We Commit to the Moon-Mars Mission

by Benjamin Deniston

With contributions from Kesha Rogers and Paul Gallagher. The video of Deniston's July 27 presentation on this subject is available on the LaRouche PAC website.

Aug. 4—A 50-year, international crash program for lunar industrialization, the development of fusion-powered space flight, and Mars colonization will be the most important driver for the U.S. and global economies. President Trump's plan to return to the Moon by 2024 is the correct first step; let's see the full program through.

LaRouche PAC is circulating the petition, "We Commit to the Moon-Mars Mission," calling upon President Donald Trump and the U.S. Congress to commit to the following crucial elements required to ensure the success of that mission. Each of these elements, enumerated here, is further developed in the pages that follow.

• Successfully realize the Artemis mission to bring mankind—including the first woman—to the Moon *to stay* in 2024, as President Trump and his NASA Administrator, Jim Bridenstine, have called for.

• Make Artemis the first step towards the industrialization of the Moon, as the economic platform enabling human colonization of Mars and human exploration of the Solar System—as first thoroughly defined by the late space visionary Krafft Ehricke.

• Develop advanced fusion propulsion spacecraft, fueled by the helium-3 resources on the Moon—enabling safe and rapid human travel to Mars and other regions in the Solar System, with the goal of achieving constant one-gravity acceleration/deceleration as the standard for human interplanetary missions.

• Achieve this Moon-Mars program through an international 50-year crash program, as outlined by the late economist Lyndon LaRouche—ensuring the high rates of economic payback on Earth which can only be reached by developing new space and fusion technologies, and sharing those technologies internationally as the basis for durable peace on this planet.

• Reform or eliminate the speculative and predatory aspects of the international financial system, as a necessary step to ensure sovereign nations can generate the long-term credit agreements needed to facilitate this mission.

• Remove barriers to international collaboration in space—especially impediments to U.S. cooperation with China and Russia (as typified by the so-called Wolf Amendment, barring NASA from working with China).

This program coheres with remarks made by Lyndon LaRouche to a December 2009 international conference in Russia:

Christopher Sloan

Artist's concept of Selenopolis, Krafft Ehricke's city on the Moon, a modern city housing thousands, powered by fusion power plants seen under construction on the right.

In order to realize the objectives which stand before us now, we have to give mankind a new mission—mankind as a whole. The mission is typified by the idea of the Mars colonization program. This requires us to make the kinds of changes, in terms of scientific progress, which are needed for mankind's future existence.

We have many problems on this planet. And we can not solve those problems, extensively, without going into a development of the Solar System as a habitat of mankind. We're on the edge of doing that, scientifically. There are many scientific discoveries, yet to be made, which will make it possible to act for man's colonization of Mars. That will be in some time to come. But what we need now is the *intention* of accomplishing the Mars colonization program. We need to educate and develop generations of young people who will be oriented to that kind of mission. In the coming period, we will have the birth of young people who will be part of the colonization of Mars, in one way or the other, before this century is out.

We need to give mankind a sense of purpose, developmental purpose, not only throughout the planet, but through the influence of Earth on the adjoining regions of the Solar System, and beyond.

Those objectives are feasible. There are, admittedly, many problems to be solved, scientific problems, which are not yet resolved. We have many questions. But, essentially, we know this is feasible. We know this should be feasible within two or three generations. What we have to do, is give to people, who will be the grandchildren, born now, to give them something to realize. When we're dead and gone, they will be there, three generations from now, four generations from now. They will be the people who actually colonize areas beyond Earth itself. We need to give them the opportunity to do so. We need to give society, in the meantime, the mission-orientation of achieving that colonization, for our descendants, three generations or so down the line.

Artemis: Back to the Moon by 2024

Successfully realize the Artemis mission to bring mankind—including the first woman—to the Moon to stay in 2024, as President Trump and his NASA Administrator, Jim Bridenstine, have called for.

Have you heard? After more than 45 years, we're finally going back to the Moon—this time to stay! In 2017 President Trump signed Space Policy Directive 1 calling for the return of American astronauts to the surface of the Moon, and in 2019 he said this should be accomplished by 2024 (before the end of his prospective second term). This bold plan has been called Project Artemis, named after the twin sister of the ancient Greek god Apollo (the namesake of the first Moon-landing program). It's a very fitting name, as this mission will bring the first woman to the Moon.

The Project Artemis plan is to land astronauts on the Moon's South Pole by 2024, followed by the establishment of a regular human presence on the Moon by 2028—focused on new scientific investigations, learning how to utilize the resources of the Moon, and demonstrating technological advancements needed for human exploration of Mars.

The Lunar South Pole is of particular interest. As NASA's deputy associate administrator of the Science Mission Directorate, Steven Clarke, said:[1]

> We know the South Pole region contains ice and may be rich in other resources based on our observations from orbit, but, otherwise, it's a completely unexplored world.... The South Pole is far from the Apollo landing sites clustered around the equator, so it will offer us a new challenge and a new environment to explore as we build our capabilities to travel farther into space.

On the South Pole, the current target is Shackleton crater. Measuring 13 miles across and 2.5 miles deep, the crater's peaks are exposed to almost continuous sunlight, while its floors and walls are in near perpetual shadow. As discovered in recent years, these permanently shadowed craters contain critical stores of water ice, while the access to sunlight at the peaks is of interest for solar power (until compact nuclear power can be brought online). As NASA Administrator Jim Bridenstine has stressed, we are going back to the Moon to stay, requiring that we learn how to utilize the resources available on the Moon.

How are we going to get there? NASA's current plan is as follows.

In June of 2020, the first mission, Artemis 1, will use

1. "Moon's South Pole in NASA's Landing Sites," NASA.gov, April 15, 2019, https://www.nasa.gov/feature/moon-s-south-pole-in-nasa-s-landing-sites

a Space Launch System (SLS) rocket to send an uncrewed flight of the Orion spacecraft into an orbit reaching 40,000 miles beyond the Moon (testing key hardware and operations).

In 2022 we'll see the first phase of the Gateway Lunar Orbital Platform, establishing humanity's first lunar-orbit space station. In 2023, Artemis 2 will bring four astronauts on a lunar fly-by mission (bringing mankind beyond low-Earth orbit for the first time since Apollo). By 2024 the Gateway Lunar Orbital space station will have power and propulsion, a small human habitat, and a docking port for the Orion spacecraft.

In 2024 Artemis 3 will send the Orion spacecraft to dock with the lunar Gateway space station, from which the astronauts will descend to the lunar surface in a new lunar landing vehicle—*the first crewed landing on the Moon since Apollo 17 in 1972!*

From 2025 to 2028, a series of additional Artemis missions have been proposed to establish a permanent lunar outpost, and pursue the objectives of scientific investigations, the study and utilization of lunar resources, and preparation for manned Mars missions.

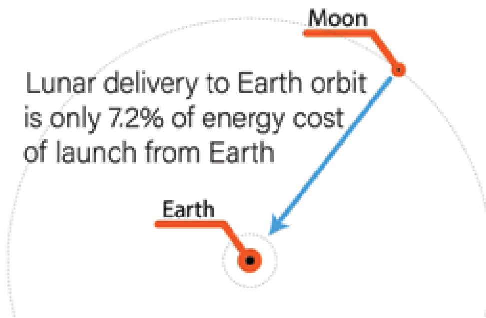
Artemis will open a new chapter in the history of mankind—marking the beginning of mankind's expansion into the Solar System, and the industrialization of the Moon is the next critical step.

Lunar Industrialization

Make Artemis the first step towards the industrialization of the Moon, as the economic platform enabling human colonization of Mars and human exploration of the Solar System—as first thoroughly defined by the late space visionary Krafft Ehricke.

The Moon isn't just an exciting place to explore; it will provide key resources for the interplanetary economy and become a vital manufacturing center supporting mankind's colonization of Mars and beyond.

The first comprehensive lunar industrial program was designed by the great space visionary, rocket pioneer, and philosopher Krafft Ehricke (1917-1984). As Ehricke noted, "the energy required to deliver cargo from the Moon to geosynchronous orbit and return to the Moon is 7.2% of that required for the same mission from Earth"[2] (the significantly lower gravity on the Moon makes it much easier to launch from the lunar surface). Because of this, once we get mining, processing, manufacturing, and transportation infrastructure operating on the Moon, it becomes far more economical to develop and launch certain products from the lunar surface (as compared with launching from Earth).



One of the first resources we'll develop from the Moon will be water—used not only for the needs of astronauts and eventual space agriculture, but also to provide oxygen and hydrogen for propellant. Even at this very first stage of lunar mining, the ability to refuel spacecraft in Earth orbit or lunar orbit using lunar resources will qualitatively transform mankind's relation to space—freeing us from the immense limitation of needing to lift all space mission requirements from the Earth's surface. (Note that 90% of the weight of the Saturn V rocket that took mankind to the Moon was simply fuel.)

Additional priority lunar resources include helium-3 for fusion (discussed below) and rare-earth metals. Further resources available in abundance on the Moon include silicon, aluminum, magnesium, iron, and titanium (with many additional resources available in varying abundances).

Compact, advanced nuclear fission systems can power the first lunar mining and manufacturing capabilities, while more advanced capabilities will come with the development of fusion technologies. As stated in a 1987 study of Lyndon LaRouche's Moon-Mars program:[3]

> The breakthrough in materials-separation and processing, however, will be the application of directed energy, rather than conventional gross

2. "Lunar Industrialization and Settlement—Birth of Polyglobal Civilization," Krafft Ehricke, in: *Lunar Bases and Space Activities of the 21st Century*, edited by W.W. Mendell, Houston, TX: Lunar and Planetary Institute, 1985, p. 827.
3. *Executive Intelligence Review Quarterly Economic Report*, First Quarter 1987, page 122.

heat, through the technologies developed in the emerging fields of laser and plasma chemistry. The fusion power plant can provide coherent microwaves, x-rays, visible light, and electromagnetic radiation from the entire spectrum, which can be applied directly to materials. Plasma processing, using by-products of the fusion reaction, can be used in a "fusion torch" or furnace, to break rocks and soil down into their constituent elements directly. Processing without chemicals, high temperatures, equipment with moving parts, holding vats, or other intermediate steps, will bring humanity into the era of one-step materials-refining.

TABLE 1

Type of Space Operation Supported	Specific Products or Services Provided by Space Operations	Contributions from Lunar industries & Infrastructure	Delivery Location for Lunar Products or Services
Information	Communications, monitoring, navigation, etc.	Servicing/repair of satellites in geostationary orbit.	Primarily geosynchronous orbit
Transportation	Cargo and passenger flights between Earth orbits and lunar orbits	Lunar liquid oxygen, [lunar hydrogen], propellant containers, heat shields	Refueling stations in lunar orbit, distant Earth orbit, geostationary, and low Earth orbit.
Manufacturing	Pharmaceuticals; electronic and optical products; solar panels; alloys, parts, components	Raw materials, semi-finished products	Near Earth orbit
Space Stations	Manufacturing; medical and recreational facilities; food production; exo-urban habitats	Oxygen for air; water; components, subsystems, and entire modules	Near Earth orbit geostationary, and other orbits

Not only will this support entirely new capabilities in space, the technologies needed for mining and processing the dispersed resources on the Moon—and the technologies required for manufacturing in space environments (with an emphasis on increasingly automated systems)—will create the largest levels of economic payback on Earth (as discussed below).

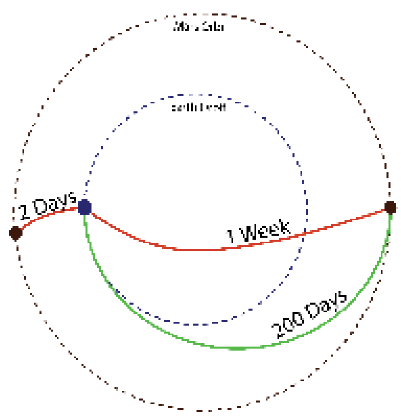
As much as possible, the large components for space stations, spacecraft, and other space infrastructure should increasingly be constructed from lunar and other near-Earth resources, with facilities on the Moon and in lunar and Earth orbits. **Table 1**, adapted from a 1983 study by Ehricke, illustrates how resources and products developed from the Moon will be used to support various Earth-Moon space operations.[4]

In the mid-1980s, Lyndon LaRouche, picking up on Ehricke's work, proposed that the fusion-powered spacecraft used for manned Mars missions should be largely manufactured from lunar resources—integrating the success of a Mars colonization mission with the requirements of lunar industrialization and fusion propulsion technologies.

Lunar Helium-3 for Fusion Propulsion

Develop advanced fusion propulsion spacecraft, fueled by the helium-3 resources on the Moon—enabling safe and rapid human travel to Mars and other regions in the Solar System, with the goal of achieving constant one-gravity acceleration/deceleration as the standard for human interplanetary missions.

FIGURE 1
Lunar Delivery to Earth Orbit



The green, 200-day, trajectory is a standard orbital trajectory—the best option available with chemical propulsion systems. The two red trajectories (two days and one week) are fusion-powered flights to Mars at its closest and farthest positions from Earth (travelling at a constant one-gravity acceleration/deceleration).

4. "Profitability of Manufacturing in Space in View of Lunar Industrial Development and Geo-Socio-Economic Benefit" (presented to ASME Winter Meeting—Manufacturing in Space, Boston, Nov 17-18, 1983). Published in L. Kops, ed., *Manufacturing in Space*, PED Vol. 11 (NY: ASME, 1983), pp.183-198).

Rapid and safe human travel to other planets—such as Mars—requires *fusion propulsion*. For example, using today's technologies based on chemical propulsion systems, a flight to Mars takes about 200 days—subjecting prospective astronauts to an extended stay in the dangerous, high-radiation deep-space environment, and the debilitating effects of prolonged zero-gravity on the body. With advanced fusion propulsion, a trip from lunar orbit to Mars orbit can take less than two days.

TABLE 2

Energy Density Values

	Energy in 1 kg of fuel	Increase over chemical
Chemical (hydrogen and oxygen)	4 kWh	—
Nuclear fission (nuclear power plant fuel)	1 million kWh	250,000
Fusion (deuterium and helium-3)	100 million kWh	25,000,000

The energy density values have been rounded to the first significant digit, for emphasis on the orders of magnitude. More precise values are: 3.72 kWh/kg for hydrogen-oxygen, 1.03×10^6 kWh/kg for typical nuclear fission fuels used in power plants, and 9.75×10^7 kWh/kg for deuterium-helium-3 fusion. Direct fission of uranium-235, outside of the context of a nuclear fuel containing significant amounts of uranium-238, is 2.28×10^6 kWh/kg.

How can fusion get us to Mars 100 times faster? It starts with *energy density:* fusion reactions provide millions of times more energy (per unit of weight) compared to chemical reactions. With today's chemical propulsion systems, interplanetary spacecraft can only carry enough fuel for short burns of thrust, sending the spacecraft on a slow orbital trajectory for the majority of the flight (with no ability to carry the additional heavy weight of the fuel required for anything more than short burns). With fusion reactions, once spacecraft can be equipped with the equivalent of 25 million times more fuel (owing to the higher energy density), an entirely new mode of space travel becomes possible: *constant high-thrust acceleration spaceflight*—with the ultimate goal of acceleration rates that simulate Earth's gravity (one Earth gravity) for the crew during the entire trip.[5]

While constant-acceleration space flight at one gravity is the gold standard we'll strive for, earlier generations of fusion propulsion systems will come first (along with fission systems), and important improvements will be provided along the way. Various designs for fusion-powered spacecraft have been investigated for decades (including proposals from NASA, the national laboratories, and ongoing studies by private companies), although the development of fusion propulsion in space has suffered from the same problem as fusion power on Earth—a crippling lack of funding. (See box: The Suppression of Fusion.)

However, the prospects of returning to the Moon are now stimulating a new perspective on fusion, with growing international interest in the helium-3 fusion fuel resources available on the Moon. This rare isotope of helium, helium-3, is far more abundant on the Moon (compared to Earth), and is a superior fusion fuel (compared with the fusion fuels available on Earth).

Currently fusion experiments largely focus on hydrogen isotope fuels, where most of the energy released can't be directed or controlled (and can only be captured to generate heat). This is workable for first-generation fusion power plants generating electricity, but the shift to helium-3 fuels opens up an entirely new regime of potential. With helium-3 fusion, nearly all of the energy produced by the fusion reactions can be directed and controlled. For power plants, this enables more efficient modes of electricity generation (with far less energy lost as heat, potentially doubling the electricity produced per unit of energy).

For spacecraft propulsion, helium-3 ensures that nearly all of the fusion energy can be directly applied to the thrust propelling the spacecraft—allowing for far more efficient engine designs.

It has been estimated that there is enough helium-3 on the Moon to power the Earth for thousands of years. The unique availability of this ideal fusion fuel on the Moon, coupled with the fusion requirements for space travel and for powering the Earth, push the lunar helium-3 program to the forefront of the lunar industrialization program.

Economic Payback

Achieve this Moon-Mars program through an international 50-year crash program, as outlined by the late economist Lyndon LaRouche—ensuring the high rates

5. Technically, this would be constant acceleration for the first half of the flight, rotating the spacecraft 180 degrees at the midpoint, and constant deceleration for the latter half of the trip.

of economic payback on Earth which can only be reached by developing new space and fusion technologies, and sharing those technologies internationally as the basis for durable peace on this planet.

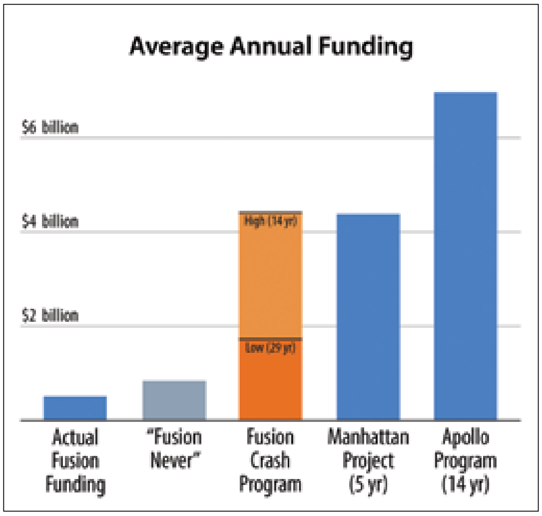
A Moon-Mars crash program to develop the technologies required for lunar industrialization, fusion-powered space travel at one-gravity acceleration, and Mars colonization is the most important program for

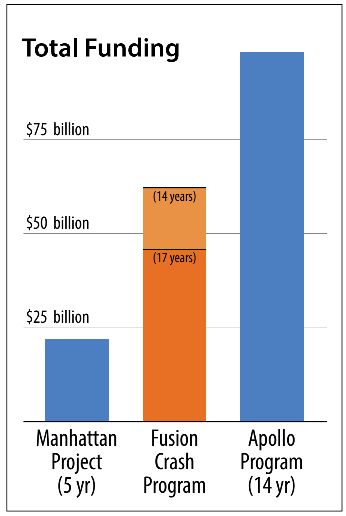
The Suppression of Fusion

The reason we don't have commercial, widespread fusion power today is that the required crash program was never implemented. For example, in 1976 the U.S. Energy Research and Development Administration defined a comprehensive proposal for a crash program development of fusion power in 15 to 30 years—an approach that would have brought fusion power online by 2005 at the latest, and by 1990 at the earliest.

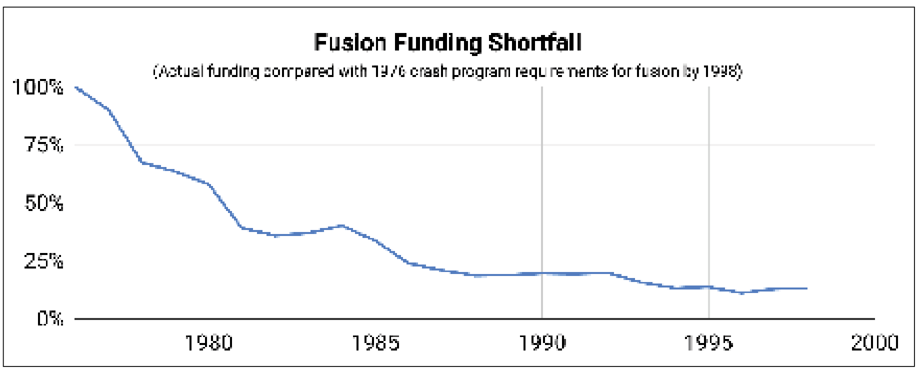
In terms of total funding, this 1976 proposal would have sat between two earlier successful crash programs, the Manhattan Project and the Apollo program. In terms of average annual funding, it was on the lower end (compared with Apollo and the Manhattan Project).

However, at the time of this 1976 study, it was also noted that constant funding at the projected 1978 level wouldn't be enough to achieve the breakthrough—a "fusion never" level of funding. In reality, since the early 1980s fusion funding has been *below* the "fusion never" level, and *far below* the crash program requirements. The reason your home isn't powered by abundant, cheap fusion power today is that the required investments were simply never made.





Values are in 2008 dollars. Actual fusion funding is the average annual funding from 1976 to 2005, as provided by the Department of Energy for magnetic confinement fusion research and development. The fusion crash program values are from the U.S. Energy Research and Development Administration, as reported in "Fusion Power by Magnetic Confinement: Program Plan: 1976," ERDA report ERDA-76/110. The Manhattan Project and Apollo Program values are from "The Manhattan Project, the Apollo Program, and the Federal Energy Technology R&D Programs: A Comparative Analysis," by Deborah D. Stine, June 30, 2009, in the Congressional Research Service's Report for Congress, RL34645.



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generating economic growth today. To understand this, simply look at the precedent of President John F. Kennedy's Apollo lunar landing program. For every $1 the U.S. government spent on the 1960s Apollo program, the U.S. economy generated over $10 in payback within the next decade—a pretty good investment![6]

However, despite the resounding economic success of the Apollo program, most economists and politicians today understand very little about how and why crash programs work as economic drivers—or, what even qualifies as a crash program.

The defining characteristic of a successful economic driver crash program is the accelerated development and implementation of new technologies throughout the economy which increase the productive powers of the labor force.

For a counter-example, doubling or tripling the physical and financial costs of electricity by forced mass-implementation of solar and wind power generation is *not* a positive economic crash program. Creating the technologies needed for fusion-powered space fight and a human base on Mars in 50 years *is* the key program that will generate the technological breakthroughs that will advance the global economy.

As Lyndon LaRouche states in his 1984 "LaRouche Doctrine":[7]

> Advances in technology are transmitted into the productive process as a whole through the incorporation of improved technologies in capital goods, most emphatically capital goods of the machine-tool or analogous classifications. Therefore, the only means by which a national economy can sustain significant rates of technological progress, is by placing emphasis upon the capital-goods sector of production, and maintaining sufficiently high rates of turnover in that sector to foster high rates of technological innovation in the goods produced.

Since capital goods and machine tools are the items used to produce all the other goods required by the economy, when the capital goods employ new technologies the productive powers of the labor force are increased as a result—ensuring the same labor force (applying the same effort) can produce more of the goods required by society, and at higher qualities, because they're utilizing higher technology capital goods in the productive process.

This is the secret of the economic success of the Apollo program. As would be expected, capital goods production for the aerospace sector of the U.S. economy dramatically increased under Apollo, rising 90% in the 1960s, over the 1950s—however, the non-aerospace and non-defense sectors increased as well, *and at a faster rate*, with non-aerospace and non-defense capital goods production increasing *130%* over that same time period, and with many of these new capital goods incorporating the new technologies developed by the Apollo program (since it only took two years for Apollo technologies to be applied in the general economy).

Thus, Apollo was a successful economic driver crash program, not merely affecting the industries and productive processes immediately related to space, but driving the entire economy to a higher technological level. The source of Apollo's greater than $10-to-$1 payback is no mystery, and can, *and must*, be done again.

The present and future requirements for the U.S. and world economies are immense. The United States has suffered from two generations of post-industrial policies, ensuring much of the productive workforce and associated skill sets have been lost, and manufacturing facilities have been shut down. The American Society of Civil Engineers estimates that the United States needs $4.5 trillion in infrastructure investment by 2025 simply to fix the country's existing water systems, roads, bridges, dams, etc.—without even considering new infrastructure systems like a modern high-speed rail network, or a continental water management system.

The world also has great needs over the coming generations, with an expected global population of 9.5 billion in 25 years, and 10.5 billion in 50 years. China's Belt and Road Initiative has made tremendous strides in starting a long-suppressed process of infrastructure development for much of the developing world, and it will take an incredible effort to complete the full-scale modern infrastructure development required worldwide.

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6. "The Economic Impact of NASA R&D Spending," Michael K. Evans, Chase Econometric Associates, Inc., April 1976.

7. "The LaRouche Doctrine: Draft Memorandum of Agreement Between the U.S. and the U.S.S.R.," *Executive Intelligence Review*, April 17, 1984.

For example, over the next 25 years, global electricity generation will need to be quadrupled (at minimum), requiring the equivalent of 10,000 large nuclear power plants; if we take China's high-speed rail development as a benchmark, the world will need 400,000 miles of high-speed rail; and with 35% of the world population dependent upon dwindling groundwater supplies, massive water transfer and desalination systems will be required for basic water security.

It's because of the immense costs of these requirements in the United States and globally, that we can't afford *not* to commit to this Moon-Mars program.

LaRouche's 50-year crash program for lunar industrialization, fusion propulsion at one-gravity acceleration, and Mars colonization encapsulates all the major categories of technological advance immediately before us. Securing these technologies through the pursuit of mankind's destiny on the Moon and Mars is the only way to secure mankind's future on Earth.

Reform the International Financial System

Reform or eliminate the speculative and predatory aspects of the international financial system, as a necessary step to ensure sovereign nations can generate the long-term credit agreements needed to facilitate this mission.

The new space and fusion technologies generated by the Moon-Mars mission will create tremendous leaps in productivity and economic wealth when applied throughout the industrial economies of the leading spacefaring nations, and proliferated to the developing countries as high technology capital goods exports.

This means a new credit and monetary system needs to be set up, which restricts or ends flows of capital into speculation, looting, and the kinds of banking fraud we've become so familiar with in the 21st Century. The new system is designed to channel capital flows, instead, into new, high-technology industry, new and more advanced economic infrastructure, scientific institutions, and direct productive investment in other nations.

These goals had been Franklin Roosevelt's goals for the Bretton Woods credit and money system created at the end of World War II. During the 30 years that Bretton Woods operated, average economic growth was 4% per year in the industrial economies and 3% per year in what were called the Third World countries—the highest sustained growth rates in history. When the Bretton Woods system was torn down and replaced with the current system of floating currency exchange rates and unregulated financial speculation, economic growth and wage levels plunged.

Therefore a "new Bretton Woods" is needed to ensure the required investments can be made in the science and technologies needed for lunar industrialization, fusion power development, and Mars colonization—a commitment to 50 years of rapid, real, and sustained progress. Starting in the 1990s, the late economist Lyndon LaRouche (1922-2019) proposed four specific nations should take the lead in launching this new Bretton Woods system: the United States, China, India and Russia (nations which are now also key leaders in space technology).

First, these nations should initiate a new Bretton Woods conference to work out long-term agreements for joint investments to develop the Moon-Mars mission technologies, and to build new economic infrastructure on Earth utilizing existing and future technologies. They—including other nations that join in—will establish an international development bank or a series of international funds for such investments.

Additionally, each nation can issue new credit for the space and fusion crash programs, and new infrastructure construction, through a national bank or national credit institution of its own.

Next, nations will need to establish new relative values between their currencies, and guarantee to keep these new currency exchange rates stable (utilizing controls against currency speculation). The U.S. dollar's value, for example, is too high because of constant speculative investments in dollar assets, holding back U.S. productive investment and economic growth; a new Bretton Woods agreement would end this.

Finally, a new Bretton Woods credit system requires that nations use the Glass-Steagall Act principle—separating commercial lending banks from investment banking and speculative "shadow banks" (only commercial banking is to be protected and deposits insured by the taxpayer—no more bailing out losses from speculation). Thus, commercial banks will participate in the mobilization of credit to companies producing for the Moon-Mars mission and energy technology crash programs, and won't divert federal credit into worthless speculation.

With this new system, money and credit can serve its proper function: to facilitate physical investments in the future creation of higher levels of physical productivity of societies. As before with the Apollo program, LaRouche's 50-year Moon-Mars program will generate far more value that its costs.

Remove Barriers to Collaboration in Space

Remove barriers to international collaboration in space—especially impediments to U.S. cooperation with China and Russia (as typified by the so-called Wolf Amendment, barring NASA from working with China).

The new historical era initiated with LaRouche's Moon-Mars program is also the end of the era of geopolitics—a dog-eat-dog view of the world built upon the assumptions of finite resources and limits to growth.

As Ehricke beautifully elucidated in his philosophical work, this "closed-world" view is unnatural, and will only lead to further conflict, war, and suffering. Mankind's natural condition is the creation of an "open-world" process, in which the conquest of the Moon and Mars are the next frontiers in a trajectory of endless progress for our species—bringing new resources, new technologies, and new wealth at every step of the way. The *necessity* of pursuing this next frontier—to ensure mankind doesn't suffer from a "closed-world" death spiral—is what Ehricke called the *Extraterrestrial Imperative*.

We see this conflict between "open" vs. "closed" world views expressed today in the attempts to subvert and block U.S. cooperation with China and Russia. In 2011, the U.S. Congress passed the so-called Wolf amendment (colloquially named after former U.S. Rep. Frank Wolf), prohibiting NASA from working with any Chinese citizens affiliated with the Chinese government (including the China National Space Administration).

While NASA can work with Russia's space agency Roscosmos, our overall relations with Russia have further deteriorated following the fraudulent "Russiagate" accusations of interference with the 2016 U.S. presidential election (coming on top of decades of military-strategic policies intended to threaten Russia's security).

It's time to end these geopolitical, closed-world policies, and engage in cooperation with China, Russia, and other nations in an international pursuit of LaRouche's 50-year Moon-Mars program.

As Lyndon LaRouche said in an address to that December 2009 international conference in Russia:

> In order to realize the objectives which stand before us now, we have to give mankind a new mission—mankind as a whole. The mission is typified by the idea of the Mars colonization program. This requires us to make the kinds of changes, in terms of scientific progress, which are needed for mankind's future existence.
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> We have many problems on this planet. And we can not solve those problems, extensively, without going into a development of the Solar System as a habitat of mankind. We're on the edge of doing that, scientifically. There are many scientific discoveries, yet to be made, which will make it possible to act for man's colonization of Mars. That will be in some time to come. But what we need now is the *intention* of accomplishing the Mars colonization program. We need to educate and develop generations of young people, who will be oriented to that kind of mission. In the coming period, we will have the birth of young people who will be part of the colonization of Mars, in one way or the other, before this century is out.
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> Those objectives are feasible. There are, admittedly, many problems to be solved, scientific problems, which are not yet resolved. We have many questions. But, essentially, we know this is feasible. We know this should be feasible within two or three generations. What we have to do, is give to people, who will be the grandchildren, born now, to give them something to realize. When we're dead and gone, they will be there, three generations from now, four generations from now. They will be the people who actually colonize areas beyond Earth itself. We need to give them the opportunity to do so. We need to give society, in the meantime, the mission-orientation of achieving that colonization, for our descendants, three generations or so down the line.