

Space Renaissance International 3rd World Congress 2021

“The Civilian Space Development”

Call for papers Symposium 4 on Congress Theses

Thesis 1 – Status of Civilization and perspective of expansion into outer space

“The status of civilization approaching the threshold of 10 billion Earthers on one only planet”

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Abstract

The status of Civilization is analyzed from the points of view of demography, science, technology, social, economy, environment, evolution, expansion into outer space.

Particular attention is paid to the current extremely critical situation, which sees several concurrent crises threatening civilizational survival itself.

Global risks are briefly analyzed, versus the significant opportunities provided by a kick-off of an expansion into outer space, formally offered to civilization as a whole, and for the various implicit stakeholders: The Human species, and Human civilization, Nature and ecology, Earthly sentient species, Earthly plant species, an Earthly life sustaining environment and the Solar system environment.

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.

Our applied methodology is the combined and simplified version of risk assessment and opportunity analysis (SWOT = Strengths, Weaknesses, Opportunities, Threats).

Such analysis is designed as a methodological indication, in addressing the main civilization risks, vulnerabilities and opportunities, and according to our humanist philosophical tools and scheme of values.

SRI suggests that a more comprehensive analytical project could be developed, following on from the congress, in deepening understanding of the immanent global civilization risks and the related mitigation strategy.

Paper

1 The global civilization risk during next 10 years, towards 2030

All of the risks we are analyzing here are mainly due to the growth of our species within the closed environment of our mother planet.

Such existential risks have trended low in past history, to about year 1800, at the dawn of the industrial age when the global population was less than 1 billion. The capacity to pollute the environment may have been very much higher, during many of these phases. Yet as our number was much the lesser, the integral amount of pollution accumulated was very much lower. According to progressive numeric and cultural growth, global populations rapidly expanded, although the ensuing capability for pollution was somewhat mitigated by technological advancement.

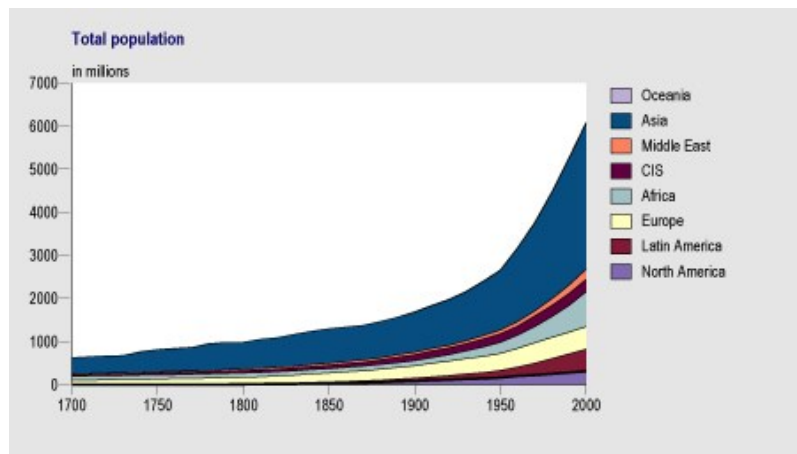


Figure 1. Total world population evolution until AD 2000¹

For example, it would be possible to describe a hypothetical environmental footprint of the current size of human population, given technologies equivalent to the practices of ancient Romans or the middle ages.

Within the context of the closed world, a regressive cultural decay has now taken over. Within the last few decades of the past century, we see a sense of distrust in the future, distrust in good will and ultimately in human intelligence itself, and the sentiment that the whole human enterprise has led to ecologic disaster. The defeatist perspective is made evident in many entertainment products, as futurism moved to the fore, science fiction was rapidly "colonized" by dystopian novels and movies, and science and technology were blamed as being guilty for having "wasted the planet". Such nihilist misconceptions have also influenced young generations and environmentalist movements, which became adherents of de-growthist strategies, in the expectation that nature can fix our mistakes.

Such a misconception has simply increased the vulnerability to the many risks humanity is faced with. Given the emerging context of the closed world we may examine a few examples:

- In presence of the worst economic crisis of all times, and growing unemployment, governments are now trying to limit and contain the process of industrial development.

- In presence of a growing risk that coastal cities will be flooded by raising sea waters, we only focus on decreasing global carbon dioxide emissions, the long term strategy, instead of learning the lessons from the Netherlands and building dams.
- In presence of decrease of the Earth's green lounges, we renounce the usage of water surplus (as ices melt) to arrest and claim the growing deserts.
- In presence of rising pollution, due to industrial terrestrial settlements, we don't even describe or put in place projects to relocate polluting industries into orbit.

The assessment of the above situation is not necessarily rational, since it is heavily affected by ideological biases: some exponents will blame capitalism and ultra-liberalism as the main culprits of disaster, others blame socialism.

Both capitalist and socialist ideologies will hold their part of responsibility in such a situation. However, the major fault of our political systems is not to be capable of an up to date, humanist, social analysis. They don't recognize the risks, they are unable to identify and assess them, therefore they can't draw mitigation strategies.

1.1 The risks created by the tremendous conjunction of the multi-crises

The global economy was already in a deep crisis, before COVID19. The crisis catalyzed in 2008 by the explosion of several financial bubbles has not yet been solved nor recovered.

The climate on our planet is worsening, with increased extreme meteorology events, floods, and melting of perennial ices.

The resources of our planet are clearly showing their scarcity, in addressing the needs of almost 8 billion citizens. Statistics say we are consuming each year 1,5 times the available resources on our planet, yet environmentalists repeat that "We don't have a planet B".

The **energy sources** of our planet are not sufficient for the development of 8 billion citizens. Replacing fossil energy sources with renewable sources, though this could at least downsize the issue of pollution, will not solve the future energy needs problem (as better argued in further chapter of this document).

The planetary globalization of informational resources encouraged many people living in poor and underdeveloped conditions to seek to **migrate** towards more advanced countries, in trying to improve desperate living conditions, creating large illegal migration movements, with attendant risk of death during the passage. Such huge migration processes will also be seen as generating social conflicts in destination countries, whose cultural systems are often not durable enough to integrate the flow of newcomers.

Employment is in deep crisis over many decades, due to several concurrent threads:

- the relocation of manufacturing productions from traditional industrialized countries to recently industrialized countries
- the obsolescence of the taylorist mode of production
- the advent of automation and artificial intelligence
- the predominance of pure financial economy over the industrial economy
- the crisis of the concept of industry itself, due to the massive ecological and environmentalist concerns

What it was called, already in 1996 by Viviane Forrester "the redundancy of the workers"² poses the urgent and still overdue need for new social organization models, while the inertia of the older rationales still prevents the needed evolution.

All of the above crises are ferociously attacking equitable human civilization, questioning the mainstream social models, and undermining the achievements that an expansive industrial society had assured to the citizen of the advanced countries, and which had provided the peoples of emerging countries with an objective to aim for.

Each of these crisis points acts as a feedback on the other crisis points, feeding social conflicts and the possibility of resource wars, for the control of the residual few resources.

1.2 The risk of extensive cultural damage in the philosophical cage of the closed world

The awareness that the planet's resources are finite, and that they will not be sufficient forever in supporting any number of humans, generates a generalized fear of the future, and the growing consciousness that our children and nephews will live in conditions worse than ours.

Such an impetus causes a horrible sensation 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. And, since dreaming of prizes doesn't suffice, a fertile ground for unscrupulous mafias and neomedieval social models is gaining momentum.

The high risk of 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. Societies will feel powerless to help themselves, while their aspirations as citizens, and subjects of any government, will shipwreck in the general unavailability of decent jobs.

The ground will be laid for isolationist, repressive and authoritarian regimes to ascend, nations and alliances will be fragmented, the road to international cooperation will become just a dream of some elders, and insular tribal societies will take over.

1.3 The risk of uncontrolled pollution

1.3.1 Planetary pollution and extreme climate change

Perhaps we don't yet understand exactly how much and in which ways our growth in the closed planet system impacts the planet's climate. Certainly our capacity for pollution – and our inability to fix it – is moving towards an increasing risk of unrecoverable environmental disasters.

The question is not whether our industrial activities are increasing the global warming process or not. We are already seeing the calamitous effects of extreme climate events, the melting of polar ices, the melting of the permafrost and the consequent liberation of huge quantities of methane. And it should be understood that methane is a greenhouse gas, very much more dangerous than carbon dioxide.

Uncontrolled pollution poses a high risk. Micro-plastic and other wastes already permeate the sea. Poisoning the ocean is the means to poison our planetary life supporting system, which gives us oxygen and a great part of the food we daily consume.

All of our terrestrial countermeasures should be assessed for their cost, real effectiveness and benefits -- since, as Robert Heinlein wrote, "There Ain't No Such a Thing As a Free Lunch" (TANSTAAFL)³ -- and they should be applied in the proper measure. However, the most effective countermeasure, to mitigate the pollution risk and, in general terms, the human environmental footprint on Planet Earth, is to progressively move the industrial burden outside the planet, and

achieve a far larger environment, an extension where our human metabolism will develop greater resources and with much less damage and impact.

1.3.2 Space debris

Since the beginning of the space age more than seventy years ago humanity has launched many thousands of satellites into orbit, and most of these are now inactive, dangerous wreckages, which pose an increasing risk of collision with other satellites and the operations of manned spacecrafts. When wreckages eventually collide, an unpredictable mass of smaller debris are produced, which greatly increase the general risk: any small fragment, traveling at orbital speed, can open holes in the hull of manned spacecrafts, causing quick depressurization.

Hereafter is the NASA’s view of such a problem: *“LEO is an orbital space junk yard. There are millions of pieces of space junk flying in LEO. Most “space junk” is moving very fast and can reach speeds of 18,000 miles per hour, almost seven times faster than a bullet. Due to the rate of speed and volume of debris in LEO, current and future space-based services, explorations, and operations pose a safety risk to people and property in space and on Earth. There are no international space laws to clean up debris in our LEO. LEO is now viewed as the World’s largest garbage dump, and it’s expensive to remove space debris from LEO because the problem of space junk is huge --- there are close to 6,000 tons of materials in low Earth orbit.”*⁴

According to ESA, the increasing arena of objects in space orbit dramatically increases the likelihood of collisions. The following picture represents the evolution of space debris since 1957 to end of 2020. Red (PL) = Payload; Orange (RB) = Rocket Body; Dark Green (RM) = Rocket mission related object.

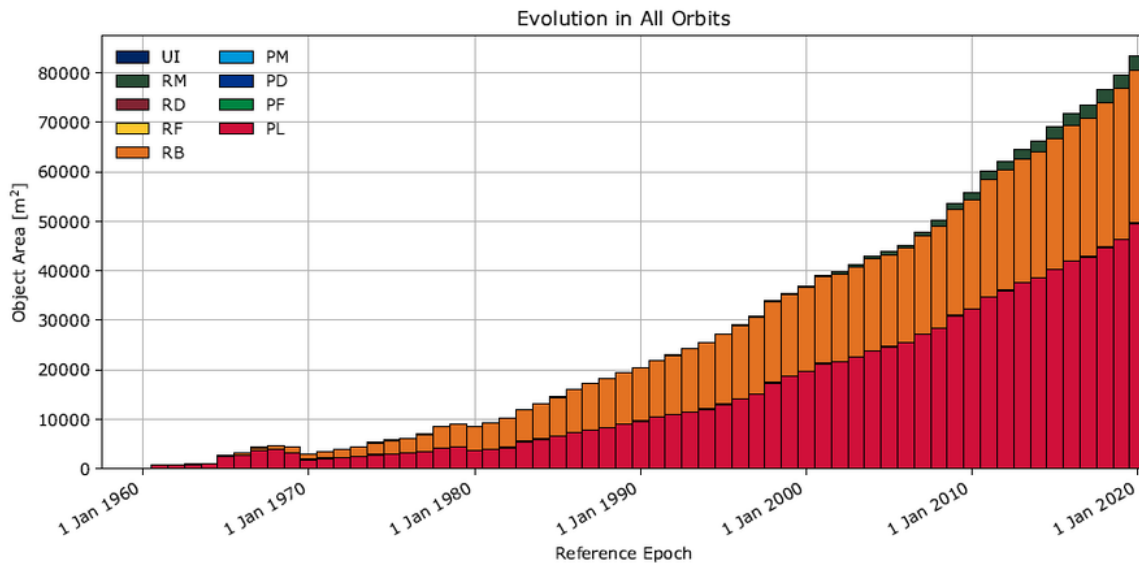


Figure 2. The growth of space debris since 1957

Space debris, and in general terms the orbital pollution, represents a very high risk for the navigation through the interface between Earth and Cosmos. Such a risk could represent a serious hindrance to civilian space development.

1.4 The risk of progressive decrease of freedom, democracy and ethics

There is a great variety and diversity of human types. In referring to Steven Wolfe's human types classification⁵ and to Howard Gardner's types of intelligences outline⁶, we are provided with an immense variety of different human psychological and attitudinal characters. Encompassing the prospect of equitable cultural diversity, we obtain an extremely rich and profound enumeration of human types, in our world. Each one of these organisms having their unique and proper inclinations, psychological characteristics, goals, wishes, and paths to reach their own self-realization and highest objectives (as illustrated by Abraham Maslow's scale).

To further qualify Steven Wolfe's classification of the seven human basic types: the Wanderer, the Settler, the Inventor, the Builder, the Visionary, the Protector, the Evolver.

Howard Gardner classification of the eight types of human intelligence: Linguistic, Logical/Mathematical, Spatial, Bodily-Kinesthetic, Musical, Interpersonal, Intrapersonal, and Naturalist.

Imagine the combinations inherent among the above two orders of human types, add in the cultural geo-located and ethnic variety, and you will have a general idea of the huge diversity of human types, and then consider how much any fixated or coercive regime or ideology was and will always be refuted, in thinking to impose a unique model, defining social behaviors, limits and social organization.

For example: a wanderer might never accept remaining closed in their own domain, nor they could be comfortable using the tools which obtain a remote worldview across the planet and beyond. A builder may not understand the needs of wanderers, and protectors even less: they may see the expansive activities of exploration as worthless and extremely dangerous. Mathematical intelligences may consider musical intelligent people as bizarre, and so on. If we think about the conundrum, it is perhaps true that each different ideological biases will have their origin in one of the different human types: when one of these ideologies reaches power, it will tend to glorify its own human type, and oppress the other types.

Recollecting these classifications is useful to always have in mind that it is hard and complex *cultivating freedom for all and each of the different human types.*

The current pandemics, and before that point, the numerous strategies oriented to containment and degrowth, are clearly indicating the future we have before ourselves, should humanity choose to remain confined within the boundaries of planet Earth.

In order to combat the contagion, and before vaccines are fully available, our freedom of movement has been greatly reduced. With the loss of freedom of movement, the freedom to have social contacts, to meet people, to work with other people, or even to love and ultimately have children will become severely impacted. Such effects will be "assured", even without imposing restrictive laws similar to those imposed by Chinese government some decades ago in pursuit of population control.

Needless to say, such a momentum is going to destroy the essential human nature itself: humans are social animals, and our civilization cannot survive without traveling, meeting people, working together, falling in love, making children, the expectation of working together for the future. In the worst case, we might assume that a society of individuals closed and isolated in their own cubicles, constrained to onanistic virtual relationships, will be extremely weak, very much vulnerable to the many risks which are posed by the closed world environment. A society of

individuals forced to immobility and mortified in their vital fertility, closed in their homes, cheated of their future and basic rights, will quickly decay. Human civilization itself will implode and perish.

1.5 The cosmic threats

1.5.1 Life-ending asteroid and comet impacts

Existential life threatening and extinction events, such as asteroid and comet impacts have been discussed many times, from the very beginning of the space advocacy movement. The argument that humans shouldn't keep all of their eggs in one rather vulnerable basket seems to be obvious common sense.

Near Earth asteroids cross Earth's orbit several times each year. Since the low perception of the risk is a significant part of our vulnerability, our mission is mainly focused on outreach and raising awareness of the risks to civilization and possible countermeasures. Therefore it is worth analyzing the way that this topic is managed by the media, and explained to the public.

The threat from near Earth objects is often reported in 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.

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 the terrestrial planet. We have made significant progress in discovering and tracking the orbits of the majority of large Earth crossing asteroids that have 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.

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 is also 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.

Even from these brief notes it should be clear that the magnitude of the asteroid and comet impact hazard is unacceptably high, as is our vulnerability to the effects – it is 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 this one is predictable and avoidable.

1.5.2 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 aim 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.⁷

1.6 The great success of our species and its growth in a closed environment

Despite the many moralistic explanations of the multi-crises, aiming to charge different social subjects as responsible entities, the crisis is ultimately due to human growth, as a species, within the closed environment of planet Earth.

After the historic renaissance of 1500, the development of science, and later several industrial revolutions, generated the great success of a biological species that termed itself as *human*, on the third planet of this solar system.

The catalytic industrial revolution allowed social growth, the development of mass education and health systems. We saw human dignity assured by having a monthly income, without being forced to struggle in deathly competition or to adapt to immoral compromises.

Mass education systems have enhanced the growth of new generations of entrepreneurs enabled not only by the dream of prosperity, but by guiding humanist ideals as well. Recent concepts such as the making of mankind a spacefaring species may be in fact be our sole possibility to survive and keep on growing and developing, as a unified global civilization.

The trend of an exponential industrial growth continued unabated until the demographic development of humans reached a dimension that is now questioning their sustainability within the limits of this planet. Once such a breakpoint was reached, the only possible scenario was a global crisis. That's what we have now.

But certainly, humans are a cultural species, not just an animal one. Therefore we are also attempting to provide workable cultural responses to the multi-crises, not only to contemplate the death of millions, as we are doing, with COVID19.

So far, the response that has emerged in society at large, is a passive one: degrowth. Such a reaction is the most obvious, given the usual physical paradigm of action and contrary reaction: the crisis was caused by our growth, therefore we shall degrow.

Degrowth, for a complex society, that has reached the limits of its ecological niche, is the simplest and least demanding option, at least in terms of strategy, design and projects development. In the current situation, zero strategy and zero projects is enough, to fully pursue a de-growthist goal: while nature will do the whole dirty job. When our number falls vertically, markets will narrow, science and technology will retire, so will ingenuity and enthusiasm for new discoveries and technological advances.

Though simple and less demanding – in terms of engagement and work –, degrowth doesn't seem to be the best solution, in a humanist scheme of values. To go over the planet's limits, in accessing a greater ecological niche, though more demanding, seems to be a far better solution.

1.7 Anti-humanist ideological misconceptions

1.7.1 Learning sustainability on our planet before going to space

Not only in society at large, but also inside the space community, we often heard the following concept: *"Humans have not learned how to live sustainably on Earth, and we need to learn this lesson before seeking to create settlements in space"*. Critics will also say that we, the optimistic space advocates, and future space citizens, are proposing untimely and unrealistic plans.

Can we work together with the bearers of such a different vision? Yes, I would say that we should, certainly we will never get tired to discuss with them, to demonstrate that they are utterly wrong.

Clearly the statement *"Humans have not learned out to live sustainably on Earth and we need to learn this lesson before seeking to create settlements in space"* positions civilian space development in a hypothetical future, giving the highest and urgent priority to a viewed sustainability on Earth. We should always claim that, at least, the two strategies have the exact same priority.

The argument is a strongly divisive item, we should finally acknowledge it as a concept that it tends to separate humanist from non-humanist space advocates.

The first answer was given by Krafft Ehrlicke in his "The Extraterrestrial Imperative" (Bulletin of the Atomic Scientists, 1971)

"One of the most irresponsible statements, parroted ad nauseam since rational concern for our environment has exploded into an emotional syndrome, defines man as the only animal smearing

his nest. Each animal fills its nest with the products of its metabolism if it is unable to get out of it. Space technology gives us for the first time the freedom to leave our nest, in order not to dirty it."

To say that we humans need to learn to live sustainably in the closed system of our mother planet before to start moving to outer space is like to say that a bird should "learn" to clean its nest before learning to fly, and taking its own waste elsewhere.

The reality is the exact reverse: none of the 17 Sustainable Development Goals of the UN 2030 agenda will be achievable under these terms, Humankind in fact does not have any possibility to achieve sustainability on Earth if we don't start immediately expanding into space. To start expanding into space is a necessary condition for any sustainable development.

What else will we "learn", remaining confined within the limits of our mother planet? Maybe we will have to learn again how to light a fire in a cavern, in a time shorter than we expect...

We must begin moving the burden of our industrial development outside our planet. This is the key, as Jeff Bezos wisely understood, making his cislunar development plans accordingly, with the goal of perpetuating human development and making of Earth a beautiful garden. Is Bezos's plan unrealistic and untimely? Are Elon Musk's plans to travel to the Moon and Mars unrealistic and untimely?

Such plans can be considered unrealistic and untimely only in the frame of a redundant 'old space' vision, that is perfectly in tune with the use of space only for Earth. The priority goal of the *planet-savers* is to mitigate climate change and pollution in the closed Earth, using outer space for such goals. This is exactly the UN strategy that we saw in Wien in 2018, at UNISPACE+50. Even so we have to admit that the UN, at least, in their 17 SDG's include many social issues, totally neglected in the narration of the *planet-savers*.

1.7.2 Degrowth will only lead to more degrowth and, finally, to premature death of civilization

If humanity has to remain closed within the limit of Earth atmosphere, the only *sustainable* strategy is the one indicated by Serge Latouche⁸: degrowth.

The demographic issue is all but simple, and this has been so far managed with some superficiality by the supporters of a green transition within the closed world. Demographic stabilization is offered and discounted as a desirable goal, without analyzing (i) its real feasibility and (ii) the outcomes, which will be worse than the problem it tries to resolve. Stabilization is not a feasible possibility, since there are only two options: growth or degrowth, followed by the trend towards extinction. Working towards stabilization in the closed world will lead to implosion of civilization.

Demographic stabilization is not a good goal, for humankind⁹. Cultural growth cannot move ahead alone, without demographic growth, new growing markets are essential for social opportunity and improvement. The nursery of ideas can grow up only in a growing population¹⁰. Adriano V. Autino wrote that *"Actually we could certainly state that: the circulating money is not wealth itself. Money is just one of the measuring instruments of wealth. Real wealth is uniquely made up of natural resources and human culture, including scientific and technological knowledge and the working potential."*¹¹ Therefore humanity was never rich as it is now, with 8 billion human beings. The only missing part on Earth are now our depleting natural resources, even so there's great abundance in the solar system! That's why we need to expand. If we are not humanist, we don't need space.

It is a matter of growth versus multiplication¹². Both the forces are concurring: qualitative growth of science and technology *and* population multiplication, that will keep alive the market opportunities, working against depression, devolution, and degrowth. We might say that the multi-

crises and the consequent increasing pressure is the way that nature pushes evolution to make giant leaps ahead.

Any “new” social model, oriented to decrease the consumption of energy, will be worse than the problem. In times of pandemics, such concepts were evinced by several indicators.

Working and communicating mainly from home is an introspective yet consuming lifestyle. Moreover, the continuous use of webcams in our virtual meetings consumes a lot of energy. Therefore we will be constrained to renounce even this slim means of keeping us alive, as social beings. On other fronts, electric cars need big batteries, difficult to dispose and consuming rare earths. Leaving aside the fact that their efficiency is far from the combustion engine, and that is another limitation to our freedom of movement.

1.8 The energy dilemma

Arthur Woods and Marco C. Bernasconi in their elaboration of the “Space Energy Option”¹³ 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/h¹⁴. Of that amount:

- Fossil Fuels: 136,761 TW/h (93.30%)
- Nuclear power: 2,795 TW/h (1.91%)
- Renewables, including hydro: 6,375 TW/h (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%

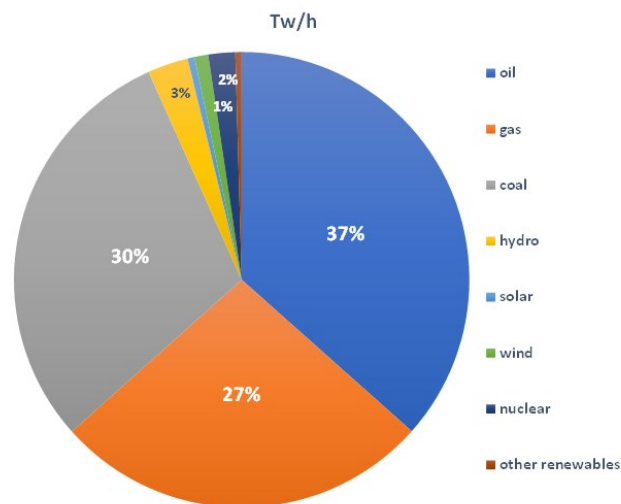


Figure 3. Global Primary Energy Consumption by Fuel 2019

The most optimistic forecasts for 2040 (IEA and Equinor Renewal) estimate that moving 30% of Global Primary Energy Consumption (GPEC) to Renewables, will result in Oil consumption being reduced to little less than 30%, Coal about 12%, Gas around 20%, Nuclear power 5%¹⁵. While

the above analysis foresees a meaningful decrease of GPEC around 500 Btu, many other reports foresee a raise of GPEC up to 700 qBtu.

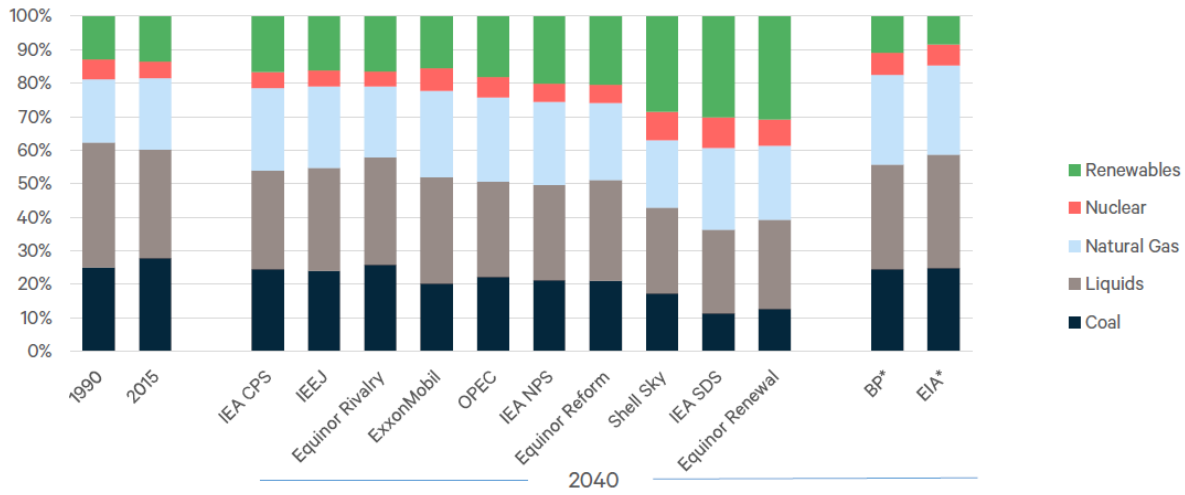


Figure 4. Shares of Global Primary Energy Consumption by Fuel – 2040

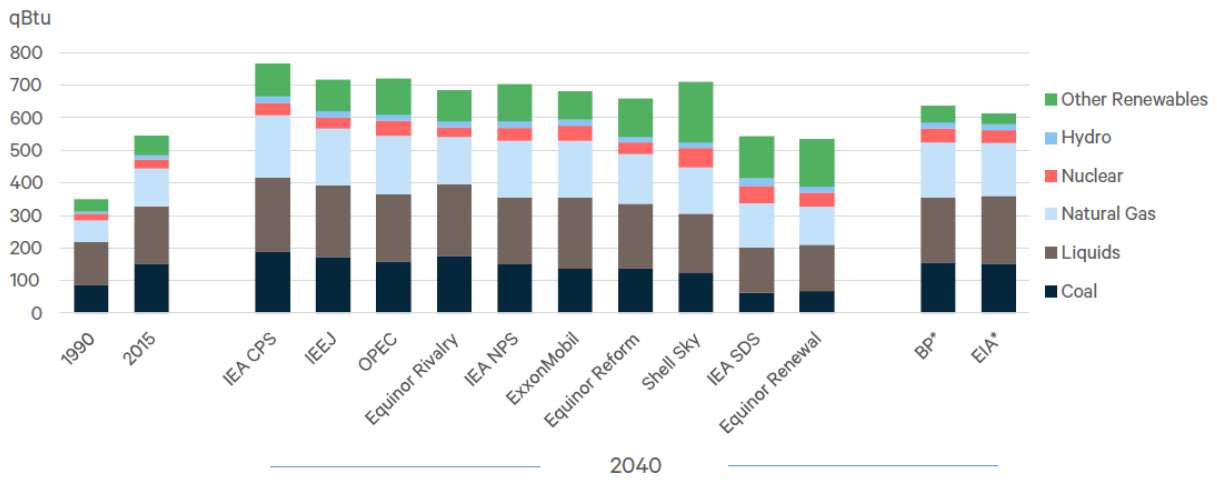


Figure 5. Levels of Global Primary Energy Consumption by Fuel - 2040

			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
<i>Fossil fuel share</i>	<i>80%</i>	<i>81%</i>	<i>77%</i>	<i>74%</i>	<i>72%</i>	<i>58%</i>	<i>79%</i>	<i>78%</i>
CO₂ 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 6. 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 to examine the forecast by IEA¹⁶ (Figure 6), where we can see 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 humanity will be obliged to remain alone, closed in our homes, with feeble light, and being very much constrained from our video-communication (if that is still allowed). 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?

The whole world is now investing in the energetic transition, therefore it will no doubt be realized, at least at some extent. 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.

Such a conclusion makes perfectly sense, in the framework of the closed world, should Civilization remain closed inside the boundaries of our mother planet's atmosphere. Not only nuclear

technology wouldn't be enough: neither wind nor solar photovoltaic could complete the task of supplying enough clean energy to the world, especially considered that a burgeoning electronic society requires increasing 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 probable that earthly renewable energy sources could work as a transitional bridge, provided that a serious space industrialization program is quickly kicked off and developed, taking profit from the reduction of Earth-orbit transport systems cost.

In contribution to this paper, Alberto Cavallo¹⁷ has said that the energy issue cannot be discussed separately from the industrialization issue.

It would be nice if we could purport the space option as the definitive solution to all energy needs of the Earth, but the issue is far more complex.

About 50 years ago, the Club of Rome claimed that fossil fuels were going to end soon¹⁸. It did not happen - in fact some countries like the US that were net importers are now *net exporters* of fossil fuel¹⁹. As known oil fields get exhausted, new research becomes convenient and new fields are discovered. 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 gas²⁰.

Damage made to the environment is the good reason for abandoning fossil fuels soon. This transformation is already going on. These 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 sources²¹; wind power is just a little more expensive; coal fired power plants are being replaced by gas fired combined cycles. Gas is still a fossil fuel, yet carbon dioxide emission of these plants are just one third the emissions of coal fired plants, they are much quicker to build and much cheaper too. Btw, all gas turbines in production today can accept a mix of hydrogen and methane as fuels. With small changes they will accept 100% hydrogen, so they are also ready to use that fuel when, in few decades, it becomes available in enough quantity, so overcoming the problem of the non-dispatchability of solar and wind power. It is very possible to produce hydrogen when solar and wind power are available and use it as a power source when they are not. 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, is being made.

	Total installed costs			Capacity factor			Levelised cost of electricity		
	(2020 USD/kW)			(%)			(2020 USD/kWh)		
	2010	2020	Percent change	2010	2020	Percent change	2010	2020	Percent change
Bioenergy	2 619	2 543	-3%	72	70	-2%	0.076	0.076	0%
Geothermal	2 620	4 468	71%	87	83	-5%	0.049	0.071	45%
Hydropower	1 269	1 870	47%	44	46	4%	0.038	0.044	18%
Solar PV	4 731	883	-81%	14	16	17%	0.381	0.057	-85%
CSP	9 095	4 581	-50%	30	42	40%	0.340	0.108	-68%
Onshore wind	1 971	1 355	-31%	27	36	31%	0.089	0.039	-56%
Offshore wind	4 706	3 185	-32%	38	40	6%	0.162	0.084	-48%

Figure 7. Total installed cost, capacity factor and levelised cost of electricity trends by technology, 2010 and 2020

This significant process won't happen shortly – that's true - but let's compare the extensive parameters of Space Based Solar Power with the currently ongoing transformation. Today the possibility of transferring even a small amount of power from GEO to Earth appears to be far from any quick feasibility. Huge technological improvements and financial investments are needed to make this happen. Thousands of huge solar generators in space should be built - would all the materials be carried up from Earth? How many launches would be required? How much fuel would be needed?

The complex issue should be examined in reverse. It will be eventually be possible to move most industry to space, since energy is easily available there, once the industrialization of space has been effectively bootstrapped, and once we have started building factories in space, with in situ resource utilization (including reconvered space debris as a primary objective). Yet, SBSP will not be the sole starting point, it will be seen as a part of the industrialization process.

Sending energy to Earth may become realistic only after the process of industrialization of space has commenced. Huge technical improvements are needed to do this - but huge improvements are already evolving our ground based systems and these may well contribute towards a partial solution of the energy problem on Earth before we are ready to beam it down from space.

Much more though, an essential point of industrializing space is moving energy intensive consuming and polluting industries to space. In doing so, the energy needs on Earth will 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 infrastructures on the ground and beaming energy to them from above.

The problem of energy becomes impossible to be managed, when faced with the old mindset of top down power systems - even if the top is so high that it is in orbit. Space based power systems are an essential part to develop industry in space and remove it from Earth. This is a big part of the solution of the energy dilemma. And Earth can do by itself, once it is freed from the unsustainable load we have created till now, with our current, old style, industrial development.

1.9 The risk of a Civilization implosion

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

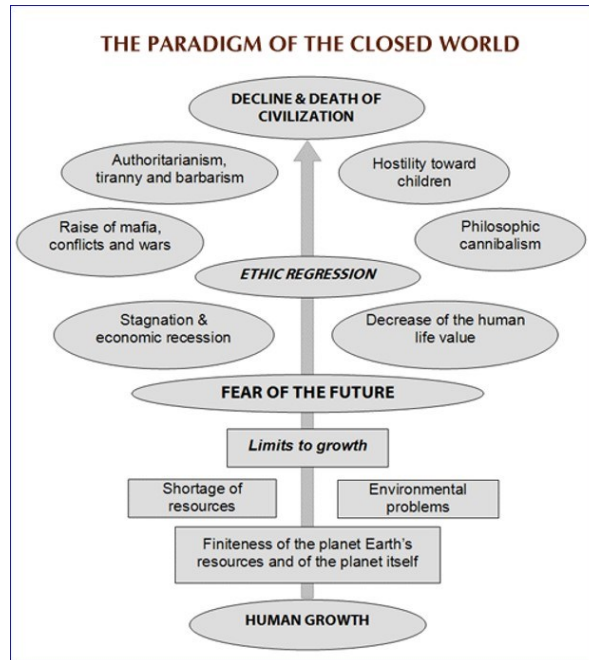


Figure 8. The paradigm of the closed world

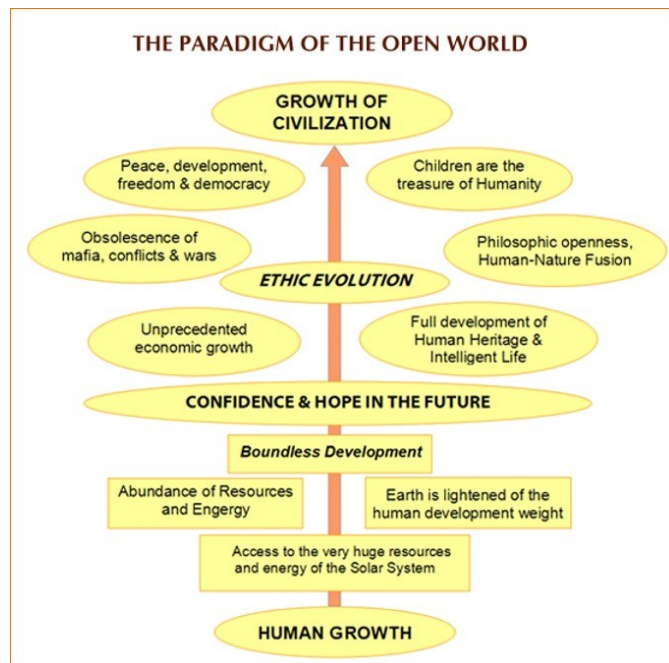


Figure 9. The paradigm of the open world

The implosion of civilization was discussed by astrophysicist Stephen Hawking²² and other thinkers of different orientations, but Hawkins was strangely consonant with James Lovelock²³. 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 factors²⁴. Exactly as in our current situation, as we discussed in 1.1 - The risks created by the tremendous conjunction of the multi-crises.

Yet the main problem, even before finite planetary resources are exhausted, is the very strong psychological depression that this critical situation determines: humans extensively feel, on a biological level even more than rationally, the limited nature of our Earth environment. Many people are now embarking on involutions 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 realizes 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 system 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.”*²⁵ 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 when there's a prevailing hope that the debts will be remitted. In other words, investments will generate a return.

The multi-crises were already braking the economy before the pandemics, moving under the impact of the leading crises: environmental issues and climate change.

But it was not enough: another powerful civilization-collapse came up: COVID19. The global economy is now almost frozen, with the sole exception of China, which has attempted to restart moderate growth.

The situation generates and perpetuates a planetary psychological depression²⁶, the hope to have a decent return on investment is falling more and more.

Many bearers of simplistic solutions are showing up everywhere, with recipes based on the mantra of “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.

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. These humane essentials come before everything else.

The current circumstance means that we are in dramatic need of a vaccine against the pandemic. But growth can restart only if a valid development vector raises the scenery. Only the combined effect of immunity from Covid19 and the inspiring locus of an industrial space development can avoid the forthcoming civilization implosion.

2 The greatest opportunity: expanding civilization into outer space

Expanding civilization into space is evidently not only a more and more desirable option, but the only option that will allow our civilization to survive and retake the road of development, which has been brutally disrupted by the multi-crises described in the chapter above.

2.1 The main stake-holders requirements

Human civilization, at the threshold of 8 billion citizens, needs new resources, energy and space to retake its development. Such an evolutionary step is needed in order for civilization to survive as a high level and as an advanced cultural community, evolving towards all the key indicators, such as quality of life, science, technology, democracy, freedom, ethics, human rights, fair competition and collaboration. Reaching out to use the energy of our star in the space of the solar system, our civilization will be raised one degree in the scale traced by Kardashev²⁷, and later by Bob Zubrin, Carl Sagan, Steven Wolfe, M. M. Cirkovi'c²⁸ and other philosophers.

Human species, at the threshold of 8 billions beings, needs to expand into a greater ecological niche, in order to assure the basic needs, referred to in Maslow's scale²⁹, to be satisfied, avoiding recession on the evolution scale back towards animal behaviors.

2.2 Adding the social assessment criteria to the civilization's evolutionary scale: only a type II civilization can be totally inclusive

According to the Russian astronomer Nicolai Kardashev, a civilization can be defined by its use of energy:

- Type I - Technological level of a civilization that can harness all the energy that falls on a planet from its parent star.
- Type II - A civilization capable of harnessing the energy radiated by its own star. Lemarchand stated this as a civilization capable of utilizing and channeling the entire radiation output of its star.
- Type III - A civilization in possession of energy on the scale of its own galaxy. Lemarchand stated this as a civilization with access to the power comparable to the luminosity of the entire Milky Way galaxy.

Three more levels were added later, to extend the scale to type 0, harnessing less than the whole energy reaching the surface of its planet; type IV, in control of the energy of the whole universe; and type V, with access to the energy of other universes.

Writes Robert Zubrin³⁰: *“Adopting Kardashev’s scheme in slightly altered form, I define a Type I civilization as one that has achieved full mastery of all of its planet’s resources. A Type II civilization as one that has mastered its solar system, while a Type III civilization would be one that has access to the full potentiality of its galaxy.”*

Carl Sagan suggested to extend the classification criteria to include the mastery of information. In this respect such approach can be reconducted to Krafft Ehrlicke's concept of the “age of metabolism of information”³¹. Interesting to note that Ehrlicke was one of the very few futurists which were able to predict the advent of the network, during the early 1970's.

An encouraging reflection by Carl Sagan is that “the universe is not old enough to exchange information effectively over larger distances.” Meaning that our civilization should not necessarily be compared to competitors very much more advanced.

Further elaborations were indeed defined, especially if we consider that Kardashev was more a scientist than a philosopher, who sketched his famous scale with the sole purpose to assess the probability of the existence of other civilizations in the universe.

Even so, we could perhaps add at least one more criteria, to the evolution scale. Beyond energy, resources and information, from our humanist point of view, we could add the essential degree of a fundamental, real and democratic inclusion of the citizen inside the society, as the social evaluation criteria.

Civilizational history so far has clearly demonstrated that expansion to the whole surface of our planet was not enough, to allow the totality of earthly citizens to be included in a decent welfare, with sufficient opportunity of work and wealth for everybody. This is evident since we still have a huge percentage of Earthers trapped into starving geo-social situations. And this problem is mainly due to the scarcity of resources, as described in chapter 1 of this document.

Evolving to a level II civilization – by expanding into outer space – will also allow a progressive and fundamental step in our social evolution. More: such a social evolution will not only assure that the basic Maslow’s needs will be satisfied, but it will also allow all individuals – with their huge diversity – to aim for their highest goals, self-realization.

The reality follows: on Earth there’s not enough for everybody, but we need everybody, and more people, to succeed in our evolutionary next step. Expanding this statement: 8 billions of *compeborating* (competing and collaborating) intelligences are perhaps the minimum threshold necessary to step to the stars. And for sure we need to “grow up” much more, and reach maturity, by starting to really harvest the energy and resources of our solar system. We can grow further only expanding into outer space.

This is why the developed civilization assessment criteria so far – Kardashev, Zubrin, Sagan – have been missing the full motivation of our next evolutionary step: although we have agreed that evolutionary scale criteria should include energy, resources and information, one could argue “Why should we need, or want, to move from one level to the next one?” Please note that this is not a trivial question. This is exactly the question daily posed by nihilist anti-evolutionary claimed common sense. Therefore all of the space advocates should be prepared to reply and (surprise!) only Astronautic Humanism provides the proper concepts.

The rationale is fulfilled only by adding the social evaluation criteria: a type I civilization cannot be fully inclusive, since the planetary resources – in our case – are not enough to allow a fully inclusive and endowed society. We don’t know what the paradox might look like on a bigger planet with more resources, and likely a higher gravity, and maybe sentient and intelligent beings of a different size... One could speculate about the potential of any number of beings as a nursery of ideas and potential work and number of mouths to be fed, a complex to be resized but not substantially changed. Most likely there must be, on the radical path of evolution, a break point where the problem of the number of mouths (Thomas Malthus) ventures to overcome the number of brains (Julian Simon)!

Considering *our* planet and *our* civilization, at the point where *we* are, social evolution can happen only by a further growth, on all vectors, including the demographic and social ones. And a further growth is possible only expanding into space, i.e. becoming a type II civilization. Evolution to a type II civilization is, at the same time, the main necessary condition and the main goal, of a fully inclusive society.

To close the evolutionary discussion, we will have to learn the main lesson of the pandemic. **Pandemics such as COVID19 will be defeated as quickly as possible, or they will become endemic, reproducing themselves in new varieties, and requiring new vaccinations each**

year. The only available weapon is quick and massive vaccination. Those who oppose vaccines will expand upon an old naturalist concept, namely: what does not kill you makes you stronger. However, this is nothing but the eugenic idea: the alleged improvement of the species by eliminating the weakest individuals. Even if a natural elimination process might be valid for animal species, it is not a valid evolutionary concept, for a culturally advanced species, which has in its evolutionary curriculum intelligence, fair competition and collaboration, rather than strength and physical prowess. Science, the fruit of human intelligence, is the only instrument we have to go beyond the limits and traps set by nature. When a species, by its development, reaches the limits of its own ecological niche, nature raises the pressure on it, to force it to an evolutionary leap, if capable, or to extinction, as already described in this document.

The pandemic must be defeated as quickly as possible: Civilization needs all of its members, who are not "mouths to be fed" as Malthus claimed, but intelligences essential to the evolutionary leap that our species is facing. Every single human life matters, each individual holds the solution to one of the greatest problems: the multiple crises gripping civilization within the limits of the closed world. Many crises are encircling us, limiting our freedom of movement, and our very ability to react and respond to crises. Yet our numbers, which have become excessive within the limits of our planet, are the true wealth of our species, if we are willing to accept the evolutionary challenge posed by nature., Nicolai Kardashev, Krafft Ehrlicke, Julian Simon, Stephen Hawking, Carl Sagan, Robert Pirsig, Bob Zubrin and other neo-humanist philosophers have composed excellent rationales that made Malthus destructive theories fade away, on the book of history.

2.3 A feasible utopia: each-one to reach their own highest Maslow objectives

What is recorded in history, is ever, the failing point of every utopia is the scarcity of material resources. When resources and space are limited, competition becomes more ferocious, pushing humans backwards on the evolution path, and no utopia can survive. This has been the destiny of all of the 1900's utopias, both collectivist and libertarian.

But what will be our history, in a context of a greater abundance of resources and space?

We have not able to figure such a context, so far. Rather, we have tended to project onto the future our psychological flaws, which stem from the fact that we always had to deal with an economy of scarce resources.

The word *economy* mainly means, in our society, *management of scarce resources*.

A future millennial history, if civilization expands into the solar system, will need a new language and a new narration, to mean *management of abundant resources*.

We will need a new word -- *ecotrophy* could be a good candidate -- to mean the management of abundant resources in the new greater world. In his book "A greater world is possible"³², A. V. Autino discusses the etymology of the term "economy", from the ancient Greek *oikos-nomea* (according to Aristotle: administration of the house, namely family, assets, business, slaves + people around the family), and then the latin translation *parsimony*, up to the Middle Ages: "*The Middle Ages appears to be the natural incubator of the modern use of the term economics. In the isolated villages and fiefdoms, besieged by the brigands and armies of the neighboring noblemen (the apotheosis of a closed world), the anthropological concept of management of scarce resources will have taken the definitive upper hand, compared to a more classical conception (in the Greek and Roman sense) of virtuous administration, that is, performing, soothing and useful to the whole community. In any case, it seems that humanity has perhaps never had a*

philosophical concept of the management of abundance, except in the fairy-tale and mythological context (willingly, indeed hopefully, refuted by circumstantial evidence)."

It will not be easy, indeed, to emancipate our culture from the negative reputation attached to the concept of abundance, that was often associated to depraved habits of waste and contempt of the poorest.

The utopias of the past saw momentum upon a claimed fair management of the scarce resources. And so did any subsequent dictature.

The generations which will grow up during the 20's of the Twenty First Century and beyond will have the great opportunity to forge a totally new utopia, based upon abundant resources, communications, energy and space. A new, moral, concept of abundance will follow.

It will be the first *feasible* utopia.

The old ideologies have insisted on the concept of equality of all individuals in their basic rights in order to satisfy the basic Maslow's needs – food, shelter, clothing. A rationale due to the need to work with scarce resources, the goal was to emancipate all people from famine and ignominious living conditions. Such goals were obtainable only at the cost of bloody revolutions. New leaderships, established by the revolution, turned sooner or later into a new tyranny.

Many could say that this is the human nature, and it will always be so.

We, as humanists, think that, instead, within a regime of abundant resources, people will be more than happy to work in peace, dealing through fair competition in which losers will never be starving or perish, because other elevating opportunities will always be available. In that situation, only a few psychopaths will insist with violence and hard confrontations.

The paradigm of abundance means real freedom, for all individuals, to pursue their own goals and ideals, according to their particular psychological types and cultures (see the variety of human types in 1.4 The risk of progressive decrease of freedom, democracy and ethics).

The old utopia, which was actually taken from the Acts of the Apostles³³, said *"from everyone according to his abilities; to everyone according to his needs"*. This statement *"presupposes a criteria that judges needs, not aspirations or desires (...)* Since the utterance does not take care to provide a description of the method that should be used to estimate needs, it is clear that it refers to easily identifiable needs, which everyone can see, what are the basic needs of human beings: eating, dressing, protecting themselves from the weather, heat and cold."³⁴ This utopia applies to the lowest level of the Maslow scale³⁵: it is therefore necessary, but not sufficient, for an advanced full inclusive society.

An up-to-date utopia, more suitable for our days, could say something like the following statement:

"by each one according to their capabilities, creativity and availability"

"to each one according to their desires and their capacity for imagination".

The closed world offers only few lucky people the possibility to find their own ways to really apply their creativity. Such a cruel limitation is due to the scarcity of resources, and the consequent barriers opposed by powerful cartels, monopolies and mafias.

The open world, in opposition, offers virtually unlimited opportunities to develop personal ideals and creativity! What in the closed world was seen by many as an egoist claim – to realize any

individual desires – in the context of a society developing into the solar system will be, not only legitimate, but socially quite appropriate and useful.

Certainly there will always be people void of imagination and desires. But no worry: such capacities can be cultivated, by proper education, oriented to grow up truly free, curious and joyous people!

The open world context of abundant resources will allow people endowed with imagination and desires to aim towards and work to reach their highest Maslow's goals, without "stealing" anything from less imaginative people or compromising the environment and the nature of our mother planet. And this will result in greatest welfare, better living conditions, peace and freedom for everybody.

For the first time in its history humanity has the true opportunity to realize an utopia, the greatest one: the full realization of human heritage!

2.4 What we have, what it takes

2.4.1 The probability of success

Considering the high risks described in chapter 1, we could say that the situation is productive, since our species gives its best only when facing high risks. In a more mature stage of our growth, we would be able to think about risks and their mitigation even before being in the middle of a crisis, but now we are there. We should be at least grateful that space pioneers and space advocacies have emerged a few decades before the blasting of the multi-crises.

This is the way that nature acts, it seeks to solicit evolution: it raises the pressure on selected species, by all the available means. Writes Krafft Ehrlicke, in his criticism to the Limits to Growth³⁶: *"Meadows and Forrester, for example, in their book The Limits to Growth, compare the growth of mankind to the mindless and senseless multiplication of lilies in a pond. I never considered mankind a lily in a pond, senseless and mindless. One is already expressing a negative mental attitude by using such an analogy. Experts no longer take this limit to growth nonsense seriously. Even the Club of Rome is trying to back off from it—now that the philosophy has done its damage—in order to sneak into public confidence in some other way. The Global 2000 Report, a warmed-over version of the original limits to growth nonsense, contains outright misinformation and, like its infamous predecessor, totally ignores the human capacity for limitless growth. Growth, in contrast to multiplication, is the increase in knowledge, in wisdom, in the capacity to grow in new ways. And that's what nature shows us in the first place, on a very large scale. The entirety of evolution is growth, not multiplication. Comparative evolutionary analysis shows that when saturation of a given growth potential was reached, multiplication set in. Multiplication eventually interferes with the existing environment—biological or human. To the quantitatively (linear or exponential) rather than qualitatively extrapolating mind, the pressure of multiplication appears to be a limit to growth, when in reality, evolutionary pressure is nature's preparation for the next growth thrust."*³⁷

Ehrlicke makes a sharp distinction between growth and multiplication, and assigns a key role to multiplication only when the numeric dimension of a species reaches the limits of its ecological niche. As humanists, we might believe that multiplication has a key role alongside the whole process of cultural growth, since a bigger nursery holds a very greater potential than a smaller one. Therefore we prize Krafft Ehrlicke, as a forerunner of astronautical humanism, but we also need Julian Simon³⁸, and perhaps Robert M. Pirsig

as well – with his *metaphysics of quality*³⁹ –, to have a true complete representation of the heritage and potential of humankind.

However, for the sake of assessing the probabilities of success in the current caudine forks of the multi-crises, Ehrlicke is what we need: natural pressure forces a species to evolve, gaining access to a bigger niche, either that or to implode, and to accept a premature extinction.

The probability of success now, depends upon how many members of our species understand the true nature of the challenge and what is at stake.

Two kinds of actors are key: brave pioneers and efficient advocates.

Pioneers might provide disruptive events, new methodologies, tools and vehicles, focusing popular attention.

Advocacy (philosophers) might explain why pioneers are not crazy at all, but the only wise people, in the core of the storm.

2.4.2 The new space industrial segment and the age of Big Space

“Between teenage crisis and age of reason, New space is now old: the first start-ups shall confirm their promises, while new players pop up and try to find their way. [...] “new space” trends are preparing the advent of big space.” Wrote Gil Denis (Airbus Defence and Space) in a paper⁴⁰ from January 2020.

The Space Frontier Foundation defined New Space as *“People, businesses and organizations working to open the space frontier to human settlement through economic development”*. And, in its “Frontier enabling test”, the Foundation says: *“A ‘frontier enabling’ technology or policy is one which has as its effect the acceleration of the creation of low cost access to the space frontier for private citizens and companies, enables or accelerates our use of space resources, and/or accelerates the rate at which wealth can be generated in space.”*⁴¹

Other – broader – definitions of “new space” were given later, while many new and old aerospace corporates decided to jump in the new market:

Space Tec Partners: *“New Space refers to the emergence of the private spaceflight industry. New space ventures are increasingly created, such as private launch companies, small satellite constellations, or sub-orbital tourism, as well as more specific efforts to reinvent the traditional space industry supply chain.”*⁴²

Writes Helen Tung, on NewSpace2060: *“For the purposes of simplifying and not complicating the definition, I would say: NewSpace is non-traditional space players making and/or engaging in activities that make space flight, space applications or space activities faster and cheaper.”*⁴³

Faster and cheaper access to space will certainly allow many more private enterprises to walk through the frontier. It will also allow traditional satellites manufacturers and launchers increased profits in the new market. Yet it is an economy that will not damage a comprehensive civilization expansion into outer space nor the construction of space infrastructures, providing that the issue of space debris will finally be directly addressed and solved by both industries and governments.

Since the historic flight of ScaledComposites’s SpaceShipOne in 2004, the new space industrial segment has grown exponentially, counting now many hundreds of companies, mainly concentrated in the US, but also in Europe, Arabic Countries and Asia.

The edge of the new space frontier is, without any doubt, reusable rockets technology, kicked-off in 2015 by Space X in the US, and later adopted by Blue Origin (Jeff Bezos's company) and now by several other companies and in China.

The differences between "old" and new space are not only the technologies. There are meaningful differences in the business approach as well. For many years marketing was customer-oriented, and that made perfectly sense in a captive market, which was dominated by space agencies. Mission and technological requirements were dictated by the agencies call for tenders, and often these were tailored to match the capabilities of the traditional big aerospace companies, the masters of expendable rockets. The old space eco-system cartel assured high price to orbit cost for 50 years, since the days of launch of Sputnik and Explorer satellites.

The advent of the new space societal opportunity was triggered, 47 years after Sputnik 1, by the victory of the X Prize, established by Gregg Maryniak and Peter Diamandis, and won by ScaledComposite's SpaceShipOne in its historic flight, on October 4th 2004. Looking at this history, it is worthwhile to recall that this event demonstrated for the first time that cheap access to space is possible, and it encouraged hundreds of young entrepreneurs, including Elon Musk, Jeff Bezos, and Richard Branson.

Many have tried to answer the question 'what is new space?' According to NewSpace Global (data analysis and coverage of NewSpace Industry): *"NewSpace is a global industry of private companies and entrepreneurs who primarily target commercial customers, are backed by risk capital seeking a return, and seek to profit from innovative products or services developed in or for space."*⁴⁴

NewSpace Global, Alt.space, NewSpace, Hobby Space, Entrepreneurial Space, and other labels have been used to describe approaches to space development that differentiate significantly from those taken by NASA and the mainstream aerospace industry. Multiple businesses and organizations are working to open the space frontier to human settlement through a process of economic development.

Through 2021, Space X is developing and testing Starship, the first two stage earth to orbit fully reusable vehicle. This will be, just 16 years after the X-Prize, the most ambitious outcome of new space so far, and this ability will kick-off the new space age: the Big Space. Will this moment be the kick-off of Civilian Space Development as well? That potential depends on the alignment of many other conditions and potentials: social, economic, political and philosophical.

The following figures (Figure 10 to Figure 12) show the main differences between old and new space, and the key factors determining the shift from the old to the new space paradigm.

While Old Space programs were exclusively funded by public money, the New Space development is mainly privately funded, though big companies (e.g. Space X and Blue Origin), include commitments by space agencies. It has been the advent of Space X, with its lower prices, pragmatism and reusable technologies, that broke the monopoly of the traditional aerospace companies, giving birth to an open market. Though less flexible, and reluctant to change, big aerospace corporates as Boeing, Lockheed Martin, Northrop Grumman and others were forced to lower their prices and begin to convert to reusability, making agreements with Blue Origin and other New Space dealers.

Moving from the classical supply chain, driven by agencies' requirements, the new mission strategies are based on innovation concepts and goals. Moving out from a traditional science, telecommunication and exploration, new stakeholders have entered the vista: space industrialization, moon mining, asteroids resource exploitation. While traditional manned missions requirements were based on astronauts as military trained explorers, new space begins to aim at transporting and accommodate civilian space passengers and settlers. Expendable rockets are

gradually replaced by reusable rockets, while the first fully reusable vehicle – Space X’s Starship – will quickly make obsolete most other any launchers. The lowering of the cost to orbit will allow a shift from mainly robotic space exploration missions to manned spaceflight, including future settlement configurations, aided by robots and AI. While the old paradigm only undertook programs fully controlled by Governments, the new space paradigm focuses on corporate independence from Governments. While the old space programs were de facto closed to private investors – even though agencies were encouraging private enterprises to put their money into development, without any warrant of a return – new space ventures are now mainly based on autonomous private investment. In talking about care for Earth environment, while Old Space focused on Earth observation, New Space missions have begun adding another rationale: specifically improving Earth environment by moving industrial development to space. Last, but not least, after too many decades of the irresponsible proliferation of wreckages and debris in orbit by traditional aerospace, new space is finally working to avoid new debris, and to remove, recover and recycle discarded objects in space.

To take note of the most important differences: while a traditional mission cost was too high, and the only achievements were the fallout from space research, new space is focusing on cheap and faster access to space. Why is this so? Certainly it is because new space entrepreneurs are driven by ideals, which extend beyond profit. Of course profit is important, since without profit no company can survive, yet Musk, Bezos, Branson, Bigelow and others are motivated by their strong ideal to make humanity a space faring species. Such an ideal makes the difference, and generates an orientation to results as soon as possible and sound achievements, instead of science fiction dreams and fairy tales.

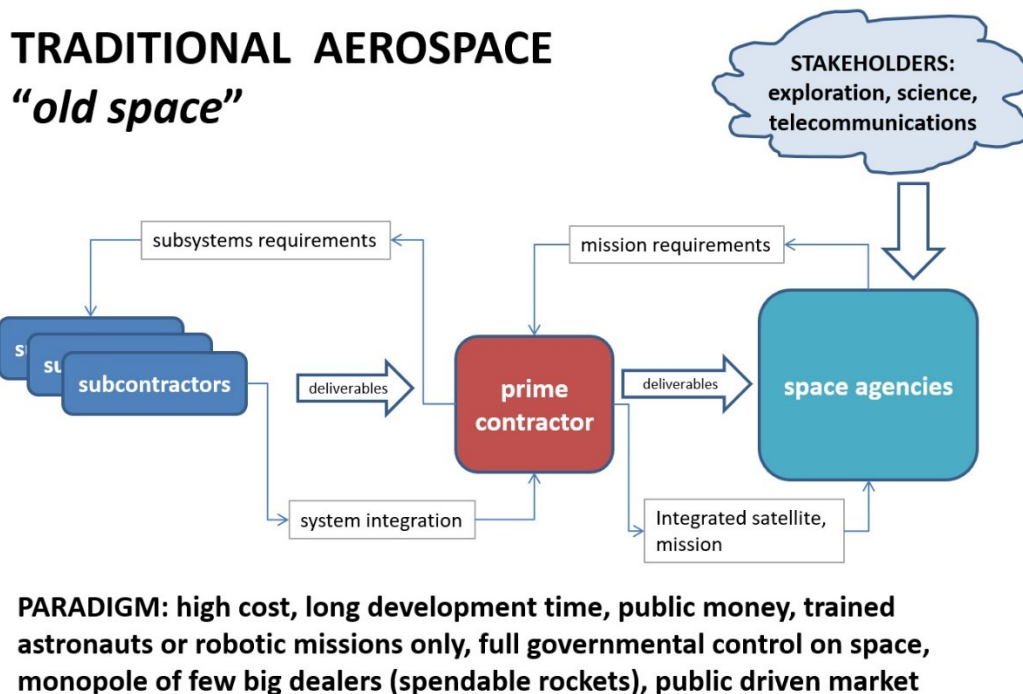
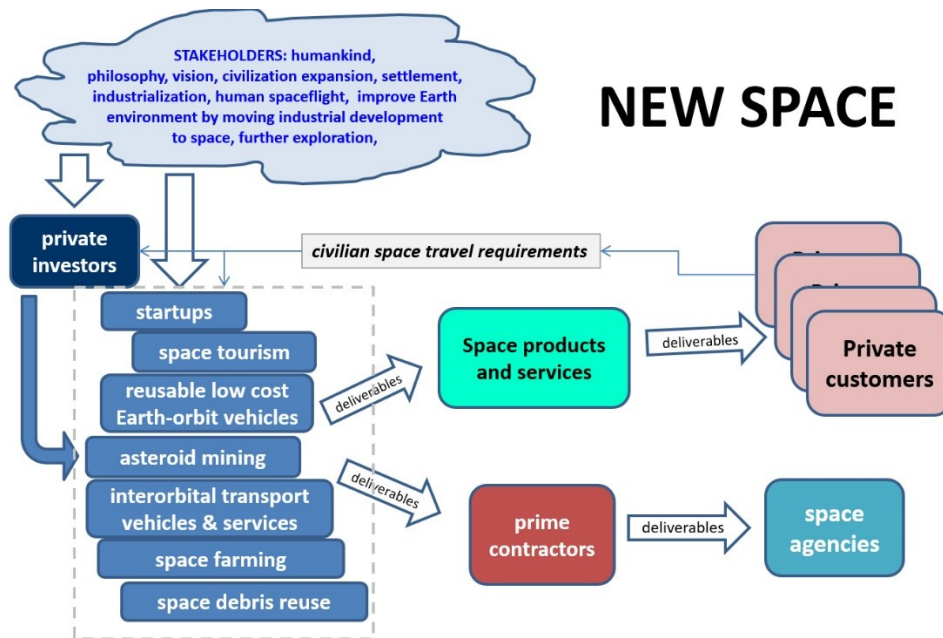


Figure 10. The paradigm of the traditional aerospace



PARADIGM: faster, better and cheaper access to space, pragmatism, commercially minded, independent from governments, private capitals, civil space development, business & vision driven market

Figure 11. the paradigm of the New Space

THE CHANGE OF PARADIGM

OLD SPACE	NEW SPACE
Funded by public money	Privately funded
Classical supply chain, driven by agencies requirements	Companies' mission strategies based on own innovation ideas and goals
Science, telecommunication, exploration	Space settlement, space industrialization
Astronautics, by military trained explorers(*)	Civil space passengers and settlers(*)
Spendable rockets	Reusable rockets
Mainly robotic space exploration	Human spaceflight, for settlement, aided by robots and AI
Controlled by Governments	Independent from Governments
De facto not available to private investors	Mainly based on private investors
Earth environment care by Earth observation	Earth environment improvement by moving industrial development to space
High mission cost, distant future achievements	Cheap and faster access to space
Irresponsible proliferation of wreckages and debris in orbit	Avoiding new debris, recovering and reusing old ones

(*) **the very key factor:** carrying civil passengers means a full change of mission requirements, e.g. low acceleration, low cost, safer reentry in atmosphere, protection from cosmic radiations, artificial gravity,

Figure 12. the change of paradigm, from Old Space to New Space

2.4.3 Does New Space require a new financial context?

Many economists foresee a spectacular growth for the space economy. Morgan Stanley envisages the space economy will be worth 1 Trillion by 2040: as the space economy accesses the next giant leap.⁴⁵

Morgan Stanley's Space Team estimates that the roughly \$350 billion global space industry could surge to over \$1 trillion by 2040.

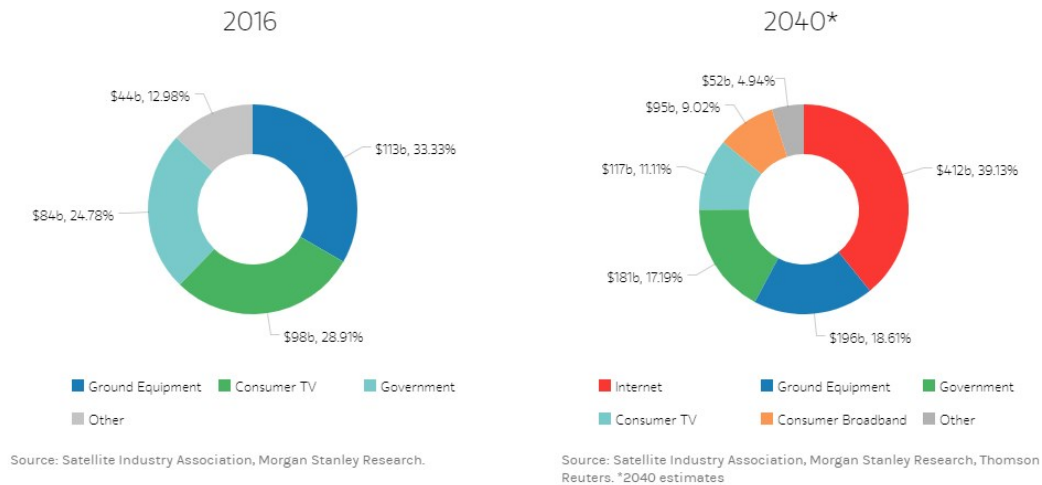


Figure 13. Morgan Stanley Space Team estimation of space industry development to 2040

Morgan Stanley, is one of those economy dealers that few years ago – when the space shuttle was retired – declared the end of space age. They are now painting a truly different picture. In Feb 17 2021 they published a study, in which 10 drivers of the New Space Ecosystem are identified. We can see that these guys are not necessarily space idealists: they will only take care of the segments that make money. It is therefore quite interesting that, in their lists, they mention some of the key civilian space development drivers, namely: asteroid mining and space tourism. Space debris is mentioned as well, but the most related area of interest is defined as planetary monitoring. Nothing is mentioned concerning debris recovery and reuse, an economy on which some companies, and research institutes, are beginning to work.

It seems that space tourism has become the most interesting new space activity: proposing access to space for private citizen, space explorers, space adventure programs and others. Also the latent potential for extracting water, rare minerals and metals from near-Earth asteroids as well.

Of course, 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 will go 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?

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. The only effective result would be for the suppliers of satellites and related space services. Humankind would not have had 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.

Such a forecast makes evident the dimension of our mission: to turn most of the space economy figure, during next 10 years, towards civilian space activities, industry, tourism, health.

If and when a paradigm for Civilian Space Development leads out the earthly global economy, we will grow in manifold accordingly: this is the greatest opportunity at stake, to initiate such a formative process during next 10 years.

The space economy will not reach the 1 trillion benchmark without being guided by the impetus for Civilian Space Development. The global economy cannot grow anymore within such limited constraints, it will implode, unless it is led by the innovative space economy.

Space Economy 2040: \$3.5 Trillions

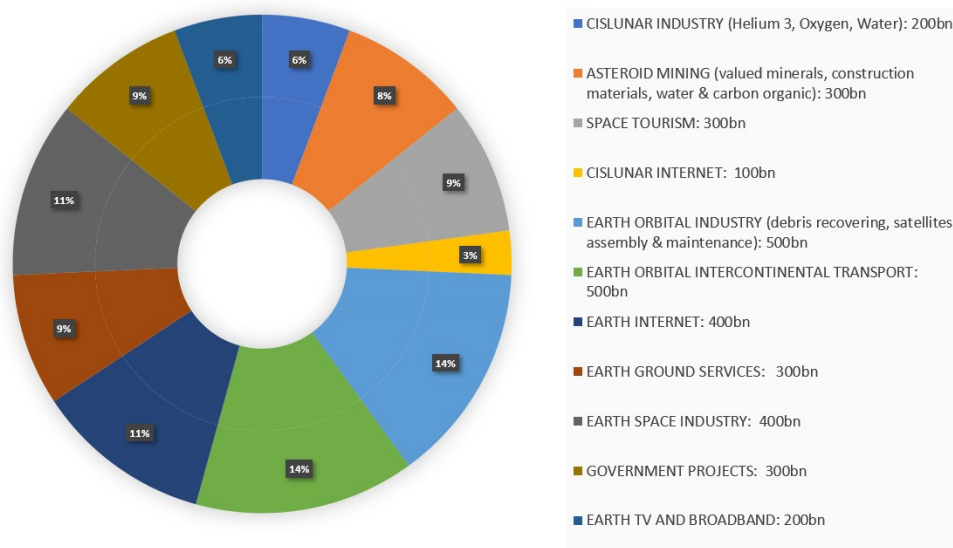


Figure 14. Space Economy 2040, whit Civilian Space leading global economy

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

The post-Covid19 world will be characterized by many conditions quite different from the world before pandemics:

- global economy and many manufacturing segments in a deep crisis
- some segments – namely e-commerce and web services in general – growing at two figures
- 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 inclined to prize public works and projects, for the sake of environmental concerns
- governmental subsidies to unemployed people will become a usual trend, in trying to avoid dramatic social conflicts
- immobilized uninvested capitals will seek profitable ventures
- investments in civilian space development will quickly repay for themselves
- and will relaunch the global economy, leading it out.

Money, as a mean of accountability, is phasing through a quick and devastating evolution, that can be broken down more or less as follows:

- Money 1.0 - made of gold, silver and other metals, in ancient times, their value was equal to the value of the material they were made of.
- Money 2.0 - became paper sheets, having a material value very much lesser than the nominal value. But the value was still tied to a corresponding value in gold, guarded in the national banks.
- Money 3.0 – still paper sheets, but no longer tied to a corresponding value in gold⁴⁶
- Money 4.0 – electronic money are bits in a banks servers, and can be easily created.
- Money 5.0 – bitcoins are “mined” by supercomputers each time certain kinds of transactions are completed anywhere in the world.

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.

More freedom requires more maturity, and a higher ability to choose in the true interest of stakeholders, we have already seen that stakeholders of industrial strategies in 21st Century are not only the investors, but represent the whole humankind and the environment of this planet as well.

Big money can be quickly generated, and directed to the proper programs by a simple click.

Which programs to boost as a priority and which programs to leave at a lower level will become more and more a matter of political decision. The main governments of the world, so far, have demonstrated weakness, and lack capability to take the right decisions, in a context of stormy electoral twists, and birth of new political parties which don't have any durability, all of them lacking a new long term development strategy.

Bitcoins are free from any central bank's control, though banks are working assiduously to recover the lost ground.

There are some questions which are harder to answer today, e.g.:

- a) Will a financial environment exist, which is not based on banks, where investors will have the opportunity to direct money to promising civilian space projects, even if such projects are not be considered “bankable” by the institutional banks?
- b) Will such a new financial environment be secure enough to assure the proper return to investors, upon success of the funded programs?
- c) Will new financial tools, namely those oriented to new space and civilian space development, allowing big and small investors to participate in civilizations expansion into space?

- d) Will governments avoid construing obstacles to the development of the possible financial environment?
- e) Will governments decide to sustain this new financial environment?

One thing is for sure, is that electronic money requires energy, and bitcoins require huge amounts of energy to be “mined”. This means that we are entering a stage in which money will represent energy, not only metaphorically. Investors of the near future will direct energy, literally, to their selected programs.

Brian Wang, in this article⁴⁷, has no doubts that a sustainable space boom will transform the world and then the solar system: *“The Apollo, Starlab era was killed with the bureaucracy that created insanely expensive systems. The Space Shuttle was supposed to be the beginnings of affordable space with a planned \$5 million per launch cost. However, the Space shuttles ended up costing over \$1 billion per launch. This time rocket launch and satellite construction costs have been continually improving for the last 6+ years so that there is a proper foundation for continued profits and new business models. Prices will continue to drop and SpaceX and other space companies are establishing very profitable businesses. Profits and revenues will make this a permanent space boom.”*

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 guys of the planet are Jeff Bezos and Elon Musk. And Elon seems to soon become the first: at the end of February 2021 Bezos's patrimony is worth 180 \$B (decreasing), and Musk legacy is 176 \$B (increasing). 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.

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

The New Space Economy will save our ass!

If we want to say it in a simple and easy to understand way, we could say “the New Space Economy will save our ass!”

In other words, should the development of the new space economy be hindered or derailed, the global earthly economy will 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.

2.4.4 The space advocacy movement

The space advocacy movement anticipated and qualified the birth and the growth of the new space segment, starting at least 60 years ago, and maybe earlier. Some reflection on this history is due.

The British Interplanetary Society was the very first space advocacy association, founded in Liverpool UK in 1933 by Philip E. Cleato. The American Astronautical Society was founded in 1954 by 37 individuals aimed to advance serious proposals for space flight. The SETI Institute was founded by Carl Sagan in 1960. Followed the National Space Institute (1974), and the historical L5 Society, in 1975.

America was definitely a true incubator for space advocacy: not surprisingly, considering that science fiction, as a literary genre, was also born in that country. Establishing the 1960's space race, a number of qualified organizations emerged : Space Studies Institute (1977), The Planetary Society (1980), Citizens' Advisory Council on National Space Policy (1980), Students for the Exploration and Development of Space SEDS (1980), Canadian Space Society (1983), Space Foundation (1983).

The International Space University was founded in 1987 in France, by Peter Diamandis, Todd Hawley, Robert D. Richards, and Christopher D. Mau.

The National Space Society, in 1987 incorporated the L5 Society.

The Space Frontier Foundation was founded by Rick Tumlinson in 1988.

The Living Universe Foundation in 1992.

In 1998 came the Mars Society, founded by Robert Zubrin. And in 1999 followed the Alliance to Rescue Civilization. The Moon Society was born in 2000, the Space Exploration Alliance and the Tau Zero Foundation in 2004. In 1998 some of the forerunners of the Space Renaissance formed the Greater Earth, as an international discussion group, nowadays run by Arthur Woods. And in 2008 the Space Renaissance Initiative was born, and incorporated in 2010 as Space Renaissance International. The Alliance for Space Development, born in 2015 in the USA as an umbrella organization, groups several USA associations, including Space Renaissance USA, Inc., the SRI USA Chapter. There are nowadays many other space advocacy organizations, not only in the USA, but across Planet Earth, though the biggest concentration is still in the USA.

This is a real patrimony, essential to the evolution of our civilization evolution from mono-planetary to a multi-planetary civilization. The new space industry is the very obviously needed asset, but large qualified space education and outreach organizations are essential too. Their – our – goal is to raise public awareness about the evolutionary need to expand civilization into the outer space.

Humanist space philosophers have the irredeemable task to explain to the world the true meaning of affairs that are often plain and evident to see, but not so easy to understand in their significance and importance to our life, as globalized citizens of Planet Earth.

During the last 30 years, these organizations were among the first to advocate the development of reusable, low cost, launch systems, the very first step to lowering the cost to orbit. They also criticized the main space agencies, because for many decades they were not requiring their providers to develop reusable rockets. Many space organizations played their part, in the discussion, promoting a change of paradigm, from self-targeted space exploration to space settlement.

We have understood that, in the current critical situation, it is of key significance that the various space organizations relate each-other, with purpose to collaborate, even so that doesn't imply a

merger into a unique large organization, although the effect can be proposed, when shared goals are acknowledged as a priority, to be brought to the public attention and to the desktop of decision makers. That's why it is important to consider initiatives such as promoted by Prof. Joe Pelton and Jim Crisafulli⁴⁸, having the goal to connect several space advocacies with universities, corporations and individuals working to expand civilization into the outer space.

Some tasks on which we will call the whole space community to help, creating a stronger outreach to the people. At least, roughly:

- a) **Supporting Space X in a determined and pragmatic strategy, in developing fully reusable space vehicles. Mass media's often don't provide much correct information, describing Elon Musk as an eccentric billionaire, nurturing crazy dreams, like founding a city on Mars. If such a "crazy dream" is moving Elon to do that, let's work for the birth of other 10 Elons on Planet Earth, at least!**
- b) **Explaining the essential role of space tourism, that's this is not "a toy for very rich people", but the only industrial segment nowadays which is focusing on civilian passenger transportation and housing in space.**
- c) **To promote everywhere a far higher priority for the enhancement of enabling technologies for civilian space development, i.e.: protection from cosmic radiations, artificial gravity, low cost safe and comfortable space vehicles, and green environments in space habitats.**
- d) **Explaining Jeff Bezos's plan, to move our industrial development into geo-lunar space transforming Planet Earth in a beautiful garden.**
- e) **Explaining that we actually need the equivalent of many "Planets B". Without that we cannot save Planet A, nor civilization.**
- f) **Defending the vision of the space economy leading the global Earth economy, as the only strategy for a true renaissance, a space renaissance.**

We have called our organization "Space Renaissance", but we should certainly remember that such a title belongs to the space movement, and it will not remain bound to us, unless we are able to properly indicate a few true priorities, and easily understandable concepts for public outreach, which can be shared between us and multiplied within the wide human society.

2.4.5 Government choices between keeping exclusive control of space and opening to private enterprises

There's probably too much to say, about governments, and obviously many sentiments, according to the various points of view. Many space enthusiasts think that private enterprise will open the frontier, notwithstanding governments. Other positions in the space movement are more institutionalist, and feel that, without governments and space agencies, nothing will really be possible.

We are witnessing many divergent, different and incoherent attitudes, by the space faring nations.

It is appropriate to talk about USA, as being a Country – notwithstanding all of its faults and lack of vision – which is evolving as the essential space faring nation of planet Earth.

NASA, and the US Government, have advanced the new space industry which is mainly growing on their national ground, yet they keep on giving credits to SLS, the Space Launch System, that will be used for the Moon Artemis program. This is an old-space big rocket, fully wasteful, and

costing very much more than the Space X's services which provides the same characteristics, based on reusable rockets.

From the point of view of civilian space travel, we also observe that the Crew Dragon, by Space X, is very much more ergonomic and 'civilian shaped', when set against the competitor, Boeing's Starliner, which has similar instrumentation and interior design, to the retired space shuttle and Apollo capsules.

While the traditional aerospace companies – such as the American Boeing, Lockheed Martin, Northrop Grumman, United Technologies, and the European Airbus – attempt to trudge after Space X, shyly and slowly moving towards reusable rockets, and lowering their prices, Space X is hitting the ground running. Elon Musk's pragmatic approach already allowed Space X to gain the first score as launch services provider: comprising 65% of the US market⁴⁹. Reusability allows Space X to price at two thirds of its main competitor, ULA, about \$62 million average per launch. ULA has thus been constrained to lower its prices.

The main outcome of such an incremental process – thanks to Space X's reusable rockets technology – is the fact that NASA has become an open market, open for new dealers, providing services at a lower cost.

The US Administrations have pushed with more or less urgency the US space program, however they appear more concerned about Chinese competition, than by any serious understanding of the key importance of space development for both the US and the global economy. Perhaps, if China didn't exist as a competitor, USA could choose to decrease their engagement in space. It perhaps follows that we must be happy, because in the world we see such a powerful competitor as China, which may have clearer ideas and vision, about the need to expand into outer space.

There were, and there still are, considerable concerns after the victory of Democrats during 2020 presidential elections, that the human space flight programs of NASA might be subsequently penalized, giving more relevance to the Earth observation programs, in order to contrast climate change. We don't know if such an issue has been taken seriously or not. And it is not necessarily the scope of our congress to indicate the best policy for the US Space Agency: as we know, that is traditionally aligned to the interest of United States, and SRI is an International association.

However, US space policy is no doubt relevant for the whole Earth citizens. Therefore we would recommend – in the case that higher priority is granted to climate change and other Earth targeted programs – not to cut back human spaceflight programs: there are other ways to obtain the needed budget. To use less expensive services (reusable rockets) and maybe take some portion from the burgeoning military agenda (600 bn/year). Even a 1% of that budget would be significant for NASA, whose annual budget is about 30bn. With 1% of the military budget the NASA budget would be 36bn, 20% more. Enough to pay for at least 600 (six hundreds) Starship launches!

China and India seem to have a clear vision about why we should expand into space. They have experienced a huge poverty issue, having a growing population in a rather closed territory, and they conceive space as a new natural territory in which to expand. The Chinese space program is fairly ambitious and timely. Both China and India have ongoing Moon programs, and China has just delivered an automated vehicle to Mars.

The Russian government's space strategy is not so clear. Russia took profit, since the retirement of the space shuttle, by employing the sole vehicle to reach the ISS, and Russian corporations have made several attempts to jump start a space tourism industry. Nowadays US again has their own vehicles – Space X's Dragon, and likely the Boeing's Starliner in near future – and the privileged position for Roscosmos came to an end. The latest news mentions an agreement between Russia and China, for a joint Moon program. A venture which will be productive, as

China will profit from the Russian long lasting experience in space, and Russia will profit from the strong determination and extensive capital that China can put forward.

The European Union, and the European Space Agency, developed a strategy targeted to Earth observation and telecommunication satellites. The prospect of a European shuttle, Hermes, was abandoned in late 1990's. Nowadays, Europe has not typically entered the astronautic club, which remains so far generally limited to US, Russia and China. However, under the mandate of Jan Woerner, we have seen some quite progressive and decisive alignments moving in the direction of Civilian Space Development: the concept of a Moon Village⁵⁰ being launched by ESA, after it was initially proposed by a coalition composed of the 'archistar' Norman Foster⁵¹, together with D-SHAPE⁵² and other partners. The famous picture of a moon habitat 3d printing emerged from such a coalition. And we're particularly proud to say that Enrico Dini, CEO of D-SHAPE, is a member of SRI for many years! Enrico is the inventor of the lunar 3d printing for habitats construction. Another SR Italia member, who should be mentioned, is Luca Rossetini, CEO of D-ORBIT⁵³, the first Italian new space corporate. ESA has developed several probes for the automated exploration of the Solar System. However so far it has not signaled that it is working extensively on human space flight projects, their agenda being satisfied by exporting European astronauts on NASA programs. Neither was ESA particularly active in promoting a European reusable rocket. The Arian 6, proposed by Airbus, was conceived as a fully expendable rocket. Adeline, a possible successor as a reusable first stage⁵⁴, will return back to Earth through a soft horizontal landing on a runway, using small winglets, deployed at a critical point of the descent. Adeline has been included on ESA's agenda since 2015, even so in 2018 an official in the CNES launcher directorate declared the concept "not financially interesting". More recently though we heard rumors about a possible acceleration of Airbus on the road of reusability... better late than never.

In general terms:

- **SRI sees the competition among China, India, Russia and USA in the new *space race* as an opportune condition. Should only a single Country be interested in space, its political leaders could fall asleep, void of a competition, and not having a clear vision of the importance of expansion into outer space.**
- **SRI feels that private new space industry is key, definitely essential for civilian space development, but it should be widely and politically supported in its epic giant effort.**
- **We also believe that, besides fair competition, collaboration is also important, and SRI will make worthwhile effort to sustain competition plus collaboration – a perhaps “compeboration” – among corporate entities, agencies, universities, institutions and the good willing people of Planet Earth.**
- **SRI recommends that all of the Governments of Planet Earth bet on Civilian Space Development, if they can. However, at very least, not to construe obstacles on the road of the new space industry and market.**

Competition is valuable since, as Robert Pirsig described, human intelligences work better in parallel than in series Pirsig writes : *“People, like everything else, work better in parallel than they do in series, and that is what happens in this free-enterprise city. When things are organized (...) in a bureaucratic series, any increase in complexity increases the probability of failure. But when they're organized in a free-enterprise parallel, an increase in complexity becomes an increase in diversity more capable of responding to Dynamic Quality, and thus an increase of the probability of success. It's this diversity and parallelism that make this city work. And not just this city. Our greatest national economic success, agriculture, is organized almost entirely in parallel. All life has parallelism built into it. Cells work in parallel. Most body organs work in parallel: eyes, brains,*

*lungs. Species operate in parallel, democracies operate in parallel; even science seems to operate best when it is organized through the parallelism of the scientific societies.*¹⁶⁵

However, given Elon Musk's spirit of pragmatism, we cannot say that ruthless competition must be adopted as a unique model, useful for any time and any situation. In the current critical situation of our Civilization, collaboration is important too. We believe that authentic practices, implemented through the birth and growth of the world wide web -- such as Creative Commons and Open Source --, have brought great benefits to the advance of general knowledge, this without destroying genuine undertaking and the spirit of competition. The suitably recommendation could be to make key concepts available for free, although recognizing intellectual primacy to their inventors. History is quickly demonstrating that the market is prizing visionary entrepreneurs for very much more than their good ideas: courage, pragmatism, method, determination, scientific test / error / correction / retry. Is it realistic to ask this question: why is only Space X designing ,building and using reusable rockets, over the past 6 years? Has Elon Musk hidden any secret formula from competitors? Did any protectionist measure existed, or any patents, hindering competitors to develop the same technologies? Clearly not. Nowadays other companies in the world are also going down the same path, and will likely take profit from the early errors made and solved by Space X. Space X already holds a competitive advantage, and doesn't need to raise protective barriers. This attribute represents openness and collaboration with humanity. Why? Because Elon has a vision for humanity, not only for his own company.

The new space industry needs wide scale support and consensus, namely in such a critical time period as our global society entered in 2020. So far public opinion has been more or less benignly indifferent, with a small minority appreciating the key role of new space for the destiny of our civilization. Given the possible worsening of the multiple crises, we could soon be witnessing a rising hostility towards space activities, in the name of false concepts, such as using money for more important earthly goals. At this significant juncture, governments could enter into the game, keeping the right stance, and aiming high. Which is why SRI mission includes encouraging political decision makers to understand the importance of civilian space development for human society as a whole. Their job is to assure a future to their communities, and this perspective will become possible only by expanding into space.

2.4.6 Good humanist ideological concepts: active strategies to save Civilization

Our understanding of the civilization status is that we have to face several parallel crises: environmental, social, economic, unemployment, migrations, pandemics. All of such crises are exacerbated by humanities successful growth in the closed system of our mother planet, and now the breaking point of a possible implosion of the civilization is closer than was expected.

Our duty is to study and adopt active (and not passive) strategies to fight the global crisis: the first strategy is to actively fight even the idea of a possible holocaust, and to preserve the right to the future (i.e. to have children) for all of the 8 billion terrestrial citizens. Which means, simply, expanding into outer space. We might perhaps envision that with the onset of civilizational expansion into space, many people will become space citizens. It is even possible to assume that demographic growth will progressively move from Earth to space, as a typical and extensive migration and social process.

We mention this potential not just because we are romantic space enthusiasts, or because space is our whim. Yes, of course all of that is true, and we are proud of that!

However the main reason is that we are Civilization Savers.

Humanity needs to start expanding into outer space before 2030 because human civilization may not succeed in passing over the multiple crises with which it is immediately faced, should we abdicate this huge evolutionary step.

We, as an engaged space organization, can properly chart the path towards the expansion of civilization - including all terrestrial life - beyond the atmosphere of Earth, planting it elsewhere in the Solar System. If this does not happen, soon, then it may never happen. If our fragile civilization collapses and the world population is reduced to 1 billion or less, there may be no motivation to move humanity into space -- and this would be -- not only bad for our species -- but also bad for the ultimate survival of life as we know it.

Thus, it is our obligation and responsibility to assure that this first move beyond the atmosphere of physical Earth into the region of Greater Earth is successful. Once this region is "occupied and/or settled" the path to the rest of the cosmos will be open.

This is the "cultural dimension" of space development and, as our humanity is composed of diverse cultures, our arguments should be as universal as possible. For us to be successful, space development must be as meaningful to the peoples of the less developed world as it is to us. As such, and as Ehrlicke pointed out, space development scenarios needs to offer a real and tangible promise of economic security and prosperity which becomes the basis of hope for a brighter future for the human species.

3 We call all of the space-expansionists and civilization-savers to join the Space Renaissance

We, the space expansionist movement, should also begin working on a key issue: are we a minority inside a minority? We should understand that, remaining as a minority in society will decrease the possibilities, in overcoming the crisis. The heroic efforts of Elon Musk, Jeff Bezos and Richard Branson will be not sufficient, if not duly supported by a strong public outreach, creating the popular consensus for civilizational growth, and encouraging governments to support or, at least, not to hinder these efforts.

The goal should be to help to convey capital and public support into the new space enterprises, and promoting the research that will elaborate civilian space development.

SRI therefore is calling all of the *space-expansionists*, the *space-optimists* and the *civilization-savers* to join together, unifying our efforts in the global Space Renaissance Movement, in order to speak with a louder voice to the large public. This will make the difference.

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