The Astronomy On-Line Project

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A major Web-based educational programme, known as Astronomy On-Line, has just taken place in close collaboration between the European Association for Astronomy Education (EAAE), the European Southern Observatory and the European Union.

During a period of two months, from early October to late November 1996, a comprehensive network of astronomy-oriented educational Web-pages was built up at various European sites, including the ESO Headquarters in Garching. Throughout this period, astronomy-interested groups of mostly young people from all over Europe registered with Astronomy On-Line; in the end, 720 groups with approximately 5000 participants from 39 countries took part.

The Astronomy On-Line Web-site at ESO received up to 100,000 hits per day. All pages were mirrored once per day or more frequently to about 25 mirror sites in other European countries. No accurate statistics are available for the number of entries at these sites, but there is little doubt that Astronomy On-Line quickly developed into what the organisers early claimed: the World's Biggest Astronomy Event on the World-Wide Web.

Background

Astronomy On-Line took place under the auspices of the European Union within the yearly European Week for Scientific and Technological Culture. This Programme was first conceived in April 1996 and presented to the European Commission during a special meeting in Brussels early that month. From the beginning, it was carried out under the direct responsibility of the newly established European Association for Astronomy Education, with technical support by ESO and financial support by the European Commission.

The main goal was to create a system which would attract young people, in particular students in Europe's high schools, to participate in an exciting, well-structured "astronomical" Web event. The benefits from such a Programme would be many-fold: interest in the science of astronomy and astrophysics, useful knowledge about the efficient use of the nearly unlimited possibilities on the Web and, not the least, the establishment of personal contacts across Europe's borders. There is no doubt that all three goals were amply fulfilled.

Throughout the summer of 1996, discussions were held between the involved parties at EAAE and ESO, in particular during an intensive one-day meeting that took place at the ESO Headquarters in mid-June. At that time it was decided to set up an International Steering Committee of eight key persons and also National Steering Committees in all participating countries. The latter would be responsible for all Astronomy On-Line-related activities, including the establishment and subsequent operation of national Astronomy On-Line Web sites.

The Programme

The basic Web structure was available at the beginning of August. This

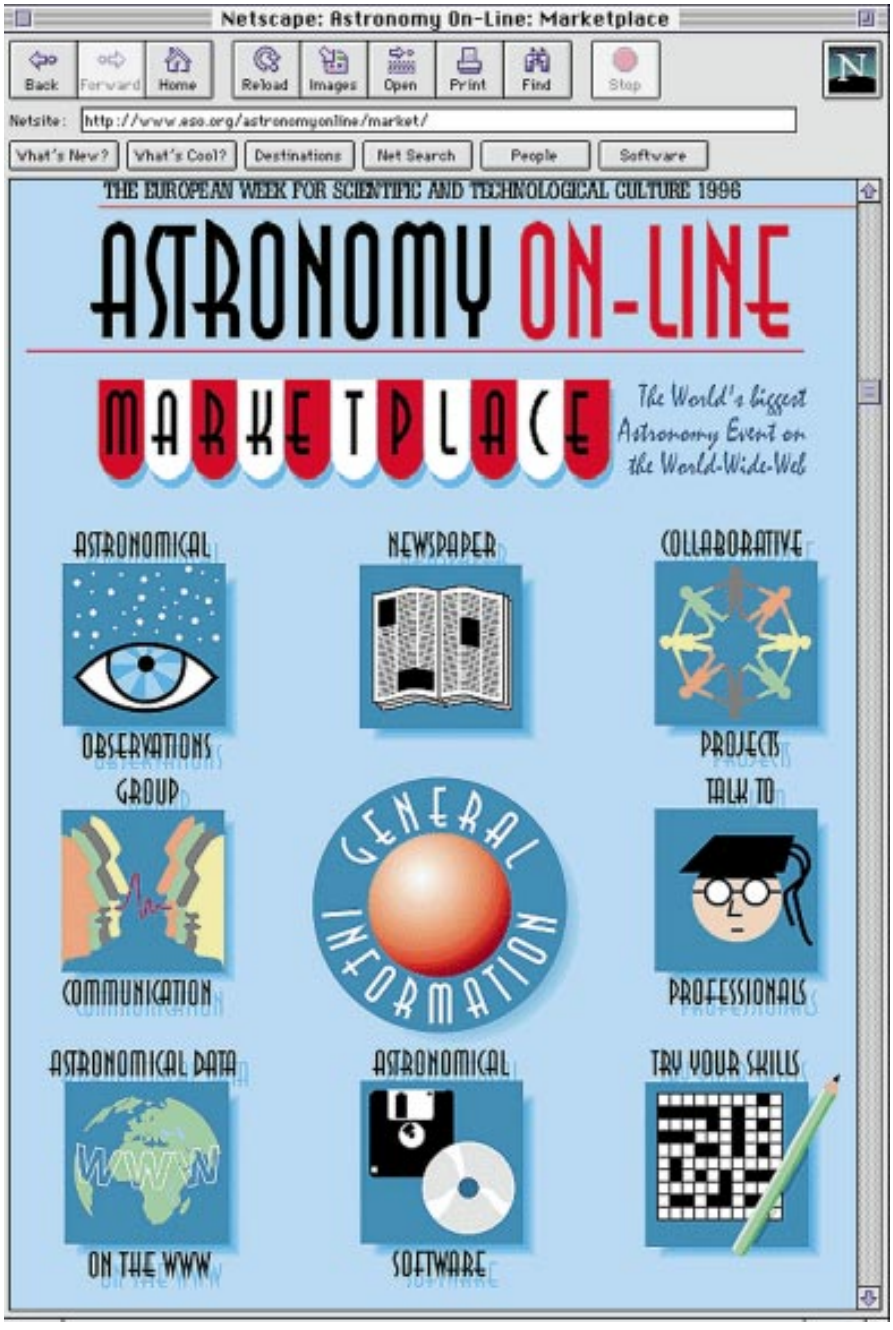

Figure 1: The virtual marketplace was the focal point of Astronomy On-Line.

involved a very welcome and effective support by the ESO Data Management Division staff. From then on, many European astronomy teachers contributed actively to the development with information, exercises, images, texts, etc. which were progressively inserted into the Astronomy On-Line structure. In fact, this process continued until the last few days in November, providing a steady inflow of new possibilities for the participants and thereby ensuring that their interest continued at a high level.

No other project of this scope and volume had ever been attempted anywhere in the world, and Astronomy On-Line, as a pilot project, had to be set up with comparatively little previous experience available. Thus, it was natural that various modifications took place during its implementation. The organisers were also pleased to obtain advice from many sides.

In view of the relatively short time available, a simple and efficient strategy was adopted. It took the form of a "Market Place". According to this concept, the participants were able to access a central Web page with nine different "Shops", each representing different activities. The corresponding URL is: http://www.eso.org/astronomyonline/market/

For instance, one much visited "Shop" enabled the students to join a series of "Collaborative Projects". This included observations of the Lunar Eclipse on 27 September and the Solar Eclipse on 12 October. These two events could be followed live on the Web, thanks to diligent observers among the participants who made their images available in real time. In the follow-up activities, the measurements made by the students were among others used to calculate the distance to the Moon and thereby the physical size of our satellite. Considering the comparative simple observational tools employed, the achieved accuracy was quite impressive.

In another Collaborative Project, the participants made measurements of the length of a gnomon shadow at local noon, repeating the historical experiment of Eratosthenes and, when these values were compared, the circumference of the Earth was calculated to within 5 percent of the correct value.

Another Shop permitted participants to submit requests for observations from several professional observatories in Bulgaria, Denmark, France, Germany, Great Britain, Portugal, Slovenia, Spain and La Silla in Chile. These had kindly made a substantial number of nights available for this purpose. Many excellent observing proposals were received and, although the weather – as expected at this time in Europe! – was not equally good in all places, most of the requests could be satisfied. The data files were transmitted through the Web to the proposers, and groups of students at many schools have since been busy reducing their observations of galaxies, stellar clusters, comets, etc. A group of ESO fellows provided great support for this part of the Astronomy On-Line Programme.

In order to promote knowledge about Web techniques, specific information was inserted into the Astronomy On-Line structure with the appropriate Web links, e.g. about how to search on the Web. "Treasure Hunts" were established in support, with visits to various astronomy related-sites, for instance the ESO VLT pages. And, not the least, the students had the opportunity to communicate via e-mail and during the last few days of the project, also by "Whiteboard" and "Chat".

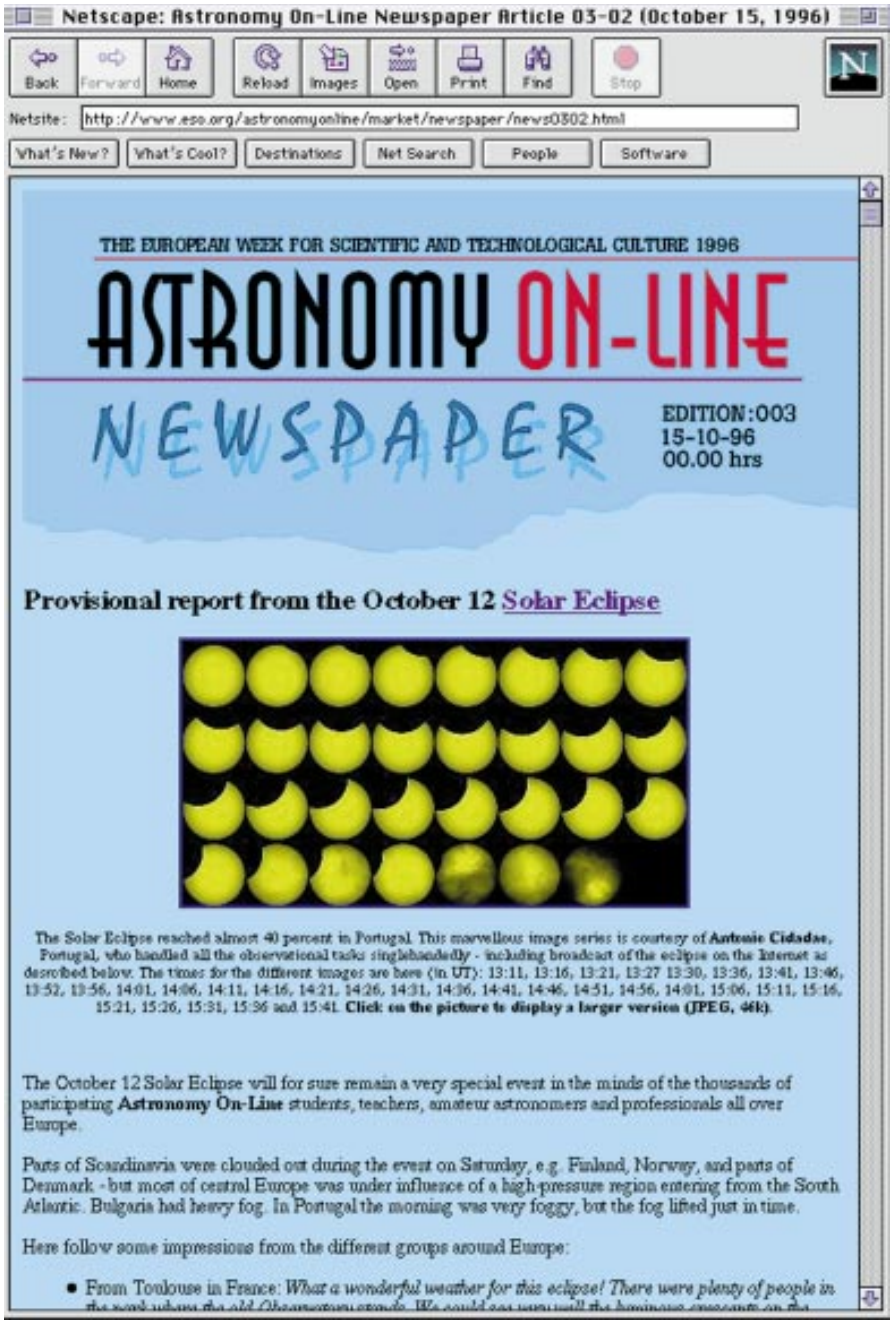

Figure 2: Activities around the partial solar eclipse on October 12 became a prelude to the many collaborative projects, carried out during the Astronomy On-Line peak phase.

The ESO Astronomy On-Line Team

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In many observatories professional astronomers agreed to answer questions. Reports to the Steering Committee reveal they were positively impressed by the quality and depth of many of the inquiries submitted by the young participants.

An Astronomy On-Line "Newspaper" kept the participants informed about the latest developments. This not only included information by the observatories, but also reports of the related activities from the participants themselves.

Reaching the Public

The success of a programme such as Astronomy On-Line obviously lies in the effective organisation of the work and tasks. Equally important, however, is to reach as many potential participants as possible.

This was achieved through a combination of information meetings for teachers (at the national level), the distribution to secondary schools of attractive posters as well as press releases and video news reels to the media both by ESO and the National Steering Committees. Thus Astronomy On-Line found its way into newspapers, magazines, radio and TV.

Also a big effort on the part of the National Steering Committees went into finding suitable sponsors, e.g. network providers and hardware companies, as well as maintaining close contact to the national ministries of education, who in many cases provided extremely valuable help.

Astronomy On-Line maintained a very high visibility during the peak phase of the programme. At the same time it was a pilot programme and as such, the experience from it is of great interest to experts in network-based learning. For this reason Astronomy On-Line was followed very closely by Dr. Jari Multisilta from Tampere University of Technology. At the end of the programme (22 November 1996), all participants were invited to fill in a detailed questionnaire about their own background and personal experience with Astronomy On-Line. Following the evaluation of the incoming replies, it is the intention to publish the results in the journal *Education & Information Technologies*. A provisional report, however, is already available on the Internet (http://www.eso.org/astronomyonline/market/newspaper/news1703.html)

Current Status

The entire Astronomy On-Line structure is still available at the Web, for instance from the central ESO site URL: http://www.eso.org/aol/. Although the daily number of hits is considerably lower than during the "Hot Phase" in November, it is still obvious that it is being used extensively.

The EAAE organisers of Astronomy On-Line early decided that it would be desirable to continue this programme and to establish it on a more permanent basis. Indeed, it has already become an important tool for the exchange of information among Europe's astronomy educators. Few doubt that it will again be used extensively when particular events as Solar and Lunar Eclipses offer the opportunity of joint projects among astronomy-interested students in Europe's schools.

Early 1997, the EAAE made a formal approach to the EU for continued support of Astronomy On-Line. If granted, this would ensure the maintenance and further development of the Astronomy On-Line Web sites, thus enhancing the usefulness of this unique educational tool. Meanwhile, the Astronomy On-Line site at ESO will be kept running.

Conclusion

Apart from its educational aspects, Astronomy On-Line proved to be a powerful vehicle for stimulating the interest in astronomy. Reports filed by the National Steering Committees show the huge number of national activities, that were prompted by the very existence of the programme. These activities ranged from popular talks by professional astronomers, visits to local observatories, joint (and public) observations – in particular in connection

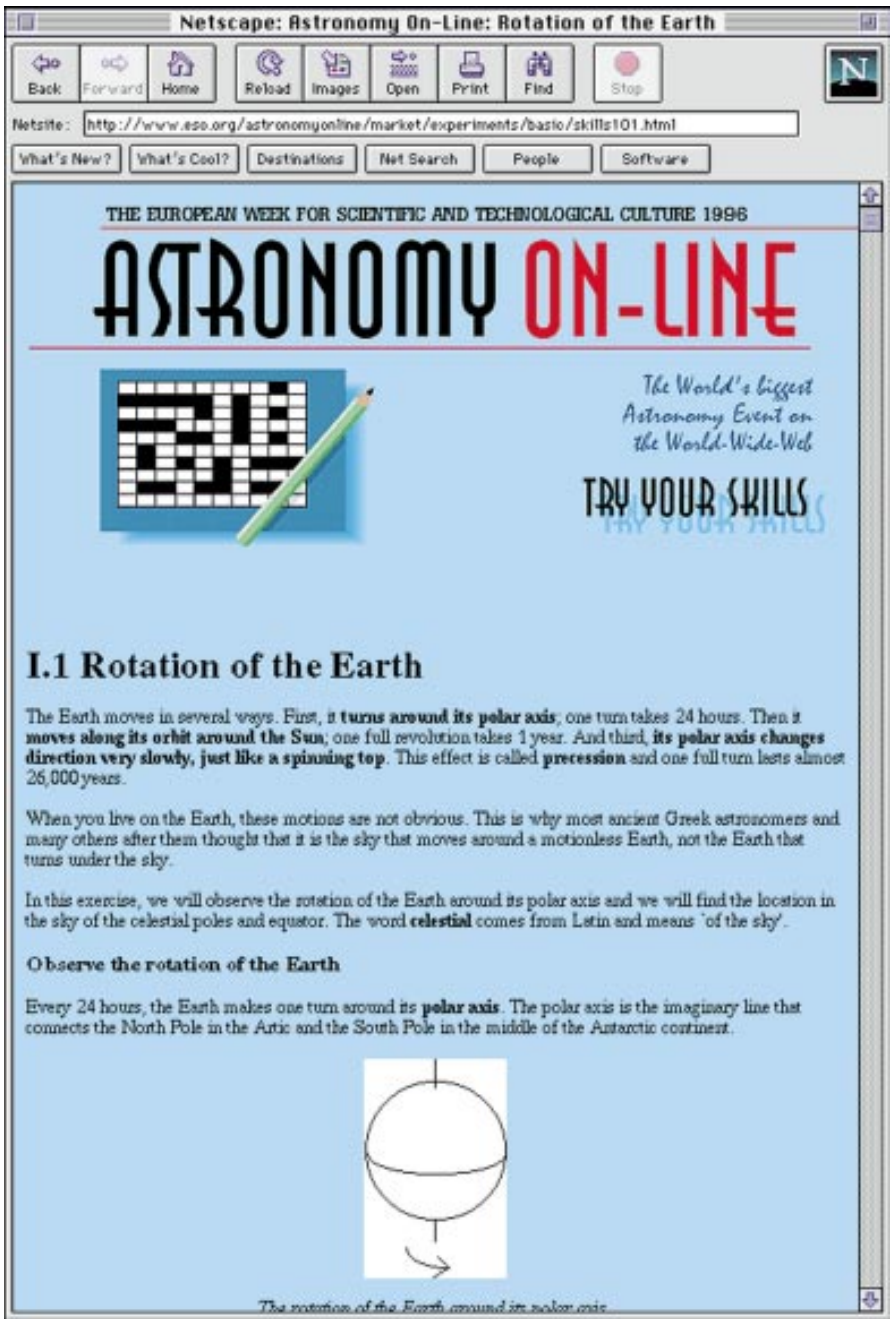

Figure 3: The "Try your skills" shop had a wide range of exciting exercises on offer.

with the lunar eclipse and the partial solar eclipse – to dedicated, often highly successful, efforts to accelerate school plans for getting an Internet connection.

We at ESO have been pleased to be involved in this project from the beginning and thereby to contribute to the three goals mentioned above. We are also confident that Astronomy On-Line will provide a stimulus to young people to become more interested in natural sciences, especially at a time when worries have been expressed at many European Universities about the dwindling number of young people who are considering to pursue a career in these fields.

The European Week for Scientific and Technological Culture

The objective for the European Week for Scientific and Technological Culture is to improve European citizens' knowledge and understanding of science and technology, particularly in their European dimension: it addresses both pan-European scientific and technological co-operation, as well as science and technology in each European country.

"The Week" is organised every autumn by the European Commission in collaboration with national and international research organisations, universities, museums, TV, etc.

Acknowledgements

Astronomy On-Line was made possible by the active personal involvement of a large number of dedicated people all over Europe and, indeed, on several continents. Thanks to their unremitting efforts, it became possible to implement in an extremely short time, a project which will undoubtedly serve as a very useful example for similar events within other subject areas.

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Availability of IDL at ESO/ST-ECF

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Introduction

The range of astronomical computing has become so broad that there is no one single data-processing system which covers all possible aspects. Thus, in addition to the indigenous data analysis system MIDAS (Munich Image Data Analysis System) ESO supports a number of other analysis systems. The two most important ones are, at this time, IRAF (Interactive Reduction and Analysis Facility), and IDL (Interactive Data Language).

For many years now, IDL has played a significant role in astronomical data analysis. Originally developed by Dave Stern of Research Systems Inc. in the late seventies, IDL has survived many transitions of hardware platforms and operating systems, all the time improving the functionality while retaining full backward compatibility. This is a truly remarkable achievement.

For Space Telescope data analysis, IDL has been an important tool since the very early days. Since it had been used for the analysis of IUE data, and staff of the IUE centre at GSFC was heavily involved in the development of the Goddard High Resolution Spectrograph (GHRS), a large amount of spectroscopic analysis software was available in IDL. In addition, IDL provided the possibility to read the HST native data format, GEIS (Generic Edited Information Set). Because of its importance for HST data analysis, ST-ECF has been supporting IDL since 1984. More recently, IDL has been made available for the full ESO community.

An often heard objection to the use of IDL is its commercial nature, i.e. license fees have to be paid. However, there are several aspects to consider: the costs are quite moderate in comparison with the other computer system related costs (hardware, operating system, utility software), and buying an IDL license opens up an enormous amount of astronomical application software which has been developed over the years, representing an effort of hundreds of person-years; and, IDL has the potential of considerable cost savings by increasing the efficiency and productivity of software developers.

IDL is available on the ESO local area network to staff and visiting astronomers. Copies of the most important astronomical libraries are available locally, or they can be downloaded through the Internet.

Application Programme Development

Experience shows that it is very difficult to incorporate contributed software written by astronomers for their own research into systems like IRAF and MIDS. The reason for this is that the requirements for adherence to standards, level of documentation, testing, quality control and configuration management have to be so strict that researchers are unwilling and/or incapable of following them. On the other hand, such requirements are absolutely necessary in order to keep the system transportable, maintainable, and reliable. As a consequence, we can hardly ever incorporate "contributed" software into MIDAS or IRAF as is. Instead, we have to take the research software (which may or may not run under one of those systems), re-design and re-code it in the proper manner, and then incorporate it into the target system.

We have found this process to be very smooth when IDL is used. IDL allows quick and easy, step-by-step prototyping by the researcher or by the s/w developer. A large function library encourages modularity. The code is eminently readable, making the process of re-casting it into a different target language very easy. In fact, IDL can be considered a powerful detailed level design language with the advantage that it actually executes.

Of course, there is a penalty for all this: although IDL is very fast as far as interactive languages go, and it can actually be pre-compiled to speed up the execution, it cannot compete with Fortran or C when it comes to pure number crunching involving a large number of