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AN INNOVATIVE APPROACH TO SPACE EDUCATION

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ABSTRACT

At present, Canada does not have enough scientists to be competitive in the global economy, which is rapidly changing from a reliance on natural resources and industry, to information and technology. Space is the final frontier and it is a multi-disciplinary endeavour. It requires a knowledge of science and math, as well as non-science areas such as architecture and law. Thus, it can attract a large number of students with a diverse range of interests and career goals. This paper presents an overview of the space education program designed by Canadian Alumni of the International Space University (CAISU) to encourage students to pursue studies and careers in science and technology and to improve science literacy in Canada.

2. WHAT IS CAISU?

Canadian Alumni of the International Space University (CAISU) is the association of Canadian alumni of the International Space University (ISU). Its members number over sixty and are widely distributed across Canada and the world. The organization is run by a board of directors and a number of members donate their time and resources to help in the organization's activities. CAISU was formed in 1990 and incorporated as a non-profit corporation by Consumer and Corporate Affairs Canada under the Canada Corporations Act.

3. WHAT IS ISU?

The International Space University is a non-profit organization with headquarters in Cambridge, Massachusetts. It was created in 1987 and for each year since 1988 it has operated a ten week summer session. Approximately 130 students attend each year and come from all parts of the world. The summer session includes core and advanced lectures and seminars in a variety of space related subjects from law and art to science and engineering. A well organized design project gives students practical experience in

project management and working with people from other cultures and backgrounds. ISU intends to evolve from a summer session campus to a full time Master of Space Studies degree program starting in 1995.

4. CAISU SPACE EDUCATION MANDATE

CAISU serves two purposes. First, it is an alumni organization in that its members are Canadian citizens who have attended the International Space University. Secondly, CAISU is interested in furthering space education and research in Canada. At present, CAISU organizes an annual space education and careers conference. In 1991 the conference was held in Montreal, in cooperation with the International Astronautical Federation. In 1992 the conference has held in Ottawa, in collaboration with the Canadian Aeronautics and Space Institute (CASI). The conference has been the major educational endeavour of CAISU to-date, and last year attracted over 200 students from Ontario and Quebec. CAISU members are also active giving talks at other conferences and to students in high school s and universities across the country.

In order to broaden the scope of its space education mandate to participate more actively with students at both the university and K-13 levels, CAISU is currently developing a closer working relationship with the Canadian government, particularly with the Canadian Space Agency.

The goals of the CAISU Space Education Program are twofold: to encourage students beginning high school to take science courses and pursue a career in science and technology, and to provide interested Canadians, particularly students and educators, with access to electronic mail communication and a space database.

The CAISU space education programs consists of two major components, a Speakers Bureau and an electronic communications network and space database, hereby referred to as CAISU.Net.

5. THE SPEAKERS BUREAU

The Speakers Bureau will consist of CAISU members willing to donate their time and expertise on space to schools and universities who request speakers to give presentations on space-related topics. Presentations will include printed material for distribution, slides, overheads, and demonstration materials. All areas of space studies will be covered, e.g. space law, space life sciences, astronomy, aerospace engineering, space art and architecture, and materials processing.

CAISU speakers will also be involved in giving talks on the Canadian space program, on behalf of the Canadian Space Agency. At present, the space agency has a strong education mandate from the federal government, however, it lacks the staff to implement it. Canada is a geographically vast country with a scattered population base. CAISU members come from all parts of Canada and therefore are able to give talks in different areas of the country. The Speakers Bureau will make use of printed material and posters already available from the Canadian Space Agency and Canadian aerospace companies.

6. CAISU.NET

The proposed CAISU.Net will be a Macintosh computer-driven communication network accessed by modem. It will offer free electronic mail access to CAISU members, enabling them to collaborate on research endeavours. It will link students and teachers in different parts of Canada, allowing them to establish electronic mail penpals with students in other countries with Internet access. Service will also include a source of space related bulletins such as those issued daily by NASA , a source of space related data such as may be available from CSA and NASA to the public domain (Geo-Ref, Voyager Images etc.), and access to an international database of space knowledge stored on CD-ROM.

CAISU.Net will also provide a space expert information line for students and teachers. Eventually, it is hoped that the computer network will be extended in capability to include telescience projects. One project could involve students downloading live space images into the classroom, collected from a controllable telescope. Another application of this technology would be to control a simulated Mars rover which would transmit back images of a simulated Mars landscape.

7. CAISU.NET INFRASTRUCTURE

Before this system can be made available to the general public, the technology must be developed and tested. Setting up the infrastructure which would electronically connect the entire CAISU community is the first step. Two hardware configurations have been considered. According to the first configuration, the central CAISU.Net node will be a Macintosh Centris 650 with 8 megabytes of RAM, a 500 megabyte hard disk, a CD-ROM drive and QuickTime video hardware. It will have a data modem to provide external access and network hardware for the Internet connection. The system will be run by a small team of CAISU volunteers, each with specific tasks like account management, list management and interfacing to ISU.Net. In fact CAISU and its members will also be providing additional hardware support to this project. It is proposed that the system will be connected into the Space Agency network domain by a 56kbps Bell leased line.

The Macintosh Centris 650 is a mid-range computer with very good computing capabilities. It is a new model which is built around the Motorola 68040 chip; it can perform all operations available to the higher-end Macintosh Quadra but at a more affordable price. It is clear that in the near future (less than 2 years), this processor will become the new minimum configuration for Macintosh line of computers. Selecting a 68040-based machine allows for future expandability in a very fast changing world of computers.

The configuration includes a UNIX-based operating system and a large storage system for data to be shared in the CAISU.Net community, which will include K-13 students. UNIX has become an industry-standard for internet-style communication. The data modem will provide added external access, and the QuickTime interface board and video hardware will allow us minimum visual data transfer capability to carry out our first experiments in telescience. Since the UNIX station described above must be dedicated to internet communication for efficient operation, an additional workstation is necessary to carry out daily operations and programming necessary for the development and upkeep of the entire network. A Macintosh IIvx will adequately serve this purpose. For efficient data communication, a data modem will be a necessary addition. We note that by no means is this configuration a top-of-the-line solution. It is adequate and expandable.

It is possible as a secondary option to utilize the lower end Macintosh model such as the Mac II vx 5/400/CD as the UNIX station, coupled with a Macintosh LC III as the workstation. The IIvx can, at a later date, be upgraded to a Centris 650, but the LC III has limited upgrade capabilities. Clearly this system will address immediate needs with a working system. We feel that though this is a viable alternative, it limits us to somewhat older technology and a less powerful configuration.

8. RELATIONSHIP TO ISU.NET

As part of its plan to remain an international university, ISU will set up a global campus network with a Central Campus located in Strasbourg, France and Affiliate Campuses distributed around the world. The campus sites will be connected together and to the rest of the world through an electronic network called ISU.Net.

A part of ISU.Net currently exists as a communications and information server. It provides the principle means for keeping ISU alumni, faculty, staff and supporters in touch. ISU.Net is also part of each summer session and includes a large network of computers for use by students, staff and faculty and an Internet link connecting the session to the rest of the world. The planning and preparation for ISU.Net is an ongoing process and workshops organized by ISU are held two to three times each year. We wish to embark on a more active participation in ISU.Net.

CAISU recently received a computer donation from the Institute for Space and Terrestrial Sciences in the form of an Apollo UNIX Workstation. This computer is the first node in the CAISU.Net, providing Toronto-area alumni with access to the Internet and ISU.NET. This approach may be used in other cities where there are large groupings of members. Connecting into Bell Canada's DataPac network is another option. Having access to the Internet will enhance opportunities for CAISU to become involved in joint projects with other alumni abroad, for example ISU colleagues in Russia or China. Internet communication allows, at no extra cost, to make this one of the principal means of communication in any such project.

9. WHY AN APPLE MACINTOSH SYSTEM?

No system exists which is perfect for all applications. Computing power, price, flexibility, compatibility, and availability of software are all things which need to be taken into consideration when choosing which platform to work on. Macintosh now offers a wide range of machines which deliver a wide range of computing power. Apple has, in the last few years, taken a very aggressive approach to their pricing to bring their machines into a more affordable range for home, business, and technical use. The Macintosh line of computers is known for its flexibility and compatibility between software programs, and more recently, even across platforms. Software is available for practically all applications which are available on any other platforms.

ISU is, for the most part, an Apple Macintosh based university. For its summer sessions and ongoing efforts it has received support from Apple in the USA, France, Canada and Japan. A network of Macintoshes are set up at each session giving students access to electronic mail and to the production of documents, animations and graphics. ISU has also

received support from Apple for developing ISU.Net. CAISU is presently seeking support from Apple Canada Education Foundation, in the form of Apple equipment and software.

10. CONCLUSIONS

The proposed CAISU Space Education Program seeks to improve science literacy among young Canadians by providing speakers on space science and the Canadian space program, and by offering both teachers and students free electronic mail capability and access to an international database on space. It will increase CAISU membership access to the Internet, permitting alumni to collaborate on space research projects. The CAISU space education program is a cost effective approach to nurturing the desire in young minds to pursue studies and careers in space.

11. ACKNOWLEDGEMENTS

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