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IAC-22-E1.6-67567

# "WHY THE CIVILIAN SPACE DEVELOPMENT SHALL KICK-OFF NOW"

Rel. 1.00 02.09.2022

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**Abstract**

The current extremely critical situation sees several concurrent crises threatening civilizational survival itself. The global risk is very high, and would require very much more attention and dedicated resources by the decision makers, and not only in the domain of space policy. This paper analyzes the current historical conjunction by different points of view -- social, economical, environmental, anthropological -- with particular attention to the possibility that the worsening of the global multiple crises could invalidate the efforts to open the space frontiers. Understanding the immanent global civilization risks and the related mitigation strategy, an active strategy, to go over the passive approach so far adopted by the leaders of Planet Earth. The status of the expansion into outer space as a cohesive social process is analyzed as well, in assessing the probabilities of success, taking into consideration the social, economical and political climates and the minimal conditions essential to success, i.e. what should change to make this possible. The futurist narrative of anticipation was promising the future in space since a couple of centuries so far. The time to realize that future is NOW, or we could miss the favorable historical window. A comprehensive SWAT analysis -- risks vs. opportunities -- shows that initial meaningful steps of civilian space development shall take place within 2030, or the "launch window" could be missed forever. The aim of this paper is to draft the key arguments for large public outreach, aimed to gain public consensus and support to a coherent plan, giving priority to the following goals (excerpt from the 3rd Space Renaissance World Congress Final Resolution):

1) Not going back, but going forward to the Moon: to produce fuel in space, from lunar and asteroid materials.
2) Space debris recovery and reuse. Not only an overdue cleaning action, reuse of space debris will mark the transition towards the 1rst orbital industrial business.
3) Enhance life protection in space, from hard radiations.
4) Start experimenting with simulated gravity, to protect human health from damages to perception, psychology and physical conditions.
5) Target younger generations to empower their growth and inspire them on their path to space.
6) Supporting 100% reusable space transportation vehicles: low cost, safe and reliable passenger space transportation vehicles.
7) Produce food in space.
8) Space Safety. Protection from asteroids impacts and strong solar storms.
9) Support space tourism industries effort to develop civilian space travel and accommodations (hotels).
10) Space Based Solar Power, to feed the space industrial infrastructures.
11) Support space related art and bring art into space.
12) To add an 18th SDG, bootstrap the civilian space development, to UN 17 SDGs.

## THE MULTIPLE CRISES OF THE CLOSED WORLD PHILOSOPHY

Even before the war in Ukraine – that's now monopolizing the general attention – our civilization was being attacked by multiple crises: resources shortage, energy shortage, pollution, climate change, economic crisis, migration, unemployment, pandemics, a general cultural decay, decrease of freedom, democracy and ethics. All of these symptoms can be summarized in one concept: the crisis of the closed world philosophy.

Eight billions humans cannot make it anymore in one planet alone: we do need "Planet B", even if we could "save Planet A". Yet, we cannot save planet A, without achieving planet B, or, better, the equivalent of several planets B. we also will see that – applying the Gerard O'Neill model – we wouldn't even need "planets", to live in space, though planets will however be necessary for industrial, logistic and research purposes.

Earth resources are not enough to allow the development of 8 billions humans. The web society needs more energy, respect the previous social models. and we can't generate it on Earth surface anymore: renewable sources – though useful – are not a true alternative. Pollution and climate change are threatening our health and our freedom, and economy has been in perpetual

crisis, for 50 years. Resource conflicts are worsening, in the new global scenario, while unemployment, social conflicts and mass migration are challenging the social and educational infrastructures of the so-called advanced societies. Pandemics, such COVID19, threaten our human nature, imposing hard limitations to our habits to socialize, work together, travel, love and have children.

Due to the combined effects of the above multiple crises, we are witnessing a global cultural decay, a general decrease of freedom, democracy and ethics.

The real risk is an implosion of civilization, that re-proposes the alternative: a space age or a stone age. A generalized fear of the future, and the growing consciousness that our children and nephews will live in conditions worse than ours is running rampant. Such feeling is present both in the industrial countries and in the pre-industrial ones, once called "emergent", since people of those countries understand that they will not be allowed to reach the same life style of the developed countries, for many reasons: climate change is just the last one.

An horrible sensation is also gaining momentum: that people are useless and redundant: we are given a zero-sum game where the only possibility to survive is to "win" some kind of lottery, grabbing some kind of prize. Yet, dreaming of fabulous prizes is not enough to earn the dinner for ones own family: a fertile ground for unscrupulous mafias and neomedieval social models is now prepared, the ideal ground for violent and despotic social involution.

An economical endemic crisis and involution, with dramatic falling employment, will feed the social fear: this is the apparent social dividend of the multi-crises. Isolationist, repressive and authoritarian regimes will raise, international cooperation will fade, insular tribal societies will take over.

The awareness that the planet's resources are finite, and will not be sufficient forever in supporting any number of humans, is spreading into all of the social classes, pushing each individuals to think only for themselves.

The combined action of such multiple crises on our civilization determines an increasing pressure, a kind of *metaphysical warming*[1], that could lead to a global implosion before 2030, if proper countermeasures are not put in place in time.

A too pessimistic forecast? We will see that some hope and positive factors exist, in the first quarter of the 21st Century, and a well conceived space settlement strategy can still overthrow fate of civilization. The key questions are: will the good factors be supported enough? Will they be in time?

## THE INCREASING PRESSURE OF HUMANS IN THE EARTH CLOSED ENVIRONMENT

### Uncontrolled pollution and climate issues

The increasing pressure of humans in the closed environment of our mother planet manifests itself in several ways. Uncontrolled pollution determines a high risk: micro-plastic and other wastes already permeate the seas. Poisoning the ocean means to poison our planetary life supporting system, which gives us oxygen and a great part of the food we daily consume.

Extreme climate events kill many people and jeopardize economy. Possible rise of sea levels put coastal cities at risk. Possible new ice ages threats human life and infrastructures on the whole planet. Production of more food, air and water by the same finite amount of materials is a «miracle» that science has repeatedly permitted mankind… yet the quality of the products will however be decreasing, and innovation cannot strike at the heart of the problem: continued growth in a finite system leads to system collapse.

### Orbital debris, risk and opportunity

Not only the surface of Earth and the seas are deeply polluted: space debris in Earth orbit are now counted in the figure of millions. Space junk, which includes both natural meteoroids and man-made objects, has become a growing area of concern as the region of space immediately surrounding Earth becomes more and more crowded with rocket parts, satellites and other objects. This debris, which travels at approximately 15,700 miles per hour in low- Earth orbit, poses a threat to both spacecraft and astronauts due to their fast speeds. Several countries including the USA, China and India have used missiles to practice blowing up their own satellites creating lots of new debris. Over the International Space Station's 23-year orbital lifetime, there have been about 30 close encounters with orbital debris requiring evasive action. Three of these near-misses occurred in 2020. In May 2021 there was a hit: a tiny piece of space junk punched a 5mm hole in the ISS's Canadian-built robot arm. Satellite operators will likely need to navigate around this new cloud of space junk for several years and possibly decades. In fact, various missile tests may have increased the total amount of space junk, including discarded pieces of rockets and satellites in Earth's orbit, by as much as 10%. These shards are spinning at incredibly fast speeds and risk hitting active satellites that power critical technologies, like GPS navigation and weather forecasting.

To remove space debris from LEO is quite expensive, and it's hard to believe that such an indispensable activity will be seriously put in place, considering what was made so far to eliminate plastic pollution from Earth surface and from the sea. Things may radically change if we start considering orbital debris as a huge value, as they are,

indeed. Each satellite costed huge money to be designed, constructed and sent to orbit. In 2017, when this article[2] was written, the total weight of space scrap was estimated about 7,500 tons, or 7.5 million kilograms: seven million and half kg of gold in orbit!

Such a great richness can be recovered, reprocessed and used as in situ resources to build space infrastructure. That will highly contribute to kick-off the Orbital and Cislunar industrial development. The conditions that will allow such a spectacular development are already on their way: low cost 100% reusable launch vehicles, suitable to transport civilian workers and cargo in space.

## THE COSMIC THREATS

We cannot say if cosmic threats, such as possibly impacting NEO's and cosmic radiations will increase global risks during next years. However they can be considered a constant risk, that has not yet been given adequate attention. Furthermore, both these issues are quite relevant to the solution, i.e. the kick-off of a serious program of space settlement. Therefore worth to be mentioned in this paper, discussing the urgency of such development.

### Near Earth Asteroids and Comets

Life-ending asteroids and comets impacted on Earth several times, over the history of this planet. The argument that humans shouldn't keep all of their eggs in one rather vulnerable basket is obvious common sense.

On a daily basis, about one hundred tons of interplanetary material drifts down to the Earth's surface. Most of the smallest interplanetary particles that reach the Earth's surface are the tiny dust particles that are released by comets as their ices vaporize in the solar neighborhood. The vast majority of the larger interplanetary material that reaches the Earth's surface originates as the collision fragments of asteroids that have run into one another some eons ago. With an average interval of about 10,000 years, rocky or iron asteroids larger than about 100 meters would be expected to reach the Earth's surface and cause local disasters or produce the tidal waves that can inundate low lying coastal areas. On an average of every several hundred thousand years or so, asteroids larger than a kilometer could cause global disasters. In this case, the impact debris would spread throughout the Earth's atmosphere so that plant life would suffer from acid rain, partial blocking of sunlight, and from the firestorms resulting from heated impact debris raining back down upon the Earth's surface. Since their orbital paths often cross that of the Earth, collisions with near-Earth objects have occurred in the past and we should remain alert to the possibility of future close Earth approaches. It seems prudent to mount efforts to discover and study these objects, to characterize their sizes, compositions and structures and to keep an eye upon their future trajectories.[2]

There are many millions of asteroids in the Solar System, mainly to be found in the Main Asteroid Belt between Mars and Jupiter. Most have unstable orbits and can potentially drift into the inner Solar System, becoming hazards to our home planet. We have made significant progress in discovering and tracking the orbits of the majority of large Earth crossing asteroids having the potential to destroy the environment on a planetary scale, but our monitoring infrastructure is still unable to detect small objects – those that pose a threat on a local or regional basis. While progress is being made we cannot reliably detect smaller potentially dangerous objects with enough time to develop and deploy suitable countermeasures. The threat from near Earth objects is often reported by the media in a rather over-dramatic fashion, and as a problem for which we have no solution. The media report that an object has passed close to the Earth, or will do so in the future, but they rarely mention the real and pervasive ongoing threat that asteroids and comets represent to the survival of our species on this planet.[3]

Any global asteroid risk assessment program would recommend the deployment of countermeasures as soon as possible, but this process would require sufficient detection and monitoring resources to be in place.

Alternatively, it is worth considering that asteroids and comets represent vast reservoirs of the resources that we can extract in space, including water, minerals, building materials and so on. Asteroids will become essential raw materials for space exploration and settlement.

It should now be clear that the magnitude of the asteroid and comet impact hazard is unacceptably high, as is our vulnerability to the effects – it is maybe the most serious danger that our species faces. In fact it is the only naturally occurring environmental hazard that puts the future of our entire species at risk. Unlike other natural hazards, however, this one is predictable and avoidable.

### Cosmic radiations

Hard radiation, coming from the sun and from remote supernovae, is very dangerous in space, and represents a serious threat to human life and health, and to any forms of life that we will bring with us during our expansion outside Earth.

On Earth surface, these radiations are less dangerous, because the atmosphere acts as a shield as does the magnetic terrestrial field. The amount of radiation which reaches Earth is tolerated, by humans. In developing on this planet, our biology has adapted to the existing conditions. It could be that we would eventually adapt to different environmental conditions, but this would involve many generations, failures, serious illnesses and genetic modifications.

Earth owns a magnetic field, due to its liquid metallic nucleus, but Mars does not, since its nucleus is colder, and almost solid. Cosmic radiations could become dangerous

on Earth surface too, due to: particularly high sun flares, unexpected changes of the protection conditions (Earth's magnetic field), inversion of the magnetic poles, a process that occurred in the past, causing immense environmental catastrophes, and which could be already in progress.

The risk represented by cosmic radiations should be considered potentially high on Earth, and extremely dangerous in space, with progressive increase of the danger, according to different protection conditions:

- Earth surface
- Low Earth orbit
- Geo-stationary Earth orbit
- Within Van Allen Belt, mid-way between Earth and the Moon
- Moon surface
- Cislunar space
- Outside magnetic Earth, 1.5 million km from Earth
- Mars orbit
- Mars surface
- Beyond Mars, Asteroid Belt, and beyond

The mitigation of the cosmic radiations risk requires a program of immediate action, giving high priority to scientific research for protection technologies and suitable strategies, both on Earth and in space.

It is evident that the risk represented by cosmic radiations is a real danger even on Earth surface, our civilization has a high interest to fully master the matter and implement mitigation strategies, both in space and on Earth.

The recommendation is to study and develop both active and passive shields that work with high efficiency. Active shields are those that create a deflection of the radiation through the production of a strong magnetic field, and thus protect a whole living module. Passive shields, instead, are characterized by absorbing the radiation, and generally consist of special garments/covers for astronauts and/or equipment.[3]

## THE ENERGY ISSUE

Energy is the very key node of the current break-event of human history. The demand and the use of energy affect all of the aspects: economy, environment, social conditions, lifestyle, evolution. Arthur Woods and Marco C. Bernasconi, in their elaboration of the "Space Energy Option"[4], have written: "Humanity is facing an imminent Energy Dilemma in that the limited proven reserves of fossil fuels could reach exhaustion levels at mid-century and none of the alternative terrestrial energy options – nuclear – wind – ground solar (PV) – can be sufficiently scaled to achieve the goal of divesting from fossil fuels by the year 2050 as is being called for by the United Nations, the European Union, many governments and numerous organizations to address the Climate Emergency."

In 2019, total World Primary Energy consumption was 146,584 TW.hr[5]. Of that amount:

- Fossil Fuels: 136,761 TW.hr (93.30%)
- Nuclear power: 2,795 T./hr (1.91%)
- Renewables, including hydro: 6,375 TW.hr (4,35%)

| Fuel | Tw.h | % |
|---|---|---|
| oil | 53.620,00 | 36,58% |
| gas | 39.292,00 | 26,81% |
| coal | 43.849,00 | 29,91% |
| hydro | 4.222,00 | 2,88% |
| solar | 724,09 | 0,49% |
| wind | 1.429,60 | 0,98% |
| nuclear | 2.795,90 | 1,91% |
| other renewables | 651,81 | 0,44% |
| total | 146.584,40 | 100,00% |
| | | |
| total fossils | 136.761,00 | 93,30% |
| total renewable | 6.375,69 | 4,35% |
| total nuclear | 2.795,90 | 1,91% |

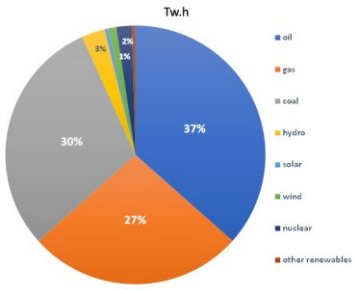


Figure 1. Global Primary Energy Consumption by Fuel 2019

The world wide web is maybe the greatest technological achievement of the last 100 years. Yet, if we will stubbornly remain closed within Earth's boundary, our civilization will be forced to renounce to it, or to witness a hard restriction of the use of the network to few privileged ones. Normal Earthers will be requested to stop even communicating, for the sake of energy saving.

### The energetic "green" transition will not be enough

The whole world is now investing in the energetic transition, though the many conflicts and wars going on Planet Earth – more than 70, including the global economy devastating war in Ukraine – are raising serious perplexities about the implementation of a full shift to renewable sources of energy.

However, the referred article (Woods & Bernasconi) states that none of the terrestrial solutions will be sufficient to complete the job, to match the growing energy needs of a cultural evolving civilization. Nuclear technology will not be enough, neither wind nor solar photovoltaic could supply enough clean energy to the world, especially considering that a burgeoning electronic society requires increasing (and not decreasing) energy supply.

Any energy and industrial strategy which is limited within the atmosphere of planet Earth, will not solve the energy dilemma and the climate emergency, will accelerate the many environmental problems, will destroy the industrial development model without replacing it with a more efficient alternative, will not satisfy any of the 17 UN 2030 Sustainable Development Goals.

However, it is likely that earthly renewable energy sources could work as a transitional bridge, provided that a serious space industrialization program was quickly kicked-off and developed, taking profit from the reduction of Earth-orbit transport systems cost.

| | | | Stated Policies | | Sustainable Development | | Current Policies | |
|---|---|---|---|---|---|---|---|---|
| | 2000 | 2018 | 2030 | 2040 | 2030 | 2040 | 2030 | 2040 |
| Coal | 2 317 | 3 821 | 3 848 | 3 779 | 2 430 | 1 470 | 4 154 | 4 479 |
| Oil | 3 665 | 4 501 | 4 872 | 4 921 | 3 995 | 3 041 | 5 174 | 5 626 |
| Natural gas | 2 083 | 3 273 | 3 889 | 4 445 | 3 513 | 3 162 | 4 070 | 4 847 |
| Nuclear | 675 | 709 | 801 | 906 | 895 | 1 149 | 811 | 937 |
| Renewables | 659 | 1 391 | 2 287 | 3 127 | 2 776 | 4 381 | 2 138 | 2 741 |
| Hydro | 225 | 361 | 452 | 524 | 489 | 596 | 445 | 509 |
| Modern bioenergy | 374 | 737 | 1 058 | 1 282 | 1 179 | 1 554 | 1 013 | 1 190 |
| Other | 60 | 293 | 777 | 1 320 | 1 109 | 2 231 | 681 | 1 042 |
| Solid biomass | 638 | 620 | 613 | 546 | 140 | 75 | 613 | 546 |
| Total | 10 037 | 14 314 | 16 311 | 17 723 | 13 750 | 13 279 | 16 960 | 19 177 |
| *Fossil fuel share* | *80%* | *81%* | *77%* | *74%* | *72%* | *58%* | *79%* | *78%* |
| $CO_2$ emissions (Gt) | 23.1 | 33.2 | 34.9 | 35.6 | 25.2 | 15.8 | 37.4 | 41.3 |

Notes: Mtoe = million tonnes of oil equivalent; Gt = gigatonnes. Other includes wind, solar PV, geothermal, concentrating solar power and marine. Solid biomass includes its traditional use in three-stone fires and in improved cookstoves.

Figure 2. World primary energy demand by fuel and scenario (Mtoe) by IEA

Considering the volatility of forecasts, especially in this period of big changes, we can however observe that the energy consumption of the electronic-internet society will more likely to be raised much during next 30 years. Let's just think about video-communication and the advent of electronic money, requiring super-work by super-computers. Average forecasts estimate an energy consumption increase of 1.5% per year.

It is quite interesting the forecast by IEA (Figure 2), where the global energy consumption in 2030 and 2040 set within the scenario of the (Earth bounded) so called "sustainable development": these consumptions are moving towards a meaningful degrowth. A process which probably means that, at a certain point, the fairy tale of the global connectivity will be dismantled, and citizens will be obliged to remain alone, closed in their homes, with feeble light, and being very much our video-communication to be just a memory of a "golden age". A definitely unsustainable (from the point of view of quality of life) technological involution of our world.

The radical stoners of wasteful habits will keep on stubbornly defending the degrowth of consumables. But what will they say, when citizens will be requested to stop even communicating, for the sake of energy saving?[3]

## The long-term solution of the complex energy dilemma is moving industry to space

50 years ago, the Club of Rome claimed that fossil fuels were going to end soon. It did not happen: as known oil fields get exhausted, new research comes out, developing new techniques for novel oil harvest, and new fields are discovered according to those techniques. As Sheikh Zaki Yamani, a former Saudi Arabian oil minister, once said, *the stone age did not end for lack of stones*, and the oil and gas age will not end for lack of oil and gas.

Damage made to the environment is the good reason for abandoning fossil fuels soon. This transformation is already ongoing: fossil fuels will progressively be replaced by renewables within a long and complex transitional process. Several facts are most important: the leveled cost of ground based solar energy is now the lowest of all energy sources; wind power is just a little more expensive; coal fired power plants are being replaced by gas fired combined cycles. Hydrogen will become, in few decades, a good solution for accumulation and dispatchability of energy

By reworking and reusing transitional power plants we will have built a bridge solution from coal to renewables. This is just a part of a set of very complex transformations, yet quick progress.

An essential point of industrializing space is moving energy intensive consuming and polluting industries to space. In doing so, the energy needs on Earth could be reduced to the personal needs of the inhabitants. The long-term solution of the complex energy dilemma is moving industry to space, not keeping industrial infrastructures on the ground and beaming energy to them from above. The development of Space Based Solar Power is of course of paramount importance, but to feed space customers.

## THE RISK OF CIVILIZATION IMPLOSION

The sum of all the mentioned risks, and related crises, could lead to a civilization implosion, as Stephen Hawking and James Lovelock have also predicted. And the breaking point of such an event is much closer than was expected.

The implosion of civilization was discussed by astrophysicist Stephen Hawking[6] and other thinkers of different orientations, but Hawkins was strangely consonant with James Lovelock[7]. These two authors were in agreement, when looking at the possibility that the world system will remain physically and philosophically closed for much longer than the already three-quarters of a century since humanities first rocket reached space. According to many scholars of ancient civilizations, civilization collapses have occurred many times in history, and in the large part of cases, the collapse was not due to a single factor, but to several concurrent factors[8]. Exactly as in our current situation.

The real issue is not the end of terrestrial resources, but the very strong psychological depression that this critical situation determines. Humans feel, on a biological level even more than rationally, the limited nature of our planet environment. That's why the de-growthist nihilist narrations resonate so deeply in the public opinion. Many simplistic solutions show up everywhere, with recipes based on "Simple: it is enough that everybody…".

In that is-enough-that-everybody stands the totalitarian threat to freedom of our complex society. There's no such thing as something that everybody can do without being forced.

Many people are now embarking on involutional and retrograde directions -- such as through the adaptation of radical environmentalism and de-growthism or even the uptake of animalism and animality as ethical models. When humanity will realize that a future under these conditions only construes as misery and deprivation, the

hour of anger will come. In this way, the process of the implosion of civilization will be further sped up. This will happen, as matter of course, if the world is kept stubbornly closed by the joint action of several concurrent stolidly retrograde forces.

Modern Western society was once compared to a stable bicycle whose wheels are kept spinning by economic growth. Should that forward-propelling motion stop, the pillars supporting our society – democracy, individual liberties, social tolerance and more – would start staggering. When the wheels remain steady for too long, a total civilization collapse could be looming.

Safa Motesharrei, a mathematician conducting studies on societal dynamics, wrote: *"If we make rational choices to reduce factors such as inequality, explosive population growth, the rate at which we deplete natural resources and the rate of pollution – all perfectly doable things – then we can avoid collapse and stabilize onto a sustainable trajectory, but we cannot wait forever to make those decisions."*[9] As many other thinkers, Motesharrei seems to be sure that reducing factors of inequality and human environmental footprint is *perfectly doable*. Such concept – the claimed simplicity of the solutions -- is part of the problem, not of the solutions.

The society of 8 billion humans is not simple at all, rather it is highly complex, and its wheels are moving only thanks to an immense neural network of commercial connections, all of them based on cascade *debts*, called *investments*. People keep investing until there's a prevailing hope that the debts will be remitted. In other words, investments will generate a return.

The multi-crises can be reverted, and civilization avoid the collapse, only if people will see true reasons to expect that they can go back to their social life, meeting, working together, loving, having children, and restart progressing from that level. These humane essentials come before everything else.

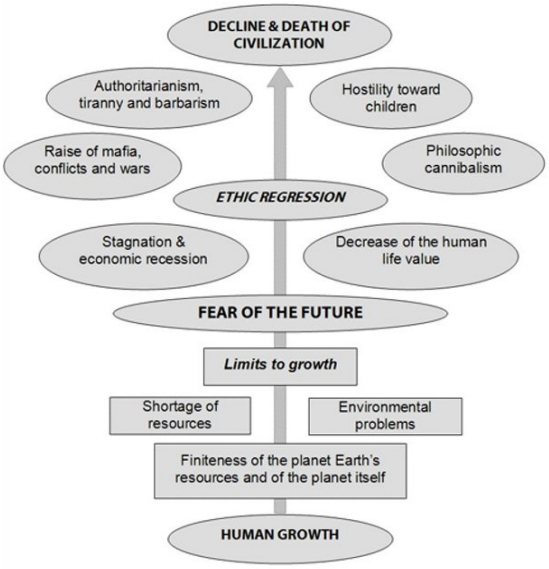


Figure 3. The paradigm of the closed world

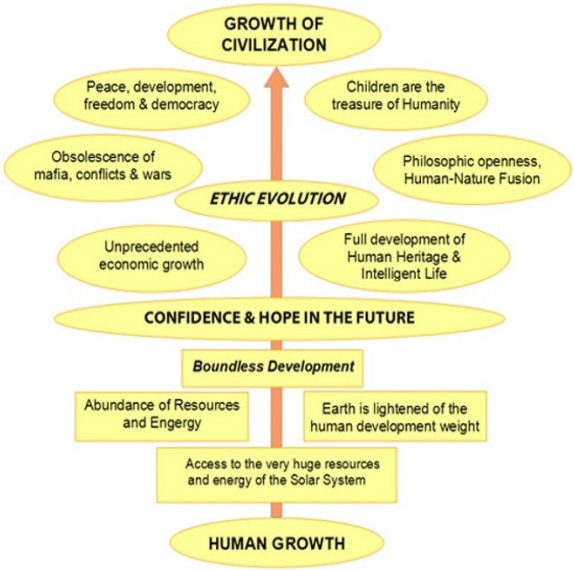


Figure 4. The paradigm of the open world

## 2040: A FULL SPACE ECONOMY OR A ZERO ECONOMY

Morgan Stanley, one of those that few years ago – when the space shuttle was retired – declared the end of space age, in Feb 2021 published a study, in which 10 drivers of the New Space Ecosystem are identified. Namely: asteroid mining and space tourism. Nothing is mentioned concerning debris recovery and reuse, an economy on which some companies, and research institutes, are beginning to work. Space tourism has become the most interesting new space activity, together with the latent potential for extracting water, rare minerals and metals from near-Earth asteroids. In the economic forecast, the above two activities are worth a small part of

the 'Other' segment of the 2040 pie: 52 billions, less than 5%. The largest slices goes to satellite launch, satellite internet, Government programs for Earth observation, monitoring the weather climate, maritime data GPS. The Government slice, since the 1960's, also includes deep space exploration, Moon, Mars and beyond, Lunar landing, missions to the Moon, building products and infrastructures for Moon missions.

Is it a plausible estimation that the space economy will be worth 1 trillion in 2040?

Is it a practical estimation that satellites and Earth oriented space activities will represent the largest percentage of the space economy in 2040?

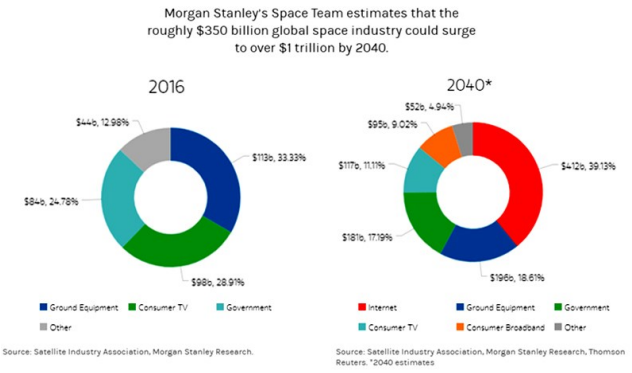


Figure 5. Morgan Stanley Space Team estimation of space industry development to 2040

Should the space economy figure in 2040 turn out to be the one sketched by Morgan Stainley, we could say that Civilian Space Development will not really have deployed at all. Humankind would not have advanced into outer space, the high frontier will remain closed to humans, only to be inhabited by automated machines.

Should this trend prove to be realistic, it is quite probable that the space economy will never reach 1 trillion, because the Earthly economy will collapse far earlier, before 2030.

The space economy will never reach the 1 trillion bench-mark without being guided by the impetus of Civilian Space Development. The global economy cannot grow anymore within the current limiting constraints: it will implode, unless it will be led by the innovative new space economy.

The classical objection "where will we find the money to pay for such a visionary space program?" should be reversed to this one: "where will we find the determination and political capacities to prioritize and channel human efforts into Civilian Space Development?"

Thinking about the 17 SDG of the UN 2030 Agenda[10], we can observe that all of them depend by the realization of one, key, goal, the 8th SDG: "Decent Work and Economic Growth". Without economic growth none of the other SDGs will be feasible, whatever the good will that could be applied. Thus the main effort should be dedicated to raise economic growth. And the only sustainable growth in the 21st Century is in outer space[11].

The post-Covid19 and (hopefully)post Ukraine quasi-world-war world will be characterized by many conditions quite different from the world of before: global economy and many manufacturing segments in a deep crisis; some segments – namely e-commerce and web services in general – growing; some Countries – in the Asian area – in a strong recovery trend; the central banks of the main Countries (US, EU, Russia, China, India etc.) will keep on pumping money into the economy, trying to avoid a generalized breakdown; public opinion will be more incline to prize public works and projects, for the sake of environmental concerns; governmental subsides to unemployed people will become a usual trend, in trying to avoid dramatic social conflicts.

In the same time, immobilized uninvested capitals will seek profitable ventures, and investments in civilian space development will quickly repay for themselves, relaunching the global economy, leading it out.

In a recent article, published on Spacenews.com, Dr. Greg Autry mentioned a Bank of America's forecast: a $2.7 trillion space economy[12] (not far from the Space Renaissance prediction of 3.5 trillion).

Money, as a means of accountability, is phasing through a quick and devastating (r)evolution, at the hand of electronic money. Electronic money now multiplies the funding capabilities in the global society, both for private enterprises and public goals, such as sustaining recovering economies. However, while trading and investments in the traditional financial paradigm have been somehow anchored to existing wealth and material resources, the new financial paradigm, which is based on an immaterial accountability of means, delivers a very higher degree of freedom to the leaderships of the world, whatever their chairs are located: government, multinational corporates, big financial institutions, and space agencies.

Yet, electronic currency is not free of charge: they require it requires huge amounts of energy to be "mined". Such energy – consuming planetary resources as any other energy source – can be directed over worth projects or to useless activities, just targeted to financial profit, void of any true industrial development value. And of course, though electronic money can be a great asset, to direct energy where needed, economy cannot sustain itself on finance only for a long period: a robust industrial development is required, in order to achieve a true growth. A new industrial development, nowadays, can be made only in space. Brian Wang, in this article[13], has no doubts that a sustainable space boom will transform the world and then the solar system. Wang sketches a burning agenda toward 2040: SpaceX Starlink will make terrestrial fiber optics obsolete in 10 years, thanks to zero lease costs, when compared to cell towers. Satellites network communication will be 1.5 times faster, across the

vacuum, compared to fiber glass media. Orbital point to point transportation will quickly replace cargo planes and then passenger airlines: SpaceX will dominate the commercial rocket launch business with over 60% market share. Blue Origin will follow on, for the agenda of reusable space vehicles, other competitors will likely emerge, however the market is immense. Thousands of reusable starships will support Earth orbit industrialization and colonization, and the road to the Moon and Mars will be open.

One thing to be looked at as well, is that the two richest men on the planet are Jeff Bezos and Elon Musk. What will it mean that these two individuals are both running new space companies? And will this mean that Musk's fortune becomes more closely tied to space, while Bezos's is more due to Amazon? Not surprisingly, Bezos has decided to step down from the position of Amazon's CEO, to focus more on Blue Origin.

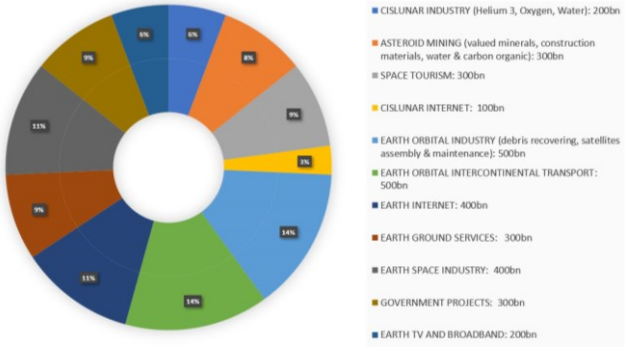


Figure 6. Space Economy 2040, whit Civilian Space leading global economy

Whatever Morgan Stanley may say, humanity is heading to the stars, and is prizing the champions on that road!

In other words, should the development of the new space economy be hindered or derailed, the global earthly economy is threatened to collapse, including all of the previously leading segments.

Alternatively, should the new space economy be allowed to develop according to its great potential, it will lead out the global economy, and all of the earthly traditional segments will be driven and dragged into the renaissance, including telecommunication, tv, broadband, and space exploration.

Space economy, should it be free to develop, in 2040 could be worth 3.5 $Trillions, or more.

We ensure this, and the big crisis will be but a record on the history books of our great-nephews.

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