THE 5th SEASON: BIRTH OF A BABY SOLAR CIVILIZATION

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DO WE REALLY KNOW WHAT SPACE IS?

- If we are “normal citizen” we don’t imagine what space really is
- If we are scientists we think we know it (and that everyone do)
- If we are media operators, by definition we “do know” everything
- =
  - nobody is (or show to be) surprised by space,
  - nobody feels the wonder,
  - only astronauts do, but they are still few people,
  - nobody *communicates* the wonder of space.

THE VIEW AT THE BOTTOM OF THE WELL IS…

… FLAT AND LIMITED!

THE VIEW AT THE TOP OF THE WELL IS…

… 3D, 360° !

THE FIFTH SEASON

- End of the Terrestrial Civilization?
- Space Option or *Extraterrestrial Imperative*?
- The Fifth Season is in Space
- Awareness

THE SPACE SEASON FRUITS

- Cheap transportation
- Structural lightness of space engineering
- The solution of the energy problem forever
- The products of the gravitational well
- The asteroids belt Cornucopia
- Signs of a golden age
- Safety
- A boundless economic growth and freedom
- The Moon Kindergarten


AN HAPPY EVENT!
EARTH IS NOT SICK: SHE'S PREGNANT!
AN UNSUSTAINABLE GROWTH
HUMAN MIDWIVES NEEDED
THE SPACE AID TO RECOVER OUR PLANET

END OF PRESENTATION

Thanks for your courtesy…

…Aim high!

LAYER II ----------

LAYER II

THE NEW MILLENNIUM BEGUN UNDER A DARK STAR

- Scarsity of resources
  - energetic resources dramatically scarce
  - food resources and cultivable ground are shortening
  - back-warded conflicts threaten our daily life
  - global economy is stagnant, lacking of industrial development lines
  - environmental problems threaten our health and survival
- China and India started their industrial development
  - the resources of this planet are not enough
  - other conflicts are at the horizon, even worse than the current ones
- Decadent cultural vectors dominate the cultural scene: industrial decline is generally accepted, when not advocated.

THE HOMO SAPIENS'S SEASONS

- Our growth, as a sentient species, is very near to its natural limit, in the closed environment of this planet.

- The awareness of the environmental and resources problems is, at the same time, **the measure and the agent** of such a process.

- The seasons of our history:
  - springtime - up to Neolithic begin
  - summer - from neolithic revolution to the advent of written cultures
  - autumn - harvest of our cultural progresses, up to our present days
  - winter - decline and end of civilization, due to space/resources lack

SPACE OPTION OR *EXTRATERRESTRIAL IMPERATIVE*?

- But, as an intelligent technologic species, we hold a space technology, though at initial stage
- so we have an alternative: we can have a FIFTH SEASON, after winter.
- such a fifth season can only be out of our birth planet
- the fifth season can only take place in the extraterrestrial space
- that's why space is not an option, but an imperative.

AWARENESS

- The awareness of the possible end is very diffused, not so the awareness of the real alternatives.
- Up to today, we were able to address the extraterrestrial space for:
  - Telecommunication (all)
  - Research, Earth Obervation (EU)
  - Research, Exploration (US)
- Awareness ranges in the public opinion more or less as follows:
  - a waste of public money
  - a dangerous environment, to be avoided (better send robots, if really needed)
  - an interesting subject for entertainment
  - a tool to enlarge our scientific knowledge
  - one of the options for development, competing with other sciences (nano-tech, bio-tech, ..)

EARTHLING SCIENCES AND ASTRONAUTICS

- Scientific development is one of the keys, for the continuation of our civilization.
- But: any scientific development allowing us to grow up a little bit further in this closed environment, will only delay our end of some tens years.
- Earthling Sciences, alone, are not a true alternative.
- All the Earthling Sciences, prisoner of a closed environment, are not a true alternative.
- They can only help us to survive a little more during winter: it will not give us a fifth season!
- Here's another reason why Astronautics is not an option, for Humans.
- It is an imperative, as Krafft A. Ehricke so farsightedly pointed out more than 30 years ago!

THE FIFTH SEASON IS IN SPACE

- Only in the extraterrestrial space humans can escape the physical limits of this planet:
  - gravity,
  - attrition,
  - time constrains,
  - season cycles,
  - resources finiteness,
  - territory constrains,
  - environmental constrains.
- Settling out of the terrestrial atmosphere and gravitational well we will achieve a very greater degree of freedom.

CHEAP TRANSPORTATION

- December 1997: targeted to GEO, Proton-Asiasat 3 failed to an elliptical orbit, useless for its mission.
- The fuel of the small asset correction engine was not enough to correct the course to the right orbit.
- But the Hughes engineers didn't give up,
- they used that few fuel for a "gravity assist" behind the Moon!
- Asiasat-3 was so redirected to the right Earth orbit.

MERCANTILE ASTRONAUTICS

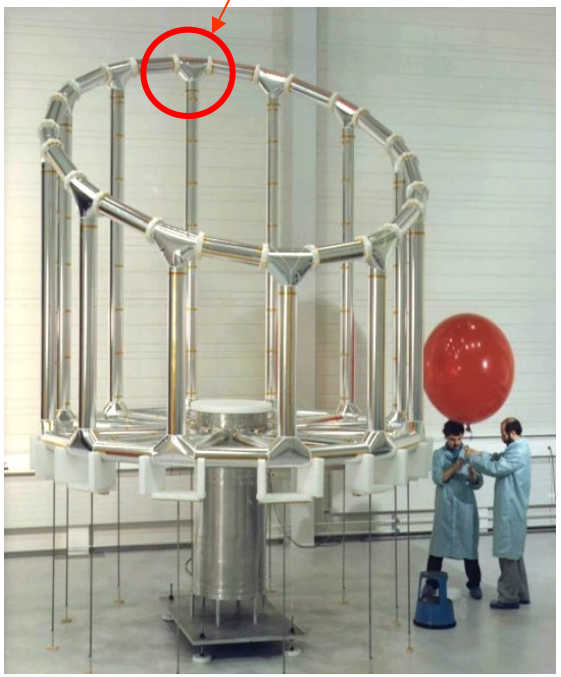
- Think to leave Italy by a small raft, with a 6 cv engine, make a trip to New York and return, all with few litres of gasoline!
- Non-perishable goods deliveries on the Moon - Earth route or everywhere in the Solar System,
- transfer a whole cargo, using a motorbike engine!
- Profits, for a mercantile space transport enterprise, are simply incalculable,
- and the benefits, for a space economy, in terms of development potentiality, are incalculable as well.

THE GIFT OF THE GRAVITATIONAL WELLS

- Gifts = absence of gravity, absence of attrition, use of moon gravity as accelerator.
- On the Earth's GW bottom, in our atmosphere, each kg-km costs a lot of money, in fuel and wear of the machines.
- Gerard O'Neill (1970's): US transport system spends 25% of total energy budget for gravity and attrition, wasting 2,5 oil tons per citizen.
- What's now the waste of energy for transportation on the whole planet?
- When we'll be out of the gravitational well, the GWs will be benefits, no more costs!
- Let's make proper calculations, and communicate to many transport entrepreneurs, to assess the convenience of the space transportation.
- And first of all they should be properly entertained by a well-illustrated story of Asiasat 3!

STRUCTURAL LIGHTNESS OF SPACE ENGINEERING

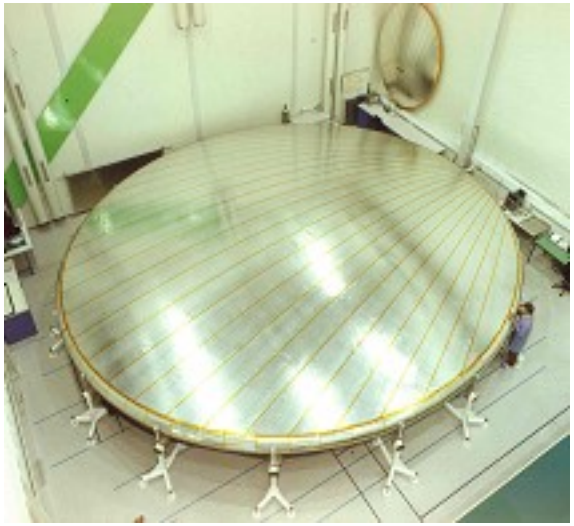
- This thing is a complex inflatable structure, the ISRS Solar Shield for FIRST (M.C. Bernasconi)
- Closely observing an inflatable structure, and tasting by fingers its thickness, is a shock-vision, as much important as the previous case (Asiasat3).
- We are used to see earthling structures:
  - on Earth such a structure shall be a very solid one, even only to sustain itself,
  - other structures, e.g. solar arrays and transmitting-receiving antennas having tens meter diameter, on Earth should have heavy structures and pylons,
  - Earth engineering has to fight with gravity, winds, and with many kinds of vibrations.



The ESA “FIRST” Solar Shield

PIECES OF EXTRATERRESTRIAL TECHNOLOGY

- The first reaction, touching an inflatable structure, is a smile:
- “It can’t work, tell me that you are not deploying in space this garlic-skin!”.
- Seeing the pictures, the inflated structures in their test chambers, we can’t realize how light and inconsistent they are.
- Very simple: they *are not made for this planet*.
- They are pieces of extraterrestrial technology,
- many people should feel the fascination of touching a piece of extraterrestrial technology.



Inflatable Space Rigidized Antenna Reflector Structure (M.C. Bernasconi)

CONVENIENCE OF SPACE ENGINEERING, VS. THE EARTHLING ONE

- O'Neill, on energy: a football field size reflector, in zero G, has the mass of a car.
  - In order to produce the same amount of energy, an earthling power plant should burn one million oil barrels for thirty years.
  - The space reflector will produce the same energy at zero cost, until when the Sun will shine.
  - As to maintenance and wear and tear, a space industrial plant, at zero gravity, will cost a small fraction of its earthling sister.
  - In fact, though turbines, generators and machineries will have thousand tonns masses, they will weight zero in absence of gravity,
  - so they will work with bearings or in air, without attrition, having so a practically endless operative life.
  - The maintenance operations, will be very easy in absence of gravity.
- O'Neill: the space industry can be built in volume, rather than on plain surfaces,
  - thus all the user machines will be very closer to the central power plant,
  - and the distribution structures will be very shorter.

THE SOLUTION OF THE ENERGY PROBLEM FOREVER

- The Sun boundless energy, at nearly zero cost, is waiting there for us, just outside of our cosmic home.
- A panel in orbit is always oriented to the Sun (Space Sunflower concept) and receives (except at eclipse) 1400 W/m2, 24h/day, 365 days/year.
- The yield is incomparably higher wrt earthling photovoltaic, where we have night time, bad weather, different insulation areas, etc…
- We can deploy very large surface panels, while on Earth we should fight with many problems, covering the ground by black panels for very large extensions.
- Directing the beam on Earth where energy is needed, also the energy transfer costs will be significantly downsized.
- As to environment, SPS will move the most part of the thermal burden out of the planet' atmosphere.

SYNERGIES BETWEEN SPS PLANTS AND PASSENGER SPACE TRANSPORTATION

- Patrick Q. Collins: very profitable synergies are possible between space solar power plants and passenger space transportation.
- The development of the space tourism market will lower the Earth-to-orbit cost.
- A low ETO cost will lower the cost of realization of space power plants, at least in the first phase.
- Later the main materials for space power plants will be produced at lower cost on the Moon or asteroids.
- The possibility to supply energy from space to space clients (hotels and orbiting industrial platforms) will lower the costs of such facilities, and this will further enlarge the markets.
- The more we will increase our activities outside of the gravitational well, the more the space economy will take off,
- and we will also become able to exploit the gravitational well, after having invested to escape it.

THE PRODUCTS OF THE GRAVITATIONAL WELL

- To look into the well from top is very different than watching up from the bottom.
- On the top of the well we'll own huge amounts of potential energy.
- The Earth – Orbit momentum, or the momentum between two different orbiting levels, only need proper (feasible) technologies.
- Technologies will take off when many people will be sitting there, and will concretely see the possibilities.
- E.g.: a very huge energy is currently wasted – with high danger for the safety of the astronauts – when the spacecrafts re-enter the atmosphere:
  - Could those 25 minutes of hell be used to charge an electric accumulator?
  - Thinking about the shuttle nose as a plasma-breathing engine, with a grid in front, and a powerful heat exchanger just after the grid, maybe it could be possible!
  - Each descent in the gravitational well would than repay in part the cost of the launch, and would decrease the danger for astronauts.

THE ASTEROIDS BELT CORNUCOPIA

- Between Mars and Jupiter orbit, the asteroid belt is a nearly endless reserve of raw materials.
- The total mass of the Belt may total little less than 1/1000th of the Earth' mass.
- O'Neill: while mining Earth requires hard drilling, Asteroids are a very high number of small objects, very very easy to mine.
- O'Neill calculated that, if we dogged down to 800 m. the whole Earth surface, and removed the 10% of the total volume of the spherical layer, we had got only the 1% of the materials contained in the three bigger asteroids!
- Most asteroids may be composed of three materials:
  - mostly silicates, metals (iron and nickel), while the rest is a mix of those materials and carbon-rich substances.
- All what we need, in order to build habitats, the machinery needed to sustain life and artificial ecosystems, and industrials plants for economic activities.

SIGNS OF A GOLDEN AGE

- All the light we're able to enjoy, and something more
- The Space Green Revolution
- Personal Wellness, Culture and Arts

SAFETY

- The big mistake of safety
- A Second Source
- Defense from Cosmic Impacts

A BOUNDLESS ECONOMIC GROWTH AND FREEDOM

- Opening the High Frontier will change our life
- Why we do need a Growing Economy
- Astronautics will guarantee the economic and civil growth in freedom
- The incoming Space Economy
- The Figures of the Space Economy

THE MOON KINDERGARTEN

- A giant test facility
- Moon is the obliged next step of our Road Map
- The best place for extraterrestrial experience and growth

HUMANITY IS GROWN UP

- You built a normal house, with doors two meters tall, and ceiling at 2.50 m., and your son grew up, and now is 2.10 m. tall.
- He flexes his neck to enter a room, and you have problems finding shoes and trousers of his measure. Everything cost more than normal size, let alone feeding such a giant!
- In few words, the boy is *"unsustainable"*, and let's hope that he will soon find a job and start living on his own means and resources.
- But, surely you will not charge him of "being grown too much", or "eating exorbitantly".
- And surely you will not continuously exhort him to reduce his size.
- The above recommendations are exactly what we daily administer to our youth (the humanity's "big boy").
- What should we do, instead? Obvious: to enlarge our home, or to help our big son to build a bigger home.

EARTH IS NOT SICK: SHE'S PREGNANT!

HUMAN PREGNANCY	PLANETARY PREGNANCY
Newborn	The space colonies, a terrestrial environment reproduced out of the Earth's body
A pregnant lady	The terrestrial biosphere
Reproductive apparatus: womb + fetus	Humanity and the modified environment
Unsustainable growth, in the body of the woman	Unsustainable growth of the number, of the activities and of the consumptions of the Humans.
Changes of temperature, humor, changes of metabolism	Chemical and climatic changes, pollution
In proximity of the birth, exhaustion of the amniotic liquid, the mother can nomore sustain the fetus	Lack of resources, energetic problems, continuous crisis of the economy
Contractions, pushes, baby's expulsion	Seaquakes, earthquakes, upsettings and breakups of the terrestrial crust

HUMAN MIDWIVES WANTED

- A wise lady treats her body with extra care during pregnancy – eating well, getting plenty of sleep, avoiding drugs, and seeking appropriate medical attention.
- The implications for ourselves are obvious, especially since that there are no experienced doctors or midwives.
- The most important: pregnancy is a process, that shall have an end, possibly a happy end, and not a tragedy.
- The end of the Mother Earth's pregnancy will be the birth of a Baby Solar Civilization, settled on Earth's orbit, on the Moon, on the Lagrange points: the nursery.
- Then, when the baby will be grown up, maybe the Solar System will not be enough!
- But that one will be quite another time and another history.
- Currently, our first duty, as Humans, is to help Lady Earth to give birth to her Baby!

PLANETARY STATISTIC EXPERIENCE

- Space does not have only gifts for humans, but also for the nature of this planet.
- There are no chances, for us, to recover the ecological system of this planet by remaining confined on this planet.
- Our only hope to complete this task, or at list to try helping such a process, is to become a multi-planetary civilization.
- Only so we will make the needed experience of artificial ecosystems on orbital platforms and on planetary settlements.
- If we want to have a chance to understand how the organic systems works, we shall reproduce organic (Earth-like) systems in small, starting from scratch, and adding one by one the Earth conditions:
  - artificial gravity,
  - then air,
  - then chemical components.

THE SPACE AID FOR THE EARTH' ECOSYSTEM

- Space is important because it supplies the environmental conditions that we cannot find here, at the bottom of the Earth gravitational well:
  - absence of any chemical components, absolute sterile environment;
  - the vacuum (to realize a vacuum chamber on Earth is a very hard and expensive thing, while in space it is free of charge!);
  - boundless space, in order to setup as many experiments we deem needed, without spending a cent more;
  - whole worlds fully or almost fully sterile (Moon, Mars, other planets), where we can start from dead dust, preparing small fertile areas and bootstrap the process of life (the K. Ehricke paradigm: man *first).*

BACK, TO HELP OUR MOTHER PLANET

- Nowadays we understand almost zero the ecological global processes, at planetary level.
- Whatever our impact on the terrestrial ecosystem, our growth in a closed environment is no more sustainable, not only by the planet, but by us humans, first of all.
- Once we will be in safe, soundly settled on extraterrestrial Solar System resources,
- and the progress of our Civilization will be surely restarted without possibility to fall back,
- one of our priorities should be to recover the damages we made on our Mother Earth.
- Not before.
- As I said, we will also have better knowledge, to do it better.
- I'm sure any Mother would understand and agree.

LAYER III ----------

LAYER III

ALL THE LIGHT WE'RE ABLE TO ENJOY, AND MORE

- O'Neill placed huge orbiting space colonies at the L5 Lagrange Points.
- Even thinking, initially, to smaller structures, like hotels and ISS-size industrial plants, any of such structures will benefit of boundless and very abundant sun light and energy.
- Think about having ten or twenty 300W halogen spots at home, and freedom to switch them on all together, for all the time we like…
- But what a warm and beautiful atmosphere, when it's on! Every metal surface is shining, and golden details sustain your positive thinking very very much!
- We can play with light, creating different environments, using powerful lights and different colors, getting artistic effects,
- from soft shades to violent contrasts, silk and gold, flames and fluid blue waters.
- We're on a space habitat, where the sunlight comes directly to us from panels, by thousands of optical fibers, or under the form of electric power, powering our lamps.
- Of course the concept applies to all electric and electronic equipments, for work and free time, for music, for domestic comfort, for entertainment, etc…

THE SPACE GREEN REVOLUTION

- Boundless availability of sunlight, power and heat
- Boundless energy and absence of gravity
- Complete absence of parasites,
- the result will surely be greater than the result of the earthling pesticides “green revolution” (7 times more production) 40 years ago (Gunter Pauli),
- and all without using pesticides or dangerous products, that were the main factors of the green revolution.
- Pauli advocates a second green revolution, on Earth, by re-engineering the food production processes, implementing optimized synergies to fully eliminate wastes.
- Maybe he could succeed, improving the earthling sustainability. But for how much time? Ten, fifty years? Then he too shall bend to a no-growth future.
- Not so the *space* green revolution.

PERSONAL WELLNESS, ARTS AND CULTURE

- Most of us Earthlings don't benefit enough of the Sun light and energy.
- Standing up, in the morning, the mirror gives us back the result: our skin is pale, and our flesh is… out of tune.
- In those two or three weeks of holidays, at seaside or mountains, a kind of miracle: the mirror begins to be very more civil, showing us the face we had years before.
- The miracle is due to:
  - sun light,
  - rest
  - having fun
  - eating well
  - physical activity (swimming, walking, etc…)
- After few days of holyday:
  - our mood is very high, we feel very optimist about the solution of our problems, life is smiling us,
  - all the relations with our relatives and friends improve accordingly.

PERSONAL WELLNESS, ARTS AND CULTURE

- Who is used to take note about the changes of feelings and moods, can't avoid asking himself: "why can't I live the whole year like these few days?"
- On space habitats, the Sun light is continuously 100% available, without interruptions nor reductions, with its full healthy power.
- Just need engineering solutions to filter the hard Sunlight radiations (same problem we will have on Earth, if the ozone layer will keep on reducing).
- The space habitat will contribute allow us to rest. To sleep in zero gravity – as reported by many astronauts – is the best way to rest they ever experimented.
- Culture, arts, fun and sport activities will be very much enhanced, with a lot of zero gravity sports and arts.
- Flying in the air, diving in zero gravity pools, different games using one or more balls, races, and so on.
- Zero and low gravity also offer to musicians and theatre artists an incomparable environment for experimentation and research!

THE BIG METAPHYSIC MISTAKE

- Space is considered as a very difficult, dangerous and unsafe environment.
- But, recent and less recent catastrophes remind to us how Earth can be unsafe, causing the death of thousands Earthlings in few minutes
- As a Mono-Planet Civilization, many extinction menaces threaten us, e.g.:
  - asteroids and comets impacts
  - environmental crisis
  - resources shortage
  - epidemics
  - natural catastrophes (earthquakes, tsunamis, floods, etc…)
  - very hot and very cold weather
  - nuclear wars
  - pollution
- A rational thought should conclude that this planet is a very unsafe place for Humankind, if we will not quickly get some alternative places.

A SECOND SOURCE

- When buying computer systems, many people check attentively the existence of a second source, in order to be reasonably sure to have maintenance and spare parts for a good number of years.
- The same people seem not to care at all the need to have a "second source" for their (and my) cosmic home!
- Nevertheless, our safety – as a species – would decisively increase if we had at least a second source.
- This is maybe the main reason for human space flight: settling on another celestial body, we will half the possibilities of extinction of human kind.
- Since nature didn't provide a second Earth-like planet, at our current range (Solar System), we will have to build artificial environments outside.
- But there are no major obstacles to this, except our nearsightedness and meanness!
- Raw materials are plentiful, so water and energy, as we saw at the previous points, very cheaper than here on Earth, once we will be out of the gravitational well.
- And we have 6.5 billion of intelligences, all endowed with hands and opposable thumb!

DEFENSE FROM COSMIC IMPACTS

- Several asteroids and/or comets stroked our planet, during its life of 4 billion years.
- (Spaceguard UK) There are now more than 150 ring like structures on the Earth, identified as definite impact craters.
- Relative probabilities of a US citizen to dye from a variety of causes:
  - aircraft accident = 1/20.000
  - killer asteroid = 1/25.000
  - flood = 1/30.000)!
- Studies explored the possibilities to divert and/or destroy the possible incoming objects,
- but also the opportunities to catch them and use their raw materials for building the space infrastructure.
- An artificial space house can simply move, if something is pointing to hit it!
- This is a primary, very efficient way of defence, that our species experimented since the dawn of our history: the escape!
- However, space settlements will be in a very much better position, to put in place any strategy, against an incoming cosmic object, including destruction and/or capture.

OPENING THE HIGH FRONTIER WILL CHANGE OUR LIFE

- In July 2000, during the new economy boom, I wrote: "…missing the development of Astronautics and the colonization of the geo-lunar space, the terrestrial globalised Economy will know new heavy crises very soon. On the contrary, the start of a Space Economy, opening the world system, will assure a near-endless growth period."
- Only few economists dare to make forecasts, about the possible figures of the Space Economy: sub-orbital tourism and orbital tourism. (P. Collins is one).
- Such a process will cause several evolutionary social processes, at least:
  - softening of all the wars and conflicts;
  - wish to cooperate and compete in the most gigantic adventure of all times;
  - an extraordinary and long lasting thrust to arts and culture;
  - progressive reduction of the poverty and underdevelopment;
  - continuous birth of new market segments, with consequent continuous increase of wealthy opportunities for both the Earthlings and the Spatials.

WHY WE DO NEED A GROWING ECONOMY

- The 20th century collectivist regimes (both fascist and socialist), faced to bad economy, quickly involved into ferocious dictatorships.
- A fun joke says “Capitalism is an unfair distribution of richness, while Communism was a fair distribution of misery”.
- In the aim of the revolutionaries, at least, since Communism quickly ended to be an *unfair distribution of misery*!
- A Growing Economy is a must in any ideological context:
  - If the pie is growing up, there is a possibility (though not automatic) that an utopian society can realize, where everybody have the possibility to become rich, without pillaging other people.
  - If the pie is steady or, worse, decreasing, everyone will be afraid not to can feed his/her children.
  - Fear is the mother of all conflicts, wars and barbarianism.

ASTRONAUTICS WILL GUARANTEE THE ECONOMIC AND CIVIL GROWTH IN FREEDOM

- The Space Fifth Season, an endless golden age, will assure a boundless environment for free development.
- A formidable perspective, for the relaunching and development of the global economy.
- A revolution that will outclass the first industrial revolution, and that will bring the world economy to an unprecedented development.
- A new awareness is to be brought to the light:
  - it will be the Space, that will provide the new industrial development lines, the new energy sources, and a horizon of open development.
  - It will be the Astronautics, that will guarantee the economic and civil growth, in full liberty, for at least one millennium.

THE INCOMING SPACE ECONOMY

- P. Collins: Space Tourism and the related sectors can provide, even alone, the whole development and growth scenario needed by the 21st century human society.
- In 20th century, the declined industries (e.g. agriculture, steam-engines, mining, textiles, …) were replaced by new industries: car manufacturing, electricity generation, etc…
- Economic growth will stop, in the 21st century, without new industries.
- “Almost no-one in 1902 could even imagine, let alone predict, the rise of passenger air travel, nor a fortiori its growth to its current world-changing scale.”
- Today is the same: economists predict growth in many areas of different technologies, but not in passenger space travel!
- However, “The most significant industrial development of the 20th century was the development of passenger air travel from zero in 1900 to 1.5 billion passengers per year in 2000.”

THE FIGURES OF THE SPACE ECONOMY

- The figures of the space economy will surprise everyone (Collins):
- the number of space tourists could reach 700.000 per year, 17 years after start, at an average flight price of $20.000 per passenger.
- With one million per year, 10,000 people will need to be housed in orbit, and several thousand staff will work in orbit.
- The hotel industry will be the largest employer in space, with a huge number of side industries.
- With 5 million passengers in 2030, the annual growth rate will be 16%!
- 40 million people would have visited space by 2030 (cost for taxpayers near zero).
- The economic value of the space economy, in expected profits, would be about $1 trillion higher than if the space economy would not take-off.
- Several million people would be directly and indirectly employed in related activities.

A GIANT TEST FACILITY

- Moon is the best place for big telescopes and scientific laboratories.
- Moon is a unique environment, at few hours navigation from Earth, which combines low gravity, absence of atmosphere, and a solid ground under feet.
- We can build underground habitats, protected against space hard radiations, and to experiment protection technologies against radiations.
- Most of what it cannot be tested on Earth, due to the high cost of vacuum and low gravity simulation, on the Moon can be easy and cheaply tested.
- Even half an hour of a good artificial vacuum is very expensive: to simulate a six months mission is fully unsustainable.
- On the Moon, vacuum is fully free of charge, with solid ground under feet.
- Low gravity can be used for many purposes, and
- Zero gravity, in Moon orbit, is incomparably easier to reach from the Moon ground than from the Earth's surface.

MOON IS THE OBLIGED NEXT STEP OF OUR ROAD MAP

- Moon is a wonderful, cheap and easy, test environment!
- Something that the planning of scientific missions, financed by public money, could find not so relevant.
- While entrepreneurs, limited by budget availability and ROI times calculations, will surely pay the due attention to such conditions.
- The question is always the same: do we only aim to play with space?
- Do we only want to satisfy our scientific curiosity, or do we want to go there and work and live?
- If we are serious, Moon is the obliged next step of our road map.

THE BEST PLACE FOR EXTRATERRESTRIAL EXPERIENCE

- "If The Lord wanted us to travel in space, He had given us the Moon around Earth, as a school classroom and gymnasium"!
- K.A.Ehricke: Low gravity, vacuum, absence of "Weather" support both slide landing and the DDM (Drop Delivery Method); certain lunar surfaces (Mare areas) support high-speed landing.
- Vacuum allows high-speed approach to the surface without temporary communication blackout due to ionised boundary layer formation.
- Absence of aerodynamic effects, superb sky and ground visibility (including optical signs at night) permit high predictability and automation of approach navigation.
- The absence of aerodynamic heating greatly simplifies the design of spacecraft targeted to the moon landing.
- Moon yards will allow the maintenance of spacecrafts, in an easy way (Moon weight = 1/6 Earth weight), while liquids keep on falling down, and things don't need to be tied.
- Most of all, it will be a step, not completely different from Earth conditions, allowing thus to make precious statistical experience.
- Industrial age taught us that quality and safety only can come from cumulative experience, that allows to calculate statistical data.