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## **KEO**

### **the Archeological Bird of the Future**

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**“KEO, THE ARCHEOLOGICAL BIRD OF THE FUTURE”**

**Abstract**

**KEO, the Archeological Bird of the Future, is a project linking art and space, which seeks to involve people of all ages and cultures in a collective work of art: while exciting our imagination, it invites us to reflect upon the use we make of the exceptional capabilities our species is endowed with.**

**A time capsule to be launched in 2001, KEO is meant to come back passively to its native soil, where it will land safe and sound, in some 50,000 years. It will then act as our messenger to our (potential) distant descendants, delivering to them, intact, our common offering: all the messages that each of us, men, women and children of today's Earth wish to pass on to the Future.**

**Already presented at the 48th Intl. Astronautical Congress, where it was received with enthusiasm, KEO has now entered project phase 2. While briefly describing the optimization achieved for the capsule itself, this year's presentation will concentrate on the solutions developed to ensure proper preservation of all data throughout time and space. It will also mention the public outreach activities under development, thereby providing evidence of the benefits such an undertaking can offer to society.**

**KEO partners in the technical field:**

**Aerospatiale . CEA . CNRS . Digipress . Ecole des Mines de Paris . Intespace .  
Sup'Aéro**

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## **KEO**

### **The archaeological bird of the future**

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#### **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 message—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.

Companies, 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 48<sup>th</sup> 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 totaled 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 capsule mass back down to 100kg. The final results of this phase should be known by the end of the third quarter of 1998.

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 in the form of microspheres 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 Accélérateur 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:  $\text{SiO}_2=70.8\%$ ,  $\text{Na}_2\text{O}=13.9\%$ ,  $\text{K}_2\text{O}=0.4\%$ ,  $\text{CaO}=8.4\%$ ,  $\text{MgO}=4.4\%$ ,  $\text{Al}_2\text{O}_3=1.5\%$ ,  $\text{Fe}_2\text{O}_3=0.08\%$ ,  $\text{SO}_3=0.3\%$ ).

Before being exposed to radiation, the disk was engraved in an identical fashion to those that 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.

Therefore, the total radiation charge received by KEO over a 50,000-year flight is equivalent to  $10^8$  ions per  $\text{cm}^2$ . It has been verified that a charge of  $10^{10}$  ions per  $\text{cm}^2$  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  $\text{cm}^2$ , 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.

### **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.

### **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 solely 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 an invitation to everyone on this planet to write a 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](http://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, designed and set up free of charge by [Babel@STaL](mailto:Babel@STaL), allows the general public access to the most pertinent project information. The Home Page contains an icon that if clicked upon 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 28<sup>th</sup> 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 will be carried along in the surge of its inspirational dream.**

