III. LaRouche's Design for the Moon-Mars Mission

1986

The Science and Technology Needed To Colonize Mars

by Lyndon H. LaRouche, Jr.

PART 1 OF 2 PARTS

April 20, 2019—It will be evident to the reader that Lyndon LaRouche's ideas expounded in this 1986 article have stood the test of time magnificently, and must light our way today. But certain circumstances would have changed Mr. LaRouche's way of expressing them were he writing this during the Twenty-First Century. Writing in 1986 when the United States was in a form of confrontation with the then-Soviet Union, LaRouche spoke of the Mars colonization mission as a U.S. mission. But later, after the breakup of the Soviet Union, he wrote of it as a cooperative international mission in which Russia, China, India, Japan and other applicable nations would be invited to join as sovereign equals. This article was first published in the November-December 1986 issue of Fusion *magazine.*

Rarely mentioned in news media accounts so far, forces around President Ronald Reagan are now working industriously to elaborate what could be seen by future generations as the crowning achievement of Mr. Reagan's Presidency: the commitment of the United States to establishing a permanent colonization of the planet Mars, 40 years from now.

Such a mission-assignment for the United States is fully feasible today, on the condition that we recognize that about 40 years of step-by-step work will be needed to bring us to the point that we can build the first self-sustainable Earthlike artificial environment under "domes" on Mars. We are presently developing each and all of the new technologies needed to accomplish that, although it will require about 40 years of scientific development and engineering to bring us to the point of applying those technologies to this specific task.

It is also economically feasible. For every penny

NASA/JSC

Artist's concept of a manned rover departing a Mars landing craft.

spent on the research and development work of the NASA-manned landing on the Moon, we gained between 10 and 20 cents of income, perhaps even more, from the application of those technologies to our civilian economy. Civilian use of new technologies we shall be developing in connection with the Mars-colonization mission, will increase the average productivity of labor by at least tenfold over the coming 30 to 40 years, perhaps two to threefold by approximately the end of this present century.

The Mars-colonization mission is not only feasible, both technically and economically; it is urgent that we undertake this project, both for scientific reasons, and also for economic reasons. There are certain classes of technical and economic problems now developing on Earth, which we shall not solve on Earth without help from some of the scientific and economic by-products of a Mars-colonization project.

Above all, it is time that we begin work on that project.

The purpose of this present report, is to assist both policy shapers and the general public in understanding the most basic features of a 40-year Moon-Mars-colonization mission-assignment. We describe the most basic features of the project itself. We also describe the way in which such a project will affect life on Earth during this 40-year interval. The objective of the report is to provide the reader with an integrated view of both the project itself, and its impact on our lives back here on Earth.

The Technologies Needed for Regular Travel Between Earth and Mars

By about the time our astronauts first landed on the Moon, the United States had worked out most of the technologies needed for establishing an industrial colony on the Moon. Had the NASA program not been scaled down repeatedly, beginning with the 1966-1967 cutbacks, the United States would already have today, a functioning industrial colony on the Moon. With approximately 10 years of effort, beginning today, we could rebuild our space-mission capabilities to the point that we could begin such a colonization of the Moon.

For several reasons, the colonization of Mars can not be accomplished with the technologies we had either developed, or were working to develop, at the beginning of the 1970s. Essentially, the difference boils down to the fact that Mars is a far greater distance from the Earth than the Moon is. We need more advanced technologies to overcome the several kinds of effects of that great distance.

Therefore, setting the date for colonizing Mars had to wait, until we had begun to master four kinds of new physics breakthroughs: controlled thermonuclear fusion, as the primary source of energy used, lasers and other forms of coherent electromagnetic pulses as a basic tool, new developments in biological science of the kind now emerging around optical biophysics, and much more powerful, more compact computer systems to assist us in handling these new physics technologies. During the past dozen years, we have made some spectacularly promising breakthroughs in the four areas just listed. At an easily foreseeable rate of continued progress in these four areas of technology, all the conditions for establishing the first permanent colony on Mars could be met approximately 40 years from now.

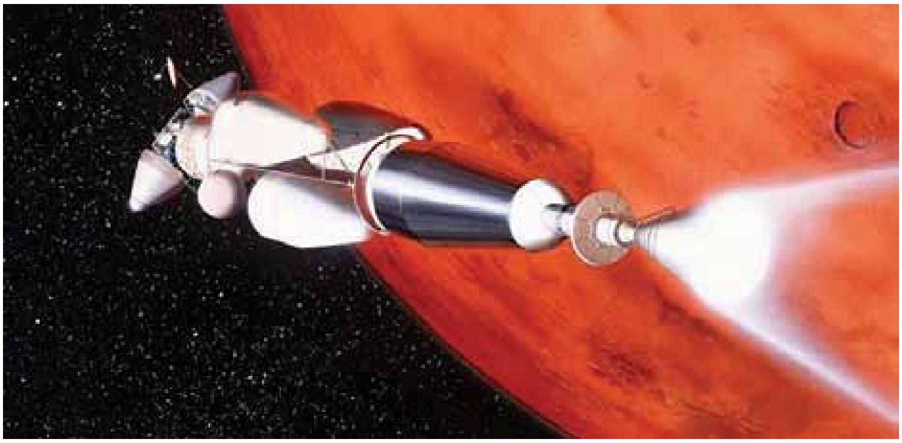
For example: to bridge the long distances between Earth and Mars, we need continuous acceleration for about half the journey, and continuous deceleration for the second half. For the sake of the health of the passengers, it would be desirable to maintain the equivalent of a standard gravity on the surface of the Earth during the flight; the easiest way to do this is to fly the spacecraft at the appropriate constant rates, of both acceleration or deceleration. The proper way to achieve such continuous acceleration, is by use of controlled thermonuclear fusion, preferably using modes of fusion we call inertial confinement.

On the surface of Mars, we shall require a great deal of artificial energy. We shall consume much more energy per person than in the most developed industrial regions of Earth today, simply to maintain an agreeable artificial environment. The basic industries we develop on Mars, to produce essential materials from the natural resources available there, will operate at much higher temperatures than are used in any basic industries on Earth today. For these uses, we require energy generated at very high energy densities. This requires what we call today the second-generation level of controlled thermonuclear fusion, which should be on-line about 25 to 30 years from now.

The most common industrial tool we shall use on

Mars is advanced forms of what we call lasers and coherent particle beams.

To master the problems of biology, both on Mars itself, and in long interplanetary flights, we require development of what we call today *optical biophysics*. Work in this area has been under way in the Soviet Union for decades, and, has begun to take off in the Western countries more recently.


NASA/Pat Rawlings (SAIC)

Artist's conception of a fusion rocket orbiting Mars.

To handle the new kinds of industrial processes used, both on Mars and in interplanetary flight, we require systems which use much more powerful computers than exist today, computer units which can perform the equivalent of a billion floating-point arithmetic operations in an average second, and also computer units which can perform what are called nonlinear calculations at the speed at which the controlled processes are reacting. The first kind of improvement in computer systems is already in progress, and first steps are now being made on the second problem.

So, one of the reasons we must allow 40 years for the beginning of permanent colonization of Mars is that decades are required to develop these four sets of technologies up to the level they are fully reliable for use at great distances from the nearest repair shop on Earth.

There are other reasons we must allow so long a period of time. Before we actually start building the first permanent habitation on Mars, we must complete a series of preliminary steps. The best way to view these steps is to look backward from a point in the imagination, about 40 years ahead. At that point, we shall have assembled in orbit above Mars, all the gear we need, to be taken down to the surface of Mars to begin building the first permanent habitation. Let us consider some of the steps which must be completed, before we have reached that point of readiness to begin the permanent colonization.

We start with the assembly of all this gear in Mars-orbit, and trace our steps backward, to indicate at least some of the major steps of preparation.

In the Orbit of Mars

Before beginning to construct the first permanent colony on Mars, we shall have made a significant number of interplanetary flights from Earth-orbit to Mars-orbit, and return. These flights will haul the materials needed to begin the colonization from something like a great railway freight classification yard, in an orbit perhaps about 22,000 miles above the surface of Earth. The spaceships will haul this material from Earth-orbit to Mars-orbit, and return for another load.

Let us suppose that we use one of Mars' moons, Phobos, as the destination to be reached by those spaceships carrying freight. We might prefer to use a large orbiting, manned station, rotating to provide the personnel inside a reasonable gravity effect. The first thing would be to construct such a manned station, on which technicians and scientists would serve a tour of duty, before catching a return flight to Earth-orbit. The primary missions of the station will include the functions of serving as a spaceport and providing warehouse-management for the freight being parked, entrusted to their supervision, in Mars-orbit.

Let us turn our attention to those space vessels carrying the freight and personnel. Each will be very large, much larger than today's ocean supertankers. They will not fly on long solitary flights; since the United States began working on a manned Mars mission, at the beginning of the 1950s, it has been understood that the ships will fly in flotillas, each commanded by its captain, and the flotilla under the immediate, overall command of a flag-officer, of the rank equivalent to naval commodore or admiral. The minimum number will be about five in each flotilla. Physical communication among the ships, during the interplanetary flights, will be provided by fast-flying "space launches."

We shall probably launch 5 or more flotillas during the time required for 1 flotilla to complete the journey from Earth-orbit to mars-orbit. This suggests a minimum of 10 to 15 flotillas in various stages of outward and return journeys during the time any one flotilla completes its round trip: probably as many as 100 such giant space vessels in service during the period of buildup for the initial colonization of Mars.

Where shall we construct approximately 100 such giant space vessels? Most of the weight of the ships' components will be produced in industrial colonies on the Moon. Also, the greatest part of the weight of the freight carried to Mars orbit will be manufactured on the Moon. Much of the preassembly will be completed in Moon-orbit, and the final work of assembly and readying done, possibly, in Earth orbit.

Painting by Christopher Sloan

Selenopolis, the first city on the Moon, housing thousands, as envisioned by Krafft Ehricke, is powered by fusion reactors.

The components supplied from Earth's surface, and personnel will probably reach the space terminal above Earth in two stages. In the first stage, the flight from Earth's surface will occur in trans-atmospheric aircraft, craft which lift up through the atmosphere as airplanes, and then shift to spaceflight for the remainder of their outward journey. These trans-atmospheric craft will carry passengers and cargo to a relatively low-orbit terminal, where the passengers or freight are transferred to space ferries, for the remainder of the journey to the space terminal.

Trace the developments leading up to 2026-2027 backwards in time, to the present. The result looks something like the following. The indicated dates are estimates provided solely for purposes of illustrating the conceptions involved.

Phase 1: Lift-Off From Earth. We must first build a space terminal, a permanent, expandable space station, above Earth. We shall also build a system of lower-orbit stations, as the place where both the trans-atmospheric craft and the space ferries dock to exchange passengers and cargo. We must build fleets of trans-atmospheric "shuttles," and "space ferry" shuttles. Complete this phase during 1995-2000.

With the completion of Phase 1A, we must prepare the first steps of colonization of the Moon. This is done in a manner resembling the more ambitious preparations for the beginning of permanent habitations on Mars, but with very much less effort than for Mars. Complete during 2000-2005.

We construct the first permanent habitation on the Moon, approximately 2000-2005.

Phase 1 is done entirely with materials and technology supplied from the surface of Earth.

Phase 2: Industrialization of the Moon. Establish a Moon-based industrial power grid. Do this during a span of time which precedes and follows the establishment of the first permanent habitation there: about 2000-2010.

Establish a self-sustaining supply of a major part of required foodstuffs and materials from the Moon, as the first step of agro-industrial development of the Moon, approximately 2005-2015.

(c) Develop the first steps of space export-oriented primary materials production on the Moon, about 2005-2015.

Expand and improve the permanent habitations on the Moon at a pace ahead of industrial requirements: 2005-2015.

Phases 1 and 2 of the operation are based on perfected technologies available during the years 1995-2010. By about 2015, the industrial economy of the

Moon is a significant space exporter, producing types of basic space-use ceramics materials and products beyond anything yet produced on Earth today.

NASA

Artist's depiction of a Mars Artificial Gravity Transfer Vehicle.

Phase 3: Manned Exploration of Mars. *Unmanned survey of Mars: 1995-2005*. Place a system of permanent, unmanned satellites in orbit around Mars, and drop linked sensoring stations to the Mars surface. This will aggregate to a complete astrophysical observations complex, as well as a Mars survey.

Place the elements, for assembly, of a future manned orbiting station in Mars orbit, circa 2005.

A series of manned visits to Mars-orbit in flotillas of approximately five exploration vessels. During this phase, a series of craft is assembled in Mars-orbit for descent to Mars' surface: 2005-2010.

Manned visits to Mars surface: 2010-2015. Manned flight to Mars-orbit is based on technologies perfected during 2000-2005. Manned visits to the surface are based on technologies perfected during 2005-2010.

Phase 4: Build Interplanetary Space-Fleet. Assemble approximately 100 such vessels during 2015-2025.

Phase 5: Launch Powered Flights of Flotillas to Mars.

(a) Build the Mars-orbit space terminal: 2020-2025.

(b) Begin delivery of materials for constructing the permanent habitation on the surface: 2020-2025.

(c) Complete delivery of materials and personnel to begin main descent to Mars surface for constructing permanent colonization: 2025-2026.

Phase 6: Descend to Construct on Mars Surface: 2026-2027. The foregoing listing merely illustrates the conception of the phase approach required. Our leading points are to show that:

(1) the colonization of the Moon is an indispensable, integral feature of a Mars colonization mission;

(2) the steps required compel us to proceed in rather well-defined, pre-timed phases;

(3) 40 years is a reasonable lapse of time for completing all the essential phases, not too tight a schedule, and not too loose a schedule.

This summary will now serve as background for discussion of the other key points to be considered. Next we shall consider some of the leading reasons we must colonize Mars; and then, we shall consider the benefits this will mean for people who stay behind on Earth, both during each decade of the coming 40 years, and later.

The Scientific Objectives

The astronomers are the first to tell us why we must go some distance away from Earth's orbit. The Earth's atmosphere prevents us from observing the full spectrum of radiation from the stars and galaxies, and we have reached near to the limit of what we can discover about our larger universe by Earth-based observatories. We can do a little better with telescopes and radio-telescopes in near-Earth orbit, but for many important measurements, the area in the vicinity of the Earth's orbit is a very dirty and noisy place. We must be able to measure the full range of the spectrum of electromagnetic radiation in space, from the very long wave to the very, very short: from every distant star, galaxy, and other phenomenon to be observed.

Building observatories as far out as Mars orbit, and beyond, will make young astronomers very happy, but our purpose for spending these many billions of dollars is obviously not merely to give astronomers some special sort of personal pleasure. The point is, with aid of such observatories, our astrophysicists will be able to answer many questions very important for life on Earth, questions which can not be answered without information from such complexes of space-based scientific observatories.

As physical science progresses, what was accepted as the best physics yesterday seems to break down around the edges. Usually, when this first occurs, the physicists mumble the ugliest curse word in their scientific vocabularies: “anomalous.” At first, they look at the embarrassing experimental results suspiciously, thinking someone must have played a mean prank upon them. Sooner or later, some physicists warn: “It’s no good calling these embarrassing experimental results “anomalies.” We have to face scientific facts; there is something wrong with our existing scientific textbooks.”

The history of “anomalies” is the history of fundamental progress in science. Modern science began with the work of Nicholas of Cusa. In 1440, Cusa published a book, *On Learned Ignorance* (De Docta Ignorantia) which accomplished, chiefly, two things. Cusa presented a discovery which modern science calls the Principle of Least Action, and which mathematicians refer to as the isoperimetric theorem (see Appendix). Cusa proved that geometry, as then taught, contained a fundamental error, and that this error had a bad effect on our thinking about physics. In the same book, Cusa presented a way of thinking about physics which set the stage for the later work of such leading figures as Leonardo da Vinci, Kepler, and Leibniz. Every step of fundamental progress in experimental science since has centered around discovering mistakes, called “anomalies,” in generally accepted scientific doctrines.


NASA

Artist’s depiction of a habitat on Mars.

By about the middle of the 19th century, with the work of Karl Gauss and his collaborators, science developed a more effective way of looking at this problem of “anomalies.” It was established as a rule, that to settle any fundamental principle of physics, we must move away from the everyday scale of experimental work, and study the way in which the universe behaves at its extremes, the very, very large and the very, very small. In other words, we can not say that any physics principle is true experimentally, until we have proven that principle by means of astronomical observations and also on the size-scale of molecules, atoms, and subatomic behavior.

It has also been recognized, off and on, since the work of Leonardo da Vinci, that we must also prove principles of nature in a third region of physical experiments and observation: living processes. Today’s progress in optical biophysics is reminding us of that, once more.

In brief: The practical importance of astrophysics for life on Earth is that without the special kind of knowledge of laws of the universe we gain from astrophysics, we are blocked in scientific progress on the scale of everyday practice. Astrophysics, microphysics, and optical biophysics, are the frontiers of all scientific progress on Earth today.

To explore the behavior of the stars and galaxies, we must measure the full range of radiation from those sources. We must measure not only the visible light, but also microwaves and radio frequencies, the very large infrared spectrum, the ultraviolet, the X-ray region, and so forth. The farther from the Sun we make those observations, the better. What we are searching for is “anomalies” in our present textbooks’ physics. We are searching for the kind of evidence, which compared with work in microphysics and optical biophysics, will enable us not only to uncover those “anomalies,” but to solve them.

NASA

Artist's depiction of humans exploring near a base on Mars.

The rate at which science progresses on the surface of the Earth depends very much on these kinds of coordinated investigations.

A considerable amount of benefit can be gained from unmanned observational stations placed in various locations around our solar system. More and more, we are faced with the fact that there must also be manned laboratories and manned observatories in space, as well.

So far, most of our space exploration has been based on these kinds of objectives. This will continue to be a large part of man's work and life in space for the foreseeable decades ahead.

Once we move to place observatories and space laboratories at interplanetary distances, the idea of permanent colonies in space pops up. Once we think of putting a few dozen scientists and technicians at interplanetary distances, we are already raising the question of space colonization.

The logic of the problem is simple enough. To support a few dozen scientists and technicians in the "front line" missions of research in space, we must have a much larger number of people there to maintain the life-support systems on which those scientists and technicians depend. As soon as one has sketched the table of organization for the persons necessary simply to maintain those life-support systems, we realize that once we have decided to put a few dozen scientists and technicians into front-line space missions, we might as well put a few hundred such scientists and technicians out there. The size of the life-support staff needed to sustain a few dozen scientists, would actually support hundreds with relatively little more effort.

Once we have decided to put observatories and laboratories a significant part of the distance toward Mars-orbit, we see it is much better to go all the distance, and take advantage of the fact that Mars is the most convenient place to establish a logistical base for the more remote stations.

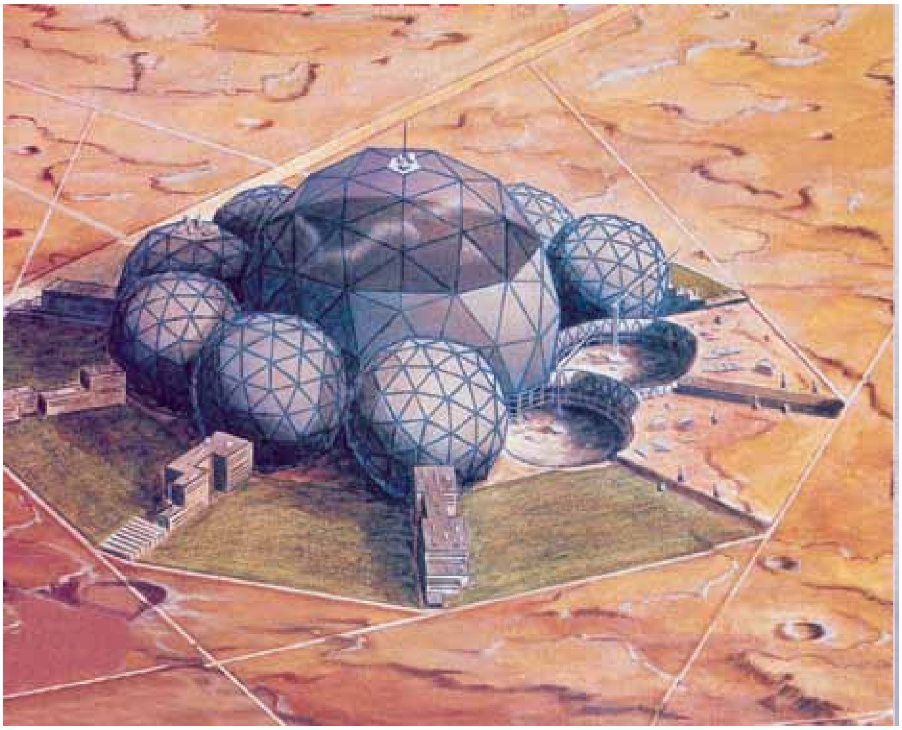
Once that point is settled in our minds, we must estimate the minimum population on Mars necessary to maintain all functions indispensable to life support on that planet. Even with continued logistical support from

NASA/Case for Mars

Greenhouses and other food production will be a necessary component of any future Martian settlement.

the industrial base on the Moon, we are in the range of a city-sized population in our initial Mars colony. We must stop thinking in terms of the word base, as we might say "Antarctica base"; the word we must use is permanent colony, a chiefly self-sustaining, permanent colony on Mars.

We might look at the project in this way. Think of it as recruiting several thousand scientists, and supporting research technicians, to staff the major U.S. laboratory in space research. However, instead of establishing this university-like research center in the middle of Arizona, we place it on Mars. To provide the goods and services the scientific teams and their families require, we develop a small city around the research center, analogous to the case of Los Alamos.



Painting by Christopher Sloan

Kepleropolis, a domed city on Mars. By this time, there are nearly half a million residents living on Mars.

This population is composed of human beings, not robots, and also not fellows clomping around in space suits in some Hollywood science fiction sort of space opera. Without a human ecosystem, many of them would go mad, or nearly so. Building an atmosphere on Mars so that the colonists could bicycle or hitchhike around the planet's highways, might be a bit farfetched for the foreseeable future; cities and farms in Earthlike artificial environments, under large domes, is the more likely prospect for the foreseeable future. Within such domes, human activity and environment must be as Earthlike as possible. Think of a similar center placed in the middle of the Sahara Desert: pretty bleak and unlivable outside the oasis under the air-conditioned dome.

An Illustration

To make a bit clearer, the kind of work which requires large colonies of scientists in space, we describe some of the relevant features of one type of work to be done.

To analyze and measure radiation from very distant astronomical objects, as accurately as today's leading scientific questions require us to do, we must construct what we call lenses of very large aperture, floating in space at some distance from Earth. These *lenses* measure a great variety of kinds of radiation from distant sources.

Such supergiant astrophysical lenses are not the solid sheets we ordinarily associate with giant telescope mirrors. They are built up out of a kind of mosaic of many individual sensory devices, each separated from all of the others by rather large distances of interplanetary solar space. The total number of such sensory devices would be distributed over an area many thousands of miles in diameter, and even much larger. The radiation sensed by each and all of these component devices is coordinated, as "information," by a supercomputer, a computer of capacities way beyond anything presently in use. The bigger the area of the "lens," the more precisely we may focus on very distant objects and regions of galactic and intergalactic space. The principles involved are very basic principles of known electromagnetic optics.

Ask a mature young astrophysicist dealing with anomalous cosmic ray and other radiations from the Crab Nebula region, or fast-rotating binary-star complexes, or "black hole" regions, what he would really like for Christmas, something which is technologically thinkable today, something which would be of great practical value for exploring the most important kinds of anomalous phenomena with precision. While he is thinking about this, interrupt him with a hint: "Imagine a lens with an aperture on the scale of the Mars orbit." He will respond with statements to the effect: "That's technically possible; you have just described every astrophysicist's dream."

What we shall accomplish by about 2027, will be far more modest than that, but we shall be moving in such directions.

This is not science-fiction fantasy. This merely describes, on a larger scale, what we are already doing today. We are already using this kind of technology. The importance of very-large-aperture lenses of this sort in interplanetary space is not only a very well-defined technologic requirement; there is a well-defined need for such observatories in terms of leading problems of present-day physics. Any good physicist can write out a list of specifications for building and operating such devices in space, as well as writing out a list of some of the observations which are indispensable for settling certain fundamental anomalies of physics today. This list of requirements for improved technologies is fully covered by the technologies we have indicated as needed and developable, for starting a permanent mars colony by 2026-2027.

There are fundamental principles of physics, which recommend developing such observational instruments along one of the solar system's available Keplerian orbits. The physics significance of Keplerian orbits, is that they are what are sometimes called force-free pathways, or better named "Least Action" pathways. We must use this principle of "neo-Keplerian" physics (Kepler's work as corrected by Gauss et al.), to ensure the desired stability of the lens's mosaic, to minimize the perturbations in the lens-object's relative position with respect to the other elements of the mosaic. Earth's orbit is one of those accessible to us during the coming decades; the Mars orbit is a happier choice.

The kind of observatories which justify, and which require, Mars-colonization belong more or less to the family of such instruments we have just described. Thus, we are dealing with thousands of elements of each large mosaic, each of which requires either direct, manned intervention, or robotic intervention under human control within that locality of interplanetary space.

Similar considerations apply to manned laboratories, and semiautomatic laboratories in interplanetary space. A whole range of industrial and other production and research projects, most of currently known practical importance for life on Earth, are involved.

So, within the span of the foreseeable future, about two to three generations ahead, we must anticipate tens of thousands of scientists and engineers working in interplanetary space. Much of this work has a more or less well-defined urgency for settling questions which are important to life on Earth itself. To support tens of thousands of scientists associated with such projects, either permanently in space, or on extended tours of duty there, requires colonies in space with populations on the scale of important cities on Earth today.

All of this requires powered spaceflight, preferably at accelerations and decelerations with the effect of one Earth gravity, or high accelerations in craft modified to reduce the effect on the passengers and crew to that of one Earth gravity. It requires the conditions which can be provided only by 40 years of the kind of development we have outlined here.

The Spiritual Imperative for Conquest of Space

Empiricists generally, and behaviorists in particular, have a definition of "human nature," which is very simplistic, very wrong, and very morally degrading. They insist that "human nature" is based essentially on irrational sorts of hedonistic impulses, or "instincts." It is not accidental, that the behaviorist psychologists base their research into "human nature" on close observations of monkeys and other beasts. They are flatly wrong; human beings are not beasts, at least not the sorts of individual one should wish to have as a neighbor, or to marry one's daughter.

Human beings are absolutely distinguished from beasts by virtue of the fact, that every normal newborn infant has what is sometimes called "the divine spark of reason." This spark, if developed, enables each of us to develop the power of creative reasoning, the quality of reasoning typified by the work of the best scientific discoverers. Such persons are potentially of great benefit to both contemporary society and future generations: One new, useful idea, discovered by such an individual mind, is of benefit to all mankind. This benefit is partly direct. It is also indirect: new, better ideas to come, will start from the most advanced discoveries of preceding scientists.

This same spark of reason, gives man not only the capacity for scientific discovery, which no beast can do. This spark of reason is the basis for durable ideas of beauty, and for that quality of lovingness toward other persons typified by Christian love: not bestial forms of erotic "love," but what the classical Greeks called "agapē." Everything that is good and beautiful in a person, is a reflection of the development of this divine spark of reason.

It is the potential for development of this divine spark of reason, which places mankind above the beasts, which defines mankind as in the image of the living God. This quality which sets each of us above the beasts, is our true "human nature." The fuller realization of this beautiful potential in ourselves, is our true self-interest.

If this be our "human nature," then what does this nature tell us is mortal man's proper destiny? Can it be anything but the efficient self-development of that capacity for good which is the divine spark of reason within us? To be good, can never be separated from good deeds, from work which is consistent with goodness. Which, then, is the goal: the deeds of which goodness makes us capable, or the goodness which is affirmed by such deeds? The answer to this seeming paradox is elementary: Good deeds are necessary to the fulfillment of the quality of goodness in ourselves; it is by responding to the challenge about us with good deeds, that we strengthen goodness within us. To become good, by aid of deeds which respond properly to whatever practical challenge faces us, is our true self-interest, our true goal.

What we have just said, goes far from everyday thinking today. Ordinarily, only theologians, philosophers, and a handful of scientists who think philosophically, concern themselves with such ideas. For that reason, most readers may have some difficulty, both in grasping the concept we have just described, and in recognizing the practical importance of such ideas in day-to-day life. At this point, we must make the idea clearer, and show the reader the practical importance of such ideas.

The philosophy we have just outlined, is indispensable for any society which has entered the era of exploration and colonization of space. No person could survive extended periods in space exploration or colonization, without adopting this point of view: Without this philosophical outlook, many of them would break down psychologically under the impact of a gradual accumulation of "subliminal" psychological stress.

This will show up, sooner or later, as the major human flaw in the Soviet space program. Psychological problems of this type have already appeared around the edges of the impact of space exploration on sectors of the U.S. population, including some veterans of that program. The difference between us and the Soviets on this account, is that Western culture provides us with the resources needed to overcome the "culture shock" of space exploration, whereas Russian culture, both Soviet "materialist culture" and present-day relics of pre-Soviet mysticism, does not.

Although this philosophical "technology" is indispensable for extended space exploration and colonization, the reality and importance of this principle is rather easily demonstrated by suitable forms of reflections on the recent 2,500 years of European culture. The problem addressed has "always been there"; the conditions of space exploration on a large scale, *over* extended periods, merely brings this "factor" up front as an immediate practical issue of great importance.

Think back to the greatest heroes of European culture, since Solon of Athens during 599 B.C. Although some aspects of their contributions to our civilization are still of continuing practical importance today, most of the practical things accomplished in their lifetimes have vanished into the dust: used-up, outlived parts of our civilization's earlier history. Yet, however obsolete most of their practical work has become, our civilization would not have progressed as far as it has, in its best periods to date, had these heroes of the past not lived. The question posed to each of us, by the example of these heroes, is: "What is durable, and therefore most important, in our mortal lives?"

Brilliant new discoveries of today, make many ideas of the preceding time obsolete. Later, many of today's discoveries, and great deeds, too, will be made obsolete. So, we are forced to recognize that there are two ways of looking at our mortal lives. On the one side, we place the emphasis upon the concrete actions which seem to make a person important or unimportant during his or her lifetime: the actions which make one appear to be important, or unimportant to most contemporaries. On the other side, we look at ourselves as we look back to the great heroes and devils of the distant past; many of the things which appeared most impor-

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"This combined development of the moral character, and science-like intellectual development, the pursuit of the good . . . developed in the individual and the nation, is that person's, that nation's potential for responding to contemporary challenges in a way which will have enduring value. Shown: members of the LaRouche Youth Movement in Bogotá, Colombia display pedagogical exhibits at a summer camp.

tant to the opinion of their contemporaries have vanished into the dust of past events.

The second view instructs our conscience: What is important in our living and having lived, is our contribution to human progress. The specific acts we perform have importance, of course. But, the aspect of those actions which survives, is the way those actions either contribute to the progress of man's moral and material self-development, or have an opposite effect.

The simplest case, is the obscure parents engaged in the sustenance and loving rearing of a child. For that child to develop, the child must be sustained materially, of course. Therefore the physical care of the child is an essential part of a moral act. However, the essential thing, is the development of that child's character. The very least contribution made by the development of the character of a child by its parents, schools, and so forth, is the child's capacity and resolution, as a later adult, to the building of the character of his *or* her own children and grandchildren. In this way, the most ordinary activities of parental life, even by an illiterate mother confined to the limits of ordinary life in the household, the extended family, the local community, have a moral outcome which extends to far-distant generations.

From this historical vantage point, this historical way of looking at individuals of both the distant past and the present, the most essential aspect of a good and important action by a living person, is that person's moral character and scientific intellectual development. It is the ability to choose between right and wrong, and the ability to react to challenges in a way which is efficiently consistent with goodness, which enables an individual, or an entire nation, to choose and to perform the kinds of actions which will be rightly judged as beneficial by later generations.

Let us call this combined development of the moral character, and science-like intellectual development, the pursuit of the good. This quality of goodness, as developed in the individual and the nation, is that person's, that nation's potential for responding to contemporary challenges in a way which will have enduring value.

As we have indicated here, so far, at least implicitly so, there are limits to our power to foresee the practical work which will confront *our* grandchildren and great-grandchildren. Each decade ahead, the exact nature of that work becomes less and less concrete, less precisely exact. Even the most developed scientists can not look much more than 50 years ahead in forecasting the general levels of technology, and related problems, which might confront our grandchildren and great-grandchildren.

How, in that case, can we know whether the outcome of our generation s' work will be ultimately good or disastrous? Our capacity to pose suggested answers in practical terms, is a limited one. We find ourselves on sure ground, only if we make our more fundamental goal, the enrichment of the moral character and science-like intellectual development of the coming generations. If we can accomplish that, we are pre-assured that our grandchildren and great-grandchildren will

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Two children fascinated by an X-ray mirror cylinder.

have a greater moral and scientific capacity than we today; therefore, they will be better equipped to perpetuate the good into the 50 years following their lifetimes, than we.

To make this point clearer, consider the case, that we make the United States a great economic and military power, unchallengeable, on either count, by any nation or combination of nations on this planet; yet, we neglect the development of the moral character of our children and grandchildren. In that case, as we see in the fallen nations and empires of the past, those grandchildren and greatgrandchildren will destroy this nation with wrong choices.

That has been precisely the root of our undoing over the postwar period to date. Our postwar State Department turned our foreign policy away from the nation-building perspective we developed during the war years under President Franklin Roosevelt. We allowed the subversion of the morals of the nuclear-family household, the rock on which the development of the child's character depends. We allowed the immoral subversion of our educational systems. We tolerated the spread of the rock-drug-sex counterculture during the past quarter century. Although, into the middle of the1960s, we continued to be the world's greatest economic and military power in history, over the past 20 years we have frittered both away, through our neglect of the moral character building of our children and grandchildren. It is those so-mistreated children who are now taking the lead in destroying the institutions upon which our nation's future depends.

Our essential task is twofold.

First, on the practical side of policy shaping, a wise nation lays the foundations for what will be bequeathed, materially, to our posterity, 50 years or so ahead. The ordering of the leading practical goals of our nation to be consistent with, and sparked by the Moon-Mars colonization mission-assignment, essentially fulfills the practical side of our obligations to posterity's general welfare.

The Moon-Mars colonization mission, illustrates the point, that what the world and our nation will be, 50 years from now, will depend upon what we do, or fail to do, during each of the five decades between now and then. To build a house, or an industry, the basic economic infrastructure and the foundation of that house or industry must be constructed first. To operate a farm, wasteland must first be developed as fertile land. It would be impossible, 50 years from now, for our posterity to do the kinds of things a successful Moon-Mars mission makes possible, unless, during each of the next five decades, we accomplish the step-by-step tasks needed to make this possible. That, our posterity can not control; that is our moral responsibility to the future generation of this nation, which no one but we can do.

Second, whether our grandchildren and great-grandchildren will build upon, or destroy what we have bequeathed to them, depends chiefly upon the development of their moral character. Provided we have bequeathed our posterity a good material foundation, the rest depends upon their moral character.

The first, the material basis for the future 50 years ahead, is indispensable, but the second, the development of the moral character of our posterity, is what is essential, what is fundamental.

The practical question on which we are concentrating here, is: How should we think, in order that we may


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Dr. Wernher von Braun (left) briefs President John F. Kennedy on the Saturn V Launch System at Cape Canaveral, Florida on November 16, 1963.

place the essential and the indispensable both in the properly coordinated perspective? It is the development of good moral character and science-like intellectual development of the individual and the national culture, which has permanently efficient effect. The meeting of the practical tasks of present-day society, is indispensable to the perpetuation of the good; however, if the development of the moral character and science-like intellectual development of the individual and the culture is consistent with the principle of the good, then each generation will tend to make the right choices of leading practical tasks.

We must think of a process of the self-development of the good within our national culture. In this process, it is the development of the good which is fundamental, and the practical tasks merely the indispensable activity of goodness.

Our potential capacity to act and think in this way, is bequeathed to us as the essential thread of Augustinian culture. The work of the great Jewish reformer and collaborator of St. Peter, Philo of Alexandria, contributed nourishment to the elaboration of Christianity, as our Judeo-Christian heritage is summed up in an integral way by the work of St. Augustine. This culture incorporates the Socratic method of Plato, while correcting the crucial theological defect in Platonic paganism.

The center of Augustinian culture, from the special, limited standpoint of European civilization's statecraft, is the way in which Augustinian Christianity defines the human individual. We define the individual as being in the likeness of the living God, in respect to that divine spark of potential for creative reason in the person. This divine spark defines each person as a universal existence, both spiritually and from the vantage point of practice of statecraft.

This universality is most readily portrayed from the standpoint of reference to the individual scientific discoverer. Although each scientific discoverer depends upon the contribution of his or her entire society, past and present, to the development of his individual powers: each particular scientific discovery is the work of an individual human mind. As this discovered idea for practice has impact upon all humanity, present and posterity, so that discoverer is a universal being by virtue of the development of his or her individual character, as an individual character.

As we have indicated already, the same universality of the individual personality, applies also to the simple parent who shapes a positive outcome of the development of the child's character. It applies to all who use the development of their moral character, of their science-like intellectual development, as an integral part of whatever work they perform.

If the individual, developed in this moral way, is conscious of this kind of universality as his or her personal identity, and as the essential center of his or her personal self-interest in life, we are thus presented with the kind of person morally, philosophically prepared for the work of space exploration.

(To be continued.)