



Case 99

An Idea that Works

This article introduces innovations in space travel engines that *could* shape The Blue Economy “on Earth”, which is known as ZERI’s philosophy in action. This article is of part of a broad effort by the author and the designer of the Blue Economy to stimulate open source entrepreneurship, competitiveness, employment and in this case it is a call for creative approach to our societies’ challenges based on breakthroughs in science. For more information about the origin of ZERI <www.zeri.org>. This is the second last case, a visionary, not implemented example that permits us to imagine solutions beyond the obvious brought to us by a teenage scientist.

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The World Market for Space Travel

The world market for cargo into space is estimated for 2012 at \$100 billion a year including the placement into orbit of military, civilian and scientific satellites. The commercial cargo is valued at \$3 billion per year. The United Launch Alliance based in Centennial, Colorado (USA), a joint-venture of Lockheed Martin and Boeing provides spacecraft launch services for mainly two customers: the US Department of Defense and NASA. It owns and operates launching platforms located at Cape Canaveral Air Force Station (Florida) and Vandenberg Air Force Base (California). Space tourism is a completely new space-related business that was first pioneered by the Russian Space Agency. The publicized price for flights on a Soyuz spacecraft was \$20 to 35 million per trip. While Russian orbital space tourism was halted in 2010 due to limited seats on shuttles, it is expected to resume in 2013 at a ticket price of +\$50 million per trip.

Virgin Galactic was the first enterprise to offer space tourism, with a ticket price of \$200,000 dollars to enjoy the experience of a few minutes of weightlessness with a grand view of the Earth just 100 kilometers above the ground. XCOR Aerospace, a California-based upstart is offering seats on its winged Lynx suborbital space vehicle at \$95,000 for flights starting in 2014. Space Exploration Technologies, competes in this emerging market with the extraordinary offer to take a trip around the moon for \$100 million a seat scheduled before 2020. At these rates it is no surprise that - according to the US Federal Aviation Agency - the space tourism market will become a one billion dollar industry within a decade. As the American and British entrepreneurs focus on



transport into space, the Russian Orbital Technologies company is building a space hotel for 7 guests with a planned opening in 2016. The cost of a five day stay is calculated at one million dollars, food and drinks included.

The Innovation

The fact that people are prepared to spend a fortune on exploring outer space when there are so many critical issues to be resolved on Earth is difficult to understand. We should be exploring our own world and find ways to live sustainably. We should acknowledge that “The sky is not the limit anymore” and from there on we should prioritize our attention on a humane life for all on Earth eradicating poverty and develop the capacity to respond to basic needs with what is locally available. Virgin Galactic justifies its new business of space tourism claiming this is a clean-tech project that will push carbon composites into applications across a range of industrial sectors. Professor James Lovelock, an early day environmentalist and co-author of the Gaia Theory endorses Virgin Galactic as one of the important industrial projects of the 21st century. The same professor also believes that nuclear power will offer the clean fuel the world needs. We wonder if he has revisited this logic after the Fukushima disaster?

Aisha Mustafa is a 19 year old student at the University of Sohag, on the Western bank of the Nile in the middle of Egypt. As a physics student, with a keen interest in astrophysics she developed creative insights in quantum physics. She learned about virtual particles, particles that only exist for a very short period of time. These particles permit the production of vacuum energy. While the concept is theoretical and based on the energy-time uncertainty principle, the vacuum energy embedded in a cubic meter of free space (that is space without any matter) has been estimated at 10 to the 113th power Joules. She realized that space is not really a vacuum but a hotbed of particle interactions that creates and destroys virtual particles. This space -however minute in size- could represent a tremendous potential source of energy and thus inspired Aisha to imagine how to capture this. Unburdened by experience, and with only limited insights into the existing theories, Aisha imagined how to create a new engine: the ionic engine. The power of Aisha’s approach is that unlike many established astrophysicists she is not limiting her reflections to talk and theory, she is committed to do something.

Aisha understood the theory of dynamic Casimir forces, and suggests a practical way to to use vacuum energy fields to create propulsion that needs little or no fuel at all for travel in space. She is determined to exploit quantum effects using two simple silicon plates in a vacuum placed a few micrometers apart. The plates interact with virtual photons in the quantum field and generate a net force that is either an attraction or a repulsion. Basically Aisha’s contribution is as important as theorizing that oil exists under the ground, demonstrating that it exists and finding a way to draw a small sample to prove beyond doubt that it exists and can be brought into our real world. Of course, a



few drops will not solve the energy dilemma, but this mindset and determination is a major step forward. Dr. Nabil Nour Eldin Abdellah, the President of Sohag University encouraged Aisha to continue her creative approach and provided the budget needed through the Science Club for Innovative Students to file for a patent which was granted last February by the Egyptian Academy of Scientific Research and Technology (ASRT) in Cairo. The institutional support is laudable.

The First Cash Flow

The innovative propelling device is based on an interesting mix of quantum physics, space technology, chemical reactions and electrical sciences. Propelling devices from a car engine, to a plane, spacecraft and satellites use fuel that forces a gas out of the engine to move forward at high speed, even supersonic speed. Propelling devices also rely on chemical reactions or electric probes via accelerating ions to generate a forward movement. The creative mind of Aisha leaves these traditional solutions behind and imagined how to propel forward with an electric force generated between separate surfaces and objects in a vacuum by zero-point energy, which is considered the lowest state of energy. The power of her invention is that Professor Marc Milles, who directed the NASA propulsion physics project has provided the theoretical framework but never came up with the logic that provided Aisha with her patent. She takes the original analyses exploring the flow of energy embedded in a vacuum - and yet to be tapped described by Prof. John Davidson of Cambridge University in his book "The Secret of Creative Vacuum" to a realistic framework.

While space travel is for decades to come still based on traditional propulsion systems, Aisha's breakthrough does qualify for further funding - knowing that Egypt lacks the academic platform to engage in this frontline research. Maybe Virgin Galactic could push the boundaries of the energy challenge by inviting Aisha to be part of their quest to lead in space travel. For now, Aisha is proud of her achievement as a teenager, but aims to finish her studies and hopes to test her invention at a major scientific research organization so that her patent could be readied for one of the upcoming space missions.

The Opportunity

Aisha offers all of us who have been following the emerging innovations in The Blue Economy a solid inspiration. While her logic applies in space, there is no reason that sometime in the future her logic could not be applied on Earth. Whereas the creation of a vacuum and free space is a major challenge - even dismissed as impossible by experts, it is only necessary to create this state on a tiny scale in order to potentially generate a massive power source. While we have been promised free energy before, the contribution of Aisha goes beyond the obvious with the capacity to visualize a new reality. Whereas no one knows how this can be done today or in the near future, and many will claim this is fantasy, we need the perseverance and the creative mind of the



young and unburdened like Aisha Mustafa to focus on the questions to which we do not yet have an answer. The future depends on our capacity to navigate from fantasy over vision to reality.

Maybe we need to source ourselves with creative minds of people like Jules Verne, the French 19th century author who pioneered science fiction writing about travels through space, air and underwater before these travels were invented. The reason why I committed over a year of full time work to research, meet, assess, study and write these cases, is that we urgently need a generation that is prepared to invent what has not been thought of. We need to be inspired. The last work of Verne written around the turn of the century, which was only published in 1994, was a novel called “Paris in the 20th Century”. It is a tale about a young man who lived amongst glass skyscrapers, who could move around the country in high speed trains, had access to gas-powered cars, a calculator and worldwide communication networks, and yet he could not find happiness and comes to a tragic death. When youth unemployment reaches historic highs, it is a bright light to know how Aisha images not a job for everyone - rather she starts by imagining her own job, following her passion underpinned by a refreshing approach to science.

Humanity acts and reacts either because we are facing a deep crisis, or we are inspired by a vision. Maybe we need both: a crisis and a vision. People do stop smoking when they are diagnosed with lung cancer; people do migrate with the promise of a better future elsewhere. The business models that I described offer a vision, and provide pathways beyond the excessive desire to consume much unneeded stuff (remember the substitution of something with nothing). Our desire to have a quality life has to be reconciled with innovations that are not only based on a new technology, rather are based on a fresh way of looking at the same ever changing reality before us. It is within this context that cash flow, net present value and earnings are not anymore the singular objective, but the tools that empower communities to create the future they want and where the desire to make the necessary cheap and the indispensable for life free offers the pre-conditions for a happier society. This is what I envision with The Blue Economy.

Gunter Pauli is the author of the Report to the Club of Rome:
“Blue Economy: 100 Innovations - 10 years - 100 million jobs” published in 35 languages worldwide.

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For further background on the 100 cases: www.TheBlueEconomy.org