IV. Science

Toward a Global Strategic Defense of Earth, and Beyond

by Janet G. West

July 15—The Schiller Institute has sponsored dozens of conferences over decades, and consistently presented solutions to the world's most pressing concerns. Over the years, several speakers at these conferences have made the call for a Strategic Defense of the Earth.

At a Schiller Institute conference April 13–14, 2013 in Germany, for example, two of the speakers addressed the growing dangers of asteroids and comets, and the necessity for the development of a strategic defense of Earth (SDE), modeled on the economics of the SDI as conceived by Lyndon LaRouche, Jr., such that international cooperation for the SDE would also lead to an economic boom.

FIGURE 1
Near-Earth Asteroid

NASA

Author Kirill Benediktov warned a Schiller Institute conference a decade ago, that until capabilities for defense of the planet are established, humanity is playing "Russian roulette with the Cosmos." Here, an artist's concept of Asteroid 2020 FQ approaching Earth.

At that conference, Kirill Benediktov, a writer and member of the editorial board of the website *Terra America*, gave a presentation on "The Asteroid-Comet Danger and Planetary Defense—a View from Russia." Benediktov announced that Dmitry Rogozin, Director General of Roscosmos (2018–2022)—

> proposed the establishment of a civilian-military system for defense of the Earth from threats from outer space, of both military and natural origin, the latter in case of a dangerous approach to Earth by comets, asteroids, and other space objects.
>
> Rogozin stressed that the idea of such a major project under the auspices of the United Nations, among other things, gives Russia an opportunity to seize the strategic initiative from the U.S.A. in deploying a global BMD [ballistic missile defense] system, including its segment in Europe. It will also make it possible to "package" a decision on establishing a truly unified and joint European missile defense system into a major civilian project for space exploration, in which Russia has its own unique scientific, practical, and industrial role to play. Essentially, Russia and the United States could take on a noble mission to save the planet.

At the same conference, Jason Ross, speaking for the Schiller Institute, elaborated on the kind of economics and change in thinking that would be required for a successful SDE to be built. He also presented a short video clip on the asteroid belt, discussed below.

This anticipated discussion between the major nations of the world must include discussions regarding asteroid defense not only for Earth, but for the Moon and for Mars, before colonization efforts get underway in the decades ahead. These planetary bodies don't have an atmosphere by which an asteroid or meteoroid could burn up and be destroyed, so we must task our scientists and engineers to develop means to protect fledgling colonies, as well as whatever spacecraft we use in those efforts.

Let's look at what kinds of observatories on Earth are part of the planetary defense mission.

NASA's Planetary Defense Mission

In January 2016, NASA established the Planetary Defense Coordination Office (PDCO), as part of an ongoing mission of planetary defense. Planetary defense is considered to be "applied planetary science" to address the hazard of near-Earth objects (NEOs), such as asteroids and comets potentially crashing into Earth. Like the planets, asteroids and comets orbit the Sun, and anything from less than one to tens of kilometers across and within 45 million kilometers of Earth is considered to be a near-Earth object. For reference, Venus is presently about 40.2 million kilometers from Earth; Mars is presently about 297.8 million kilometers; and the asteroid belt—a vast torus between Mars and Jupiter—is 300–595 million kilometers from Earth.

Recent analysis of data from the space-based NEOWISE infrared telescope (see **Figure 2**), has shown that more than 90% of near-Earth asteroids larger than 1 km in diameter (large enough to have global consequences if they strike Earth's biosphere) have been discovered already. The NEOWISE website describes its mission:

> The NEOWISE project is the asteroid-hunting portion of the Wide-field Infrared Survey Explorer (WISE) mission.... NEOWISE harvests measurements of asteroids and comets from the WISE images and provides a rich archive for [studying] solar system objects....
>
> As of May 2023, NEOWISE is 90% into the 19th coverage of the full sky.... Over 1.4 million infrared measurements have been made of 42,670 different solar system objects, including 1,483 NEOs and 267 comets.

But the website of the University of Arizona's College of Science reported on the asteroid count as of Dec. 8, 2022:

> However, only about 20–30% of asteroids as small as 100 m in diameter have been discovered by astronomers so far. Objects in this size range, while not likely capable of causing global extinction events, could cause significant regional damage [on Earth]. The object that caused the 1908 Siberian Tunguska blast, which caused damage to a city-sized region, is thought to have been between 30–100 m in diameter.
>
> Our recent results using the small sample of about 500 NEOs that we observed with NEOWISE suggest that there are ... about 20,500 objects larger than 100 m. At sizes as small as 30–50 m, millions are predicted to exist. Of the 20,500 NEOs larger than 100 m, about 4,700 are so-called potentially hazardous asteroids—objects with orbits that come particularly close to the Earth's orbit.

It has been noted that if the 1908 object that struck over Siberia, had struck St. Petersburg instead, just four hours earlier in the Earth's rotation, the city—with all its people and its historical and scientific treasures—would have been devastated.

According to the NASA website, the Planetary Defense Coordination Office is responsible for early detection of potentially hazardous object (PHOs),

FIGURE 2
The NEOWISE Telescope

NASA

NEOWISE, the asteroid-hunting telescope in orbit around Earth, in an artist's rendition.

defined as having a size large enough to do serious damage (30-50 meters) that come within 8 million kilometers of Earth's orbit; to track the PHOs and issue warnings about potential impacts; to develop strategies and technologies to mitigate PHO impacts before they occur, such as the successful DART (Double Asteroid Redirection Test) mission, and to play a lead role in coordinating with U.S. government planning agencies (the Federal Emergency Management Agency, the White House, etc.) for responses to an actual impact threat.

Indeed, NASA is heavily involved with various advisory groups, planning committees, and the like—both domestically and internationally; it has conducted extensive and intense exercises with FEMA to test responses to and mitigation of a simulated incoming asteroid. Reports and studies have been made—some in excruciating detail of the shockwave and thermal effects of an impact—such as the report on "Evacuation and Shelter Plans for Asteroid Impacts Informed by Hurricanes and Nuclear Explosions."

But, where is any mention of civil defense and evacuation plans? Yes, there may be advance warnings, but does any major U.S. city actually have an evacuation plan for such a cataclysmic event? The most "advanced" instructions are those similar to a tornado or earthquake—stay away from windows, hide in a basement or your shelter, and so forth.

Global Coverage of the Night Sky

The focus for space agencies around the world has been, first, on detection and tracking of asteroids and comets. There's a remarkable system of telescopes globally which monitors our skies 24/7/365. The existing array of telescopes is capable of viewing the night sky in the infrared, visible light, and radio-wave frequencies. However, there is also a potential blind spot—that of asteroids which pass between Earth's orbit and the Sun.

One of the primary telescope systems is Las Cumbres Observatory Global Telescope Network (LCOGT), a private foundation, founded in 2005 by the American technologist Wayne Rosing. The goal is to build "a global network of robotic telescopes for scientific research and education. Once completed, the network will become a unique tool, capable of continuous monitoring from both the Northern and Southern Hemispheres." It initially started with the Faulkes Telescope Project supported by the Dill Faulkes Educational Trust.

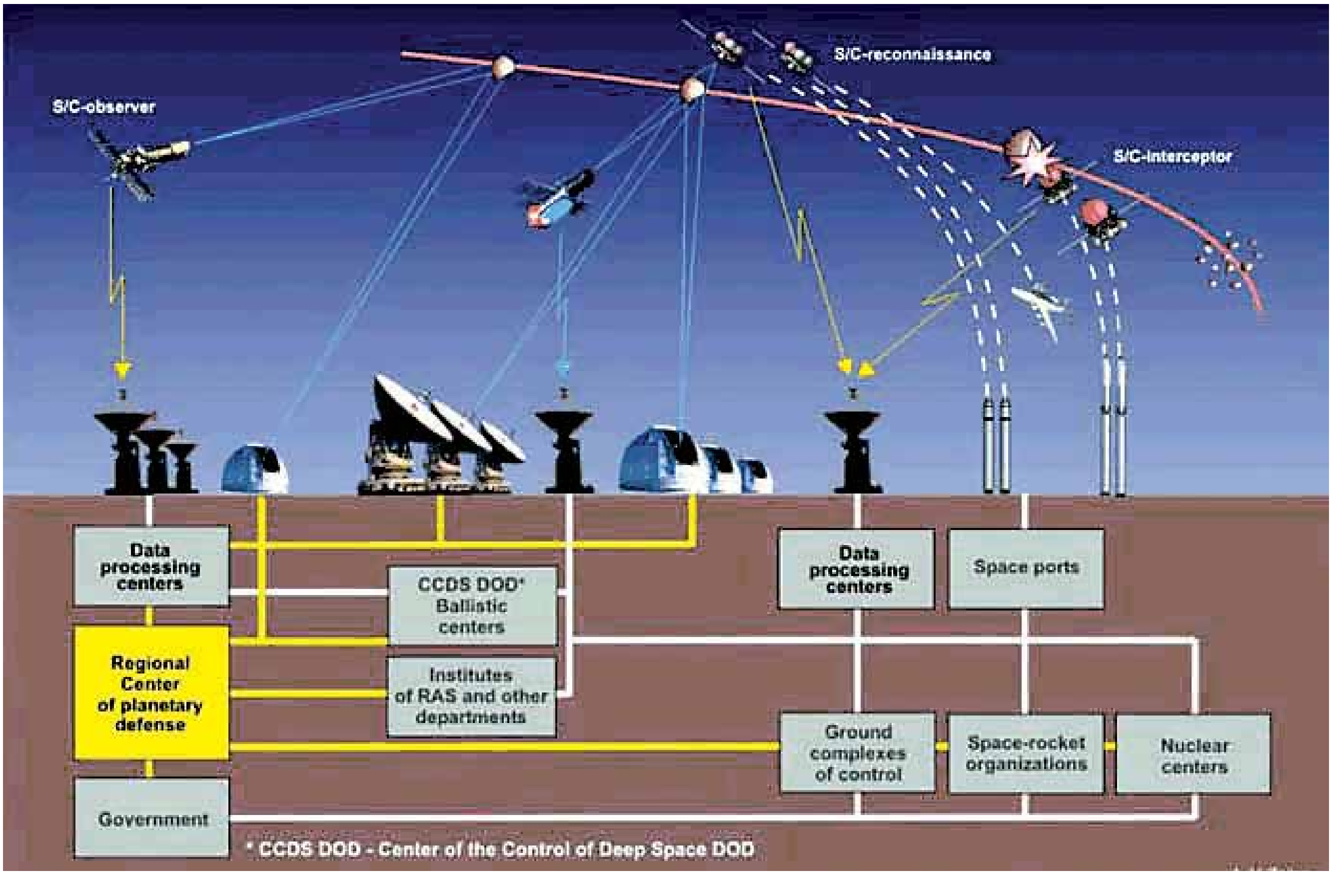
The website of Las Cumbres Observatory describes its mission:

> The LCO initially acquired the two Faulkes 2-meter telescopes: Faulkes Telescope North located at Haleakalā Observatory on Maui Island, Hawaii; and Faulkes Telescope South at Siding Spring Observatory (SSO) in eastern Australia. LCO also purchased the company that built the Faulkes telescopes, Telescope Technologies Limited of Liverpool, with the intent of installing additional 2-meter telescopes at different sites to form a robotically operated network. Rosing and the LCO staff came to understand that a network composed of many smaller telescopes would provide greater observing capacity….
>
> During 2012 and 2013, nine 1-meter telescopes were constructed and deployed to McDonald Observatory at Fort Davis, Texas; Cerro Tololo Interamerican Observatory (CTIO) in Chile; South African Astronomical Observatory (SAAO), near Sutherland, South Africa; and Siding Spring Observatory (SSO) in NSW, Australia…. From 2015–2017, seven 40-cm telescopes were deployed to CTIO, Haleakalā Observatory, SSO, and to Teide Observatory on Tenerife in the Canary Islands. In 2017, Tel Aviv University's WISE Observatory joined the network with the installation of an LCO high-resolution spectrograph (NRES) at the site. In 2019 a second 1-meter telescope was deployed at McDonald Observatory, and in 2021 two 1-meter telescopes were installed at Teide Observatory, bringing the 1-meter network to a total of thirteen telescopes.

The LCO mission includes the observation of transient astronomical events. For this, its capability is a global distribution of telescopes that allows observations to be passed from one telescope to the next; uniform instrumentation across the network; fully robotic operations; and rapid delivery of data to scientists. Scheduling of observations is done via AI called the Scheduler, which can analyze competing requests and conditions at each telescope site, direct individual

FIGURE 3

The Citadel Planetary Defense System



Schematic of the layered Russian Citadel Planetary Defense system.

telescopes to make the desired observations, and then compile the results.

The other main network of the asteroid impact early warning system of telescopes is the Asteroid Terrestrial-Impact Last Alert System (ATLAS), developed by the University of Hawaii and funded by NASA. It consists of four observatories, some of which also function on the LCOGT network. (Its website includes a short video of the DART impact on Dimorphos on September 26, 2022.) The ATLAS telescope network includes the Sutherland Observing Station (South Africa); El Sauce Observatory, Rio Hurtado (Chile); Mauna Loa (Hawaii); and Haleakalā (Hawaii).

South Africa's Sutherland Observatory, for example, consists of "four major telescopes on a barren plateau outside the Karoo town of Sutherland—all optical telescopes, which gather ultraviolet, infrared, and visible light from distant stars and galaxies."

There are currently three main telescopes at Chile's El Sauce Observatory, all of which are large 50-cm+ reflectors. This area boasts some of the best dark skies on the planet, averaging 300 clear nights each year.

And Hawaii's Haleakalā Observatory ("Science City") has capabilities described on its website:

> One of Science City's many accomplishments is the detection of 19 near-Earth asteroids [in one night]—the highest number of asteroids monitored in a single night—and the tracking of Venus. Most recently, Maui's loftiest peak saw the unveiling of what's been called the biggest digital map of the Cosmos—an assemblage of data that showcases three billion stars, galaxies, and other celestial objects.

FIGURE 4
The Lowell Discovery Telescope

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The Lowell Discovery Telescope in the Coconino National Forest, Arizona (4.3 m), is one of the many telescopes worldwide that contribute to the tracking of near-Earth objects.

What Is an Interferometer?

Interferometers—with their high precision—play a role in tracking near-Earth objects. What are they? According to Caltech.edu, "Interferometers are investigative tools used in many fields of science and engineering, [which] work by merging two or more sources of light to create an interference pattern, which can be measured and analyzed: hence 'Interfere-meter,' or interferometer. The interference patterns … contain information about the object or phenomenon being studied. They are often used to make very small measurements that are not achievable any other way. This is why they are so powerful for detecting gravitational waves—LIGO's [Laser Interferometer Gravitational-Wave Observatory] interferometers are designed to measure a distance 1/10,000th the width of a proton!"

Complementary Observatories

Other observatories that assist in the search and monitoring of asteroids—amid all of their other missions and tasks—are spread around the world:

- Antarctic: Part of the Astrobiology Science and Technology for Exploring Planets (ASTEP) mission
- Argentina: The Bosque Alegre Astrophysics Station, located about 48 kilometers southwest of Cordoba at an altitude of 1,200 meters in the Sierras Chicas
- Canary Islands: The Telescopio Nazionale Galileo
- Chile: This observatory includes the Atacama Large Millimeter/submillimeter Array (ALMA), currently the world's largest radio telescope; and the 4.1-meter Southern Astrophysical Research (SOAR) Telescope
- Israel: The Wise Observatory is a professional astronomical research facility owned and operated by Tel Aviv University, which hosts the main 1-meter telescope and a number of smaller automated telescopes. Its clear desert skies and favorable geographic longitude allow the tracking of transient and time-variable phenomena when it is daytime at most other observatories on Earth
- Italy: The Astrophysical Observatory of Asiago was once the largest telescope in Europe, a reflector with a primary mirror diameter of 122 centimeters
- Namibia: The High Energy Stereoscopic System (HESS) for observing cosmic rays, and the Africa Millimeter Telescope (AMT), which will use radio waves to detect objects in the darkest parts of the universe
- New Zealand: The Mount John Observatory is run by the University of Canterbury, and features four telescopes
- The United States: Half a dozen astronomical facilities contribute to the tracking of near-Earth objects. Arizona has the Lowell Discovery Telescope (see **Figure 4**) and Navy Precision Optical Interferometer. California's Goldstone Observatory (part of the Deep Space Network that communicates with spacecraft) is sup-

ported in its radar studies of NEOs by the Table Mountain Observatory and the Mount Palomar Observatory (home of the famous 5.1-meter Hale telescope). New Mexico's Magdalena Ridge Observatory (MRO) and Interferometer (MROI) are major facilities. When all of its tracking telescopes are optically linked together, they can resolve objects with 100 times the resolution of the Hubble Space Telescope. And West Virginia's Green Bank Observatory "is the world's premiere single-dish radio telescope operating at meter to millimeter wavelengths." It has access to 85% of the celestial sphere.

The Shape of Space and the Human Mind

As mankind moves out into the Solar System—most likely first colonizing the Moon, and then Mars—we must discover the shape of the space in which we live. Commonly accepted axioms assert that time and space are linear, that space stretches out in straight lines in all directions, but the Universe will always surprise us.

The Milky Way is usually presented to us in pictures as a relatively flat, disc-shaped barred spiral galaxy. But, what if it's warped? How then do we navigate?

As Caroline Hartman outlined in her article, "Asteroid Defense: Call for More Cooperation To Protect Earth," in a previous issue of *EIR* (Vol. 50, No. 19, May 12, 2023), Earth isn't just orbiting Sun in a neat, planar elliptical orbit; the entire Solar System itself is orbiting the galactic center on one of the spiral arms of our galaxy, taking approximately 225 million to 250 million years for one circuit.

Not only is the Solar System moving up and down relative to the median plane of the galaxy as it orbits the galactic center, but the entire galaxy appears to be warped.

Dorota Skowron and associates at the University of Warsaw demonstrated the warp of our galaxy in a study published in *Science* in 2019. They showed that if, for example, our galaxy is seen edge on, it is not flat, but follows a gentle s-shape (see it here.)

They measured the distances of more than 2400 bright Cepheids, stars that pulsate in brightness. The period of pulsation is known to be well correlated with their absolute brightness (not the relative brightness that is dimmed by their distance from us). By comparing absolute brightness with apparent brightness, their distances could be calculated with greater precision, especially because they were studied at both the optical and infrared wavelengths. The infrared is scarcely attenuated by another factor, the intervening gas and dust.

The team "constructed a map of the Milky Way in three dimensions, based on the positions and distances of thousands of classical Cepheid variable stars." This map shows "the warped shape of the Milky Way's disk."

We know that most asteroids reside in the Asteroid Belt, but why does the Asteroid Belt exist? One of the first people even to hypothesize its existence was Johannes Kepler (1571–1630). Kepler not only discovered the universal law of gravitation, but in 1596, he wrote, "Between Mars and Jupiter, I place a planet," in his *Mysterium Cosmographicum*, stating his prediction that a planet would be found there. In 1619, he produced his treatise, *Harmonices Mundi* (*The Harmony of the World*), in which he developed the idea that the planets of our solar system do not have random orbits, but rather the paths of the orbits are pre-determined by harmonics.

Although he initially believed there would be a planet between Jupiter and Mars, Kepler discovered a musical dissonance (F–F#) in that region, indicating that any planet in such a location would be in such an unstable orbit that it would break apart. That hypothesis was later confirmed when the first asteroid was discovered in 1801 by Giuseppe Piazzi, who named the dwarf planet Ceres; NASA landed the spacecraft *Dawn* on it in 2015. It is a worthwhile endeavor to recreate Carl Gauss' method for determining Ceres' orbit.

Additionally, the orbits of the asteroids themselves fall into distinct rings. As Wikipedia explains it:

> The semimajor axis of an asteroid is used to describe the dimensions of its orbit around the Sun, and its value determines the minor planet's orbital period. In 1866, Daniel Kirkwood announced the discovery of gaps in the distances of these bodies' orbits from the Sun. They were located in positions where their period of revolution about the Sun was an integer fraction of Jupiter's orbital period. Kirkwood proposed that the gravitational perturbations of the planet led to the removal of asteroids from these orbits.

In the presentation by Jason Ross cited above, he noted that a team of youth selected by Lyndon La-

Rouche to concentrate on fundamental discoveries, developed a short animation which suggested that the orbits of some of the larger asteroids are themselves defined by Keplerian harmonics. Ross explains this in the video.

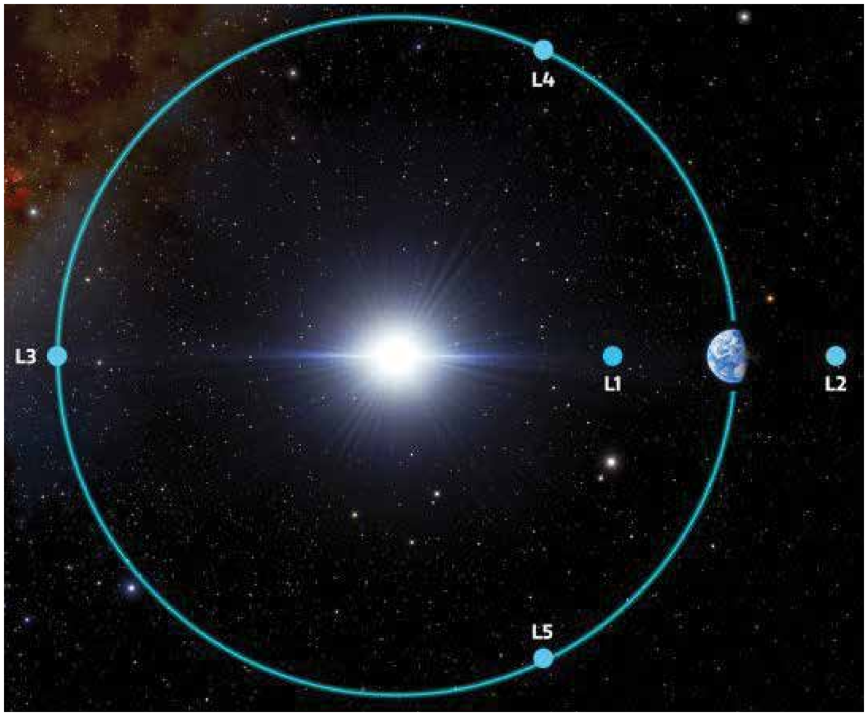
Although some orbits might appear random, our new knowledge of the shape of the Solar System, guided by Kepler's discoveries, suggests a higher ordering principle defining the nature of orbits.

Asteroids at Lagrange Points

For example, in a previous article this author presented the idea of the Lagrange points:

> Lagrange points are positions in space at which gravitational forces (as well as centrifugal forces) are in balance, so these areas can be used by a spacecraft to reduce the fuel consumption needed to remain in the same position. There are five Lagrange points for the system of the Earth, Sun and Moon; the Lagrange points are different for the other planets. [See *EIR*, Vol. 50, No. 10, March 10, 2023, pp. 10–13.]

FIGURE 5
Lagrange Points for the Sun-Earth System



J. da Silva//NOIRLab/NSF/AURA/Spa

Lagrange points are special positions in space where the gravitational pull of two large masses (such as the Sun and the Earth) precisely equals the centrifugal force on a much smaller body, so that the small body remains stationary with respect to the larger two, as the larger two orbit the center of gravity of their system (such as the Solar System). The James Webb Space Telescope orbits around the Sun-Earth L2; a few asteroids are found to have congregated around L4 and L5.

Scientists discovered that asteroids will also congregate at the stable points both ahead of, and behind a planet (points L4 and L5, respectively). (See **Figure 5**.) Missions are underway (the Lucy Mission, for one) to explore these areas in the orbit of Jupiter, called the Trojan asteroids. These are asteroids that are gravitationally trapped by Jupiter, and circle the Sun with it, in its orbit. It was first discovered in 2010 that Earth has a Trojan asteroid as well, and a second one was discovered in February 2022; there may be more.

Since the Webb Telescope was successfully placed in orbit around Earth's L2 point, perhaps some researcher or citizen-scientist somewhere in the world will discover a means by which an incoming dangerous asteroid could be deflected in some way to insert it at either the L4 or L5 point on Earth's orbit, where it would simply glide along with Earth.

The optimum pathway for solving this crisis—and other crises that mankind will face in the future—is to return economic policy to that of American System economics, which would ensure that with each new space mission, thousands of beneficial spinoffs would be generated, producing a physical profit for the economy. We will also require millions of new engineers and scientists in all areas, as space exploration will expand with each new generation.

But it is the understanding of the true nature of humanity which will determine our economics and our science. The common (Lockean) view is that man is simply a clever animal; the Earth is a speck of dust in the Universe; and our lives are small and meaningless as we contemplate the endless heavens. How do we draw courage within such a world view—to deal not only with the danger of asteroids and comets, but the very real, and far more imminent threat of thermonuclear war?

Perfecting Mankind's Creativity

We require a new paradigm of economic, cultural, political and scientific endeavors and international relations, based on sound principles, such as that put forward by Helga Zepp-LaRouche in her 10 principles for a new security and development architecture. Her final principle states:

> Tenth: The basic assumption for the new paradigm is, that man is fundamentally good, capable of infinitely perfecting the creativity of his mind and the beauty of his soul, and the most advanced geological force in the universe, which proves that the lawfulness of the mind and that of the physical universe are in correspondence and cohesion, and that all evil is the result of a lack of development, and therefore can be overcome.

Lyndon LaRouche addressed this idea in a Memorial Day address May 28, 2002, that humanity knows things not simply from experience, but from ideas:

> Mankind is capable of discovering universal principles which cannot be smelled, tasted, seen with the senses, but which the mind is able to define, and we're able to prove experimentally.
>
> This is what we mean, when we say in Christianity, Islam, or Judaism, that man and woman are made equally in the image of the Creator of the Universe. Because we each have within us, that power to discover truth, the truth of universal principles which no monkey, no lower form of life, can do. And through this power, we are able to change man's relations with nature; we're able to change ourselves, to improve and develop ourselves.... This is why every human life is special and sacred. This is why every human being, man or woman, is equal, in this quality, which need but be developed and expressed.

Perhaps the time has come in which we recognize not only that we can be patriots of our own nations, but also citizens of the world; as John Donne said in his famous poem:

> No man is an island entire of itself; every man is a piece of the continent, a part of the main … any man's death diminishes me, because I am involved in mankind….

There is a principle in America that when a person is elected to the Presidency or the Congress, he or she takes an oath of office not to defend "the United States" but to "… support and defend the Constitution of the United States against all enemies, foreign and domestic."

Perhaps it is time for us to swear to defend the entire human race, and the principle of what it means to be human, "against all enemies, foreign and domestic." That is the principle for building a strategic defense of Earth.