The New Frontiers for Mankind: We're Only Getting Started

by Brian Lantz

This is the edited transcript of Mr. Lantz's opening remarks to the June 6 conference. Subheads and embedded links have been added.

June 6—First, I'll frame it this way: The universe does not intend to die! I'm paraphrasing Lyndon LaRouche. The universe does not intend to die. It is not-entropic; it is negentropic. Its very nature is creation, and we're part of that creation, an expression of that creative principle. When we think of the new slogan of the Trump administration, the recent 2.5-minute ad, "Make space great again!" we're only recognizing what's already there. But it's important that we recognize it as the basis for our own progress, for the progress of mankind and for future generations.

Compare that to the Presidency of Obama. It was on April 15th, ten years ago, that Barack Obama went down to the Kennedy Space Center in Florida, and told NASA employees gathered to hear him, that we'd already been to the Moon. We'd done that. It was the same Barack Obama in September of the same year, who in Virginia said we don't need to invent some fancy new fusion, meaning fusion energy. It was that same Barack Obama again who in June of 2013 on his tour of Africa, in South Africa and then in Dar es Salaam, told his audience, "Well, if all these young people here get cars, get air-conditioning, get big houses, the world is going to boil over." That was Barack Obama.

New Frontiers of Discovery

But what we're now recognizing is something quite different. We're recognizing a frontier, or frontiers, and this is man at his best; going out into the universe to discover what he's about and what he's to do. This is a global effort. NASA Administrator Jim Bridenstine, as many of you may know, commented on this in the context of the SpaceX launch a week ago today. He was asked about U.S.-Russia collaboration, and he said, "Our cooperation transcends above terrestrial geopolitics." We're not in the realm of scarcity; scarcity breeds geopolitics and reinforces it.

We're in the realm of frontiers now. I want to emphasize, in terms of what we're going to be discussing here today, that the space-faring nations of the world, whose number is growing virtually every day, in their exploration going out to the Moon, going out to Mars, are going to be, and in some cases already are, working at the cutting edge of the science and technologies that will vastly increase the creative and productive powers of mankind. This is our real self-interest, especially for our young people.

Gottfried Wilhelm Leibniz, in his writings of 1671, based economics on the idea that a machine utilized by one man could do the work of 100 people. Lyndon LaRouche put it this way:

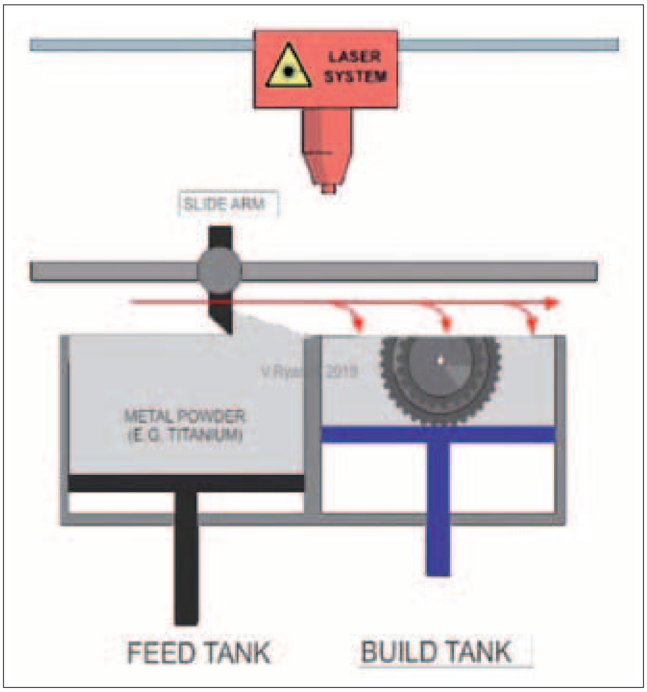
> Increases in productivity come directly, only, from improvements in technology derived from fundamental scientific discoveries; the higher the rate you convert fundamental physical discoveries into practice, the greater the rate of increase of productivity per capita of population, and per square kilometer of area.

We increase the *power* of man's labor through innovation, through the discovery of new physical principles in science. This is one feature of our report, *The LaRouche Plan to Reopen the U.S. Economy: The World Needs 1.5 Billion New, Productive Jobs*. We have to shift upward the percentage of our workforce engaged in transforming nature for man, making the physical changes on nature, back towards 50% of the workforce as outlined in the report. At the same time we also have to increase our scientific workforce, those engaged in research and development and basic science, from approximately 2% today—and that's being generous—to 5% of our workforce, at least.

Man Missions in Outer Space

I'm going to take the example here of SpaceX. Last Saturday, the SpaceX Crew Dragon spacecraft with the *Endeavour* capsule on top, successfully carried out a mission to deliver two U.S. astronauts, supplies and gear to the International Space Station. It was lofted by the Falcon 9 rocket. It is reported that the Falcon 9 rockets—86 of them to date have been flown successfully—

FIGURE 1



CC BY-SA 4.0

have now flown more missions than any other rocket in the world. More than the Atlas rocket, for example. Thirty-one of those launches were with first stages that had gone up before; they are being utilized again and again. The cost of moving a kilogram from Earth to Lower Earth Orbit has been cut to one-seventh of its previous cost, under SpaceX and its rapid development of rocketry.

Lyndon LaRouche wrote a paper in 1985, specifying the need for the private sector to become a more significant part—in fact a cutting-edge, a disruptive cutting-edge—of the U.S. space program. That indeed is what SpaceX and others are doing. There's a lot of creativity out there. There needs to be more, but it's happening. It's also happening in many fields. There is a vast global co-operative effort now underway to find a vaccine for COVID-19. And we have that kind of cooperation in space exploration, as Jim Bridenstine's remarks reflect. Such efforts involve the European Union, Russia, China, the United Arab Emirates. We're going to Mars again this year. We're going to the Moon again this year.

All of this is underway. Mankind is going, despite the entropy that had kicked in as the destructive consequence of the mindset of a mere Barack Obama, or those who shaped him. Despite that entropy, mankind as a whole expresses the very nature of the universe itself as a very creative force.

Additive Manufacturing

Let's turn to creative innovations by looking at SpaceX. For example: Additive Manufacturing (AM), also known as 3-D manufacturing. SpaceX developed the first fully 3-D printed rocket engine, the Super Draco rocket engine, used as the propulsion system of the Crew Dragon's crew capsule, which can move it safely, if needed on launch, out of the way of an otherwise potentially fatal accident. Potentially, those same Super Draco rocket engines could land the space capsule on land; that's the idea. Obviously if we're going to get to Mars and get back, we've got to be able to land and take off again.

The Super Draco engines are produced through *additive manufacturing*. **Figure 1** shows *metal laser sintering*. Running across the top, is a laser system; this could be a CO_2 laser, or some other type, but often a CO_2 laser. Down below to the right is a table, with something that looks cut away there—a series of circles. This is the item that's being built up, horizontal layer by horizontal layer.

You can see this device coming across the top. It's moving a metallic powder into the compartment where that piece of machinery is being built. It will distribute that powder over the top of it, and the programmed laser, run by a computer and utilizing a 3-D computer-aided design (CAD), will direct that laser down to precisely merge this metallic powder into another layer of the machine part that's being built. Any remaining metallic powder is then scraped horizontally off the far side. The blue there is the base of this well in which the item is being built, that will then move down. On the left side, the metallic powder is moving up. So, in the course of time, a building process.

Figure 2 shows the product. (The blue is a man's arm reaching out to a tool and brushing away the

FIGURE 2

Stratasys

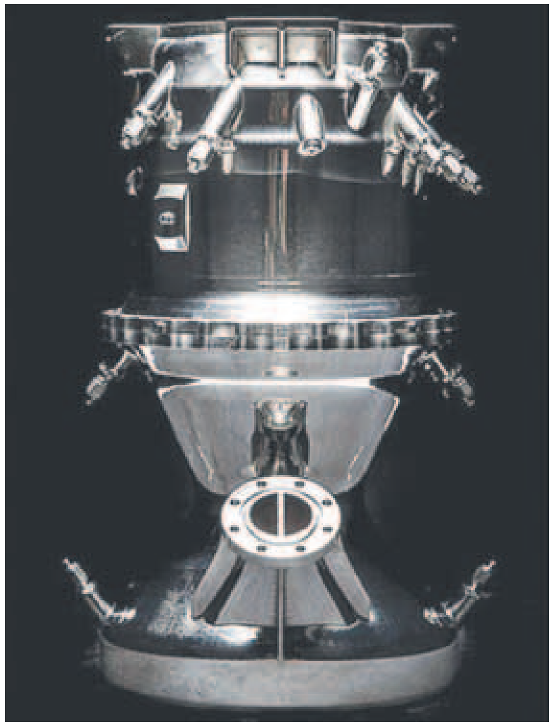
powder.) That powder, around the item as it's being built up, helps stabilize it as the metal is being fused. This is called *sintering*. Think of how snowfall becomes a glacier; compressing with heat or pressure, a solid material is formed. It's not melted; it's compressed. This is sintering.

This technique was utilized to produce the Super Draco engine, with the entire engine being made of a few parts built up by this additive manufacturing process. The product made by this process is tougher, lighter, and more durable, because it reduces the number of parts to two or three or four, and because there are not as many interfaces between parts, in which friction and other problems can develop and cause the machine as a whole to break down.

Direct Energy Deposition

Figure 3 is a rocket engine being produced by a new company called Relativity Space, using additive manufacturing. The figure shows the thrust chamber of their Aeon rocket engine. Relativity Space is aiming to produce entire rockets by additive manufacturing.

FIGURE 3



Relativity Space

In **Figure 4**, to the right in the main area, with the co-founders of Relativity Space, is the second stage of their Terran1 rocket, produced via 3-D printing. The engine was built with direct metal sintering of the type mentioned above. The simple version of their proprietary engine has just three parts to it, compared to at least 2,500 for one produced using traditional manufacturing methods and materials.

FIGURE 4

Relativity Space

Figure 5 shows a fuel tank being created by another form of additive manufacturing. The Stargate 3-D printer created by Relativity Space is claimed by the company to be "the largest 3-D printer in the world." With it, they can produce items up to 20 feet tall and 10 feet in diameter. The process used here is called *direct energy deposition* (DED)—deposition as in "deposit."

Stargate uses an electron beam and an arm—this is the actual production process—that deposits metal wire onto the surface which is then melted into the layer underneath. As it is turned, the arm climbs according to a CAD program creating the specific shape, closing at the top much like it is closed at the bottom to complete the fuel tank construction. By simply pushing a couple of buttons, an operator can cause that

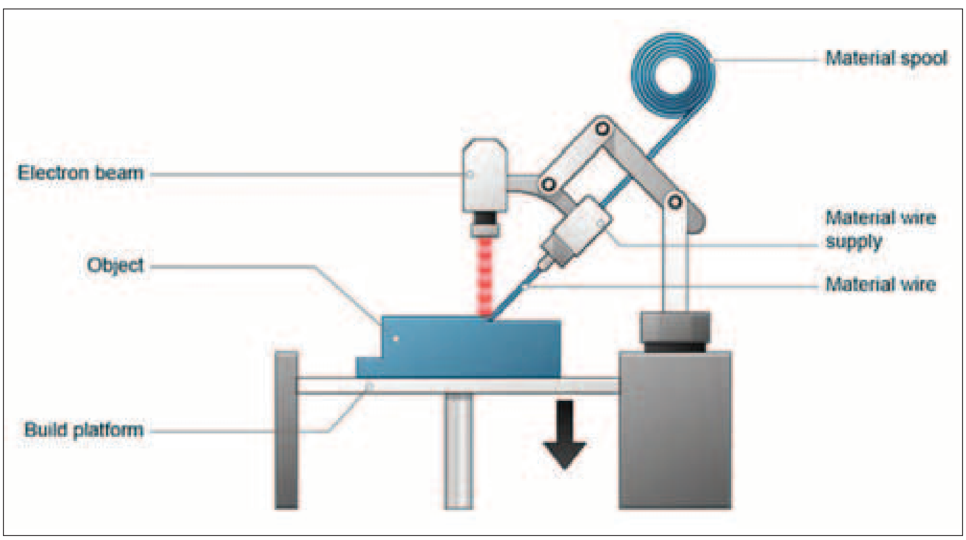
FIGURE 5

Relativity Space

Stargate 3-D printer, using DED, to move from creating one fuel tank to another, or to create another item altogether. There's virtually no tooling, in the traditional sense, involved.

The Stargate is sitting in the main construction room of the Relativity Space factory. Notice it's not greasy, no racks of tools on the walls. All the work is done by one gigantic machine. Such machines could ultimately be exported to Mars and other places to build rockets there. This is not a far-fetched effort. Relativity Space is partnering with NASA's facility at Stennis Space Center in Mississippi for warehouse and construction space, and is headquartered in Long Beach, California. The U.S. Air Force has contracted Launch Complex 16 at Cape Canaveral to Relativity Space. This is a mainstreamed process now going forward. Another revolution, another leap in terms of the *productive power* of mankind!

FIGURE 6



I think you already have the sense that additive manufacturing, or 3-D printing, on both a large and small scale, is being acquired across the board, including for medical devices and in a host of industrial and manufacturing processes.

Figure 6 is a cursive diagram of the process of *direct energy deposition*. Notice in blue on the top-right, a coil of wire. It's being fed down. The machine is constructing the blue object on the table. The electron beam has been melting the blue wire as it feeds it in. That beam is not stationary, but moves around the perimeter of the object being constructed, according to programmed instructions, digitally communicated to it.

There's another area. These days, we're in a COVID-19 environment, dealing with a deadly pandemic. Our medical science has become more central to our thinking as we search for effective treatment regimes, therapies, and vaccines. We know that mankind has got to penetrate the frontiers of the very small to make the breakthroughs required.

Medical Science: 3-D Bio-Fabrication

Right now the International Space Station is home to the U.S. National Laboratory. Did you know that we have a national laboratory on the ISS? One of the companies operating there, called Techshot, is operating a 3-D bio-fabrication facility that recently completed the production of layers of heart tissue. In this case, obviously they're not dealing with lasers, but with "feeds" of living cells encapsulated in spheroids of hydrogels or polymer material fed in, layer upon layer, in rows across an area. Over time, stabilized in space, these layers then grow together and reinforce each other.

This process is now at work on the Space Station. In fact, Techshot partners with U.S. National Laboratory to offer access to commercial companies on the Space Station for this purpose, but they're already running out of room. So contracts are being made with other space companies that are intending to send up space laboratories for further work in such research areas. This is just one example of what's going on right now in the bio-sciences related to additive manufacturing/3-D printing: *bio-printing*.

Howard R. Hollem

The B24E (Liberator) heavy bomber was redesigned for assembly-line mass production. More than 8,000 were then turned out at the Ford Willow Run Plant near Ypsilanti, Michigan during World War II.

Other areas of related research include regenerative structures for bones. Bone grafting involves artificial material that doesn't grow, but when living materials made from stem cells or from the patient's own cells, are implanted, they fuse and grow into that bone's structure. Cartilage, again from stem cells or the patient's own cells, can be injected into areas, layer upon layer, where the cartilage has worn away, and will there reproduce. This is in process; it's being evaluated in trials with animals. Skin grafting, corneas, ultimately heart replacements. All of this is going on, on the frontiers where the life sciences intersect with bio-engineering and other related areas of research.

The Mission

I'll close by focusing on the mission. What are we asking for in our call for a Space Civilian Conservation Corps? What would be its mission? Well, you already have some sense of it here, but let me give just a couple of quick additional examples. During World War II, we have the example of the B-24 Liberator bomber. The Ford Motor Company was asked to produce the Liberator—not just a few of them, but thousands, on an assembly line basis. Nobody had done anything like that. As one executive of another company, North American Aviation, put it, "You can't expect a blacksmith to make a watch overnight." He was saying it couldn't be done.

But in Ypsilanti, Michigan a plant was built over a half-mile long, and an existing plane—the Liberator bomber that was then being built in San Diego, California—was adopted as the bomber that was going to be built at this huge new plant in Ypsilanti, funded by the U.S. government. Well, Edsel Ford, Henry's son, got out to San Diego with his team and looked at this bomber, and then tried to look over the blueprints. But there were no blueprints for significant parts of the plane. Parts were being custom built, one by one, for each plane.

Edsel Ford and his team flew a couple of these bombers from San Diego to Ypsilanti, and took the bombers apart—they had a team of 1,000 design engineers working on this—to define and redesign that plane to make it suitable for production on a huge assembly line. The B-24 is a four-engine heavy bomber, one of the largest bombers made during World War II.

They produced 8,000 of these bombers in three years between 1942 and 1945; approximately half of all the Liberator bombers built in the entire country were built there in Ypsilanti. That was *the mission* taken up by Ford, by his design team, by the mechanics and engineers, and it was accomplished. The civilian airline industry came out of that process.

Elon Musk took the airline industry as a model for building rockets at SpaceX. You've got to standardize; you've got to make parts interchangeable; you've got to make it durable; you've got to make it landable; and you've got to turn it around and fly it again. Think of how we are used to seeing commercial airplanes coming in and out of airports—or at least before COVID-19 we were used to seeing them coming in and out of airports! So, this was the working approach of the SpaceX team in designing the Falcon 1, in designing and redesigning it, through many iterations. In addition, the Falcon Heavy is already being utilized by the U.S. Department of Defense; that bigger rocket is being flown as we speak.

After the launch on Saturday to the International Space Station, only three days later, on the Wednesday following, another Falcon 9 went up. This gives you some idea of the rate at which SpaceX rockets are being launched. The rocket that went up on Wednesday, was on its fifth launch; its first stage has now been used five times.

Increasing the Productive Powers of Labor

We're talking here about discovery, and increasing *powers*. Rockets are not the whole of this. We need space planes; we need other technologies to launch a greater volume of materials, supplies, equipment, and so on into space at a much cheaper rate than we can achieve even with these advances in rocket engines and rocketry. But it gives you an idea of how you have to approach this. *The mission*, think about it. If we're going to build a high-speed rail system in this country, everything from the ballast under the rails to the braking has to be developed. It has to be problem-solved. This means materials science. Machine tools have to be developed. For example, over 1,000 machine tools were used specifically to construct the Liberator bomber.

We're just beginning to crack fusion energy and bring it on line. Developing direct energy conversion from fusion energy, and all of the implications of that, is an absolutely required mission for mankind.

We need small modular nuclear reactors. This is critical for all of Africa and South America. You can't build a 1 GW nuclear power plant if the power grid to carry all that power isn't in place. You need small nuclear reactors, modular nuclear reactors that can be floated or otherwise transported and assembled and put into place quickly and brought on line. Likewise, in other areas like freshwater systems and so forth. All of these are going to require enormous brain power and advanced skills to make the changes on nature for mankind that are required.

NASA/Joel Kowsky

A SpaceX Falcon 9 carrying two U.S. astronauts to the International Space Station, May 30, 2020.

We need LaRouche's Four Laws for this. We need national credit. It's really a minor thing when you put all this into perspective. It's these projects and others like them, as in the bio-sciences, that are the new frontiers for mankind, and we're only getting started. We don't know many of the laws of the universe. We won't get closer to knowing until we start getting out there, and that's the challenge.

So, this idea of exploration, of frontiers, this is what Frederick Douglass understood about the potential of every man, woman, and child. This is the conception that the Trump administration has brought to fore with Artemis: to put a man and a woman on the Moon by 2024; to build a permanent, sustainable presence on the Moon by 2027; and to move on to the colonization of Mars in the 2030s. But it's going to take millions of productive individuals taking up these very interconnected missions to make that possible.