable metaphysical; with the entropic, increasingly orderly contraction of anti-entropic, metaphysical universe.

The scholars have also commented favorably on my philosophic observations that the omni-interacting, weightless, generalized principles apparently governing universe – discovered only experimentally and progressively by human'-intellect-directed science--disclose an a priori, anticipatory, amorphous, and only intellectually conceivable, omni-integrity of universe. By virtue of this integrity the generalized intellectual principles governing physical universe interactions and transformations never fail to provide an orderly set of consequences for any of its interacting events or for our own arbitrary or accidental experiments. We are thus confronted by a universe in which an intellect such as Einstein's could hypothetically take the measure of the physical energy universe, a measure which atomic fission later verified experimentally, thus demonstrating intellect’s embracing and equating the integrated and differentiated energy of physical universe as $E=mc^2$. There has not been, however, either experimental evidence or intuitive suggestion of the reversibility of those conditions and results whereby physical energy might take the measure of intellect, equate and inscribe the integral and differential equation of intellect and the metaphysical universe.

No scholars have published refutations of my widely publicized conclusion that all of the foregoing brain-recorded, mind-sorted, and comprehended experiences clearly disclose an infinitely greater a priori, omni-anticipatory, intellectual integrity embracing and permeating universe than that demonstrable or suggested by any known capability of any individual human intellect – nor of the integrated, cumulative capabilities of all of history's human intellects – to control total universe in such a manner as to account for all the foregoing experimentally evidenced, omni-integrated, complex behaviors of universe. Wherefore the comprehensive, superhuman, nonanthropomorphic, Universal Intellectual Integrity thus altogether manifest to man by the integrated discoveries of experimental science may be spoken of as God, for that is the most economical term

thus far intuitively formulated by humanity to identify such a macromicro, human-capability-transcending, anticipatory, embracing, and inspiring relationship.

What intellect invented the integral of all the only intellectually conceivable, weight-less, generalized principles discovered by science to be omni-operative as governing every physical experiment? Until man can answer that question he will have to accept an a priori intellect greater than his own.

I am convinced that neither I nor any other human, past or present, was or is a genius. I am convinced that what I have every physically normal child also has at birth. We could, of course, hypothesize that all babies are born geniuses and get swiftly de-geniused. Unfavorable circumstances, shortsightedness, frayed nervous systems, and ignorantly articulated love and fear of elders tend to shut off many of the child's brain capability valves. I was lucky in avoiding too many disconnects.

There is luck in everything. My luck is that I was born cross-eyed, was ejected so frequently from the establishment that I was finally forced either to perish or to employ some of those faculties with which we are all endowed – the use of which circumstances had . previously so frustrated as to have put them in the deep freezer, whence only hellishly hot situations could provide enough heat to melt them back into usability.