IUPAP Working Group on Communications in Physics

Final Report - September 2000

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Charge to Working Group

It is the primary mission of the working group to make a set of recommendations on important issues in the international aspects of physics communication, especially electronic publication, that are appropriate for IUPAP action.

1. Introduction

It was agreed in March 1998 to establish a small advisory committee or working group to assist the IUPAP Council in following the developments in the field of electronic communications in physics and to provide guidance with regard to possible initiatives that the Union should take in that area. Members of the working group met in Paris on September 24th 1998 and in Atlanta on March 21st 1999, but, as is appropriate to its charge, most of the business of the working group has been carried out by e-mail. Individual members agreed to address particular issues which were then discussed by the group as a whole. An iterim report was made orally to the Council by the Chairman of the working group in October 1999. This formal report from the working group presents some of its conclusions and recommendations.

The group quickly recognised that it should avoid technical issues which are best handled by experts, and should concentrate on identifing 'good practices' and on issues where IUPAP might have influence.

Many of our concerns affect disciplines other than physics, but the physics community has been, and is, particularly active in communications developments and it is therefore appropriate for IUPAP to address such matters. However, the group recognises the there will frequently be a need for IUPAP to coordinate action with ICSTI, ICSU and ICSU Press. Such coordination is often best handled through personal contact, and IUPAP's formal representation to ICSTI is currently through a member of the working group. Members of the working group are involved in initiatives undertaken by ICSU Press.

The matters which the group discussed can be grouped into six subject areas, each of which are covered in the different sections of this report:

- Linking, searching, and mirroring for publications of different societies and publishers
- International internet availability and reliability for scientific publications
- Availability of publications in (electronically) remote areas
- Long term archiving and availability of electronic publications
- International intellectual property questions
- Peer review and e-print archives

2. Linking, searching, and mirroring for publications of different societies and publishers

One of the major advantages of electronic publication of scientific material such as journal articles is the possibility of linking at the 'click of a mouse' the content of separate but related articles. Thus, on reading an article the reader may wish to look at an earlier article which it cites, or to look at an article published later than one which is being read but which cites it. The former is tedious for printed material and the latter impossible. Similarly, readers now have the ability to seach (by keyword, by author, or by subject for articles related to the one being read. If the articles are deposited in one or more databases such citation linking or subject searching can in principle take place easily.

All serious publishers of scientific journals now provide electronic versions and most provide the ability to provide forward and backward linking or searching within a particular journal or between a family of journals from the same publisher. The end user would, of course, welcome links to all related material regardless of which publishers are

involved. Things which inhibit that are not primarily technical but commercial, publishers naturally being concerned at giving access to copyrighted material without recompense.

Interjournal linking is now underway for many publishers. There is a growing recognition that access to at least the abstract of an article from links coming from another publisher is in their interest. This is particularly true if the reader is from an institution that subscribes to the journal being linked to; its publisher can then readily offer full-text of the article as a service to a subscriber. The announcement at the end of last year of a reference-linking initiative, CrossRef, involving most of the major physics publishers is encouraging. It will be run from a central facility, managed by an elected Board and operated in cooperation with the International Digital Object Identifier. However, each publisher will set its own access standards and determine what content is available to the user following a link. The working group obviously welcomes such initiatives.

Searching for information across journals is therefore certainly getting easier for the end-user physicist. Important databases have been established by journal publishers both society and commercial; secondary databases have been established covering material from different publishers, usually providing free access to abstracts and full-text by payment; publically funded bodies like the US Department of Energy or the National Institute of Health are seeking to establish such databases. There is, however, no effort comparable to CrossRef for cross publisher searches, and moves in this direction should be considered.

Yet despite these encouraging developments, working physicists are only too aware of the irritating difficulty of accessing information which they know is there and which, given modern networking, should only be a 'click' away. The problem is aggravated if the information is in a more specialised journal or one not published in the US or one of the active publishing countries of Western Europe.

Since most of the problems are not technical, but relate to issues of commercial return for investment, copyright, licensing etc. the working group believes that many could be solved, or at least alleviated, if the major players could come together in discussions under the independent aegis of IUPAP. **It proposes therefore that IUPAP convene a meeting of publishers and physical societies to discuss the 'Linking and Searching of Publications of Different Societies and Publishers'.**

The hope behind convening such a meeting is that the various databases held by publishers, physical societies and others will eventually form components of a virtual Global Physics Database, an ideal which will permit the end-user physicist to access the published results of the world's physics in a 'one shop' operation viewed by that end user as a single site. We are far from that ideal, despite encouraging developments, but IUPAP can do much to encourage cooperation between database holders. **The working group expects that if the convened meeting is successful, there will be a wish and need for ongoing discussion between database holders, hopefully under the aegis of IUPAP.**

(Since IUPAP has few financial resources, what it can do itself is always very limited, and must mainly act by influencing others. Not surprisingly, therefore, a similar recommendation to convene meetings of players, who do have resources, appears in other sections of the report. However, we do not believe that it would be desirable to have some, large, 'summit meeting' of societies and publishers. Progress occurs in small meetings when the players can talk freely and relaxedly. The working group is therefore urging a series of small meetings, convened and recognised by IUPAP, on rather well defined issues and which hopefully the players will be willing to fund).

The working group had some discussion of the mirroring of sites serving physics information in order to enhance access from different parts of the world. It recognised the desirability of maintaining multiple copies of any database at distant sites so as to improve access and thereby helping to safeguard data . **The working group encourages database owners, academic societies and governmental agencies to cooperate in establishing and maintaining mirroring sites.**

3. International Internet availability and scientific communications

The remit of the Working Group is broader than consideration of the developments in electronic publishing and includes, amongst other matters, the provision of adequate and affordable network communications between physicists – not simply for today's Internet but also to provide broadband connections for research.

There has been a growing disparity in the networking facilities enjoyed by physicists in the US and elsewhere, and policy makers in the rest of the World have been somewhat slow in recognising major developments that are taking place, primarily in the States, as a result of computer based networks.

Prior to 1995, the US National Science Foundation's NSFnet provided the research and academic community with a relatively uncongested network. Its privatisation led to today's Internet with its exponentially growing traffic, increasingly dominated by graphically dense Web pages. The resulting congestion deprived network resources from the very research community that would further develop the Internet. To protect the research community the major research universities therefore set up Internet2 and established UCAID, the University Corporation for Advanced Internet Development to run it.

Separately, a Federal programme, White House led, NGI, Next Generation Internet, was being developed with a simple image of 100 sites with network connections 10 times faster than now and 10 sites with network connections 100 times faster than now. After original confusion, the two strands are now complementary: Internet2 relates to advanced applications and network tools; NGI relates to advanced network technology development and testbeds etc.

The important consequences are:

a) A clear separation of commodity Internet use, private or public, from advanced use of communications for research.
b) A recognition that there are special requirements for a limited number of universities, the 'research universities' ~130 in number, and federally funded research centres.

In other countries there is no comparable clarity. The funding authorities in countries with good national research networks, like Germany or the UK, seem to be going in quite the opposite direction making these networks available to vocational training institutions and schools. Since these frequently require multimedia connectivity, the effect on the research networks can be very negative. There is here a major policy issue, easily confused with the simple political question: "Which has the higher priority, schools or universities?" The mixing of what is actually commodity traffic and research use can lead to the problems that the US had. It is therefore important in all countries that there is recognition of a need for protected bandwidth for the research community. If a country seeks to contribute to advanced physics research there has to be the creation of an equivalent of Internet2.

In Europe there is a growing consensus on the importance of good computer networking for the scientific community and amongst the Presidency Conclusions of the Lisbon European Council in March 2000 was the need to 'facilitate a very high-speed transeuropean network for electronic scientific communications'. Europe's national research and education networks are currently interconnected by TEN-155, a TransEuropean Network that provides 155 Mbps connections to many, but not yet all, countries in the Union and the European Commission is launching actions that will move from TEN-155 to GÉANT which will run at Gigabit per second rates by the end of 2001. Funding has been established of 80M€ over 4 years. (However, it must be remembered that the Abilene backbone network for Internet2 has been running at 2.4 Gbit/s for more than a year).

The association in which research and education networking organisations from countries in and around Europe collaborate, TERENA, is now an international partner and affiliate member of UCAID. (The 34 TERENA members include not only most Western and Eastern European countries but also Egypt, Iran, Jordan and Turkey).

The Working Group recommends that IUPAP strongly welcomes improved international collaboration on such matters. The pressure for commercial competition, particularly between trading areas such as the US and the European Union, is understandable, but in most areas of research and education and in the provision of the communications infrastructure, a greater degree of co-operation between regional areas would be beneficial to all. The Working Group urges that IUPAP makes a public statement to that effect.

It further recommends that IUPAP urge the Physical Societies to draw attention locally to the need for connectivity, remembering that the issue is to protect the availability and the free transfer of scientific information. They should press for the

provision of protected bandwidth for the research community by separating it from the mass media.

4. Availability of publications in (electronically) remote areas

The problem of connectivity in developing countries, mainly in the least developed countries is quite serious and it is not very clear what is the best course to adopt. In many such countries, there is no general awareness of the problem.

There are already efforts in many places, not all in the area of Physics, such as SciELO, (a virtual on-line electronic library, covering a large selection of Brazilian Journals. This is a project of FAPESP, the Science funding agency of the State of Sao Paulo, Brazil. Web site: http://www.scielo.br/); LATINDEX System, (a bibliographical information system for scientific and technical journals published in Latin America and the Caribbean, Spain and Portugal. (http://biblioweb.dgsca.unam.mx/latindex). It is run by the Library of the UNAM in Mexico city), in Latin America. There is a pilot project (http://www.hnet.msu.edu/~africa/toc/index.html) giving coverage to journals in science, technology and medicine, published in Sub-Saharan Africa, in order to enhance their visibility. On the same line, there is the Electronic Publishing Trust for Development, but they work only with Biology journals (http://dspace.dial.pipex.com/bioline/); there was recently a workshop in Colombo, Sri Lanka, where the main topic was NET ELIS (Networking for Effective Libraries and Information Services), mainly concentrating on South and Southeast Asia and Oceania, etc.

But, the solution to the problem of connectivity has to come from those countries themselves. There is no point in creating protective measures that will not be used nor appreciated. However, bodies such as IUPAP can help, as is said above, by encouraging a greater local recognition of the importance of communication facilities**.**

A possible effort sponsored by IUPAP could be to monitor the Internet connections of those places which request them. This cannot be done from a single place: many centers should share the burden in an organized way. Data should be analyzed periodically and published. IUPAP already has within its International Committee on Future Accelerators (ICFA), a subcommittee of C-11, a group which amongst other things monitors Internet connections to various regions of the world. These were set up for high-energy physicists because their large collaborations require effective computer communications if they are to work well. Building on that, it should be possible for IUPAP to enhance this monitoring role to other areas comparatively easily. IUPAP could, almost certainly, look to help from other bodies, e.g. the Abdus Salam ICTP could help monitor communications in Africa.

In most countries in the developing world there will only be a small number of institutions connecting to the Internet, but for these there is a need for protected bandwidth for the purposes of scientific collaboration and to access publications. **The Working Group recommends that IUPAP press bodies in the developed world and international organizations such as the UN and UNESCO to act together to provide international connectivity to such institutions free of charge.**

5. International intellectual property questions.

With the advent of electronic communications, issues relating to copyright and related rights have been made much more difficult. Some international organizations such as UNESCO and WIPO, for over 20 years have addressed the subject of copyright of intellectual work of an electronic nature, with the aim that reproduction rights granted by national laws and international conventions should extend to electronic storage and retrieval of protected works. Most countries recognize Science as a public good; an unfair law of copyright for electronic publications can be of serious consequences to basic sciences, in particular to the development of science in developing countries, which have not yet reached a minimum competitiveness.

The scientific community has a problem of its own that goes beyond simply protection of work. Free flow of scientific information among scholars is absolutely necessary for international collaboration and the advancement of science. In an attempt to protect intellectual property in the face of growing use of electronic communications, legislators seem to be inclined to forget the interests of the research community which will be responsible for our economic well-being in the future. They are introducing, or discussing, legislation that is shifting the traditional balance to one in favour of the interests of the commercial holders of intellectual rights, and at the expense of the research community.

While the fast (and cheap) communication systems had made collaboration easy by the exchange of individual work, as well as by access to electronic journals, a strict copyright law may threaten the right recognized by the *Universal Declaration of Human Rights, in its article 27.1, to access to culture, education, information and scientific research.*

A large part of the world, the developing World, and in particular sub-Saharan Africa and Central Asia, has serious difficulties in accessing scientific literature.

Article 27.2 is devoted to the right every human being enjoys to the protection of his/her moral and material interests related to the scientific, literary and artistic works he/she has created.

There is a delicate balance between these two articles, the latter of which is protected by national copyright laws and international treaties. While it is important to preserve the

incentives to create knowledge, the possibility of disseminating it at little or no cost should be preserved. The concern that the Digital Communications revolution could ease the infringement of copyrights is complicating the use of "fair dealing", which is the key instrument to safeguard the free flow of information.

This creates a problem to the exchange of scientific information which has to be viewed from the sides of both the developing world and the advanced countries.

An issue which is primarily a European one, but which can influence decisions elsewhere, relates to the decision of the European Commission to promote a Directive on the "harmonization of certain aspects of copyright and related rights in the information society" (a Directive is the equivalent of a Bill in EU matters). A Directive only becomes law when approved at two readings at the Parliament and by the Council of Ministers. Bodies like the Royal Society, the European Science Foundation, the Academia Europaea etc. have been lobbying to improve the legislation, thereby allowing Member States to maintain, for example, the existing arrangements for private copying or photocopying for purposes of research. At the first reading, the European Parliament decided that such use would only be permitted when accompanied by "fair compensation" for rightholders, and Member States would be obliged to abolish 'fair-use' exceptions to copyright. The effect on research and scientific communication could have been very damaging. At the time of writing, the needs of the scientific community seem to be being recognised more readily, but we will have to wait in order to examine the likely consequences of legislation.

With proposals before Congress in the States concerning modification of copyright for electronic material it is believed that there is a lot of pressure from publishers to pass a copyright law, which will include an “electronic copyright management system” (ECMS), a sort of guard over all electronically published material. The Bill would include a provision “prohibiting the import, manufacture or distribution of any device, product or component incorporated into a device or product, or the provision of any service, the primary purpose or effect of which is to avoid, bypass, remove, deactivate or otherwise circumvent, without authority of the copyright owner, or the law, any ECMS”. Since electronic publishing implies downloading, which in turn means copying, it is clear that any extensive retrieval will infringe copyright laws. Unless protected by a process of "fair dealing" or "fair use" such legislation could seriously damage scientific research.

This fact will be very detrimental to developing countries, independent of the fairness of local copyright law, which see in e-journals an economic way of getting the literature. A subscription to an e-journal is not a substitution for the printed copy. Besides, it is not yet clear what this subscription means regarding access to back issues, with the exception of PROLA (the American Physical Society’s Physical Review On Line Archive). Therefore it may be a real problem for an institution that can barely afford to subscribe to the electronic version of a given publication.

The least developed countries in particular, find themselves in a very unstable situation where toughening of the laws may throw them into deeper backwardness. Institutions in these countries have no economic resources to keep their libraries well provided with current literature, which is absolutely essential for the advancement of science at the local

level. At the international level, they have the problem of lack of visibility of their scientific production, which produces negative effects on research scientists who become academically isolated.

Many of these countries are technologically backwards and, at this moment, do not have the possibility of using Internet as a tool for their work. For others, even when the minimal technology exists, universities and scientific institutions have no access to it, either by the prohibitive prices for the connections or because they do not have the actual computers to access the Internet effectively. To download material from an e-journal by Internet is simply out of their reach.

Some of these local problems, though large, can be partially alleviated if institutes in the advanced countries are supportive. Thus, as an example, the American Physical Society has started in collaboration with the Abdus Salam International Centre for Theoretical Physics, an enterprise in which e-literature is distributed to the least developed countries on CD-ROM's. Where there are some Internet facilities it is important that libraries be given special licenses which would permit them to download whole issues of journals at very low or no cost.

Overprotective copyright laws make weapons out of the technological advances, throwing developing countries into an even deeper backwardness. And this is happening at the very time when one might hope that electronic publishing, through easy access to scientific literature ,would close the economic gap between the developed and developing world.

There are great differences in the commercial value of scientific work and other intellectual property, such as TV broadcasts, music, films, software, etc. and to have them all covered by the same law will seriously jeopardize exchange of scientific information through the electronic media. UNESCO is taking an active part towards a differentiation of public and private funded databases, but the inportant issue is to guarantee the free exchange of scientific information.

It is now time for the scientific community to come forward with a clear view of the kind of protection and free access they need, and they must seek to influence any relevant legislation. They should plea for laws that recognize the differences in intellectual properties and which are fair to science. If, despite the concerns of the scientific community, unfortunate legislation is enacted, IUPAP should urge all scientific publishers not to take advantage of the legislation and permit ‘fair use’ for personal study and research. It is the obligation of the scientific societies to take a stand on this matter.

The Working Group recommends that IUPAP announce its concern that legislators when addressing issues of copyright and related rights tend to forget the interests of the research community; that a traditional balance between the interests of copyright owners and those working in science, hammered over many years, is being upset; that this can cause damage to scientific development and hence to society. It recommends that **IUPAP**

work with other bodies to maintain scientific and educational 'fair use' exceptions to copyright law in order to safeguard the free flow of information.

It recommends that IUPAP seek to influence publishers and publishers organizations, world wide, in ways which will encourage the free flow of information for the purposes of personal study of scientists and for research.

It recommends that IUPAP work with other bodies, in order to alleviate the serious problems in accessing scientific literature in the developing world, for example by encouraging physical societies and publishers to provide CD-ROM or on-line versions of their journals at very low or zero cost.

In addition to issues relating to the copyright of published material, there are other intellectual property problems in connection with databases of scientific data, published or not. Again, there has been a growing tendency of legislators to become overprotective of the rights of database holders in a way which restrict scientific progress. Most serious was the EU Directive on the Legal Protection of Databases adopted in March 1996. At that time, the European research community was insufficiently aware of the dangers and scientific bodies only became active when it was basically too late to revise the Directive. However, last minute pressure did build into the Directive the requirement of a formal review of its impact by 2001.

A Draft Treaty on Intellectual Property in Respect to Databases largely modeled on the EU Directive was proposed for adoption by the World Intellectual Property Organization, WIPO at a Conference in December 1996. By then, the scientific communities in Europe, the US and elsewhere had been sufficiently alerted to the dangers that it proved possible for the Draft Treaty to be withdrawn. In the US the National Academy of Sciences, National Academy of Engineering and the Institute of Medicine have been very active and Bills before the US Congress which would have damaged scientific progress have been resisted. A joint group on Data and Information was formed by ICSU and the ICSU Committee on Data for Science and Technology, CODATA and has been raising the issues internationally.

However, there are still concerns that legislators world-wide do not recognise the needs of research and are too influenced by the commercial holders of databases. **The Working Group recommends that IUPAP formally state its concerns at the overprotection of the rights of holders of science and technology databases and that IUPAP will support the activities of ICSU and CODATA in this area.**

6. Peer review and e print archives

For the moment e print archives are used not only as an independent source of scientific communication, but also in conjunction with the traditional physics journals (traditional including the electronic version of paper journals): the archives are used by the authors to submit manuscripts, by the referees to have access to them, etc.; in addition, in most

cases the texts remain accessible in the archives after publication, which turns out to be a very useful feature for physicists in many circumstances. Such archives are clearly welcomed by the physics community.
Their evident usefulness has caused some to argue that they could replace more traditional publication, whether printed or electronic. Nevertheless, the vast majority of physicists seem to think that the intellectual aspects of the selection and evaluation process, which are traditional in published journals, are extremely useful procedures which should be preserved in the future. True, proposals have been made for "spontaneous refereeing", basically by attachment to the manuscript of comments of any reader who wishes to do so; but most scientists do not seem to consider this as realistic or as a serious form of peer review. In fact, most physicists seem to agree that the basic processes involved in the traditional refereeing process will probably not change drastically (even if the technicalities may change with growing use of electronic communication, etc.).

Starting from the idea that the selection will be made more or less as it is made now, the natural question then is whether or not a traditionally refereed journal can be built on top of the archives, as a series of links towards texts which have been "frozen" by some technical means (which already exist). In other words, can one see some journals just as "selection filters" acting on a general data base? (If the ideal virtual Global Database discussed in Section 2 came into existence then it could contain more or less all text written in the world on physics).

Technically, there is no special difficulty in creating such an archive based journal. The problem lies more in sociology and tradition: will such a scheme be accepted as desirable by a sufficient number of scientists in the community? An attempt to create such a journal was initiated at Boston University, but has not progressed far enough to be seen as practical. It would be interesting to develop more complete initiatives in this direction.
(A similar initiative in the biological sciences is a newly announced peer-reviewed journal, BioMed Central built on top of the PubMed Central database with articles free to the reader and always available from the database).

Another independent initiative is JHEP, a very successful purely electronic journal which started in 1997 and covers only High Energy Physics (this is about 5 percent of all physics); it is entirely free for authors and readers, and has reached a stage where several hundred articles are published every year. It has become a major journal in the field in an extremely short time. For the moment it is supported by the Italian Physical Society (estimations suggest that its real cost is of the order of 300.000 US dollars per year), but at some point international support will probably become appropriate. Discussions are under way to create an "international centre for scientific publishing", funded for instance by the fundamental research agencies, and then to generalize this system to more subfields of physics.

The APS's Physical Review Special Topics - Accelerators and Beams is again a purely electronic journal free to the reader and supported by central funding in this case a number of accelerator laboratories. The business plan of the New Journal of Physics set

up by the Institute of Physics and the German Physical Society is an electronic journal free to the reader funded by charges to the authors.

The Working Group recommends that IUPAP announce that it welcomes and encourages such experiments, not primarily to reduce costs to academic institutions though that would be desirable, but because of improved services to the physics community.

The importance of the e print archives, even in an unrefereed state, cannot be overestimated. They are significant especially to those who cannot afford access to scientific journals, and, for the speed with which access is provided, to all researchers. **IUPAP can play a role in assuring that there is international participation in funding, assuring availability, and, if possible, in their operation by mobilizing Physical Societies worldwide to assume such responsibilities.**
The issue of reliability and quality of content of scientific material is also critical. **IUPAP should urge strongly the maintenance of high quality peer review systems in primary publication regardless of the medium employed.**

There is a separate issue resulting from the convenience of electronic communications. It means that there is a large amount of 'grey' material on the Web. **The physics community as a whole has a great responsibility to maintain quality standards and to ensure that the source and authority of electronic material, whether in text or as data, is clearly identifiable, whether that material is aimed at physicists or to society as a whole. The Working Group therefore recommends that IUPAP should establish guidelines in this area.**

7. Long Term Availability of Electronic Publications

Assuring the long term availability and readability of scholarly or otherwise significant electronic materials can be an overwhelming problem when many different media formats make up a collection, or when original creators and owners of materials have been unwilling or unable to select only those records worthy of preservation. Monumental problems of this kind face the US National Archives . The variety of material that has been digitized ranges from old census data stored on tapes in a 1960's computer format (and essentially unreadable) to photocopied material whose significance is as marginal as its volume is large. Further, federal agencies are obliged by US law to preserve all computer files and electronic mail. Keeping all of this material readable in the face of continuous developments in both software and hardware, particularly when there are many different formats and computer types to keep track of, can be an impossible task.

As time passes the difficulty of migrating an archive from an outmoded format to a current one increases in proportion to the number of steps it has fallen behind. The Task Force on Archiving of Digital Information recommended in a 1996 report a system of

independent certification of archival repositories, which would then be empowered to "exercise an aggressive rescue function to save culturally significant digital information" in the event that the possessor of the information fails to do so. This recommendation can be adopted to serve the physics community well in preservation of the many electronic modes of distribution of physics papers and data. The good news is that the maintenance of the readability of the corpus of physics information is considerably simpler than that faced by the National Archives. If at this stage we limit our considerations to maintaining the readability of electronic journals and e-print servers we have a manageable problem whose solution depends on the commitment of the "owners" of the databases to keep their information readable. Fewer formats are used, and for any one journal or series the issue is fairly simple and straightforward, provided that changing of formats takes place when the old and the new are still in use.

The American Physical Society (APS) recently embarked on a systematic program to build a complete digital archive of its past and future publications. The commitment is to keep the Physical Review On-Line Archive (PROLA), as well as the current issues of its electronic journals, readable and accessible. So far librarians have received PROLA warmly and seem to be willing to pay for a well maintained archive. The inclusion of libraries in all discussions about archiving is essential. Many of them question the long term commitment of some publishers in maintaining archives. Because of those concerns, the APS plan includes one or two respected and trusted university libraries as well as the U. S. Library of Congress as partners, to mirror the PROLA archive. In the unlikely event of an organizational failure or natural disaster that disables APS from providing and updating the electronic archive, the partners can step in but need take no active role otherwise.

In several countries, such as the UK or Holland, with strong physics publication activity, there has been a voluntary agreement between publishers and the National Archives for the Archive to maintain a readable backup, even though there is not yet a legal copyright deposit requirement for electronic material.

In summary, it should not be difficult to keep the electronic versions of physics journals readable. There is a strong economic motivation for
publishers, both society and commercial, to undertake this, as long as the archives are saleable. In the event that publishers falter there should be a backup that involves university libraries, national archives or some trustworthy third party.

Special problems will arise as electronic journals take greater advantage of attaching multimedia material and data - as some already encourage. Such enhancements of a physics article can be of great added-value, but they complicate archiving greatly.

It is recommended that IUPAP convene a meeting of society publishers, selected commercial publishers and librarians to discuss some of these issues. Questions to be considered would be:

1) Commitments by publishers to maintain the readability of their electronic archives, and the future viability of reference links.
2) Establishment of backup mirrors at institutions which would commit to updating the archives in the event that publishers fail to do so.

It is further recommended that IUPAP should encourage discussions at a more technical level to consider the problems associated with archiving primary publications which include or attach multimedia or data.

References:

Section 6:
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Section 7:
-Stille, Alexander, "Overload," New Yorker, 8 March 1999, page 38-44.
-Report of the Task Force on Archiving of Digital Information,"Preserving Digital Information," 1 May 1996

Summary of Recommendations for Action by IUPAP

A) Linking, searching, and mirroring for publications of different societies and publishers

- IUPAP should convene a meeting of publishers and physical societies to discuss the 'Linking of Publications of Different Societies and Publishers', concentrating not on technical matters, but on issues of commercial return for investment, copyright, licensing etc.
- An output of that meeting should be ongoing discussion between its members under the aegis of IUPAP.
- IUPAP should encourage database owners, academic societies and governmental agencies to cooperate in establishing and maintaining mirroring sites in order to enhance access from different parts of the world..

B) International Internet availability and scientific communications

- IUPAP welcomes improved international collaboration between research and education networking organisations in different regions. Commercial competition between trading areas is understandable, but in most areas of research and education and in the provision of the communications infrastructure, a greater degree of co-operation between regional areas would be beneficial to all. IUPAP should make a public statement to that effect.
- IUPAP should urge the Physical Societies to draw attention locally to the need for connectivity, remembering that the issue is to protect the availability and the free transfer of scientific information. They should press for the provision of protected bandwidth for the research community by separating it from the mass media.

C) Availability of publications in (electronically) remote areas

- IUPAP should sponsor an effort to monitor the Internet connections of those places in the developing world which request them. IUPAP could, almost certainly, look to help from other bodies in doing this.
- IUPAP should press bodies in the developed world and international organizations such as the UN and UNESCO to act together to provide international connectivity, free of charge, for the small number of institutions connecting to the Internet in the countries of the developing world.

D) International intellectual property questions

- IUPAP will work with other bodies to maintain scientific and educational 'fair use' exceptions to copyright law in order to safeguard the free flow of information.
- IUPAP will seek to influence publishers and publishers organizations, world wide, in ways which will encourage the free flow of information for the purposes of personal study of scientists and for research.
- IUPAP will work with other bodies, in order to alleviate the serious problems in accessing scientific literature in the developing world, for example by encouraging physical societies and publishers to provide CD-ROM or on-line versions of their journals at very low or zero cost.
- IUPAP will formally state its concerns at the overprotection of the rights of holders of science and technology databases.
- IUPAP will support the activities of ICSU and CODATA in this area.

E) Peer review and e print archives

- IUPAP should announce that it welcomes and encourages experiments in the publication of purely electronic journals, not primarily to reduce costs to academic institutions though that would be desirable, but because of improved services to the physics community.
- IUPAP should urge strongly the maintenance of high quality peer review systems in primary publication regardless of the medium employed.
- IUPAP should organize Physical Societies to assume responsibilities for maintaining and possibly operating e print archives.
- The physics community as a whole has a responsibility to maintain quality standards and to ensure that the source and authority of electronic material, whether in text or as data, is clearly identifiable, whether that material is aimed at physicists or to society as a whole. IUPAP should establish guidelines in this area.

F) Long Term Availability of Electronic Publications

- IUPAP should convene a meeting of society publishers, selected commercial publishers and librarians to discuss issues concerning the long term availability of electronic publications, including:

1) Commitments by publishers to maintain the readability of their electronic archives, and the future viability of reference links.

2) Establishment of backup mirrors at institutions which would commit to updating the archives in the event that publishers fail to do so.

- IUPAP should encourage discussions at a more technical level to consider the problems associated with archiving primary publications which include or attach multimedia or data.