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From Panel 4 The World Land-Bridge: It's Being Built! (continuation)

China's Helium-3 Revolution

Benjamin Deniston, LaRouche Policy Institute, USA

Craig Isherwood: The next part of this panel is a discussion about China's Helium-3 Revolution. Joining us from the United States via Google Hangouts is Ben Deniston from the LaRouche Policy Institute. People who have been following the LaRouche website will see Ben on numerous occasions, giving addresses. So Ben, we'd like to welcome you to our conference on this very interesting topic.

Benjamin Deniston: I'm very happy to be addressing you from across the Pacific. I work with Lyndon LaRouche; I'm part of his scientific research team, sometimes referred to as "The Basement". We have a small team, and we've had the great opportunity to work closely with Mr LaRouche on areas of scientific matters, scientific investigations, economic studies, and related matters.

One thing we've been taking a serious look at over the recent period is what China is doing with their lunar program. In the context of everything we're talking about here, a real revolution going on around the world, this BRICS alliance emerging, all kinds of global development being unleashed and launched, Mr LaRouche has highlighted, in particular, China's space program, and their Lunar program, as something distinct: as something that he sees, that embodies the whole spirit and future-orientation of this global dynamic now occurring. He has discussed this as going to a more fundamental issue, which is the need to redefine our understanding of what Mankind is as a species on this planet; but not just on this planet—in the solar system and beyond.

That is something Mr LaRouche has spent a lot of his time, much of his life, focussing on developing: a more scientific, accurate conception of what makes mankind unique. What makes the human species qualitatively different, rather than just another animal species? [He has focussed on] not just recognising that, but coming to understand it in greater detail, coming to develop new and higher insights into what is the unique, creative capability that only the human mind has, which we don't see existing in any animal species. How can we begin to develop the types of cultures, and relations among cultures, and relations among nations, and goals for co-operation among nations, vectored towards further developing that unique human creative capability?

He has referred to the Renaissance, the 15th-century European Golden Renaissance, as a reference point for the type of shift we need to make right now. We need a political shift, we need a change in political policies, we need a change in strategic policies, but we also need a deeper change in society's understanding of what mankind is on this planet. What's our mission, what's our goal? He has pointed

to China's space program as a leading expression of the type of activity, directed towards a better understanding of that deeper issue.

I want to discuss this, starting with a reference to a Chinese official by the name of Ouyang Ziyuan. He is referred to as the father of China's lunar program. We picked up on this a couple of years ago, when China made their first successful soft landing on the Moon, with Chang'e 3 mission's soft lander and rover. This is part of their lunar exploration program, and the father of that program is a very interesting fellow.

I want to read one quote from him, from a paper he published in 2008 along with some associates, to give a flavour of the direction of thought, embedded in China's current lunar program and their space efforts. In this paper Dr Ziyuan said, "China's Chang'e program will accomplish the unmanned lunar exploration task by three phases: of orbiting, landing and returning"—returning a sample back to the Earth, which is their next mission; I believe it is going to happen around 2017. The he goes on to say, "After 2020, China will actualise the dream of manned lunar landing and lunar base establishment step by step. As the progress of lunar exploration, China will be able to explore Mars, other planets, asteroids, comets, and interplanetary space. Through the exploration of celestial bodies of the solar system, it will drive forward the innovation and advancement of aerospace science and technology, improve the development of high and new technologies, serve economic growth and sustainable development of human society. China's Lunar Exploration Program will make significant contributions to a great renaissance of the Chinese nation."

What we are seeing now, as was stated there—not all of these steps have been necessarily officially declared, in terms of time frames or dates—but what we're seeing now with the current program is the precursor to, likely, an intention to send people back to the Moon. But, then, [there is] also an intention, as he says, to build habitation, to build settlements, to build bases, and to use those as a base of operation to further our expansion out into the solar system.

He is also a proponent, and has many times spoken of the great potential, of developing the resources from the Moon, and in particular the fusion fuel resources; specifically, a certain type of helium that is very, very, *very* rare on Earth, but is rather abundant on the Moon: the isotope helium-3. It is a type of helium, which is not the type you would get in a balloon, on Earth. It is a helium isotope that can be used for what you would call a "second generation" or an "advanced" fusion reaction.

And at one point, speaking of the interest in helium-3, Ouyang Ziyuan said, "When obtaining nuclear power from helium-3 becomes a reality, the lunar resources can be used to generate electricity for more than 10,000 years for the entire Earth", just to give you a sense of the scale of the helium-3 resources available on the Moon. Ten thousand years is not something you can even contemplate; we have no idea where mankind will be in 10,000 years, especially if we continue the current process of development initiated by this BRICS orientation, and we can make it through this collapse of this British system.

Advanced Fusion Reactions

To get at this helium-3 issue: fusion is the most powerful energy source, power source, that we currently know of. It can be done with various types of fuel, some of which are available on Earth. Helium-3, this particular type of helium which is abundant all over the Moon, allows for the potential for an advanced type of fusion reaction, with a much more efficient conversion of the energy of the fusion reaction into electricity. It would enable us to skip what we currently do for most of our power generation, which is to use a fuel—react or combust a fuel, generate heat, and use that heat to generate steam to spin a turbine to generate electricity. There is the potential, with these advanced fusion fuels, to generate electricity directly from the process of the fusion reaction itself, from the activity of the plasma of the fusion reaction. This enables not just fusion power, but helium-3 enables a second-generation, advanced fusion reaction, which would completely revolutionise our activity as a species, just to put it bluntly.

To put this into context: one thing that Mr LaRouche has pointed to is looking at the evolution of human societies from the standpoint of the qualitative shifts in power sources and what he calls “energy flux density”. This is something we’ve studied in our work. For example, I’ve done studies looking at the history of the United States and the qualitative transitions of the U.S. economy, moving from a predominantly wood-based economy to an economy dependent upon coal, moving then to a petroleum/natural-gas-based economy, and then to the potentials of nuclear power, which has been largely halted in the United States, but has greater potential.

What you see with these transitions, historically, is that the power per capita, the energy per person, of the total economy, increases with each of these steps. You get these qualitative increases in the energy flux density of the economy as a whole, which have been a driving force in creating real economic growth, allowing us to transition to new resource bases, develop new resources, develop new modes of production, which couldn’t exist in the lower system. What we’re looking at with fusion power—ideally, helium-3 fusion technologies—is the next stage in the natural, qualitative advance of mankind. This is the process that really characterises Mankind’s progress. As Dennis [Small] was saying towards the end of his remarks, this is real economics: studying how it is that the human species qualitatively supersedes and transcends its previous state, its previous potentials, in going into a qualitatively higher level.

Today, that means nuclear power, and especially fusion technologies. If you look at the history of mankind’s progress and these transitions, from wood to coal to fossil fuels to nuclear fission, the next step in the process of further utilising nuclear power, nuclear fission, the next step for mankind—not just something that we can choose to do, but what is, inherently, the next step to take—is going to a fusion economy, fusion technologies.

One way you can begin to understand the differences between these types of fuel sources is comparing the energy-density of different fuel types. You could say, “What is the amount of energy in a given weight of fuel?”—comparing, say, gasoline to nuclear fuel. Or, to put it another way, to have the same amount of energy, how

much fuel do you need of different types? Nuclear fuels, like fission, like fusion, are generally a million times, or over a million times, more energy-dense than chemical reactions.

Because that's a difficult thing to conceptualise, a million-fold difference, I pulled together one example, which is a variation of a study I had done for the situation in the western United States, to try and give a pedagogical picture of what a million-fold increase in energy-density is. I decided to look at the water needs, the water situation in Australia, and I pulled together a quick example. This is something that I know is obviously an issue over there. It's an issue here in the United States as well: the need for water. And we have a problem in the United States with people saying, "Well, there's a finite amount of resources… We can't use up this fixed amount of resources, we can't draw down our resources to the point where we have nothing left, we have to learn how to conserve with less, we have to learn how to utilise less". It's this very backwards mentality that's been a driving factor in the economic decline of the United States.

Whereas in reality, with this type of qualitative transitions of human progress that I'm describing, mankind creates new resource bases. Again, take this water issue: water is inherently a renewable resource! When we use water, it doesn't no longer become water. If we use water to water our crops, it's still water. When we consume water, it's still water, unless there's a chemical reaction occurring, something like plants utilising it for photosynthesis. Water is constantly cycling in and out of various systems, various forms. Most of what we depend upon currently is the water that gets evaporated by the Sun, by solar radiation, enters the atmosphere as water vapour, and then falls as rainfall or snowfall over an area, over a continent or a territory, and then gets utilised on that territory, and then runs back off into the ocean again to begin that cycle again. It's inherently a cyclical process, a renewable process.

Water in Australia

For fun, today I pulled up what I could find for the figures for that cycle for Australia as a whole. There might be various different estimates; I found a figure of about 570 km^3 per year. That's the amount of annual run-off from Australian rivers back into the ocean, which is one measure of this cycle of evaporation/precipitation/run-off. So, you have something on the order of 570 km^3 per year of flux of water into Australia, utilised on the continent, and then flowing back into the ocean. That's a cycle of water supply that the people of Australia depend upon.

In a fusion economy we don't have to limit ourselves to relying upon that natural cycle as it currently exists. We already have technologies to remove salt, purify ocean water through desalination, and began to create our own resources of fresh water for our own use. In effect, it's like taking over the role of the Sun. We can begin to create our own cycles. Again, this is not just using up some finite resource; we can take in ocean water, and instead of the sunlight evaporating it and turning it into fresh water, we can turn it into fresh water ourselves. We can desalinate it, we

can bring it inland, we can use it for crops, we can use it for irrigation, we can use it for economic activity, it can flow back out into the ocean again when we're done. We can create our own cycles of activity.

To get back to this issue of fusion and energy-density, I thought it would be interesting to look up how much helium-3 would be needed to match the entire continental water cycle for Australia. How much helium-3 fuel, how much energy would we need to produce with helium-3, in order to desalinate enough water—570 $km^{3?}$ This is a fun exercise, this is a huge, huge amount of activity here, this is a vast amount of water, so I'm not actually proposing that we do exactly this, but just to give a sense of the scale of activity mankind could achieve with this type of fusion-level economy. If we were to match the water cycle of the continent of Australia with fusion power, it would take about 25 tons of helium-3 per year. That could fit in the cargo bay of one of our former space shuttles. That's not necessarily a huge amount of fuel; if you have a conception of how much water that is, that's not necessarily a lot of fuel. It could probably fit, also, in one railcar for a train. So one railcar, one space shuttle-load of helium-3 from the Moon, per year, could allow mankind to create his own water cycle matching the current natural water cycle of Australia. Again, a fun exercise!

What if you were to try and do this with coal? We could desalinate ocean water with coal. You could use coal to generate electricity to power desalination, the same way you would use fusion to generate electricity to power desalination; you still use electricity, either way. But with coal, it would take not 25 tons, it would take 530 million tons of coal. The helium-3 would fit into one rail-car; 530 million tons of coal, if you were to put *that* into railcars, would wrap around the entirety of the coast of Australia three and a half times.

When you're talking about a million-fold difference in energy-density with nuclear reactions versus chemical reactions, I went through this example to give you a sense of the scale you're talking about: one railcar, one single railcar-worth of helium-3 fuel, versus enough railcars to wrap around the entire coast of all of Australia three and a half times. That gives a sense of why fusion, the energy-density of fusion, is so important for the future of mankind. Again, I'm not advocating that we desalinate this particular amount of water, but with a fusion economy, with that scale of energy flux density, that scale of power available per capita, we are effectively creating a new resource base, allowing mankind to produce our own fresh water, as needed to fill the needs of mankind. We are no longer simply dependent upon the natural cycles which exist. That's just one example which I thought might resonate down there, since you're facing similar water concerns that we're familiar with here in the United States, on the west coast.

New Horizons

That's just one example, which deals with this idea of increased energy density, increased energy per amount of fuel, available with nuclear reactions, fusion reactions. You also get a completely new quality of power, when you move into this

domain of nuclear reactions. No amount of chemical energy, no quantity of energy from chemical reactions, from petroleum or natural gas or coal, will allow you to perform transmutation—to transform one element into another element. You can do that with nuclear reactions; we open up completely new qualities of activity that were simply inaccessible in the domain of chemical activity.

Moving into this nuclear domain opens up completely new types of reactions, potentials for mankind which simply didn't exist in the lower domain. It opens up new potentials for technologies using controlled high-temperature plasmas, such as—ideally, in the future, at some point—things like the fusion torch concept, where you could take, potentially, in an extreme example, trash out of a landfill. The constituent elements of trash in a landfill are materials that we use, they're elements that we use, that's why they ended up in a landfill, because they were things that we utilised. If we had an advanced fusion economy powered by a helium-3 driver program, you could be breaking down trash and separating out the elements and the isotopes, and have pure raw materials and resources from what's otherwise trash.

This is something people have done studies on, and there are designs and proposals for these types of systems, where you could create a controlled high-temperature plasma in whatever you put into it. It would break it down into the basic chemical elements, and even separate out the isotopes of those elements, and allow you to produce pure resources, raw materials, out of lower-quality ores, lower-quality resources, or at some point maybe even effectively what we view as trash, currently.

These are the type of transitions. A leap to a fusion economy is not just more energy, more power, to do the same thing. It enables a qualitative transformation in what we define as a resource, what resources are available to us. It's the type of policy that embraces the spirit of what China's President has defined as win-win economic progress: that if nations are co-operating in developing these types of new technologies—in developing, at this point, the needed infrastructure to develop nations and regions—and these types of technologies transform the productivity of these regions and nations, this is what mankind does! This increases the total amount of physical wealth, or value, available to mankind. Increasing energy flux density, moving towards a fusion economy, is an absolute necessity for the progress of mankind, because this is the shift that is going to create an entire new level of potential wealth, resources and growth available to mankind as a whole.

Coming back around to what I opened with, this gets at another issue Mr LaRouche has been emphasising. He has us working on getting at more at the science of what allows mankind to do this. This type of qualitative shift is something no animal species does. Despite the lies they tell students in many universities today, we're not just a smarter animal; we're not just doing things a little bit more, or a little bit faster, or a little bit better, than another animal species. What characterises human, qualitative economic leaps, is the type of activity which doesn't exist in the animal domain.

It is this type of progress that defines mankind as unique, and it's something that we have to increasingly respect and understand, that has to become the basis of human economic relations going into the future: that there is a unique creative

potential in mankind as a distinct species, and policies, strategy, the strategy of nations, have to be subsumed by the need to develop that, the need to facilitate the growth of that human economic, that human creative potential. And so, why Mr LaRouche has focussed so much on China's lunar program, and their space program, is because, I think, he sees that as potentially getting most directly and most clearly at this issue, at an expression and a pursuit of the distinct creative capabilities that make mankind unique, and must become the central governing principle for this potential new paradigm that we're heading into now.

Roy Broff: I happen to be an engineer, and I have certain interests in space and technology. We all know that—or many of us know that—the Chinese invented the rocket, but many of us also know that it was Stanley Kubrick who put the Americans on the Moon. How are the Chinese going to put the Chinese man on the Moon, when Stanley Kubrick was, unfortunately, killed by the Americans, and there is no second Stanley Kubrick? How are we going to overcome the magnetic radiation belt, without any magnetic metal or any other shield which will protect human beings? Thank you.

Ben Deniston: To my knowledge it took a little more than Stanley. I think we had a big rocket called the Saturn 5 that got us there, and I know China's pursuing a similar path. I've never personally bought into the idea that the radiation levels at the Van Allen Belts would ultimately prevent mankind from ever passing through them and going to space. I think we demonstrated that with John F Kennedy's program in the 1960s.

I would just emphasise what I touched on at the beginning, which is that what's so exciting and important about what China's doing, is they're not saying, "We're just going to go put a flag there, and then give up and not come back." They're saying, "We're going to look at this, we're going to use this, as a base of operations to expand mankind's presence throughout the solar system." This is China saying it! They're one of the few nations that has a record of pursuing the programs—again, we were talking about water: in the United States we've been talking about water for decades, and we're still in a water crisis. China has just completed the biggest water-management, water-development projects that mankind's ever undertaken! They've returned activity to the Moon, and they're directed towards and intent on not just going back, but ensuring that mankind has a presence there, permanently, in developing the resources on the Moon, and expanding mankind's presence as not just a factor on Earth, but in the solar system. I think that's an incredibly exciting perspective that younger generations should be fighting to make happen.

Craig Isherwood: Thanks very much, Ben.