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KEO

the Archeological Bird of the Future

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The archaeological bird of the future

KEO: Project Summary

KEO is a satellite that will be launched into space in the year 2001. It will pursue a lengthy orbit around the planet Earth, returning safe and sound in 50,000 years' time.
Its mission is to act as our ambassador, delivering a unique collection of messages that we, as present inhabitants of the Earth, wish to transmit to our distant descendants.
A global communication initiative will be launched in 1999 inviting everyone on this planet to come and breathe "life" into KEO through their messages - sharing their thoughts, hopes, wildest dreams and deepest convictions - and by doing so, bequeathing a unique and individual blueprint to distant generations.
This universal gift to Earth's future will also be shared by Earth's present inhabitants once KEO is launched. Through reading each other's messages (whether they come from a child of the ghetto, an African animist, a Nobel prizewinner in Economics or a European senior executive), we may discover another image of humanity at the dawn of the third millennium.
Company, institutions and engineering students, all specialists in space technology, are collaborating today to realize the KEO project. Through the generous donation of their skills and time, they are working to ensure that KEO will safely complete its 50,000 year odyssey. As of today, the partners associated with the project include: Aerospatiale, the Atomic Energy Commission, Digipress, Ecole des Mines de Paris, Intespace and Sup'Aéro.

KEO: Project Status

A year ago during the 48th International Astronautical Congress in Turin, together with Aerospatiale we demonstrated the technical feasibility of the project. In the "A" phase of KEO's technical development, the capsule mass totalled 176kg, its diameter was 770mm with a payload density of 0.852 (allowing KEO to remain buoyant should the capsule land in the sea)
However, for KEO to be accepted as a free passenger on a launcher such as Ariane 5 (with whom negotiations are currently underway), its mass would have to be cut back to 100kg.

KEO: Dimension Optimization

This optimization which would take into account the different elements of KEO's design (such as mission, reentry aerodynamics, protective shield and insulation structures, equipment), would bring the the capsule mass back down to 100kg. The final results of this phase should be known by the end of the third quarter of 1998 (cf exhibit N° 1).
As a consequence of this reduction in mass, a corresponding 10cm geometrical reduction of the external diameter of KEO is expected. However a 45cm diameter will be kept for the payload containing the 100 glass-tempered CD ROMs used to record the individual messages received, as well as the different archaeological gifts planned for the project.
The KEO payload is composed of (1) an artificial diamond made of Zircon containing 4 inclusions taking the form of micro-spheres of gold which comprise a sample of water taken from the world's oceans, air from the atmosphere, fertile soil and human blood, (2) a glass plaque the size of a postage stamp engraved with a variety of human faces bearing witness to the ethnic diversity of our race, (3) the position in the sky of the principal radio pulsars along with their rotation speed, thus allowing our distant descendants to calculate the date of KEO's launch by comparing the past and present rotation speeds, (4) glass disks containing an updated version of the "Library of Alexandria" which will describe the present

geopolitical state of our planet, a catalogue of the planet's flora and fauna, our knowledge scope and finally….(5) the entire collection of messages from today's human community.

KEO: Durability of the Information Stored on Board

Last year we were not yet able to demonstrate the capacity of the glass materials to withstand cosmic radiation without losing the engraved information. Today, we now have proof that our messages will survive. On 22 July last, a joint experiment was carried out by CNRS and CEA at Ganil (Grand Accélerateur National d'Ions Lourds) in Caen.
A glass disk, similar to the one KEO will carry, underwent controlled irradiation. (This disk had the following chemical composition: SIO_2=70.8%, Na_2O=13.9%, K_2O=0.4%, CaO=8.4%, MgO=4.4%, Al_2O_3=1.5%, Fe_2O_3 =0.08%, SO_3=0.3%).
Before being exposed to radiation, the disk was engraved in an identical fashion to those which will be loaded onto KEO. It contained information engraved on a spiral which, rotating outwards from the center had a track pitch of 0.74 micrometers whose smallest pits were 0.4 micrometers in length and whose longest (those representing a sequence of 11 numerical elements) were 1.87 micrometers in length with a depth of 162 nanometers.
Following an irradiation density equivalent to the radiation flux KEO will receive during its 50,000 year flight around Earth (with an initial orbit under the Van Allen belts at an altitude of between 1,500 and 1,700km) the test glass disk remained perfectly readable (cf exhibit N° 2).
Therefore, the total radiation charge received by KEO over a 50,000 year flight is equivalent to 10^8 ions per cm^2. It has been verified that a charge of 10^{10} ions per cm^2 does not in any way impact negatively on the legibility of the basic engravings. Furthermore, it has been demonstrated that even with an additional charge of 10^{12} ions per cm^2, the engravings remained legible and intact. Although a slight tanning of the disks was observed, this did not prevent the reading of the information contained therein.
A single glass disk with a diameter of 120mm and a thickness of 0.6mm can store up to 20 million A4 pages each containing 2,000 characters (cf exhibit N° 3).

KEO: Micro Inclusions in the Diamond

Last June, the CEA military in Valduc made the first gold sphere for KEO with an external diameter of 2mm and an internal one of 1.7. This sphere contained a small volume of air from the Valduc plateau. This sphere is the first of four destined to represent one of KEO's archaeological presents – the diamond (cf exhibit N° 4).

KEO: Born of Space Technology and Giving Birth to a Worldwide Communication Dream

Both a technological feat and an inspirational bearer of dreams, KEO cannot rely soley on its own technical performance to achieve success. This can only be achieved once the quality and efficiency of its communication drive has allowed the greatest number of human beings all over the world to participate in the project.
The global communication issue has been top of the KEO agenda for a year. The project cannot be deemed successful unless there is a invitation to everyone on this planet to write their message. This invitation cannot simply be limited to those who have access to the Internet or to those cultures with a sophisticated media. In fact, the latter do not pose any major problems. The challenge lies in reaching out to those living in the most primitive or remote settlements.
However, this is not an insurmountable challenge, in that even in the most remote settlements, we sometimes find members of the local religion, school, post office or health clinic.
That is why in addition to our Internet site www.keo.org, we are continuing to take

measures to ensure the writing of messages from the remotest regions of the earth.

KEO's internet site which has been designed and set up free of charge by Babel@Stal, allows the general public access to the most pertinent project information. The Home Page (cf exhibit N° 5) contains an icon which if clicked on allows the visitor to obtain explanations of the data relative to the project. Questions concerning KEO - why this project? what is its goal? why 50,000 years? how is it technically possible and so on - are comprehensively answered.

Furthermore, the navigation bar provides answers to who we are, who makes up the team, who are our partners, what are our needs (eg translation of the site into Arabic and Chinese). A specific section is devoted to frequently asked questions (eg why is it named KEO?). Finally, the latest KEO news on exhibitions, television and press reporting etc. is covered.

But the universal and multi-cultural dimensions of KEO have meant that we have had to target a multitude of communication media. These include not only the written press, radio and television but international organizations and networks which will allow us to reach the most inaccessible regions on the planet.

To our great satisfaction, we have seen that reaction (sometimes spontaneous) has on the whole been very favorable to the project. For example, the first scientific review to write about KEO was *Nature* (8 January 1998). Recently, the *Le Monde* newspaper in its 15/16 August edition devoted an entire page. The *People's Daily* in China gave similar coverage as did *La Folha de S.Paulo* in Brazil in its Sunday supplement of 28th June. TV channels such as RAI 3, LCI, Canal+ and La Cinq gave coverage spread over several programs.

Our communication strategy takes advantage of the innate willingness of such media to approach us and expert opinion is always welcome.

However, traditional media apart, other methods allow us to reach further. To do this, we have had to "invent" new forms of communication which rely on both international organizations and networks. For example last July in Washington, we presented KEO at the *International de l'Education* Congress (a Brussels-based organization grouping under one wing the union representatives of around 23 million teachers throughout the world).

Our presentation highlighted the fact that KEO was a rare educational tool in that every teacher, irrespective of the subject taught, could both explain the project and encourage his or her pupils to reflect upon and write their message. As a result of this presentation, the *International de l'Education* has decided to promote the communication of KEO throughout its network.

A similar endeavor is currently underway to address our information technology needs, in particular the management of the messages database. Support from companies in this endeavor would be most welcome.

From one day to the next, KEO is pursuing its primary goals, effectively aiming at initiating a universal reflection amongst all of humanity, offering the opportunity to every person on this planet through writing their message to participate in this archaeological gift.

Once in orbit, it will be possible for everyone to read each other's messages and perhaps by doing so, we will all be encouraged to act more in the common interest of our gifted species, as together we must face the future of this small planet called Earth.

A symbolic "message in a bottle", KEO through its technical expertise hopes all men, women and children to be carried along in the surge of its inspirational dream.