

2nd International Convention of Technologies of the Frontier – Belgirate June 7th 2008

**“IMHOTEP- Prophet of the Space Age?
or Reaching for the Stars- Past and Future”**

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Abstract

Imhotep, with his master, the Pharaoh Djoser, launched a programme of construction which was perhaps the greatest building project in history. Many aspects of the motivations, challenges, and organisational problems faced in this project resemble the task of establishing human daughter civilisations beyond the Earth. The colonisation of the Moon, and Near Earth Asteroids Capture and Mining, will lead to Space Based Solar

Power and Expansion of Humanity into the Solar System,

This construction of a new human civilisation in O’Neill type colonies and extraterrestrial habitats by means of Geo-Lunar System Industrialization, will be an effort spanning generations, and use new materials and techniques. Like the Egyptian civilisation before it, it will evolve in logical, philosophical, and economic steps, changing Humanity forever. What Imhotep began in a context of magic, we will do with science and technology - reach for the stars, in the common interests of Humanity, both on Earth and in the Sky!

The Background.

Much has become clearer about the social background of which Imhotep and the Pyramid Age.

In the fourth Millennium BC, a series of wars between states bordering the Nile had led to the formation of two superstates by about 3200, which were later known as Upper and Lower Egypt. The unification of Upper Egypt by the real Scorpion King paved the way for the unification of these Kingdoms by King Menes into a single state, thus founding the Old Kingdom under its First Dynasty. This Kingdom had early pictographic script, and a strong belief in the Afterlife with the practice of royal burial in flat mud brick Mastabas (table tombs). It also had a complicated polytheistic religion, in which the King acted as Osiris on Earth. His soul, or ka, would survive death with the proper rites, and mediate between the people of Egypt and the forces of Nature, as personified by their deities. The rapid unification of Egypt over the next few centuries produced some profound results.

Firstly, peace broke out between clans and the growing regional powers, leading to great stability and economic security. The climate was good, and agriculture prospered. Secondly, the unification allowed for Egypt-wide organisation of irrigation, and hence an unrivalled prosperity for the period. During this time observation of the Heavens, and record keeping, led to two developments - first, the discovery of the solar calendar, and of the “indestructible” circumpolar stars, and more speculatively the logical conclusion that, since stones and metals occasionally dropped out of the Sky, there must be true land up in the Sky, the Realm of their chief gods! The cult of the Ben-Ben stone at Heliopolis, which is symbolised by the capstones on the Pyramids, and, later, the obelisks, is often ascribed to an incoming meteorite, while the earliest use of iron in the ancient world was almost certainly meteoritic. The certainty of food, thanks to the predictable annual Nile floods, allowed a growth of population, and an administrative or priestly class under a system of universal order known as “Maat”. This annual flooding also prevented agriculture for several months in the year. There was thus a centralised State, a large population fed from stored supplies, and for several months, a large potential labour force. This situation all depended on a unified Kingdom personified by a god King - the Pharaoh - and the

regular inundation by the Nile, harnessed to renew the soil by country-wide irrigation systems. In turn this depended on the favour of the gods, who gave them their calendar and guaranteed a benign climate. These gods, for the most part, lived in the Sky, in their own material Kingdom; was not the Milky Way a Nile in the Sky, and the Constellation of Orion a celestial Pharaoh?

Finally, in the early Third Millennium BC, the circum-polar stars - the “Indestructibles” - as described on the walls of King Unas’s tomb were discovered, and assumed a great mystical significance.

The Project

We do not know how the central Idea of the Old Kingdom originated - that the deceased Pharaoh should have his corpse preserved for an afterlife journey to the Gods in Heaven, to ensure divine favour for his former earthly kingdom and blessings for his anointed heir. But we do know that around 2680 BC, the Third Dynasty Pharaoh Djoser, and his chief Minister Imhotep took this Idea to its logical conclusion; that the former flat mastaba tombs should be replaced by a vastly more ambitious memorial which would immortalise his Royal master and his possessions. Meanwhile his Ka, or soul, was to be launched forth as ambassador to the Gods. Such an unprecedented task would require a totally new material - cut and dressed stone blocks. These were more durable than anything used before, and were aligned precisely with the North Polar regions and the summer solstice, thus linking the Kingdoms of Earth and Heaven in eternal Order, and preserving the wealth and prosperity of the Old Kingdom. This overarching Idea seems fanciful, but is duly documented on the painted walls of the Fifth Dynasty tomb of Unas, and exemplifies sympathetic magical thought. With mummification of the King’s corpse, and the use of spells, incantations and a specially designed building, the King’s soul was to undertake an interstellar journey to the Gods for the greater good of Egypt and its people. The Tomb is not merely a memorial, but a Resurrection machine, requiring the latest technology and skills.

The builders, we learn, were not abject expendable slaves, oppressed by the whip. Dr Zahi Hawass, Supreme Curator of Antiquities in Egypt, has excavated large camps and cooking facilities for the workers at Giza, showing that workers received full meals of meat, fish, poultry, bread, and beer, and were supported by fully equipped medical teams. Imhotep was known and worshipped as a great healer, among other things, for 2,500 years. Rather, the workers were an elite, highly skilled group, honoured to work in “the Name of the King”. Egyptian historical records describe Djoser, Sneferu and Menkaura as good kings who had their subjects’ welfare at heart, and gave them peace security and bread.

Djoser’s step pyramid was but the first step towards the true Pyramids, with their precise alignments for launching the Pharaohs directly to the circumpolar Indestructible stars. Under the Fourth Dynasty Pharaoh, Sneferu, two attempts led to the first true pyramid, while his son Khufu took the stone technology to its limits with the Great Pyramid at Giza. Immensity apart, it contains mysterious shafts over 60 metres long, carved through solid masonry, which led directly to the celestial North polar region. These are accepted as the routes by which the Pharaoh’s ka was to fly directly to the Kingdom of the Gods, in his afterlife - to us, an accurate inertial guidance system.

This was a monumental effort, over generations, to launch “ambassadors” into Space to bring back wealth and prosperity for Humanity below, using the highest mathematics, engineering, and organisation of the day. They clearly saw their afterlife Kingdom as a real, substantive, realm, requiring physical preparation. Death was not dissolution but a necessary change of phase to enable this Journey. He also needed provisions, directions, and assistance against the hazards of the journey.

Leaving aside the small matter of prior death, does this not sound very like an interstellar mission in magical rather than scientific terms?

Opinions differ as to whether the Old Kingdom Pyramids were as one vast ongoing project, or whether each tomb was unique to an individual king. Bauval, controversially, has ascribed to Imhotep or Djoser the truly grand goal of reproducing the Kingdom of Heaven on Earth in a terrestrial representation of the Constellation of Orion or Osiris. Although the three Great Pyramids do match the layout of the stars of Orion's Belt, Betelgeuse, Bellatrix and Rigel are not convincingly represented, and the inscriptions of the Unas tomb point to the circumpolar stars/polar region - the Indestructibles - as the goal for the Pharaohs' Great Journey.

Taken together, the grand Idea of launching their Pharaohs to the Kingdom of the Gods realised the largest building activity in history. Over 130 years, over 30 million tons of stone were quarried, prepared, and moved accurately into monuments which have survived four millennia. Moreover, this was executed not under the lash but as an act of Faith, and the workers were well looked after and motivated to a high degree.

Problems and Methods .

The massive scale of this period of construction and the accuracy of alignments has led to much mystification. For example, in 1996, I attended a conference largely dedicated to the proposition that the Face on Mars and assorted pyramids in the Cydonia region were built by Visitors from previous interstellar migrations. Having proceeded to mess up their own planet, the Visitors came to Earth, whereupon they recreated their civilisation as the Pyramids of Giza. They maintained that a NASA cover-up of these facts was operating, whereupon I suggested that a private Mars mission by proponents of Martians at Giza be assembled to "reveal the truth".

This proved unnecessary, since several very detailed surveys of Mars have adequately resolved the Face and Pyramids of Mars into tricks of lighting and perspective.

However, I did have one very illuminating discussion with a civil engineer who had written a book on the Face of Mars, in which he claimed to prove, mathematically, that humans could not have built the Pyramids without Alien help. I disproved his arithmetic very simply. In the process, I showed an even greater achievement by Imhotep and his successor architects which has relevance in today's world. My counter argument was later confirmed by Dr Zahi Hawass in his archaeology around the Giza plateau, which became world famous in 1999, three years after the "Face on Mars" Convention.

Briefly, the author argued that, since 2.5 million stone blocks of average mass 2.5 tons were used to build Khufu's tomb in about 20 years, using a work force of 100,000 men (Herodotus), we have 20 years / 2.5 million stone blocks or 600 million seconds divided by 2.5 million stones - ie one stone had to be cut, moved 2 kilometres from the Giza quarries, and placed every 4 minutes! This is impossible, ergo human beings could not have done the job. 30+ million tons of stone (perhaps 12 million stones over 130 years does not greatly improve matters (one every 6 minutes!). Fallaciously, he insisted that the Egyptians were working in series, and that the entire work force pulled one stone at a time. However, if 100-200 workmen hauled one block of 2.5 tons, we have a mere 25 kg load hauled each man - not lifted - up a ramp, over a distance of 2 kilometres from the quarry. At 1-2 kilometres per hour (unladen, we walk at about 6 kms/hour), we have 25,000 men hauling 125-250 blocks every 2-3 hours, allowing for the return trip to the quarry + comfort breaks - or about 1,000 (four trips) per day. This requires 2,500 days - or 7-8 years. 17 years would have been sufficient to have built Khufu's pyramid with rotating teams well within his lifetime, as desired. In other words, this is parallel, not serial, working. To my surprise, my author had some difficulty in grasping this, and remained unconvinced. In December 1999, Dr Zahi Hawass' excellent programme appeared on BBC TV at the turn of 1999/2000. He had excavated massive camps and middens for thousands of workers, as well as inscriptions inside the corbelled roofs of the King's Chamber, carved by the workers themselves! They were indeed organised into teams, of about 100-200 men, and had their own team names such as "the Strong Boatmen of Khufu", "The Pure", and so on. Rewarded with bonuses of meat or beer, they enjoyed competitive rivalry as they earned their performance-related pay. Furthermore, evidence

of severe non-lethal injuries treated by bonesetters was described, showing that workers were not expendable, but cared for. They were native born Egyptians, not foreign slaves taken in battle.

Use of simple tools, and organisation of the tasks and manpower, on quasi-industrial production lines, allied with a sound agriculture, and plenty of labour and time was enough to achieve the impossible.

The true miracle remains the motivation and dedication to a very remote and longterm goal, and organisational genius of a whole country behind the project. I have often wondered whether the Sage Imhotep, in building a Resurrection Machine, was not also consciously building the first Nation State.

Comparisons with Our Times

Some of the more imaginative among you will be noticing some parallels between our goals of building a longterm future for Humanity in Space for the good of our species, and the Old Kingdom's magical interstellar missions, probably initiated by Imhotep. We have, like Imhotep, the parallel goal of achieving benefits here on Earth (survival, good harvests, predicable climatic conditions, harmony between man and nature or the gods, clean energy and spiritual development) by undertaking Heavenly voyages . We also have a shared idea of Space as harbouring accessible benefits and real resources. We have hazards beyond (demons, spells, radiation , biomedical hazards) to be addressed, and the need to have well preserved or maintained bodies. In Egypt this was after death; we prefer not to wait so long! We both share a need for new technologies, materials and methods of working. In Egypt, monumental stone was the technological frontier, while the astronomical discovery of the indestructible Stars provided the goal. Our enterprise is to be based on the Age of scientific discovery and invention, while energy and raw materials are to be extracted from heavenly bodies . Even in detail, it is interesting to consider the use of parallel processing - in stone - by the workmen of the Pharaohs. We saw that this industrial development enabled this massive programme of construction and created a whole new order of logistics and management. This was probably more fantastic, in its way, than the supposed aid of aliens from Mars.

Recently , our scientists have acquired mountains of data in various fields which have caused a problem not dissimilar to that facing Imhotep and his advisers. In fields as diverse as searching for the radio signals of Extraterrestrial civilisations, the classification of millions of galaxies to understand their origins, the search for weak gravitational wave signals among the background noise coming from Space , the movements of global climate, and the 3D structure of protein, we have mountains of data, which super computers would need thousands of years, in some cases, to analyse. Like the 100,000 workers pulling each stone every 4 minutes, this is clearly impossible! Seti@Home, in 1999, introduced the entirely new paradigm of breaking the data up into small pieces and letting thousands (now millions) of home computers tackle the data in parallel. More recently, the GalaxyZoo project went one step further and recruited 100,000 members of the public not just to contribute computer time, but to take a short tutorial and directly classify 1 million galaxies. Computers proved unable to do this job and the three research scientists of Oxford certainly could not, unaided!

100,000 citizens worldwide have accomplished the work of centuries in six months, and papers on cosmology and galaxy evolution are expected in 2008-9. This parallel processing of information has an obvious analogy with the Pharaohs' earlier parallel processing of stone.

The fate of the Old Kingdom is instructive; after centuries of peace and prosperity, it collapsed tragically into chaos and, according to some Upper Egypt Tomb inscriptions, even cannibalism of children.

As a result of studies from ice cores, and the levels of the Nile, this tragedy is believed to have been due to a decades' long drought, now ascribed to dramatic climate change caused by massive volcanic eruptions in Iceland. Intriguingly, at about the same time, the Empire of Sargon of Akkad, in Mesopotamia, also suffered a sudden collapse. Two curious meteor impact sites at Rio Cuarte, have

been attributed to impacts by a pair of 300 metre sized asteroids in the Late third millennium BC. The reality of a Bronze Age catastrophe is now widely accepted, even if its causes remain unclear.

Contemporary Egyptians must have considered the concept of “Maat” , maintained by magic and religious ritual, was fatally flawed. Scribes of the time bemoaned the disregard and disrespect for traditional order and religion - much as our older citizens bemoan the degeneracy of youth!

We should note that climatic catastrophe does not require the presence of an advanced industrial civilisation, and is impervious to religious or ritual acts born out of misplaced guilt. The Pyramid building order collapsed into a horrific darkness. In time, a new Egypt - the Middle Kingdom - emerged. Although Egypt developed new civilisations from its traditions, the serene order of certain harmony with the gods never fully returned. The stars gave way to the Sun, and the Pharaohs, although absolute monarchs, were balanced more by their priests and nobles than before. Nobles and even wealthier commoners could aspire to a full afterlife, on a personal rather than on State level, and faced judgement based on their moral worth rather than through spells designed as technical devices to deal with demons.

Our Situation Today

Like the founders of the Old Kingdom, we have enjoyed growth in population and wealth over several generations, with new technologies, new methods of organisation, and better understanding of the Cosmos and our place in it . We also are groping our way towards a kind of Unity. We also need a new relationship with Nature and the Universe, if we are to maintain or develop our economies and societies for the good of our much larger population. Aside from our own follies, we face real hazards from Nature. These include depletion of resources for energy and construction, food shortages , climate changes, whether or not triggered by our activities, solar variations, pandemics, and cosmic impacts. We are also aware that these problems cannot be tackled by appeals to magic, or by religious incantations. We, too, will have to seek solutions from beyond the Earth - but based on science and technology, not magic and metaphysics.

Fortunately we have a centuries old tradition of science, exploration, and technology to draw upon - which has enabled our civilisation to undertake great things.

Many of our sources of energy will become increasingly scarce, expensive, and controlled by regimes upon whom we would rather not become dependent. We have also discovered, in the past two generations, vast new sources of raw materials and energy. The Sun sends only one part in two billion of its output to the Earth - the rest is lost into the Void . We know of 160 moons, thousands of asteroids, and Kuiper Belt objects , millions of comets and, beyond all this, hundreds of new planets orbiting other stars. Imhotep was wiser than he knew - there is indeed a vast dispersed new Kingdom of Heaven awaiting those bold enough to reach for it. Access to this will assure our descendants of wealth and, for the species, near-immortality. In our democratic Age, we cannot and will not delegate to one Ruler the task of intercession with the gods on our behalf, but, using science and technology, will ensure such access for our people. This task is correspondingly grander than that facing Imhotep, and will, of necessity, take many generations. We should recall that the Great Pyramid Age began, in essence, as an Idea - possibly in the head of one man, Imhotep.

Just so, the Idea of a great leap away from the constricting and menacing bonds of our crowded Earth into the wider cosmos will surely be require an ideology which can sustain aspirations over several generations. Such an Idea will be all the more powerful if it can be accompanied by progress in small steps, each generating visible profits. We should now look at both ideological underpinnings for a cosmic civilisation , and steps whereby we can attain it.

Some Philosophical Factors

The past 500 years in the West have been remarkable. From a backwater on the Western end of Eurasia, isolated from the leading scientific and technical developments of China, and, indeed, its own past, by a narrow version of Christian dogma, Mediaeval Europe has explored and for a time mastered much of the world. It created an enduring legacy of scientific and technical knowledge, which reaches further out into Space and Time than anything previously imagined. This process began with a growing critical reappraisal of the narrow theocratic versions of Christian dogma, upheld by an authoritarian Church and Aristotelian cosmology which had for centuries held Mediaeval thought in its thrall. The 14th century Black Death, which killed up to 50% of all Europeans in 2-3 years, triggered a process of agonising reappraisal in its shocked survivors.

The idea that half of Humanity could have been summarily and agonisingly destroyed by a vengeful God made many question the idea of God as Love. This was all the more true, since it was impossible to believe that the Good were spared while the Guilty perished. The exceptions to this rule were too numerous and obvious to be discounted. Blaming the Jews, a traditional alternative solution to Nature's vagaries, did little to preserve confidence in established thought, since Jews perished impartially. Furthermore, the whole apparatus of penances, tithes, prayers, and indulgences did nothing to stay the all-conquering microbe, while the visible corruption of much of Mediaeval Christendom led directly to the Reformation.

In the Arts and Sciences, however, the reaction was more radical still. Instead of relying on failed dogma, thinkers went back to the wisdom of the Classical period and rediscovered half remembered Greek learning. This was, meanwhile, being transmitted by Muslim and Jewish scholars, many of whom were displaced by the Mongol Hordes. This Renaissance (rebirth of Classical Knowledge) carried an implicit new outlook, based not on divine revelation, but on human investigation and free thought. The underlying philosophy, Humanism, put human intelligence and interests at the centre of things, rather than the supposed whims of an inscrutable Deity and his minions. The task of explaining the world, and of running society, became human rather than divine concerns. The rewards were freedom of thought, expression, and conscience, which led in time to democracy and basic liberty of the individual. These have been won at great cost, but have produced societies wherein errors and injustices can, in principle, be corrected without mass bloodshed, even if much time and argument are required.

Even more dramatically, as Dr Amartya Sen has noted, no modern democracy equipped with press freedom has ever faced mass famine, and, as others have noted, no elected democracy has ever made aggressive war upon another one. However misguided the recent adventures in Iraq, no-one disputes that Saddam Hussein was a bloodthirsty tyrant with malevolence at his heart. Furthermore, since America is a democracy, it is highly probable that Iraq will have traumatised her, rendering a similar venture in the future very unlikely; democracies can learn from history in a way which other systems cannot.

Underlying these freedoms are, most fundamentally, the freedoms of thought, most especially the revolution in philosophy which we call Science. Picking up where Ancient Greece left off, Science has evolved into a system which can not only propose theories about the furthest reaches of time and space, and the evolution of the Cosmos, but put them to the test. Most important of all, Science is the only system of ideas which can correct its mistakes without witchhunts or persecution. In the last ten years, the Roman Catholic Church has after 4 centuries finally conceded that Galileo was correct, and pardoned him. Remember that it took only months for Galileo to demonstrate that one view of the distant Heavens was correct and that an older one, upheld for 16 centuries or more, did not fit new observed facts. How was this done? With long debates or systematic and bloody persecution? No - the true revolution was born out of two pieces of glass cleverly mounted in a wooden tube, which Galileo used to observe the phases of Venus and the moons of Jupiter. The telescope is arguably the most revolutionary instrument ever made by Humankind, and perhaps the most democratic and

bloodless. Not only did it disprove centuries of Christian cosmology at a stroke, but today this revolution can be replicated by any eight year old for the cost of a small bicycle . The past few centuries have replaced speculation and dogma with human observation and reason, and, more profoundly still, the concept of provisional truth. For instance, the question of whether the nebulae were part of our Galaxy or were distant island galaxies on their own, was decided not by dogma or bloodshed, but by an accumulated weight of evidence, underpinned by free enquiry. Scientific debates can be heated and even acrimonious but are not decided by concentration camp guards or Grand Inquisitors.

Thus, Humanism is a product and generator of a Science based culture and has conferred inestimable benefits on all Humankind. For many, nevertheless, it is deeply unsatisfying since the truths revealed by Science are provisional fits to observations, and not immutable. Also, human nature remains for the foreseeable future, imperfect. Nevertheless, Freedom for the human mind, and the actual material benefits of democracy all have the same source and hang together. Humanist thought and the discoveries of biology and cosmic evolution also point the way to a new human role in the Universe. The Universe has evolved, like an embryo, through various stages of complexity - from universal symmetry of forces and particles via stars, galaxies, and planets, chemistry and biochemistry to the seeming miracle of Life. Beyond this is Mind - the most miraculous complexity which seeks to understand its own origins and that of its parent Universe. It is difficult not to see the rise of Mind as a new phase in the Universe's history, and hence that Humanity, as carrier of Mind, has a unique value .We do not know yet if we are alone in this Universe as a mindful species. The growing evidence is that Mind is, at any rate , very uncommon. Many have said that in such a vast Universe as ours, there must be countless mindful species. It might, however, have taken 13.7 billion years for the Universe to grow a mindful species, and that we may be the first of a crop which is now due to flower. We must, as always, be guided by the evidence - such as it is.

Humanity is not guaranteed a full term in which to develop its full potential. Many species have gone extinct, and we can do the same; pandemics, cosmic collisions, catastrophic changes in climate (whether or not caused by our activities) supervolcanism, Gamma Ray Bursts, or solar variability are but some of the factors which could destroy our species, or, more probably, our civilisation and its achievements. Of these, the freedoms and discoveries of the Renaissance, and the scientific revolution, are perhaps the greatest and most distinctive.

In our stellar neighbourhood, there are abundant energy and raw materials - but the real estate is undeveloped, and harbours no civilisation and probably at best only primitive life. A logical implication of Humanist philosophy is that human life, mind, and civilisation has a central role in the Universe, and that its continued existence and development needs no justification beyond itself. From there, it is natural to propose that the interest and absolute duty of Humanity converge on ensuring its own survival and extension . The situation we have now reached is that this interest can best be served by extending our reach out into the wider Universe, before the wider Universe steps in and snuffs out our potential for development. A dispersed and capable species is more likely to prevail against localised extinction threats than is one confined to one planet.

I have discussed the merits of Humanism and the scientific outlook so emphatically for two reasons; firstly because we know from 5 centuries that, on a utilitarian level, these attributes are better guarantors, although imperfect, of human freedom and welfare than any of the alternatives. Dostoyevsky's "Grand Inquisitor", in the Brothers Karamazov, offers bread and security in exchange for freedom . This bargain has been proved in many trials to be a Faustian pact - it never delivers its promises. Secondly, Humanism, allied to the discoveries and applications of science, give our species a central role not only in ensuring the preservation of Mind against natural disasters, but also in the eventual evolution of a living and mindful Universe. No other life form, other than an as yet unknown Alien race, can do this job. We can, in fact, turn traditional religion on its head and propose

that, having taken 13.7 billion years to originate Mind, it will take a little longer to evolve a Deity. Fortunately, there are a few trillion years left!

More fundamentally, such a promotion of Humanism is necessary because its central tenets - Freedom of thought, and the intrinsic value of Humanity in and to the Universe, is under threat on at least two fronts. Victory by either of its two opponents would the benefits and values of our scientifically based freedoms and welfare. The results would be impoverishment, and, as our extension onto the wider stage would be aborted, negation not only of our chances of escaping premature extinction, but denial of a truly meaningful role in cosmic evolution.

These two fronts are:-

1/ Religious fundamentalism. Today, this is represented chiefly by the various fundamentalists within Islam, but is also found within sub-sects of Christianity and Judaism. These groups reject the Enlightenment, and the discoveries of science, particularly in respect of cosmology, cosmic and biological evolution, and Mind as a natural phase change in an embryonic Universe. Since Creation is described entirely with reference to ancient divinely inspired texts, these groups cannot accommodate the findings of science. More insidiously, the whole concepts of provisional truth and freedom of enquiry cannot be accepted - even if these developments have liberated humans in a revolutionary manner. The return of Humanity to a purer, simpler, and more absolutist way of life, even at the cost of several billion lives, is preferable to them. Either we become extinct, due to our wickedness and God's legitimate displeasure - or we would survive, in diminished numbers and capabilities, within the intellectual and cultural constraints set by long dead prophets! Religious "thought police" would not only curtail the sciences, but also the Arts. The Taliban's love of Music is well known through its prohibition in an earlier Afghanistan. A Fundamentalist regime for Earth, from any religious tradition, would create a world in which the thoughtful living would envy the dead. The fact that stars and planets are observed in formation (thus denying the idea of a single Creative moment), against the background of a Cosmos billions of years old, could not survive in a vision in which all was Created by Divine fiat, backed by auto da fe, a few millennia ago. Observations would count for nothing, and enquiry would be punishable by death and torture.

2/ Secondly and perhaps even more deadly, is the "Green" movement, which increasingly promises us manmade apocalypse, ascribed to climatic changes based on our sinful ways of life. The Green Movement, it is true, has two flavours. Some retain the scientific and humanistic outlook, and propose that we manage our environments, here and beyond, in the human interest, with human survival and development as the over-riding goal. Only a fool wishes to foul his own nest and abort his descendants. It is all about sound management, which depends on accurate information and modelling of the various factors involved in our climate- eg volcanism, solar flux, cosmic ray flux, ice-ages, oceanic plankton growth, rain forests, and pollution - some of which is due to Humanity. This balance is a complicated one, and Space technology and advanced computing power is absolutely essential if we are to manage safely and in our own interest. This Humanistic environmentalism has every reason to support Space technology and its growth, so long as that is itself managed appropriately. Cleaner fuels, better management of Space debris, and reusable space vehicles are all just objects of a Green campaign.

However, not far beneath the surface, severe anti-human trends can be seen. These vary from the stated goal of ending the present period of relative human prosperity to drastic reduction in human populations, alleging that "Mother Earth is in Danger", and that we are the problem. This school openly wishes to reverse the Enlightenment and its products, and to return to a purer and simpler Age. This would not be done in the human interest, since Green extremists rate this rather low - but in the interests of an imagined pure Mother Nature. Science and development are held to be unnatural, although these are products of the human brain - itself a product of Nature. They do not even have the

religious rationale of Creation to justify this idea, merely a deep-seated hatred of Humanity. Their true motivation is the same which has motivated all other absolutist ideologies - a thirst for absolute power. Some are already calling for the end of Freedom and Democracy (the two main benefits of the science-based Enlightenment) to “Save the Planet”. This is a classic fraud - Earth is not in danger - but we may be, from would-be tyrants. The current proposal is compulsory carbon rationing, to be enforced by a police state, if electorates cannot be driven by guilt into accepting it. The last two centuries prove that Police States are homicidal, deceitful and never succeed in their stated goals. They are also corrupt, and would cost, in money and resources, far more than a proposed human extension into Space. These “Grand Inquisitors” would surely aim for a Global Police State - since that alone would suffice. All independent sources of inquiry or authority, especially in environmental questions, would be abolished , probably by traditional means such as intimidation, imprisonment, and mass murder. An absolute authority which places an Idea of a pure State of Nature above the interests of a hated Humanity has available many techniques for major reductions in population. After setting up a privileged elite, they would engineer a mass famine. This can easily be achieved via economic incompetence - as in the Chinese Great Leap Forward of 1958-62. No Auschwitz or Siberia would be needed.

The resemblances between the religious Fundamentalist and the Green routes to “Hell” are striking, and far from coincidental, since they are both based, not upon human(e) ideologies, but human evil and the lust for power at any cost . These two schools reject scientific scepticism, democratic pluralism or, even worse, any advances in technology which offer reasonable solutions to our real problems. Attitudes to Space exploration and technology thus are touchstones for various proponents of these opposing trends, since Space technology is essential for management of our planet , if we are not to simply rely on the destruction of Humanity and its culture, or the wrath of God.

If a Global Green Police State seems farfetched - consider the state of Russian Socialism in 1902, and that of German National Socialism in 1922. Improbably, both succeeded in achieving power and mass ruin, while failing utterly in their proclaimed ideological goals. If guilt and fear prevail, the next major world tyranny could well wear a Green Shirt.

Space as a positive Alternative

How can Space development help us? Firstly, we must admit that the science of Climate Change is not, yet, certain. Since 2000AD , the global temperature, as a whole, has NOT risen, but has remained static, while the first two months of 2008 have been significantly colder; many countries have endured lower temperatures than any since 1981. Snowfalls in Athens and Jerusalem and freezing conditions in China are cases in point. We cannot simply say that all Climate Change is due to global warming induced by an over-active Humanity. Space technology is essential if we are to understand our Climate scientifically, rather than simply use it as a justification for authoritarian regimes to restrict and control the aspirations of billions. The present cold period is not global warming, but does coincide with a prolonged period of solar inactivity; the next solar cycle is already several months overdue. What if we are facing a new Maunder minimum and a new Little Ice Age? What if the relationship between the solar cycle, our magnetosphere, cloud formation and incoming cosmic particulate radiation is the major factor, not human emissions?

We need to monitor temperatures, in the Oceans and remote lands, not just those in or near cities. We need to understand the cycles of icecap melting and freezing; the circulation of ice is more complicated than some believe. We need to assess the state of oceanic plankton, and the remote rain forests, if we are to follow the cycle of carbon emission and absorption as a whole. Synoptic observation from Space over the long term is needed. More directly, if we wish to regulate the abuse of rain forests by illegal logging , Space technology can and does work- notably over Amazonia, some 5million square kilometres of tropical forest. From 2004-7 logging there has been cut by two thirds - thanks entirely to the use of space satellites.

Whether or not we accept anthropogenic global warming in full, we face, this century, a crisis in energy supplies and in raw materials for a growing population. Fossil fuels are not infinite and are held by unstable or unreliable powers. Nuclear energy has problems of waste disposal, and security. These can be addressed, but, again, Uranium is not an infinite resource. Wind power is only applicable to certain regions, and is in any case very inefficient, since the wind is not ours to command!

Solar power is clean, renewable, and good for several billion years, but is diffuse and dependent on day/night cycles and weather. Today, solar power converted to heat in hot water supplies, is becoming viable for many people, but mass industrial scale generation of electricity, and hence also electrolysis of water, to hydrogen fuel would be the Holy Grail for clean energy. Few would disagree that, were this to become possible, much of our present anxiety would be greatly reduced.

We should note that Earth receives only one part in two billion of the output of the Sun, and that if solar energy were collected in Space and beamed to Earth by microwave, much less land area would need to be given over to its collection. This land would be needed for marginal agriculture if we are to feed 9-10 billions. Also, in high orbit, there would be no day/night cycle and no weather to reduce efficiency. Since Solar Power Satellites were first proposed in 1968, conversion efficiencies have risen four fold, and the estimated mass of the satellites has fallen greatly. What has not fallen, of course, has been the cost of lifting solar power satellites up into orbit!

For decades now, proponents of SPS have noted that fabrication of these vast collectors could be much cheaper if the raw materials were derived from lunar or asteroid mining. A ton can be lifted from the Moon 25 times more cheaply than the same ton from Earth, even if ordinary rocketry is used. With solar or nuclear generated electromagnetic propulsion the costs would be far lower. SPS, assembled from ET materials in lunar or L1 orbit, could be shipped to geosynchronous Earth orbit by ion or solar sail tugs, at low cost.

Thus we have a strong humanistic and environmental case for establishing a “two planet” economy, in which Earth and Moon function as one economy, with additional help from asteroids and short period comets. The relative balance between Moon and asteroids is much debated and, ultimately, less important than the decision to reach out beyond Earth itself. The present Project Constellation inaugurated by President Bush in Jan 2004, leads to an American return to the Moon, with a base, in the next 12-13 years or so. At the same time, we have a renewed interest in SPS from the Pentagon, notably Col. M. “Coyote” Smith, who is heading a study group into the prospects for secure energy supplies for the US in coming decades. Japan has also proposed a demonstration SPS by 2025, while China and India are also reaching for the Moon.

“Plan Bush” would create the conditions for a programme of Geo-Lunar industrialisation, leading to Solar Power satellite development. Given the presence of a lunar base built for other reasons, the emergence of SPS could appear attractive economically by 2025-30, especially as fossil fuels are likely to be scarcer and much more expensive than at present.

Such a two planet economy would also reach out to asteroid mining and possible deflection in the event of potential impact, thus removing a potential cause for human extinction, with positive economic results. It is always wise to turn an enemy into a source of profit...

Alongside this development, we can also discern another major generator of Space development - the rise of Space tourism. Tourism has always been a major economic activity of humankind; after warfare, energy, food/construction, and communications, and is now set to reach Outer Space. Initially we are looking at suborbital flight, of 100 kilometres or so, for perhaps half an hour. Sir Richard Branson’s Virgin Galactic is building its Spaceship 2, and plans to start flight tests this year, with fares paying passengers by 2010. Prices are high - \$200,000, but 200 have already booked flights, while 85,000, including this author, have expressed interest. My own plans are to fly before my 70th

birthday, costs and health permitting. If Branson succeeds, others will rival him and the drive to fly higher for longer will stretch the envelope, probably to Low Earth Orbit, by 2020.

The next step - orbital hotels for longer stays - is already prefigured in the private sector. Robert Bigelow, an American hotel entrepreneur, has already orbited two inflatable prototype habitats, in a programme leading to habitable space station modules by 2011-15, at a far lower cost than NASA. These are lighter than ISS modules and are inflatable, and so can be launched on smaller and cheaper rockets. In protection against radiation and micrometeorites/debris they are actually superior to ISS modules. Thus within 10 years, we have the prospect of private space enterprise creating access to destinations in Space, serving a real market. An evolutionary progression from high value small hotel rooms to larger resorts seems clear enough. The evolution of hotel resort complexes to free floating Space cities or cruise liners supported from extraterrestrial raw materials and logistics would be only a matter of time. An end result, O'Neill type space colonies, with supporting industrial bases on the Moon and asteroids (asteroid capture and mining, and Geo-Lunar industrialisation) is visible. This course would run in parallel and be at times intertwined with the development of solar power satellites.

Even interstellar propulsion should take its first infant step, by 2012. The Planetary Society is pioneering the Cosmos solar sail - a demonstration of solar light propulsion, which is the only method of interstellar propulsion even remotely feasible this century. The Planetary Society aims to raise 4.2 million dollars, raised from its membership, and fly Cosmos 2 from a Russian rocket.

This stepwise breakout into Space would be as massive a project as that begun by Imhotep millennia ago, and would perhaps take as long in time. The moral challenge, of committing ourselves to a very longterm enterprise for a distant future, - is harder for us than for Imhotep - but many of the underlying ideas are similar.

The principal differences are that our venture into the Heavens will be made, in time, by millions of the living, not just one dead King - and secondly that we have moved from magic to science. Space civilisation will not fall foul of climate changes beyond our comprehension, as did the Old Kingdom. I imagine that Imhotep and Djoser would understand our programme, and cheer us on to the Stars!

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